

**AMITY TOWNSHIP**  
**Berks County, Pennsylvania**

**STANDARD SPECIFICATIONS AND  
DETAILS FOR**

**SANITARY SEWER EXTENSIONS  
AND REPAIRS**

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Prepared By:

ARRO Consulting, Inc.  
50 Berkshire Court, Suite 209  
Wyomissing, Pennsylvania 19610  
(610) 374-5285



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# **GENERAL**



## SECTION 1. INTRODUCTION

Amity Township has prepared these Standard Specifications to provide the public within the Township's service area with the requirements to apply for access to the Township's system.

## SECTION 2. DEFINITIONS

Allowable Industrial Waste: Any solid, liquid, or gaseous substance, water-borne waste or form of energy ejected or escaping from any industrial, manufacturing, trade, or business process or from the development, recovery, or processing of natural resources, as distinct from sanitary sewage, which complies with all provisions of the most current Amity Township Sewer Use Ordinance and which is allowed to be discharged into the sewer system by Amity Township, Berks County, Pennsylvania, or allowable by the Standard Specifications of Amity Township.

Basement: That part of a building which is wholly below ground level.

Building Sewer or Lateral: The extension of the building drain from the curb line or property line to the public sewer or other place of disposal.

Connection: The jointure, or the process of making the jointure, of one Sewer Line to another.

Developer: An individual, group of individuals, corporation, or agency vested with ownership, legal or equitable, sole or partial, of any property situated in the service area of the Township.

Force Main: A pipe that delivers wastewater, under pressure, discharged from a pump station to its destination at a point of gravity flow downstream, or at a treatment plant.

Gravity Sewer Main: A collection pipe, to which Lateral or Building Sewers are connected, which delivers wastewater, by gravity, to a point of discharge downstream.

Improved Property: Any property within the service area upon which there is erected a structure intended for continuous or periodic habitation, occupancy, or use by human beings or animals and from which structure sanitary sewage and/or industrial wastes shall be or may be discharged.

Industrial Waste: Any liquid or gaseous substance, whether or not solids are contained therein, discharged from any industrial establishment during the course of any industrial, manufacturing, trade, or business process or in the course of the development, recovery, or processing of natural resources, as distinct from sanitary sewage.

Lateral or Building Sewer: The extension of the building drain from the curb line or property line to the public sewer or other place of disposal.

Owner: Amity Township.

Person: Any individual, industrial, partnership, co-partnership, firm, company, corporation, association, joint stock company, trust, estate, governmental entity or any other legal entity, or their legal representatives, agents, or assigns. The masculine gender shall include the feminine, and the singular shall include the plural where indicated by the context.

Plumbing Fixture: Any receptacle intended to receive and discharge any liquid, water, or water carried waste into a Building Sewer.

Right-of-Way: A public way including Streets and sanitary sewer easements.

Sanitary Engineer: An engineer retained or employed by the Township, including any authorized member of the staff of such engineer.

Sanitary Facilities: Toilets, sinks, and other Plumbing Fixtures and related piping intended to receive and discharge Sanitary Sewage into a Building Sewer or Lateral.

Sanitary Sewage: The normal water-carried household and toilet waste from any Improved Property, excluding, however, the effluent from septic tanks or cesspools, rain, storm and ground water, as well as roof or surface water drainage or percolating or seeping waters, or accumulation thereof, whether underground or in cellars or basements.

Sanitary Sewer: Any pipe or conduit constituting a part of the sewer system, or usable for sewage collection purposes.

Service Line: That part of the Sewer Line connecting to the Building Sewer or Lateral at the curb line or property line and extending to and connecting to an Improved Property.

Sewage Treatment Plant: Devices and/or structures or facilities owned by the Township for the treatment and disposal of Sanitary Sewage and Industrial Waste.

Sewer Line: Any pipe or conduit constituting a part of the Sewer System and used or usable for sewage collection or transportation purposes, including Sewer Mains, Lateral Sewers, Service Lines, and Building Sewers.

Sewer Main: Any pipe which collects and transports wastewater from Lateral or Building Sewers to the Township's Sewage Treatment Plant.

Sewer System: Sewer Mains, Lateral Sewers from a Sewer Main to the Service Line, pumping stations, sewer Force Mains, Sewage Treatment Plants, and all appurtenant facilities operated by Amity Township in furnishing sewage service.

Storm Sewer or Storm Drain: A pipe or conduit which carries storm, surface water, drainage, and certain industrial water discharges, such as cooling and air conditioning waters.

Street: A public way including any highway, street, road, lane, court, public square, alley, or other passageway.

Tenant: Any Person in possession of a whole or a part of an Improved Property, who is not an owner.

Township: Amity Township, or in appropriate cases, acting by and through its authorized representatives.

Township Representative: An authorized agent of the Township who may be the Township Solicitor, Sanitary Engineer, or an employee of the Township, representing or acting on legal issues, or being responsible for construction observation, on behalf of the Township.

Vent Pipe: Shall mean any pipe extended vertically from a Service Line to provide ventilation for the system of piping and to prevent siphonage and back pressure.

### **SECTION 3. CONDITIONS OF SERVICE**

- A. No Connection, through which Sanitary Sewage or Industrial Waste does or may enter the Sewer System, shall be constructed, altered, repaired, or allowed to exist, which does not comply with the Township's most current edition of these Specifications entitled "*Standard Specifications and Details for Sanitary Sewer Extensions and Repairs*".
- B. Any sewers, pump stations, Force Mains, and other sewerage facilities constructed, or constructed and maintained, within the service area of the Township, by a Developer shall meet the requirements of the Township's most current Standard Specifications, specified previously, before the ownership of such facilities is accepted by the Township, or before the Township will permit sewage from said facility to discharge into the Township's system.
- C. The requirements of the Township's most current Sewer Use Ordinance shall apply to all direct and indirect contributors to the Township's system.

#### **SECTION 4. RESPONSIBILITIES OF THE DEVELOPER**

- A. It shall be the responsibility of the Developer to accomplish and bear all costs for the connections of his/her work to the existing Township facilities. The Developer shall cooperate with the Township by installing the Lateral Sewers for existing improved or unimproved properties when the new facilities are extended enroute to the Developer's project(s).
- B. The Developer shall become familiar with the laws of the Commonwealth of Pennsylvania and the requirements of the Pennsylvania Department of Environmental Protection (PaDEP), and the local municipality, including those concerning the employment of labor and the performance of work; and shall also become familiar with the requirements of the Township prior to proceeding with construction of new facilities.
- C. All pipelines should be constructed in public Streets, unless the Township agrees otherwise in writing. If the Township agrees in writing to permit pipeline construction in non-public Streets, or on private property, the Developer shall provide the Township with permanent Rights-of-Way in accordance with the requirements herein.
- D. The Developer shall provide a Palmer-Bowlus type sewage flow metering system with ultrasonic reader and recording equipment when a new sewer main is constructed outside of the Township boundaries and connected to the Township's sewer system, when such sewage flow, in the opinion of the Township's Sanitary Engineer, is of a sufficient quantity and such sewage flow would not be measured and recorded by a meter at the point of intermunicipal connection. The Developer's engineer shall contact the Township to discuss design parameters and equipment preferences.

#### **SECTION 5. APPLICATION PROCESS**

- A. Sewer Service Requests:
  - 1. Requests for sewer service within the service area shall be made by completing an "Application for Sewer System Extension" with the Township. A copy of this application can be found in the Appendix of this Manual. Said application shall be accompanied by the following:
    - a. Payment of current application fee.
    - b. Photocopy of the appropriate portion of a 2000 scale USGS topographic quadrangle map showing the location of the requested sewer service.

2. In response, the Township will issue a letter stating if adequate capacity is available at the time of the request. Such letters do not constitute a reservation of capacity.

**B. Preliminary Plan Submission:**

1. Preliminary plan submissions for Sewer System extensions or additions shall be made after receipt of the letter from the Township indicating adequate capacity. The plans shall be accompanied by the following:
  - a. Two (2) sets of preliminary Sewer System plans and specifications prepared in accordance with the requirements of these Standard Specifications. If the preliminary plans do not include the entire development, an overall Sewer System and utility plan shall be included for the entire development. In case of submissions which are clearly incomplete or which are significantly non-responsive to the Township's standards for system additions and extensions, the Township will reject the proposed submission without extensive review, pending the receipt of plans which reasonably address the Township's requirements. It shall not be the Township's responsibility to design such extensions or additions.
  - b. Payment of the review escrow fee based on the Township's capacity letter. The review escrow fee will be used by the Township for reimbursement of review and administration costs.
2. The Township and its consulting engineer will review the preliminary plans and specifications, and provide written comments to the Developer's engineer. Each resubmittal required prior to approval of the preliminary plans shall contain two (2) sets of plans and specifications.

**C. Final Approval:**

1. Upon approval of the preliminary plans, the Township will issue a letter indicating special conditions that must be met, and specific documentation, information, agreements and fees which must be submitted by the Developer to gain final approval. The items required may include, but not necessarily be limited to, the following:
  - a. Two (2) copies of a completed Application for Construction of Sewerage Facilities.
  - b. Required fees.
  - c. Two paper sets (2) of approved sewer plans and specifications and a CD of the same information in electronic format compatible with the Township's software.

- d. Written approval from the Berks County Conservation District for the erosion and sedimentation control plan for the project.
  - e. Written approvals from PaDEP, as required, for stream crossing permits, sewer extension permits, water quality management permits, and planning modules.
  - f. Documentation that proper notification has been given to Berks County and the municipality(ies) where the project is located, in accordance with Act 14.
  - g. Plats and descriptions for all Rights-of-Way required for the project. These plats and descriptions will be used by the Township's Solicitor in preparing Right-of-Way agreements.
  - h. Completed Agreement for construction of the facilities.
  - i. Completed Indemnification Agreement.
  - j. The name of the Developer's proposed contractor.
  - k. Construction schedule to enable the Township to schedule its inspection personnel.
  - l. Certified construction cost opinion from the Developer's engineer.
  - m. Tapping Fees as set forth in the Township's Resolution Imposing Tapping Fees and Connection Fees. For commercial and industrial developments, these fees are based on the anticipated usage in gallons per day as it relates to cost per EDU and must be paid prior to the Township's approval. For residential developments, these fees may be paid as the development progresses; however, the Township will guarantee no capacity until the fees are paid.
  - n. Connection Fees, as set forth in the Township's Resolution Imposing Tapping Fees and Connection Fees.
2. Upon receipt of the required documentation, the application will be acted upon by the Township at a regularly scheduled meeting. Upon approval of the application, a Permit for Construction of Sewerage Facilities will be issued to the Developer. This permit will be accompanied by the following information:
    - a. Special conditions of the permit.



- b. Sewage flow (in gallons per day) reserved for the development.
- c. Names of Persons to be contacted to schedule inspections.
- d. Any unusual or special issues relative to the permit.

D. Financial Security for Construction of Sewer Facilities:

The Township will not collect financial security for the construction of the proposed sewer facilities. Instead, the Developer shall submit financial security for the sewer facilities to the Township.

**SECTION 6. CONSTRUCTION OF SEWER IMPROVEMENTS**

A. Preconstruction Meeting:

After receipt of the construction permit, the Developer or the Developer's contractor shall conduct a pre-construction meeting at the project site. The Developer shall contact the Township at least three (3) working days prior to the proposed pre-construction meeting. Agenda items shall include schedule, sequence of construction, and a review of key components of the Township's Standard Specifications. The Developer's contractor shall provide an emergency 24-hour phone list to the Township in accordance with Section 10 of this General Section, as well as shop drawings for all materials to be used on the project. No work may proceed until emergency phone list is received and shop drawings are approved in writing by the Township.

B. Inspection During Construction:

After construction commences, the applicant shall be responsible for coordination of construction observation activities with the Township.

The construction of sewer improvements shall at all times be subject to the inspection by the Township or its authorized representative. Construction and testing of all sewer improvements shall be performed in the presence of Township personnel or a duly authorized representative of the Township with the exception of final grading, seeding, and/or paving. No pipes, manholes, or other facilities shall be backfilled, nor shall any testing be performed, unless a duly authorized representative is present. If the Developer fails to comply with this requirement, the Township reserves the right to require the Developer to uncover the facilities so that proper inspection and retesting can be performed. The Developer is responsible for coordinating construction activities and required inspections. A 48-hour notice is required for all inspections.

In order to facilitate required inspections, no work shall be conducted by the Developer on Saturdays, Sundays, or holidays without written approval from the Township.

Additional inspection and testing requirements are provided in the Specification section of these Standard Specifications.

C. Final Inspection:

A final construction inspection will be performed after vegetative cover is well established and/or after final paving has been completed, as applicable. The Developer shall be responsible for requesting the final construction inspection. A seven calendar day notice is required for final construction inspection. The Township will issue an approval letter if all completed work is in accordance with the Standard Specifications.

**SECTION 7. DEDICATION OF SEWER IMPROVEMENTS**

A. Deed of Dedication and Record Plans:

After satisfactory completion of construction of the sewer improvements, the Developer will supply all deeds of dedication, easements, bills of sale, title insurance, and such other items as determined necessary by the Township, in forms provided by the Township, at the time of the requested dedication. Construction shall not be considered complete until the final paving has been installed or suitable ground cover has been established as applicable. The Developer or the Township's representative shall promptly record the deed(s) of dedication after approval of a resolution of acceptance by the Township at a regular meeting.

Along with the Deed of Dedication, the Developer shall submit record plans for the project. These plans shall be submitted in hard copy (two [2] sets of prints) and also on a CD in an electronic format that is compatible with the Township's GPS software.

Record plans shall be developed using the following information:

1. Contractor's Lateral Sewer Record Plan information.
2. Upon completion of construction and final inspection, the Developer shall survey the constructed improvements and will forward the survey data to the Sanitary Engineer. The costs associated with this survey shall be borne by the Developer.

B. Operation and Maintenance Financial Security:

The Township will not collect financial security for the operation and maintenance of the proposed sewer facilities. Instead, the Developer shall submit financial security to the municipality in which the project is located.

C. Release of Operation and Maintenance Financial Security:

Prior to the release of the operation and maintenance financial security, the Township may conduct an inspection and then inform the municipality that the work is satisfactorily completed, whereupon the municipality may then release the security provided for the sanitary Sewer System.

## SECTION 8. PLAN REQUIREMENTS

A. The Township has adopted the following requirements for submission of all drawings:

1. Drawing Scales: Horizontal Scale 1" = 50' and Vertical Scale 1" = 10'.
2. Drawing Sheet Size: 24" x 36".
3. Each sheet shall show plan view at the top and its corresponding profile below.
4. All utility plans indicating proposed lot locations shall indicate lot numbers, Street addresses, and adjoining property owner's name(s), if known.
5. All utility plans shall display the north arrow (preferably pointing up).
6. All utility plans and profiles shall indicate existing and proposed sanitary sewer locations, including all manholes, as well as all proposed and existing gas mains, water mains, Storm Sewers, electric conduits, and any other underground utilities.
7. All utility profiles shall numerically indicate slopes, pipe sizes, manhole rim and pipe invert elevations, distances between manholes, manhole numbers, and piping materials proposed along the utility line.
8. All utility plan views shall indicate direction of flow using flow arrows and manhole numbers. Manhole numbers shall be assigned using the following format: Up to 4 letter prefix indicating name of development, followed by a dash, followed by the manhole number (Example: WF-1 represents the first manhole in the Wagner Farm development). In order to avoid duplication with other prefixes within its system, the Township will assign prefixes (up to 4 letters) based

upon the name of each development. The Developer's engineer shall contact the Township's Collection System Supervisor for the prefix. The Developer's engineer shall assign manhole numbers, starting with #1 and numbering consecutively.

9. All utility plans shall indicate existing and new Rights-of-Way.
10. All utility plans shall indicate lands to be dedicated to the Township.
11. All plans shall include the following statement:
  - a. NOTE: Sanitary Sewer Lines shall be designed and constructed in accordance with the Amity Township "Standard Specifications and Details for Sanitary Sewer Extensions and Repairs".
12. All plans shall be signed and sealed by a professional engineer or professional land surveyor, registered in the Commonwealth of Pennsylvania, shall be dated, and shall include all revision dates.
13. All plans shall include an overall utility plan sheet containing the following information:
  - a. Key map and relative location of the proposed facilities within the affected Municipality.
  - b. Lot numbers
  - c. North Arrow
  - d. Sanitary sewer utility
  - e. Manhole numbers
  - f. Sanitary sewer flow arrows
  - g. Pipe sizes and materials
  - h. Storm Sewer pipes and structures
  - i. Water mains
  - j. Fire hydrants
  - k. Gas mains

- l. Electric lines (overhead and underground)
  - m. Telephone lines (overhead and underground)
  - n. Cable TV lines (overhead and underground)
  - o. Existing and new utility Rights-of-Way
14. The overall utility plan sheet will not be subject to the previously stated horizontal scale.
15. The overall utility plan shall be independent of the soil erosion and control plan.
16. Detail sheet(s) shall be provided for the proposed sewer facilities. Details shall be sufficient for construction of the facilities, and should include the applicable details from Appendix A of these Standard Specifications.

**SECTION 9. HIGHWAY AND STREET OPENING PERMITS AND RESTORATION OF SURFACE**

- A. Unless otherwise determined by the Township and except as herein provided, whenever the surface of any municipal Street is disturbed by construction of the Sewer Lines, it will be the responsibility of the Developer to secure and maintain Street Opening Permits from the Municipality, or Highway Occupancy Permits from the Pennsylvania Department of Transportation. Developer shall be responsible for all costs relating to such permits, including but not limited to, insurance financial security, and inspection fees required by the agency having jurisdiction over the roadway.
- B. Unless otherwise required, all Street restoration, including curbs and sidewalks, shall be in compliance with the requirements of the Municipality or the State.

**SECTION 10. EMERGENCY MAINTENANCE DURING CONSTRUCTION**

- A. The Developer shall have available at all times, including non-working hours, weekends, and holidays, an emergency maintenance crew and a Person of authority and responsibility to act in cases of emergency, such as flooding, cave-ins, or other unsafe conditions, resulting from construction activities. The Developer shall submit to the Township all the names, addresses, and telephone numbers of the emergency crew supervisor(s) prior to beginning construction operations. The Developer shall be responsible for costs resulting from such emergency work.

- B. The Developer is responsible for all costs incurred for any emergency work performed by the Township or others on the Developer's behalf.

## SECTION 11. SINKHOLES

- A. Sinkholes: Where a sinkhole is found or formed during construction or warranty period, the Township shall be notified immediately. An evaluation of the sinkhole shall be conducted by the Township's Sanitary Engineer. A method of sinkhole remediation shall be chosen by the Sanitary Engineer. Remediation of the sinkhole shall be completed under the direction of the Sanitary Engineer and as specified hereinafter.
- B. Sinkhole Prevention and Remediation: Soil located above a zone of solution activity is usually soft and wet. Contractor shall maintain the depth of excavation to the absolute minimum required to accommodate the work, and shall take measures to prevent the development of localized low spots. If weak, yielding, or saturated conditions are encountered, Contractor shall perform excavation as described below:
1. Perform excavation and backfill of unstable subgrade as follows:
    - a. If, during preparation of subgrade, soft or unstable areas are detected, excavate the unsuitable subgrade to the limits directed by the Engineer.
    - b. Backfill the excavated areas with on-site soil backfill material.
      - (1) Compact in layers not exceeding six inches loose depth. Compact to 95% of the soil's maximum standard dry density, to pipe trench bottom or structure aggregate base bottom.
    - c. If during subgrade excavation operations a sinkhole develops, the Contractor shall remove all soft or unstable soils located in the base of the sinkhole and shall continue excavation until stable soils are encountered, the "throat" of the sinkhole is exposed, and/or the presence of rock outcrops or the depth of excavation preclude further excavation.
      - (1) Due to the instability of the sides of an existing sinkhole, extreme caution must be exercised during sinkhole remediation to prevent collapse of the soils due to pressure from equipment.
    - d. Following removal of all unstable soils from the base of the sinkhole, an evaluation of the stability of the base and sidewalls shall be conducted by Township's Geotechnical Engineer.

This evaluation will be used to make specific recommendations regarding remediation of the cavity. As a guide, the sinkhole should be backfilled as described below.

- (1) If the base of the excavation exposes a “throat” or opening into bedrock, grouting and/or concrete may be required to fill or block the throat in order to prevent additional soil from collapsing or being washed into the opening.
  - (2) Having established or modified the integrity of the base of the sinkhole, Contractor may proceed with backfilling of the excavation. Sinkhole shall be backfilled approximately 1-1/2 feet with crushed aggregate having a maximum particle size of approximately 3/4 inches.
  - (3) Backfill the final 1/2 to 2/3 of the excavation using site soils compacted to at least 95% of soil’s maximum dry density.
- e. Payment for additional work will be made using the unit prices for Miscellaneous Unclassified Excavation and Miscellaneous Aggregate Backfill.

## **SECTION 12. BORING, JACKING, AND TUNNELING**

- A. General: Installation of pipe lines shall be by open-cut methods unless boring, jacking, and/or tunneling is approved or required by the Township, PennDOT, railroad company, or other entity having jurisdiction over a particular location where a pipe line is being installed. Prior to the start of such construction, complete plans and specifications shall be submitted to and approved by the appropriate entity.
- B. Casing Pipe Materials:
1. Steel Casing Pipe: ASTM A53 or other suitable steel meeting the approval of the appropriate entity.
    - a. 35,000 psi minimum yield strength.
    - b. Full circumference welded joints.
    - c. Asphalt coated.
    - d. Minimum wall thickness: 0.375 inch.

- e. Steel casing pipe shall be at least six inches in diameter larger than the outside diameter of the carrier pipe bell, or as required by the owner of the right-of-way, the entity issuing the permit, or the Township.
  - f. Smooth wall steel pipes with a nominal diameter of over 54 inches will not be permitted for use as casing pipe.
2. Casing Spacer:
- a. The extender shall furnish and install casing spacers meeting the following specifications:
    - (1) Split-ring band with minimum of two runners on each half of the band.
    - (2) Band material: 14-gage, hot-rolled and pickled carbon steel with epoxy coating.
    - (3) Band liner: 0.090-inch thick PVC.
    - (4) Riser material: 10-gage carbon steel with epoxy coating.
    - (5) Runner material: UHMW polyethylene.
    - (6) Studs, nuts, and washers: Type 304 stainless steel.
    - (7) Acceptable manufacturer: Advanced Products and Systems, Inc. (APS) Model SI, Material Specification C1.
3. Casing End Seals: Synthetic rubber with Type 304 stainless steel bands; APS Model AC or AW.
4. The type of casing spacer shown in either the Casing Cradle Detail – Gravity Sewer Installation Via Boring/Jacking or the Casing Cradle Detail (Open Cut or Force Main), as applicable will also be approved for use on gravity sewers.

### **SECTION 13. STREAM CROSSINGS**

- A. Construct stream crossing in accordance with an approved Stream Crossing Plan and an approved Sedimentation and Erosion Control Plan. Obtain all Federal, State, and Local permits.
- B. Make all necessary provisions for cofferdamming, dewatering, and removal of excess excavated material.



- C. Maintain the flow in the stream at all times.
- D. Construct stream crossings as shown on either the Casing Cradle Detail – Gravity Sewer Installation via Boring/Jacking or the Casing Cradle Detail (Open Cut or Force Main), as applicable. Encase pipe to limits shown on the Standard Detail with PennDOT 408 Class A concrete. The vertical distance between top of concrete and the lowest point in the stream bed shall be no less than 36 inches.
- 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 to provide a firm bond between the encasement and the rock. Where concrete encasement to the dimension shown on either the Casing Cradle Detail – Gravity Sewer Installation via Boring/Jacking or the Casing Cradle Detail (Open Cut or Force Main), as applicable is entirely in rock, the vertical distance between top of encasement and the lowest point in the stream bed may be 12 inches, but no less.

#### **SECTION 14. PUMP STATIONS**

- A. The Developer is responsible to acquire the services of a professional engineer, registered in the State of Pennsylvania, to design the pump station. The Developer's engineer shall contact the Township to discuss design parameters and equipment preferences.
- B. The Township has established, as a minimum, the following design guidelines:
  - 1. The wet well portion of the pump station shall be a precast reinforced concrete wet well with a flat precast concrete cover. The joints between the precast sections shall be tongue and groove and be sealed with two rows of mastic sealant or approved equal. The top of the pump station wet well shall be set above 100-year floodway elevations and the depth shall be set for proper operation of the pumps and the pump control system. The top cover shall be provided with a lockable watertight aluminum access hatch (double leaf) that is sized appropriate for pump removal and a gooseneck stainless steel vent pipe. The bottom of the wet well shall have concrete fillets formed in the corners to funnel the sewage to the pumps to avoid sludge build-up. All penetrations through the wet well walls shall have neoprene seals cast into walls per the precast manufacturer to make a watertight seal around penetrations. The wet well shall have a corrosion-resistant coating on all surfaces of the interior of the wet well.
  - 2. The valve pit portion of the pump station shall be a precast reinforced concrete valve pit with a flat precast concrete cover. The joints between the precast sections shall be tongue and groove and be sealed with two rows of mastic sealant or approved equal. The top of the valve pit shall

be set above 100-year floodway elevations. The top cover shall be provided with a lockable watertight aluminum access hatch (30" x 30" minimum), an aluminum access ladder if required, and a gooseneck stainless steel vent pipe. All penetrations through the valve pit walls shall have neoprene seals cast into walls per the precast manufacturer to make a watertight seal around penetrations. Interior bottom of valve pit to have a sump hole for water removal. The sump shall drain to the wet well. The drain pipe shall have a backflow preventer or trap inside the wet well.

3. The pumps for the wet well shall be duplex non-clog sewage pumps as manufactured by Flygt Corporation. The pumps shall be rail mounted for easy removal. All pump rails, brackets, chains, and hardware shall be stainless steel. Provide a stainless steel debris basket on rails and also a stainless steel lifting mechanism for pump and basket removal. A spare pump shall be provided and delivered to the Township for proper storage.
4. The pump controls shall consist of a pressure transducer with a back-up five-float system. The controls shall provide for alternating pump operation and dual pump operation. The levels of operation shall be low water alarm, high water alarm, both pumps off, lead pump on, and lag pump on. Provide alarm and Verbatim autodialer to notify Township of high level, low level, and other alarms associated with the pumps. Two phone lines shall be provided at the pump station – one phone line for Verbatim alarm box and one for the flow analyzer. The pump control cabinet shall be as manufactured by Flygt Corporation. The autodialer and flow analyzer should be mounted in the control panel.
5. All piping throughout the pump station shall be ductile iron (Class 53) until outside of the valve pit. Joint shall be mechanical joint for exterior buried pipe and flanged for interior piping. Each discharge line in the valve pit shall have a swing check valve and a gear-operated plug valve that are easily accessible for maintenance purposes. The valves shall be equipped with handles for manual operation. All piping in valve pit shall be properly supported and restrained against thrust.
6. Pump station shall be fitted with an automatic flow meter that records data over at least a one month time period. Direct flow readout shall be provided. Flow meter recorder and display shall be mounted in the building. The flow meter shall also be capable of transmitting a signal to a remote location designated by the Township. The flow meter shall be as manufactured by Endress Hauser Model 50-53.

7. A standby diesel generator of adequate capacity shall be provided for the pump station. The generator shall be as supplied by Katolight Emergency Systems, Inc., and shall be equipped with a belly-mounted fuel tank. Also provide an automatic transfer switch and an automatic programmable exercise option to exercise generator without operator involvement.
8. A building shall be provided to house the diesel generator, pump controls, and autodialer. The building shall be constructed of reinforced concrete footer and floor, and split-face block walls with a finish to match other Township pump stations. The roof shall be wood truss with sheathing, felt paper, and 35-year fiberglass shingles. The building shall have power ventilation activated by a thermostat and/or generator operation. The building shall be heated and insulated, and all exterior wood shall be encased in vinyl fascia and soffit. The access door and door frame for the building shall be a painted steel double door of adequate size for generator removal.

If a chemical system is required for odor control or pretreatment, all required safety equipment and alarms must be provided.

9. Locate the electric meter so the meter can be read without entering the pump station. Provide interior lighting with wall switch for the building and a separate switch for exterior lighting. Exterior lighting shall be sufficient to illuminate entire pump station area. Provide interior electrical outlets and exterior weathertight outlets for power tools and portable lighting.
  10. The pump station and the building shall be enclosed with a 6-foot high aluminum chain link fence with three strands of barbed wire around the top. Provide a 16-foot wide double-leaf access gate with leaf hold-backs and a lockable latch. Posts shall be a minimum of 2½" diameter aluminum.
  11. A bituminous paved access shall be provided from the street to the pump station area. Provide pavement access to the wet well, valve pit, and building. The remaining area inside the fence shall be covered with crushed stone placed over a weed-blocking landscape fabric material. Around the outside of the fence, plant arborvitae on four-foot center for screening. The disturbed area outside the fence shall be graded with topsoil and seeded.
- C. If the development is located outside of the Township, the flow from the pump station must be metered before it enters the Township's sanitary sewer system. The flow meter shall be capable of transmitting a signal to a remote location designated by the Township.

- D. The Developer shall provide two (2) sets of prints and specifications to the Township or the Township's Sanitary Engineer for review. The information shall also be provided on a CD in an electronic format that is compatible with the Township's software.

**SECTION 15. COMMUNITY TREATMENT/DISPOSAL SYSTEMS**

Community treatment/disposal systems shall not be permitted within the Township's service area.

**SECTION 16. LOW PRESSURE SYSTEMS**

Low pressure systems, including grinder pumps and septic tank effluent pump (STEP) systems, are permitted within the Township's Sewer System only upon approval of the Sanitary Engineer.

**SECTION 17. PRIVATELY-OWNED INDIVIDUAL GRINDER PUMPS AND/OR NON-CLOG SEWAGE PUMPS**

A. General:

1. Application:

- a. Privately-owned individual grinder pumps or non-clog sewage pumps may be used when the individual discharges into a manhole/box outside of the right-of-way and flow from that manhole/box is by gravity through a six (6) inch lateral to the Township's gravity collection system, or when the individual discharges into a pressurized sewer system owned and maintained by the Township.

2. Quality Assurance:

a. Acceptable Manufacturers:

(1) Environment One Corporation (Site Specific Design, Inc., 215-887-3730)

(2) Approved Equal

- b. The units shall meet accepted standards for plumbing equipment for use in or near structures and shall operate free from noise, odor, or health hazards.

c. Requirements of Regulatory Agencies:

- (1) Comply with construction code requirements of State, County, local, and such other political subdivision specifications as may exceed the requirements of the codes, standards, and approving bodies referenced throughout these specifications.
  - (2) Provide electrical control cabinets and pump units constructed in accordance with the requirements of the Underwriters Laboratory, or other nationally-recognized certification agency, and labeled accordingly.
  - (3) Units shall comply with the applicable requirements of the Pennsylvania Department of Environmental Protection and the National Sanitation Foundation.
- d. Each unit shall be factory tested. The manufacturer must have the facilities to perform listed tests. The minimum test required shall be:
- (1) Watertightness of the unit at maximum depth.
  - (2) Pump output in gpm at at least two different operating points.
  - (3) Amperage and wattage of electrical consumption.
- e. Single Source Responsibility: To ensure single source responsibility and parts supply, obtain pump units from one manufacturer.
- f. In general, the individual grinder pump station shall be a complete factory built by an acceptable manufacturer or approved equal.

3. Submittals:

- a. When applying for the permit, submit for approval a minimum of three (3) sets of completely dimensioned shop, layout, or setting drawings and catalog cuts as required to provide a complete description of system equipment as specified in this Section.
- b. Submit shop drawings certified for construction by the manufacturer which includes location of electrical connections, wiring diagrams, anchor bolt layout, details indicating construction and materials of construction, diameter of shafting, dimensions and rated horsepower of all motors, gear and bearing ratings, service factors, and weights of principal parts and completely assembled equipment.
- c. Submit evidence of Underwriters Laboratories (UL) listings and approvals on electrical control panels and pump units.

B. Products:

1. General:

- a. A minimum of one simplex (single) pump unit shall be required to be installed at all residential property locations. Duplex pump units as a minimum shall be required to be installed at all commercial and/or industrial locations unless approved in writing as a simplex unit by Amity Township.
- b. Pumps shall be installed in fiberglass-reinforced polyester or high density polyethylene basins for outdoor installation only. Indoor installations will not be permitted.
- c. The pump package shall consist of the basin, pump and motor, junction box, start-stop level controls, motor high temperature shut-off, motor seal leak alarm, high water level alarm, shut-off valve, discharge piping and fittings, and all internal wiring terminating into a junction box.
- d. An externally-mountable control panel shall be provided for each unit.
- e. The location of the pump package and control panel shall be determined by the property owner or the developer, outside of the right-of-way.

C. Execution:

1. Installation of Pump:

- a. The pump unit shall be installed at a location to be determined by the property owner or developer.
- b. The depth of the pump unit will be dependent upon the location and depth of the proposed house service. The inlet port on the basin shall be set so that a minimum grade of two (2) percent for the new four (4) inch gravity service line can be maintained.
- c. All pump basins shall be installed on a bed consisting of AASHTO No. 8 or No. 57 coarse aggregate and shall have a concrete anti-flotation collar poured around the bottom as shown on the Drawings. The remaining excavated area shall be backfilled to six (6) inches below grade with excavated material containing no soil lumps, stones, concrete, or foreign objects larger than one (1) inch in maximum dimension. Six (6) inches of topsoil with seed and supplements shall be placed to grade the surrounding excavated area.

- d. If the excavated material does not meet the requirements described above, a backfill material consisting of AASHTO No. 8 or No. 57 coarse aggregate shall be used to a point six (6) inches below finished grade.
- e. Only sanitary sewage shall be connected to the grinder pump station. No groundwater, sump pump, or roof drains are permitted to be connected.
- f. Minimum pipe size shall be one and one-quarter (1¼) inches. All piping will conform to Section 02733 of this Specification.

D. Maintenance:

- 1. All residential or commercial sanitary sewage grinder pumps installed in Amity Township will be owned and maintained by the property owners.
- 2. Amity Township will enforce the Sewer Use Ordinance and will require that any owner repair or replace a malfunctioning grinder pump system that could cause a nuisance or public health hazard.
- 3. Repairs or replacement of the grinder pump system will comply with the requirements of this Specification.

**SECTION 18. STANDARD OF QUALITY**

All construction, reconstruction, and alterations of sewer facilities shall be performed in accordance with recognized industry and trade standards and these specifications. The Township reserves the right, at its discretion, to stop, or require reconstruction of, any work not conforming to these Standard Specifications.





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# ***SPECIFICATIONS***



**Section 01300**  
**Submittals**



## SECTION 01300

### SUBMITTALS

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Submittal procedures.
- B. Action on submittals.
- C. Shop Drawings.
- D. Product data and warranties.
- E. Samples.
- F. Manufacturers' instructions.
- G. Manufacturers' certificates.
- H. Construction Progress Schedule.
- I. Submittals specified in other documents/sections.

##### 1.02 SUBMITTAL PROCEDURES

- A. Transmit each submittal with Owner Representative's accepted form.
- B. Number each submittal. Number shall consist of the following parts, each separated by a dash:
  - 1. Project Name.
  - 2. Five-digit Specification Section number.
  - 3. Two-digit sequence number starting for each Specification Section with 01 and continuing with 02, 03, etc., for subsequent submittals with the same Specification Section number.
  - 4. Use the fourth part of the number only for resubmittals. For the first resubmittal of a previous submittal, add -R1 to the previous number. For the second resubmittal, change to -R2, and so on.

As an example of the numbering process for Contract Number 1, the third submittal under Section 03300 would be numbered 1-03300-03 and the second resubmittal of this same submittal would be numbered 1-03300-03-R2.

- C. Identify Project, Contractor, Subcontractor, or supplier. Identify pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.
- D. Apply Contractor'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 and Specifications. Stamp shall have the following format:

Approved for Contract Requirements

The Contractor's signature below indicates that this Submittal has been checked with the Drawings, Specifications, and site conditions and found to meet all requirements of same, including dimensions, and that the Contractor's guarantee fully applies to the Product(s) covered.

RE: Project \_\_\_\_\_

Submittal Number \_\_\_\_\_

Drawing Sheet Number \_\_\_\_\_ Detail Number \_\_\_\_\_

Deviations from Contract Documents? No \_\_\_\_\_ Yes \_\_\_\_\_ (letter attached)

By \_\_\_\_\_

Signature (Contractor)

Contractor's Name \_\_\_\_\_

- E. Schedule submittals to expedite the Project, and deliver to Owner's Representative at business address. Coordinate submission of related items.
- F. Submit letter which specifically identifies deviations from these Specifications. Identify Product or system limitations which may be detrimental to successful performance of the completed Work.
- G. Provide space for Contractor and Owner Representative's review stamps.
- H. Revise and resubmit submittals as required. Identify all changes made since previous submittal.
- I. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.03 ACTION ON SUBMITTALS

- A. Owner Representative's Action: Where action and return is required or requested, Owner's Representative will review each submittal, mark with the action taken, and where possible return within two weeks of receipt. Where submittal must be held for coordination, Contractor will be so advised by Owner's Representative.
- B. Submittals returned with "APPROVED" action indicate that the information submitted was found to be in conformance with the design concept and in compliance with the requirements of the Specifications. The Contractor remains responsible for work-related errors, deviations, and discrepancies in the submittal, but may proceed with performance of the work covered by the submittal.
- C. Submittals returned with "APPROVED AS NOTED" action indicate that the information submitted was found to be in conformance with the design concept and in compliance with the requirements of the Specifications, provided the noted clarifications or corrections are

incorporated in the Work and in the Record Documents. The Contractor remains responsible for work-related errors, deviations, and discrepancies in the submittal, but may proceed with performance of the work covered by the submittal. Resubmission of information is not required.

- D. Submittals returned with "RETURNED FOR CORRECTION" action indicate that:
  - (1) information submitted is at least partially not in conformance with the design concept,
  - (2) information submitted is at least partially not in compliance with the requirements of the Specifications, (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 with the Shop Drawings and Product data. Owner's Representative will note the deficiencies or corrections required, and return the submittal to the Contractor. Performance of the work covered by the submittal shall not proceed until corrected information is submitted and approved.
- E. Submittals returned with "NOT AS SPECIFIED" action indicate that the Owner's Representative interprets the information submitted to be not in conformance with the design concept or not in compliance with the Specifications. This action may also indicate non-compliance with the Contractor's responsibility to review information and submit notification of deviations and discrepancies for the Owner Representative's review. Performance of the work shall not proceed until new information is submitted and approved.
- F. Review Action does not establish submitted information as an authorization to deviate from the Specifications.
- G. For all re-submittals except the first, Owner's Representative and Owner Representative's consultant(s) will record manhours required for review of the re-submittal. At the discretion of the Owner's Representative, Contractor may be charged for review of such repeat re-submittals at Owner Representative's and Owner consultant's current hourly rates.

#### 1.04 SHOP DRAWINGS

- A. Submit the number of opaque reproductions which Contractor requires, plus two copies which will be retained by Owner's Representative.
- B. After review, distribute in accordance with Article on "Submittal Procedures" above.

#### 1.05 SAMPLES

- A. Submit samples of Products if required by the individual specifications or as requested by Owner's Representative.

#### 1.06 PRODUCT DATA AND WARRANTIES

- A. Submit the number of copies which the Contractor requires, plus two copies which will be retained by the Owner's Representative.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.

- C. Submit sample warranty certificates, if any, in quantities specified under paragraph A.
- D. After review, distribute in accordance with Article on “Submittal Procedures” above.

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 these Specifications.

1.08 MANUFACTURER’S CERTIFICATES

- A. When specified in individual Specification Sections, submit manufacturers’ certificate to Owner’s Representative for review, in quantities specified for Product data.
- B. Indicate Product conforms to or exceeds specified requirements. Submit supporting computations, reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Owner’s Representative.
- D. When required by individual Specification Sections, include computations signed and sealed (or stamped) by a registered Professional Engineer.

PART 2 – PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 – EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION



**Section 01400**  
**Quality Controls**



SECTION 01400  
QUALITY CONTROL

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Quality assurance and control of installation.
- B. References.
- C. Inspection and testing laboratory services.
- D. Manufacturers' field services and reports.

1.02 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Specifications, request clarification from Owner's Representative before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.
- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.03 REFERENCES

- A. Conform to reference standards cited in Specifications.
- B. Should specified reference standards conflict with Specifications, request clarification from Owner's Representative before proceeding.

1.04 INSPECTION AND TESTING LABORATORY SERVICES

- A. An independent firm will perform inspections, tests, and other services specified in individual Specification Sections and as required by the Owner's Representative.

- B. Reports will be submitted by the independent firm to the Owner's Representative, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Specifications. Reports will be submitted to Owner's Representative within 48 hours after completion of test.
- C. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
  - 1. Notify Owner's Representative and independent firm at least 24 hours prior to expected time for operations requiring services.
  - 2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
- D. Retesting required because of non-conformance to specified requirements will be performed by the same independent firm on instructions by the Owner's Representative. Payment for all testing and retesting will be paid by the Contractor.

1.05 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual Specification Sections, require Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, and testing, adjusting, and balancing of equipment as applicable, and to initiate instructions when necessary.
- B. Submit report in duplicate within 14 days of observation to Owner's Representative for review.

PART 2 – PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 – EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

**Section 01500**  
**Construction Facilities and**  
**Temporary Controls**



## SECTION 01500

### CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Regulatory requirements.
- B. Storage
- C. Barriers.
- D. Water control.
- E. Progress cleaning.

##### 1.02 REGULATORY REQUIREMENTS

- A. Comply with applicable laws and regulations of authorities having jurisdiction, including but not limited to building codes, health and safety regulations, utility company regulations, and environmental protection regulations.
- B. Provide electrical equipment which is UL listed.

##### 1.03 STORAGE

- A. Contractor shall provide and pay for storage of materials and equipment off site when on-site storage is not adequate.
- B. Contractor shall transport materials to site(s) as required for performance of Work on a daily basis.

##### 1.04 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide protection for plant life designated to remain. Replace damaged plant life.
- C. Protect vehicular traffic, stored Products, site and structures from damage.

1.05 WATER CONTROL

- A. At all times during the construction of Work on this Project maintain the flow of storm water, naturally occurring water and wastewater in existing facilities and channels affected by the Work.
- B. Particular attention is directed to above requirement in regard to the maintenance of flow in existing sewer service connections during removal and replacement of the sewer mains.
- C. Contractor assumes responsibility for damages to property caused by flooding due to blocking or restriction of storm water passages, natural waterways, and wastewater facilities.
- D. Do not at any time permit wastewater flow from existing sewers to flow into nearby waterways or to flow on surface areas.

1.06 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove waste materials, debris, and rubbish from site daily and dispose off-site.
- C. Remove mud and construction debris on a daily basis from paved surfaces used by the Contractor.

PART 2 – PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 – EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION



**Section 01560**  
**Soil Erosion and**  
**Sedimentation Control**



## SECTION 01560

### SOIL EROSION AND SEDIMENTATION CONTROL

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Work required by regulations to prevent soil erosion and control sedimentation during Work on a Project.

##### 1.02 RELATED SECTIONS

- A. Trenching, Backfilling, and Compacting: Section 02221.
- B. Finish Grading: Section 02260.
- C. Paving and Surfacing: Section 02500.

##### 1.03 SEDIMENT AND EROSION CONTROL PLAN

- A. The Sediment and Erosion Control Plan shall conform to the requirements of the Berks County Conservation District.
- B. For design, construction, and maintenance of any measures not included in the original plan but required because of unforeseen or changed Project conditions, refer to the requirements of Chapter 102 of Pennsylvania Administrative Code, Title 25 as authorized by the Clean Streams Law, Act 222, as amended and instructions of Berks County Conservation District.

##### 1.04 REGULATORY REQUIREMENTS

- A. The sediment and erosion control measures are subject to inspection by State, county, and local regulatory agencies. The Contractor shall be fully responsible for constructing and maintaining the sediment and erosion control measures to the extent that they are, at all times, acceptable to the regulatory agencies. The Contractor shall be liable for payment of any fines or legal costs that the Owner may incur as a result of the Contractor's failure to properly construct and maintain the sediment and erosion control measures.
- B. One objective of the "Sediment and Erosion Control Plan" is the protection of private property. To assist any damaged property owners in redress of grievances, the following stipulations are made:
  - 1. Any silt, sediment, or mud leaving the construction site will be construed as damage to neighboring property and evidence of negligence on the part of the Contractor.
  - 2. Any damages claimed by neighboring property owners will be rectified and restitution made by the Contractor.

- C. Comply with the requirements of Chapter 102 of Pennsylvania Administrative Code Title 25 as authorized by the Clean Streams Law, Act 222, as amended.
- D. Comply with any local laws, codes, and regulations concerning the construction and maintenance of sediment and erosion control measures.

#### 1.05 CONSTRUCTION SEQUENCE

- A. Install all sediment and erosion control measures prior to start of clearing operations.
- B. Conduct construction operations in accordance with the following general sequence:
  1. Construction of sediment and erosion control measures including ditches, swales, silt fences, and construction entrances.
  2. Clearing, removal of debris, and stockpiling of soil materials.
  3. Construction of stabilized construction roads, temporary parking lots, and construction staging areas.
  4. Excavation and, if required, embankment construction.
  5. Construction of building, structure, pipeline, and other items required by the Contract Documents.
  6. Backfilling, final grading, paving, seeding, and other ground stabilization.
  7. Removal of temporary sediment and erosion control measures.

#### 1.06 GENERAL SEDIMENT AND EROSION CONTROL METHODS/PROCEDURES

- A. In all cases, the smallest practical area of land surface shall be disturbed.
- B. Stripped topsoil shall be placed up slope from proposed construction areas where possible. Stockpiles shall be stabilized immediately. Topsoil shall be kept separate from all other materials.
- C. Excavated material shall be placed up slope from the excavation whenever possible. Runoff from spoil piles shall be directed through a sediment filter structure and discharged in a non-erosive manner. Stockpiles of excavated material shall be stabilized immediately.
- D. Stockpiles of stripped topsoil, or excavated material and other erodible/soluble areas and materials shall be stabilized immediately.
- E. Utility excavations shall be open only long enough to properly install and inspect all underground facilities in accordance with applicable Specification Sections.
- F. Dewatering equipment discharge shall be directed onto a stabilized surface so that erosion does not occur. Discharges shall be directed through a sediment filter structure or sedimentation basin and discharged in a non-erosive manner.
- G. Backfilled excavations shall be restored to original type of cover and grade in accordance with Specifications. Temporary stabilization is required for any and all erodible/soluble areas and materials.

- H. Areas to be seeded or sodded shall be finish graded with six inches of topsoil unless otherwise specified. Positive drainage shall be maintained away from all structures. No isolated low spots shall be created.
- I. All sediment shall be prevented from entering any storm drain, ditch, or water course through use of a sediment filter structure.
- J. Construction access from unpaved areas to paved areas or streets (public or private) shall be via a stabilized construction entrance. The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto the paved surface. Sediment spilled, dropped, or tracked onto paved surface shall be removed immediately.

#### 1.07 SPECIFIC SEDIMENT AND EROSION CONTROL PROCEDURES

- A. Clearing/Grubbing: Shall follow the procedures as outlined in Section 02100.
- B. Rough Grading/Foundation Excavation:
  - 1. Upstream diversion facilities shall be re-established and relocated as required to maintain function during excavation operations.
  - 2. Temporary and permanent diversion and collection system shall be modified or installed at the downstream limits of all areas to be excavated. All discharge from such facilities shall be via either temporary or permanent sediment traps and discharge structures.
  - 3. Temporary and permanent sediment traps and discharge structures shall be modified or installed at all points of discharge of sediment-carrying water.
- C. Dewatering Operations: Dewatering operations, when required, shall discharge through filter bags onto non-erodible surfaces.
- D. Temporary Sediment Traps for Storm Drain Inlets:
  - 1. Traps shall be installed immediately upon completion of any new storm drainage inlet structure. Traps shall also be installed where there is a possibility of runoff from the construction area entering existing storm drain inlets.
  - 2. Sediment traps shall be inspected after each rain and maintained in a functional condition at all times during the construction period.
  - 3. Traps shall be removed when contributing drainage areas are stabilized.
- E. Silt Fence Sediment Barrier:
  - 1. Silt fence sediment barrier shall be used to filter sediment from runoff.
  - 2. Sediment barriers shall be inspected after each rain and repaired as required to maintain proper function.
  - 3. Remove sediment behind barrier whenever sediment deposit reaches depth of approximately six inches.
  - 4. Materials:
    - a. Geotextile fabric: PennDOT 408, Section 735, Class 3 Type A or B.
    - b. Stakes: PennDOT 408, Section 865.2(c).
- F. Straw Bale Sediment Barrier:
  - 1. Straw bales shall be used only as short-term control measures.
  - 2. Bales shall be securely staked across areas of concentrated flow.
  - 3. Bales shall be inspected regularly and replaced as necessary.

- G. Stabilized Construction Entrance:
1. Install stabilized construction entrance at each point where construction traffic leaves Project site and enters any paved or public roads.
  2. Stabilized construction entrances shall be used to reduce tracking of mud onto paved roads.
  3. Any sediment or mud which flows or is tracked onto any paved or public roads shall be removed daily.
  4. The stabilized construction entrance shall be removed when permanent pavement structure will be constructed.
  5. Materials:
    - a. Rock: PennDOT 408, Section 703.3, AASHTO #1 – 8-inch thickness.
    - b. Geotextile fabric: PennDOT 408, Section 735, Class 4.
- H. Temporary Cover: The following methods shall be used to provide temporary ground cover and stabilization of erodible surfaces:
1. Seeding:
    - a. Refer to Section 02260, Paragraph 3.06C, for seed mix and rate of application.
    - b. Temporary seeding on slopes in excess of 5:1 shall be mulched. All temporary seeding between June 1 and September 15 shall be mulched. Temporary seeding shall be watered as required to develop cover.
    - c. Mulch shall be straw, shall be clean and free from noxious weeds, and shall be applied at the rate of 100 pounds (2-3 bales) per 1,000 square feet.
  2. Black Polyethylene Sheeting: 3 mil black polyethylene sheeting may be used to stabilize erodible/soluble material stockpiles. Sheets shall be overlapped so as to shed and not contain water. Sheets shall be anchored with tires or approved equal at six feet O.C. along seams and edges and ten feet O.C. throughout.
  3. Plywood Sheeting: Plywood sheeting may be used to protect existing vegetation under short duration storage/stockpile areas. Use of this protection method shall be limited to maximum four days. Contractor shall be responsible for restoring or replacing vegetation damaged under sheeting.

#### 1.08 RESTORATION

- A. After completion of construction, remove all temporary erosion and sedimentation control devices. Restore areas in which these devices were located to the original condition.

#### PART 2 – PRODUCTS

NOT APPLICABLE TO THIS SECTION

#### PART 3 – EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

**Section 01570**  
**Traffic Regulation**





SECTION 01570

TRAFFIC REGULATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. General requirements for control of public traffic through the Work area with the goal of ensuring safe and efficient traffic movement and providing safe working conditions for Contractor's personnel.

1.02 REGULATORY REQUIREMENTS

- A. Requirements of Regulatory Agencies:
  - 1. Traffic regulation on streets other than State Highways shall be performed in accordance with the requirements of Amity Township.
- B. State Highways:
  - 1. The Contractor shall provide traffic control in complete compliance with the rules and regulations of the Pennsylvania Department of Transportation (PennDOT), including but not necessarily limited to the following:
    - a. Pennsylvania Code Title 67, Transportation: Chapter 203 – Work Zone Traffic Control.
    - b. Pennsylvania Code Title 67, Transportation: Chapter 459 – Occupancy of Highways by Utilities.
    - c. Section 901 “Maintenance and Protection of Traffic During Construction” of the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented, and such other sections therein which complement Section 901.
- C. All signing, barricades, cones, and other traffic control devices shall conform to the requirements of Pennsylvania Code Title 67, Transportation:
  - 1. Chapter 203 – Work Zone Traffic Control.
- D. All traffic detouring is the responsibility of the Contractor.
- E. Contractor shall coordinate closing streets during working hours with Amity Township and surrounding affected municipalities.

PART 2 – PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 – EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION



**Section 01600**  
**Materials and Equipment**



## SECTION 01600

### MATERIAL AND EQUIPMENT

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Transportation and handling.
- B. Storage and protection.

##### 1.02 TRANSPORTATION AND HANDLING

- A. Transport and handle Products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to assure that Products comply with requirements, quantities are correct, and Products are undamaged.
- C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

##### 1.03 STORAGE AND PROTECTION

- A. Store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive Products in weather-tight, climate controlled enclosures.
- B. For exterior storage of fabricated Products, place on sloped supports, above ground.
- C. Provide off-site storage and protection when site does not permit on-site storage or protection.
- D. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- F. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- G. Arrange storage of Products to permit access for inspection. Periodically inspect to assure Products are undamaged and are maintained under specified conditions.

#### PART 2 – PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 – EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION

**Section 02010**  
**Subsurface Exploration**





SECTION 02010

SUBSURFACE EXPLORATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Digging Test Pits:

1. In locations where required by the Owner's Representative, or indicated on the Drawings, dig test pits to determine the location and elevation of existing subsurface utility pipelines, cables or structures. Dig such test pits in the presence of an authorized representative of the owner of the subsurface utility pipelines, cables or structures. The Contractor is further advised that no excavation, pipe laying or other work is permitted at above referenced locations without the presence or approval of an authorized representative of the owner of the subsurface utility.
2. In locations where new sewers are to be connected to existing sewers, the Contractor will not be permitted to proceed with new construction until he has dug test pits and determined the exact location and elevation of the existing sewers. Dig such test pits only at the locations agreed to by the Owner's Representative.
3. Digging test pits in locations required by the Owner's Representative or indicated on the Drawings will be classified as "Miscellaneous Unclassified Excavation and Refill."
4. Payment for this additional work will be made at the applicable unit prices bid under the Schedule of Unit Prices for Miscellaneous Unclassified Excavation.
5. Test pits or other miscellaneous excavation dug to obtain information on subsurface conditions or underground obstructions without written requirement of the Owner's Representative will be at the Contractor's expense.

PART 2 – PRODUCTS

NOT APPLICABLE TO THIS SECTION

PART 3 – EXECUTION

NOT APPLICABLE TO THIS SECTION

END OF SECTION



**Section 02100**  
**Clearing and Grubbing**



## SECTION 02100

### CLEARING AND GRUBBING

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. The Work of this Section includes, but is not limited to:
  - 1. Clearing.
  - 2. Grubbing.
  - 3. Stripping and stockpiling topsoil.
  - 4. Debris disposal.

##### 1.02 DEFINITIONS

- A. Clearing: The removal of trees, brush, down timber, rotten wood, rubbish, any other vegetation, and objectionable material at or above original ground elevation not designated to be saved. Clearing also includes removal of fences, walls, guard posts, guard rail, signs, and other obstructions interfering with the proposed work.
- B. Grubbing: The removal from below the surface of the natural ground of stumps, roots and stubs, brush, organic materials, and debris.

##### 1.03 JOB CONDITIONS

- A. The Contractor shall clear all obstructions within the permanent and construction rights-of-way except those specifically designated to be saved or restored, in the Specifications, or in the field. Right-of-way limits and obstructions specifically designated to be saved or restored will be marked by the Owner's Representative.
- B. Trees larger than 3 inches in diameter and shrubs planted by landowners shall not be cleared unless approved by the Owner's Representative.
- C. Contractor shall make every effort to protect and avoid damage to trees or shrubbery within the Project area(s). Prior to commencing with construction in any private right-of-way, the Contractor and Owner's Representative will meet with the property owner(s) to identify special needs and desires.

#### PART 2 – PRODUCTS

##### 2.01 MATERIALS

- A. Temporary Fencing:
  - 1. Undamaged picket snow fence, 4' high, formed of wooden slats, tightly woven with wire cable.
  - 2. Undamaged plastic temporary fence, 4' high, formed of polyethylene plastic fabric as manufactured by Tenag Corporation or equal.

3. Soil-set fence posts, studded "T" type, 6' high.
- B. Tree Wound Dressing:
1. Antiseptic and waterproof, asphalt base.

### PART 3 – EXECUTION

#### 3.01 PREPARATION

- A. Notify the Owner's Representative at least 48 hours prior to beginning any clearing work.
- B. Protect benchmarks, utilities, existing trees, shrubs, and other landscape features designated for preservation with temporary fencing or barricades satisfactory to the Owner's Representative. No material shall be stored or construction operation carried on within 4 feet of any tree to be saved or within the tree protection fence.
- C. When a private enclosure fence encroaches on the work area, notify the property owner at least 7 days in advance of the clearing/grubbing operations to permit the owner to remove it, construct a supplemental fence, or make such other arrangements as may be necessary for security purposes. Upon failure of the property owner to reasonably proceed with the work required to secure his property, carefully remove the fence, in whole or in part, and neatly pile the materials onto the owner's property. Reconstruct fence when work in area is complete.
- D. Inform all companies, individuals, and others owning or controlling facilities or structures within the limits of the work which have to be relocated, adjusted, or reconstructed in sufficient time for the utility to organize and perform such work in conjunction with or in advance of the Contractor's operations.
  1. Comply with the provisions of Pennsylvania Act 287 of 1974, as amended by Act 38 of 1991.

#### 3.02 EXECUTION

- A. Clearing:
  1. Confine clearing to within the limits of the right-of-way or easement.
  2. Fell trees in a manner that will avoid damage to trees, shrubs, and other installations which are to be retained.
  3. Where stumps are not required to be removed, flush-cut with ground elevation.
- B. Grubbing:
  1. Grub areas within the construction limits to remove roots and other objectionable material to a minimum depth of 8 inches.
  2. Remove all stumps within the cleared areas unless otherwise authorized by the Owner's Representative.
- C. Stripping and Stockpiling Topsoil:
  1. Strip topsoil to whatever depth it may occur from areas to be excavated, filled, or graded and stockpiles at a location approved by the Owner's Representative for use in finish grading.
  2. The topsoil is the property of the Owner and shall not be used as backfill or removed from the site.

D. Debris Disposal:

1. Trees, logs, branches, brush, stumps, and other debris resulting from clearing and grubbing operations shall become the property of the Contractor and shall be legally disposed.
2. Do not deposit or bury on the site debris resulting from the clearing and grubbing work.
3. Burning of debris is not acceptable within Amity Township.

E. Restoration:

1. Repair all injuries to bark, trunk, limbs, and roots of remaining plants by properly dressing, cutting, tracing and painting, using approved arboricultural practices and materials.
2. Replace all trees, shrubs, and plants designated to be saved which are permanently injured or die during the life of the Contract as a result of construction operations with like species acceptable to the project Owner.
3. Remove protective fences, enclosures, and guards upon the completion of the project.
4. Restore guard posts, guard rail, signs, and other interferences to the condition equal to that existing before construction operations.

END OF SECTION





**Section 02151**  
**Shoring**



## SECTION 02151

### SHORING

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Shoring, sheeting and bracing necessary to protect excavations against loss of ground, caving or slipping.
- B. Shoring, sheeting and bracing necessary to protect existing buildings, streets, walkways, utilities, and other improvements.

##### 1.02 RELATED SECTIONS

- A. Trenching, Backfilling and Compacting: Section 02221.

##### 1.03 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
  - 1. Shoring materials and installation work shall conform to Federal, State, and local laws, rules, regulations, and requirements.
  - 2. Provide material for sheet piling, sheeting bracing and shoring and drive or set in place in accordance with Federal, State, and local laws for excavations and construction and as may be required to protect the workers and the public, or to maintain the trench pay-line widths specified in Section 02221.

##### 1.04 SITE CONDITIONS

- A. Responsibility for Condition of Excavation:
  - 1. The failure or refusal of the Owner's Representative to suggest the use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to suggest sheeting, bracing, struts, or shoring to be left in place, shall not in any way or to any extent relieve the Contractor of any responsibility concerning the condition of excavation or of any of his obligations under the Contract, nor impose any liability on the Owner's Representative or the Owner; nor shall any delay, whether caused by any action or want of action on the part of the Contractor, or by any act of the Owner's Representative, Owner, or their agents, or employees, resulting in the keeping of any excavation open longer than would otherwise have been necessary, relieve the Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of his obligations under the Contract relating to injury to persons or property, nor entitle him to any claims for extra compensation.
- B. Tight Sheeting:
  - 1. Protect excavations deeper than eight feet with tight sheeting from the top of the original grade to below the structure foundation except for excavations where stable rock is

- encountered. If stable rock is encountered at a depth greater than eight feet but above the structure foundation, carry sheet down to the top of the rock.
2. Include cost for tight sheeting in the lump sum price bid in the Proposal for the structure or structures that requires the tight sheeting.
- C. The Owner's Representative reserves the right to order sheeting and bracing left in place for the protection of the finished work or adjacent property. Sheeting and bracing which have been ordered left in place by the Owner's Representative must be removed for a distance of three feet below the established or existing grade, whichever is lower. Trench bracing, except that which must be left in place, may be removed when the backfilling has reached the respective levels of such bracing.
  - D. Before starting work, check and verify governing dimensions and elevations.
  - E. Protect existing active sewer, water, gas, electricity and other utility services and structures.
  - F. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal and discontinuing of services, as affected by this work.

## PART 2 – PRODUCTS

### 2.01 MATERIALS

- A. General: Provide suitable shoring and bracing materials which will support loads imposed.
- B. Wood Materials: Use wood sheeting, sheet piling, bracing and shoring which is in good serviceable condition and timbers of sound condition.
- C. Steel Materials: Steel sheet piling and bracing of equal strength may be substituted for wood.

## PART 3 – EXECUTION

### 3.01 INSTALLATION

- A. Drive or set sheeting, sheet piling, braces or shores in place and arrange such that they may be withdrawn as the excavations are backfilled, without damage to piping and structures, and without damage to or settlement of adjacent structures and pavements.
- B. Owner's Representative reserves the right to order sheeting driven to the full depth of the excavation or to such additional depths as may be required for the protection of the work.
- C. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- D. When tight sheeting is required, it shall be driven to prevent adjacent soil from entering the excavation either below or through such sheeting.
- E. Install internal bracing, if required, to prevent spreading or distortion to braced frames.

- F. Remove sheeting, shoring and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.
- G. Repair or replace, as acceptable to Owner's Representative, adjacent work damaged or displaced through installation or removal of shoring and bracing work.

END OF SECTION



**Section 02221**  
**Trenching, Backfilling and**  
**Compacting**





SECTION 02221

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Trench Excavation for Piped Utilities.
- B. Bedding and Backfilling.
- C. Surface Restoration.

1.02 RELATED SECTIONS

- A. Clearing and Grubbing: Section 02100.
- B. Shoring: Section 02151.
- C. Finish Grading: Section 02260.
- D. Paving and Surfacing: Section 02500.
- E. Manholes: Section 02601.
- F. Gravity Wastewater Sewer: Section 02731.
- G. Force Mains: Section 02732.
- H. Cast-In-Place Concrete: Section 03300.

1.03 DESCRIPTION

- A. Definitions:
  - 1. Rock Excavation: Removal of consolidated hard mineral material mass exceeding one-half cubic yard in volume which, cannot be excavated except by drilling and blasting or drilling and wedging. Structure foundations of concrete or of masonry or stone laid in cement-mortar is classified as rock if the volume requiring removal at any single location exceeds one-half cubic yard. No soft or disintegrated rock which can be removed with a pick, or any material which can be broken down by sledge hammers, or any ledge or single boulder less than one-half cubic yard in volume, or loose, shaken, or previously blasted rock, or broken stone in rock filling or elsewhere, or rock exterior to the line of measurement as hereinafter specified, will be allowed as rock.
    - a. Items involved in the excavation such as sidewalks, curbs and street or roadway paving of whatever material is not classified as rock excavation.
  - 2. Unclassified Excavation: Removal of materials of any kind in the excavation, excluding rock excavation.

3. Miscellaneous Unclassified Excavation: Unclassified excavation required by the Owner's Representative and not included in other items for payment.
4. Subgrade: Trench bottom prepared as specified to receive pipe bedding, concrete cradle or concrete encasement or the bottom of excavations prepared to receive pipe line structures.

#### 1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
  1. AASHTO T99 – Moisture-Density Relations of Soils, Using a 5.5-lb. Rammer and a 12-in. Drop.
  2. AASHTO T191 – Standard Method of Test for Density of Soil In-Place by the sand cone method.
- B. American Society for Testing and Materials (ASTM):
  1. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- C. The "PDT Sections" noted herein refer to sections contained in the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408/90, as supplemented. The references pertain only to materials, construction equipment, methods and labor. The payment provisions do not apply to work to be performed under this Contract.
  1. PDT Section 703 Aggregates
- D. State Code: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67. Transportation, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities, July, 1989 (PennDOT Chapter 459).
- E. State Publication: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 203, Work Zone Traffic Control (PennDOT Chapter 203).

#### 1.05 PROJECT CONDITIONS

- A. State Highways: All work within the right of way of State Highways shall be performed in strict accordance with the requirements of PennDOT Chapter 459.
- B. Classification of Excavated Materials: Under this contract, all excavation shall be unclassified; that is, the removal of all materials, excluding rock, of any nature, kind, type or origin will be considered the same and shall be included in the unit pricing as indicated in the Bid Form.

### PART 2 – PRODUCTS

#### 2.01 MATERIAL

- A. Backfill Material: Excavated material free of cinders, ashes, refuse, vegetable, or organic material, boulders, rocks, stone, or other material which, in the opinion of the Owner's Representative, is unsuitable. Backfill material shall conform to the requirements established under "Classification of Backfill Materials", specified below.

- B. Aggregate Backfill and Bedding: Fine aggregates and coarse aggregates conforming to PDT Sections 703.1 and 703.2. Aggregate Backfill and Bedding requirements established under "Classification of Backfill and Bedding Materials", specified below.
- C. Flowable Fill: Per PennDOT requirements for state highways.
- D. Classification of Backfill and Bedding Materials:
  - 1. Pipe Bedding: AASHTO No. 8 Coarse Aggregate.
  - 2. Initial Backfill: AASHTO No. 8 Coarse Aggregate.
  - 3. Aggregate Backfill (To Restoration Depth Other Than Seeded/Sodded Areas): PennDOT No. 2A or PennDOT No. 2RC Coarse Aggregate where indicated on the Drawings.
  - 4. Backfill Material (To Restoration Depth, Seeded/Sodded Areas): Excavated material approved by the Owner's Representative and containing no stones larger than six (6) inches in maximum dimension. A maximum of 20% of the backfill volume may be stones so long as the stones are evenly distributed within the material.
  - 5. Miscellaneous Aggregate Backfill (Unsuitable Subgrade Replacement): AASHTO No. 3 Coarse Aggregate.
- E. Underground Warning Tape:
  - 1. Reinforced underground utility marking tape with minimum 8.0 mil overall thickness molecular weight virgin polyethylene, warp oriented, coated and closed cross-woven 10 x 7 count. No less than 2000 lb. tensile break strength per 12" wide. Provide 6-inch minimum width tape, color coded, impregnated with color-stable, lead-free, organic pigments suitable for direct burial. Permanent printing under Mylar layer shall repeat "Sanitary Sewer Buried Below".
  - 2. Non-magnetic.
  - 3. Provide for:
    - a. Sanitary sewers, green.

### PART 3 – EXECUTION

#### 3.01 TRENCH PREPARATION AND EXCAVATION

- A. Perform clearing and grubbing in accordance with requirements of Section 02100.
- B. Perform sheeting and shoring in accordance with requirements of Shoring: Section 02151.
- C. General: Excavation of every description and of whatever substances encountered shall be performed to the lines and grades indicated on the Drawings and specified herein, or as directed by the Owner's Representative.
  - 1. Excavation shall be made by open cut, unless written permission to tunnel or bore is given by the Owner's Representative or is specifically outlined in the specifications or shown on the Drawings.
  - 2. Trenches may be excavated and backfilled either by machinery or by hand as the Contractor may elect, provided, however, the Contractor shall use hand excavation where necessary to protect existing structures, utilities, or private or public properties and provided, further, that backfilling shall be done by hand to the extent hereinafter specified.
  - 3. The Contractor shall have no claim for extra compensation due to the fact that hand excavation, instead of machine excavation, may be made necessary from any cause whatever.

4. Begin excavation in trenches at the control point having the lower invert and proved upgrade.
5. Remove rock to subgrade at least 25 feet in advance of pipe laying.
6. Remove rock below subgrade of manhole locations if shattered due to rock removal operations, and in the opinion of the Owner's Representative it is unfit for foundations. Backfill to subgrade with 3,000 psi concrete per requirements of Section 03300, or other material acceptable to the Owner's Representative.
7. Excavate rock in miscellaneous excavations to the extent required by the Owner's Representative.

D. Stripping, Storing and Restoring Surface Items: The Contractor shall remove all paving, sub-paving, curbing, gutters, brick, paving block, granite curbing, flagging or other similar materials, and grub and clear the surface over the area to be excavated. He shall properly store and preserve such materials that may be required for future use in restoring the surface. The Contractor shall be responsible for any loss or damage to said materials because of careless removal or neglectful or wasteful storage, disposal, or use of the materials.

1. All materials which may be removed, including rock, earth and sand taken from the excavation, shall be stored, if practical, in the roadway or such other suitable place and in such manner as the Owner's Representative shall approve.
2. If more materials are removed from any trench than can be backfilled over the completed pipe or stored in the street, leaving space for traffic, the excess materials shall be removed and stored at a suitable site provided by the Contractor.
3. The Contractor shall bring back as much of the approved materials so removed as may be required to properly refill the trench.
4. When directed by the Owner's Representative, the Contractor shall furnish such other suitable materials as may be necessary to properly refill the trench.
5. The Contractor shall restore all shrubbery, fences, poles or other property and surface structures, removed or disturbed as a part of the work, to a condition equal to that before the work began, furnishing all labor and materials incidental thereto.
6. The Owner's Representative may mark certain trees, shrubs, or other items that are not to be disturbed or damaged. In the event such items are disturbed or damaged, they shall be replaced or compensated by the Contractor.
7. Any tree which is approved by the Owner's Representative for removal shall be cut into four foot lengths and stacked next to the pipe line right-of-way and become the property of the land owner if it is so desired, otherwise it shall become the property of the Contractor and shall be removed.

E. Width of Trench: Pipe trenches shall be sufficiently true in alignment to permit the pipe to be laid in the approximate center of the trench. The trench shall be wide enough to provide a free working space on each side of the pipe; however, the trench width at least 12 inches above the top of the outside barrel of the pipe shall not exceed dimensions shown in the following table:

Maximum Trench Widths

Nominal Pipe Diameter (Inches)	Aggregate Backfill and Temporary Pavement (Width Inches)	Final Pavement Restoration (Width Inches)	Final Seed/Sod Restoration (Width Feet)
3 and smaller	12	36	30
4	24	48	30
6	24	48	30
8	24	48	30
10	28	52	30
12	30	54	30

Maximum Trench Widths

Nominal Pipe Diameter (Inches)	Aggregate Backfill and Temporary Pavement (Width Inches)	Final Pavement Restoration (Width Inches)	Final Seed/Sod Restoration (Width Feet)
14	32	56	30
15	33	57	30
16	34	58	30
18	36	60	30
20	40	64	30
21	42	66	30
24	48	72	30
27	54	78	30
30	60	84	30
33	63	87	30
36	66	90	30
42	75	99	30
48	84	108	30
54	90	114	30
60	96	120	30
66	106	130	30

1. At manholes, the width for excavation and restoration shall be measured to the limits specified in Section 02601, Paragraph 3.02B.
2. Where sheeting and shoring are used, the maximum allowable width of trench as shown in the preceding table shall be measured between the closest interior faces of the sheeting or shoring as placed. Whenever, for any reason, the maximum trench width is exceeded below the top of the pipe, the Contractor may be ordered by the Owner's Representative to cradle or encase the pipe in concrete at the Contractor's expense in order to insure the structural integrity of the pipe.
3. If the maximum width of trench specified above cannot be maintained, the Contractor shall install temporary sheeting at his own cost and expense.
4. Where lines are to be constructed on rights-of-way or easements in open areas, the maximum width of trench at the top specified hereinbefore may be exceeded only if the construction is kept entirely within the limits of the right-of-way or easements and can be carried on without damage to adjoining property. The angle of slope shall be the angle at which the trench bank will stand without sliding and in no case shall the angle of slope be steeper than one-half horizontal to one vertical.
5. In locations other than rights-of-way or easements, the Owner's Representative may, as warranted by working conditions, and where permitted by the Pennsylvania Department of Labor and Industry requirements, waive the requirements that the maximum width of trench at the top shall not exceed the dimensions specified hereinbefore.
6. Excavate rock for manhole and chamber installation one foot outside the exterior lines of the manhole walls and to a depth of six inches below the outside bottom.

- F. Length of Trench:
1. The Contractor shall limit all trench openings to a distance commensurate with all rules of safety.
    - a. Complete trench excavation at least twenty-five feet in advance of pipe laying and keep trenches free from obstructions, except that at the end of a work day or at the discontinuance of work, the pipe laying may be completed to within five feet of the end of the open trench. Additional open trench limitations as follows:
      - (1) The Owner's Representative is empowered to require trench refilling over completed pipelines if in his judgement such action is necessary. No claim for extra compensation will be allowed for such trench refilling even though work must be stopped elsewhere as a result.
      - (2) If Work is stopped on a trench, except as required by the Owner's Representative, and the excavation is left open for an unreasonable period in advance of construction in the opinion of the Owner's Representative, the Owner's Representative may order trench refilling at the Contractor's expense and not allow trench reopening until ready for actual use.
- G. Pumping and Draining: The Contractor shall remove by pumping, draining, or otherwise, any water which may accumulate in the trenches and other excavations and shall build all dams and do all other work necessary to keep the trenches or other excavation as free from water as possible.
1. Where it is impractical to completely drain the trench, special pipe or jointing materials may be authorized.
  2. While the pipelines are being laid, the Contractor shall have sufficient pumping machinery ready for immediate use.
  3. All surface waters shall be prevented from entering the open ditches or excavations by proper grading of the surface in the vicinity of the excavation.
- H. Accommodations of Drainage: The Contractor shall keep gutters, sewers, drains and ditches open at all times so that the flow of storm or other waters shall not be obstructed. If the material excavated from the trenches must temporarily extend over gutters or other waterways, it shall be the duty of the Contractor to plank or bridge over the gutters, without extra compensation, so that the flow of water is not impeded.
- I. Maintenance of Traffic: Work shall be conducted so as to cause a minimum of inconvenience to pedestrian and vehicular traffic and to private and public properties along the line of work. It shall be the duty of the Contractor, at all times, to maintain crossings, walks, sidewalks, driveways, and other roadways open to traffic and in a satisfactory condition, and to keep all fire hydrants, water valves, fire alarm boxes, and letter boxes accessible for use. Whenever it is necessary to maintain pedestrian traffic over open trenches, a timber bridge at least three feet in width and equipped with side railings shall be provided. When the excavated material will encroach upon sidewalks or private property, planking shall be placed in order to keep the sidewalk or private property clear of excavated material.
1. In important thoroughfares, highways, or in narrow streets, the material excavated from the trench shall be removed from the site of the work at the Contractor's own expense in order to provide suitable space for traffic. The Contractor shall, at his own expense, bring back as much of the approved material as necessary to properly refill the trench; or he shall, at his own cost and expense, furnish such other suitable materials as may be necessary to properly refill the trench.
  2. When the Work necessitates that an existing driveway be blocked, the Contractor shall judiciously work to reopen the driveway as soon as possible.

3. When it is necessary to haul soft or wet materials over public streets, the Contractor shall provide suitable vehicles and shall conform to all laws and ordinances relevant to such hauling.
  4. Maintenance and protection of traffic on Township streets and State Highways shall be in strict accordance with PennDOT Form 408, Section 900; and Title 67, Chapter 203. The Contractor shall modify the sign locations daily in order to protect that section of highway to be disturbed during that same day.
  5. When working in other public rights of way, maintenance of traffic shall be as directed by the governing authority.
- J. Blasting and Explosives: Not permitted in performance of trenching work.
- K. Protection of Utilities, Property and Structures: The existence and location of underground utilities as indicated on the Drawings is presented merely to serve as a notification that such utilities do exist in the general proximity of the work. Any utilities not shown, or not located as shown, shall not be cause of the Contractor to deny responsibility for their protection and/or repair during construction.
1. The Contractor shall notify all utility companies in advance of construction to include requesting the utilities to be located in accordance with Pennsylvania Act 287 as amended by Act 38 of 1991, and cooperate with agents of these companies during the progress of the work. Procedures for emergency action and repairs to utilities shall be established with the utility company prior to commencement of the work. During the course of his work, if the Contractor damages any of the aforementioned utilities, he shall immediately follow the procedure of emergency action and repair as established at his own expense.
  2. Whenever the Contractor, during the progress of the excavation, shall uncover service pipes or lines, which because of injury or age are in poor condition, he shall immediately notify the proper authority in order that steps may be taken for replacement or repair. Locations of repairs, and the procedures of repairs that have been made shall be recorded by the Contractor.
  3. The Contractor shall, at his own expense, sustain in their places, and protect from direct or indirect injury, all pipes, conduits, tracks, walls, buildings, and other structures or property in the vicinity of his work, whether above or below the ground, or that may appear in the trench. He shall at all times have a sufficient quantity of timber and plank, chains, ropes, etc., on the ground and shall use them as necessary for sheeting his excavations and for sustaining or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened, whether such structures are or are not shown on the drawings.
  4. Pipes and underground conduits exposed as a result of the Contractor's operations shall be adequately supported along their entire exposed length by timber or planking, installed in such manner that the anchorage of the supporting members will not be disturbed or weakened during the backfilling operation. Backfill of selected material shall be carefully rammed and tamped under and around the supports and all supports shall be left in place as a guard against breakage of the supported structure due to trench settlement.
  5. Where necessary, in order to keep one side of the street or roadway free from any obstruction or to keep the material piled alongside of the trench from falling on private property outside the right-of-way, a safe and suitable fence shall be placed alongside the trench.

### 3.02 PIPE BEDDING AND TRENCH BACKFILL

- A. Bedding: The trench shall be excavated to a depth of six (6) inches below the outside diameter of the pipe barrel, or deeper if so specified. The resultant subgrade shall be undisturbed, or

compacted as approved by the Owner's Representative if disturbed. The bedding shall then be prepared by placing a thoroughly compacted aggregate pipe bedding and initial backfill material, as specified hereinafter, in 4-inch (uncompacted thickness) layers to 12-inches above top of pipe. Bedding shall provide uniform and continuous bearing and support for the pipe at every point between bell holes.

1. Bedding installation for PVC pipe shall be in accordance with ASTM D2321.
  - a. Assure that sufficient bedding is worked under the haunching of the pipe to provide adequate side support.
  - b. Prevent movement of pipe during placing of material under the pipe haunch. Walking or standing on pipe will not be permitted.
  - c. Excessive tamping of Initial Backfill material over the top of the pipe will not be permitted.
  - d. Do not use rolling equipment or heavy tampers to consolidate backfill until at least two feet of backfill is placed over the top of the pipe.
  
- B. Special Bedding:
  1. Concrete Cradle and Concrete Encasement: If concrete cradle and/or encasement is indicated on the Drawings or required by the Owner's Representative, the trench shall be excavated to a depth of six (6) inches below the outside of the barrel of pipes 24-inches in diameter or less and nine (9) inches below the outside of the barrel of pipes larger than 24-inches in diameter. All of this excavation may be done by machine. Method of placement is specified in Section 02731.
  2. Unstable Subgrade: Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the opinion of the Owner's Representative, should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth recommended by the Owner's Representative and replace with Aggregate Backfill.
    - a. Before pipe is laid, the subgrade shall be made by backfilling with aggregate material, as directed by the Owner's Representative, in 3-inch (uncompacted thickness) layers thoroughly tamped and the bedding prepared as hereinbefore specified.
  3. Special Foundations: Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the Owner's Representative, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, the Contractor shall construct a foundation for the pipe, consisting of piling, timbers or other materials, in accordance with plans prepared by the Owner's Representative.
  
- C. Backfilling Methods:
  1. General: Backfilling shall not be done in freezing weather except by permission of the Owner's Representative, and it shall not be done with frozen material. Do not backfill when the material already in the trench is frozen.
    - a. Where aggregate backfill is not indicated on the Drawings or specified herein, and in the opinion of the Owner's Representative should be used in any part of the work, the Contractor shall furnish and backfill with aggregate as directed.
  2. In State Highways all backfill shall be in accordance with the requirements of PennDOT Chapter 459.
  3. Should there be a deficiency of proper backfill material, provide acceptable borrow material at no additional expense to the Owner.
  4. No bulkheads or retaining walls for backfilling will be allowed in the trenches over piping, except for temporary use.



5. Do not permit excavations to be used as refuse dumping areas.
- D. Pipe Bedding Beneath and to Centerline of Pipe: All trenches shall be backfilled, from the bottom of the trench to the centerline of the pipe with bedding material placed in layers of 4 inches (uncompacted thickness) and compacted by tamping or other approved mechanical methods. Bedding material shall be deposited in the trench for its full width on each side of the pipe and fittings simultaneously.
- E. Initial Backfill Over Pipe: From the centerline of the pipe and fittings to a depth of one (1) foot above the top of the pipe, the trench shall be backfilled by hand or by approved mechanical methods. The Contractor shall use special care in placing this portion of the backfill so as to avoid injuring or moving the pipe. The backfill shall be placed in layers and compacted by tamping or other approved mechanical methods. Depth of backfill layers shall be based on the recommendations of the compaction equipment manufacturer. Information indicating the manufacturer's recommendations shall be approved by the Township Engineer. In lieu of the manufacturer's recommendations, a maximum layer thickness of 12" shall be used. Do not machine compact immediately over pipe in Initial Backfill. Step back lifts of backfill in trench.
- F. Aggregate Backfill to Restoration Depth (Areas other than Seeded/Sodded Areas): From one (1) foot above the top of the pipe to restoration depth, the trench shall be backfilled by hand or by approved mechanical methods. Backfill in this section of the trench shall be coarse aggregate material subject to limitations specified and consolidated by tamping in layers or other approved mechanical methods unless otherwise specified. Any consolidation method utilizing water such as jetting or puddling shall not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching. Depth of backfill layers shall be based on the recommendations of the compaction equipment manufacturer. Information indicating the manufacturer's recommendations shall be approved by the Township Engineer. In lieu of the manufacturer's recommendations, a maximum layer thickness of 12" shall be used.
- G. Backfill Material to Restoration Depth (Seeded/Sodded Areas): From one (1) foot above the top of the pipe to restoration depth, the trench shall be backfilled by hand or by approved mechanical methods. Backfill in this section of the trench shall be excavated material subject to limitations specified and consolidated by tamping in layers or other approved mechanical methods unless otherwise specified. Any consolidation method utilizing water, such as jetting or puddling shall not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching. Depth of backfill layers shall be based on the recommendations of the compaction equipment manufacturer. Information indicating the manufacturer's recommendations shall be approved by the Township Engineer. In lieu of the manufacturer's recommendations, a maximum layer thickness of 12" shall be used.
- H. Underground Warning Tape: For the purposes of early warning and identification of buried pipes during future trenching or other excavation, provide continuous identification tapes in trenches. Install in accordance with printed recommendations of the tape manufacturer, and as modified herein. Bury tape at a depth of 12 inches below grade; in pavements measure 12 inches from subgrade of pavement.
- I. Compacting: During the course of backfilling and compacting work, the Owner's Representative may, at any location or depth of trench, make tests to determine whether the Contractor's compaction operations are sufficient to meet specified requirements. Compact trench backfill as follows:
1. All trench excavation and backfill within State Highway right-of-way will be subject to inspection by representatives of the Commonwealth of Pennsylvania, Department of

Transportation, and the work must be performed in accordance with the requirements of that department.

2. Use mechanical tampers to compact backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 90 percent of maximum density obtained at optimum moisture content as determined by AASHTO T99. Perform field determinations of density, when requested by the Owner's Representative, in accordance with AASHTO T191.
3. The use of HYDRA-HAMMER for compacting backfill in trenches is prohibited.
4. The use of puddling, jetting, or backhoe bucket for compacting backfill in trenches is prohibited.

### 3.03 RESTORATION AND CLEAN-UP OF SURFACE

- A. Replacement of Structures by Contractor: The Contractor shall restore (unless otherwise stipulated) all sidewalks, curbs, gutters, shrubbery, fences, poles, sod or other property and surface structures removed or disturbed as a part of the work to a condition equal to that before the work began, furnishing all labor and materials incidental thereto.
  1. Replacement of curbs and sidewalks, shall be in full accordance with the materials and methods specified in Section 02500 - Paving and Surfacing and as detailed on the Drawings.
- B. Pavement Replacement: As specified in Section 02500.
- C. Finish Grading: Seeding or sodding as specified in Section 02260.
- D. Clean-Up and Maintenance of Surfaces:
  1. 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. Failure of the Contractor to perform this work shall be cause for the Owner's Representative to order the work by others, and charge all costs to the Contractor.
    - a. All surplus materials furnished by the Contractor and temporary structures shall be removed from the site by the Contractor.
    - b. All dirt, rubbish and excess earth from the excavation shall be disposed of by the Contractor in a manner and place acceptable to all governing agencies.
    - c. The construction site shall be left clean at the end of each working day to the satisfaction of the Owner's Representative.
  2. Repair or Correction of Unsatisfactory Conditions: All unsatisfactory conditions resulting from the Work shall be corrected.
    - a. Any subnormal or dangerous condition caused by the Work, on any surface, shall be repaired or corrected within two hours of observance or notification of its existence. If repairs or corrections are not made within this period, the Owner shall cause to have the work completed with the resulting costs charged to the Contractor.
    - b. There will be no additional payment made for maintenance work.
  3. Contractor shall be responsible for injury or damage resulting from lack of trench maintenance during the correction period. If trench surfaces are not satisfactorily maintained or repairs are not begun within three days after written notice from the Owner's Representative, such repairs will be made by the Owner and the resulting costs charged to the Contractor.

- E. Traffic Signal Systems: Severed, damaged or removed loop detectors, lead-in wires, conduit, junction boxes, etc., shall be repaired within five (5) days at no cost to the Owner. The Contractor shall engage a PennDOT approved traffic signal contractor to perform repairs/restoration. Only PennDOT approved materials shall be used.

END OF SECTION



**Section 02260**  
**Finish Grading**



SECTION 02260

FINISH GRADING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. The Work of this section includes, but is not limited to:
  - 1. Placing topsoil.
  - 2. Soil conditioning.
  - 3. Finish grading.
  - 4. Seeding.
  - 5. Sodding.
  - 6. Maintenance.

1.02 QUALITY ASSURANCE

- A. Testing Agency:
  - 1. The Contractor has the option to use soil testing to justify decreasing lime and fertilizer rates. When soil testing is selected by the Contractor, the soil and soil supplement testing shall be performed by a Soils Testing laboratory engaged and paid for by the Contractor and approved by the Owner's Representative.
    - a. Collect soil samples under the direction of the Owner's Representative.

1.03 REFERENCES

- A. Pennsylvania Department of Transportation Publication 408 Specifications (PDT):
  - 1. PDT Section 804 Seeding and Soil Supplements.
- B. Pennsylvania Seed Act of 1965, Act 187, as amended.
- C. Agricultural Liming Materials Act of 1978, P.L. 15, No. 9 (3 P.S. 132-1), as amended.
- D. Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86 (3 P.S. 68.2), as amended.
- E. Rules for Testing Seeds of the Association of Official Seed Analysts.

1.04 SUBMITTALS

- A. Samples:
  - 1. When directed, furnish three strips of sod, 4½ feet long by 12" wide, laid on 3" of topsoil and tamped in place. The samples shall be representative of the sod and workmanship to be provided.
  - 2. Advise the Owner's Representative of the location of the field, and area within the field, from which the sod is to be taken for approval.

- B. Certificates:
  - 1. Prior to use or placement of material, submit certifications of material composition of the following for approval:
    - a. Topsoil analysis.
    - b. Fertilizer.
    - c. Lime.
    - d. Seed mixture(s).
  - 2. If soil tests are performed to justify decreased liming and fertilizer rates, submit certified soil sample analyses, including laboratory's recommended soil supplement formulation.

#### 1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Seed:
  - 1. Deliver seed fully tagged and in separate packages according to species or seed mix. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.
- B. Sod:
  - 1. Mow sod in the field to a height of not more than 2½" within 5 days prior to lifting.
  - 2. Cut sod to a depth equal to the growth of the fibrous roots, but in no case less than 1½", exclusive of grass and thatch. Do not cut sod when the ground temperature is below 32°F.
  - 3. Deliver sod to the project site within 24 hours after being cut and place sod within 36 hours after being cut. Do not deliver small, irregular, or broken pieces of sod.
  - 4. During wet weather, allow sod to dry sufficiently to prevent tearing during handling and placing. During dry weather, moisten sod to ensure its vitality and to prevent dropping of the soil during handling. Sod which dries out will be rejected.

### PART 2 – PRODUCTS

#### 2.01 TOPSOIL

- A. Having a pH of between 6.0 and 7.0; containing not less than 2% nor more than 10% organic matter as determined by AASHTO T194.
- B. Fertile friable loam, sand loam, or clay loam which will hold a ball when squeezed with the hand, but which will crumble shortly after being released.
- C. Free of clods, grass, roots, or other debris harmful to plant growth.
- D. Free of pests, pest larvae, and matter toxic to plants.

#### 2.02 FERTILIZER

- A. Basic Dry Formulation Fertilizer:
  - 1. Analysis 0-20-20 and as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.



- B. Starter Fertilizer:
  1. Analysis 10-5-5 or 12-6-6 and as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.

2.03 LIME

- A. Raw ground limestone conforming to Publication 408, Section 804.2(a)

2.04 SEED

- A. Fresh, clean, dated material from the last available crop and within the date period specified, with a date of test not more than 9 months prior to the date of sowing. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance. All seeds will be subject to analysis and testing.

Table 1 – Grass and Agricultural Seeds

Species	Minimum Guaranteed Purity (Percent)	Maximum Weed Seed (Percent)	Minimum Guaranteed Germination (Percent)
Kentucky Bluegrass ( <i>Poa pratensis</i> ) Domestic Origin; min. 21 lb. per bushel	90	0.02	80
Perennial Ryegrass ( <i>Lolium perenne</i> , var. Pennfine)	95	0.15	90
Kentucky 31 Fescue ( <i>Festuca elatior arundinacea</i> )	98	0.25	85
Crownvetch ( <i>Coronilla varia</i> , var. Penngift)	99	0.10	70
Pennlawn Red Fescue ( <i>Festuca rubra</i> , var. Pennlawn)	98	0.25	90
Annual Rye Grass ( <i>Lolium multiflorum</i> )	95	0.25	95
Timothy ( <i>Phleum pratense</i> )	98	0.25	95

2.05 SEED MIXTURES

- A. See “Seeding Restoration Table” in Part 3, Article 3.06.

2.06 INOCULANT

- A. Inoculate leguminous seed before seeding with nitrogen fixing bacteria culture prepared specifically for the species.

- B. Do not use inoculant later than the date indicated by the manufacturer.
- C. Protect inoculated seed from prolonged exposure to sunlight prior to sowing.
- D. Reinoculate seed not sown within 24 hours following initial inoculation.

## 2.07 MULCHING MATERIALS

- A. Mulches for seeded areas shall be one, or a combination of, the following:
  - 1. Hay:
    - a. Cured to less than 20% moisture content by weight.
    - b. Contain no stems of tobacco, soybeans, or other coarse or woody material.
    - c. Timothy hay or mixed clover and timothy hay.
  - 2. Straw:
    - a. Cured to less than 20% moisture content by weight.
    - b. Contain no stems of tobacco, soybeans, or other coarse or woody material.
    - c. Wheat or oat straw.
  - 3. Wood Cellulose:
    - a. No growth or germination inhibiting substances.
    - b. Green, air dried. Packages not exceeding 100 pounds.
    - c. Requirements:
 

Moisture content:	12% ±3%
Organic Matter:	98.6% ±0.2% on the oven dry basis
Ash content:	1.4% ±0.2%
Minimum water-Holding Capacity:	1000%
  - 4. Mushroom Manure:
    - a. Organic origin, free of foreign material larger than 2" and substances toxic to plant growth.
    - b. Organic Matter: 20% minimum
    - c. Water-Holding Capacity: 120% minimum
    - d. pH: 6.0

## 2.08 SOD

- A. At least three year old, well-rooted Kentucky Bluegrass (*Poa pratensis*) sod containing a growth of not more than 10% of other grasses and clovers.
- B. Free from noxious weeds such as Bermuda grass, wild mustard, crab grass, and kindred grasses.

## PART 3 – EXECUTION

### 3.01 TIME OF OPERATIONS

- A. Spring Seeding:
  - 1. Preliminary operations for seed bed preparation may commence as soon after February 15 as ground conditions permit.
- B. Fall Seeding:
  - 1. Preliminary operations for seed bed preparation may commence after July 15.

### 3.02 PREPARATION OF SUBGRADE

- A. "Hard pan" or heavy shale:
  - 1. Plow to a minimum depth of 6".
  - 2. Loosen and grade by harrowing, discing, or dragging.
  - 3. Hand rake subgrade. Remove stones over 2" in diameter and other debris.
- B. Loose loam, sandy loam, or light clay:
  - 1. Loosen and grade by harrowing, discing, or dragging.
  - 2. Hand rake subgrade. Remove rocks over 2" in diameter and other debris.

### 3.03 PLACING TOPSOIL

- A. Replace topsoil and spread over the prepared subgrade to obtain the required depth and grade elevation. Final compacted thickness of topsoil not less than 3-1/2".
- B. Hand rake topsoil and remove all materials unsuitable or harmful to plant growth.
- C. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry.
- D. Do not handle topsoil when frozen or muddy.

### 3.04 TILLAGE

- A. After seed bed areas have been brought to proper compacted elevation, thoroughly loosen to a minimum depth of 5" by discing, harrowing, or other approved methods. Do not work topsoiled areas when frozen or excessively wet.
- B. Liming:
  - 1. Distribute limestone uniformly at a rate of 100 pounds per 1,000 square feet.
  - 2. Thoroughly incorporate into the topsoil to a minimum depth of 4".
- C. Basic Fertilizer:
  - 1. Distribute basic fertilizer uniformly at the rate shown in Seeding Restoration Table.
  - 2. Incorporate into soil to depth of 4" by approved methods.
  - 3. Incorporate as part of tillage operation.
- D. Liming and Fertilizer rates may be decreased if lesser rates are indicated by soil tests provided by the Contractor.

### 3.05 FINISH GRADING

- A. Remove unsuitable material larger than 2" in any dimension.
- B. Uniformly grade surface to the required contours without the formation of water pockets.
- C. Rework areas which puddle by the addition of topsoil and fertilizer. Re-rake.
- D. Distribute starter fertilizer as shown in Seeding Restoration Table.

- E. Incorporate starter fertilizer into the upper 1” of soil.

3.06 SEEDING

- A. Uniformly sow specified seed mix by use of approved hydraulic seeder, power-drawn drill, power-operated seeder, or hand-operated seeder or by hand. Do not seed when winds are over 15 mph.
- B. Upon completion of sowing, cover seed to an average depth of 1/4” by hand re-raking or approved mechanical methods.
- C. Seed and soil supplement materials application as follows:

Seed Restoration Table

Restoration Condition	Topsoil	Lime*	Basic Fertilizer	Starter Fertilizer	Seed Mix and Sowing Rate (% by Weight)
Temporary Cover (**)	N/A	N/A	N/A	N/A	100% Annual Ryegrass Sow 9# per 1000 Sq. Yds. March through May/August through September
Bank Areas	Yes	100# per 1000 Sq. Ft.	No	10-5-5 @ 50# per 1000 Sq. Ft. or 12-6-6 @ 33# per 1000 Sq. Ft.	45% Crownvetch 55% Annual Ryegrass Sow 9# per 1000 Sq. Yds Anytime except September and October
Lawns and Park	Yes	100# per 1000 Sq. Ft.	0-20-20 @ 50# per 1000 Sq. Ft.	10-5-5 @ 50# per 1000 Sq. Ft. or 12-6-6 @ 33# per 1000 Sq. Ft.	50% Kentucky Bluegrass 30% Pennlawn Red Fescue 20% Perennial Ryegrass Sow 21# per 1000 Sq. Yds. March through May/August through September
Open Fields and Woods	No	No	No	10-5-5 @ 50# per 1000 Sq. Ft. or 12-6-6 @ 33# per 1000 Sq. Ft.	100% Red Fescue Sow 36# per 1000 Sq. Yds. March through May/August through September

\* Unless lesser rate indicated by soil test.  
 \*\* Unless otherwise specified in the Section 01560.

- D. Seeding and soil supplement material application may be performed by the hydroseeding method. Rates of application, methods and equipment shall be approved by the Owner’s Representative prior to commencing with work.

3.07 MULCHING

- A. Mulching within 48 hours of seeding.
- B. Place hay and straw mulch in a continuous blanket at a minimum rate of 1,200 pounds per 1,000 square yards.
  - 1. Anchor hay or straw mulch by use of twine, stakes, wire staples, paper, or plastic nets.

2. Emulsified asphalt may be used for anchorage provided it is applied uniformly at a rate not less than 31 gallons per 1,000 square yards.
  3. Apply approved chemical mulch binders at the manufacturer's recommended rate.
- C. Chemical mulch binders or a light covering of topsoil may be used for anchorage when the size of the area precludes the use of mechanical equipment.
- D. Apply wood cellulose fiber hydraulically at a rate of 320 pounds per 1,000 square yards.
1. Incorporate as an integral part of the slurry after seed and soil supplements have been thoroughly mixed.
- E. Spread mushroom manure uniformly to a minimum depth of 1/2".
- F. When mulch is applied to grass areas by blowing equipment, the use of cutters in the equipment will be permitted to the extent that a minimum of 95% of the mulch is 6" or more in length. For cut mulches applied by the blowing method, achieve a loose depth in place of not less than 2".
- G. When mulching by the asphalt mix method, apply the mulch by blowing. Spray the asphalt binder material into the mulch as it leaves the blower. Apply the binder to the mulch in the proportion of 1.5 to 2.0 gallons per 45 pounds of mulch.
1. Protect structures, pavements, curbs, and walls to prevent asphalt staining.
  2. Erect warning signs and barricades at intervals of 50 feet or less along the perimeter of the mulched area.
  3. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a street or other body of water.

### 3.08 SODDING

- A. Prior to sod placement, complete soil preparation or topsoiling. Place sod within 7 days of trench backfill.
- B. Apply lime and fertilizer as specified. Work into the soil a minimum of 2".
- C. Do not place sod when the temperature is lower than 32°F.
- D. Place sod by hand with tight joints and no overlap. Transverse joints shall be broken or staggered.
- E. Place sod so that the top of the sod is flush with the surrounding grade.
- F. Use of tools which damage the sod or dumping of sod from vehicles will not be permitted.
- G. Water sod to the saturation point immediately after placement.
- H. After watering, tamp with an approved tamper to close all joints and insure close contact between sod and sod bed. After tamping, the sod shall present a smooth, even surface free from bumps and depressions. If so directed, use a light roller, weighing not more than 65 pounds per foot of roller width to complete firming and smoothing the sod.
- I. When placing sod in ditches, place the strip with the long dimension at right angles to the flow of water. At any point where water will start flowing over a sodded area, the upper edge of the

sod strips shall be turned into the soil below the adjacent area and a layer of compacted earth placed over this juncture to conduct the water over the edge of the sod.

- J. In ditches and on slope areas, stake each strip of sod securely with at least 1 wood stake for each 2 square feet of sod. Stakes shall be 1/2" by 1" with a length of 8" to 12". Drive stakes flush with the top of the sod, with the long face parallel to the slope contour.

### 3.09 MAINTENANCE

- A. Maintenance includes watering, weeding, cleanup, edging and repair of depressions, washouts or gullies.
- B. Those areas which do not show a prompt catch of grass within 14 days of seeding or sodding shall be reseeded or resodded until complete grass catch occurs.

END OF SECTION

**Section 02500**  
**Paving and Surfacing**





## SECTION 02500

### PAVING AND SURFACING

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Temporary Paving.
- B. Permanent Paving.
- C. Shoulder Restoration.
- D. Cement Concrete Sidewalks and Curbs.
- E. Bituminous Pavements.

##### 1.02 RELATED SECTIONS

- A. Trenching, Backfilling and Compaction: Section 02221.
- B. Pavement Markings: Section 02855.

##### 1.03 QUALITY ASSURANCE

- A. Source Quality Control:
  - 1. Use materials conforming to requirements of the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, latest edition.
  - 2. Use products of a bituminous concrete producer regularly engaged in production of bituminous concrete conforming to the standards referenced herein.
  - 3. Maintain quality of work by using products of a qualified bituminous concrete producer and qualified plant operating workmen.
- B. Requirements of Regulatory Agencies:
  - 1. Removal, protection and replacement of paving on State Highways must be performed in accordance with the requirements of the Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 459, Occupancy of Highways By Utilities.
  - 2. Removal, protection, and replacement of paving on State Highways will be subject to inspection by representatives of the Commonwealth of Pennsylvania Department of Transportation.
  - 3. Inspection, insurance, or other charges demanded by the Commonwealth of Pennsylvania Department of Transportation, or other authority having jurisdiction will be paid by the Contractor.
  - 4. Pavement removal and replacement requirements on State Highways specified in this Section are the requirements of the Highway Occupancy Permit obtained for the Project and supersede similar requirements of Title 67, Chapter 459, regulations. However, the

requirements of the Highway Occupancy Permit are subject to change by the Pennsylvania Department of Transportation.

5. Removal, protection and replacement of paving on streets other than state highways must be performed in accordance with the requirements of the municipality in which such work is located.

#### 1.04 REFERENCES

- A. The "PDT Sections" noted herein refer to sections contained in the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, latest edition. The references pertain only to materials, construction, equipment, methods and labor. The payment provisions do not apply to work to be performed under this Contract.
  1. PDT Section 305 – Bituminous Concrete Base Course.
  2. PDT Section 401 – Plant Mixed Bituminous Concrete Courses.
  3. PDT Section 420 – Bituminous Wearing Course ID-2 and Bituminous Wearing Course ID-2, RPS.
  4. PDT Section 421 – Bituminous Binder Course ID-2 and Bituminous Binder Course ID-2, RPS.
  5. PDT Section 491 – Milling of Bituminous Pavement Surface.
  6. PDT Section 630 – Plain Cement Concrete Curb.
  7. PDT Section 676 – Cement Concrete Sidewalks.
  8. PDT Section 704 – Cement Concrete.
  9. PDT Section 705 – Joint Material.
  10. PDT Section 962 – Painting Traffic Lines and Markings.
- B. Commonwealth of Pennsylvania Department of Transportation Bulletin 25: Specifications for Bituminous Materials.
- C. Commonwealth of Pennsylvania Department of Transportation Bulletin 27: Bituminous Concrete Mixtures, Design Procedures, and Specifications for Special Bituminous Mixtures.
- D. Commonwealth of Pennsylvania, Pennsylvania Code, Title 67 – Transportation, Department of Transportation:
  1. Chapter 203 – Work Zone Traffic Control (PennDOT Chapter 203).
  2. Chapter 459 – Occupancy of Highways by Utilities (PennDOT Chapter 459).

#### 1.05 SUBMITTALS

- A. Certificates: Furnish certification from bituminous and aggregate producer attesting that materials conform to requirements of Pennsylvania Department of Transportation Specifications.

#### 1.06 PROJECT CONDITIONS

- A. State Highways:
  1. All work within the right of way of State Highways shall be performed in strict accordance with the requirements of PennDOT, Title 67, Chapter 459.
  2. Employ traffic control measures in accordance with the requirements of PennDOT, Title 67, Chapter 203.

- B. Time Requirements:
1. State Highways: The permanent replacement of street roadway and shoulder pavement will not be permitted until at least 90 days after the required temporary pavement has been placed. However, permanent replacement pavement must be placed within 210 days after the required temporary pavement has been placed.
  2. Streets other Than State Highways: The permanent replacement of street roadway and shoulder pavement will be placed as soon as the trenches have been acceptably backfilled; however, in the event the permanent pavement cannot be placed due to the weather limitations, provide a temporary pavement.
- C. Protection:
1. Protect paved surfaces outside of the limits of work. Repair pavement outside limits damaged by constructing operations at no additional expense to the Owner.
  2. The Contractor shall be liable for damages to all roads caused by equipment. The repairs may include lane or full roadway width overlays as directed by PennDOT or other entity having jurisdiction.

## 1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not install aggregate base course when ambient temperature is below or is expected to fall below freezing.
- B. Do not use aggregate containing frost nor place aggregate base course on frozen subgrade.
- C. Terminate placement of bituminous concrete surface courses of permanent pavement between October 15 to 31, and do not resume placement prior to April 1 to 15; interim days between date depending upon weather conditions.
- D. Do not place bituminous concrete surface of permanent pavement when the ambient temperature is 40°F or lower; nor when the temperature of the pavement, base or binder on which it is to be placed is 40°F or lower.

## PART 2 – PRODUCTS

### 2.01 MATERIALS

- A. Bituminous Materials and Pavements:
1. Asphalt Cement: AC-20 conforming to PDT Bulletin 25.
  2. Temporary Paving:
    - a. State Highway: Type 2-P Bituminous Stockpile Patching Material conforming to Section 484 of Bulletin 27.
    - b. Township Road: Type 2-P or ID-2.
  3. Bituminous Concrete Base Course: Conforming to PDT Section 305; mixture limited to asphalt cement.
  4. Wearing Course: Hot mixed, hot laid, Bituminous Wearing Course ID-2: Conforming to PDT Section 420.

- B. Cement Concrete:
  - 1. All concrete work for driveways, curbs, gutters, and sidewalks shall be in accordance with the latest edition of the Amity Township's Code of Ordinances found in Chapter XXVI entitled "Streets, Sidewalks, Driveways, and Curbs."
- C. Superpave: Per PennDOT requirements for state highways.
- D. Traffic Paint: Conforming to PDT Section 962.2 (b).

### PART 3 – EXECUTION

#### 3.01 PREPARATION

- A. Pavement Removal:
  - 1. Saw cut and remove existing pavement to neat lines equidistant from the centerline of the trench.
  - 2. Initial pavement removal will be to width indicated in the Maximum Trench Widths table in Section 02221 under Aggregate Backfill and Temporary Pavement Width.
  - 3. Prior to permanent pavement restoration, saw cut and remove trench edge pavement one foot from each edge of trench. If pavement is removed or disturbed for a greater width than indicated in the "Final Pavement Restoration Width" specified in Section 02221, without written authorization of the Owner's Representative, the Owner will require the Contractor to replace such pavement without compensation.
  - 4. Perform milling of the 6:1 skew line transition for State Highway crossings in accordance with PDT Section 491, and as indicated on the Drawings.
  - 5. Subgrade: Backfill and compact trenches per requirements of Section 02221.
  - 6. At joints between existing pavements and new paving work, the edges of existing pavements shall be cut and neatly trimmed. An application of Class AC-20 petroleum asphalt shall be provided at all locations where new bituminous paving joins existing bituminous paving.

#### 3.02 INSTALLATION

- A. Temporary Pavement: Install temporary pavement over areas where the pavement has been removed, with top surface flush with surface of adjacent pavement, and maintained until permanent restoration is made.
  - 1. In State Highways, install temporary pavement to 2 inches thickness after compaction.
  - 2. In Borough or Township Roads, install pavement to 1½ inches thickness after compaction.
- B. Replacement of Permanent Pavement:
  - 1. General:
    - a. The Contractor shall restore all street paving, shoulders, driveways, and parking areas, including subgrade, and base courses with materials, as specified herein. This includes areas within the Maximum Trench Widths as well as areas disturbed outside the Maximum Trench Widths. Such restoration is for that area removed or broken in the execution of the work or that subsequently fails as a result thereof.
    - b. Method of preparing and placing mixture, compaction, and protection of in-place bituminous concrete for pavement shall comply with PDT Sections 305.3 and 401.3.
    - c. Types and thicknesses of replacement pavements shall conform to the specifications of PennDOT or the applicable municipality where the work is performed.

2. Bituminous Concrete Base Course (BCBC): Construct in accordance with the requirements of PDT Section 305.
    - a. Where roadways receive trench restoration only, install the Bituminous Concrete Base Course with the top surface below the surface of the adjacent pavement a distance equal to the thickness of the replacement surface course pavement.
  3. Bituminous Concrete Wearing Course (ID-2): Construct in accordance with the requirements of PDT Section 420.
    - a. Install wearing course with top surface flush with surface of adjacent pavement.
- C. Shoulder Restoration: Restore as required to match existing with the exception of State Highways, which will be restored in accordance with PDT Standards.
- D. Roadway Traffic Lines and Markings: As specified in Section 02855.
- E. Curbs, Sidewalks, and Driveways: Limit of restoration/reconstruction for curbs, sidewalks, and driveways will be 2'-0" on each side of the trench. Trench payment width as indicated in Section 02221.
  1. Cement Concrete Curbs: Replace curbs to dimensions, shape and workmanship indicated on the Drawings. Construction methods specified in PDT Section 630.
  2. Cement Concrete Sidewalk: Replace cement concrete sidewalk removed or disturbed as indicated on the Detail Drawings; width to match existing. Construct bed and concrete surface as specified in PDT Section 676.
  3. Cement Concrete Driveway: Backfill as specified in Section 02221. Replace cement concrete to same workmanship, thickness and finish as the original driveway unless otherwise required by the Owner's Representative.
  4. Bituminous Concrete Driveway: Provide a 2-inch thick wearing course of ID-2 bituminous concrete with the top surface flush with the top surface of the adjacent existing paving.
  5. Gravel Driveway: Restore to a condition equal to its original undisturbed condition using the same type and quality material as that of the particular driveway restored.
- F. Contractor shall be responsible for all costs associated with restoring/reconstructing all paved areas, curbs, sidewalks and driveways disturbed beyond the specified limits.

### 3.03 CLEAN-UP AND MAINTENANCE

- A. During construction, surfaces of all areas including, but not limited to, roads, streets, and driveways shall be maintained daily basis to produce a safe, desirable, and convenient condition.
  1. 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.
  2. Failure of the Contractor to perform this work shall be cause for the Owner's Representative to order the work to be done by others, and charge all costs to the Contractor.
- B. Repair or Correction of Unsatisfactory Conditions: All unsatisfactory conditions resulting from the work shall be corrected.
- C. Continuously maintain temporary pavement without additional compensation until it is replaced with permanent pavement.

- D. Any subnormal or dangerous condition caused by the work, on any surface, shall be repaired or corrected within two hours of observance or notification of its existence. If repairs or corrections are not made within this period, the Owner will have the work performed by others and charge all costs to the Contractor.

END OF SECTION

**Section 02601**  
**Manholes**





## SECTION 02601

### MANHOLES

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Precast Reinforced Concrete Manhole Components.
- B. Manhole Frame and Cover.

##### 1.02 RELATED SECTIONS

- A. Trenching, Backfilling and Compacting: Section 02221.
- B. Manhole Rehabilitation: Section 02650.
- C. Gravity Wastewater Sewer: Section 02731.
- D. Force Mains: Section 02732.
- E. Division 3 – Concrete.
- F. Grout: Section 03600.

##### 1.03 QUALITY ASSURANCE

- A. Shop Inspection:
  - 1. All materials furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.
- B. Field Inspection:
  - 1. All materials shall be furnished and installed and tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the Owner's Representative.
- C. Source Quality Control:
  - 1. Maintain uniform quality of products and component compatibility by using the products of one manufacturer in the case of precast reinforced concrete manholes.
  - 2. Obtain certificate of construction compliance with ASTM C478 from the precast reinforced concrete manhole manufacturer. Submit same certificate as part of required submittals.
  - 3. Obtain certificate of material compliance with ASTM A48, Class 30 tensile strength from the manhole frame and cover manufacturer. Furnish certification that tensile test bars were from same pour as castings. Submit same certificates as part of required submittals.

4. Laboratory Tests:
  - a. Submit three manhole frame and cover tensile test bars for each 50 manhole frames and covers, or less (if total required is less than 50). One test bar machined and ready for testing. Owner's Representative will verify certifications, release one bar for the Machines Bar Tensile Test, and retain two remaining bars.
  - b. Testing Laboratory shall furnish both Owner's Representative and Contractor two copies of test result reports. Same reports will be considered as sufficient evidence of acceptance or rejection of materials represented.
5. Shop Tests:
  - a. Manhole component manufacturers must be equipped to and shall perform the number of tests the Owner's Representative may deem necessary to establish quality of manhole components offered for use.
  - b. Manufacturers shall furnish to the Owner's Representative certified test records or reports with sworn statement of tests made as specified.
  - c. Precast Reinforced Concrete Manholes: Conduct tests as specified in ASTM C478.
  - d. Manhole Frames and Covers:
    - (1) Test for AASHTO HS-20 highway loading unless required otherwise by the agency having jurisdiction over the roadway.
    - (2) Test one manhole cover of each design submitted for approval.
  - e. The Owner's Representative reserves the right to accept certified test records or reports of previously conducted tests.

#### 1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  1. ASTM A48 – Gray Iron Castings, Spec. for.
  2. ASTM A615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Spec. for.
  3. ASTM C32 – Sewer and Manhole Brick (Made from Clay or Shale), Spec. for.
  4. ASTM C270 – Mortar for Unit Masonry, Spec. for.
  5. ASTM C478 – Precast Reinforced Concrete Manhole Sections, Spec. for.
  6. ASTM C923 – Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
  7. ASTM D4101 – Plastic Injection and Extrusion Materials, Spec. for.
- B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Specifications.
- C. Federal Specifications:
  1. Fed. Spec. SS-S-210A – Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints (Type 1 Rope Form).

#### 1.05 SUBMITTALS

- A. Shop Drawings and Product Data:
  1. Manufacturer's published detail drawings, modified to suit design conditions if required, and Contractor prepared drawings as applicable.
  2. Manufacturer's descriptive literature and specifications covering the product specified. Include installation information.

- B. Certificates:
1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
  2. Manufacturer's sworn certification that components and products will be manufactured in accordance with specified reference standards for components and products.
  3. Manufacturer's sworn certification that manhole frame and cover tensile test bars were poured from the same iron as castings they represent.

#### 1.06 PRODUCT 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.

#### 1.07 SITE CONDITIONS

- A. Environmental Requirements:
1. In no instance set or construct manhole bases on subgrade containing frost.
  2. To improve workability of Performed Plastic Sealing Compound during cold weather, store at temperature above 70°F or artificially warm compound in a manner satisfactory to the Owner's Representative.
  3. During warm weather stiffen Preformed Plastic Sealing Compound by placing under cold water or by other means as recommended by the compound manufacturer.

### PART 2 – PRODUCTS

#### 2.01 BASIC MATERIALS

- A. Cast-In-Place Concrete Products: Formwork, Reinforcement, and Cast-In-Place Concrete conforming to requirements of Division 3 - Concrete.
- B. Non-shrink, non-metallic grout as specified in Section 03600.
- C. Epoxy Bonding Compound: Use product such as A. C. Horn EPOXTITE BINDER; Sika Chemical SIKADUR-HI-MOD or equal.
- D. Manhole Steps: Spacing as indicated on Detail Drawings.
1. Aluminum Step: Aluminum Alloy AA Designation 6061-T6. Coat that portion of aluminum step being embedded in concrete with heavy bodied bituminous paint.
  2. Reinforced Plastic Step: Composed of a 1/2 inch Grade 60, ASTM A615 deformed steel reinforcing bar completely encapsulated in copolymer polypropylene compound conforming to ASTM D4101.
    - a. Acceptable Manufacturers:
      1. M. A. Industries, Inc.

2. Lane Manhole Steps.
  3. Press-Seal Gasket Corporation.
  4. Or Equal.
- E. Manhole Frame and Cover: Gray iron castings conforming to ASTM A48, Class No. 30, designed for AASHTO Highway Loading Class HS-25. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects. Frame and cover design and dimensions as indicated on Detail Drawings.
1. Finish: Bearing surfaces machined to prevent rocking and rattling under traffic. Casting surfaces shotblast cleaned and coated with asphalt paint, non-tacky drying.
  2. Identification: Cast the words SANITARY SEWER integrally on cover in 2-inch size raised letters.
  3. Frame Hold-down Bolts: 316 Stainless Steel. Four per frame.
  4. Minimum weight of cover shall be 180 pounds. Combined weight of cover and frame shall not be less than 400 pounds.
  5. Tensile Test Bar: Size B, cast separately, but poured from same iron as castings they represent.
- F. Preformed Plastic Sealing Compound: 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.
1. K. T. Snyder Company, Inc.; RUB'R-NEK.
  2. Hamilton Kent Manufacturing Company; KENT-SEAL NO. 2.
  3. Or Equal.
- G. Waterstop: Gasket type waterstop composed of polyisoprene compound, ASTM C923, with stainless steel take-up clamps.
1. Acceptable Manufacturer:
    - a. Press-Seal Gasket Corporation; WS Series.
    - b. Or Equal.
- H. Manhole Insert: As shown on Detail Drawing, each manhole shall have insert installed manufactured from high-density polyethylene, meeting the requirements of ASTM D1248, Class A, Category 5, with a finish thickness of 1/8". Ventilation is achieved by either the through-bore, single- or double-valve methods. A nylon strap is factory installed to make removal of the unit a simple, one-person operation. Owner shall be contacted for dimensions and manufacturer preference.
1. Acceptable Manufacturer:
    - a. Parson Environmental Products, Inc.
    - b. Or Equal.

## 2.02 PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS

- A. Materials and Construction: All new, unused materials, conforming to requirements specified in ASTM C478 except as follows:
1. Concrete: Composition and compressive strength conforming to ASTM C478 except use Type II or Type III 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 Section 3.6.11 and 3.7.2 of 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 Detail Drawings.
  4. Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing preformed plastic sealing compound as specified previously.
  5. Manhole Component Design: Base, tapered and straight riser section, and top section dimensions and diameters, not consistent with ASTM C478, are as indicated on Detail Drawings.
  6. Lifting Holes and Lugs: Through-wall holes not permitted in manhole component construction. Factory-install lifting keys or lugs integrally in manhole components.
- B. Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe and pipe opening seal provided.
1. Pipe Opening Seals (To 60" diameter-round pipe): Resilient gasket type, cast integrally with manhole component conforming to requirements specified in ASTM C923 and of the following acceptable manufacturers:
    - a. Press-Seal Gasket Corporation; PSX Series.
    - b. A Lok Products Corporation; A LOK Manhole Pipe Seal.
    - c. Thunderline Corporation; LOCK-SEAL Modular Wall and Casing Seal.
    - d. Dual Seal Gaskets Inc.; DUAL SEAL II.
    - e. Or Equal.
- C. Precast Top Sections: Designs as required by Detail Drawings, of materials and construction as specified previously except additional and differing requirements as follows:
1. Hold Down Bolt Inserts: Factory cast in top section no less than four 3/4-inch threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Threaded inserts of 3 inches 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. Eccentric Cone Tops: Manufacture to same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections.
  3. Flat Slab Tops: Thickness versus diameter as indicated on Detail Drawings. Tops factory formed to properly accept and support required manhole frame and cover and formed to join riser section in a matching joint.
- D. Precast Grade Rings: One-piece leveling and adjusting units of 2 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 must provide for full bearing of manhole frame.

### PART 3 – EXECUTION

#### 3.01 INSPECTION

- A. Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C478 regarding repairable defects and defects subject to rejection by the Owner's Representative.

- 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 the Owner's Representative. All defective materials furnished by the Contractor 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 02221, and as specified below:
  - 1. Make excavations for manholes to a nearly vertical plane beginning at bottom of excavation one-foot beyond manhole base outside diameter (six inches each side) to two feet beyond manhole base outside diameter dimension for top of excavation limit (one foot each side).
  - 2. If surface pavement of any type is encountered (vehicle or pedestrian ways), cut such pavement to a rectangular shape as opposed to circular shape of manhole. Make limits of cut not to exceed one-foot beyond top of excavation limit as specified previously.
  - 3. Should bottom of excavation limit be exceeded, provide without additional compensation, concrete cradle or encasement for pipes entering or leaving manholes.

### 3.03 MANHOLE CONSTRUCTION METHODS

- A. Cast-In-Place Concrete Manhole Base: Construct in accordance with design and dimensions indicated on Detail Drawings. When necessary to construct wider or deeper manhole bases than indicated or specified, build such bases as required by the Owner's Representative.
  - 1. Form and pour concrete in accordance with requirements of Division 3 - Concrete. Additional requirements as follows:
    - a. Vibrate poured concrete using mechanical vibrator of a type and design approved by Owner's Representative. 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 of manhole components used in the Project.
    - c. Do not place precast riser sections on cast-in-place bases for a minimum of 48 hours after pour.
  - 2. Install sewer piping in cast-in-place manhole bases prior to pouring the concrete.
    - a. Apply Epoxy Bonding Compound in accordance with manufacturers instructions to pipe at base connection prior to pouring the concrete.
    - b. Install PVC Waterstop on pipes entering and leaving manhole base prior to pouring concrete. Install PVC Waterstop in accordance with manufacturer's written instructions.
  - 3. Use 4000 psi concrete as specified in Section 03300, unless indicated otherwise on Drawings.
- B. Precast Concrete Bases: Install bases on a 6-inch deep compacted layer of aggregate meeting requirements of Pipe Bedding as specified previously in Section 02221.
  - 1. When using prefabricated pipe opening seals for connecting pipes into manholes, and such seals create an annular space on interior and exterior of manhole wall after pipe connection is made, fill such annular spaces with preformed plastic sealing compound.
    - a. Tightly caulk sealing compound into annular spaces, completely filling the spaces, and render the installation watertight.

- b. Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.
    - 2. Length of Pipe Connections into Manholes:
      - a. Use pipes no longer than five feet in length when connecting into manholes through resilient gasket type pipe opening seals.
      - b. For all other pipe connections into manholes, use pipes of such length that a pipe joint is provided at the outside edge of manhole base or wall as applicable. Also use pipes no longer than 6 feet in length for first pipe joined thereto.
- C. 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 gradually.
  - 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 concrete as specified in Section 03300, unless indicated otherwise on Detail Drawings.
- D. 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. Double seal each joint.
    - d. Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.
    - e. Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases.
- E. Lifting Recess Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into recesses in such manner to render them completely water and air tight. Apply non-shrink grout to inner and outer surfaces of the plug installation. Sealing of lifting recesses with grout only not permitted.
- F. Frame and Cover Installation: Where required, make final adjustment of frame to elevation using precast grade rings.
  - 1. Joints between grade rings for leveling units shall be made with non-shrink grout, and shall be a full bed 1/2-inch thick and troweled smooth on the inside of the manhole. The joints between the bottom of the frame and the top of the grade ring leveling units or the top manhole section as applicable, shall also be made with non-shrink grout as specified above.
  - 2. Frames for manholes in paved roads and drives shall be grouted to the manhole as shown on the Detail Drawings.
  - 3. Frames for manholes in unpaved rights-of-way shall be bolted to manhole using stainless steel hold-down bolts.

- G. Drop Manholes: Construct in accordance with type indicated in Detail Drawings. Use same type pipe and fittings in drop connection as used in sewer line from which drop connection is made.
- H. Manhole Insert: No special tools are required to install manhole inserts. Remove the manhole cover and clean the rim of the frame. Place the manhole insert on the manhole frame rim and replace the manhole cover.
- I. Manhole Coatings: Where sewage force mains or low pressure sewers connect to manholes, the manhole interior surface shall be coated with a corrosion-resistant coating like Parson Environmental Products ParsonPoxy or equal. The Owner shall determine how many downstream manholes require corrosion protection based on the connection design.

### 3.04 INTERFACING EXISTING CONSTRUCTION

- A. Connections To Existing Sewers: Where new manholes are constructed on existing sewers, the Contractor shall have the option to use cast-in-place manhole bases or precast bases, both as specified previously.
  - 1. Replace with new, broken or damaged pipe resulting from this work. New pipe material shall match existing. Use compatible joint materials or flexible pipe coupling.
  - 2. Connect new pipe to new manhole bases or new in-line structures as specified previously.
  - 3. If precast manhole bases are used, replace existing sewer pipe with new to first joint outside the manhole base.
  - 4. Maintain flow in existing sewer both during construction operations and until concrete is cured both in the case of cast-in-place work and formed inverts.
  - 5. Cut with a saw piping to be removed. Chipping or breaking pipe with a hammer not permitted.
- B. Core drill opening in existing manholes for installing new pipes. Installation as specified in Section 02731.

### 3.05 FIELD QUALITY CONTROL

- A. General: Test each manhole constructed in the Project by the method specified herein. If the manhole is constructed on an existing sewer where sewage flow must be maintained, the test may be waived.
  - 1. Conduct tests in presence of and to complete satisfaction of the Owner's Representative.
  - 2. Should a manhole not satisfactorily pass testing, discontinue manhole construction in the Project until such manhole does test satisfactorily.
  - 3. Provide tools, materials, equipment and instruments necessary to conduct manhole testing specified herein.
    - a. Vacuum Testing Equipment:
      - (1) Use vacuum apparatus equipped with necessary piping, control valves and gauges to control air removal rate from manhole and to monitor vacuum. Gauge shall be calibrated in 0.5-inch increments.
      - (2) Provide an extra vacuum gauge of known accuracy to frequently check test equipment and apparatus.
      - (3) Vacuum testing equipment and associated testing apparatus subject to Owner's Representative's approval.



- (4) Provide seal plate with vacuum piping connections for inserting in manhole frame.
  4. Prior to testing, thoroughly clean manholes and seal openings, both to complete satisfaction of the Owner's Representative. 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. The Contractor may elect to make a test prior to backfilling for his own purposes; however, the tests of the manholes for acceptance, shall be conducted after the backfilling has been completed.
- B. Vacuum Test Procedure:
1. Perform vacuum testing in accordance with the testing equipment manufacturer's written instructions.
  2. Draw a vacuum of 10 inches of mercury and close the valves.
  3. Consider manhole acceptable when vacuum does not drop below 9 inches of mercury for the following manhole sizes and times:
    - a. 4 foot diameter – 60 seconds.
    - b. 5 foot diameter – 75 seconds.
    - c. 6 foot diameter – 90 seconds.
- C. Repair and Retest: Determine source(s) of leak(s) in manholes failing acceptable limits.
1. Repair or replace defective materials and workmanship, and conduct such additional Manhole Acceptance Tests and such subsequent repairs and retesting as required until manholes meet test requirements.
  2. Materials and methods used to make manhole repairs must meet with Owner's Representative's approval prior to use.
  3. Contractor shall be responsible for all costs associated with repairs, replacements and retests.
  4. All repairs to manholes must be done on the exterior.
- D. Clean-Up:
1. All splashed mortar and/or concrete shall be cleaned from manhole walls, steps, and base. All debris and dirt shall be removed from the manholes before lines are flushed.

END OF SECTION



**Section 02650**  
**Manhole Rehabilitation**



## SECTION 02650

### MANHOLE REHABILITATION

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Without intending to limit or restrict the extent of work involved, the Work includes rehabilitating existing manholes to eliminate infiltration as follows:
  - 1. Plugging and waterproofing manhole walls and bases.
  - 2. Resetting existing and setting new manhole frames and covers.

##### 1.02 RELATED SECTIONS

- A. Trenching, Backfilling, and Compacting: Section 02221.
- B. Paving and Surfacing: Section 02500.
- C. Manholes: Section 02601.

##### 1.03 QUALITY ASSURANCE

- A. Source Quality Control:
  - 1. Maintain uniform quality of products and component compatibility by using the products of one manufacturer.
  - 2. Shop Tests:
    - a. In accordance with the General Requirements, materials stated herein require periodic testing according to methods referenced, or as required by Owner's Representative.

##### 1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Specifications.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM C191 – Time of Setting of Hydraulic Cement by Vicat Needle, Test Method for.
  - 2. ASTM C478 – Precast Reinforced Concrete Manhole Sections, Spec. for.
  - 3. ASTM C596 – Drying Shrinkage of Mortar Containing Portland Cement, Test Method for.
  - 4. ASTM C827 – Early Volume Change of Cementitious Mixtures, Test Method for.
- C. Federal Specifications:
  - 1. Fed. Spec. FF-S-325 – Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry) Group II (Shield, Expansion Bolt Anchor) Type 4 (Wedge Expansion Anchors) Class 1 (One-Piece Steel Expander with Cone Taper Integral with Stud).

2. Fed. Spec. SS-S-210A – Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints (Type I Rope Form).

#### 1.05 SUBMITTALS

- A. Shop Drawings and Product Data:
  1. Manufacturer’s published detail drawings, modified to suit design conditions if required, and Contractor prepared drawings as applicable.
  2. Manufacturer’s descriptive literature and specifications covering the product specified. Include installation information.
- B. Certificates: Certified records or reports of results of shop tests; such records or reports to contain a sworn statement that shop tests have been made as specified, and that materials and construction are in compliance with these Specifications.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Transport, store, and handle Products specified herein in a manner recommended by the respective manufacturers of such.
- B. Deliver waterproofing materials to the job site in original, unopened packages, clearly labeled with the manufacturer’s identification and printed instructions. Store and handle material in accordance with recommendations of the manufacturer and the American Concrete Institute of Cement and Cement Products.

#### 1.07 SITE CONDITIONS

- A. Existing Conditions:
  1. Owner Obligations: The Owner will be responsible for the following:
    - a. Locating manholes and other repairs.
    - b. The right of, and access to, all manhole locations.
- B. Environmental Requirements:
  1. Do not perform the Work of this Section when weather conditions or the condition of materials are such, in the opinion of the Owner’s Representative, that work cannot be performed satisfactorily.
- C. Protection:
  1. If public safety is endangered during the progress of the rehabilitation work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways.
  2. Signs, signals, and barricades used shall conform to requirements of Federal, State, and local laws, rules regulations, precautions, orders, and decrees.

## PART 2 – PRODUCTS

### 2.01 MATERIALS

- A. Waterproof Plugging Material: Composed of a blend of Portland cement and water or a liquid chemical additive which becomes an extremely rapid setting plastic material and effectively stops hydrostatic water infiltration, ensuring a non-shrink, watertight seal.
1. Acceptable Manufacturers:
    - a. IPA Systems Inc.; IPANEX-RAPID
    - b. IPA Systems Inc.; Octoplug.
    - c. Or Equal.
- B. Waterproof Patching Material: Fast-setting blend of fine textured cement powders for waterproof joint or crack sealing and patching larger repair areas.
1. Acceptable Manufacturers:
    - a. Preco Industries Ltd.; Preco-Patch.
    - b. U.S. Grout Corporation; Five Star.
    - c. IPA Systems Inc.; Octocrete.
    - d. Or Equal.
- C. Waterproof Coating: Brush applied cementitious waterproof coating.
1. Acceptable Manufacturers:
    - a. Preco Industries Ltd.; Brush-Bond.
    - b. U.S. Grout Corporation; Five Star.
    - c. IPA Systems Inc.; DryCon.
    - d. Or Equal.
- D. Non-Shrink Non-Metallic Grout: As specified in Section 03600.
- E. Preformed Plastic Sealing Compound: 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.
1. K.T. Snyder Company, Inc.; RUB-R-NEK.
  2. Hamilton Kent Manufacturing Company; KENT-SEAL NO. 2.
  3. Or Equal.
- F. Precast Grade Rings: As specified in Section 02601, Paragraph 2.02D.
- G. Expansion Anchor and Fastener: Stainless Steel, UL listed, one piece stud (bolt) with integral expansion edges, nut and washer, and meeting physical requirements of Fed. Spec. FF-S-325, Group II, Type 4, Class 1. Stud of AISI Type 303 or 304 stainless and nut and washer of AISI Type 316 stainless.
1. Acceptable Manufacturers:
    - a. Hilti Fastening Systems; KWIK-BOLT.
    - b. U.S.E. Diamond, Inc.; SUP-R-STUD.
    - c. Molly Fastener Group; PARABOLT.
    - d. Or Equal.

## PART 3 – EXECUTION

### 3.01 INSPECTION

- A. Prior to performance of the actual work, carefully inspect the sites and locate those manholes designated to be rehabilitated.

### 3.02 PREPARATION

- A. Earthwork: Perform excavation and backfilling for manhole rehabilitation as previously specified in Trenching, Backfilling and Compacting: Section 02221.
- B. Surface Preparation:
  - 1. Cleaning: Clean surfaces by blast cleaning, acid or detergent washing, or other method approved by the Owner's Representative.
  - 2. Roughening: Mechanically roughen surfaces by blast cleaning in accordance with manufacturer's instructions.
  - 3. Surface Wetdown: All surfaces should be thoroughly wet down, saturated, moist, and all free-standing and excess water removed before applying waterproofing.

### 3.03 PERFORMANCE

- A. Repairing Cracks, Spalled Areas, and Patching Holes:
  - 1. Cracks not subject to movement exceeding 1/10-inch in width shall be routed out to a minimum depth of 1-inch and patched with waterproofing.
  - 2. Cracks with active leaks shall be sealed with waterproof plug.
  - 3. Honeycombed or spalled concrete areas and holes shall be patched with waterproofing.
  - 4. Missing or damaged bricks shall be replaced as required at no additional cost.

### 3.04 APPLICATION OF WATERPROOFING

- A. Mix and apply materials in accordance with manufacturer's instructions and recommendations.
- B. Thoroughly mix waterproofing, using equipment recommended by manufacturer, leaving no lumps or unmixed materials. Do not exceed manufacturer's recommendations for proportions of materials.
- C. Apply waterproofing at temperatures of 40°F and above. Do not apply waterproofing on frozen surfaces.
- D. Apply waterproofing in one coat, no less than 1/4-inch thick, completely filling voids, holes, cracks, leaving no pinholes or uncovered areas.
  - 1. Waterproofing may be applied by trowel unless manufacturer specifies otherwise.
  - 2. Material shall be applied continuously starting at top and including the base around all incoming sewer lines.



- E. Proper curing and protection of waterproofing:
  - 1. Protect waterproofing from excessive evaporation during hot or windy conditions, by moist curing for the first four hours or by applying an approved curing compound. Under normal conditions, no curing is required.
  - 2. For maximum wear resistance, cover waterproofing with polyethylene immediately after hardening. Contact manufacturer for specific guidance for best results. Protect waterproofing from non-pedestrian traffic for 24 hours.
  - 3. Protect waterproofing from freezing, rain, and hydrostatic pressures until it reaches its normal four hour strength (1,000 psi).

### 3.05 SEALING OF ACTIVE LEAKS

- A. Open crack or holes by cutting to a minimum depth of 1-inch; for severe leaks, increase depth to a minimum 1-1/2 to 2-inches. Dovetail joint is preferable. Leave surfaces rough and remove all loose materials.
- B. For severe leaks, install rubber hose in the lowest portion of the crack or hole to relieve the pressure.
- C. Mix and apply waterproof plug in accordance with manufacturer's instructions.
- D. Force material into crack or hole with maximum pressure. If necessary, use external force to hold waterproof plug in place until a firm set takes place. Finally, remove hose and seal.
- E. Finish off surface and render flush with a minimum 1/4-inch coat of waterproofing.

### 3.06 LIMITS OF WATERPROOFING APPLICATION

- A. Leaking Manhole Joint: Waterproofing shall be applied around the entire circumference of any manhole joint which has been patched or plugged under this Contract. Waterproofing shall extend six (6) inches in each direction from the centerline of the joint.
- B. Leaking Manhole Base: Waterproofing shall be applied to the entire base of any manhole base which has been patched or plugged under this Contract.
- C. Leaking Manhole Section: Waterproofing shall be applied to an entire manhole section if any part of that section has been patched or plugged under this Contract. Waterproofing limits shall extend vertically six (6) inches downward from the centerline of the bottom joint of the section and six (6) inches upward from the centerline of the top joint of the section.
- D. Manhole Joint: Waterproofing shall be applied around the entire circumference of all joints within a manhole, which are above any patch or plug applied under this Contract. Waterproofing shall extend six (6) inches in each direction from the centerline of the joint.
- E. Brick Manholes: If a leaking manhole is of brick construction, the entire manhole shall be waterproofed.

### 3.07 REPAIR/REPLACEMENT AND ADJUSTMENT OF MANHOLE FRAMES AND COVERS

- A. When installing new frames or readjusting existing frame in paved areas, cut pavement in a circular pattern around the manhole frame. Make limits of cut not to exceed one foot beyond the upper lip of the manhole frame.
- B. The means and methods of performing operations are the sole responsibility of the Contractor.
  - 1. Debris Removal: Dispose of demolition debris off site in a lawfully approved landfill area.
  - 2. Salvage:
    - a. Carefully remove existing manhole frames and covers.
    - b. If the existing manhole frame and cover assemblies are to be replaced by new frames and covers, the existing assemblies shall remain the property of the Owner.  
Transport to and store at a location designated by the Owner at no additional cost.
  - 3. Before entering any manhole, the Contractor shall comply with applicable local, state, and federal regulations governing manhole entry. Ultimate responsibility for compliance with all applicable regulations lies solely with the Contractor.
  - 4. Traffic control is the Contractor's responsibility and must comply with all local, state and federal regulations.
  - 5. After completing manhole height adjustment, a warning device must be placed on the manhole to prevent motorists from striking the manhole. The warning device must be maintained on the manhole unit until the paving is brought to the finished elevation of the manhole.
  - 6. The joints between the manhole frame, precast grade ring(s), and manhole cone shall be watertight and the frame and grade ring(s) shall be securely attached to the manhole cone after paving is completed.
  - 7. The flow channel in the manhole shall be completely covered before starting work on the manhole. Before removing the cover from the channel, all debris shall be cleaned from the manhole base and cover, and removed from the manhole.
  - 8. The finished top elevation of manholes within the paving project area shall be at least 1/4-inch, but no greater than 1/2-inch below the finished elevation of the new paving.
- C. Resetting Existing or Setting New Manhole Frames:
  - 1. Remove the existing frame from the cone and salvage as specified previously.
  - 2. Remove damaged brick or precast concrete grade rings and mortar, and repair the top of manhole walls where necessary to provide sound base for placing concrete grade rings or for setting the frame.
  - 3. All loose mortar or non-shrink grout shall be removed from the manhole cover frame and manhole cone before resetting the frame.
  - 4. All material used to backfill around manholes shall be thoroughly compacted. Disposal of excess material is the Contractor's responsibility.
  - 5. If a manhole frame requires to be lowered, work shall be performed in such a manner as to minimize damage to the manhole. After removing sufficient material from the manhole cone, place a leveling bed of non-shrink grout on the manhole cone before placing the manhole frame.
  - 6. Frame and Cover Installation: As specified in Section 02601.
  - 7. In unpaved areas, the frame shall be securely attached to the manhole with four 3/4-inch diameter stainless steel expansion anchors.
- D. Excavation and Backfill: As specified in Section 02221.
  - 1. Allow the grout and mortar to set up prior to backfilling.
  - 2. Backfill around the frame with 2A stone compacted in place to the depth required for pavement restoration.

E. Pavement Restoration: As specified in Section 02500.

END OF SECTION



**Section 02731**  
**Gravity Wastewater Sewer**



## SECTION 02731

### GRAVITY WASTEWATER SEWER

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Wastewater Sewer Gravity Pipelines
- B. Service Connection Piping
- C. Pipeline Testing

##### 1.02 RELATED SECTIONS

- A. Trenching Backfilling and Compacting: Section 02221.
- B. Cast-In-Place Concrete: Section 03300.
- C. Grout: Section 03600.

##### 1.03 QUALITY ASSURANCE

- A. Source Quality Control:
  - 1. Shop Tests and Inspection:
    - a. All material furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.
- B. Disposition of Defective Material: 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 the Owner's Representative. All defective materials furnished by the Contractor shall be promptly removed by him from the site at his own expense.

##### 1.04 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. ANSI A 21.4 – Cement-Mortar Lining for Cast Iron and Ductile-Iron Pipe and Fittings for Water.
  - 2. ANSI A 21.10 – Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
  - 3. ANSI A 21.11 – Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
  - 4. ANSI A 21.50 – Thickness Design of Ductile-Iron Pipe.
  - 5. 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 (ASTM):
  - 1. ASTM A48 – Gray Iron Castings.
  - 2. ASTM C361 – Reinforced Concrete Low-Head Pressure Pipe, Spec. for.
  - 2. ASTM C923 – Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
  - 3. ASTM D2321 – Underground Installation of Flexible Thermoplastic Sewer Pipe, Rec. Practice for.
  - 4. ASTM D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings, Spec.
  - 5. ASTM D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals, Spec. for.
  - 6. ASTM F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe, Spec. for.
  - 7. ASTM F679 – Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
  
- C. American Water Works Association (AWWA):
  - 1. AWWA C 100 – Cast-Iron Pressure Fittings.
  - 2. AWWA C 104 – Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
  - 3. AWWA C 600 – Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.

#### 1.05 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, catalog cut or other data as required to provide a complete description of piping and piping specialties.
  
- B. Certificates:
  - 1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
  - 2. Manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

#### 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 or 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 the Owner's Representative, for pipe laying work.



## PART 2 – PRODUCTS

### 2.01 SEWER PIPE AND FITTINGS

- A. For pipe joints, use rubber gaskets suitable for conveying domestic sewage.
- B. Ductile Iron (DIP):
  - 1. Pipe (3"-54"): ANSI A21.50 and ANSI A 21.51.
  - 2. Wall Thickness Class (Buried): Class 51.
  - 3. Cement Mortar Lining: Conforming to ANSI Specification A21.4 or AWWA C104, Latest Edition, except the thickness of linings should not be less than the following:
    - a. 3" through 12" 1/8"
    - b. 14" through 24" 3/16"
  - 4. Fittings: Gray iron or ductile iron ANSI A21.10. Fittings larger than 48 in. AWWA C100 Class B (Up to 60").
  - 5. Joints:
    - a. Rubber-Gasket Joints (Buried): ANSI A 21.11.
      - (1) For buried pipe installation, provide either push-on or mechanical joints except where other types of joints are indicated on the Detail Drawings or required by the Specifications.
  - 6. Pipe and Fittings Coating: Factory coated inside and out with bituminous material; minimum 1 mil dry thickness. Bituminous material and finished coat conforming to seal coat requirements in ANSI A 21.4.
- C. Polyvinyl Chloride Pipe (PVC):
  - 1. Pipe: Type PSM SDR-35, ASTM D3034 (ASTM F679 for over 15-inch diameter).
  - 2. Fittings: Conforming to same applicable ASTM Specification requirements for pipe.
  - 3. Joints: Push-on with elastomeric gasket, ASTM D3212; and ASTM F477 for gasket specifications.
- D. Pipe Opening Seals (for reconnection to existing manhole): Gasket type polyisoprene compound, ASTM C923, with stainless steel take up clamps.
  - 1. Acceptable Manufacturer:
    - a. Press Seal Gasket Corporation; PSX Series.
    - b. Or Equal.
- E. Flexible Pipe Coupling: Clamped design with virgin PVC coupling with two adjustable 300 stainless steel bands, and stainless steel shear band.
  - 1. Acceptable Manufacturer:
    - a. The General Engineering Company (GENCO); FERNCO Flexible Couplings.
    - b. Or Equal.

### 2.02 SERVICE CONNECTION PIPE AND FITTINGS

- A. Polyvinyl Chloride Pipe (PVC):
  - 1. Pipe: Type PSM SDR-35, ASTM D3034.
  - 2. Fittings: Conforming to same applicable ASTM Specification requirements for pipe.
  - 3. Joints: Push-on with elastomeric gasket, ASTM D3212; and ASTM F477 for gasket specifications.

- B. Saddles (Cast Iron): Correctly contoured for outside diameter of pipe and incorporating a gasket and band assembly.
  1. Saddle Body: Cast iron, ASTM A48, Class 35, coated inside and out with heavy coat of black asphaltum type paint.
  2. Gasket: Compound rubber (neoprene) tubular O-ring design, ASTM C361.
  3. Band: Type C 304 stainless steel band assembled with two 3/4-inch Type C 304 stainless steel T-bolts, washers and hex nuts.
  4. Provide spigot or bell inlet and proper adapter or coupling suitable for connection of the type and size of service connection pipe.
  5. Acceptable Manufacturer: The General Engineering Company; Sealtite, or equal.
- C. Pipe Plugs: Designed for permanent installation and removable. Obtain plugs for various types of pipe used from the respective pipe manufacturer.
- D. Cleanout covers for paved areas shall be Part No. CC4 as manufactured by GENECO, or equal.

### PART 3 – EXECUTION

#### 3.01 PREPARATION

- A. Earthwork: Perform earthwork for sewer installation as specified in Trenching, Backfilling, and Compacting: Section 02221.
- B. Inspect each section of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.
- C. Remove rejected pipe from the Project.

#### 3.02 PIPE LAYING

- A. General: All pipe shall be laid to a uniform line and grade between manholes, socket ends upgrade, with a firm and even bearing along the barrel of the pipe, close joints and smooth invert. The spigot end of the pipe is to be centered in, shoved tight and secured against the bell or socket of the previously laid pipe. The interior of each pipe shall be cleaned of all excess joint and foreign material before the next pipe is laid. The pipe shall be laid in the bedding materials as specified in Section 02221. Pipe-laying shall commence at the lowest point and proceed upgrade. At the close of each day's work, and at such other times when pipe is not being laid, the open end of the pipe shall be protected with a close fitting stopper.
  1. Excavate trenches in rock at least 25 feet in advance of pipe laying.
  2. New extensions shall be isolated from the existing system with a watertight plug in the first manhole upstream from the existing system. Plug shall not be removed until the extension is completed and accepted by the Owner for transmission of wastewater.
- B. Laying Specified Types of Plastic Pipe: Installation and joint assembly according to ASTM D2321 for Class 1 bedding material.
- C. Laying Ductile Iron Pipe: Installation and joint assembly according to AWWA C 600, and as follows:
  1. Where necessary to field cut pipe use approved pipe cutter, milling cutter or abrasive wheel saw.

2. Make joints as specified previously.
- D. Construction Control: The Contractor shall provide at least three grade boards in advance of pipe laying at all times at intervals not exceeding fifty (50) feet and stretch a line parallel with the grade line. From this line, the trench and every pipe laid shall be tested as to grade and alignment. Base lines and controlling elevations established for the construction of the work shall be preserved and kept uncovered so that they can be examined at any time.
1. The use of laser equipment shall be permitted. Grade boards as specified will not be required if a laser is used.
  2. Regardless of control used, the Contractor shall provide alternative verification of grade as work progresses. Pipe not laid to proper line and grade will be removed and reconstructed at the Contractor's expense.
- E. Variations: The Owner's Representative reserves the right to vary the line and/or grade from that shown on the drawings for pipe lines and manholes when such changes may be necessary or advantageous.
- F. Handling of Sewer Line Materials into Trench: Proper implements, tools and facilities satisfactory to the Owner's Representative shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, jointing materials, etc. shall be carefully lowered into the trench piece-by-piece by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to sewer line materials and/or workmen. Under no circumstances shall such materials be dropped or dumped into the trench.
- G. Pipe Clearance in Rocks: Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and fittings for pipes 24 inches in diameter or less, and 9 inches for pipes larger than 24 inches in diameter.
1. The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of such rock, boulder or stone.
- H. Connections to Existing Manholes or Structures: Cut required opening or openings by core drilling so as to prevent cracking and spalling concrete. Make openings of sufficient size to accommodate pipe with clamp retained gasket installed. Make connection watertight.
1. Form a new invert channel in the existing manhole base to properly conduct the flow through the existing manhole.
  2. Use non-shrink, non-metallic grout to form new channel after area has been scarified and cleaned where channel is to be formed. Pea gravel may be added to grout in accordance with manufacturer's recommendations.
    - a. Grout as specified in Section 03600.
  3. Do not permit ground water, surface water or debris to enter the existing facilities through the new connection.
- I. Drop Connections: Make drop connections where drop in invert is two feet or more or as required by the Owner's Representative. Use same pipe material used to construct the main from which the drop connection is made. Construct drop connection in accordance with design shown on the Standard Detail Drawings.
- J. Concrete Cradle and Encasement:
1. Preparation: Prior to the formation of cradle or encasement, if any, temporary supports consisting of timber wedges and solid concrete bricks or cap blocks shall be used to support the pipe in place. Temporary supports shall have minimum dimensions and shall

- support the pipe at not more than two locations, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket and the other near the spigot end.
2. Placing: After jointing of the pipe has been completed, concrete shall be uniformly poured beneath and on both sides of the pipe. Placement shall be done by the use of suitable equipment. The concrete shall be wet enough during placement to permit its flow, without excessive prodding, to all required points around the pipe surface. The width of cradle shall be such as to fill completely the trench width. In case of extremely wide trenches, concrete encasement may be confined above the top of the pipe to a narrower width but in no case shall it be less than the width of trench required for the size of pipe being used. Before depositing concrete, the space within the limits of the pour shall have been cleared of all debris and water. Water shall not be allowed to rise adjacent to, or flow over, concrete deposited for less than 24 hours. Concrete shall be protected from the direct rays of the sun and kept moist, by a method acceptable to the Owner's Representative, for a period of seven days or until backfilling is begun. In no case shall backfilling begin within 24 hours of the time of placing and the Owner's Representative shall have strict control of the rate of backfilling.
  3. Concrete: 3000 psi per requirements of Section 03300.

### 3.03 SERVICE CONNECTIONS

- A. Fittings and service pipe shall be provided in strict accordance with these specifications. All practices and precautions required for the sewer main are applicable to the service connections from the sewer to the right-of-way line, or to a location designated by the Owner's Representative.
  1. The Contractor shall place a 2" x 4" wooden marker at the end of each sewer lateral.
  2. The marker shall be one piece and may not be constructed from two or more smaller pieces.
  3. The marker shall extend from the lateral invert to 12" above grade.
- B. If rock is encountered during the installation of the lateral, the Contractor shall extend the lateral to the required distance as specified elsewhere in these specifications, and shall provide a minimum "rock-free" distance of one foot beyond the end of the lateral. No lateral shall be "budded" against rock.
- C. Reconnection of Existing Service Connections: Use PVC wye or tee fittings or cast iron tee saddles for connection to the sewer main. Use pipe, if required, as specified previously. Make connection to existing piping with flexible pipe couplings.
  1. Saddles (Cast Iron): Make connections to sewers, which incorporate a saddle connection, by machine cutting a hole in the sewer of proper size to accommodate the saddle. Use a machine specifically designed for the purpose; no other means of making the hole permitted.
    - a. Install saddle in accordance with manufacturer's installation instructions.
    - b. After saddle is satisfactorily installed, concrete cradle sewer pipe and saddle to the centerline of the saddle branch and extend cradle along the sewer pipe to undisturbed bedding.
- D. Pipe Outlet: Connect service connection piping to outlet in manner specified for joining pipe.
- E. Plugs: Close free ends of branches and service connections with a carefully fitted plug. Type of plug used and method of installation to Owner's Representative's approval. Installed plugs shall successfully pass Line Acceptance Tests.

### 3.04 TESTS

- A. General Requirements: Conduct tests specified herein so that each pipeline installed in the Project is tested to the Owner's Representative satisfaction.
1. Provide tools, materials (including water), apparatus and instruments necessary for pipeline testing.
  2. Conduct tests in the presence of and to the satisfaction of the Owner's Representative.
- B. Testing Equipment:
1. Use air compressing apparatus equipped with a control panel with necessary piping, control valves and gauges to control air flow rate to piping test section; and to monitor air pressure within piping test section and air pressure within piping test section, provide air-compressing apparatus with an approved pressure relief device set to relieve at 10 psi. Test gauge shall be calibrated in 0.5 psi increments. Provide written certification as to gauge's accuracy. Calibration no greater than six months prior to test. Test equipment must be commercially manufactured specifically for low pressure air testing.
  2. Provide an extra pressure gauge of known accuracy to frequently check test equipment and apparatus.
  3. Air testing equipment and associated testing apparatus subject to Owner's Representative's approval.
  4. Provide GO, NO-GO, mandrel and incidental equipment for deflection test. Mandrel to conform to following requirements:
    - a. Cylindrical in shape with not less than nine arms spaced evenly around the mandrel.
    - b. Minimum contact length of mandrel arms with pipe wall not less than the nominal diameter of the pipe being tested.
    - c. Mandrel diameter 95 percent of inside pipe diameter.
- C. Cleaning Prior to Tests: Before tests are conducted, clean piping using high pressure flushing equipment including sewers, branches, and service connections until free of dirt or silt or construction debris. Contractor is responsible for removal of all water, dirt, silt and debris and their disposal.
- D. Alignment: After the mains have been laid, backfilled, and cleaned, 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 the Contractor, to the satisfaction of the Owner's Representative, before the work shall proceed and before acceptance of and/or payment therefore shall be made.
- E. Leakage Tests:
1. Air Testing: The Contractor 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, cleaning and lamping has been completed. The Contractor 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. A minimum of two minutes shall be provided to allow equilibrium of the air temperature with pipe wall before test readings shall commence. The rate of air loss shall be determined by measuring the time interval required for the average internal pressure to decrease by 1.0 psig.

3. The initial test pressure to be developed in the sewer and laterals shall be determined as follows:
  - a. For depths six (6) feet or less, the internal pressure shall not be less than 6.0 psig.
  - b. For depths greater than six (6) feet, the internal pressure in psig shall be calculated as the sum of 3.5 plus the maximum height in feet divided by 2.3 between the invert of the sewer and the existing ground surface in the section of sewer to be tested. (For example, if the maximum height is determined to be 9.2 feet, the added pressure would be 4.0 psig. The initial test pressure in the sewer would then be 7.5 psig. The allowable drift would be to 6.5 psig within the time indicated elsewhere in this subsection.)
  - c. In no case shall the test pressure in the sewers or laterals be greater than the maximum internal differential joint pressure recommended by the manufacturer of the pipe.
4. The pipe shall be considered acceptable if the air loss rate does not exceed 0.0030 cubic feet per minute per square foot of internal pipe surface when tested at the initial pressure previously defined in this subsection. The time for the air pressure to decrease 1.0 psig shall not be less than the time indicated in the following table:

<u>Pipe Diameter</u>	<u>Minutes</u>	<u>Seconds</u>
6"	2	55
8"	3	57
10"	4	43
12"	5	5
15"	7	5
18"	8	30
21"	9	50
24"	11	20
27"	12	45
30"	14	10
36"	17	00
42"	19	50
48"	22	40

5. If the above rates of leakage are exceeded, the Contractor shall, at no cost to the Owner, determine source of leakage, excavate and make all necessary corrections using methods approved by the Owner's Representative and retest.
  - a. For sections of sewer containing service connections which service existing buildings, perform Line Acceptance Test by testing one joint at a time.
6. The Contractor shall submit to the Owner's Representative, for approval, the detailed test procedure and list of proposed test equipment to be used prior to testing.

F. Infiltration:

1. After the air testing described in the preceding paragraph has been completed by the Contractor, regardless of any indications of the test results made by the Owner's Representative, the Owner reserves the right to perform field investigations, prior to final written acceptance of each sewer run by the Owner and/or during the maintenance period specified elsewhere in these specifications, to establish the leakage of groundwater into the sewer and laterals constructed under this Project. The cost of these investigations shall be borne by the Owner.
2. Should the leakage exceed 100 gallons per day per inch diameter per mile of pipe for any section, the Contractor shall, at the direction of the Owner's Representative, and at no cost to the Owner, perform any additional testing or corrective work required to reduce the infiltration in each manhole run from those lines installed by the Contractor 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 the Contractor, to include testing of joints, excavation and replacement of faulty or damaged portions of the work, and all final restoration.

- G. Deflection Test: In addition to air tests and infiltration test, conduct deflection tests on PVC pipe. Test each PVC pipe sewer main installed.
1. Conduct deflection testing not less than 30 days after section of pipe sewer main and service connection between adjacent manholes is backfilled.
    - a. Pull mandrel through pipe section manually; powered pulling devices not permitted.
    - b. Consider sewer line section which mandrel cannot pass through to have more than maximum allowable deflection of percent.
  2. Lines which fail must be excavated, replaced or repaired to Owner's satisfaction, then retested.
- H. Acceptance: Observation of successful testing of manholes, sewers or force mains by the Owner's Representative 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 Owner's Representative may recommend final acceptance to the Owner. Only upon final inspection by the Owner or Owner's Representative, and upon written acceptance for same will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period as specified for the manholes, sewers or force main will commence.
1. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Contractor's expense prior to acceptance.

END OF SECTION





**Section 02732**  
**Force Mains**



## SECTION 02732

### FORCE MAINS

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Wastewater Sewer Force Main Piping.
- B. Valves.
- C. Air Release, Valve and Cleanout Manholes.
- D. Thrust Restraint.
- E. Force Main Testing.

##### 1.02 RELATED SECTIONS

- A. Trenching, Backfilling and Compacting: Section 02221.
- B. Manholes: Section 02601.
- C. Gravity Wastewater Sewer: Section 02731.
- D. Division 3 – Concrete.

##### 1.03 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. ANSI A21.10 – Gray-Iron and Ductile-Iron Fittings, 2 inches through 48 inches, for Water and Other Liquids.
  - 2. ANSI A21.15 – Flanged Cast-iron and Ductile-Iron Pipe with Threaded Flanges.
  - 3. ANSI A21.50 – Thickness Design of Ductile-Iron Pipe.
  - 4. ANSI B16.1 – Cast-iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
  - 5. ANSI A21.11 – Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A48 – Gray Iron Castings.
  - 2. ASTM A615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Spec. for.
  - 3. ASTM A616 – Rail-Steel Deformed and Plain Bars for Concrete Reinforcement, Spec. for.
  - 4. ASTM C39 – Compressive Strength of Cylindrical Concrete Specimens, Test for.
  - 5. ASTM C94 – Ready-Mixed Concrete, Spec. for.
  - 6. ASTM C150 – Portland Cement, Spec. for.
  - 7. ASTM C206 – Finishing Hydrated Lime, Spec. for.
  - 8. ASTM C478 – Precast Reinforced Concrete Manhole Sections, Spec. for.
  - 9. ASTM D4 – Bitumen Content, Spec. for.

10. ASTM D2241 – Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR), Spec. for.
11. ASTM D3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals, Spec. for.
12. ASTM D3350 – Polyethylene Plastic Pipe and Fittings Materials, Spec. for.

C. American Water Works Association (AWWA):

1. AWWA C104 – Cement-Mortar Linings for Ductile-Iron and Gray Iron Pipe and Fittings for Water.
2. AWWA C110 – Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in. for Water and Other Liquids.
3. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
4. AWWA C150 – Thickness Design of Ductile-Iron Pipe.
5. AWWA C151 – Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
6. AWWA C500 – Gate Valves, 3-in. through 48-in. NPS, for Water and Sewer Systems.

#### 1.04 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, cuts or other data as required to provide a complete description of piping, piping specialties, restraint systems and valves.
- B. Certificates:
  1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
  2. Manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

#### 1.05 QUALITY ASSURANCE

- A. Source Quality Control:
  1. Shop Tests and Inspection: All materials furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.
- B. Disposition of Defective Material: 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 the Engineer. All defective materials furnished by the Contractor shall be promptly removed by him from the site at his own expense.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Replacement of Damaged Material: The Contractor shall replace, at his own expense, all material furnished by him and found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all materials and labor required for replacement of installed material.
  1. Material furnished by the Owner that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at his own expense.

- B. Responsibility for Safe Storage: The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter, at all times. All equipment and materials subject to damage from freezing shall be drained and stored in a manner which will protect them.
- C. Hauling: All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor.
  - 1. Pipe, fittings, items of equipment, and other materials of construction shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped.
  - 2. Materials handled on skidways shall not be skidded or rolled against materials already on the ground.
- D. At Site of Work: In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench, or as otherwise directed by the Engineer. Under no circumstances should lawns, grass plots or other private property be used for this purpose without the consent of the property owner.
- E. Care of Pipe Lining: Pipe shall be handled so the lining will not be damaged. If, however, any part of the lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

## 1.07 SITE CONDITIONS

- A. Environmental Requirements:
  - 1. Keep trenches dewatered until pipe joints have been made and concrete cradle, thrust blocks 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 the Engineer, for pipe laying work.

## PART 2 – PRODUCTS

### 2.01 PIPE AND PIPE FITTINGS

- A. Cement Lined Ductile Iron Pipe: Ductile iron pipe conforming to ANSI Specification A21.51 or AWWA Specifications C151, Latest Editions, for the material class or pressure designated and ANSI Specification A21.50 or AWWA Specification C150, Latest Editions, for wall thickness.
  - 1. Minimum Thickness: Class 52 unless indicated otherwise on the Drawings or as may be required for flanged pipe or restrained joints.
  - 2. Cement Mortar Linings: Conforming to ANSI Specification A21.4 or AWWA C104, Latest Edition, except the thickness of linings should not be less than 1/8-inch.
  - 3. Fittings: Ductile or gray iron in accordance with the standard specification set forth in the ANSI A21.10 or AWWA Specification C110.
    - a. All fittings shall be minimum Class 250 with cement lining and joints as required for pipe restraint.

- b. Iron fittings to be enclosed by valve and cleanout manholes shall be of the short body flanged type in order to minimize the size of the manholes.
  - 4. Joints: Push-on type or mechanical joint type in accordance with ANSI A21.11 or AWWA C111 Specifications, for all pipe except at changes in alignment, valves, tees, caps and plugs not restrained with thrust blocking.
    - a. Joints requiring pipe restraint and not restrained with thrust blocking shall be Lok-Type or TR Flex as manufactured by U.S. Pipe; Super-Lock as manufactured by Clow; Lok-Fast as manufactured by American Pipe; Snap-Lok or Locked Mechanical joint as manufactured by Griffin; Locked mechanical joint as manufactured by Atlantic State; or approved equal.
    - b. In addition to restrained joints, adequate tie rods must be provided to develop full joint restraint and must extend to the adjacent fitting or joint as approved by the Engineer.
    - c. Mechanical joint retainer glands shall not be used.
    - d. Prior to construction, joint restraint systems shall be submitted for Engineer's review and approval.
- B. Polyvinyl Chloride Pipe and Fittings (PVC):
  - 1. 4-inches and Greater Diameter: PVC pipe conforming to AWWA C 900 for working pressure of 200 psi.
    - a. Fittings: As specified for Cement Lined Ductile Iron Pipe.
  - 2. Fittings: Ductile or gray iron in accordance with the standard specification set forth in the ANSI A21.10 or AWWA Specification C110.
    - a. All fittings shall be minimum Class 250 with cement lining and joints as required for pipe restraint.
    - b. Iron fittings to be enclosed by valve and cleanout manholes shall be of the short body flanged type in order to minimize the size of the manholes.
    - c. Acceptable Manufacturer:
      - (1) Certain-Teed; Vinyl Iron Pipe, DR 14.
      - (2) Or Equal.
  - 3. Less than 4-inches Diameter: PVC pipe conforming to ASTM D2241, SDR-21 except 1.5-inch pipe shall be SDR-26.
    - a. Fittings: Compatible PVC fittings as recommended by pipe manufacturers, and of same Class as the pipe.
    - b. Acceptable Manufacturer:
      - (1) Certain-Teed; Fluid-Tite with Integral Bell.
      - (2) Or Equal.
  - 4. Joints: Push-on type conforming to ASTM D3139.
    - a. Solvent weld joints permitted only for special situations as approved by Engineer (e.g. bored service line highway crossings).
    - b. PVC pipe joints shall be restrained at changes in alignment, valves, tees, caps, and plugs with thrust blocking.
    - c. Split retainer flanges shall not be used in place of thrust blocks.
    - d. Proposed joint restraint system shall be submitted for Engineer's review and approval.

## 2.02 SEWAGE VALVE

- A. Sewage Air Release Valve: Designed to automatically release air, gas or vapor under pressure during system operation. Valve design shall feature long body and float stem components so

that the operating mechanism is kept free from contact with sewage during operation. Valve construction as follows:

1. Valve Body and Cover: Cast iron, ASTM A48, Class 35.
2. Maximum Working Pressure: 150 psi.
3. Vent Orifice: 3/16-inch for 150 psi.
4. Discharge Orifice Seat, Mechanism and Valve Stem: Stainless Steel.
5. Orifice Button: Stainless steel and Buna-N, Nitrile Rubber ASTM SB 800.
6. Mechanism Lever Pins and Float: High strength stainless steel, ASTM A240.
7. Backflushing and Cleaning Accessories: Factory assembled to the valve and consisting of a shut-off valve at bottom inlet, a blow-off valve near the bottom of the valve body, quick disconnect couplings and shut-off valve at top of valve, and a 5-foot section of rubber hose with quick disconnect coupling.
8. Acceptable Manufacturers:
  - a. Val-Matic Valve and Manufacturing Corp.; Model No. 48 BWA.
  - b. Or Equal.

B. Sewage Air and Vacuum Valve: Designed to automatically exhaust large quantities of air during the filling of a system and to allow air to re-enter the system during draining or when a vacuum occurs. Valve design shall feature long body and float stem components so that the operating mechanism is kept free from contact with sewage during operation. Valve construction as follows:

1. Valve Body and Cover: Cast iron, ASTM A48, Class 35.
2. Inlet Size: 2-inches.
3. Discharge Orifice: 2-inches.
4. Float Stem and Guide: Bronze, ASTM B584.
5. Floats: Stainless Steel, ASTM A240.
6. Orifice Seat: Buna-N, Nitrile Rubber, ASTM SB 800.
7. Backflushing and Cleaning Accessories: Factory assembled to the valve and consisting of an inlet shut-off valve, a 1-inch blow-off valve near the bottom of the valve body, quick disconnect couplings and a 1/2-inch shut-off valve at the top of valve, and a section of rubber hose with quick disconnect coupling.
8. Acceptable Manufacturers:
  - a. Val-Matic Valve and Manufacturing Corp.; Model No. 300 Series.
  - b. Or Equal.

C. Sewage Combination Air Valves: Consisting of an air release valve and an air and vacuum valve factory piped into a compact assembly. The combination assembly shall automatically release air, gas or vapor under system operating pressure and shall also allow air to re-enter the system during draining or when a vacuum occurs. Combination valve designs shall feature long bodies and float stem components so that the operating mechanisms are kept free from contact with sewage during operation. Valve construction as follows:

1. Valve Bodies and Covers: Cast iron, ASTM A48, Class 35.
2. Inlet Sizes: 2-inches.
3. Air Release Outlet Size: 1/2-inch, NPT.
4. Vacuum Discharge/Outlet Size: 2-inches.
5. Air Release Valve Maximum Working Pressure: 75 psi.
6. Air Release Valve Vent Orifice: 5/16-inch.
7. Air Release Valve Discharge Orifice Seat, Mechanism and Valve Stem: Stainless Steel.
8. Air Release Valve Orifice Button: Stainless Steel and Buna-N, Nitrile Rubber ASTM SB 800.
9. Air Release Valve Mechanism Lever Pins and Float: High strength stainless steel, ASTM A240.

10. Air and Vacuum Valve Float Stem and Guide: Bronze, ASTM B584.
11. Air and Vacuum Valve Floats: Stainless Steel, ASTM A240.
12. Air and Vacuum Valve Orifice Seat: Buna-N, Nitrile Rubber, ASTM SB 800.
13. Backflushing and Cleaning Accessories: Factory assembled to the combination valves and consisting of two inlet shut-off valves, two blow-off valves, two clear water inlet valves, section of rubber hose and quick disconnect couplings.
14. Acceptable Manufacturers:
  - a. Val-Matic Valve and Manufacturing Corp.; Model No. 48 or 49/300 Series.
  - b. Or Equal.

### 2.03 AIR RELEASE MANHOLES

- A. Materials for air release manholes as specified for precast manholes in Section 02601.

### 2.04 CLEANOUTS

- A. Cleanouts shall be constructed of PVC, Schedule 80 material. The transition from iron fittings to PVC material shall be made by use of Long Hub Companion Flange or other approved methods.

### 2.05 VALVES AND APPURTENANCES

- A. Valves: Cast iron ball or plug valves shall be installed on service and force main lines at the locations required by the Project Drawings. Valves installed in valve/cleanout pits shall be actuated with a quarter turn type hand lever. Buried valves shall be actuated with an underground actuator through a cast iron valve box. Ball valves on individual properties shall be oriented with the seat in place for pressure.
- B. Painting: All surfaces of each valve body assembly shall be clean, dry and free from grease before painting. All unmachined surfaces of the valve body assembly shall be wire brushed down to clean metal. Two coats of an asphalt varnish shall be applied in accordance with AWWA C500.
- C. Spare Parts and Tools: Repair or service parts for one of each type and size of valve used in this work shall be furnished and stored as directed by the Engineer. The equipment shall include, in general, the following items: special tools required for maintenance or operation of valves, gaskets, rings, seals, lubricants, bolts, washers, and miscellaneous accessories required to maintain valves in proper operating service.
- D. Flanges: All flanged valves shall be drilled and faced to the ASA 125 pound standard template, and in accordance with ANSI B16.1.
- E. Gate Valves 2 Inches and Larger: All gate valves 2" and larger shall conform in all respects to AWWA Specification C500, and Federal Specification WW-V-50b, Type II, Class I. All valves shall be of the double disc, non-rising stem type, with iron body full bronze mounted. Gate valves shall be of such design as to maintain the full area of the pipe through the valve when open and shall be designed to take the full unbalanced pressure upon either face.
  1. Valves shall open left (counter-clockwise) and shall be supplied with operators as shown on the drawings and specified herein.



2. Exposed manually actuated valves shall be handwheel actuated unless otherwise indicated on the Drawings. Handwheel operators shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering.
3. Buried valves shall have 2" square cast iron operating nuts. Each valve shall also be supplied with a roadway type valve box.
4. Buried valves shall be supplied with mechanical joint end connections.
5. Valves 3-inch and larger shall be flanged end Dresser, Series 800, X-Centric, or equal.
6. Valves 2-inch and 2½ inch shall be flanged end DeZurik, Eccentric, or equal.
7. One and one-half inch valves shall be screwed end DeZurik, Eccentric, or equal.

F. Non-Lubricated Plug Valves (Eccentric-Type):

1. Designed for a minimum working water pressure of 175 psi for valves through 12-inch, 150 psi for valves 14-inch through 36-inch, and 125 psi for valve sizes 42-inch through 54-inch.
2. Provide non-lubricated eccentric-type plug valve with valve bodies of cast iron conforming to ASTM A126 Grade B or valve bodies of semi-steel with coated plug suitable for wastewater and nickel or stainless steel seats.
3. Provide full-pressure, drip-tight shutoff with rated pressure from either direction.
4. Provide straight-through, round-port configuration or rectangular-style design; however, port area shall be a minimum of 80% of corresponding pipe area.
5. Valves 8-inch and larger operated by enclosed worm and gear.
6. Provide enclosed worm and gear operator for valves less than 8-inch that must be chain operated.
7. Acceptable Manufacturers:
  - a. DeZurik; Series 100 Eccentric Valves.
  - b. Keystone, USA Valve Division; Ballcentric.
  - c. Clow.
  - d. Victaulic Series 365.
  - e. Or Equal.

- F. Valve Boxes: Standard 7-inch cast iron extension roadway type valve boxes shall be installed over buried valves and service line cleanouts. Screw threads shall be cast integrally with box wall. Welded screw threads are not acceptable.

### PART 3 – EXECUTION

#### 3.01 PREPARATION

- A. Earthwork: Perform earthwork for force mains as specified in Trenching, Backfilling and Compacting: Section 02221.
- B. Boring, Jacking, or Tunneling: As specified in Section 12 of the General Information.

#### 3.02 PIPE INSTALLATION

- A. General: All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations; spigots centered in bells; and all valves plumb. The pipe shall be laid in the backfill materials as specified. Pipe laying shall commence at the lowest point and proceed upgrade.

- B. Construction Control: During the installation of a force main, the pipe shall be laid at a constantly increasing grade to each high point, air release manhole, or point of discharge. The Contractor shall provide sufficient construction control to assure that there are no sags or loss in grade in the force main which could tend to accumulate air other than at the high points. Failure to comply with this requirement shall necessitate the Contractor take remedial steps to correct this situation. All such costs shall be borne by the Contractor.
- C. Variations: The Engineer reserves the right to vary the line and/or grade from that shown on Project Drawings for the pipe lines and manholes and to vary the location of fittings and valves when such changes may be necessary or advantageous. No claims for extra work will be allowed for changes in location or grade except as such changes are made after trenching has been done.
- D. Caution in Excavation: The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.
- E. Subsurface Explorations: Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of existing underground structures, the Contractor shall make explorations and excavations for such purposes. If the Contractor is required to perform additional work in making the explorations and excavations, extra compensation will be allowed for such additional work.
- F. Depth of Pipe: All pipe shall be laid to the depth indicated on the Project Drawings or a minimum of 3.5' from grade to the crown of pipe.
- G. Handling of Sewer Line Materials Into Trench: Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, valves, etc., shall be carefully lowered into the trench piece by piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to sewer line materials, protective coatings and linings. Under no circumstances shall such materials be dropped or dumped into the trench.
- H. Hammer Test: Ductile iron pipe and cast iron fittings shall be inspected for defects and while suspended above grade, be rung with a light hammer to detect cracks.
- I. Cleaning Pipe and Fittings: All lumps, blisters and excess coal tar coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry and free from oil and grease before the pipe is laid.
- J. Laying Pipe: Every precaution shall be taken to prevent foreign material from entering the pipe while the pipe is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without allowing earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and let there until the connection is to be made into the adjacent pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe. After placing a length of pipe in the trench, the spigot end shall be centered in the bell or coupling and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the joints. Pipe and fittings which do not

allow a sufficient and uniform space for joints shall be removed and replaced with pipe and fittings of proper dimensions to ensure such uniform space.

1. Precautions shall be taken to prevent dirt from entering the joint space.
2. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

- K. Cutting Pipe: The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner, without damage to the pipe, so as to leave a smooth end at right angles to the axis of the pipe.
- L. Threaded Plastic Joints: All plastic pipe utilized for threaded connections shall be Schedule 80 pipe.
- M. Bell Ends to Face Direction of Laying: Bell and spigot pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the Engineer.
- N. Permissible Deflection of Joints: If deflection is required, make after joint is assembled. The amount of deflection shall not exceed fifty percent (50%) of the maximum limits as specified in the AWWA Standard C600.
- O. Unsuitable Conditions for Laying Pipe: No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable.
- P. Where force mains connect to existing or new manholes, the manhole wall shall be core bored or have a precast opening. The connection between the pipe and manhole shall be made watertight and have a rubber seal made for that purpose. The receiving manhole and at least tow manholes downstream in the gravity sewer shall be coated inside with a corrosion-resistant material such as Parson Environmental Products Parsonpoxy epoxy coating or equal.

### 3.03 PIPE JOINTING

#### A. Jointing Ductile Iron Pipe:

1. Mechanical Joints: The spigot end of the pipe shall be centrally located in the bell so that the rubber gasket is evenly seated.
  - a. All loose rust or foreign matter shall be removed from the inside surfaces of the bell and outside surface of the spigot prior to assembly. Bolts shall be tightened uniformly with a ratchet wrench so as to effect the joint seal. The normal range of bolt torques to be applied are:

<u>Bolt Size - Inches</u>	<u>Torque - Ft. Lbs.</u>
5/8	45 - 60
3/4	75 - 90
1	100 - 120

- b. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning.
2. Push-On Type Joints: Make joints as recommended by the manufacturer so as to effect the joint seal.

- B. Jointing PVC Pipe: Make joints as recommended by the manufacturer so as to effect the joint seal.

#### 3.04 SETTING FITTINGS AND VALVES

- A. General: Valves and fittings shall be set and jointed to pipe in the manner specified previously for cleaning, laying and jointing pipe.
- B. Provide a precast concrete manhole for every air release and vacuum valve meeting the requirements for manholes as previously specified. The manholes shall be constructed to permit valve repairs and afford protection to the valve and pipe from impact where they pass through the manhole walls. All valves and fittings shall be supported by saddles as indicated on the Project and Detail Drawings. The saddles shall be continuous under all valves and fittings within the valve manholes.

#### 3.05 ANCHORAGE

- A. Concrete Thrust Blocks: Provide concrete thrust blocks for all fittings, and at all locations where horizontal and/or vertical deflections are made in the joints of the piping. Thrust blocking and buttresses of design indicated on Project and Detail Drawings.
  - 1. Reaction Backing: Reaction backing shall be 3,000 psi concrete as specified in Section 03300. Backing shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be as indicated on the Project Drawings or directed by the Engineer. The backing shall, unless otherwise indicated or directed, be so placed that the pipe and fitting joints will be accessible for repair.
  - 2. Metal Harness: Metal harness of tie rods of adequate strength to prevent movement shall be used. Steel rods or clamps shall be type 304 stainless steel.
- B. Anchorage for Bends: All bends deflecting 11.25 degrees or more on mains 6-inches in diameter or greater shall be provided with a thrust restrain system to prevent movement.
  - 1. Either a restrained joint pipe or thrust block system will be permitted for ductile iron pipe.
  - 2. Only a thrust block system will be used for PVC pipe.
  - 3. Suitable metal rods shall be used only as indicated on the Project Drawings or directed by the Engineer.
  - 4. Mechanical joint retainer glands on ductile iron pipe and split retainer flanges on PVC pipe shall not be used to obtain a restrained joint.

#### 3.06 MANHOLES

- A. As specified in Section 02601.

#### 3.07 FIELD QUALITY CONTROL

- A. Hydrostatic Tests
  - 1. Pressure Test: After the pipe has been laid and backfilled as specified, all newly laid pipe or any valves section thereof, shall be subjected to a hydrostatic pressure of 150 pounds per square inch, or 50% in excess of the normal working pressure, whichever is greater.

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.

- a. Duration of Test: Two hours.
  - b. Procedure: Each section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connections, and all necessary apparatus including gauges, shall be furnished by the Contractor. The Contractor will make all taps into the pipe, and furnish all necessary assistance for conducting the tests.
  - c. Expelling Air Before Test: Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall make the necessary taps at such points before the test is made. After the test has been completed, the Contractor shall insert plugs at the tapping points.
  - d. Examination Under Pressure: Any cracks or defective pipes, fittings, or valves discovered in consequence of this pressure test, shall be removed and replaced by the Contractor with sound material, and the test shall be repeated until satisfactory to the Engineer.
2. Leakage Test: A leakage test shall be conducted concurrently with the pressure test. The Contractor will furnish laboratory calibrated test gauge and measuring device, and all necessary assistance to conduct the test.
- a. Leakage Definition: Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valve section thereof, to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
  - b. Permitted Leakage: No pipe installed will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

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

in which "L" equals the allowable leakage in gallons per hour; "S" is the length of pipeline tested in feet; "D" is the nominal diameter of the pipe, in inches, and "P" is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage according to the formula is equivalent to 11.65 U.S. Gal. per 24 hours per mile of pipe per inch nominal diameter, for pipe in 18' lengths evaluated on a pressure basis of 150 psi). When testing against closed metal seated valves, an additional leakage per closed valve of 0.0078 gallon per hour per inch of nominal valve size shall be allowed. There shall be no additional leakage allowed for service connections.

- (1) The Engineer will record both the makeup water and pressure at one-half hour intervals during the test period.
  - (2) Should any test of pipe laid disclose leakage greater than that specified above, the Contractor shall, at his own expense, locate, repair, and replace the defective joints, pipe, or fittings until the leakage is within the specified allowance.
3. Common Requirements:
- a. Engineer Presence: The Engineer shall monitor the pressure and leakage tests. The Contractor shall notify the Engineer of the test day at least 48 hours in advance.

- b. If test fails to meet test requirements, the Contractor shall pay for all additional engineering personnel testing time.
- c. Weather: No testing will be authorized unless air temperature is 35°F or higher.
- d. Field Joints: All field joints of fittings and valves shall be exposed and examined during pressure and leakage test.
- e. Acceptance: Observation of successful testing of force mains or manholes by the Engineer 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 Engineer may recommend final acceptance to the Owner. Only upon final inspection by the Owner or Engineer and upon written acceptance for same will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period as specified for the force main or manholes will commence. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Contractor's expense prior to acceptance.

END OF SECTION

**Section 02733**  
**Low Pressure Wastewater Sewer**





## SECTION 02733

### LOW PRESSURE WASTEWATER SEWER

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. This work consists of furnishing all plant, labor, equipment, appliances and materials and performing all operations in connection with the construction of low pressure wastewater sewer collection and service lines, manholes, appurtenances and furnishing all tests required.

##### 1.02 RELATED SECTIONS

- A. Trenching, Backfilling, and Compacting: Section 02221.
- B. Manholes: Section 02601.
- C. Gravity Wastewater Sewer: Section 02731.
- D. Division 3 – Concrete.

##### 1.03 REFERENCES

- A. American National Standards Institute (ANSI):
  1. ANSI A21.4, Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water.
  2. ANSI A21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
  3. ANSI A21.15, Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges.
  4. ANSI A21.50, Thickness Design of Ductile-Iron Pipe.
  5. ANSI A21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
  6. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
  7. ANSI A21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
- B. American Water Works Association (AWWA):
  1. AWWA C104, Cement-Mortar Linings for Ductile-Iron and Gray Iron Pipe and Fittings for Water.
  2. AWWA C110, Ductile-Iron and Gray-Iron Fittings, 3-in. thru 48-in. for Water and Other Liquids.
  3. AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
  4. AWWA C150, Thickness Design of Ductile-Iron Pipe.
  5. AWWA C151, Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or other liquids.
  6. AWWA C900, Polyvinyl chloride (PVC) Pressure Pipe, 4-inch Through 12-inch, for Water.

##### 1.04 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, cuts or other data as required to provide a complete description of piping, piping specialties, restraint systems and valves.

#### 1.05 QUALITY ASSURANCE

- A. Source Quality Control:
  - 1. Shop Tests and Inspection: All materials furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.
- B. Disposition of Defective Material: 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 the Engineer. All defective materials furnished by the Contractor shall be promptly removed by him from the site at his own expense.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Replacement of Damaged Material: The Contractor shall replace, at his own expense, all material furnished by him and found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all materials and labor required for replacement of installed material.
- B. Responsibility for Safe Storage: The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter, at all times. All equipment and materials subject to damage from freezing shall be drained and stored in a manner that will protect them.
- C. Hauling: All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor.
  - 1. Pipe, fittings, items of equipment, and other materials of construction shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped.
  - 2. Materials handled on skidways shall not be skidded or rolled against materials already on the ground.
- D. At Site of Work: In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench, or as otherwise directed by the Engineer. Under no circumstances should lawns, grass plots or other private property be used for this purpose without the consent of the property owner.
- E. Care of Pipe Lining: Pipe shall be handled so the lining will not be damaged. If, however, any part of the lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

### PART 2 – PRODUCTS

#### 2.01 PIPE AND PIPE FITTINGS

- A. **Cement Lined Ductile Iron Pipe:** Ductile iron pipe conforming to ANSI Specification A21.51 or AWWA Specifications C151, Latest Editions, for the material class or pressure designated and ANSI Specification A21.50 or AWWA Specification C150, latest editions, for wall thickness.
1. **Minimum Thickness:** Class 50 for 6-inch diameter and Class 51 for 3-inch and 4-inch diameter pipe except as may be required for flanged pipe or restrained joints.
  2. **Cement Mortar Linings:** Conforming to ANSI Specification A21.4 or AWWA C104, Latest Edition, except the thickness of linings should not be less than 1/8-inch.
  3. **Fittings:** Ductile or gray iron in accordance with the standard specification set forth in the ANSI A21.10 or AWWA Specification C110.
    - a. All fittings shall be minimum Class 250 with cement lining and joints as required for pipe restraint.
    - b. Iron fittings to be enclosed by valve and cleanout manholes shall be of the short body flanged type in order to minimize the size of the manholes.
  4. **Joints:** Push-on type or mechanical joint type in accordance with ANSI A21.11 or AWWA C111 Specifications, for all pipe except at changes in alignment, valves, tees, caps and plugs not restrained with thrust blocking.
    - a. Joints requiring pipe restraint and not restrained with thrust blocking shall be Lok-Type or TR Flex as manufactured by U.S. Pipe; Super-Lock as manufactured by Clow; Lok-Fast as manufactured by American Pipe; Snap-Lok or Locked Mechanical joint as manufactured by Griffin; Locked mechanical joint as manufactured by Atlantic State; or approved equal.
    - b. In addition to restrained joints, adequate tie rods must be provided to develop full joint restraint and must extend to the adjacent fitting or joint as approved by the Engineer.
    - c. Mechanical joint retainer glands shall not be used.
    - d. Prior to construction, joint restraint systems shall be submitted for Engineer's review and approval.
- B. **Polyvinyl Chloride Pipe and Fittings (PVC):**
1. **4-inches and Greater Diameter:** PVC pipe conforming to AWWA C 900 for working pressure of 200 psi.
    - a. **Fittings:** As specified for Cement Lined Ductile Iron Pipe.
    - b. **Acceptable Manufacturer:**
      - (1) Certain-Teed; Vinyl Iron Pipe, DR 14.
      - (2) or Equal.
  2. **Less than 4-inches Diameter:** PVC pipe conforming to ASTM D2241, SDR-21 except 1.5-inch pipe shall be SDR-26.
    - a. **Fittings:** Compatible PVC fittings as recommended by pipe manufacturers, and of same Class as the pipe.
    - b. **Acceptable Manufacturer:**
      - (1) Certain-Teed; Fluid-Tite with Integral Bell.
      - (2) Or Equal.
  3. **Joints:** Push-on type conforming to ASTM D3139.
    - a. Solvent weld joints permitted only for special situations as approved by Engineer (e.g., bored service line highway crossings).
    - b. PVC pipe joints shall be restrained at changes in alignment, valves, tees, caps, and plugs with thrust blocking.
    - c. Split retainer flanges shall not be used in place of thrust blocks.
    - d. Proposed joint restraint system shall be submitted for Engineer's review and approval.
- C. **Polyethylene Pipe and Fittings (PE):**
1. **2-Inch thru 6-Inch Diameter:** PE pipe conforming to ASTM D1248 and D3350, SDR-9, Type III, Grade P34, Category 5, and Plastic Pipe Institute Material Designation PE-3408.

- a. Joints: Thermal butt-fusion in accordance with ASTM D2657 and manufacturer's recommendations.
2. Under 2-Inch Diameter: PE pipe conforming to ASTM D1248 and D 3350, SDR-11, Type III, Grade P34, Category 5, and Plastic Pipe Institute Material Designation PE-3408.
  - a. Joints: Socket fusion type in accordance with ASTM D2657 and manufacturer's recommendations.
3. Termination to pump basins, valves, fittings, etc., made of other materials shall be by flange assemblies. The pipe adjacent to these joints must be rigidly supported for a distance of one foot beyond flange assembly.
4. Fittings:
  - a. Under 4-Inch Diameter: SDR-11 molded polyethylene fittings of same class as the pipe.
  - b. 4-Inch thru 6-Inch Diameter: As specified for Cement Lined Ductile-Iron Pipe.

## 2.02 SEWAGE VALVE

- A. Sewage Air Release Valve: Designed to automatically release air, gas or vapor under pressure during system operation. Valve design shall feature long body and float stem components so that the operating mechanism is kept free from contact with sewage during operation. Valve construction as follows:
  1. Valve Body and Cover: Cast iron, ASTM A48, Class 35.
  2. Maximum Working Pressure: 150 psi.
  3. Vent Orifice: 3/16-inch for 150 psi.
  4. Discharge Orifice Seat, Mechanism and Valve Stem: Stainless Steel.
  5. Orifice Button: Stainless steel and Buna-N, Nitrile Rubber ASTM SB 800.
  6. Mechanism Lever Pins and Float: High strength stainless steel, ASTM A240.
  7. Backflushing and Cleaning Accessories: Factory assembled to the valve and consisting of a shut-off valve at bottom inlet, a blow-off valve near the bottom of the valve body, quick disconnect couplings and shut-off valve at top of valve, and a 5-foot section of rubber hose with quick disconnect coupling.
  8. Acceptable Manufacturers:
    - a. Val-Matic Valve and Manufacturing Corp.; Model No. 48 BWA.
    - b. Or Equal.
- B. Sewage Combination Air Valves: Consisting of an air release valve and an air and vacuum valve factory piped into a compact assembly. The combination assembly shall automatically release air, gas or vapor under system operating pressure and shall also allow air to re-enter the system during draining or when a vacuum occurs. Combination valve designs shall feature long bodies and float stem components so that the operating mechanisms are kept free from contact with sewage during operation. Valve construction as follows:
  1. Valve Bodies and Covers: Cast iron, ASTM A48, Class 35.
  2. Inlet Sizes: 2-inches.
  3. Air Release Outlet Size: 1/2-inch, NPT.
  4. Vacuum Discharge/Outlet Size: 2-inches.
  5. Air Release Valve Maximum Working Pressure: 75 psi.
  6. Air Release Valve Vent Orifice: 5/16-inch.
  7. Air Release Valve Discharge Orifice Seat, Mechanism and Valve Stem: Stainless Steel.
  8. Air Release Valve Orifice Button: Stainless Steel and Buna-N, Nitrile Rubber ASTM SB 800.
  9. Air Release Valve Mechanism Lever Pins and Float: High strength stainless steel, ASTM A240.
  10. Air and Vacuum Valve Float Stem and Guide: Bronze, ASTM B584.
  11. Air and Vacuum Valve Floats: Stainless Steel, ASTM A240.

12. Air and Vacuum Valve Orifice Seat: Buna-N, Nitrile Rubber, ASTM SB 800.
13. Backflushing and Cleaning Accessories: Factory assembled to the combination valves and consisting of two inlet shut-off valves, two blow-off valves, two clear water inlet valves, section of rubber hose and quick disconnect couplings.
14. Acceptable Manufacturers:
  - a. Val-Matic Valve and Manufacturing Corp.; Model No. 48 or 49/300 Series.
  - b. Or Equal.

## 2.03 MANHOLES

- A. Precast Reinforced Concrete Air Release and Cleanout Manholes: As specified in Section 02601.

## 2.04 CLEANOUTS

- A. Cleanouts shall be constructed of PVC, Schedule 80 material and as detailed on the drawings. The transition from iron fittings to PVC material shall be made by use of Long Hub Companion Flange or other approved methods. Ball or plug valves shall be installed at the locations indicated on the Drawings.
- B. All cleanouts installed in valve and cleanout manholes shall be provided with gate valves and 3/4" hose fittings as indicated on the Drawings.

## 2.05 VALVES AND APPURTENANCES

- A. Valves: Cast iron ball or plug valves shall be installed on service, low pressure and force main lines at the locations indicated on the Drawings. Valves installed in valve/cleanout pits shall be actuated with a quarter turn type hand lever. Buried valves shall be actuated with an underground actuator through a cast iron valve box. Ball valves on individual properties shall be oriented with the seat in place for pressure.
  1. Valves 3-inch and larger shall be flanged end Dresser, Series 800, X-Centric, or equal.
  2. Valves 2-inch and 2½ inch shall be flanged end DeZurik, Eccentric, or equal.
  3. One and one-half inch valves shall be screwed end DeZurik, Eccentric, or equal.
- B. Painting: All surfaces of each valve body assembly shall be clean, dry and free from grease before painting. All unmachined surfaces of the valve body assembly shall be wire brushed down to clean metal. Two coats of an asphalt varnish shall be applied in accordance with AWWA C500.
- C. Spare Parts and Tools: Repair or service parts for one of each type and size of valve used in this work shall be furnished and stored as directed by the Engineer. The equipment shall include, in general, the following items: special tools required for maintenance or operation of valves, gaskets, rings, seals, lubricants, bolts, washers, and miscellaneous accessories required to maintain valves in proper operating service.
- D. Flanges: All flanged valves shall be drilled and faced to the ASA 125 pound standard template, and in accordance with ANSI B16.1.
- E. Gate Valves 2 Inches and Larger: All gate valves 2" and larger shall conform in all respects to AWWA Specification C500, and Federal Specification WW-V-50b, Type II, Class I. All valves shall be of the double-disc, non-rising stem type, with iron body full bronze mounted. Gate

valves shall be of such design as to maintain the full area of the pipe through the valve when open and shall be designed to take the full unbalanced pressure upon either face.

1. Valves shall open left (counter-clockwise) and shall be supplied with operators as shown on the drawings and specified herein.
  2. Exposed manually-actuated valves shall be handwheel actuated unless otherwise indicated on the Drawings. Handwheel operators shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering.
  3. Buried valves shall have 2" square cast iron operating nuts. Each valve shall also be supplied with a roadway type valve box.
  4. Buried valves shall be supplied with mechanical joint end connections.
- F. Valve Boxes: Standard 7-inch cast iron or plastic valve boxes shall be installed over all buried valves and service line cleanouts in accordance with AWWA C500.

### PART 3 – EXECUTION

#### 3.01 PREPARATION

- A. Earthwork: Perform earthwork for low-pressure wastewater sewer as specified in Trenching, Backfilling, and Compacting: Section 02221.

#### 3.02 PIPE INSTALLATION:

- A. General: All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations; spigots centered in bells; and all valves plumb. The pipe shall be laid in the backfill materials as specified. Pipe laying shall commence at the lowest point and proceed upgrade.
- B. Construction Control: During the installation of a low pressure main, the pipe shall be laid at a constantly increasing grade to each high point, air release manhole, or point of discharge, as indicated on the Drawings. The Contractor shall provide sufficient construction control to assure that there are no sags or loss in grade in the low pressure main which could tend to accumulate air other than at the high points shown on the Drawings. Failure to comply with this requirement shall necessitate the Contractor take remedial steps to correct this situation. All such costs shall be borne by the Contractor.
- C. Variations: The Engineer reserves the right to vary the line and/or grade from that shown on the Drawings for the pipe lines and manholes and to vary the location of fittings and valves when such changes may be necessary or advantageous. No claims for extra work will be allowed for changes in location or grade except as such changes are made after trenching has been done.
- D. Caution in Excavation: The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.
- E. Depth of Pipe: All pipe shall be laid to the depth indicated on the Drawings or a minimum of 3.5' from grade to the crown of pipe.
- F. Handling of Sewer Line Materials Into Trench: Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, valves, etc., shall be carefully lowered

into the trench piece by piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to sewer line materials, protective coatings and linings. Under no circumstances shall such materials be dropped or dumped into the trench.

- G. Hammer Test: Ductile iron pipe and cast iron fittings shall be inspected for defects and while suspended above grade, be rung with a light hammer to detect cracks.
- H. Cleaning Pipe and Fittings: All lumps, blisters and excess coal tar coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry and free from oil and grease before the pipe is laid.
- I. Laying Pipe: Every precaution shall be taken to prevent foreign material from entering the pipe while the pipe is being placed in the trench. If the pipe-laying crew cannot put the pipe into the trench and in place without allowing earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and let there until the connection is to be made into the adjacent pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe. After placing a length of pipe in the trench, the spigot end shall be centered in the bell or coupling and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the joints. Pipe and fittings that do not allow a sufficient and uniform space for joints shall be removed and replaced with pipe and fittings of proper dimensions to ensure such uniform space.
  - 1. Precautions shall be taken to prevent dirt from entering the joint space.
  - 2. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.
- J. Cutting Pipe: The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner, without damage to the pipe, so as to leave a smooth end at right angles to the axis of the pipe.
- K. Threaded Plastic Joints: All plastic pipe utilized for threaded connections shall be Schedule 80 pipe.
- L. Bell Ends to Face Direction of Laying: Bell and spigot pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the Engineer.
- M. Permissible Deflection of Joints: If deflection is required, make after joint is assembled. The amount of deflection shall not exceed fifty percent (50%) of the maximum limits as specified in the AWWA Standard C600.
- N. Unsuitable Conditions for Laying Pipe: No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable.

### 3.03 PIPE JOINTING

- A. Jointing Ductile Iron Pipe:
  - 1. Mechanical Joints: The spigot end of the pipe shall be centrally located in the bell so that the rubber gasket is evenly seated.
    - a. All loose rust or foreign matter shall be removed from the inside surfaces of the bell and outside surface of the spigot prior to assembly. Bolts shall be tightened

uniformly with a ratchet wrench so as to effect the joint seal. The normal range of bolt torques to be applied are:

<u>Bolt Size (Inches)</u>	<u>Torque-Ft. Lbs.</u>
5/8	45 - 60
3/4	75 - 90
1	100 - 120

- b. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning.
  2. Push-On Type Joints: Make joints as recommended by the manufacturer so as to effect the joint seal.
- B. Jointing PVC Pipe: Make joints as recommended by the manufacturer so as to effect the joint seal.
- C. Jointing PE Pipe: Make joints by thermal butt-fusion or socket fusion as recommended by manufacturer so as to effect the joint seal.

### 3.04 SERVICE CONNECTIONS

- A. General: Service connections to PE, PVC and ductile iron pipe over 3-inch diameter shall be made by tapping through saddles or another method approved by the Engineer. The saddles shall be wide and provide full 360 support against the pipe. U-bolt style saddles shall not be used.
  1. Provide saddles for different pipe materials as follows:
    - a. 4-inch and greater Ductile Iron – Style 3408 as manufactured by Clow Corporation or equal.
    - b. 4-inch and 6-inch C-900 PVC – S90 Grass Saddles as manufactured by Ford Meter Box Company, Inc., or equal.
    - c. 3-inch PVC (Pressure Pipe) – Style 342 as manufactured by Rockwell or equal.
  2. Service connections shall be made by installing tee fittings of compatible material and the same class as the low-pressure sewer main.
  3. Where low pressure systems are connected to existing or new gravity sewer manholes, the manhole wall shall be core bored and a watertight rubber seal installed. Discharge from the low pressure system shall be directed into the channel of the manhole to provide a smooth discharge with no splashing or accumulation of debris. The interior of the receiving manhole shall be coated with a corrosion-resistant material like Parson Environmental Products Parsonpoxy epoxy coating or equal. When more than one customer is served by a low pressure system, the receiving manhole and the next two downstream manholes must be coated.

### 3.05 SETTING FITTINGS AND VALVES

- A. General: Valves and fittings shall be set and jointed to pipe in the manner specified previously for cleaning, laying and jointing pipe.
- B. Provide a precast concrete manhole for every air release and vacuum valve meeting the requirements for manholes as previously specified. The manholes shall be constructed to permit valve repairs and afford protection to the valve and pipe from impact where they pass through the manhole walls. All valves and fittings shall be supported by saddles as indicated on the



Drawings. The saddles shall be continuous under all valves and fittings within the valve manholes.

### 3.06 ANCHORAGE

- A. Concrete Thrust Blocks: Provide concrete thrust blocks for all fittings, and at all locations where horizontal and/or vertical deflections are made in the joints of the piping. Thrust blocking and buttresses of design indicated on Drawings.
1. Reaction Backing: Reaction backing shall be concrete of a mix not leaner than 1 cement; 2½ sand; 5 stone; and having a compressive strength of not less than 2,000 psi, at 28 days. Backing shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be as indicated on the Drawings or directed by the Engineer. The backing shall, unless otherwise indicated or directed, be so placed that the pipe and fitting joints will be accessible for repair.
  2. Metal Harness: Metal harness of tie rods of adequate strength to prevent movement shall be used. Steel rods or clamps shall be galvanized and painted with two (2) coats of asphalt type paint.
- B. Anchorage for Bends: All bends deflecting 11.25 degrees or more on mains 6-inches in diameter or greater shall be provided with a thrust restrain system to prevent movement.
1. Either a restrained joint pipe or thrust block system will be permitted for ductile iron pipe.
  2. Only a thrust block system will be used for PVC pipe.
  3. Suitable metal rods shall be used only as directed by the Engineer.
  4. Mechanical joint retainer glands on ductile iron pipe and split retainer flanges on PVC pipe shall not be used to obtain a restrained joint.

### 3.07 FIELD QUALITY CONTROL

- A. Hydrostatic Tests:
1. Pressure Test: After the pipe has been laid and backfilled as specified, all newly laid pipe or any valves section thereof, shall be subjected to a hydrostatic pressure of 150 pounds per square inch, or 50% in excess of the normal working pressure, whichever is greater. 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.
    - a. Duration of Test: At least one hour.
    - b. Procedure: Each section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connections, and all necessary apparatus including gauges, shall be furnished by the Contractor. The Contractor will make all taps into the pipe, and furnish all necessary assistance for conducting the tests.
    - c. Expelling Air Before Test: Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall make the necessary taps at such points before the test is made. After the test has been completed, the Contractor shall insert plugs at the tapping points.
    - d. Examination Under Pressure: Any cracks or defective pipes, fittings, or valves discovered in consequence of this pressure test, shall be removed and replaced by the

Contractor with sound material, and the test shall be repeated until satisfactory to the Engineer.

2. Leakage Test: A leakage test shall be conducted concurrently with the pressure test. The Contractor will furnish laboratory calibrated test gauge and measuring device, and all necessary assistance to conduct the test.
  - a. Leakage Definition: Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valve section thereof, to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
  - b. Permitted Leakage: No pipe installed will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

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

in which "L" equals the allowable leakage in gallons per hour; "S" is the length of pipeline tested in feet; "D" is the nominal diameter of the pipe, in inches, and "P" is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage according to the formula is equivalent to 11.65 U.S. Gal. per 24 hours per mile of pipe per inch nominal diameter, for pipe in 18' lengths evaluated on a pressure basis of 150 psi). When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallon per hour per inch of nominal valve size shall be allowed. There shall be no additional leakage allowed for service connections.

- (1) The Engineer will record both the makeup water and pressure at one-half hour intervals during the test period.
  - (2) Should any test of pipe laid disclose leakage greater than that specified above, the Contractor shall, at his own expense, locate, repair, and replace the defective joints, pipe, or fittings until the leakage is within the specified allowance.
3. Common Requirements:
    - a. Engineer Presence: The Engineer shall monitor the pressure and leakage tests. The Contractor shall notify the Engineer of the test day at least 48 hours in advance.
    - b. If test fails to meet test requirements, the Contractor shall pay for all additional engineering personnel testing time.
    - c. Weather: No testing will be authorized unless air temperature is 35°F or higher.
    - d. Field Joints: All field joints of fittings and valves shall be exposed and examined during pressure and leakage test.
    - e. Acceptance: Observation of successful testing of low-pressure mains or manholes by the Engineer 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 Engineer may recommend final acceptance to the Owner. Only upon final inspection by the Owner or Engineer and upon written acceptance for same will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period as specified for the force main or manholes will commence. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Contractor's expense prior to acceptance.

END OF SECTION

**Section 02855**  
**Pavement Markings**



## SECTION 02855

### PAVEMENT MARKINGS

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Liquid Traffic Paint Materials.
- B. Plastic Pavement Marking Material.
- C. Surface Preparation.

##### 1.02 REFERENCES

- A. The “PDT Sections” noted herein refer to sections contained in the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408/90, as supplemented. The references pertain only to materials, construction, equipment, methods and labor. The payment provisions do not apply to work to be performed.
  - 1. PDT 961 – Cold Plastic Pavement Markings or Legends.
  - 2. PDT 962 – Painting Traffic Lines and Markings.
  - 3. PDT 963 – Pavement Parking Removal.
  - 4. PDT 1103 – Traffic Signing and Marking.
- B. Commonwealth of Pennsylvania Code, Title 67, Department of Transportation Chapter 211, Official – Control Devices.
  - 1. Subchapter K – Marking.
- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM D711 – Standard Test Method for No Pick-up Time of Traffic Paint.
  - 2. ASTM D868 – Standard Method of Evaluating Degree of Bleeding of Traffic Paint.
  - 3. ASTM D969 – Standard Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint.
  - 4. ASTM D1309 – Standard Test Method for Settling Properties of Traffic Paint During Storage.

##### 1.03 DESCRIPTION OF WORK

- A. Work consists of furnishing all equipment, labor materials, and performing all operations necessary for application of traffic lines, markers or legends on roadway surfaces, in accordance with specifications and applicable drawings.

##### 1.04 QUALITY ASSURANCE

- A. Traffic line paint materials shall meet the specifications for PA DOT Traffic line Paint – Type I and Type II or the Institute of Transportation Engineers’ (ITE) “A Model Performance Specification For the Purchase of Pavement Marking Paints and Powders”, latest edition.

- B. Certification from the manufacturer, stating that the materials supplied meet PennDOT's specifications, shall accompany delivery of material, and shall be given to the Engineer prior to installation of pavement markings.
- C. Paint materials shall be products of Manufacturers who have supplied traffic line paint for installation in the State of Pennsylvania.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement marking materials to job site in their original, sealed containers or packages with labels intact and legible at time of use.
  - 1. Store paint containers lid-down.
  - 2. If the paint is used within two months after being received, no rotation prior to use is required. If the paint is on hand for more than two months, it shall be rotated several days before use.
- B. Store approved materials at the job site in a suitable and designated area restricted to storage of paint and coating materials and related equipment.
- C. Use all means necessary to ensure safe storage of materials and the prompt and safe disposal of waste. Store paint and coating products protected from weather when such products may be affected by freezing.
- D. Glass beads shall be in units of 50 lbs and packed in moisture-proof bags. The beads shall be stored in a cool dry place.

#### 1.06 PROJECT CONDITIONS

- A. Environmental Requirements:
  - 1. Adhere to manufacturer's data on air and surface temperature limits and relative humidity during application and curing of coatings.
  - 2. Schedule work to avoid dust and airborne contaminants.
- B. Protection:
  - 1. Protect pavement marking materials before, during and after application.
  - 2. Clean up or otherwise remedy without additional cost, damage by paint coatings to public or private property.

#### 1.07 WARRANTY

- A. The Contractor shall guarantee, in writing, to replace, at no expense to the Owner, that portion of the plastic pavement marker or legend material which in the opinion of the Engineer, has not remained within reasonably close proximity to the location placed, or has not remained effective in performing useful daylight and nighttime service, for a period of one (1) year from the date of installation. The required service is as follows:
  - 1. Intersection Units: Ninety percent of an intersection unit where the intersection unit is defined as all material on an approach leg within 150 feet of the intersection.
  - 2. Midblock Unit: Ninety percent of a midblock unit where the midblock unit is defined as each individual legend, symbol, crosswalk or stop line.

PART 2 – PRODUCTS

2.01 PAINT MATERIALS

- A. General: Traffic paint shall consist of a ready-mixed pigmented binder in a single package system and shall meet the requirements of ASTM-D868 and ASTM-D1309. When applied at a wet-film thickness of 15 mills, paint shall be suitable for application to traffic bearing surfaces such as Portland cement concrete, bituminous pavements, and plain or vitrified brick surfaces of streets, highways, bridges, tunnels, and parking lots.
- B. Traffic Paint shall consist of either an alkyd resin type or a combination of alkyd resin type modified with chlorinated rubber ready-mixed white and yellow traffic paints, for use on bituminous and Portland cement concrete pavements. These paints shall be reflectorized for night visibility, if specified, by adding reflective spheres before the paint dries or sets, using the drop-on or pressurized methods.
  - 1. Pigments: Except for the yellow pigment, the supplier may use any combination of pigments provided the finished paint meets all the requirements specified herein. Supplier may use any organic yellow pigment provided it does not contain any of the metals listed in Environmental Protection Agency (EPA) Code of Federal Regulations 40, Section 261.24, Table 1. Sufficient suspending and dispersing agents shall be used to prevent excessive settling as specified herein.
  - 2. Binder: The supplier may use any combination of ingredients, except tall oil resins, provided the finished paint meets all the requirements herein. Sufficient amounts of anti-skinning agents shall be used to prevent skinning as specified herein. Sufficient resin solids, compatible thinners and driers, if necessary, shall be used to meet requirements of Table I.
- C. Paint Requirements: The mixed paints shall meet the following requirements specified in Table I for white and yellow paints:

Table I  
Requirements of Mixed Paints

<u>Characteristics</u>	<u>Standards</u>	<u>Type I White and Yellow</u>
Pigment, percent by weight		55-60
Nonvolatile vehicle, percent by weight of vehicle		40 Min.
Uncombined water, percent by weight of paint		1.0 Max.
Coarse particles and skins (retained on No. 325 sieve, 1/Percent by weight of pigment)		1.0 Max.
Consistency: Krebs Units		65-70 (Type I) 70-110 (Type II)
Weight per gallon, lbs.	White Yellow	11.7 Min. 12.0 Min.
Fineness of grind, Hegman		2.0 Min.
Contract ratio, dry		0.96 Min.
Directional reflectance:	White Yellow	84 Min. 50 Min.

<u>Characteristics</u>	<u>Standards</u>	<u>Type I White and Yellow</u>
Drying time, No pick-up, minutes (lab)	ASTM D711	30 Max.
Flexibility		No cracking or flaking
Bleeding Test	ASTM D868 and D969	5 Min.
Water Resistance		---
Skinning (48 hours)		None
Storage Stability	ASTM D1309	6 Min.

Color of Yellow Paint - The color of the dry paint film when compared visually shall essentially match Color No. 33538 of Federal Standard 595.

- D. Glass spheres shall meet the requirements of PennDOT Publication 408, Section 1103.14(a)2.

## 2.02 PLASTIC PAVEMENT MARKINGS

- A. Cold plastic pavement marking material shall consist of a pigmented extruded plastic, 30 mils thick, with reflective glass spheres uniformly distributed throughout its entire cross-sectional area, meeting the requirements of PennDOT Publication 408, Sections 961 and 1103.14(b).
- B. Thermoplastic pavement marking material shall be pigmented, 125 mils thick, preformed, retro-reflective, composed of hydrocarbon resin, aggregates, pigments, binders, and glass beads, conforming to AASHTO M 249-79, and meeting the requirements of the Manual on Uniform Traffic Control Devices for Streets and Highways. Lines, legends, and symbols shall be capable of being affixed to bituminous or Portland Concrete pavements by the use of the normal heat of a propane type of torch. Colors shall be yellow or white as required by project.
1. Material shall be capable of conforming to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures.
  2. Material shall have resealing characteristics and shall be capable of fusing with previously applied thermoplastic markings when heated with the torch.
  3. Material shall be capable of being applied in temperatures down to 32°F without any special storage, preheating or treatment before application.
  4. Graded Glass Beads: Glass beads shall be clear and transparent and shall be distributed throughout the entire cross sectional area. The material shall contain a minimum of 30% graded glass beads by weight with not more than 20% consisting of irregular fused spheroids, or silica. The index of refraction shall not be less than 1.50.
  5. Pigments:
    - a. White: Similar to Federal Highway White, Color No. 17886, as per Federal Standard 595.
    - b. Yellow: Similar to Federal Highway Yellow, Color No. 13655, as per Federal Standard 595. Yellow pigment shall be of organic origin only.



## PART 3 – EXECUTION

### 3.01 SURFACE PREPARATION

- A. Contractor shall clean the surface of the roadway before application of traffic lines or pavement markings to provide a clean, dry roadway surface which is free of loose dirt and other debris, to the satisfaction of the Engineer.
- B. Surface cleaning for Cold Plastic Markings shall include as a last operation the use of compressed air or a fine bristled broom over the application area to provide a dust-free surface.

### 3.02 EQUIPMENT

- A. Line painting machine shall be of type that it shall not impede the traffic flow in adjacent lanes while painting of centerlines. One lane shall remain open to traffic while painting edgelines.
- B. Equipment used shall be capable of simultaneous application of two parallel lines in either a solid or broken pattern in forming the centerline and be capable of automatic dispensing of glass beads onto the painted surface at the required application rate, by the pressurized glass gun method.
- C. Equipment shall be capable of providing paint lines in 4-inch, 6-inch and 8-inch widths.
- D. Equipment used to apply centerlines and edgelines shall be equipped with a measuring device which automatically and continuously measures to the nearest foot, the length of each line placed.
- E. Legends shall be applied with equipment approved by the Owner's Representative; hand brushes or rollers are not permitted. Glass beads may be hand applied.

### 3.03 APPLICATION

- A. General:
  - I. Centerline:
    - a. Where existing centerlines are visible and properly located, the new centerlines shall be applied directly over the existing pattern.
    - b. Where centerlines do not exist, or existing centerlines are improperly located, as determined by the Owner's Representative, the new centerlines shall be applied at the correct location. If the existing markings have to be removed to allow correct placement of the new markings, such work shall be done in accordance with PDT Section 963 at no cost to the Owner.
    - c. On two-lane roadways, the centerline shall evenly divide the roadway, however, if a portion of the roadway on either or both sides is to be utilized for parking, the centerline shall evenly divide the traveled way.
    - d. Any centerline pattern placed more than six (6) inches from the center of the roadway or traveled way shall be removed and replaced by the Contractor at no cost to the Owner.

2. Edgeline: Contractor shall field-check all roadways which require application of edgelines. Only those roadway sections which are 20 feet or greater in width for more than 50 percent of their length shall be painted with edgelines. The Owner's Representative will determine the eligibility of each roadway for edgeline application.
- B. Liquid Traffic Paint Application:
1. Paint: Paint shall be dispensed in a wet film thickness of  $15 \pm 1$  mils. The rate of application of paint on bituminous surface treatment roads may be 25% greater. The Owner's Representative will determine whether roadways require an increased application rate.
  2. Glass Beads: Glass beads shall be applied at a rate of six (6) pounds per gallon of paint.
  3. Painted traffic lines and markings shall not be placed when the ambient temperature is less than 40°F.
- C. Cold Plastic Pavement Marking Material Application:
1. General: Cold plastic pavement markers or legends shall mold themselves to pavement contours, breaks, faults, etc., merely by traffic action of normal pavement temperatures. They shall have resealing characteristics capable of mending cracks due to pavement flexing and shall fuse with previously applied material.
  2. An adhesive activator primer sealer shall be applied to the plastic pavement marking material or roadway surface depending on the manufacturer's recommendations immediately prior to installation.
  3. Inlaid: Application of pavement markers or legends as part of an asphaltic resurfacing job. The material is properly placed on the roadway just before final compaction, and rolled into the new surface during final compaction. The result is that the pavement markers or legends will be essentially flush with the finished surface.
  4. Surface Applied: Application of pavement markers or legends onto the existing surface of asphaltic roadways. Installation of pavement markers or legends shall require only moderate pressure.
  5. Cold plastic markers or legends shall be applied only when the surface temperature is 60°F or higher unless otherwise directed by the Owner's Representative.
- D. Thermoplastic Pavement Marking Material Application:
1. Asphalt: The materials shall be applied using the propane torch method recommended by the manufacturer. The material shall be applied at ambient and road temperatures no less than 32°F without any preheating of the pavement to a specific temperature.
  2. Portland Concrete: The same application procedure shall be used as described under Paragraph 1, above. However, a compatible primer sealer may be applied before application to assure proper adhesion.
  3. Additional glass beads shall be applied on the surface after application of marking if directed by Owner's Representative.
- E. Standard Marking Details:
1. Markings, unless otherwise specified, shall be detailed and placed in accordance with the Pennsylvania Department of Transportation regulations set forth in Subchapter K of the current edition of PennDOT Publication 68 – Pavement Markings.

### 3.04 PROTECTION OF PAINTED SURFACES

- A. Crosswalks, stop bars, symbols, legends, centerlines, and lane lines applied with conventional paint shall require coning (wet line protection) for a minimum of 30 minutes or until the paint becomes track free from vehicular traffic.

END OF SECTION



**Section 03100**  
**Concrete Formwork**



## SECTION 03100

### CONCRETE FORMWORK

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Formwork for cast-in-place concrete.

##### 1.02 QUALITY ASSURANCE

- A. Design Criteria:
  - 1. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure.
  - 2. Maintain formwork construction tolerances complying with ACI 347.
  - 3. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

##### 1.03 REFERENCES

- A. American Concrete Institute (ACI):
  - 1. ACI 347; Recommended Practice for Concrete Formwork.
  - 2. ACI 350; Environmental Engineering Concrete Structures.
- B. APA-Engineered Wood Association (APA): APA Grade-Trademarks.
- C. U.S. Department of Commerce Product Standards:
  - 1. PS-1 For Construction and Industrial Plywood.

##### 1.04 SUBMITTALS

- A. Product Data: Submit data for proprietary materials and items, including forming accessories, coatings, and others as requested by Engineer.

#### PART 2 – PRODUCTS

##### 2.01 FORM MATERIALS

- A. Forms:
  - 1. Forms (Exposed Finish Concrete): Plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
    - a. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.

- b. Use plywood complying with U.S. Product Standard PS-1 “B-B (Concrete Form) Plywood”, Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- 2. Forms (Unexposed Finish Concrete): Plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
- B. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- C. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal.
  - 1. Provide units which will leave no metal closer than 1½” to surface.
  - 2. Provide ties which, when removed, will leave holes not larger than 1” diameter in concrete surface.

### PART 3 – EXECUTION

#### 3.01 PREPARATION

- A. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.
- B. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- C. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- D. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer’s directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer’s instructions.
- E. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

#### 3.02 ERECTION

- A. General: Construct forms in accordance with ACI 347.
  - 1. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
  - 2. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures.
  - 3. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required in work.
  - 4. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.



5. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
- B. Exposed Corners: Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- C. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

### 3.03 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F (10°C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

### 3.04 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Engineer.

END OF SECTION



**Section 03200**  
**Concrete Reinforcement**



## SECTION 03200

### CONCRETE REINFORCEMENT

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Reinforcement bars for cast-in-place concrete

##### 1.02 RELATED SECTIONS

- A. Concrete Formwork: Section 03100.
- B. Cast-in-Place Concrete: Section 03300.

##### 1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
  - 1. ACI 318 “Building Code Requirements for Reinforced Concrete”.
  - 2. Concrete Reinforcing Steel Institute (CRSI), “Manual of Standard Practice”.

##### 1.04 REFERENCES

- A. Comply with the latest published for the following referenced standards.
- B. American Concrete Institute (ACI):
  - 1. ACI 117; Standard Specifications for Tolerances for Concrete Construction and Materials
  - 2. ACI 315; Details and Detailing of Concrete Reinforcement.
  - 3. ACI 318; Building Code Requirements for Structural Concrete.
- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM A82; Steel Wire, Plain, for Concrete Reinforcement, Spec. for.
  - 2. ASTM A185; Steel Welded Wire Fabric, Plain for Concrete Reinforcement, Spec. for.
  - 3. ASTM A497; Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement, Spec. for.
  - 4. ASTM A615; Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Spec for.
- D. Concrete Reinforcing Steel Institute (CRSI):
  - 1. Manual of Standard Practice
  - 2. Manual of Placing Reinforcing Bars

##### 1.05 SUBMITTALS

- A. Product Data: Submit data for proprietary materials and items, including reinforcement, accessories, and others as requested by Engineer.
- B. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315.

## PART 2 – PRODUCTS

### 2.01 MATERIALS

- A. Reinforcing Steel:
  - 1. Reinforcing Bars: ASTM A615, Grade 60, deformed.
  - 2. Steel Wire: ASTM A82, plain, cold-drawn, steel.
  - 3. Plain Steel Welded Wire Fabric: ASTM A185.
  - 4. Deformed Steel Welded Wire Fabric: ASTM A497.
  
- B. Supports for Reinforcement: Use wire bar type supports complying with CRSI specifications.
  - 1. For footings, foundation mats and slabs-on-grade, use chairs with sand plates, horizontal runners, or precast concrete blocks.
    - a. Any metal chairs or spacers in contact with the ground shall be galvanized, epoxy-coated or stainless steel.
    - b. Concrete masonry units or bricks are not acceptable.
  - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

## PART 3 – EXECUTION

### 3.01 FABRICATION

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- B. Fabrication tolerances shall conform to ACI 117 requirements.

### 3.02 INSPECTION

- A. Notify Engineer 48 hours before placing concrete so an inspection of the reinforcing placement can be made

### 3.03 PREPARATION

- A. Verify that items to be embedded in concrete are secured in place and block-outs in formwork are secured in place as required. Formwork installed as work of Section 03100.

### 3.04 INSTALLATION

- A. Comply with CRSI's "Manual for Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
  - 1. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
  - 2. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations.
  - 3. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.

4. Welding of reinforcement including tack welds are not permitted on this project.
5. A blowtorch shall not be used to facilitate field cutting or bending or any other reinforcing work.
6. Reinforcement shall not be bent after partially embedded in hardened concrete.
7. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction. Lace overlaps with wire.

END OF SECTION





**Section 03300**  
**Cast In Place Concrete**



## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Cast-in-place concrete proportioning and design mixes, aggregates and cement types.
- B. Concrete Admixtures.
- C. Bonding and Curing Materials.
- D. Finishing.

##### 1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
  - 1. ACI 301 – Specifications for Structural Concrete for Buildings.
  - 2. ACI 318 – Building Code Requirements for Reinforced Concrete.
- B. Concrete Testing Service: Engage a testing laboratory acceptable to Owner's Representative to perform material evaluation tests and to design concrete mixes.
- C. Materials and Installed Work Testing: The Owner's Representative may require testing and retesting at anytime during progress of work.
  - 1. Allow free access to material stockpiles and facilities.

##### 1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials, AASHTO M182 Burlap cloth made from Jute or Kenaf.
- B. American Concrete Institute (ACI):
  - 1. ACI 301 – Specifications for Structural Concrete for Buildings.
  - 2. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
  - 3. ACI 305R – Hot Weather Concreting.
  - 4. ACI 306R – Cold Weather Concreting.
- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM C31 – Making and Curing Concrete Test Specimens in the Field, Method of.
  - 2. ASTM C33 – Concrete Aggregates, Spec. for.
  - 3. ASTM C39 – Compressive Strength of Cylindrical Concrete Specimens, Test Method for.
  - 4. ASTM C42 – Obtaining and Testing Drilled Cores and Sawed Beams of Concrete, Method of.
  - 5. ASTM C94 – Ready-Mixed Concrete, Spec. for.

6. ASTM C143 – Slump of Portland Cement Concrete, Test Method for.
7. ASTM C150 – Portland Cement, Spec. for.
8. ASTM C171 – Sheet Materials for Curing Concrete, Spec. for.
9. ASTM C172 – Sampling Freshly Mixed Concrete, Method of.
10. ASTM C173 – Air Content of Freshly Mixed Concrete by the Volumetric Method, Test Method of.
11. ASTM C231 – Air Content of Freshly Mixed Concrete by the Pressure Method, Test Method of.
12. ASTM C260 – Air Entraining Admixtures for Concrete, Spec. for.
13. ASTM C494 – Chemical Admixtures for Concrete, Spec. for.
14. ASTM C881 – Epoxy-Resin-Base Bonding Systems for Concrete, Spec. for.
15. ASTM D1751 – Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types), Spec. for.

#### 1.04 SUBMITTALS

- A. Product Data: Submit manufacturer’s product data with application and installation instructions for proprietary materials and items named herein, as requested by Owner’s Representative.
- B. Samples: Submit samples of materials as specified and as otherwise requested by Owner’s Representative, including names, sources and descriptions.
- C. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test as specified.
- D. Materials Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Owner’s Representative. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.
- E. Delivery Tickets: A delivery ticket shall accompany each load of concrete from the batch plant.
  1. Information presented on the ticket shall include the tabulation covered by ASTM C94, 16.1.1 through 16.2.8 as well as any additional information the local codes may require.
  2. Tickets must be signed by the Contractor’s representative, noted as to time and place of pour and kept in a record at the site. Make such records available for inspection upon request by the Owner’s Representative.

### PART 2 – PRODUCTS

#### 2.01 MATERIALS

- A. Portland Cement: ASTM C150 of the following Type(s):
  1. All concrete for driveways, curbs, gutters, and sidewalks shall be in accordance with the latest edition of Amity Township’s Code of Ordinances found in Chapter XXVI entitled “Streets, Sidewalks, Driveways, and Curbs”.
  2. Type II, Moderate Sulfate Resistance (manholes).
- B. Use one brand of cement throughout project, unless otherwise acceptable to Owner’s Representative.

- C. Normal Weight Aggregates: Meeting requirements of ASTM C33, and as specified herein. Provide aggregates from a single source for exposed concrete.
- D. Water: Potable quality, clean and free of injurious amounts of oil, acid, alkali, organic matter, suspended matter, and other deleterious substances.
- E. Concrete Admixtures:
  - 1. Air-Entraining Admixture: Use a product conforming to ASTM C260, certified by manufacturer to be compatible with other required admixtures.
    - a. Acceptable Manufacturers:
      - (1) Sika Aer; Sika Corp.
      - (2) MB-VR or MB-AE; Master Builders.
      - (3) Darex AEA or Daravair; W. R. Grace.
      - (4) Air-Mix; The Euclid Chemical Co.
      - (5) Or Equal.
  - 2. Water-Reducing Admixture: ASTM C494, Type A, and containing not more than 0.5% chloride ions.
    - a. Acceptable Manufacturers:
      - (1) WRDA Hycol; W. R. Grace.
      - (2) Pozzolith Normal; Master Builders.
      - (3) Plastocrete 160; Sika Chemical Corp.
      - (4) Eucon WR-75; The Euclid Chemical Co.
      - (5) Or Equal.
  - 3. Non-Corrosive, Non-Chloride Accelerator: The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.
    - a. Acceptable Manufacturers:
      - (1) Accelguard 80; The Euclid Chemical Co.
      - (2) Or Equal.
  - 4. Water-Reducing, Retarding Admixture: ASTM C494, Type D, and containing not more than 0.5% chloride ions.
    - a. Acceptable Manufacturers:
      - (1) Pozzolith Retarder; Master Builders.
      - (2) Daratard; W.R. Grace.
      - (3) Plastiment; Sika Chemical Co.
      - (4) Eucon Retarder-75; The Euclid Chemical Co.
      - (5) Or Equal.
  - 5. Prohibited Admixtures: Calcium chloride thiocyanates or admixtures containing more than 0.5% chloride ions are not permitted.
- F. Preformed Expansion Joint Fillers (Sidewalks, Curbs & Driveways):
  - 1. Nonextruding and Resilient Bituminous Fiber Types (Exterior Use): ASTM D1751.
- G. Curing Compound (curing only, not sealing): Maximum moisture loss of 0.04 g/sq.cm.
  - 1. Acceptable Manufacturers:
    - a. Kurez DR by Euclid Chemical Company.
    - b. Or Equal.
- H. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 ounces per square yard, complying with AASHTO M 182, Class 2.

- I. Moisture-Retaining Cover: One of the following, complying with ASTM C171.
  - 1. Polyethylene film.
- J. Epoxy Bonding Adhesive: ASTM C881, two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.
  - 1. Acceptable Manufacturers:
    - a. Epoxitite; A. C. Horn, Inc.
    - b. Sikadur Hi-Mod; Sika Chemical Corp.
    - c. Or Equal.

## 2.02 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Owner's Representative for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1,200 psi higher than the specified strength. This over-design shall be increased to 1,400 psi when concrete strengths over 5,000 are used.
- B. Submit written reports to Owner's Representative of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Owner's Representative.
- C. Design Mixes: Provide normal weight concrete with the following properties, as indicated on drawings and schedules:
  - 1. 4,000 psi 28-day compressive strength (Manhole Construction).
  - 2. 3,000 psi 28-day compressive strength (Pipe Encasement, Cradles, Thrust Blocks, Miscellaneous Concrete, and Channel Fill).
  - 3. Design mixes for driveways, curbs, gutters, and sidewalks shall be in accordance with the latest edition of Amity Township's Code of Ordinances found in Chapter XXVI entitled "Streets, Sidewalks, Driveways, and Curbs".
- D. Admixtures:
  - 1. Use water-reducing admixture or high range water-reducing admixture (super plasticizer) in concrete as required for placement and workability.
  - 2. Use non-corrosive, non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50°F (10°C).
  - 3. Use high-range water-reducing admixture in pumped concrete, concrete for industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water/cement ratios below 0.50.
  - 4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of  $\pm 1\frac{1}{2}$  percent within following limits:
    - a. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or subjected to hydraulic pressure:
      - (1) 4.5 percent (moderate exposure); 5.5 percent (severe exposure) 1-1/2" max. aggregate. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) 1" max. aggregate.

- (2) 5.0 percent (moderate exposure); 6.0 percent (severe exposure) 3/4" max. aggregate.
    - (3) 5.5 percent (moderate exposure); 7.0 percent (severe exposure) 1/2" max. aggregate.
  - b. Other Concrete (not exposed to freezing, thawing, or hydraulic pressure): 2 percent to 4 percent air.
- E. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions. Admixtures must be included in initial mix design approved by Owner's Representative and cannot be either added or deleted from the mix without prior approval of Owner's Representative.
- F. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
  - 1. Subjected to freezing and thawing; W/C 0.50.
  - 2. Subjected to deicers/watertight; W/C 0.45.
- G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
  - 1. Ramps, slabs, and sloping surfaces: Not more than 3".
  - 2. Reinforced foundation systems: Not less than 1" and not more than 3".
  - 3. Other concrete: Not less than 1" nor more than 4".

## 2.03 CONCRETE MIXES

- A. Job-Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cubic yard, or smaller capacity, continue mixing at least 1½ minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cubic yard, increase minimum 1½ minutes of mixing time by 15 seconds for each additional cubic yard, or fraction thereof.
  - 1. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity and amount of water introduced.
- B. Ready-Mix Concrete: Comply with requirements of ASTM C94, and as herein specified.
  - 1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.
  - 2. When air temperature is between 85°F (30°C) and 90°F (32°C), reduce mixing and delivery time from 1½ hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.
  - 3. Provide batch ticket for each batch delivered and used indicating project identification name and number, date mix type, admixtures, mix time, quantity and amount of water used.
  - 4. Production of Concrete (Ready-Mixed):
    - a. Plant equipment and facilities shall conform to the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association.

## PART 3 – EXECUTION

### 3.01 PREPARATION

- A. Inspect work to receive cast-in-place concrete for deficiencies which would prevent proper execution of the finished work. Do not proceed with placing until such deficiencies are corrected.
- B. Embedded Items: Place piping and other embedded items required for adjoining work prior to concreting. Place accurately, and support against displacement.
  - 1. Apply Epoxy bonding Compound over prepared surfaces of embedded items where required under other Sections of these Specifications.
- C. Coordinate the installation of joint materials with placement of forms and reinforcing steel.
- D. Prepare formwork in advance and remove snow, ice, water and debris from within forms. Formwork as specified in Section 03100.
- E. Sprinkle subgrades sufficiently to eliminate water loss from concrete.
- F. Pre-position joint materials, anchors and embedded items.

### 3.02 CONCRETE PLACEMENT

- A. General: Comply with ACI 304 “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete”, and as herein specified.
- B. Conveying:
  - 1. Handle concrete from mixer to final deposit rapidly by methods which will prevent segregation or loss of ingredients to maintain required quality of concrete.
  - 2. Do not convey concrete through aluminum or aluminum alloy.
  - 3. Do not place concrete by pumps or other similar devices without prior written approval of Owner’s Representative.
- C. Depositing:
  - 1. Do not allow concrete to drop vertically more than 4 feet.
  - 2. Deposit in approximately horizontal layers of 12 to 18 inches.
  - 3. Do not allow concrete to flow laterally more than 3 feet.
  - 4. Make placement continuously to produce monolithic unit.
  - 5. Carry on placing at such a rate that concrete which is being integrated with fresh concrete is still plastic.
  - 6. Do not deposit concrete on concrete which has hardness sufficiently to cause the formation of seams or planes of weakness within sections.
  - 7. Do not use concrete which has partially hardened or has been contaminated by foreign materials.
  - 8. Do not subject concrete to procedures which will cause segregation.
  - 9. Do not place concrete in forms containing standing water.
  - 10. Do not place concrete on frozen ground.



- D. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
1. If water or aggregate is heated above 100°F, combine water with aggregate in the mixer before cement is added. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 100°F.
  2. Provide materials and methods for protecting concrete from freezing during freezing or near-freezing weather. Do not use frozen materials or materials containing snow or ice.
  3. Surfaces which the concrete is to come in contact with must be free of frost, snow and ice.
  4. Concrete placed in forms shall have a temperature of 50°F or higher after placement.
- E. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
1. Temperature of concrete delivered at the job-site shall not exceed 90°F.
  2. Cool ingredients before mixing to prevent temperature in excess of 90°F.
  3. Make provisions for windbreaks, shading, fog spraying, sprinkling or wet cover when necessary.
- F. Consolidation:
1. Consolidate concrete by vibration, spading, rodding, or other manual methods. Work concrete around embedded items and eliminate air or stone pockets and other causes of honeycombing, pitting, or planes of weakness.
  2. Use vibration equipment of internal type and not the type attached to forms and reinforcement.
  3. Use vibrators capable of transmitting vibration to concrete in frequencies sufficient to provide satisfactory consolidation.
  4. Do not leave vibrators in one spot long enough to cause segregation. Remove concrete segregated by vibrator operation.
  5. Do not use vibrators to spread concrete.
  6. Have sufficient reserve vibration equipment to guard against shutdown of work occasioned by failure of equipment in operation.

### 3.03 FINISHING

- A. Floated Finish: After concrete has been placed, consolidated, struck off and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after first floating, check planeness of surface with a ten foot straightedge applied at not less than two different angles. Cut down high spots and fill low spots during this procedure to produce a surface with true planes within 1/4-inch in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction. Following straightedge checking, refloat slab immediately to a uniform sandy texture.
- B. Trowel and Fine Broom Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, such as sidewalks and driveways.
1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface.
  2. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance.

3. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Owner's Representative before application.

C. Manhole Channel:

1. Steel Trowel Finish: Obtained by hand troweling a Floated Finish. First troweling after floating shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Perform additional trowelings by hand after the surface has hardened sufficiently. Perform final troweling when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate surface by hand trowel operations. Produce finished surface essentially free of trowel marks and uniform in texture and appearance.

### 3.04 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

1. Provide moisture curing by following methods.
  - a. Continuous water-fog spray.
  - b. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
2. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours).
3. Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions.
4. Recoat areas subjected to heavy rainfall within 3 hours after initial application.
5. Maintain continuity of coating and repair damage during curing period.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

### 3.05 QUALITY CONTROL

A. Contractor will employ a testing laboratory to perform tests and to submit test reports.

B. Sampling and testing for quality control during placement of concrete may include the following, as directed by Owner's Representative.

1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
2. Slump: ASTM C143; one test at point of discharge for each load of each type of concrete; additional tests when concrete consistency seems to have changed.

3. Air Content: ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
  4. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above; and each time a set of compression test specimens made.
  5. Compression Test Specimen: ASTM C31; one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
  6. Compressive Strength Tests: ASTM C39; one set for each day's pour exceeding 5 cu. yds. plus additional sets for each 50 cu. yds. over and above the first 25 cu. yds of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
    - a. When total quantity of a given class of concrete is less than 50 cu. yds., strength test may be waived by Owner's Representative if, in his judgment, adequate evidence of satisfactory strength is provided.
    - b. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
    - c. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive by more than 500 psi.
- C. Test results will be reported in writing to Owner's Representative and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.
- D. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Owner's Representative. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION



**Section 03600**  
**Grout**



## SECTION 03600

### GROUT

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Non-Shrink, Non-Metallic Grout.

##### 1.02 RELATED SECTIONS

- A. Cast-In-Place Concrete: Section 03300.
- B. Individual grouting requirements as specified in various other Sections of these Specifications.

##### 1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
  - 1. Grout manufacturer shall furnish the Owner's Representative with current independent laboratory test results indicating the grout as non-shrink from time of placement; indicating no expansion after final set, ASTM C827; indicating 4,000 psi strength developed with a trowelable mix within 24 hours, ASTM C109; and indicating placement time based on initial set of not less than 60 minutes, ASTM C191.
  - 2. Test results, as supplied by the grout manufacturer, shall indicate that in projects of similar scope and size, the effective bearing area was between 95 and 100 percent.

##### 1.04 REFERENCES

- A. American Concrete Institute (ACI): ACI 308, Recommended Practice for Curing Concrete.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM C191 – Time of Setting of Hydraulic Cement by Vicat Needle, Test Method for.
  - 2. ASTM C596 – Drying Shrinkage of Mortar Containing Portland Cement, Test Method for.
  - 3. ASTM C827 – Early Volume Change of Cementitious Mixtures, Test Method for.

##### 1.05 SUBMITTALS

- A. Product data in accordance with Section 01300.

##### 1.06 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.

## 1.07 PROJECT 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. Water: Potable quality, free from deleterious amounts of acids, alkalis, and organic substances.
- B. Non-Shrink Non-Metallic Grout: Factory premixed material containing no corrosive irons, aluminum, chemicals or gypsums.
  - 1. Grouts containing water reducers, accelerators, or fluidifiers shall have no drying shrinkage greater than the equivalent sand cement and water mix as tested per ASTM C596.
  - 2. Grout shall be non-shrink before initial set and show no expansion after set as tested per ASTM C827.
  - 3. Initial set of grout not less than 60 minutes per ASTM C191 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 Manufacturers:
    - a. Master Builders; Set Grout.
    - b. W. R. Meadows; Pac-It.
    - c. Or Equal.

### 2.02 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 consistency.

## 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. General: Clean areas to be grouted free of oil, grease, laitance, dirt and other contaminants. Remove loose material. Remove rust, paint, and oil from metal components in contact with grout.
  - 2. Non-Shrink Grout: Perform additional surface preparation in accordance with manufacturer's instructions.



3.02 MIXING

A. Time:

1. Non-Shrink Grout: In accordance with manufacturer's 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 the Standard Details, required by Specifications, or directed by Owner's Representative.

END OF SECTION



# Application



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## ***APPENDIX A***



AMITY TOWNSHIP  
BERKS COUNTY, PENNSYLVANIA

APPLICATION FOR SEWER SYSTEM EXTENSION

NAME OF DEVELOPMENT: \_\_\_\_\_

LOCATION: \_\_\_\_\_

DATE OF APPLICATION: \_\_\_\_\_

APPLICANT'S NAME: \_\_\_\_\_

CONTACT PERSON: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

APPLICATIONS AND PERMITS:

PaDEP Permits \_\_\_\_\_  
Treatment Plant Capacity Acquired \_\_\_\_\_  
Planning Module Approval \_\_\_\_\_  
Right-of-Way Acquisition \_\_\_\_\_

TYPE OF SYSTEM:

Low-Pressure Sewer System \_\_\_\_\_  
On-Lot Grinder Pump Stations \_\_\_\_\_  
Gravity Sewer System \_\_\_\_\_  
Pump Station and Force Main \_\_\_\_\_  
On-Lot Sewer System \_\_\_\_\_

SYSTEM SPECIFICS:

Total Number of Lots/Units \_\_\_\_\_  
Total Number of EDUs \_\_\_\_\_  
Total Length and Size of Gravity Sewer System \_\_\_\_\_  
Total Length of Low-Pressure Sewer System \_\_\_\_\_  
Total Length and Size of Force Main \_\_\_\_\_  
Estimate for Improvements \_\_\_\_\_  
Estimate for Inspection and Testing Fees \_\_\_\_\_



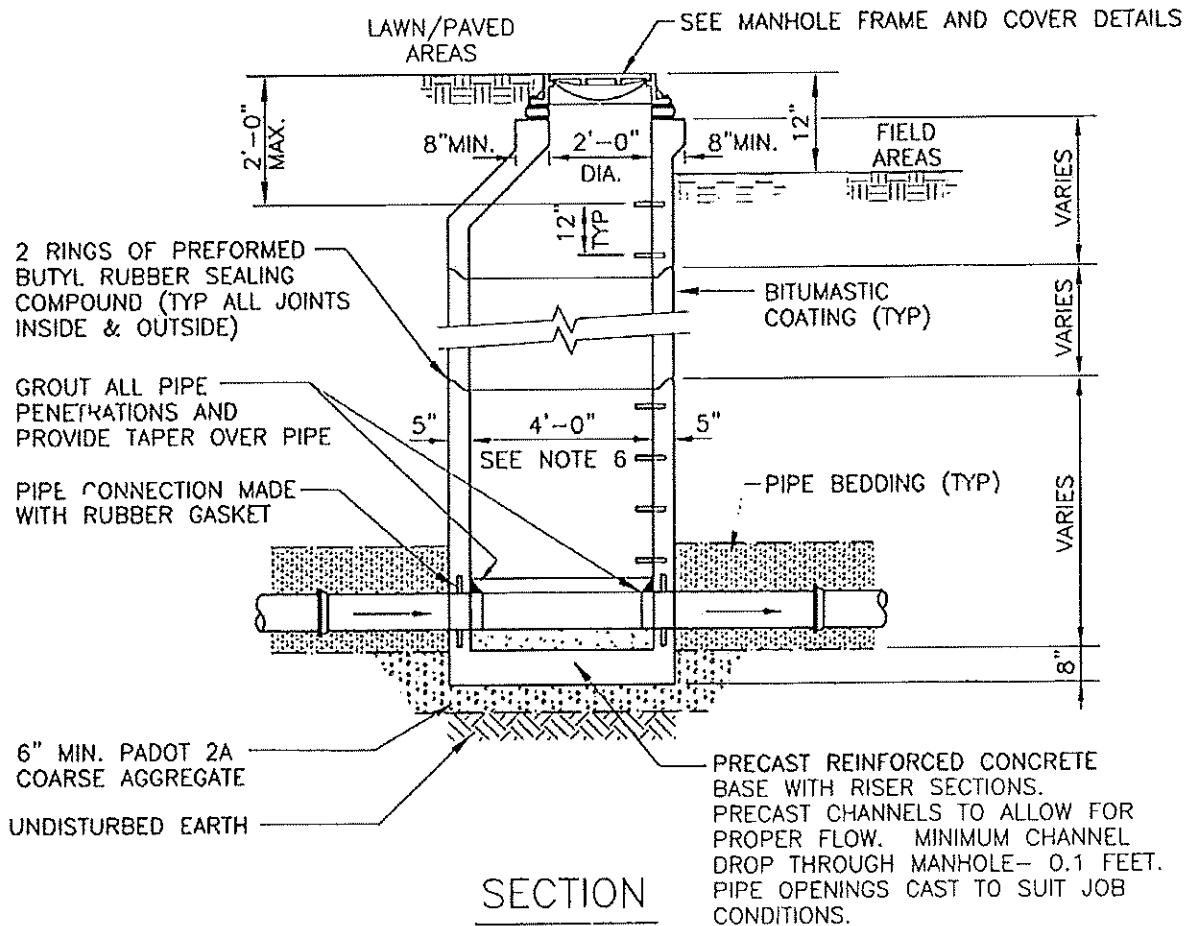


# Standard Details



**NOTES:**

1. ADJUST TO GRADE WITH CONC GRADE RINGS (MAX. VERT. ADJUST. 6")  
SEE FRAME & COVER DETAILS
2. MECHANICALLY VIBRATED PRECAST CONC SHALL CONFORM TO A.S.T.M. SPEC. C-478.
3. IF INCOMING INVERT EXCEEDS OUTGOING INVERT BY GREATER THAN OR EQUAL TO 6", SEE INSIDE SPLASH/INSIDE DROP MANHOLE DETAILS.
4. FOR MANHOLES WHERE TOP OF RIM TO INVERT DISTANCE IS LESS THAN 5'-0", USE FLAT TOP MANHOLE IN LIEU OF CONE TOP.
5. FILL ALL LIFTING HOLES WITH NON-SHRINK GROUT.
6. LARGER DIA MANHOLE REQUIRED ON INSIDE DROP AND INSIDE SPLASH CONNECTION GREATER THAN 12", SEE DETAIL 10.
7. FOR MANHOLES LOCATED WITHIN THE 100-YEAR FLOOD BOUNDARY, PROVIDE A WATERTIGHT MANHOLE FRAME AND COVER PER THE DETAILS.



**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

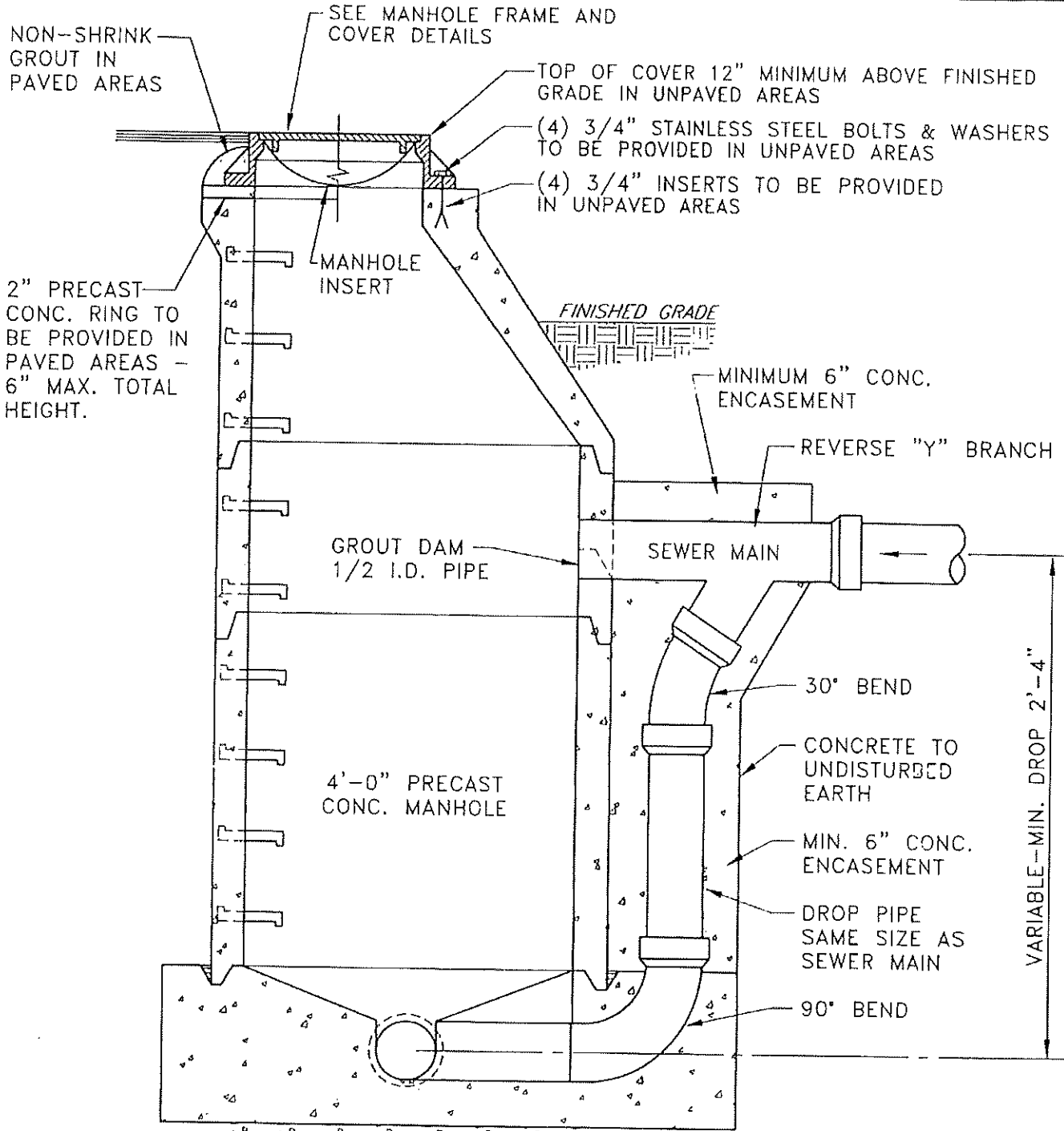
**PRECAST MANHOLE DETAIL  
8" THRU 24" SEWERS**



400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

DATE: JUNE 2005

DETAIL:



TYPICAL SECTION

NOTE:  
WHERE MANHOLE IS LOCATED WITHIN THE 100-YEAR FLOODWAY BOUNDARY, PROVIDE WATERTIGHT MANHOLE FRAME AND COVER PER DETAILS.

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

**PRECAST MANHOLE DETAIL  
WITH DROP CONNECTION**

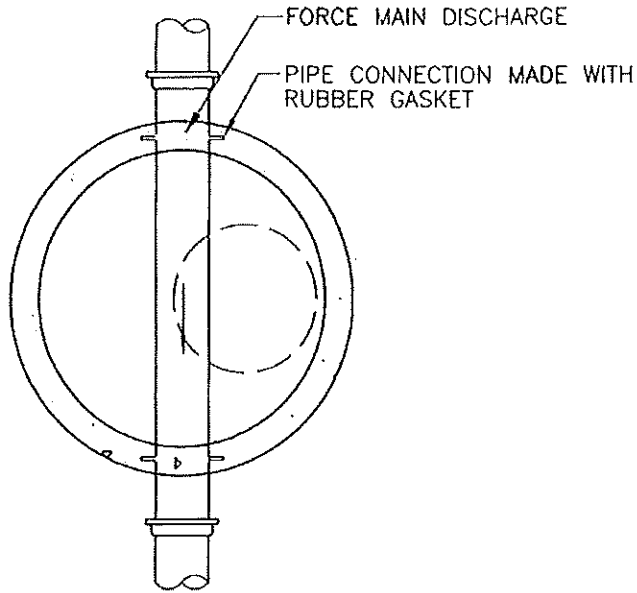
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DETAIL: 2

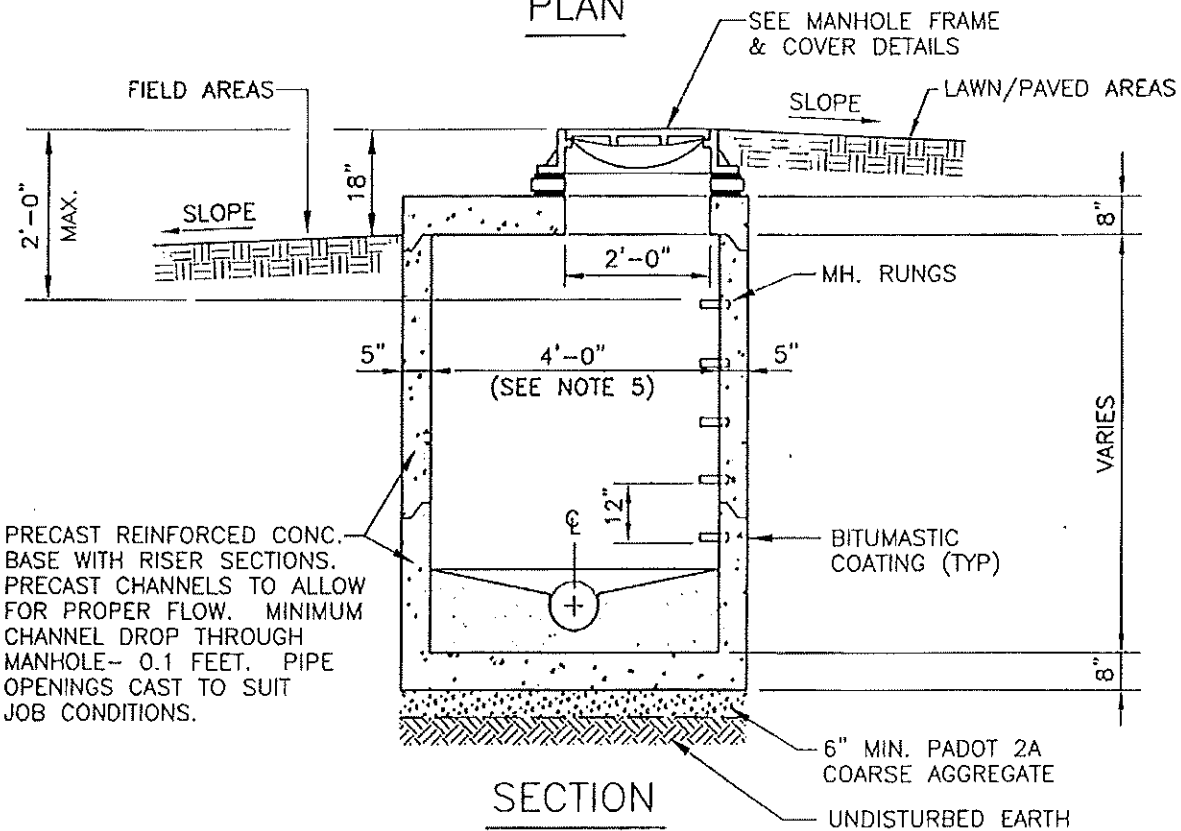
SD002.DWG

**NOTES:**

1. ADJUST TO GRADE WITH CONC. GRADE RINGS (MAX. VERT. ADJUST. 6"). SEE FRAME & COVER DETAILS.
2. MECHANICALLY VIBRATED PRECAST CONC. SHALL CONFORM TO A.S.T.M. C-478.
3. SEAL ALL JOINTS INSIDE & OUTSIDE WITH PREFORMED BUTYL RUBBER SEALING COMPOUND.
4. FILL ALL LIFTING HOLES WITH NON-SHRINK GROUT.
5. INSIDE DIAMETER DETERMINED BY PIPE SIZE & CONFIGURATION IN MANHOLE. SEE DETAIL 10.
6. WHERE MANHOLE IS LOCATED WITHIN 100-YEAR FLOODWAY BOUNDARY, PROVIDE WATERTIGHT MANHOLE FRAME AND COVER PER DETAILS.



**PLAN**



**SECTION**

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



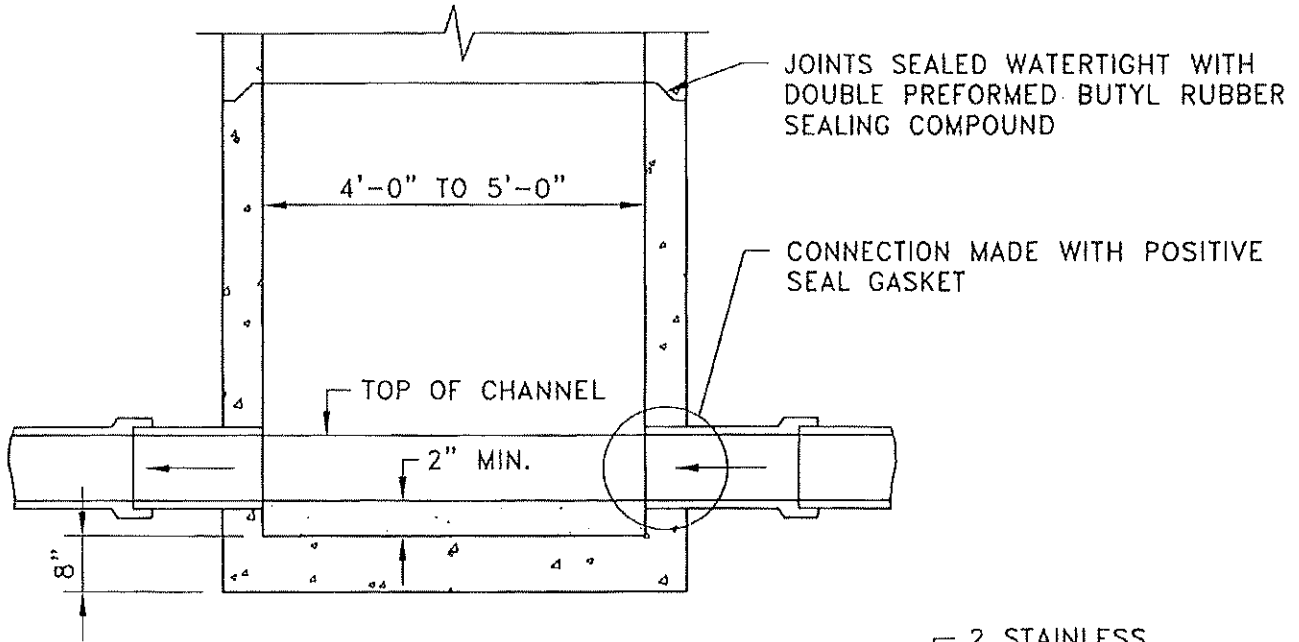
400 Washington Street, Suite 602  
 Reading, Pennsylvania 19601  
 Tel 610.374.5285

**PRECAST MANHOLE DETAIL  
 WITH FORCE MAIN DISCHARGE**

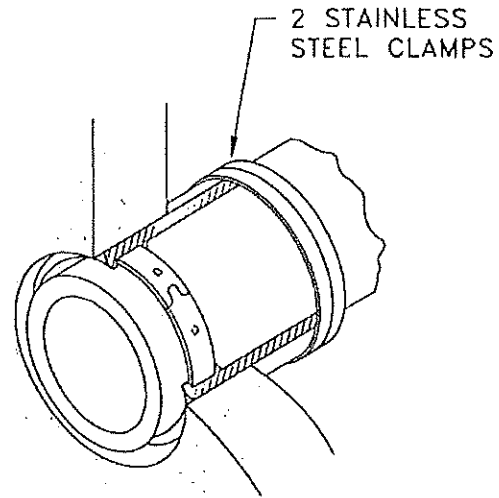
DATE: JUNE 2005

DETAIL: 3

SD003.DWC



SECTION A



EXPANDED VIEW OF  
POSITIVE SEAL GASKET

SECTION B

**AMITY TOWNSHIP**  
2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

**MANHOLE WITH PRECAST BASE  
AND POSITIVE SEAL GASKET**

DATE: JUNE 2005

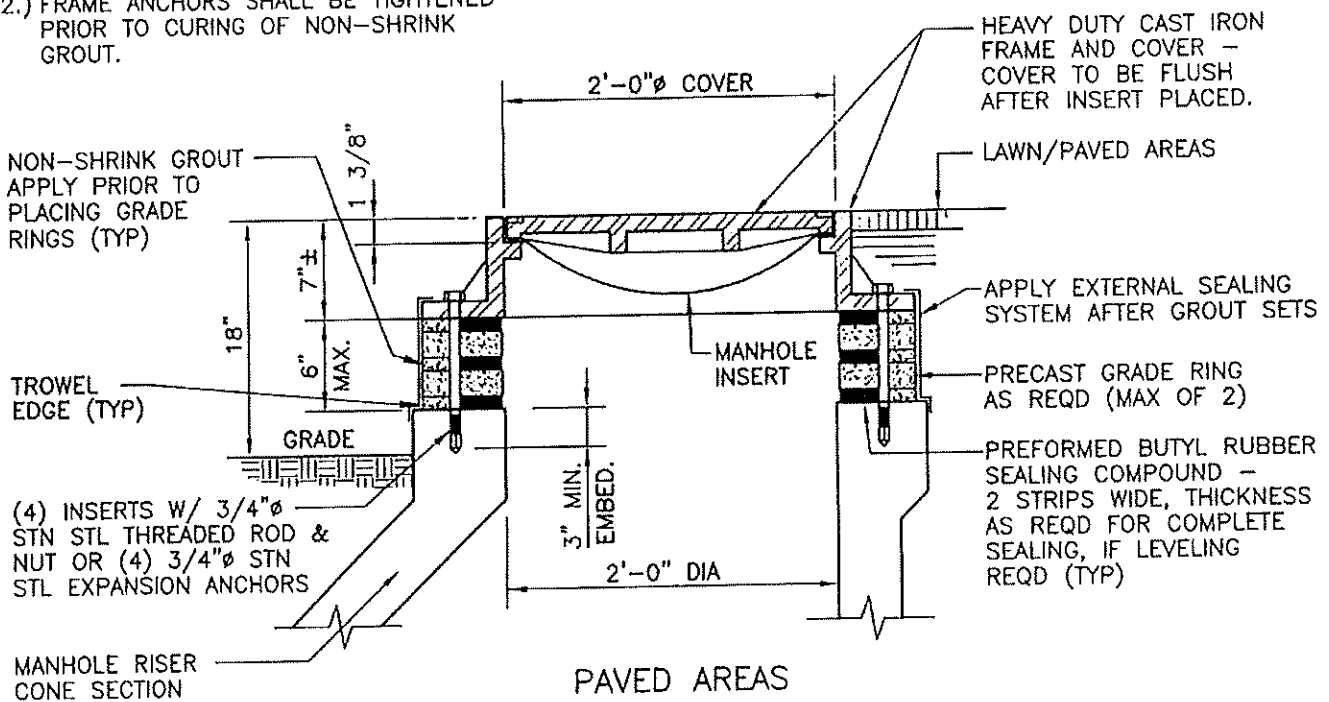
DETAIL: 4



**NOTES:**

- 1.) ANCHOR BOLT HOLES SHALL BE DRILLED WITH A PERCUSSION OR ROTARY HAMMER DRILL UTILIZING A CARBIDE DRILL BIT. CORE DRILLING, OR ROTATIONAL ONLY DRILLING, OF ANY KIND, IS NOT ALLOWED.
- 2.) FRAME ANCHORS SHALL BE TIGHTENED PRIOR TO CURING OF NON-SHRINK GROUT.

**COVER PATTERN**



**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



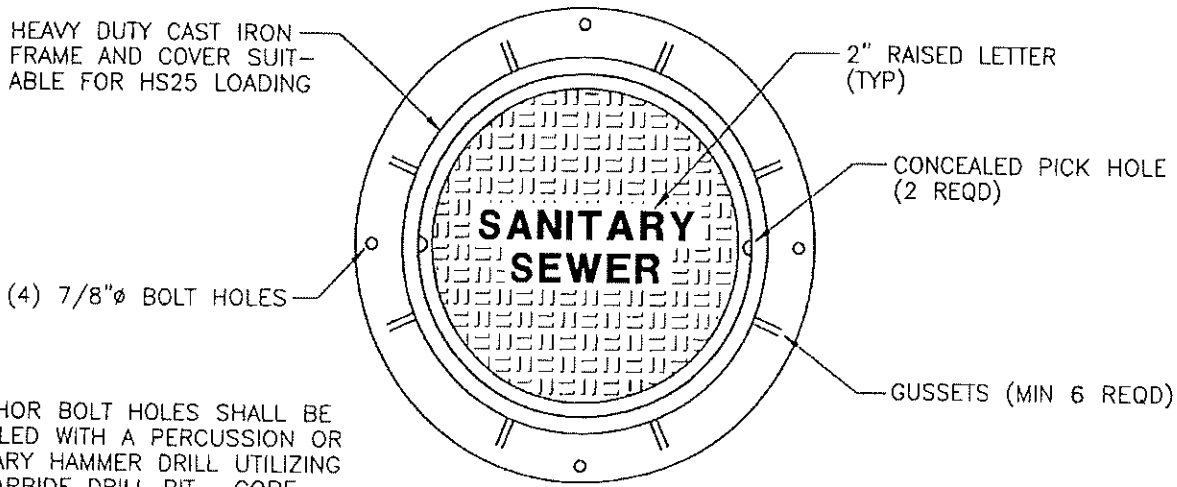
400 Washington Street, Suite 602  
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Tel 610.374.5285

**STANDARD MANHOLE FRAME & COVER  
WITH GRADE RINGS DETAIL**

DATE: JUNE 2005

DETAIL: 5

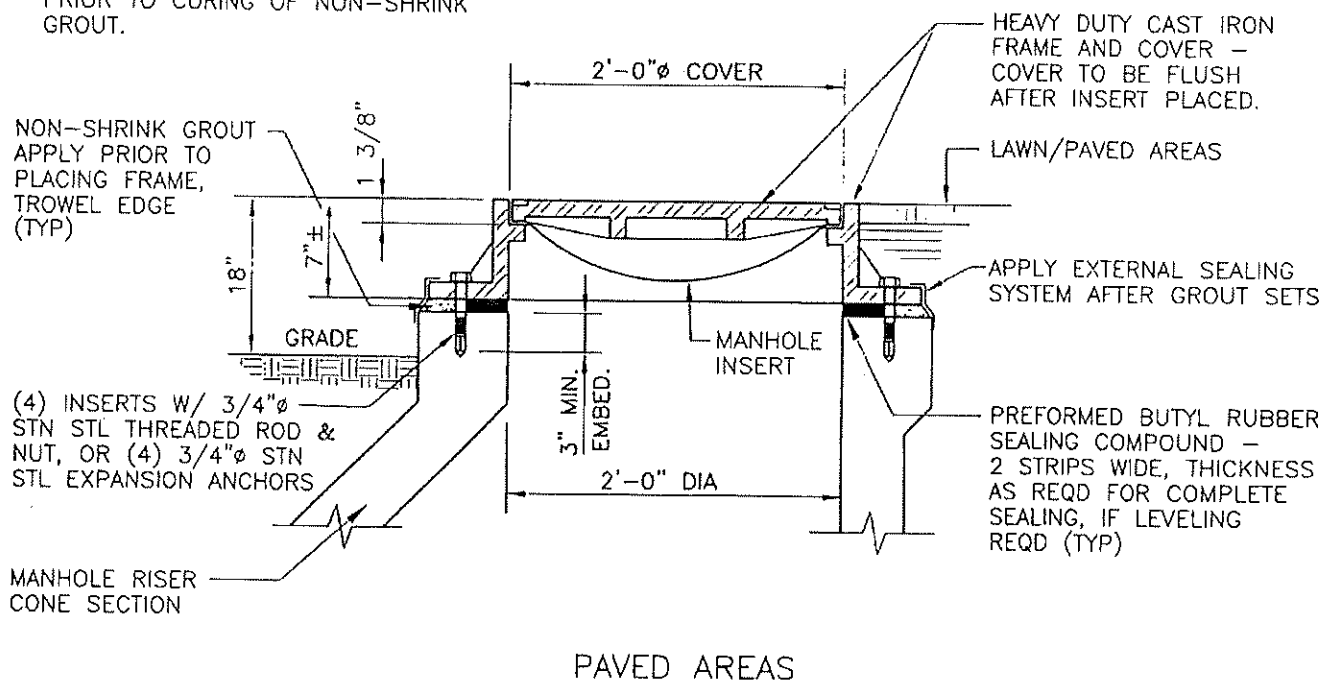
SD005.DWG



**NOTES:**

- 1.) ANCHOR BOLT HOLES SHALL BE DRILLED WITH A PERCUSSION OR ROTARY HAMMER DRILL UTILIZING A CARBIDE DRILL BIT. CORE DRILLING, OR ROTATIONAL ONLY DRILLING, OF ANY KIND, IS NOT ALLOWED.
- 2.) FRAME ANCHORS SHALL BE TIGHTENED PRIOR TO CURING OF NON-SHRINK GROUT.

**COVER PATTERN**



**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



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**STANDARD MANHOLE FRAME & COVER  
WITHOUT GRADE RINGS DETAIL**

DATE: JUNE 2005  
DETAIL: 6

SD006.DWG



HEAVY DUTY CAST IRON FRAME AND COVER, WATERTIGHT, SUITABLE FOR HS25 LOADING

2" RAISED LETTER (TYP)

CONCEALED PICK HOLE (2 REQD)

(4) 7/8"Ø BOLT HOLES

**SANITARY SEWER**

GUSSETS (MIN 6 REQD)

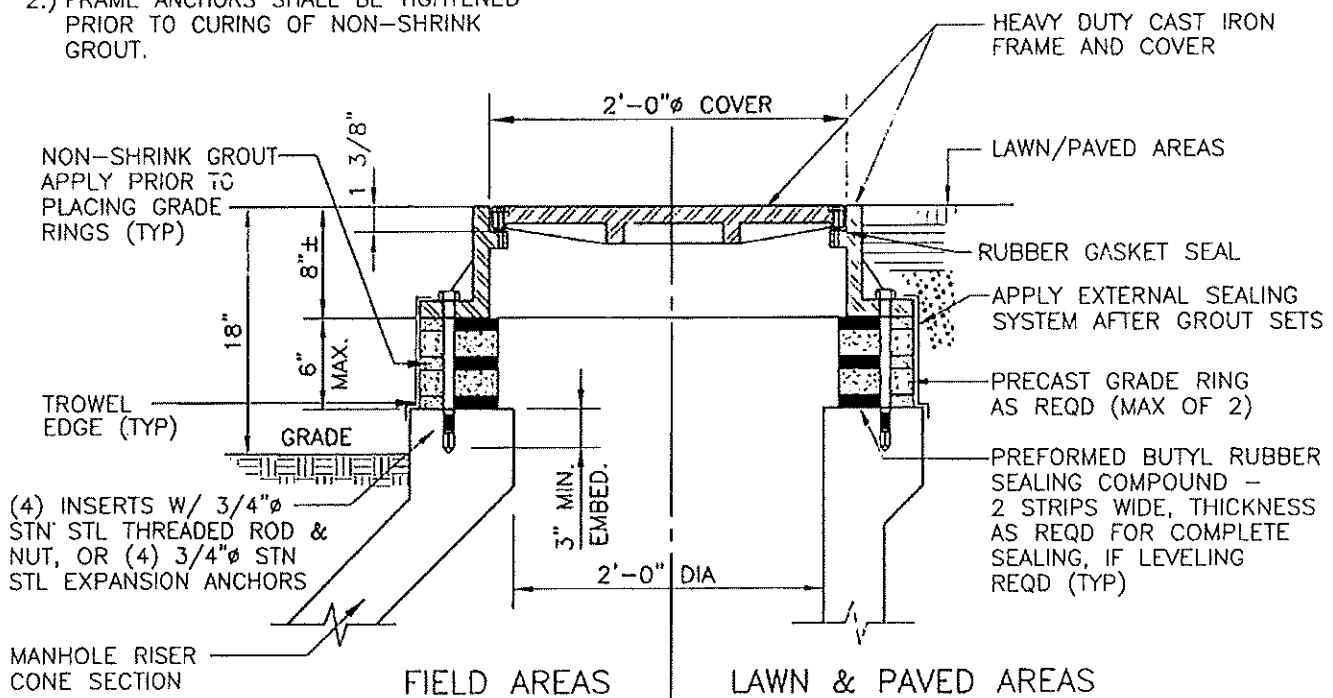
1/2" STAINLESS STEEL CAP SCREW WITH WASHER AND RUBBER GASKET (4 REQ'D.)

**NOTES:**

1.) ANCHOR BOLT HOLES SHALL BE DRILLED WITH A PERCUSSION OR ROTARY HAMMER DRILL UTILIZING A CARBIDE DRILL BIT. CORE DRILLING, OR ROTATIONAL ONLY DRILLING, OF ANY KIND, IS NOT ALLOWED.

COVER PATTERN

2.) FRAME ANCHORS SHALL BE TIGHTENED PRIOR TO CURING OF NON-SHRINK GROUT.



**NOTE:** PROVIDE WATERTIGHT MANHOLE FRAME & COVER IN SWALES, GUTTERS, FLOOD PRONE AREAS & ALL AREAS OUTSIDE OF ROADWAYS.

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



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**WATERTIGHT MANHOLE FRAME & COVER  
WITH GRADE RINGS DETAIL**

DATE: JUNE 2005

DETAIL: 7

HEAVY DUTY CAST IRON  
FRAME AND COVER,  
WATERTIGHT, SUITABLE  
FOR HS25 LOADING

2" RAISED LETTER  
(TYP)

CONCEALED PICK HOLE  
(2 REQD)

(4) 7/8"Ø BOLT HOLES

**SANITARY  
SEWER**

GUSSETS (MIN 6 REQD)

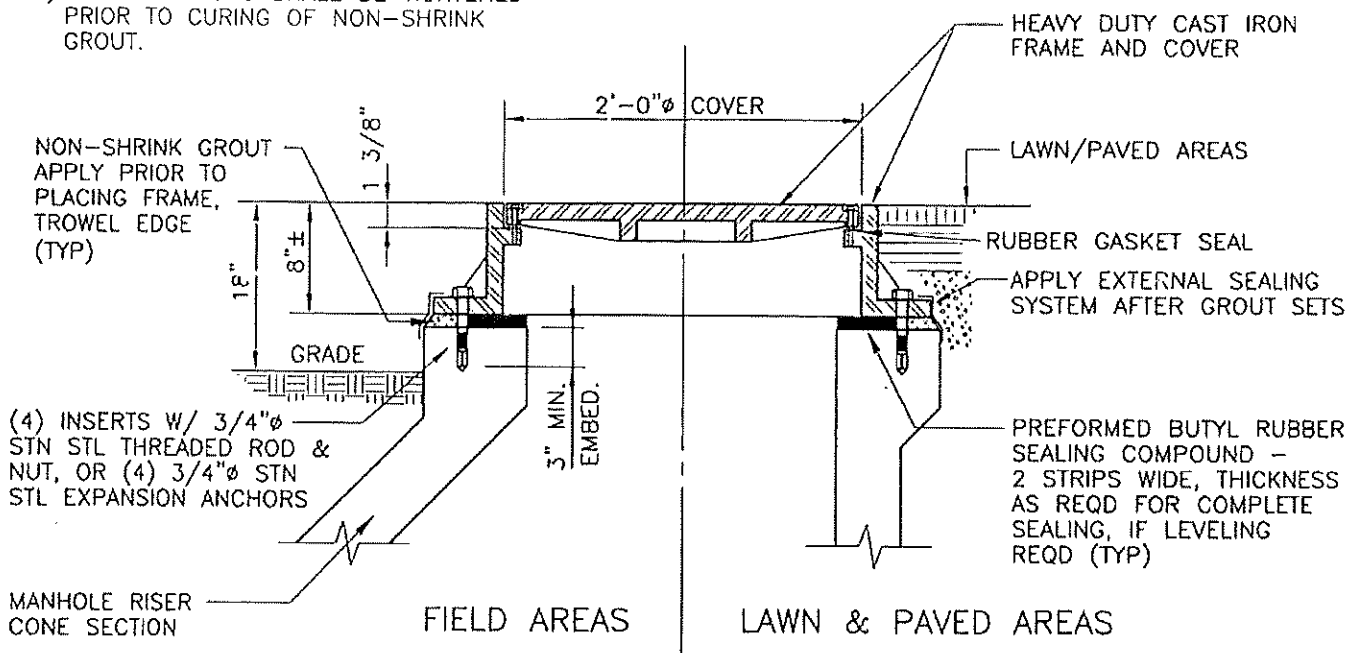
1/2" STAINLESS STEEL CAP  
SCREW WITH WASHER AND  
RUBBER GASKET (4 REQ'D.)

**NOTES:**

1.) ANCHOR BOLT HOLES SHALL BE  
DRILLED WITH A PERCUSSION OR  
ROTARY HAMMER DRILL UTILIZING  
A CARBIDE DRILL BIT. CORE  
DRILLING, OR ROTATIONAL ONLY  
DRILLING, OF ANY KIND, IS NOT  
ALLOWED.

COVER PATTERN

2.) FRAME ANCHORS SHALL BE TIGHTENED  
PRIOR TO CURING OF NON-SHRINK  
GROUT.



NOTE: PROVIDE WATERTIGHT MANHOLE FRAME & COVER IN SWALES, GUTTERS,  
FLOOD PRONE AREAS & ALL AREAS OUTSIDE OF ROADWAYS.

**AMITY TOWNSHIP**

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**STANDARD DETAIL - SEWER SYSTEM**



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**WATERTIGHT MANHOLE FRAME & COVER  
WITHOUT GRADE RINGS DETAIL**

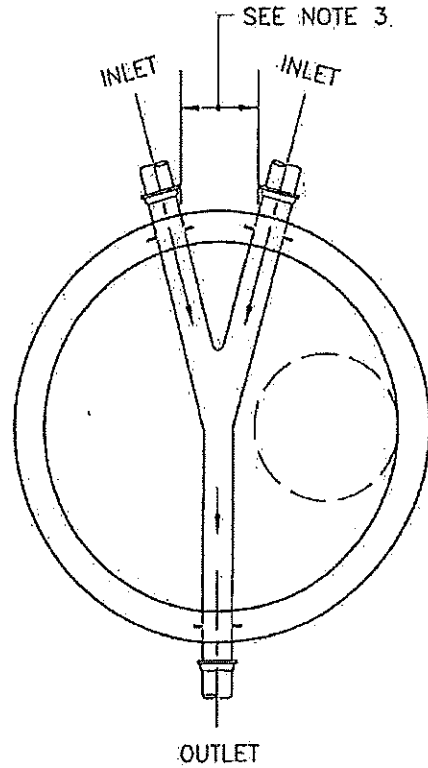
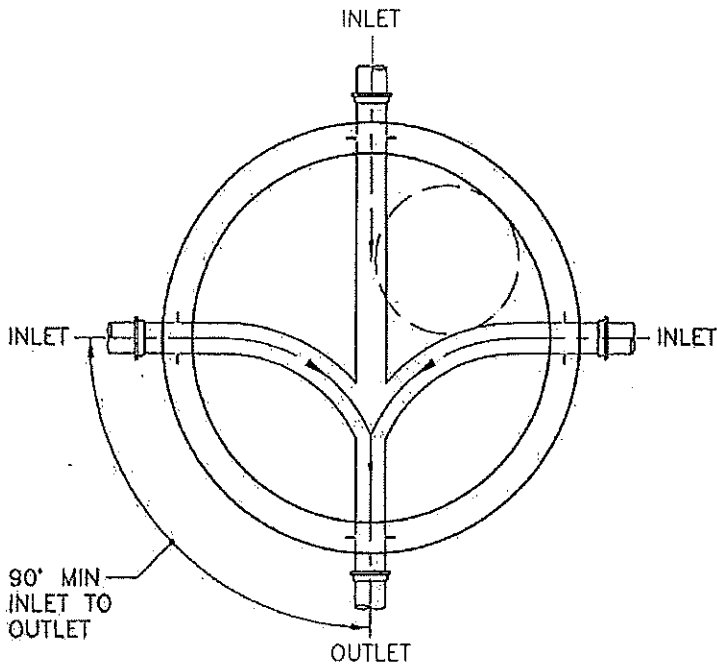
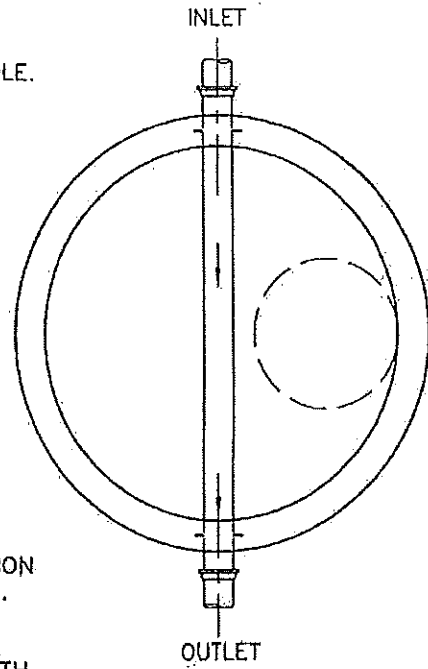
DATE: JUNE 2005

DETAIL: 8

SD008.DWG

NOTES:

1. THREE INLET PIPES AND ONE OUTLET PIPE MAX INTO MANHOLE.
2. NO LATERALS INTO MANHOLES, EXCEPT BY SPECIAL EXCEPTION FROM THE AUTHORITY.
3. MINIMUM 12" SEPARATION FROM EDGE OF PIPE PENETRATION TO EDGE OF PIPE PENETRATION
4. MINIMUM CHANNEL DROP THROUGH MANHOLE:  
 STRAIGHT THROUGH - 0.1 FEET  
 BEND - 0.2 FEET
5. ALL CHANNELS SHALL BE PRECAST, UNLESS OTHERWISE SPECIFICALLY NOTED OR APPROVED.
6. THESE DETAILS APPLY TO PRECAST CHANNELS IN NEW MANHOLES, AND FIELD-FORMED CHANNELS IN EXISTING MANHOLES.
7. CHANNEL BENCH AT PIPE SHALL MATCH 3/4 CROWN ELEVATION OF PIPE AND RISE 1/2" PER FOOT TO THE MANHOLE WALLS.
8. CHANNELS SHALL MATCH THE CROSS-SECTIONAL DIMENSIONS OF THE PIPES ENTERING AND EXITING THE MANHOLE. SMOOTH TRANSITIONS SHALL BE PROVIDED BETWEEN CHANGES IN PIPE SIZE.



**AMITY TOWNSHIP**

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**STANDARD DETAIL - SEWER SYSTEM**



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**PRECAST CHANNEL DETAILS**

DATE: JUNE 2005

DETAIL: 9

SD009.DWG

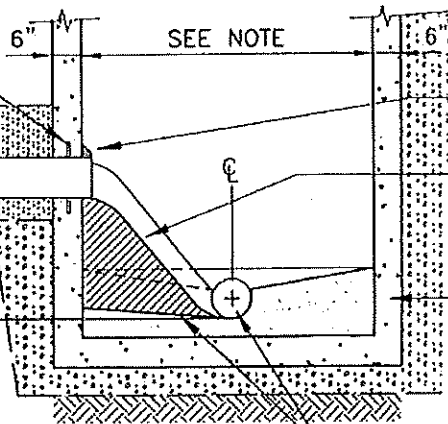


PIPE CONNECTION MADE WITH RUBBER GASKET

PIPE BEDDING (TYP)

SEWER

INSIDE SPLASH WHEN GREATER THAN OR EQUAL TO 6" BUT LESS THAN OR EQUAL TO 2'-0"



NOTE:  
MANHOLE DIAMETER SHALL BE 4' WHEN SPLASH IS 6" TO 1'-0" AND 5' WHEN SPLASH IS 1'-0" TO 2'-0".

GROUT ALL PIPE PENETRATIONS AND PROVIDE TAPER OVER PIPE

SPLASH CHANNEL FORMED INTO PRECAST CHANNEL WITH NON-SHRINK GROUT

PRECAST REINFORCED CONCRETE BASE WITH RISER SECTIONS. SEE PRECAST MANHOLE DETAILS.

PRECAST CHANNELS TO ALLOW FOR PROPER FLOW. SEE PRECAST CHANNEL DETAILS.

### SECTION INSIDE SPLASH

PIPE CONNECTION MADE WITH RUBBER GASKET

FLEXIBLE PIPE COUPLING

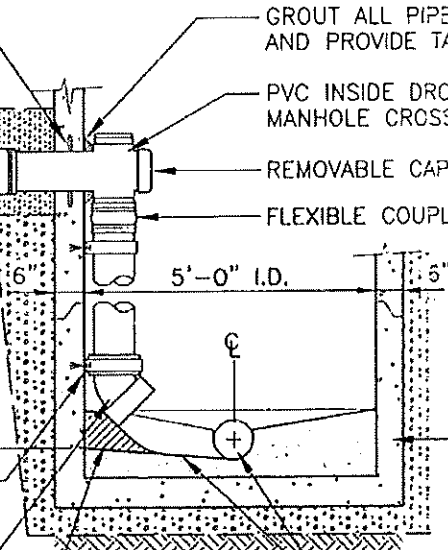
SEWER

INSIDE DROP WHEN GREATER THAN 2'-0"

2" WIDE x 1/16" THK STN STL STRAPS & STN STL ANCHORS W/ MAX EMBEDMENT OF 3" AT 18" MAX SPACINGS (TYP) - ALSO PROVIDE STRAP SPECIFICALLY FOR 45° BEND

45° PVC ELBOW

SPLASH CHANNEL FORMED INTO PRECAST CHANNEL WITH NON-SHRINK GROUT



GROUT ALL PIPE PENETRATIONS AND PROVIDE TAPER OVER PIPE

PVC INSIDE DROP MANHOLE CROSS

REMOVABLE CAP

FLEXIBLE COUPLING

PRECAST REINFORCED CONCRETE BASE WITH RISER SECTIONS. SEE PRECAST MANHOLE DETAILS.

PRECAST CHANNELS TO ALLOW FOR PROPER FLOW. SEE PRECAST CHANNEL DETAILS.

### SECTION INSIDE DROP

## AMITY TOWNSHIP

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

### STANDARD DETAIL - SEWER SYSTEM

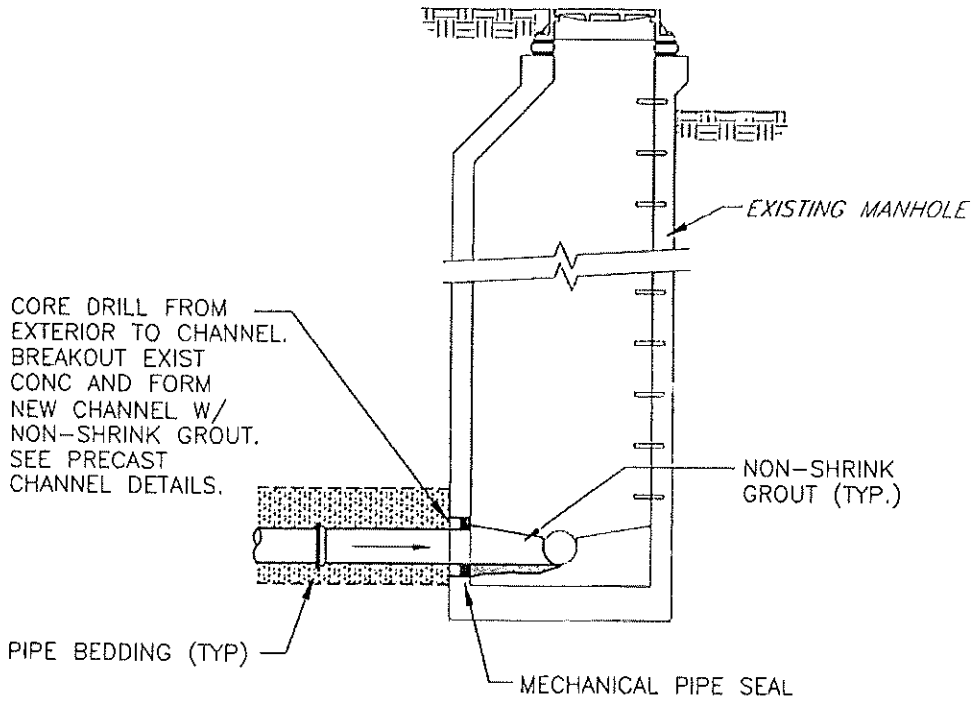


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# INSIDE SPLASH/INSIDE DROP (8"-10") MANHOLE DETAILS

DATE: JUNE 2005

DETAIL: 10



SECTION

NOTE: CROWN ELEVATION OF NEW PIPE SHALL MATCH OR BE HIGHER THAN CROWN ELEVATION OF EXISTING OUTGOING PIPE.

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

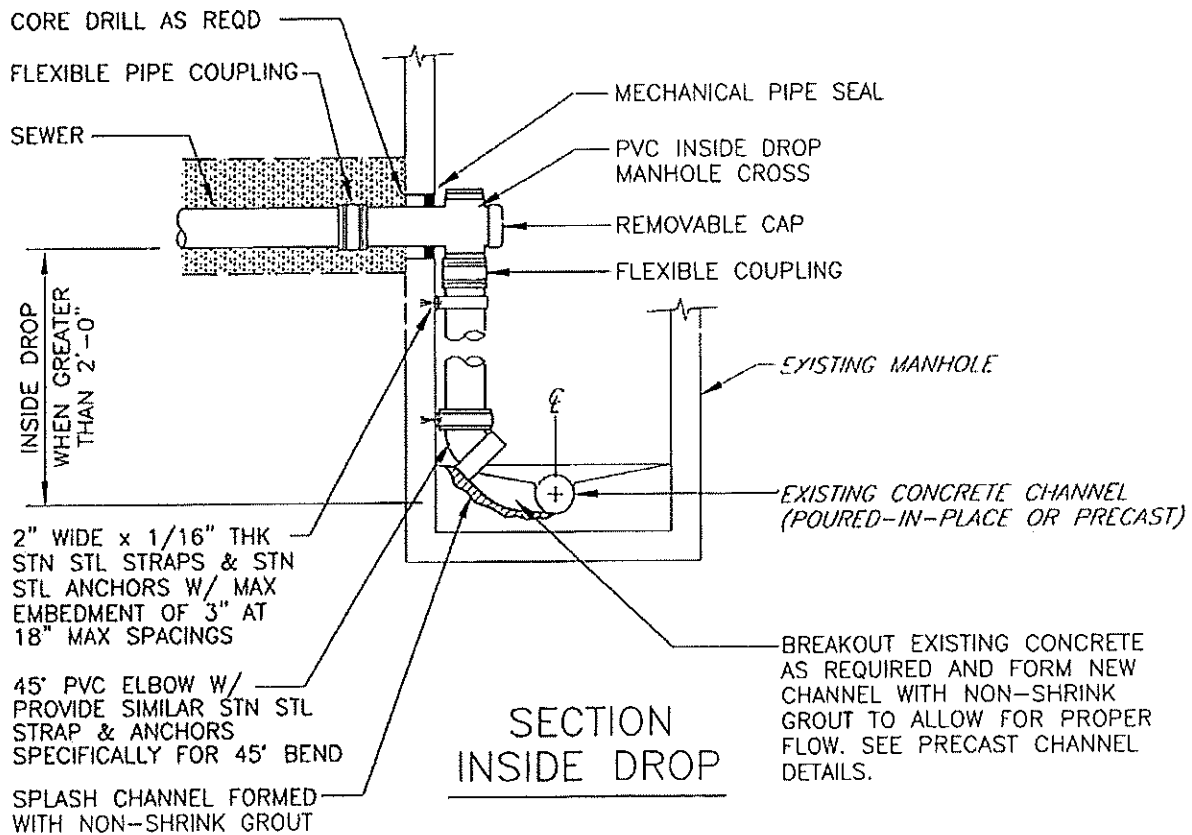
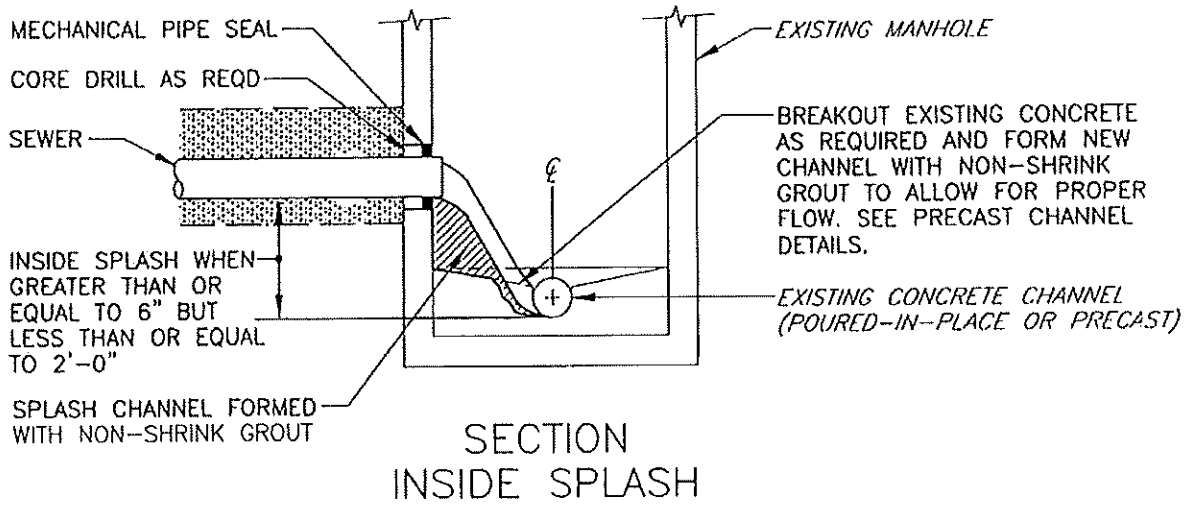


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GRAVITY SEWER CONNECTION  
TO EXISTING MANHOLE DETAIL

DATE: JUNE 2005

DETAIL: 11



(\*) BY SPECIAL EXCEPTION ONLY, IN 4 FT DIA MANHOLES

**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

**ARRO**  
 ARRO Consulting, Inc.

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 Tel 610.374.5285

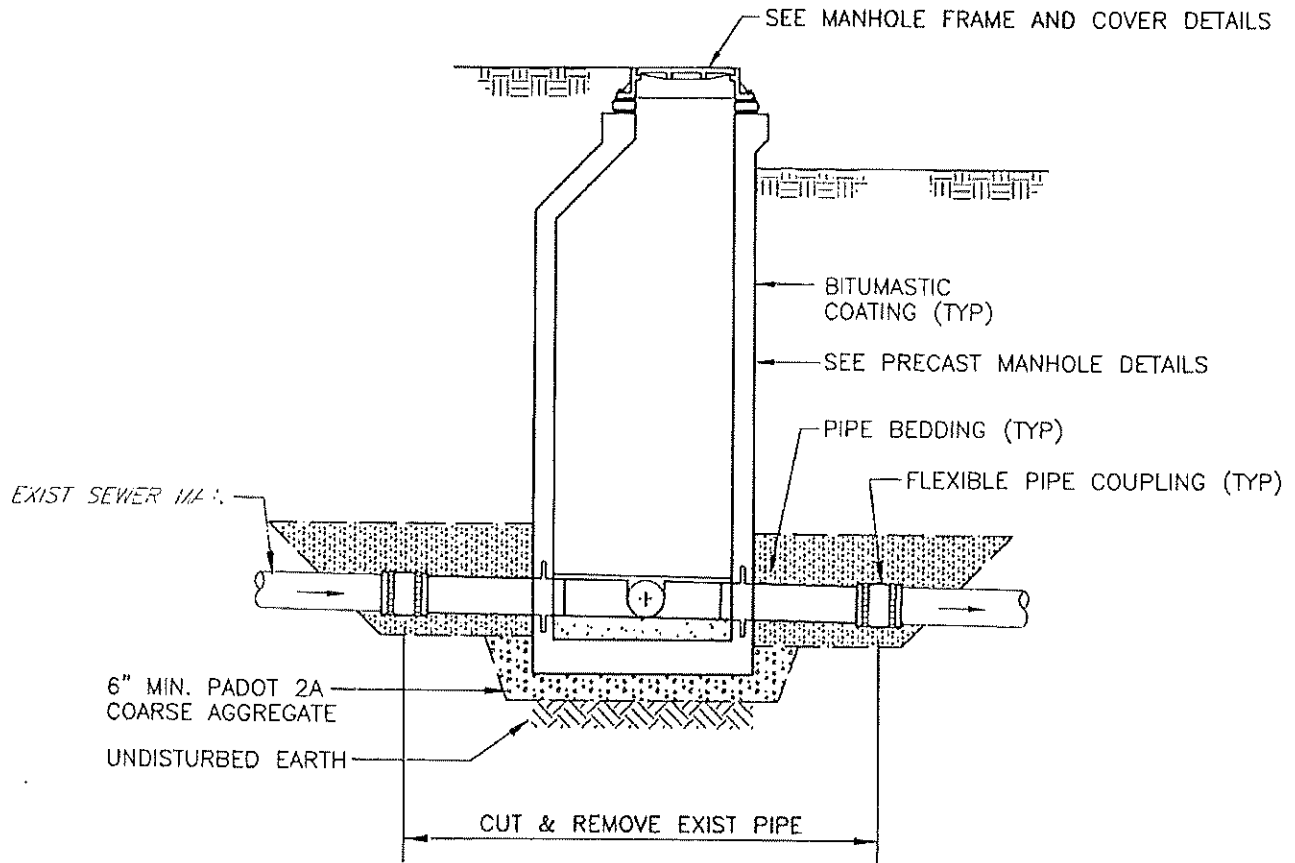
INSIDE SPLASH/DROP 8"-10" CONNECTION  
 TO EXISTING MH (BY SPECIAL EXCEPTION\*)

DATE: JUNE 2005

DETAIL: 12

NOTES:

1. INSTALL MANHOLE ON EXISTING SEWER MAIN AS FOLLOWS:
  - A. BYPASS FLOW
  - B. CUT EXISTING PIPE
  - C. INSTALL MANHOLE W/ PRECAST BASE, AS SHOWN ON DETAIL.
  
2. DOGHOUSE MANHOLES MAY BE USED ONLY BY SPECIAL EXCEPTION FROM THE AUTHORITY.



**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
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**STANDARD DETAIL - SEWER SYSTEM**



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**NEW MANHOLE  
ON EXISTING MAIN DETAIL**

DATE: JUNE 2005

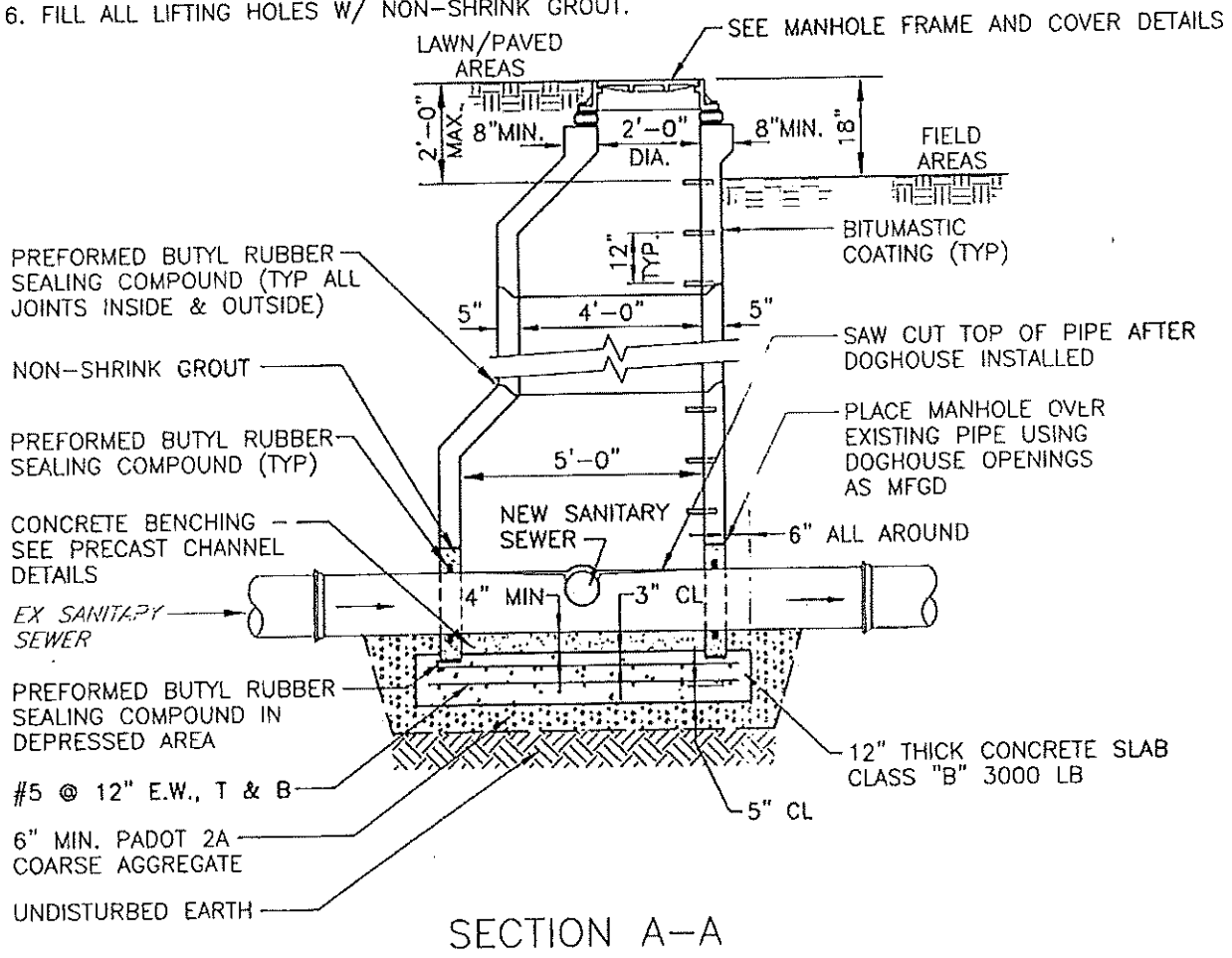
DETAIL: 13

SD013.DWG



**NOTES:**

1. INSTALL MANHOLES ON EXISTING LINES BY BYPASSING FLOW, CUTTING PIPE & INSTALLING MANHOLE WITH PRECAST BASE. DOGHOUSE MANHOLES, AS SHOWN IN THIS DETAIL, MAY BE USED ONLY BY SPECIAL EXCEPTION FROM THE AUTHORITY.
2. ADJUST TO GRADE WITH CONC GRADE RINGS (MAX. VERT. ADJUST. 6"). SEE MANHOLE FRAME & COVER DETAILS.
3. MECHANICALLY VIBRATED PRECAST CONC SHALL CONFORM TO A.S.T.M. SPEC. C-478.
4. IF INCOMING INVERT EXCEEDS OUTGOING INVERT BY GREATER THAN OR EQUAL TO 6", SEE INSIDE SPLASH/INSIDE DROP MANHOLE DETAILS.
5. FOR MANHOLES WHERE TOP OF RIM TO INVERT DISTANCE IS LESS THAN 5'-0", USE FLAT TOP MANHOLE IN LIEU OF CONE TOP.
6. FILL ALL LIFTING HOLES W/ NON-SHRINK GROUT.



**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

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**STANDARD DETAIL - SEWER SYSTEM**

**PRECAST DOGHOUSE MANHOLE DETAIL  
 (BY SPECIAL EXCEPTION ONLY)**

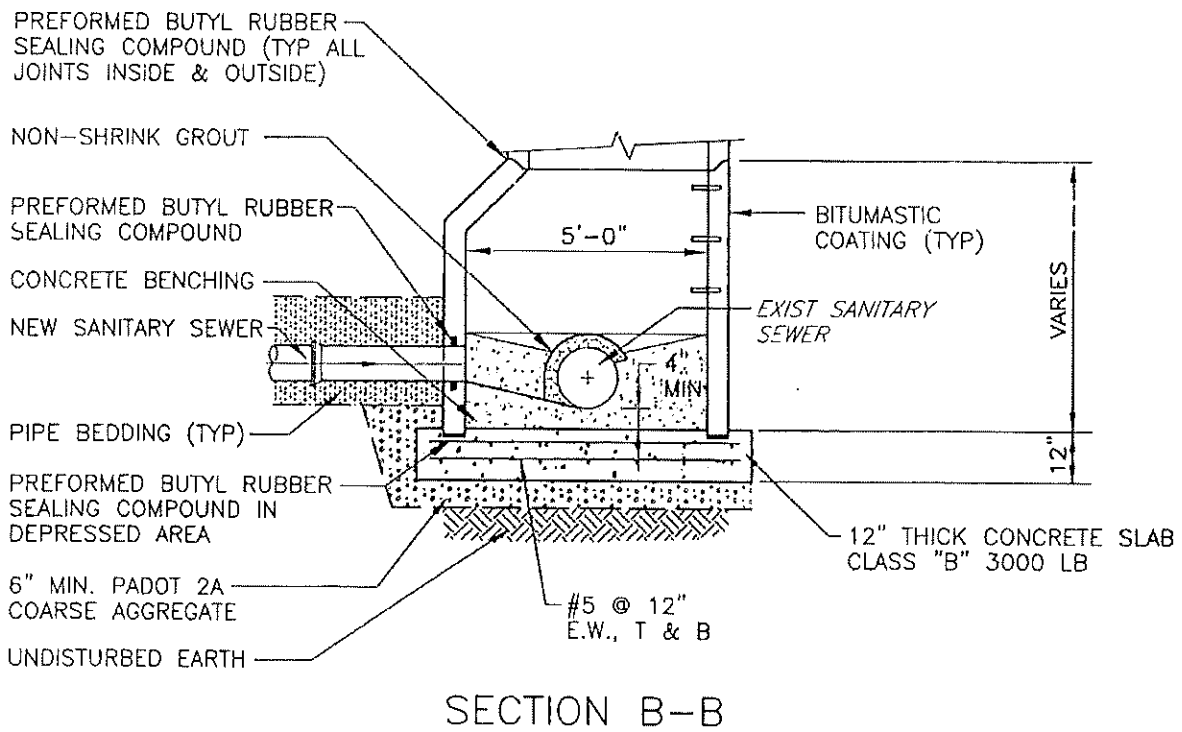
DATE: JUNE 2005

DETAIL: 144

SD014A.DWG

NOTES:

1. INSTALL MANHOLES ON EXISTING LINES BY BYPASSING FLOW, CUTTING PIPE & INSTALLING MANHOLE WITH PRECAST BASE. DOGHOUSE MANHOLES, AS SHOWN IN THIS DETAIL, MAY BE USED ONLY BY SPECIAL EXCEPTION FROM THE AUTHORITY.
2. ADJUST TO GRADE WITH CONC GRADE RINGS (MAX. VERT. ADJUST. 6"). SEE MANHOLE FRAME & COVER DETAILS.
3. MECHANICALLY VIBRATED PRECAST CONC SHALL CONFORM TO A.S.T.M. SPEC. C-478.
4. IF INCOMING INVERT EXCEEDS OUTGOING INVERT BY GREATER THAN OR EQUAL TO 6", SEE INSIDE SPLASH/INSIDE DROP MANHOLE DETAILS.
5. FOR MANHOLES WHERE TOP OF RIM TO INVERT DISTANCE IS LESS THAN 5'-0", USE FLAT TOP MANHOLE IN LIEU OF CONE TOP.
6. FILL ALL LIFTING HOLES W/ NON-SHRINK GROUT.



**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



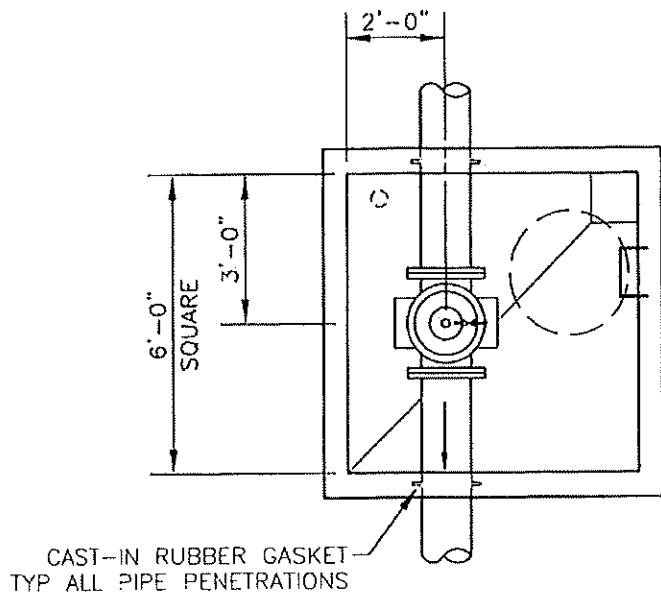
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Tel 610.374.5285

**PRECAST DOGHOUSE BOTTOM DETAIL  
(BY SPECIAL EXCEPTION ONLY)**

DATE: JUNE 2005

DETAIL: 14B

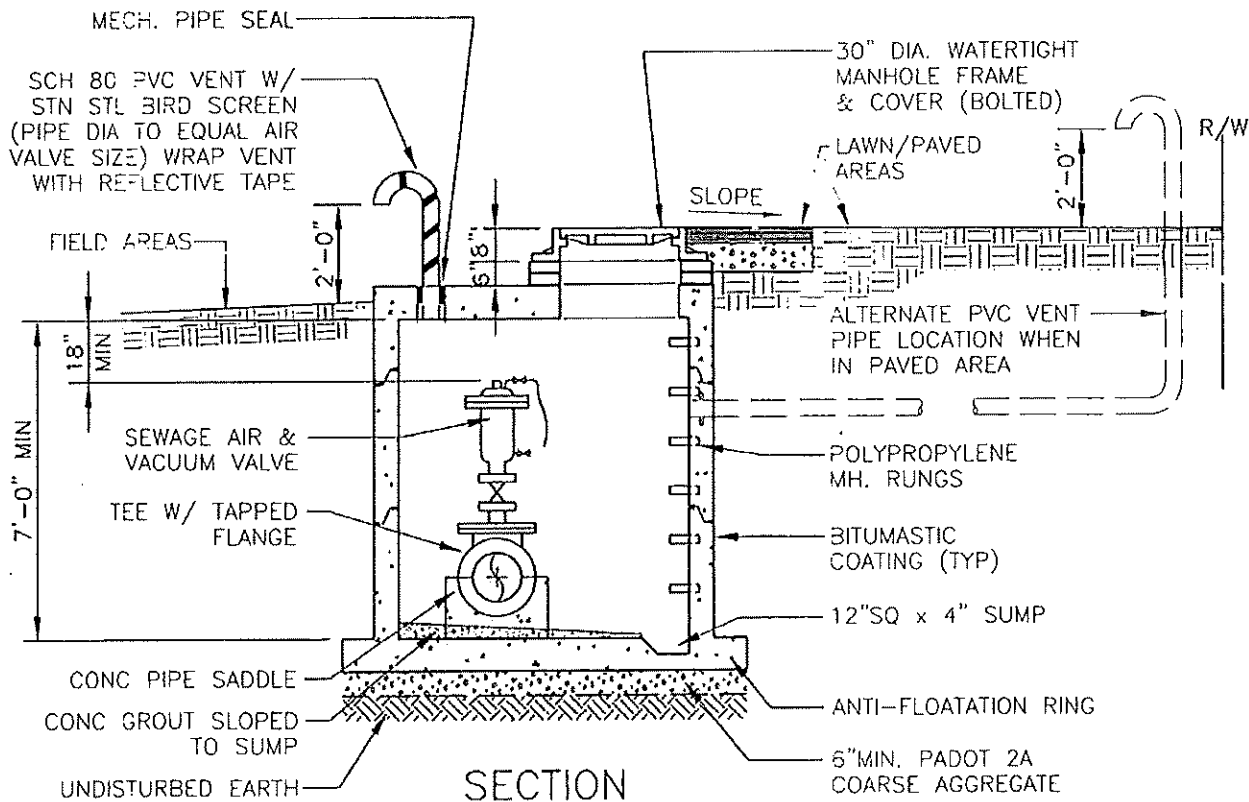
SD014B.DWG



**PLAN**

**NOTES:**

1. ADJUST TO GRADE WITH CONC. GRADE RINGS (MAX. VERT. ADJUST. 6"). SEE FRAME & COVER DETAILS.
2. MECHANICALLY VIBRATED PRECAST CONC. SHALL CONFORM TO A.S.T.M. C-478.
3. SEAL ALL JOINTS INSIDE & OUTSIDE WITH PREFORMED BUTYL RUBBER SEALING COMPOUND.
4. FILL ALL LIFTING HOLES WITH NON-SHRINK GROUT.
5. ALL EXPOSED INTERIOR CONC SURFACES (I.E. FLOOR, SUMP, SADDLE) TO RECEIVE CORROSION RESISTANT EPOXY COATING.
6. WHERE VALVE VAULT IS LOCATED WITHIN THE 100-YEAR FLOOD BOUNDARY, THE TOP OF THE CONCRETE SLAB SHOULD BE A MINIMUM OF 6" ABOVE FLOODWAY.



**SECTION**

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

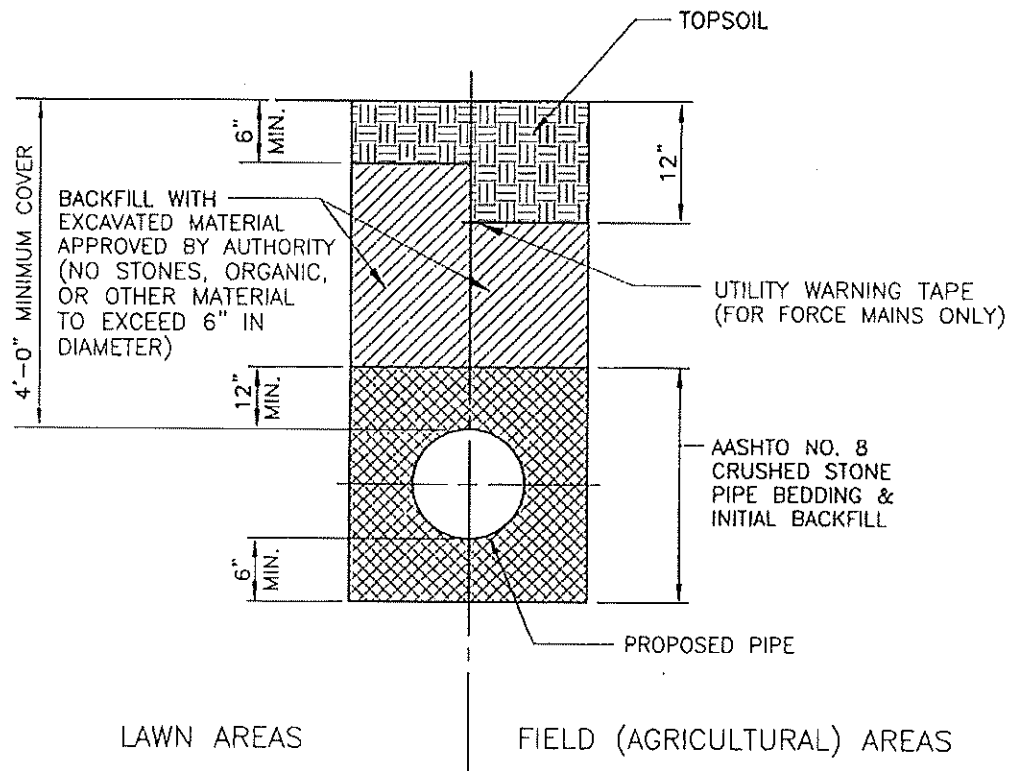


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**AIR VALVE VAULT DETAIL  
(FORCE MAIN ONLY)**

DATE: JUNE 2005

DETAIL: 15



**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



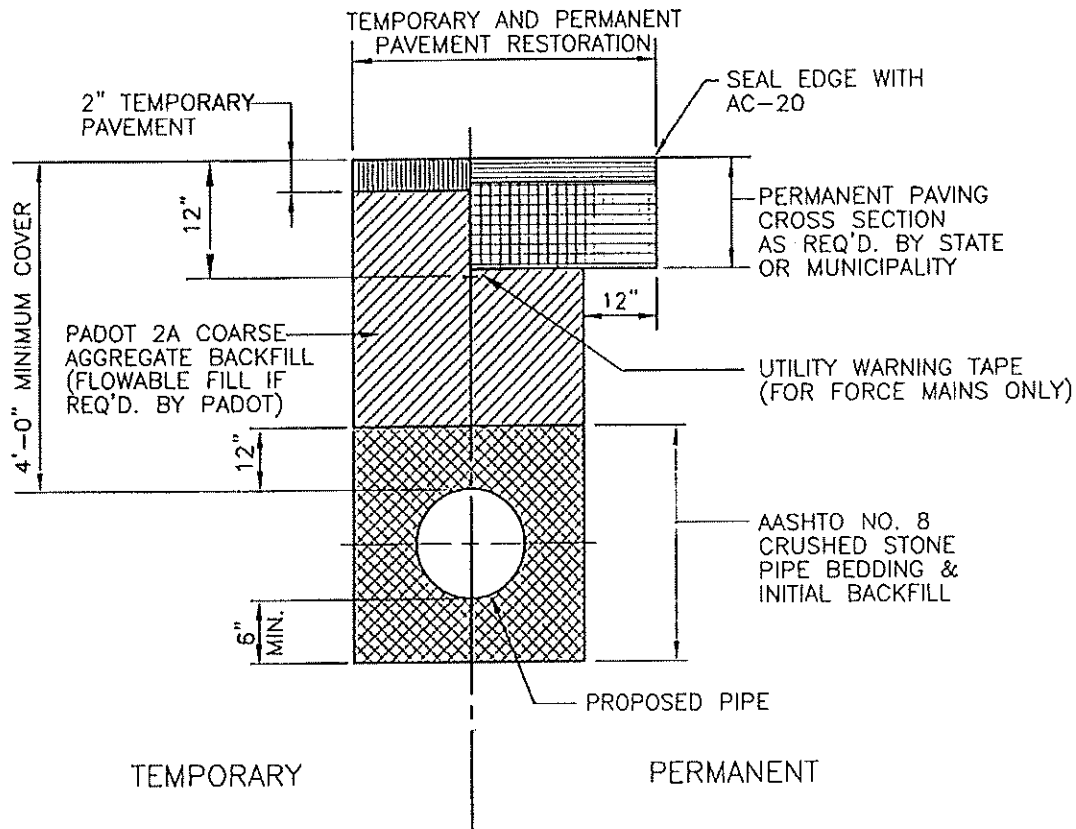
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**TRENCH RESTORATION  
 LAWN/FIELD AREAS**

DATE:  
 JUNE 2005

DETAIL:  
 16

SD016.DWG



(TYPICAL FOR STATE HIGHWAYS, BOROUGH & TOWNSHIP ROADS, SHOULDERS & DRIVEWAYS)

**NOTE:**

ALL WORK ON STATE ROADS IS TO BE PERFORMED IN ACCORDANCE WITH PADOT PUBLICATION 408.

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



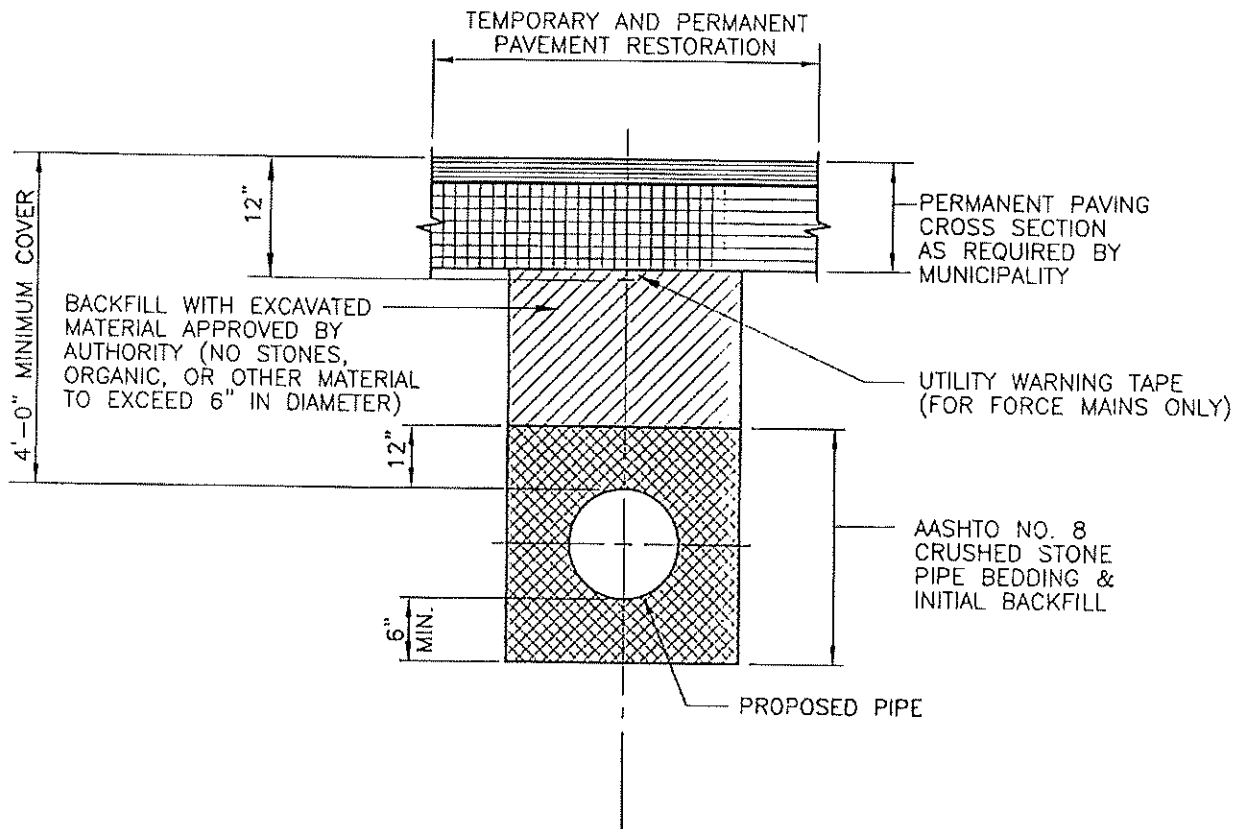
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TRENCH RESTORATION  
EXISTING PAVED AREAS

DATE: JUNE 2005

DETAIL: 17

SD017 DWG



**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



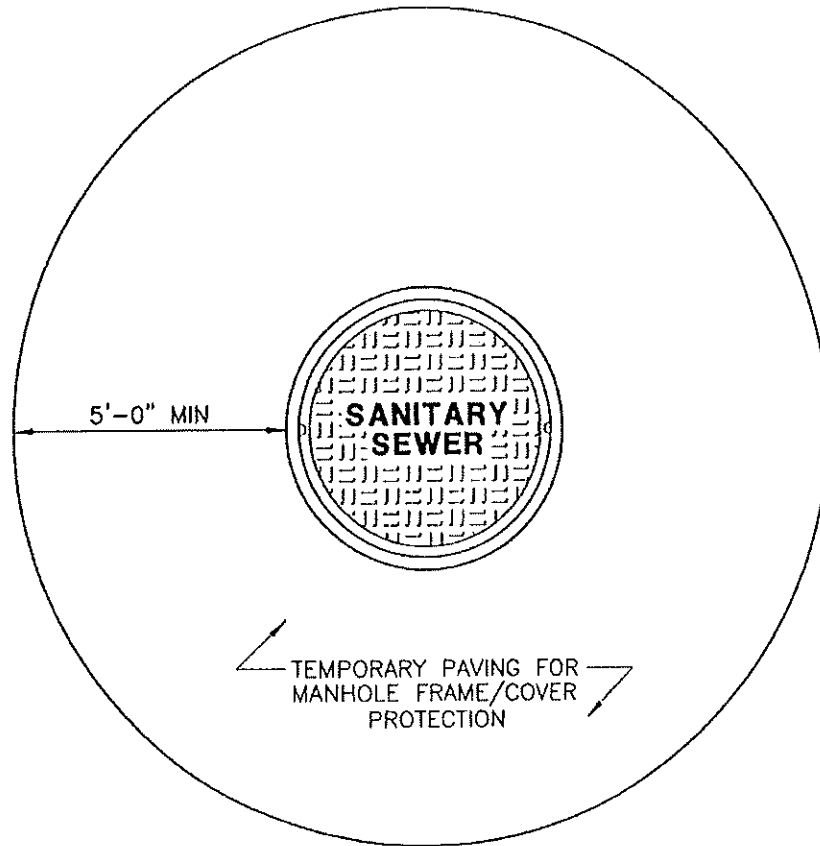
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**TRENCH RESTORATION  
 NEW ROADWAYS**

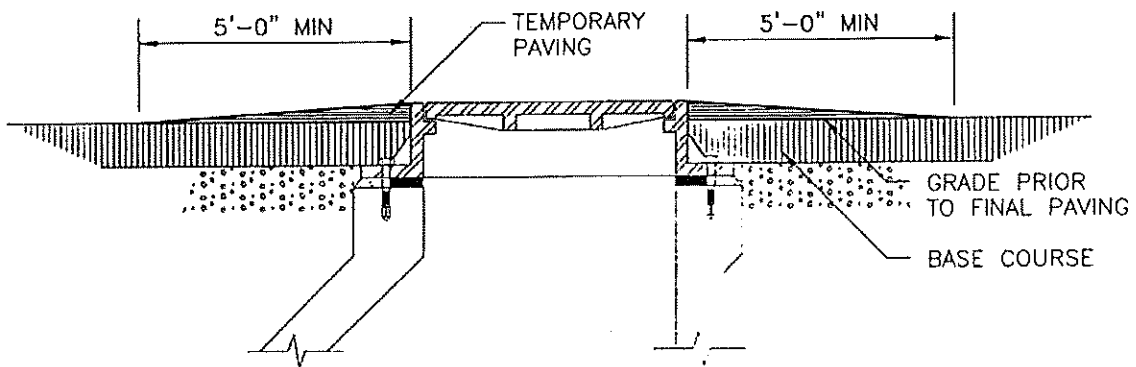
DATE: JUNE 2005

DETAIL: 18

SD018.DWG



PLAN



SECTION

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



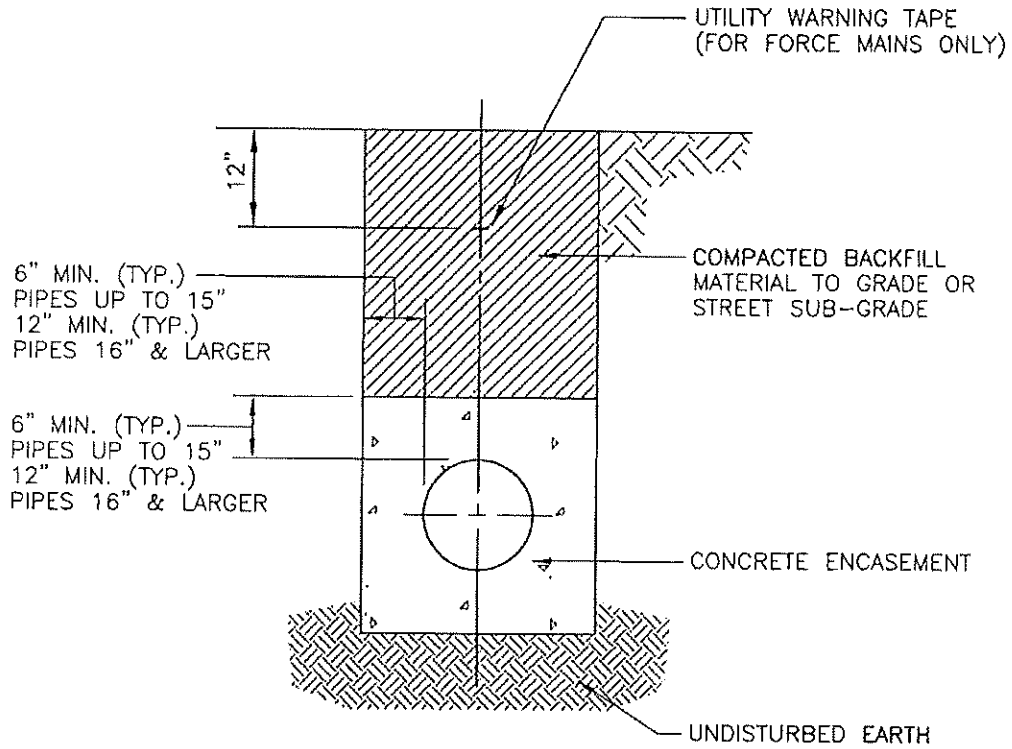
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MANHOLE FRAME & COVER PROTECTION  
DETAIL PRIOR TO FINAL PAVING

DATE: JUNE 2002

DETAIL: 19

SS019.DWG



**AMITY TOWNSHIP**  
2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



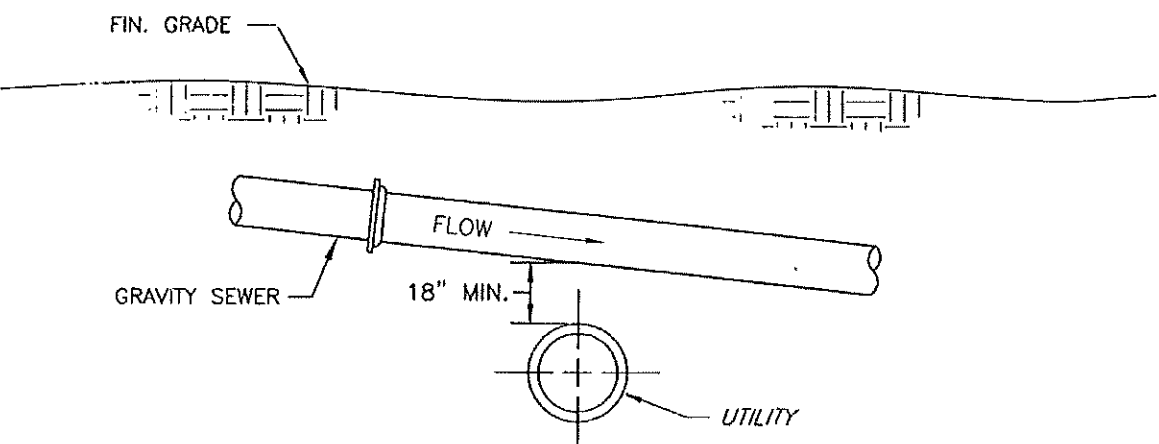
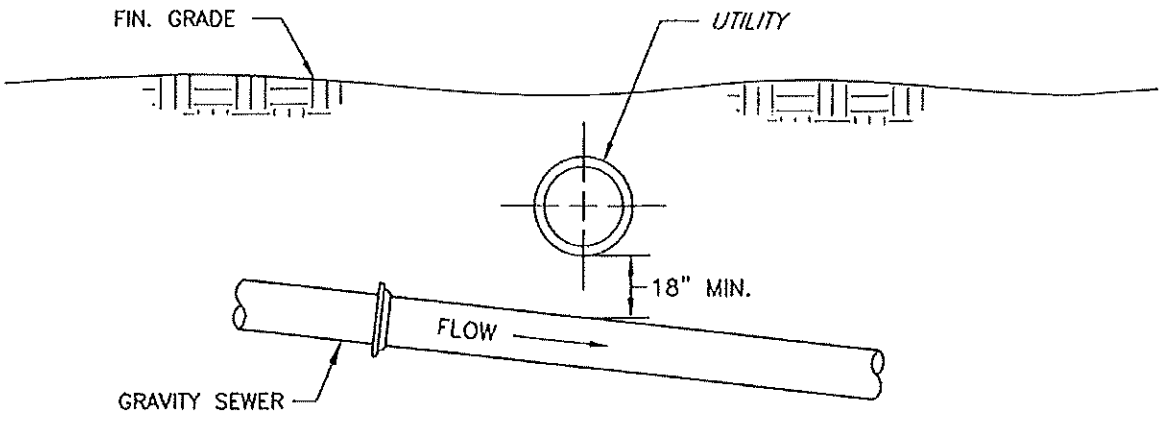
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**CONCRETE ENCASEMENT DETAIL**

DATE:  
JUNE 2005

DETAIL:  
20





NOTE: MAINTAIN SLOPE OF PROPOSED SEWER AT ALL CROSSINGS.

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 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518



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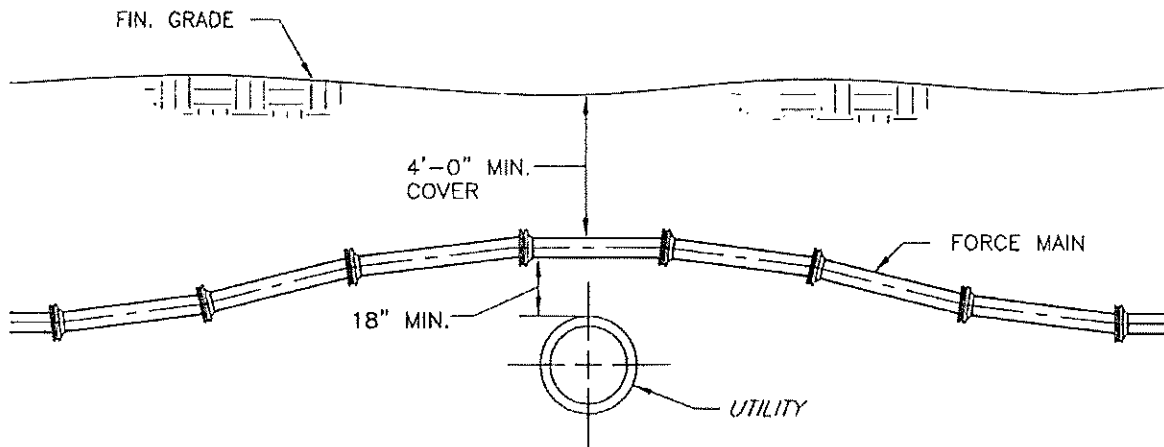
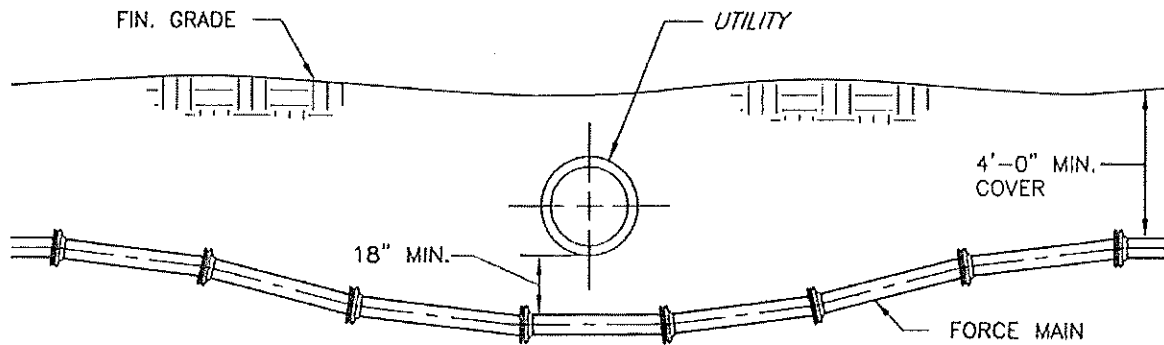
**STANDARD DETAIL - SEWER SYSTEM**

**GRAVITY SEWER CROSSING  
 UTILITIES DETAIL**

DATE: JUNE 2005

DETAIL: 21

SD021.DWC



**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
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**STANDARD DETAIL - SEWER SYSTEM**



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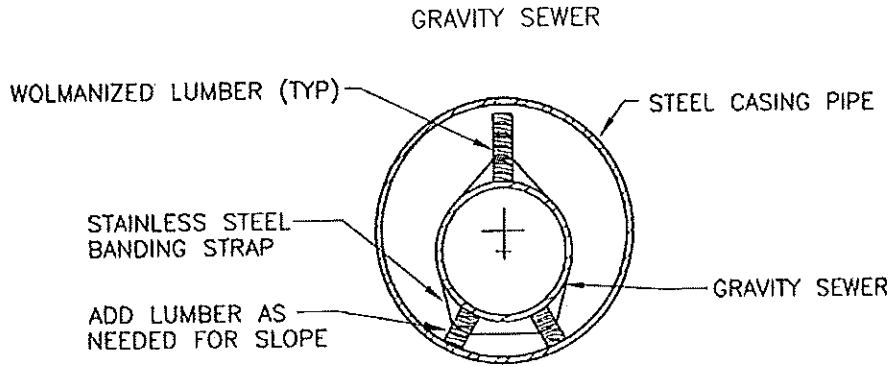
**FORCE MAIN CROSSING UTILITY DETAIL  
 (USING DEFLECTING JOINTS)**

DATE: JUNE 2005

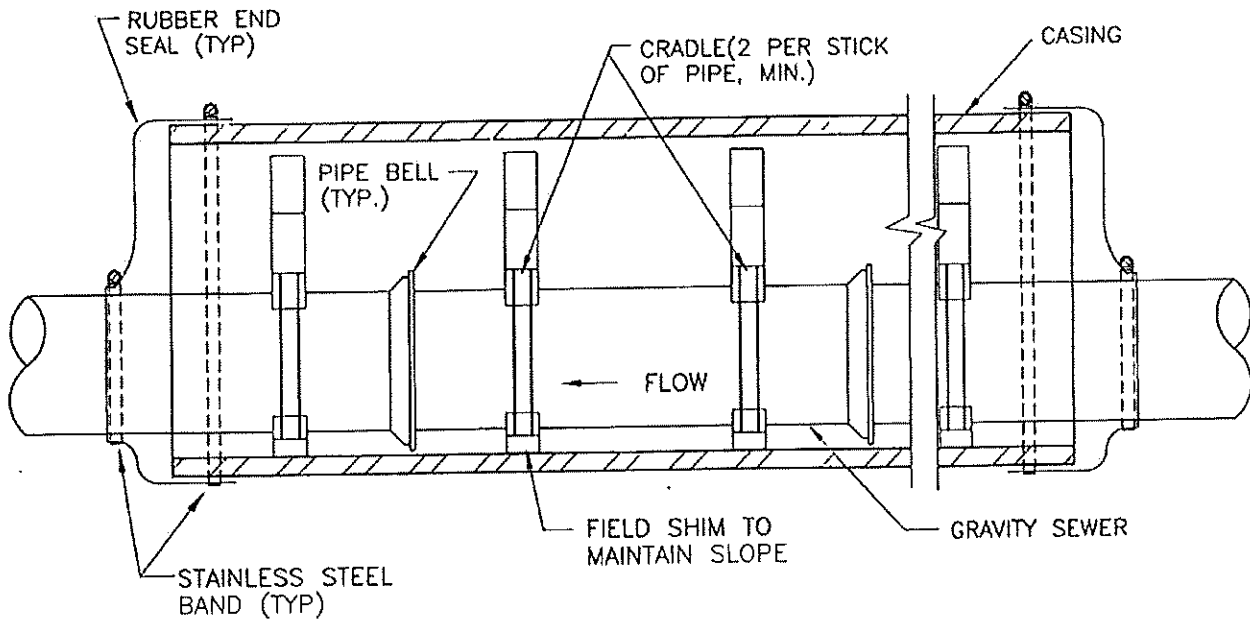
DETAIL: 22

SD022.DWG

NOTE:  
 FILL VOID BETWEEN CARRIER PIPE  
 AND CASING WITH CLEAN NATURAL  
 SAND, OR 1/4" STONE CHIPS



SECTION



ELEVATION

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



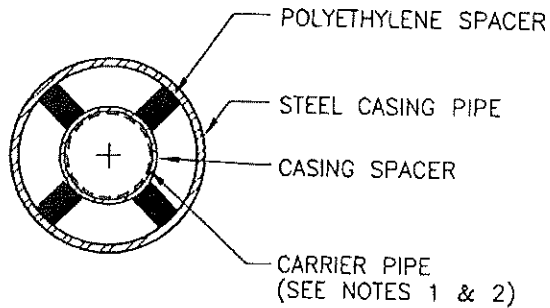
400 Washington Street, Suite 602  
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CASING CRADLE DETAIL — GRAVITY SEWER  
 INSTALLATION VIA BORING/JACKING

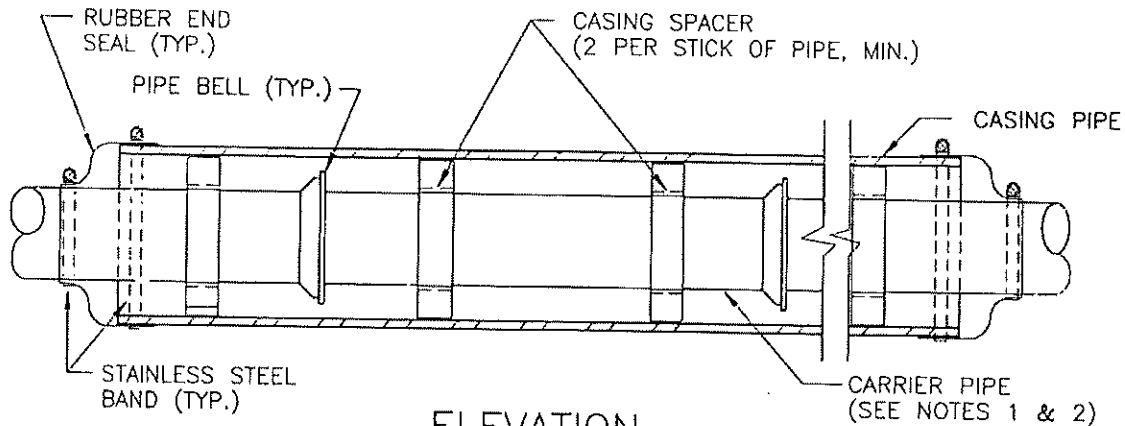
DATE: JUNE 2005

DETAIL: 23

SD023.DWG



SECTION



ELEVATION

NOTES:

- 1) FORCE MAIN PIPE SHALL BE RESTRAINED JOINT PIPE.
- 2) GRAVITY SEWER PERMITTED ONLY WHEN INSTALLATION IS BY OPEN CUT. OTHERWISE, SEE GRAVITY SEWER INSTALLATION VIA BORING/JACKING DETAIL.

**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

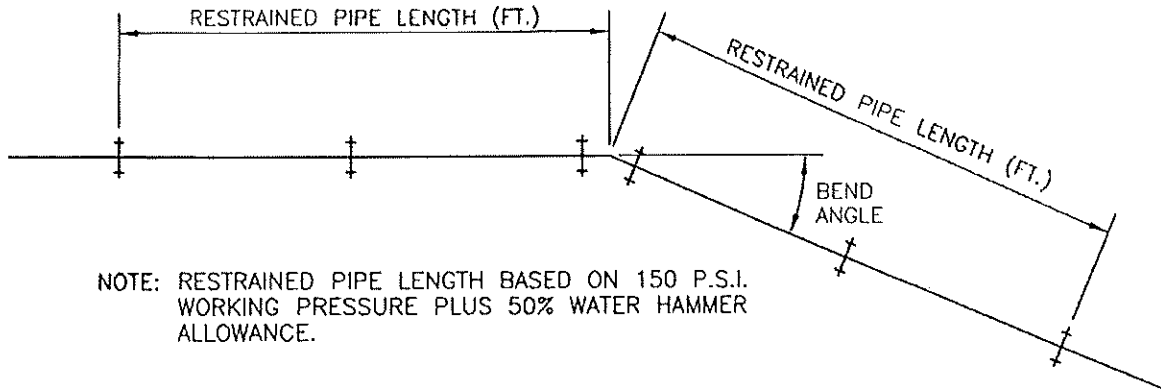


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**CASING CRADLE DETAIL**  
**(OPEN CUT OR FORCE MAIN)**

DATE: JUNE 2005

DETAIL: 24



NOTE: RESTRAINED PIPE LENGTH BASED ON 150 P.S.I. WORKING PRESSURE PLUS 50% WATER HAMMER ALLOWANCE.

HORIZONTAL RESTRAINED PIPE LENGTH SCHEDULE (DUCTILE IRON PIPE)				
PIPE DIAMETER	HORIZONTAL ELBOW DEFLECTION ANGLE			
	90°	45°	22 1/2°	11 1/4°
4"	19'	8'	4'	2'
6"	27'	11'	7'	3'
8"	35'	14'	8'	4'
10"	42'	17'	8'	5'
12"	49'	20'	10'	5'

\* ADD 12% TO LENGTH IF PIPE IS POLYETHYLENE ENCASED.

VERTICAL RESTRAINED PIPE LENGTH SCHEDULE (DUCTILE IRON PIPE)			
PIPE DIAMETER	VERTICAL ELBOW DEFLECTION ANGLE		
	45°	22 1/2°	11 1/4°
4"	20'	10'	5'
6"	28'	14'	7'
8"	37'	18'	9'
10"	44'	21'	11'
12"	52'	25'	12'

\* ADD 12% TO LENGTH IF PIPE IS POLYETHYLENE ENCASED.

NOTE: FOR PIPE SIZES GREATER THAN 12", SUBMIT ENGINEERING CALCULATIONS TO VERIFY PROPOSED RESTRAINED PIPE LENGTHS.

## AMITY TOWNSHIP

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

### STANDARD DETAIL - SEWER SYSTEM



400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610 374.5285

# RESTRAINED PIPE LENGTH SCHEDULE (DUCTILE IRON PIPE)

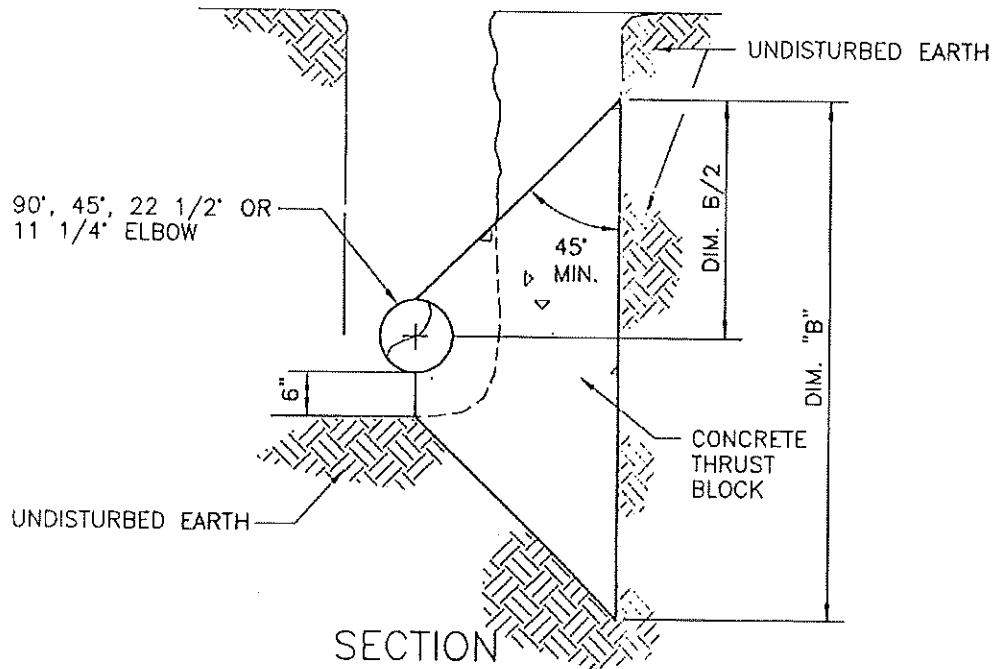
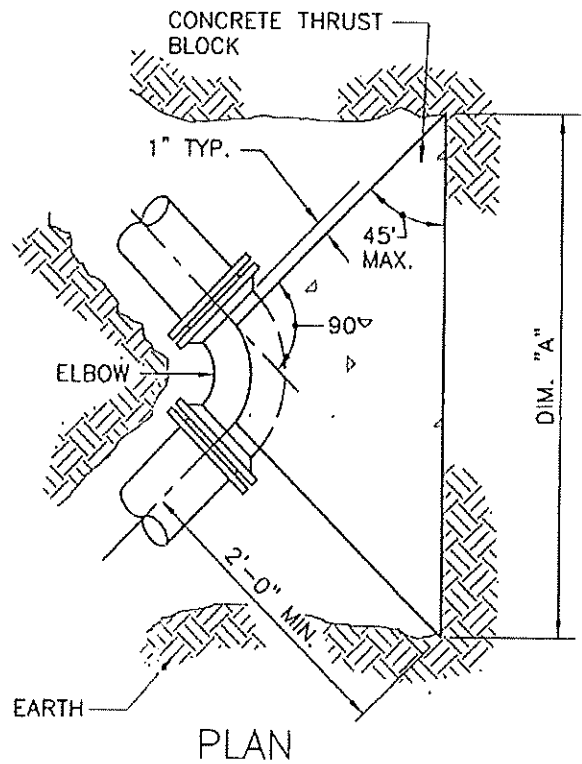
DATE: JUNE 2005

DETAIL: 25

THRUST BLOCK DIMENSION SCHEDULE - ELBOWS(*) (DUCTILE IRON PIPE)					
PIPE DIAM.	DIM.	ELBOW DEFLECTION ANGLE			
		11 1/4'	22 1/2'	45'	90'
4"	A	12"	18"	24"	24"
	B	12"	12"	12"	18"
6"	A	18"	24"	30"	42"
	B	12"	18"	24"	30"
8"	A	24"	24"	42"	60"
	B	12"	24"	30"	36"
12"	A	30"	42"	54"	90"
	B	24"	30"	36"	48"

(\*) THRUST BLOCK DESIGN BASED ON THE MINIMUM SOIL HORIZONTAL BEARING STRENGTH OF 3000 PSF AND 150 PSI WORKING PRESSURE PLUS 50% WATER HAMMER ALLOWANCE.

FOR PIPE SIZES GREATER THAN 12", SUBMIT ENGINEERING CALCULATIONS TO VERIFY PROPOSED THRUST BLOCK SIZES.



**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



400 Washington Street, Suite 602  
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 Tel 610.374.5285

**HORIZONTAL & VERTICAL UP RESTRAINT  
 THRUST BLOCKING DETAIL - ELBOWS (DIP)**

DATE: JUNE 2005

DETAIL: 26

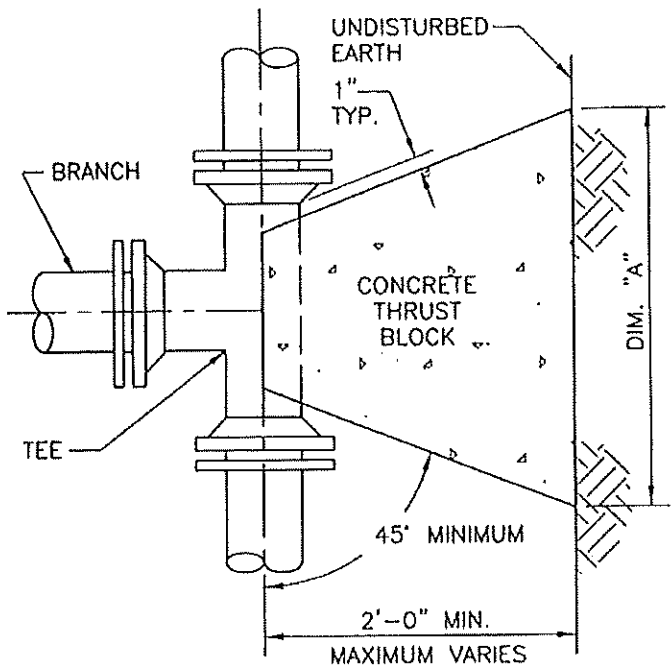
SD026.DWG

**THRUST BLOCK DIMENSION SCHEDULE - ELBOWS(\*)  
(DUCTILE IRON PIPE)**

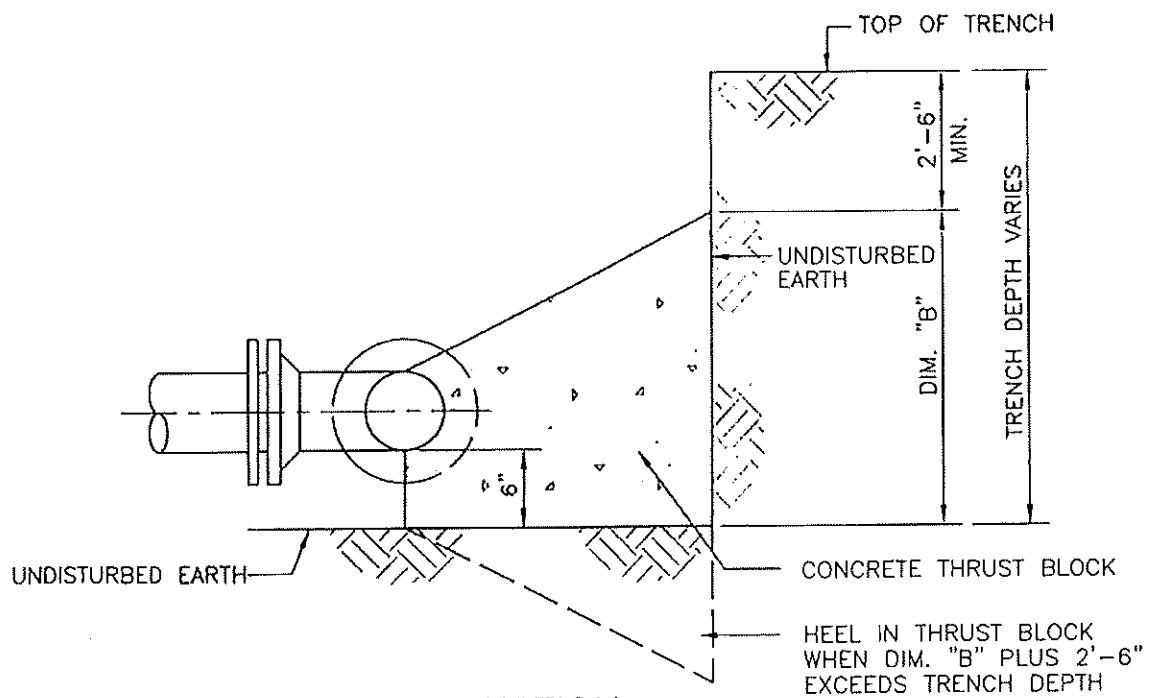
DIM.	BRANCH SIZE			
	4"	6"	8"	12"
A	36"	42"	60"	96"
B	18"	24"	30"	42"

(\*) THRUST BLOCK DESIGN BASED ON THE MINIMUM SOIL HORIZONTAL BEARING STRENGTH OF 3000 PSF AND 150 PSI WORKING PRESSURE PLUS 50% WATER HAMMER ALLOWANCE.

FOR PIPE SIZES GREATER THAN 12", SUBMIT ENGINEERING CALCULATIONS TO VERIFY PROPOSED THRUST BLOCK SIZES.



PLAN



SECTION

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610 374.5285

**HORIZONTAL RESTRAINT  
THRUST BLOCKING DETAIL - TEES (DIP)**

DATE: JUNE 2002

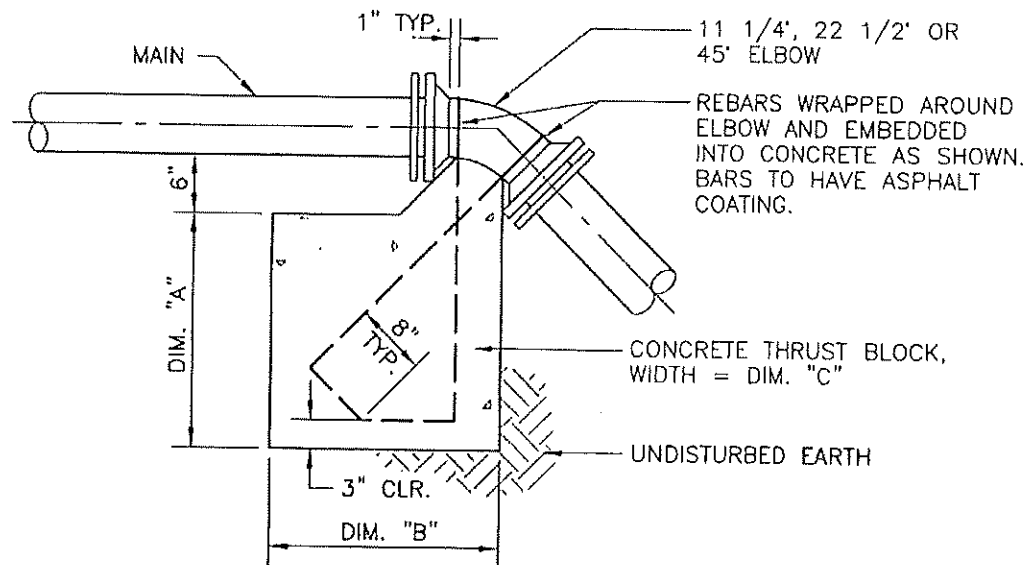
DETAIL: 27

SS027.DWG

THRUST BLOCK DIMENSION SCHEDULE – VERTICAL ELBOWS(*) (DUCTILE IRON PIPE)									
DIM.	6"-11 1/4"	8"-11 1/4"	12"-11 1/4"	6"-22 1/2"	8"-22 1/2"	12"-22 1/2"	6"-45"	8"-45"	12"-45"
A	12"	18"	36"	18"	36"	54"	36"	48"	54"
B	18"	24"	36"	24"	36"	48"	36"	48"	54"
C	18"	24"	24"	24"	24"	30"	24"	30"	48"
REBAR	#4	#4	#6	#4	#4	#6	#4	#4	#6

(\*) THRUST BLOCK DESIGN BASED ON THE MINIMUM SOIL HORIZONTAL BEARING STRENGTH OF 3000 PSF AND 150 PSI WORKING PRESSURE PLUS 50% WATER HAMMER ALLOWANCE.

FOR PIPE SIZES GREATER THAN 12", SUBMIT ENGINEERING CALCULATIONS TO VERIFY PROPOSED THRUST BLOCK SIZES.



SECTION

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



400 Washington Street, Suite 602  
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Tel 610.374.5285

VERTICAL DOWN RESTRAINT  
THRUST BLOCKING DETAIL – ELBOWS (DIP)

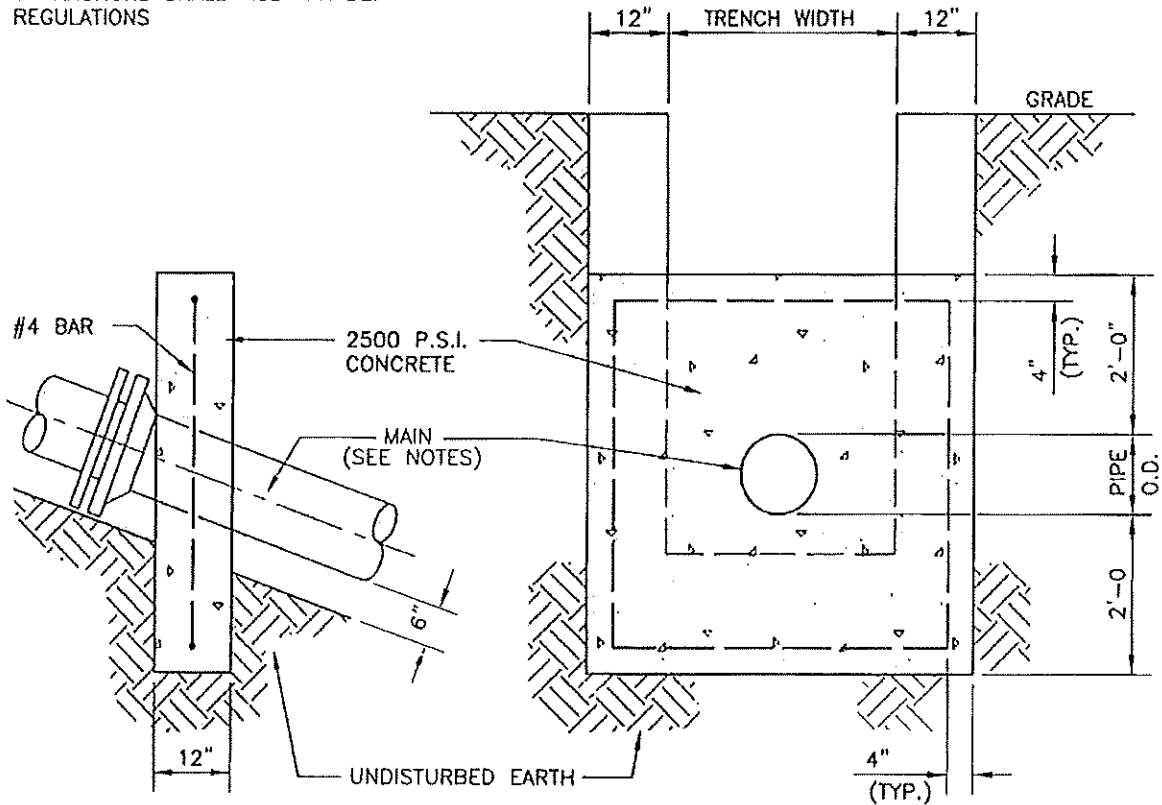
DATE:  
JUNE 2005

DETAIL:  
28



NOTES:

- 1) USE DUCTILE IRON PIPE AT ANCHOR LOCATIONS OR WRAP PVC PIPE WITH 1/2" THICK NEOPRENE AT ANCHOR
- 2) CENTERLINE TO CENTERLINE SPACINGS OF ANCHORS SHALL MEET PA DEP REGULATIONS



SIDE ELEVATION

FRONT ELEVATION

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

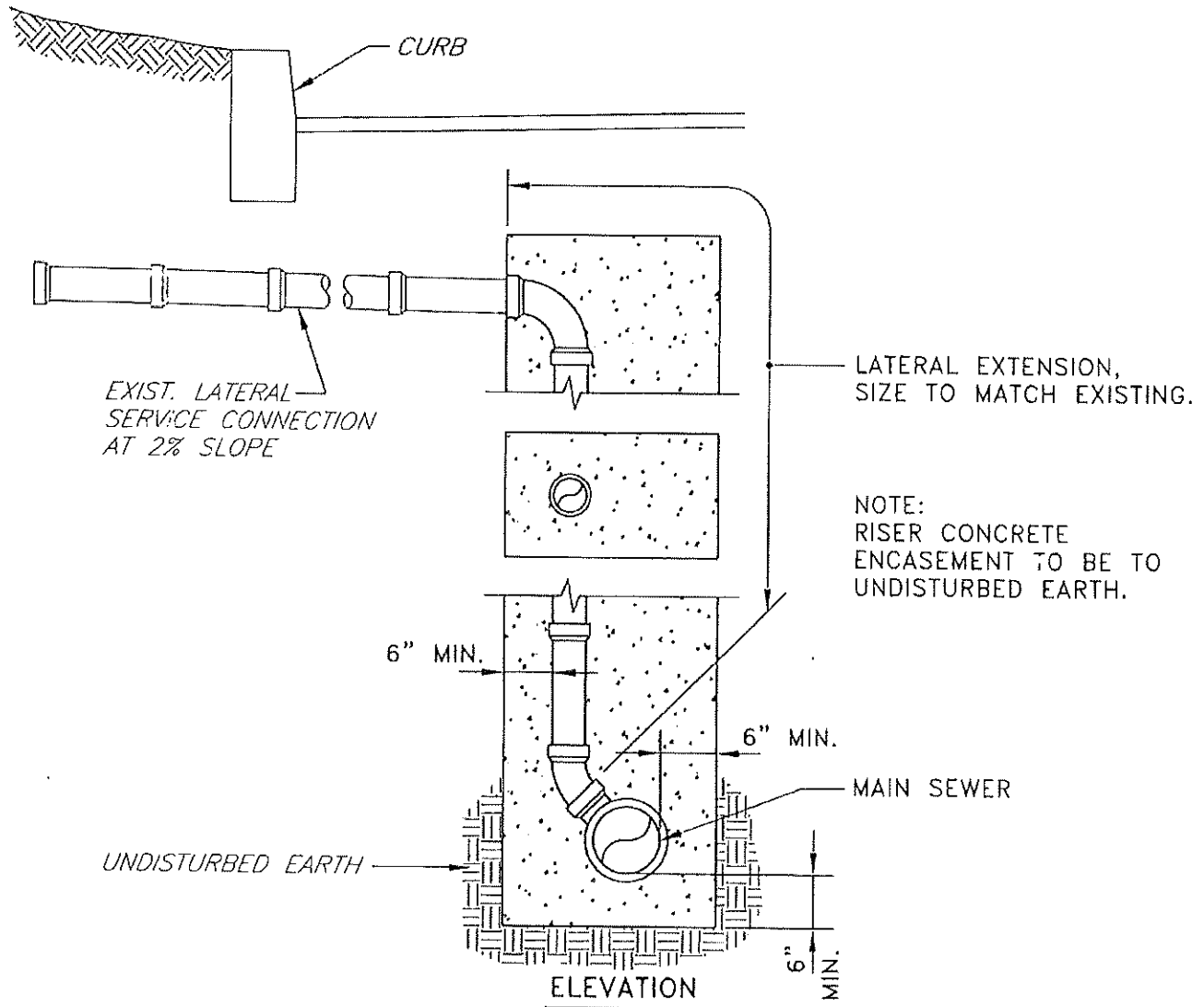
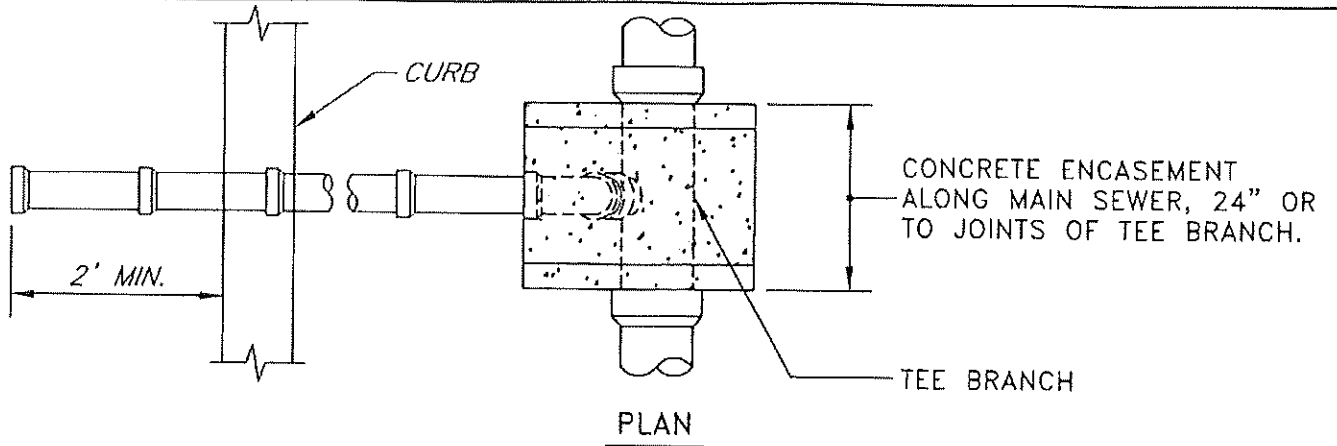
**CONCRETE ANCHOR DETAIL**



400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

DATE:  
JUNE 2005

DETAIL:  
29



NOTE:  
RISER CONCRETE  
ENCASEMENT TO BE TO  
UNDISTURBED EARTH.

## AMITY TOWNSHIP

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

### STANDARD DETAIL - SEWER SYSTEM

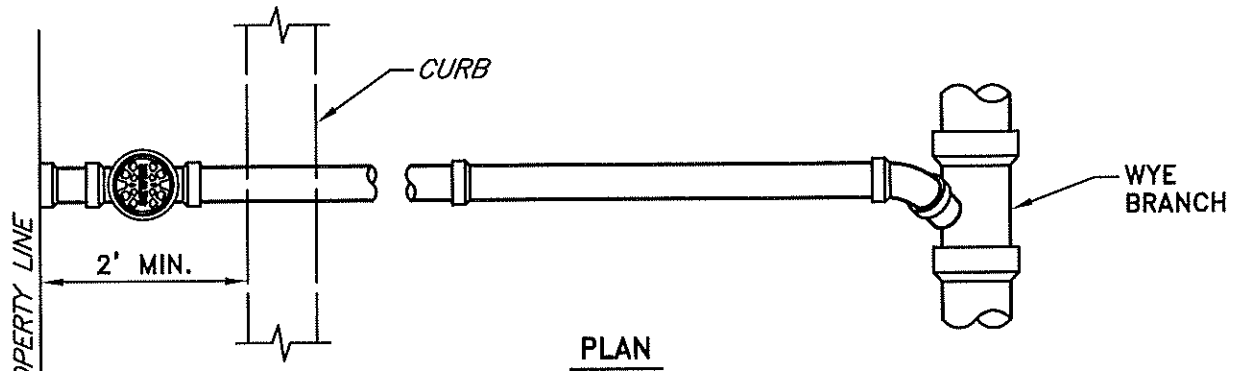


400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

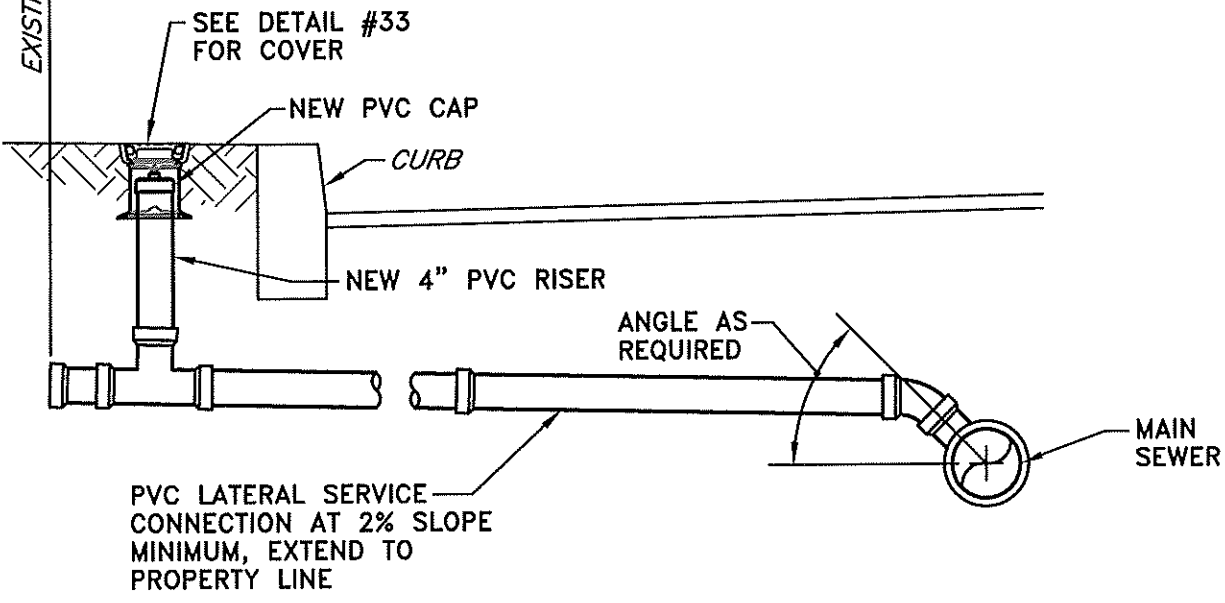
## EXISTING LATERAL EXTENSION

DATE:  
JUNE 2005

DETAIL:  
30



PLAN



ELEVATION

PVC LATERAL SERVICE CONNECTION AT 2% SLOPE MINIMUM, EXTEND TO PROPERTY LINE

- NOTES:
- 1) REPAIRS – LATERAL SIZE TO MATCH EXISTING HOUSE LATERAL.
  - 2) NEW CONSTRUCTION – 6" SERVICE LATERALS.
  - 3) PROVIDE CLEANOUTS EVERY 100' ON LATERALS.
  - 4) CONTRACTOR TO PROVIDE TREATED 2x4 OR MARKING TAPE TO GRADE TO LOCATE END OF LATERALS.

**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

**ARRO**  
 ARRO Consulting, Inc.

400 Washington Street, Suite 602  
 Reading, Pennsylvania 19601  
 Tel 610.374.5285

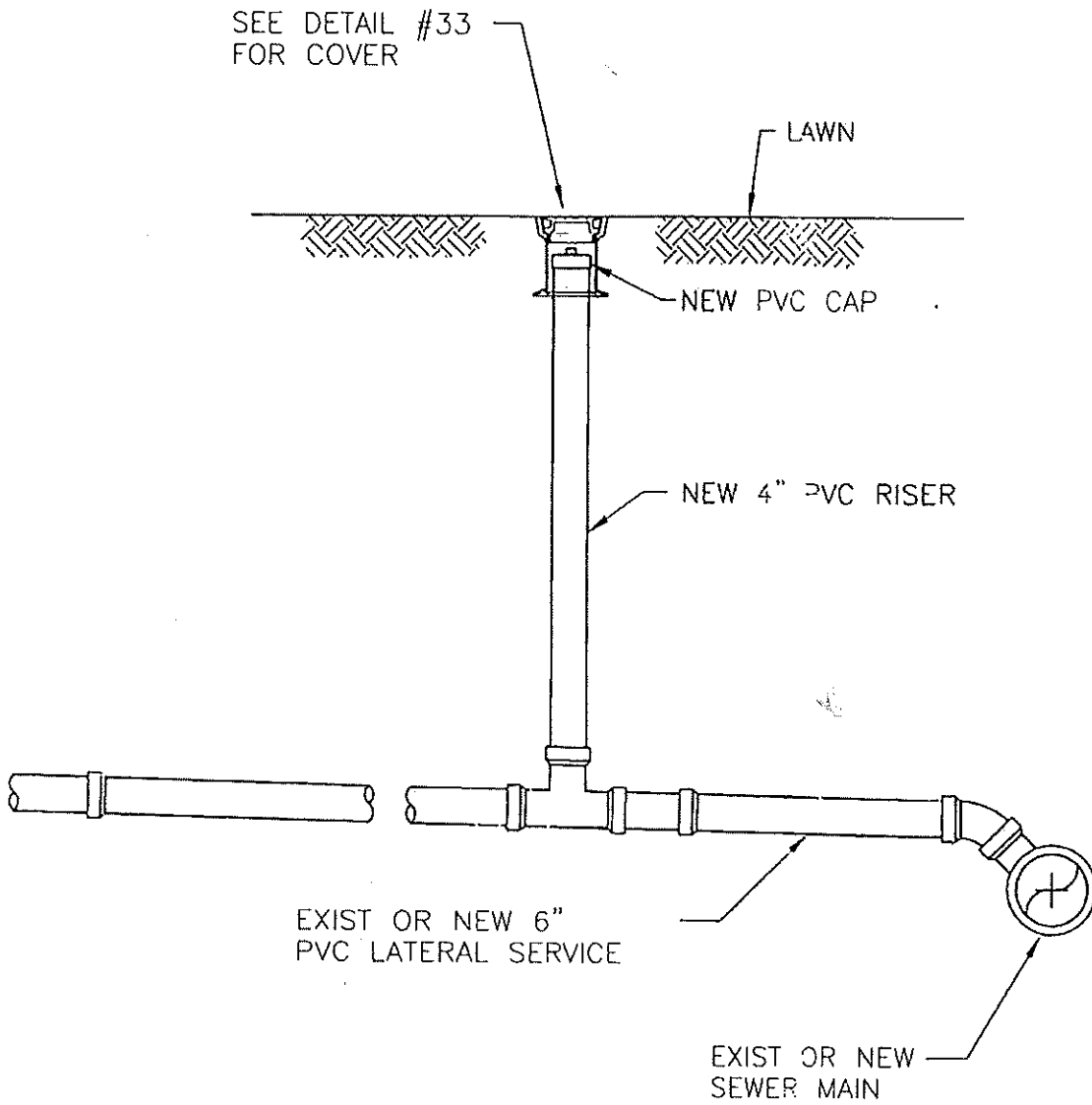
**LATERAL DETAIL**

DATE:  
 JANUARY 2015

DETAIL:  
 31

SD031.DWG





**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



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Tel 610.374.5285

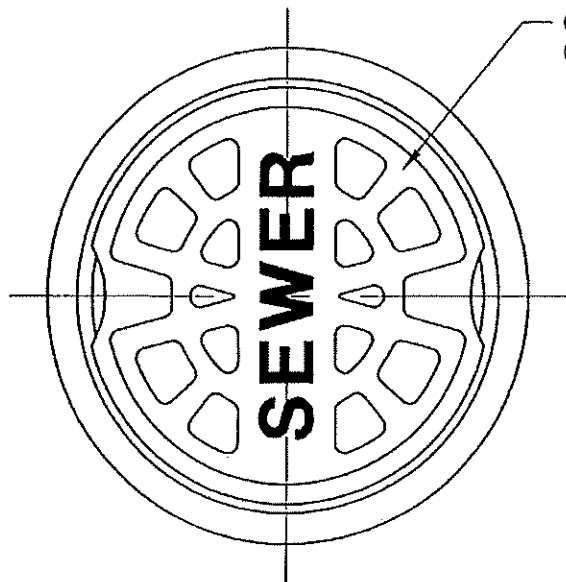
**INSPECTION / TEST TEE**

DATE: JUNE 2005

DETAIL: 32

SD0032.DWG

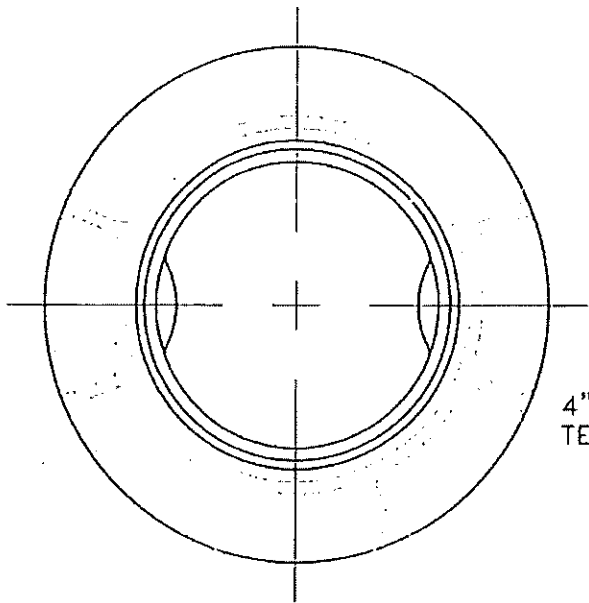




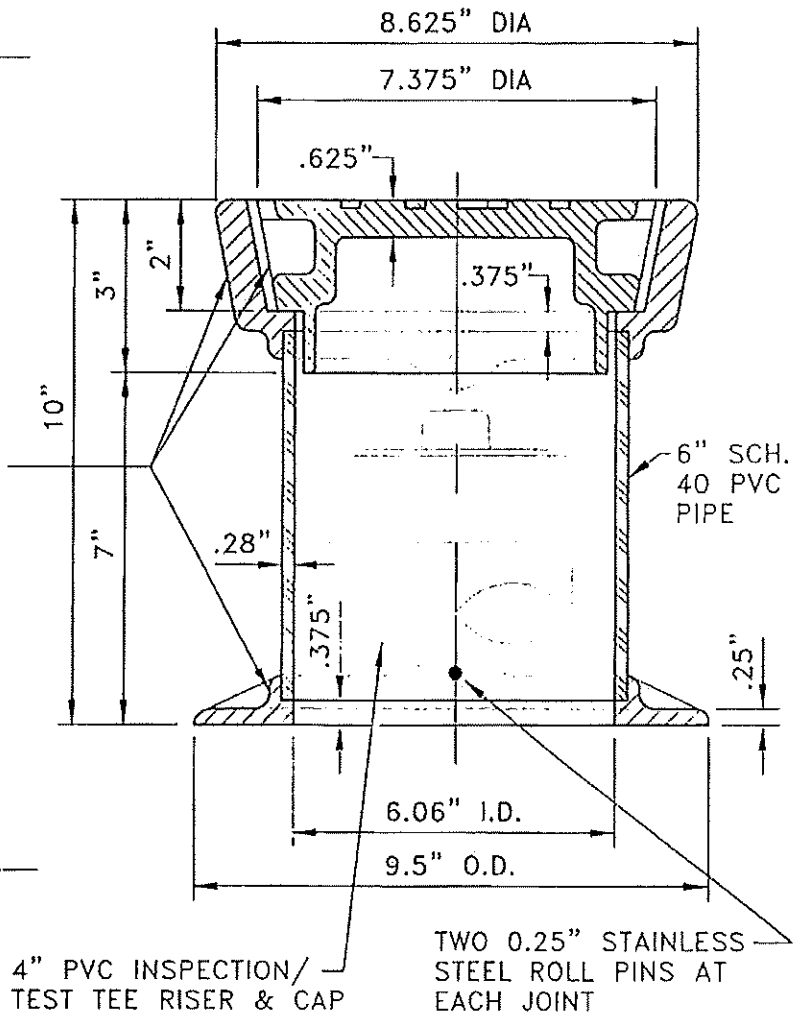
COVER W/RISER BY  
GENECO, PART NO. CC4.

TOP VIEW

ASTM A-48 CLASS 25  
CAST IRON ASPHALT  
PAINT COATED



BOTTOM VIEW



**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

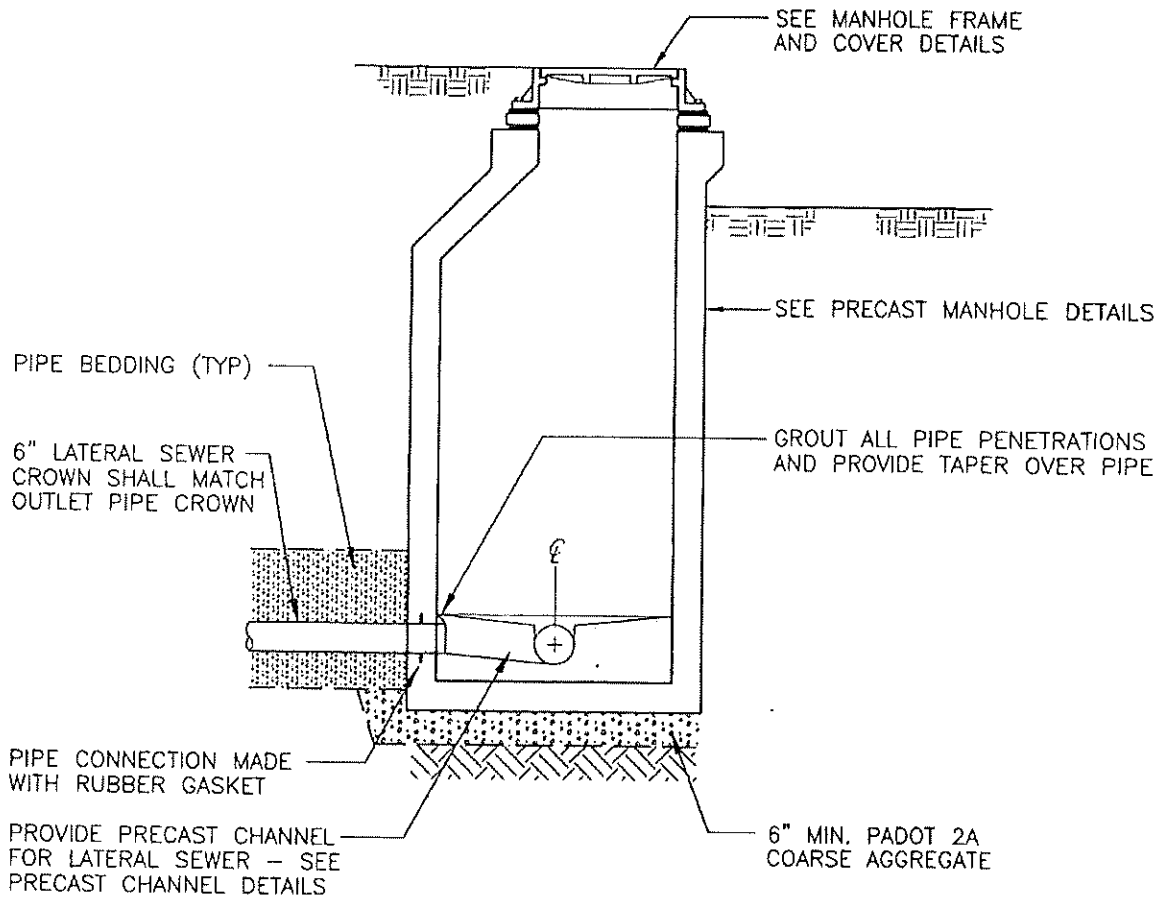


400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

**COVER FOR INSPECTION / TEST  
TEE IN TRAFFIC AREA**

DATE:  
JUNE 2005

DETAIL:  
33



**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



400 Washington Street, Suite 602  
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Tel 610.374.5285

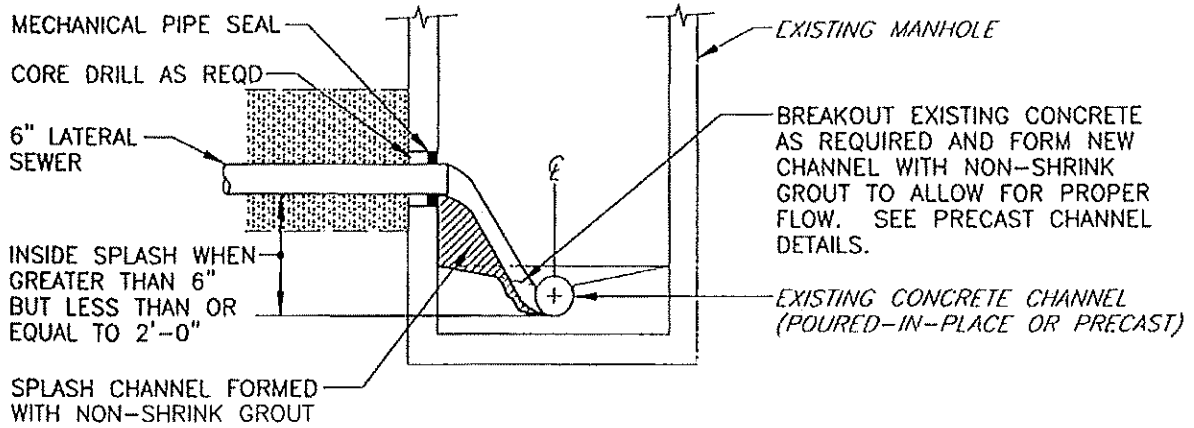
6" LATERAL INTO NEW MANHOLE  
(BY SPECIAL EXCEPTION ONLY)

DATE: JUNE 2005

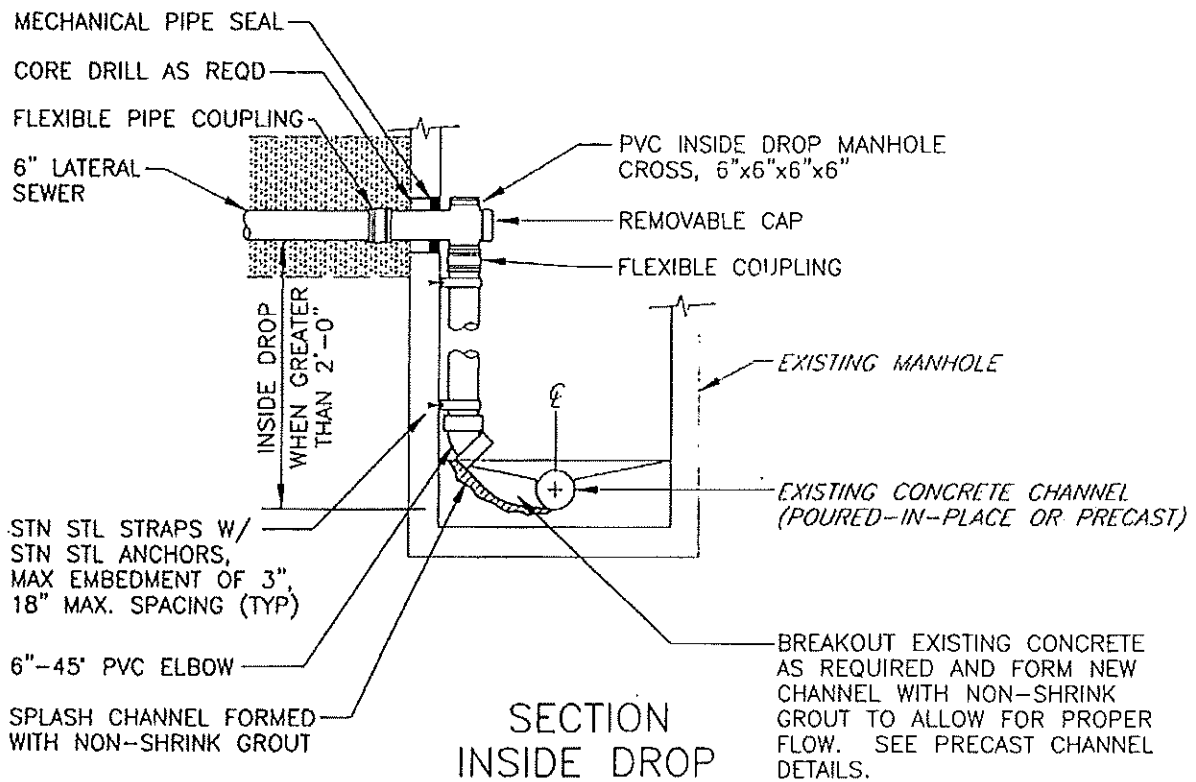
DETAIL: 34

SD034.DWG





SECTION  
INSIDE SPLASH



SECTION  
INSIDE DROP

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

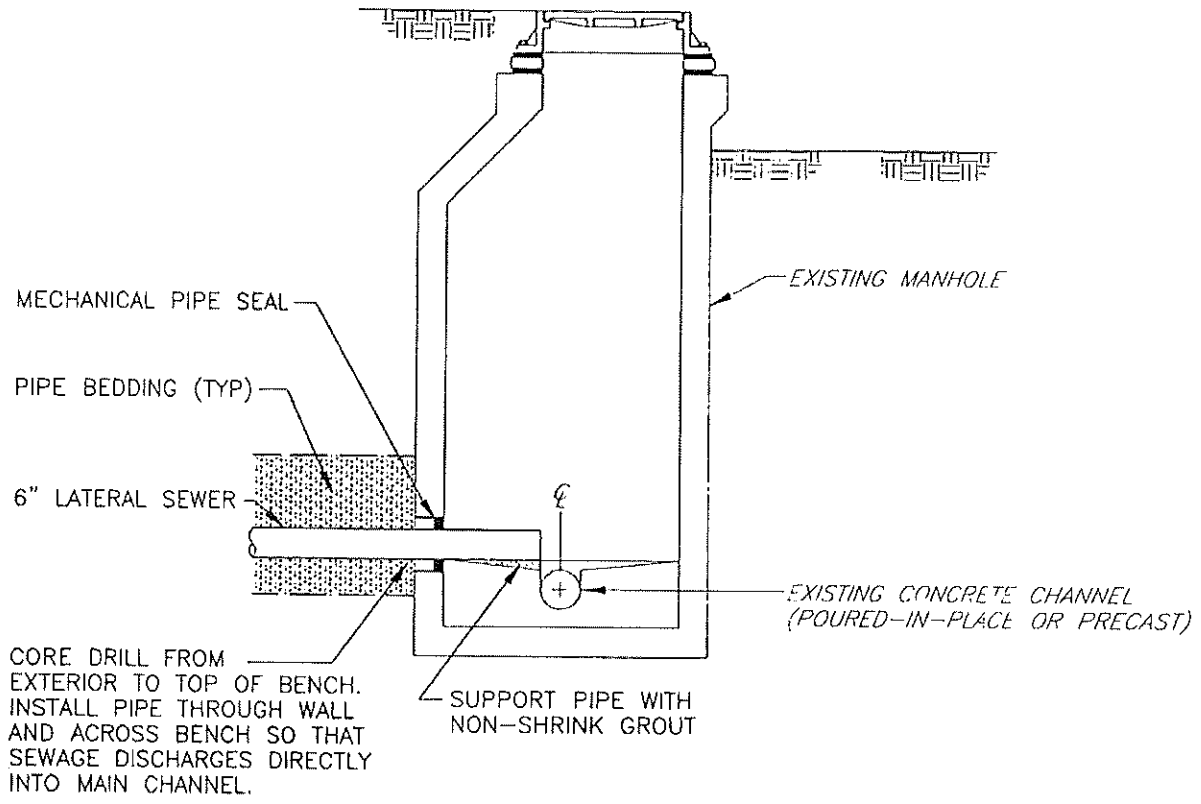


400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

INSIDE SPLASH/DROP - 6" LATERAL INTO  
EXIST. MH (BY SPECIAL EXCEPTION ONLY)

DATE:  
JUNE 2005

DETAIL:  
35



**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



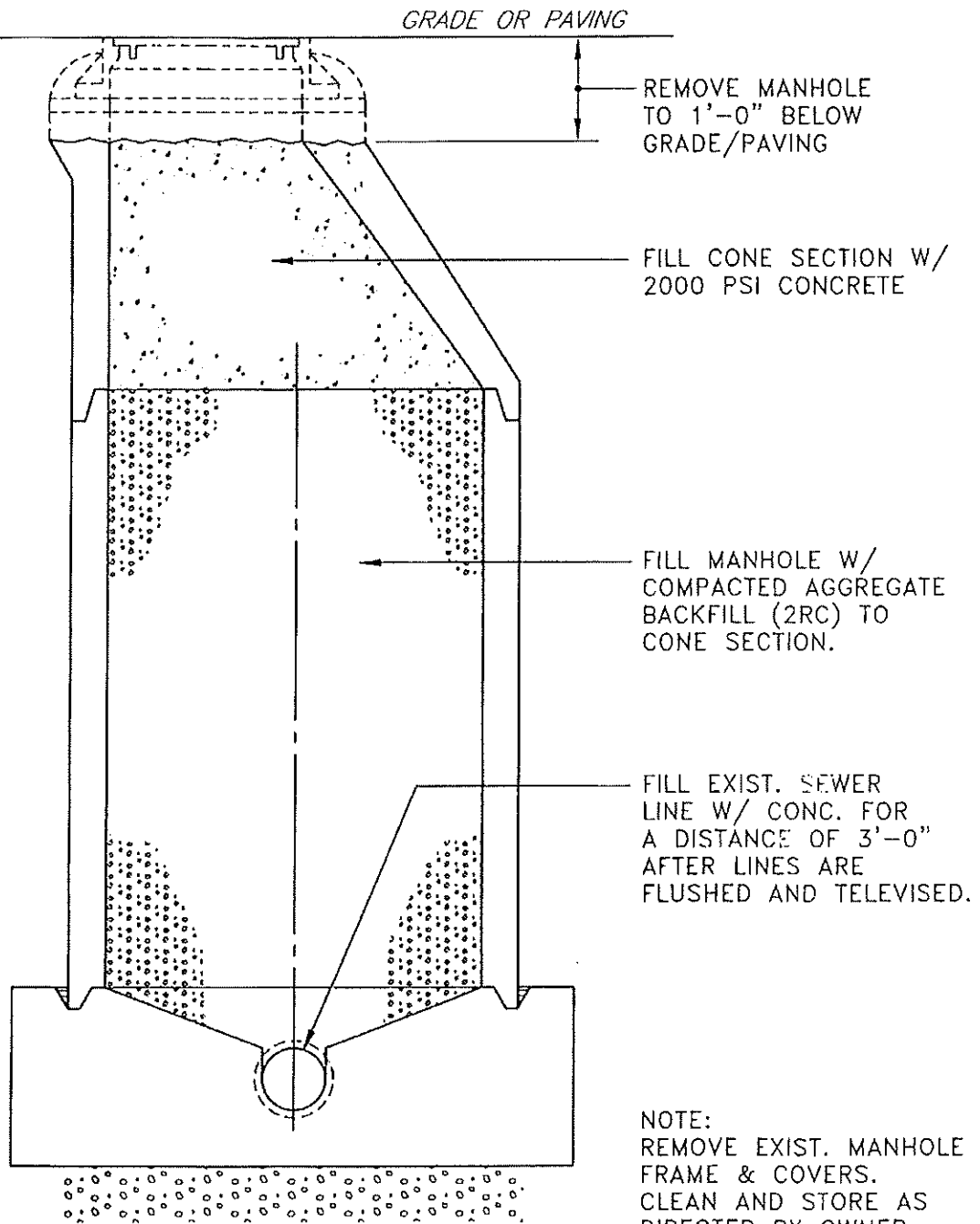
400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

**6" LATERAL INTO EXISTING MANHOLE  
(BY SPECIAL EXCEPTION ONLY)**

DATE: JUNE 2005

DETAIL: 36

SD036.DWG



TYPICAL SECTION

**AMITY TOWNSHIP**  
2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

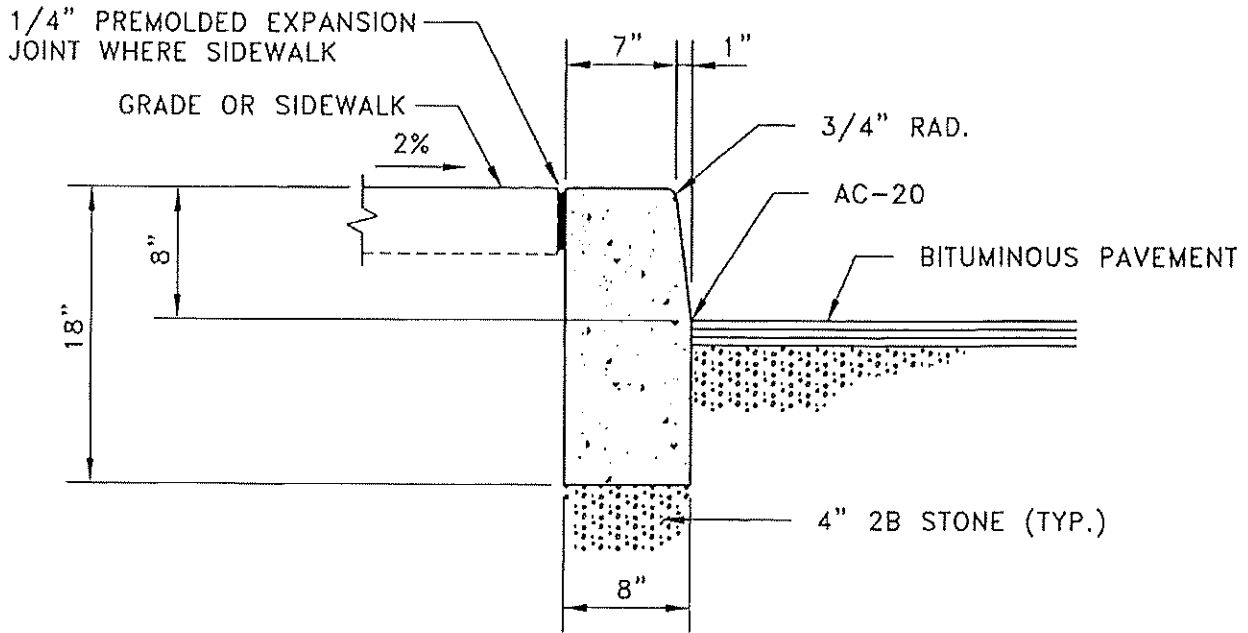


400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

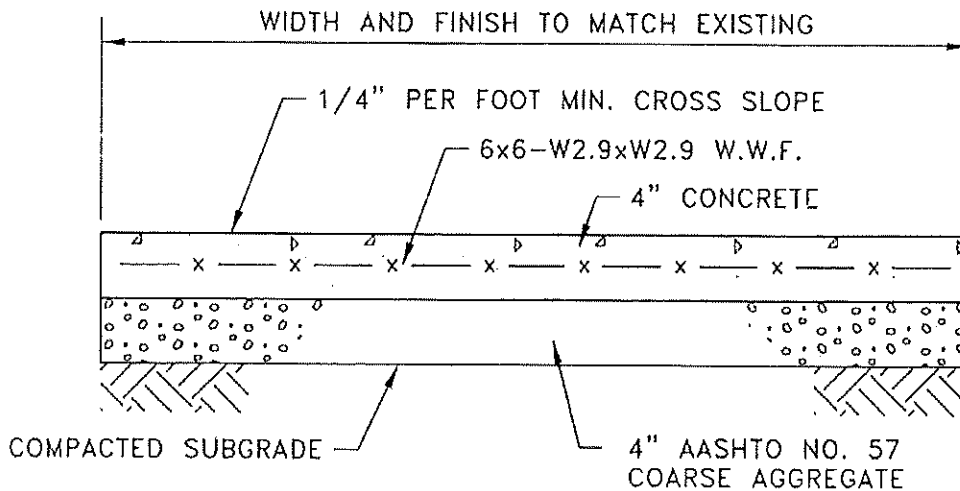
**MANHOLE ABANDONMENT DETAIL**

DATE:  
JUNE 2005

DETAIL:  
37



**STANDARD STRAIGHT CURB DETAIL**



NOTE: PROVIDE 1/2" TOOLED CONTRACTION JOINTS AT MAXIMUM 4'-0" SPACING.  
 PROVIDE 1/2" EXPANSION JOINTS AT MAXIMUM 20'-0" SPACING.

**SIDEWALK DETAIL**

**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



400 Washington Street, Suite 602  
 Reading, Pennsylvania 19601  
 Tel 610.374.5285

**CURB AND SIDEWALK DETAILS**

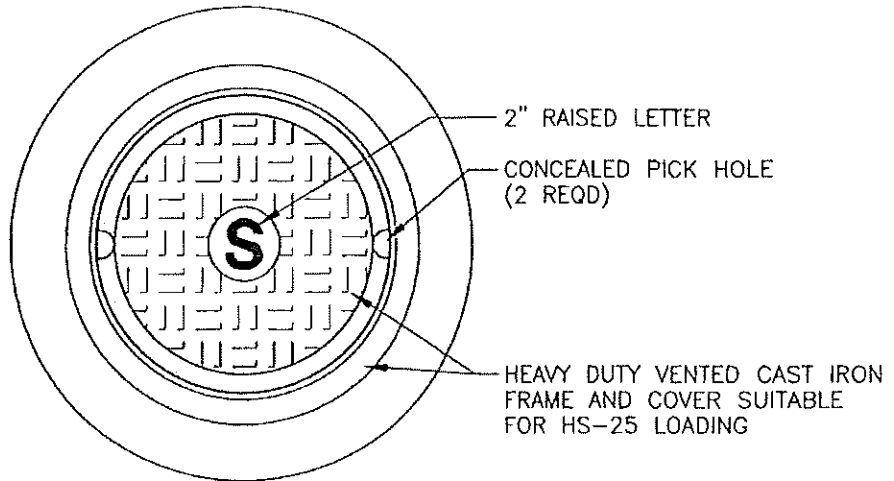
DATE: JUNE 2005

DETAIL: 38

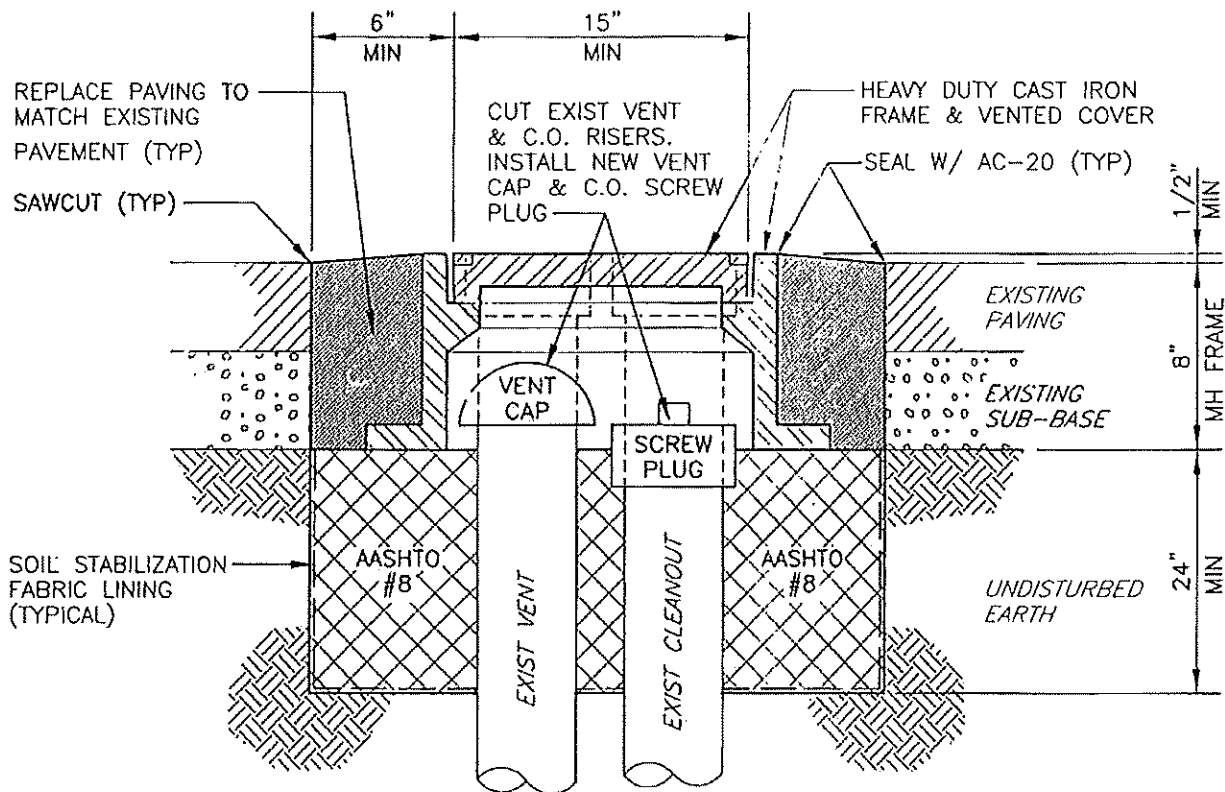
SD038.DWG

**NOTES:**

1. THIS DETAIL PERTAINS ONLY TO EXISTING VENTS & CLEANOUTS.
2. VENT CAP SHOULD MATCH EXISTING VENT MATERIAL.
3. EACH DRAIN WILL BE TESTED FOR DRAINAGE.



**COVER PATTERN**



**SECTION**

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

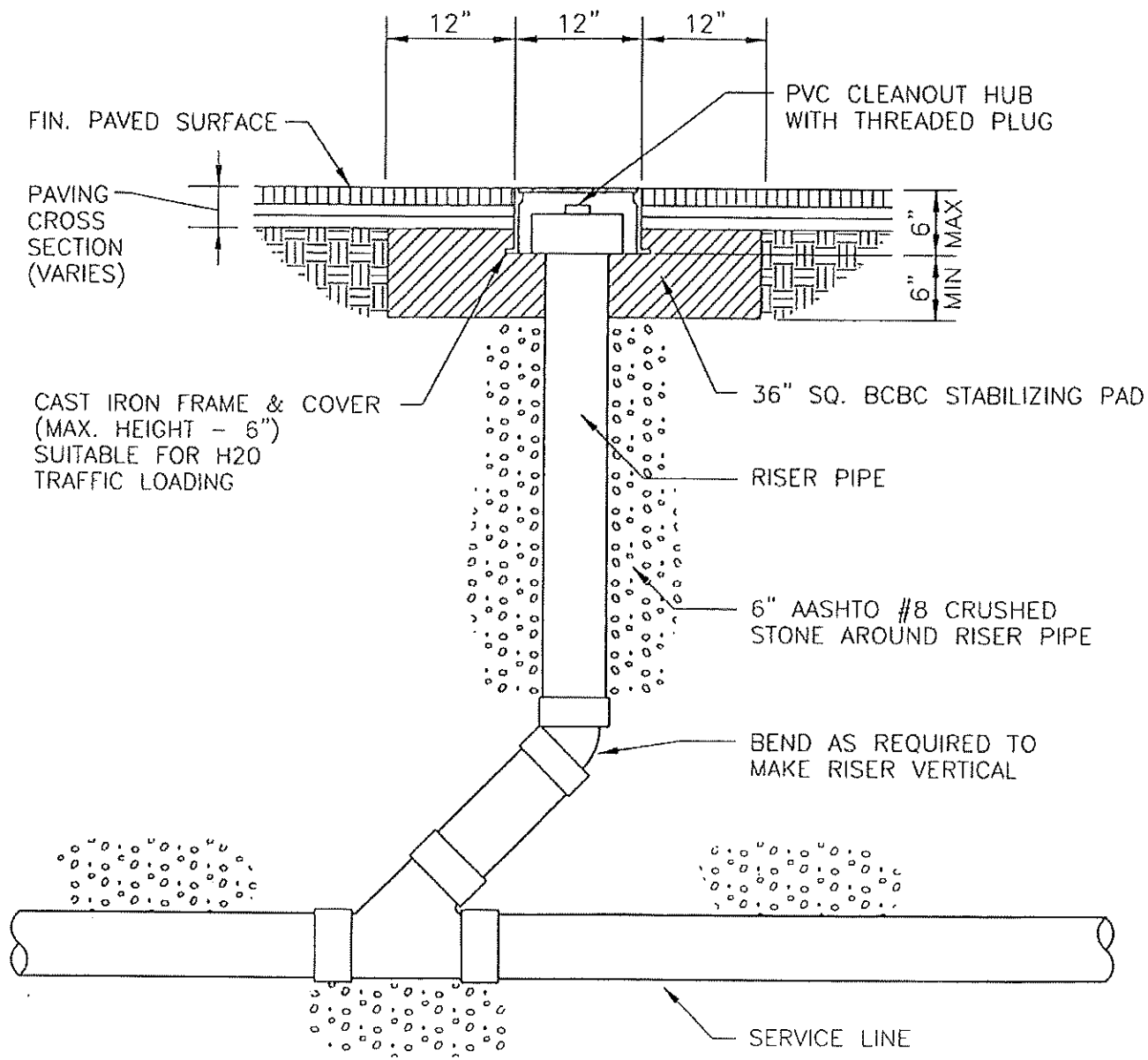


400 Washington Street, Suite 602  
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Tel 610.374.5285

**EXISTING VENTS AND CLEANOUTS  
IN PAVED AREAS DETAIL**

DATE: JUNE 2005

DETAIL: 39



**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



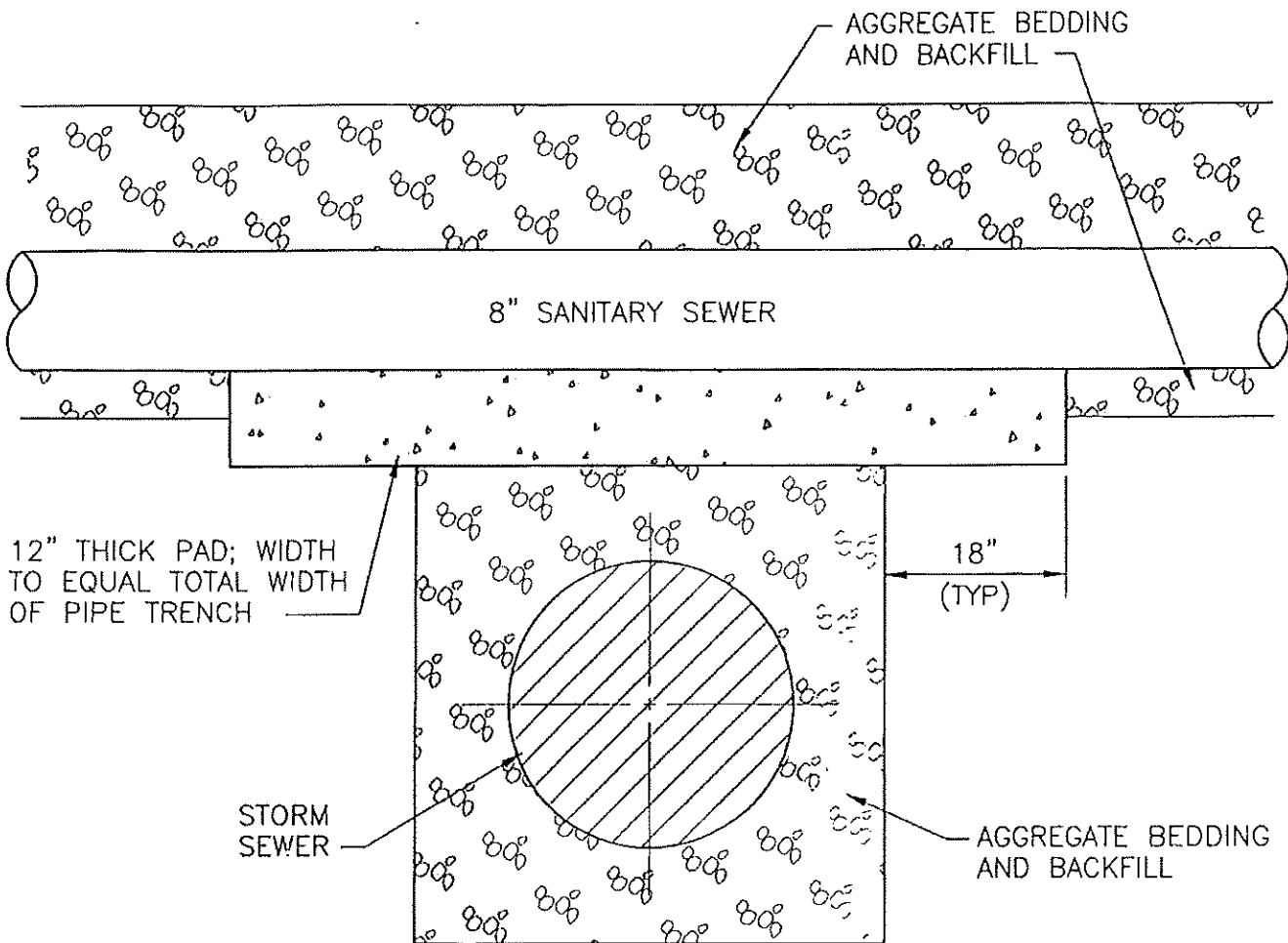
400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

NEW CLEANOUT IN PAVED AREAS DETAIL  
(BY SPECIAL EXCEPTION ONLY)

DATE: JUNE 2005

DETAIL: 40

S0040.DWG



NOTE:  
 DETAIL IS SIMILAR FOR AREAS  
 WHERE STORM SEWER CROSSES  
 OVER SANITARY SEWER.

**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

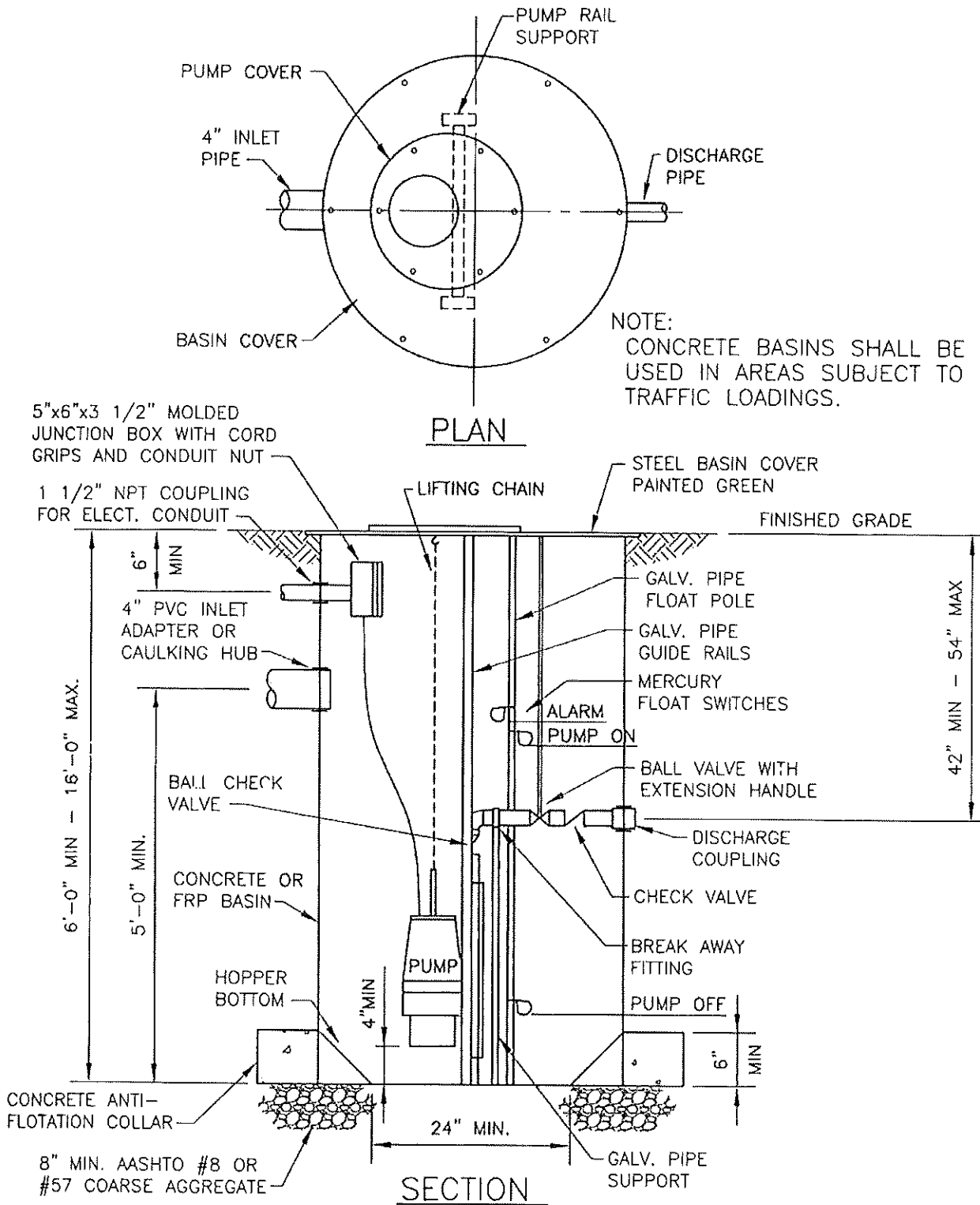


400 Washington Street, Suite 602  
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**PIPELINE CROSSING DETAIL  
 (STORM SEWER)**

DATE:  
 FEBRUARY 2005

DETAIL:  
 41



**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



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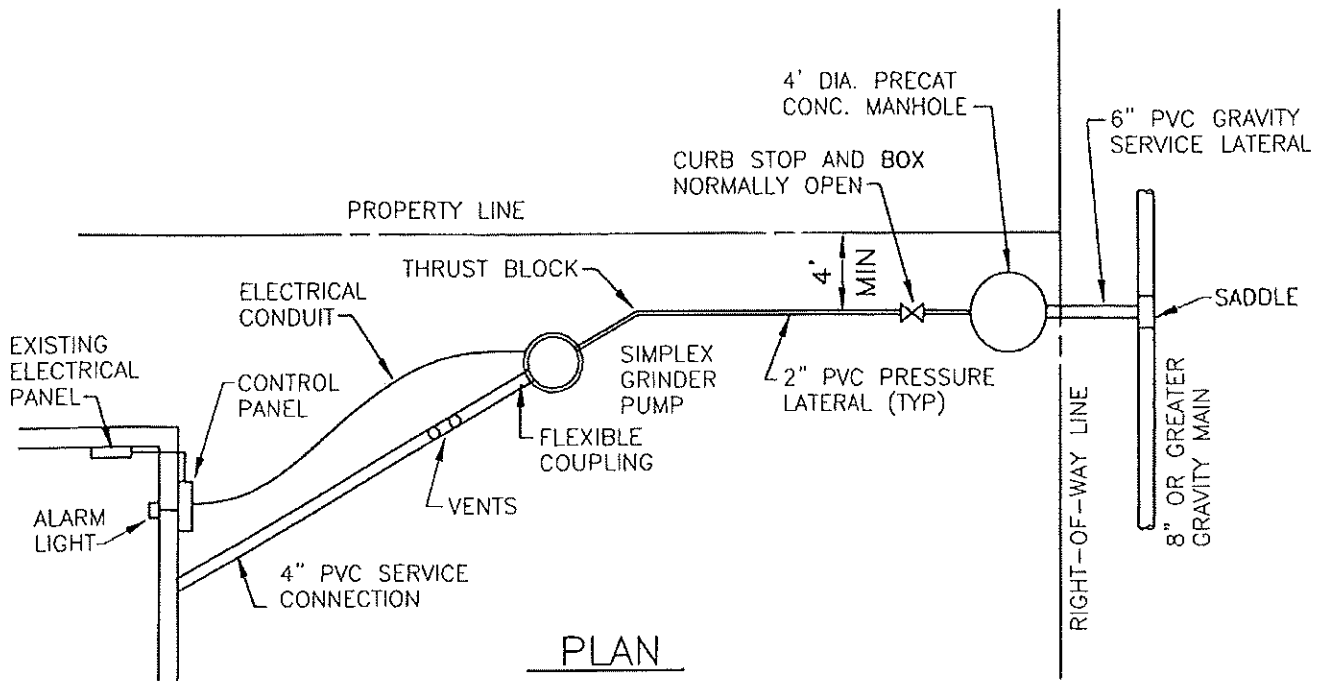
**SIMPLEX GRINDER PUMP DETAIL**

DATE: JUNE 2005

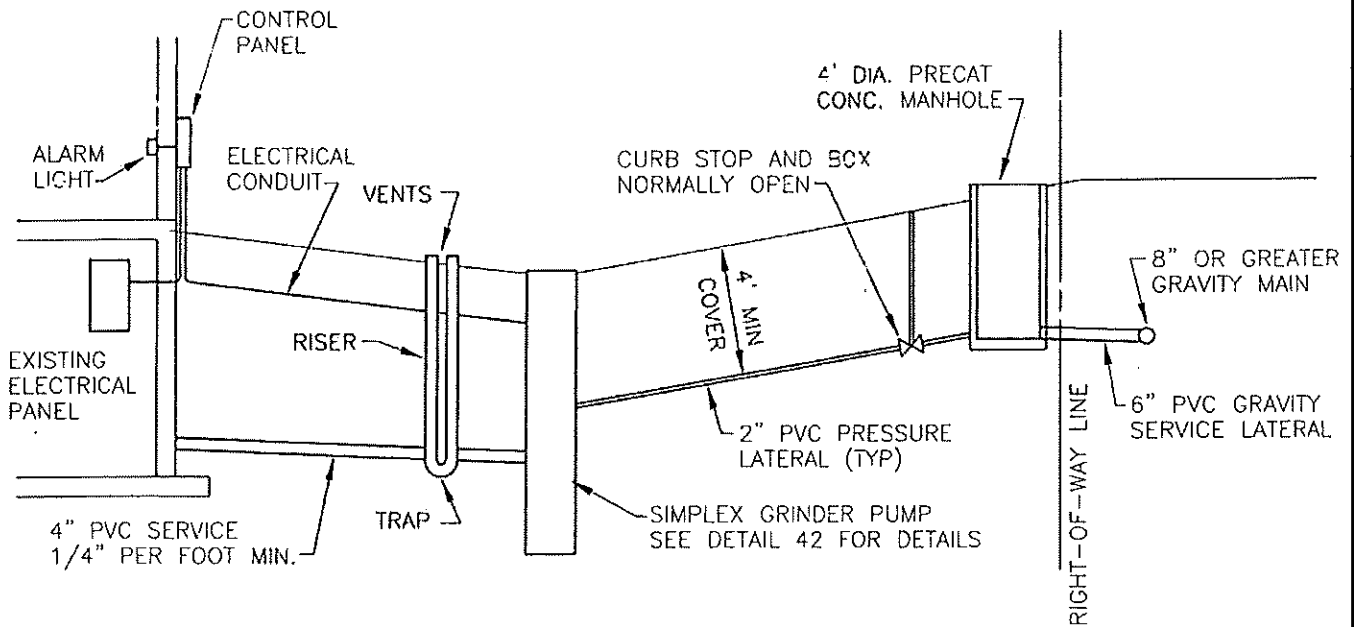
DETAIL: 42

SD042.DWG





PLAN



ELEVATION

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**

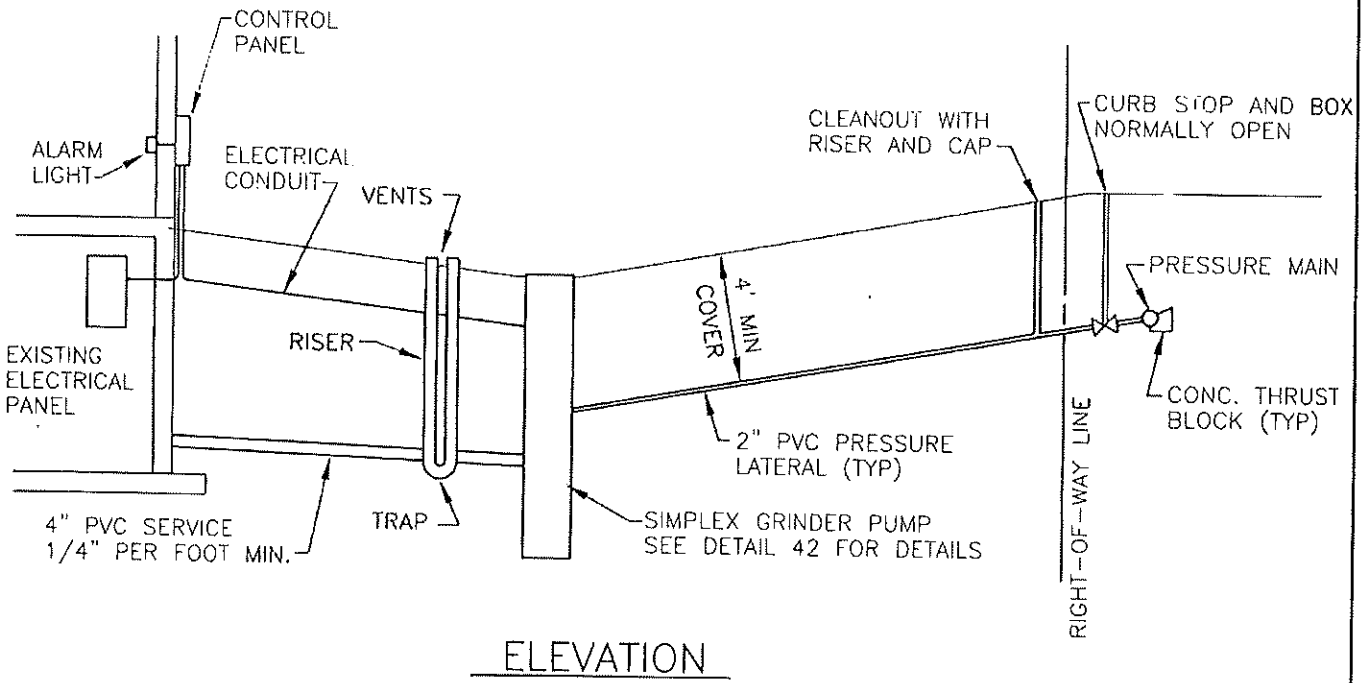
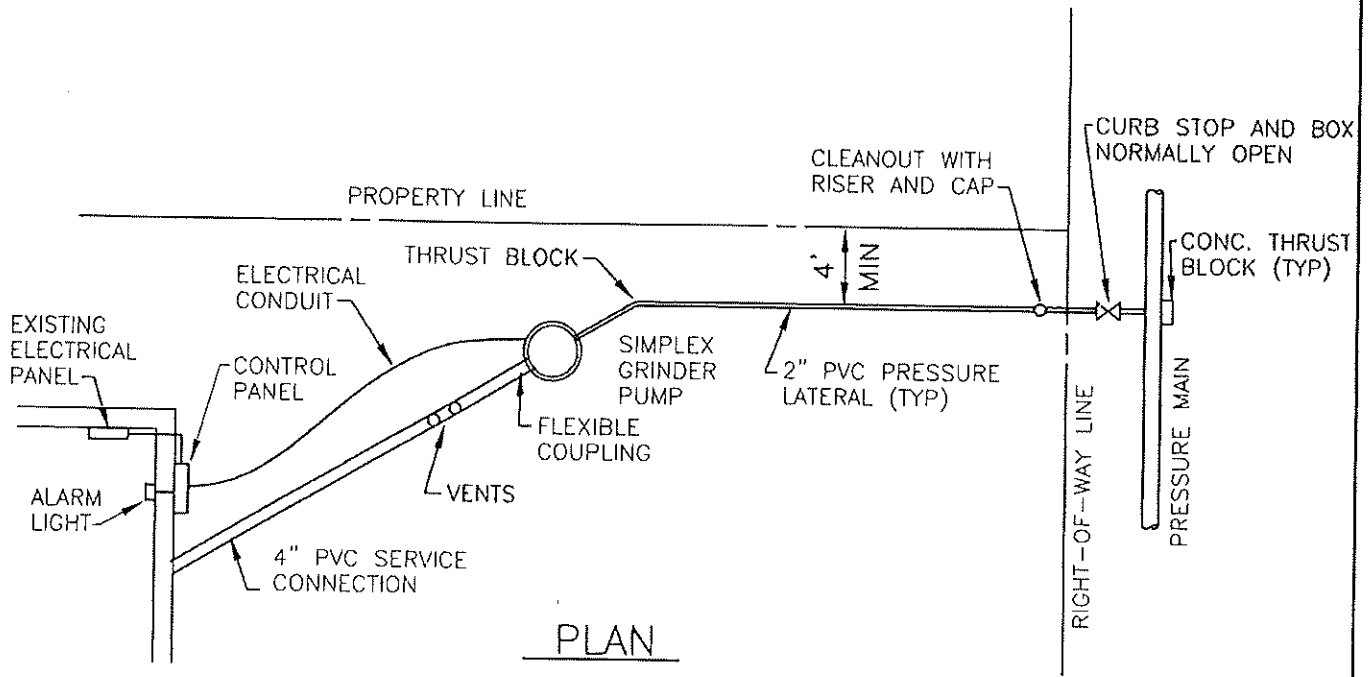


400 Washington Street, Suite 602  
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Tel 610.374.5285

**PRESSURE LATERAL DETAIL  
DISCHARGE TO GRAVITY MAIN**

DATE:  
JUNE 2005

DETAIL:  
43



**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA · 19518

**STANDARD DETAIL - SEWER SYSTEM**



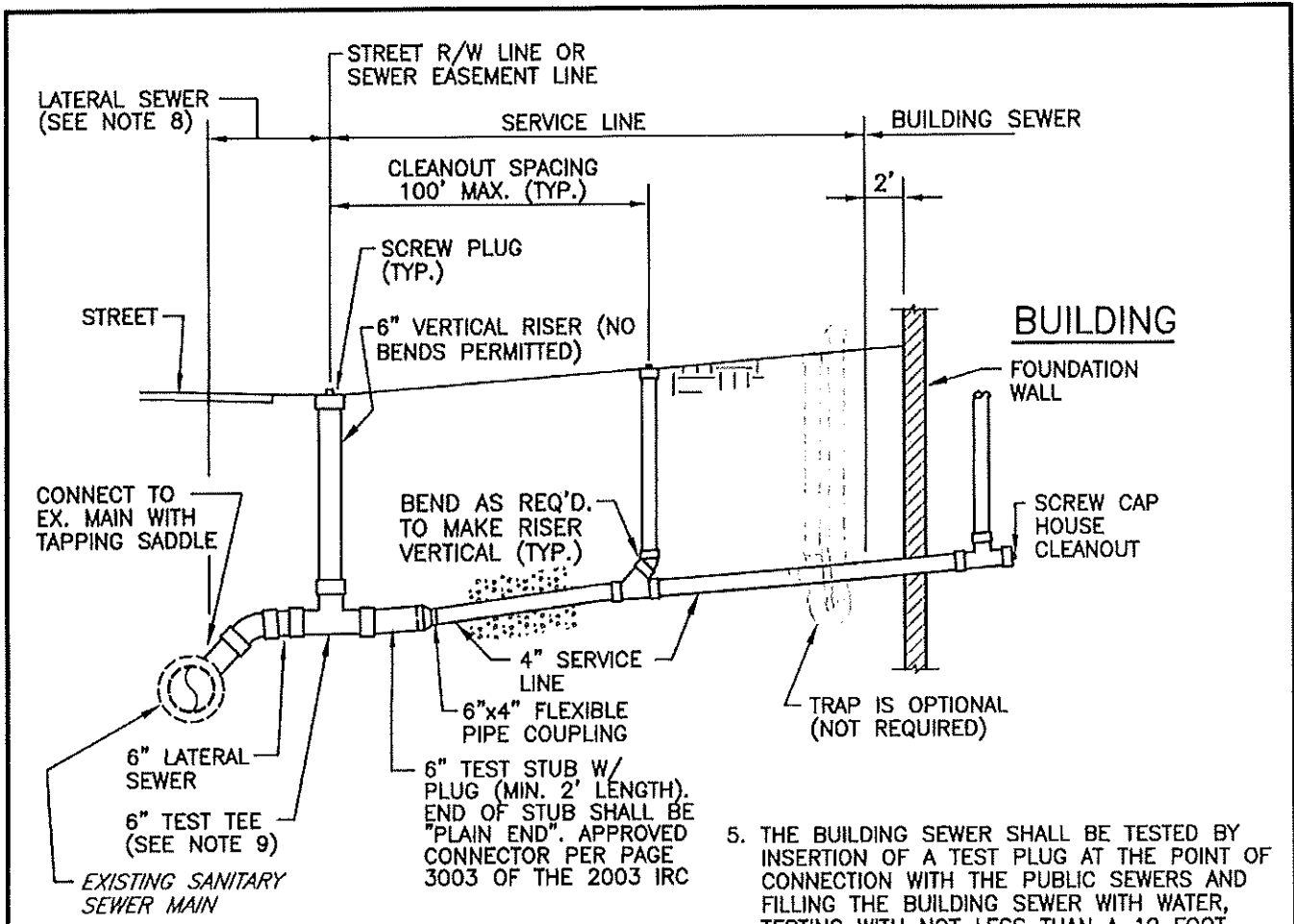
400 Washington Street, Suite 602  
Reading, Pennsylvania 19601  
Tel 610.374.5285

**PRESSURE LATERAL DETAIL  
DISCHARGE TO PRESSURE MAIN**

DATE: JUNE 2005

DETAIL: 44

SD044.DWG



**NOTES:**

1. PROVIDE 6" OF AASHTO NO. 57 (2B) STONE BELOW PIPE AND 12" ABOVE PIPE (TYPICAL ENTIRE LENGTH OF LATERAL)
2. MINIMUM SLOPE: 1/4"/FT (2%) FOR 2 1/2"Ø AND LESS, AND NOT LESS THAN 1/8"/FT (1%) FOR DIAMETER OS 3" OR MORE
3. MINIMUM DEPTH OF COVER : 3 FOOT
4. PIPE MATERIALS FOR SERVICE LINES:
  - A. PVC SDR 35
  - B. CAST IRON
  - C. MATERIAL MUST MEET REQUIREMENTS OF TABLE 3002.2 OF THE 2003 IRC
5. THE BUILDING SEWER SHALL BE TESTED BY INSERTION OF A TEST PLUG AT THE POINT OF CONNECTION WITH THE PUBLIC SEWERS AND FILLING THE BUILDING SEWER WITH WATER, TESTING WITH NOT LESS THAN A 10 FOOT HEAD OF WATER AND BE ABLE TO MAINTAIN SUCH PRESSURE FOR 15 MINUTES. TEST MUST BE PERFORMED PRIOR TO BACKFILL.
6. NO SEWER SERVICE LINE VENT CAPS SHALL BE INSTALLED WITHIN A 100-YEAR FLOOD PLAIN OR WITHIN FLOOD PRONE AREAS.
7. NO VENT CAPS OR CLEANOUTS SHALL BE INSTALLED IN DRIVEWAYS OR OTHER PAVED AREAS UNLESS SPECIFICALLY APPROVED.
8. THE LATERAL SEWER SHALL BE INSTALLED TO THE EDGE OF THE SEWER EASEMENT FOR SEWERS LOCATED IN AN EASEMENT OR TO THE STREET RIGHT-OF-WAY AS A MINIMUM, OR TO SUCH POINT, AS REQUIRED, TO CLEAR STREET SIDEWALKS AND UNDERGROUND UTILITIES.
9. SET 6" TEST TEE AT 1% SLOPE TO PERMIT VERTICAL RISER INSTALLATION WITH NO BENDS.

**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



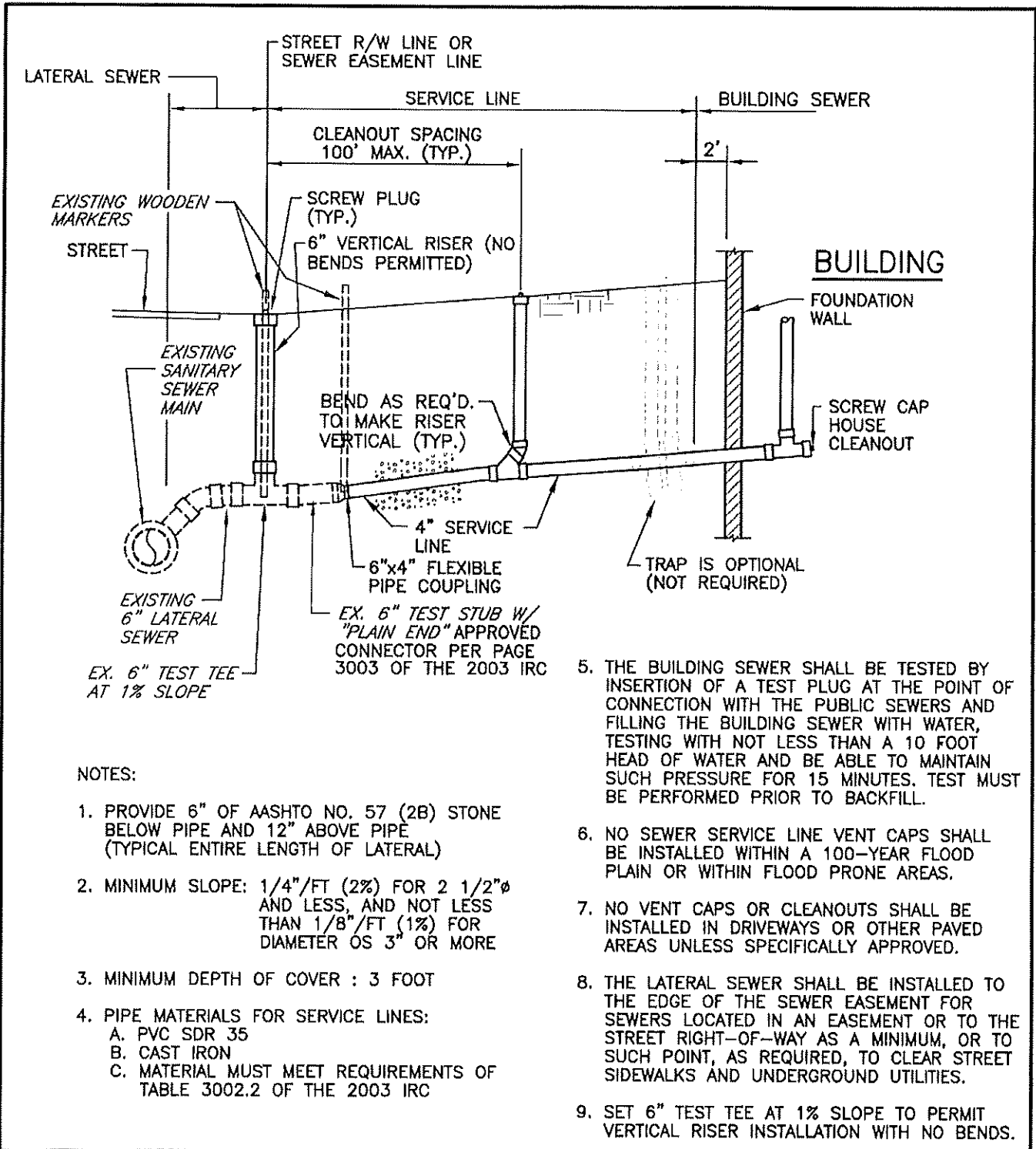
400 Washington Street, Suite 602  
 Reading, Pennsylvania 19601  
 Tel 610.374.5285

**SERVICE LATERAL AND HOUSE SERVICE  
 CONNECTION TO EXISTING SEWER MAIN**

DATE:  
 MARCH 2010

DETAIL:  
 45

SD045.DWG



**AMITY TOWNSHIP**  
 2004 WEAVERTOWN ROAD  
 DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



400 Washington Street, Suite 602  
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 Tel 610.374.5285

**HOUSE SERVICE CONNECTION  
 TO EXISTING SERVICE LATERAL**

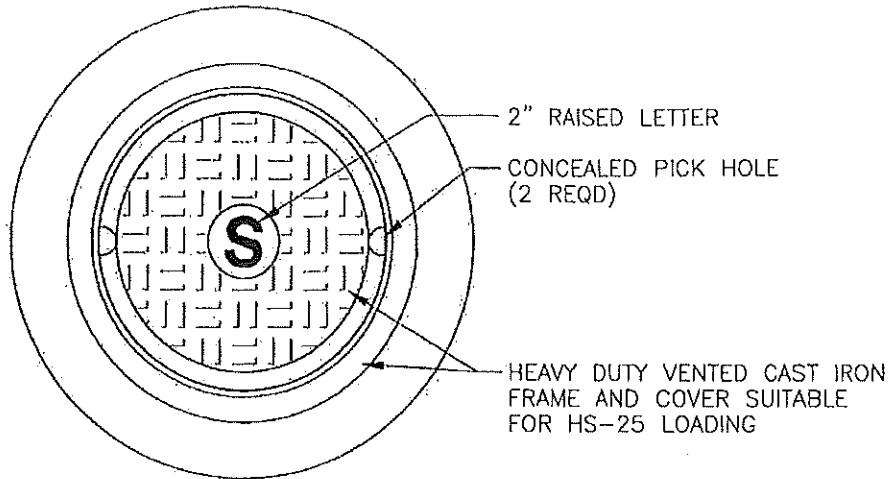
DATE:  
 MARCH 2010

DETAIL:  
 46

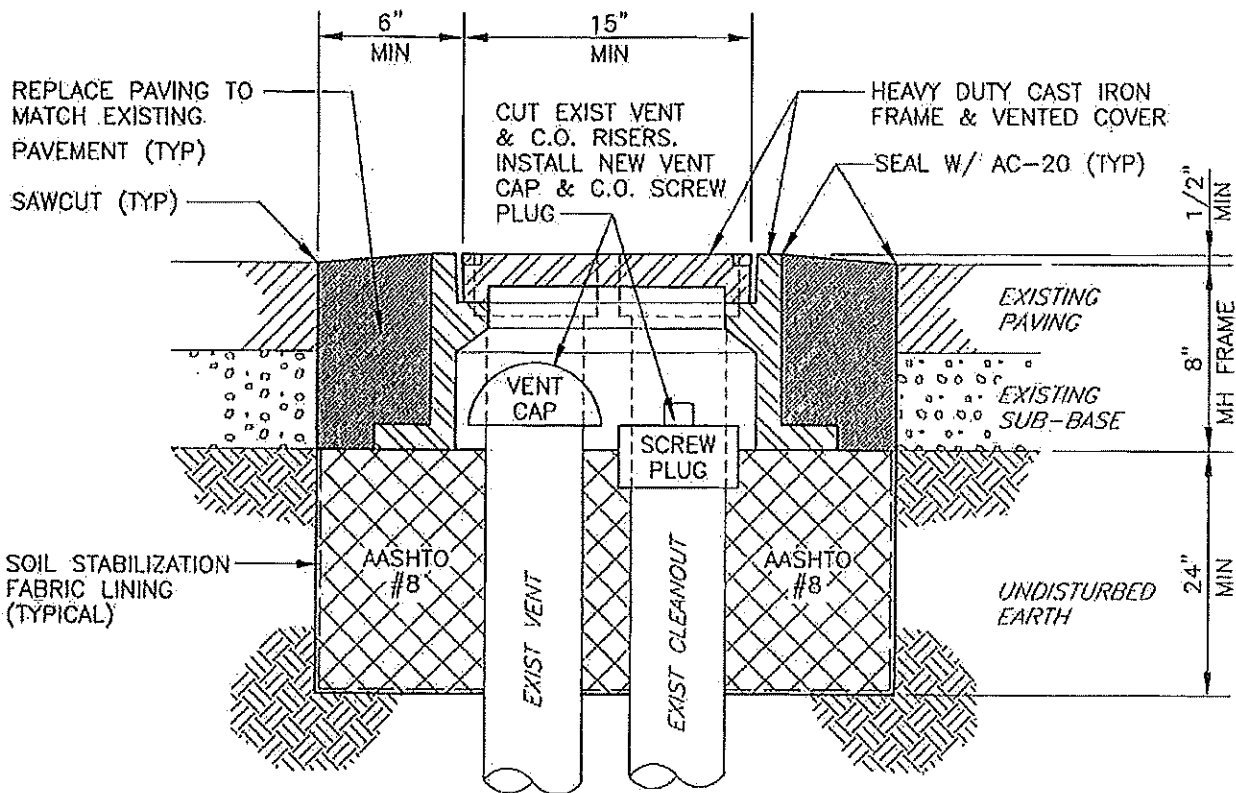
SD046.DWG

NOTES:

1. THIS DETAIL PERTAINS ONLY TO EXISTING VENTS & CLEANOUTS.
2. VENT CAP SHOULD MATCH EXISTING VENT MATERIAL.
3. EACH DRAIN WILL BE TESTED FOR DRAINAGE.



COVER PATTERN



SECTION

**AMITY TOWNSHIP**

2004 WEAVERTOWN ROAD  
DOUGLASVILLE, PA 19518

**STANDARD DETAIL - SEWER SYSTEM**



400 Washington Street, Suite 602  
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EXISTING VENT & CLEANOUT  
IN PAVED AREA DETAIL

DATE:  
MARCH 2006

DETAIL  
47

SD047 DW

