

HARBORCREEK TOWNSHIP SEWER AUTHORITY STANDARDS FOR CONSTRUCTION TABLE OF CONTENTS

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DIVISION 0 – INTRODUCTON SECTION 00010 – OVERVIEW

It is the intent of the instructions, specifications, and construction standards as presented herein to comprise the minimum requirements of the Harborcreek Township Sewer Authority for the construction of sanitary sewer facilities in Harborcreek Township, Erie County, Pennsylvania.

All engineering design of sanitary sewer facilities shall be accomplished by a Pennsylvania Professional Engineer.

All work shall be done in accordance with the requirements of the Authority and these Specifications.

The work shall be executed in the best and most workmanlike manner by qualified, conscientious, and experienced workmen.

DEFINITIONS

The following definitions shall be applicable in these Specifications:

- A. **Authority** The Harborcreek Township Sewer Authority
- B. **Authority's Authorized Representative** The Authority's authorized representative as used in these rules and regulations shall be a representative designated by the Harborcreek Township Sewer Authority.
- C. **Board** The appointed members of the Harborcreek Township Sewer Authority, as now or hereafter constituted, and its duly authorized agents or representative.
- D. **Contractor** Any individual, partnership, or corporation performing sewer construction work for the Developer.
- E. **Developer** Any landowner, agent of such landowner, or tenant with the permission of such landowner, who makes or causes to make a subdivision of land or a land development (MPC definition).
- F. **Developer's Engineer** A registered professional engineer or architect in the State of Pennsylvania and shall be the individual, partnership, or corporation selected by the Developer to accomplish utility design in any development in the Township.
- G. **Easement** A grant by the property owner to the use of a strip of land by the public, a corporation, or persons for specified purposes, and land reserved and privately owned use as access for vehicles, utilities, etc.
- H. **Engineer** The Engineer that represents the Authority. The term may also include a construction inspector employed by the Authority.
- I. **Equal** Equal as approved by the Authority

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J. **Garbage** - Solid wastes from the preparation, cooking, and dispensing of food and from the handling, storage, and sale of produce.

- K. **Industrial Wastes** Any liquid, gaseous, or water-borne wastes from industrial processes or commercial establishments, as distinct from residential sewage.
- L. **Occupied Building** Any structure erected and intended for continuous or periodic habitation, occupancy, or use by human beings, and from which structure sanitary sewage and industrial wastes, or either thereof, is or may be discharged.
- M. **Public Sanitary Sewage System** (sometimes called the "Sewer System") All public sewers, all pumping stations, all force mains, and all other sewage facilities owned or leased and operated by the Authority for the collection, transportation, and treatment of sanitary sewage and industrial wastes, together with their appurtenances, and any additions, extensions, or improvements thereto. It shall also include sewers within the Authority's service area which serve one or more persons and discharge into the public sanitary sewerage system even though those sewers may not have been constructed by the Authority and are now owned or maintained by the Authority. It does not include separate storm sewers or culverts which have been constructed for the sole purpose of carrying storm and surface runoff, the discharge from which is not and does not become tributary to the sewerage treatment facilities.
- N. **Sanitary Sewage** The normal water-carried household and toilet wastes from residences, business buildings, institutions, industrial, and commercial establishments, exclusive of storm water runoff, surface water or groundwater.
- O. **Sanitary Sewer** A sewer which carries sewage and to which storm, surface, and ground waters are not intentionally admitted.
- P. **Sewer** A pipe or conduit for carrying sewage.
- Q. "SHALL" is mandatory: "MAY" is permissive.
- R. **Stormwater Runoff** That portion of the rainfall which reaches a channel, trench, storm sewer, or sink.
- S. **Storm Sewer** A sewer which is intended to carry storm water runoff, surface waters, groundwater drainage, etc., but which is not intended to carry any sanitary sewage or polluted industrial waste.
- T. **Subdivision** The division or redivision of a lot, tract, or parcel of land by any means into two or more lots, tracts, parcels, or other divisions of land including changes in existing lot lines for the purpose, whether immediate or future, of lease, partition by the court for distribution to heirs or devisees, transfer of ownership or building or lot development. Provided, however, that the subdivision by lease of land for agricultural purposes into parcels of more than ten acres, not involving any new street or easement of access or any residential swelling, shall be exempted (MPC definition).
- U. Township Harborcreek Township, Erie County, Pennsylvania
- V. **Utility** Whenever these specifications refer to sewer lines, sanitary sewer, building sewer, lateral, or the Authority's underground utility.

W. Work - Labor, services, materials, and equipment as required for the successful completion of the project.

Abbreviations and Definitions of Terms – The following is a list of abbreviations of organizations publishing standard specifications and/or providing inspection services used in these Standards for Construction.

AASHTO American Association of State Highway and Transportation Officials

ANSI American National Standard Institute

ASTM American Society for Testing and Materials

AWWA American Water Works Association **ECSCD** Erie County Soil Conservation District

MPC Municipal Planning Code

PCA Portland Cement Association

PADEP Pennsylvania Department of Environmental Protection

PennDOT Pennsylvania Department of Transportation

EXCLUSION OF STORM WATER RUNOFF

The discharge of storm water runoff to sanitary sewers is prohibited.

All persons connecting to the public sanitary sewage system shall provide adequate means for excluding storm water runoff in the event the connection is made to a sanitary sewer.

No person connected to a sanitary sewer shall connect any roof drain, foundation drain, or stormwater sump pump thereto or permit any such drains to remain connected thereto, nor shall he permit, allow, or cause to enter any sanitary sewer any spring water or surface water from any other source.

Garage Floor Drains: Garage floor drains are allowed to be connected to the sanitary sewer system provided no storm water is allowed to enter the garage and thus enter the garage floor drain and its associated piping. Driveway grades and the grades immediately adjacent to the garage should be sloped away from the garage.

Basement Floor Drains: Basement floor drains may be connected to the sanitary sewer system provided that no storm water, nor any sump pump discharges are allowed to enter the floor drain and associated piping.

PLAN REQUIREMENTS

- The Plan Drawing at a scale of not less than 1" = 10' nor more that 1" = 100' showing the Α. following:
 - 1. Name and address of developer or property owner.
 - 2. Proposed name of the subdivision or property owner.

- 3. North arrow, scale, and date.
- 4. Name of engineer responsible for the plan.
- 5. Location map showing the vicinity in which the proposed development is located. The scale of the locations map shall be 1" = 2,000' or less and shall identify major roads.
- 6. Contours at vertical intervals of two (2) feet for land with average natural slope of four percent (4%) or less, and at vertical intervals of five feet for more steeply sloping land and location of benchmark and datum used.
- 7. Tract or property boundaries and the name of all abutting subdivisions or property owners.
- 8. Number of acres in the tract or property, number of lots, and the type of proposed development.
- 9. Existing and proposed property lot and boundary lines, including building setback lines, and information concerning lot dimensions, lot areas, and the location of any easements.
- 10. The location of all existing and proposed streets, with information concerning right-of-ways, widths, and street names.
- 11. The location of any parcels of land either existing or proposed to be dedicated or reserved for schools, parks, playgrounds, or other public, semi-public, community purposes, or are proposed "No Build" lots.
- 12. The location of any existing bodies of water or watercourses, tree masses, buildings or structures, existing sanitary sewers, and any other man-made or natural features within or abutting the proposed subdivision.
- 13. All proposed sanitary sewers shall be stationed on the plan.
- 14. All proposed laterals shall be stationed on the plan.
- 15. Indicate on the plan which manhole lids are to be vented.

B. Profiles

- 1. Profiles of all proposed sanitary sewers shall be shown for all extensions.
- 2. The horizontal scale of the profile shall be the same scale as the plan.
- 3. The vertical scale will be not less than 1" = 1' and not more the 1" = 10' and shall generally be one tenth the horizontal scale.
- 4. All profiles shall be stationed to match the plan.
- 5. Pipe slopes shall be shown on the plan or profile.

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- 6. Pipe sizes shall be shown on the plan or profile.
- 7. Manhole inverts and top of grate shall be shown on the plan and the profile.
- 8. All pipe inverts at manholes shall be shown on the profile.
- 9. Pipe lengths, between manholes shall be shown on the plan or profile.

C. Details

- 1. The submitted plan shall include the following details:
 - a. Pipe bedding
 - b. Typical manholes
 - c. Flexible gaskets for inlet and outlet pipes in the manhole
 - d. If road bores or stream crossings are required, the plan shall include details showing the casing pipe and crossing appurtenances. The location of the bore pits shall also be shown on the plan.

D. Easements

- 1. Sanitary sewer easements shall be provided for sanitary sewers intended to serve abutting lots. No structures, fences, trees, shrubs, ornamental plantings, stormwater detention or retention areas or obstructions of any kind, shall be placed within such easements. The minimum width of the easement shall be 20 feet, centered on the pipe and located at the side or rear of the lots whenever possible.
- 2. All sanitary sewer easements shall be shown on the plans and all bearing and distances shall be shown.
- 3. All sanitary sewer easements shall be recorded in the Erie County Courthouse after review of the Authority's Engineer and Solicitor.
- 4. All sanitary sewer easements shall name the Authority as grantee therein.
- E. Plans shall be signed and sealed by a Pennsylvania Registered Engineer.
- F. Two (2) copies of the plans profiles, details, and easements for proposed extensions shall be submitted to the Board on 24" x 36" sheets.
- G. After review of the plans by the Authority's Engineer, one (1) copy thereof shall be returned to the developer with such comments and notations thereon as may be deemed appropriate by the Authority's Engineer. After making the necessary modifications and corrections, three (3) final copies of the plans and an electronic copy (in PDF format) of the proposed extension shall be submitted to the Board, said plans to have the same characteristics as are set out in Section 903 thereof.

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General

- A. All sewers shall be designed in accordance with the latest version of the <u>Domestic Wastewater Facilities Manual</u> of the Pennsylvania Department of Environmental Protection, Bureau of Water Quality Management, and these Rules and Regulations.
- B. Construction of sewers shall not be permitted until all required State permits have been obtained, the Authority's permit fees have been paid, a reasonable deposit has been made by the developer with the Authority to cover inspection, Engineering, and Administration fees based upon the anticipated costs thereof and a standard developer's agreement as promulgated by the Authority has been executed by the developer and delivered to the Authority.
- C. Prior to final acceptance of any sewer extensions by the Board, the developer shall furnish to the Board "as built plans" showing the angles and distances between manholes, the top and invert elevation of each manhole and the exact location and depth of all lateral wyes, the end of and depth of the lateral, and house sewer connections relative to the nearest manhole both downstream and upstream.
- D. The developer or individual owner desiring to connect an occupied building to the sewer system constructed or being constructed by the Developer shall file all necessary applications for connection permits and pay the applicable tap connection and sewer inspection fee to the Authority, and inspection fee for each occupied building to the Township which amount shall be due and payable prior to, inspection and approval by the Inspector for each connection to an occupied building. This shall be done prior to construction.
- E. No sewer extensions constructed by a Developer will be approved for use and acceptance by the Board until said sewers are formally approved by the Board, all building tap connections and inspection fees have been paid for each building then connected to the system, and the Board has been reimbursed in full for all inspection, legal, and administrative costs incurred.

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DIVISION 1 - GENERAL REQUIREMENTS SECTION 01015 - SPECIAL CONDITIONS

PART 1 - GENERAL

1.01 SCOPE

A. Provide labor, materials, equipment, and services, and perform all operations required for completion of work required by these standards as specified and/or indicated on the Contract Drawings.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS

- A. Standards and other publications referenced to these Specifications shall be of the issues in effect at the time of the submission of plans and shall form a part the Developer's submission.
- B. References are made to the Pennsylvania Department of Transportation specifications. Unless otherwise noted, the State specifications referred to are the Publication 408 Specifications, latest revision. Reference in the State specifications to "State", "Chief Engineer", or "Department" shall be interpreted as the Engineer as herein defined. When particular articles or sections are referred to, all paragraphs other than those relating to payment shall apply.

1.03 DEVELOPER'S USE OF PREMISES

- A. Developer shall make every effort to protect and avoid damage within the work area. Prior to the commencement of construction on any private right-of-way, the Developer, Authority, and Engineer's representatives will meet to identify special needs and desires.
- B. Confine construction equipment, the storage of materials and equipment, and operations of workmen to within the new development's parcel. The Developer's construction activities may encroach onto the public road right of ways, but only with prior approval by Harborcreek Township.
- C. Pipeline materials may be stored appropriately along the route of the Work provided such stored materials do not unduly restrict public use or infringe on private property.
- D. Assume full responsibility for materials stored on site.
- E. It shall be the responsibility of the Developer not to interfere with or create any hazards to traffic. No equipment or material will be stored or permitted to stand where traffic must be maintained. It shall be the responsibility of the Developer to control dust on all roads, drives, walkways, and parking areas on which traffic is being maintained.
- F. All work being performed within the Pennsylvania Department of Transportation rights-of-way shall be done in complete accordance with PennDOT specifications and permit requirements.

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- G. The Developer shall adequately close and/or protect all excavations, equipment, and materials stored within the rights-of-way of the project.
- H. All trenches along public roads must be completely backfilled at the end of the workday.
- I. All equipment must be removed from public road rights-of-way during the prohibited hours.

1.05 USE OF STREETS

- A. During the progress of the work, the Developer shall make ample provisions for both vehicle and pedestrian traffic on any public street and shall indemnify and save harmless the Authority and Township from any expense whatsoever due to his operations over said streets. The Developer shall also provide free access to all the fire hydrants, water, and gas valves located along the line of his work. Gutters and waterways must be kept open or other provisions made for the removal of storm water. With permission of Township, municipal street intersections may be blocked only one-half at a time, and the Developer shall lay and maintain temporary driveways, bridges and crossings, such as in the opinion of the Authority and Township are necessary to reasonably accommodate the public. The Developer's occupancy in the state road right-of-way must conform to the PennDOT Highway Occupancy Permit.
- B. In the event of the Developer's failure to comply with these provisions, the Authority may cause the same to be done, but the performance of such work by the Authority at its instance shall serve in no way to release the Developer from his general or particular liability for the safety of the public or the work.
- C. The Developer shall repair at no cost to the Authority and Township, all existing roads, parking areas, grassed areas that are damaged due to the execution of his work. The Developer shall remove daily all mud, soil and debris that may be tracked onto existing streets, drives, or sidewalks by his equipment or that of subcontractors or suppliers.

1.06 CLOSING STREETS AND ACCESS WAYS TO TRAFFIC

A. The Developer may, with the approval of the Township, close municipal streets, municipal access ways, or parts of municipal streets, to vehicular traffic. Municipal streets are to remain closed as long as the construction work or the condition of the finished work requires, or as determined by the Township. The Township shall be the judge of how many streets or parts of streets it is necessary for the Developer to close at any time, and may refuse to permit the closing of additional streets to traffic until the majority of the work on the closed streets is completed and they are opened to traffic.

1.07 CLEANING UP

A. Continuously keep rights-of-way, easements, storage areas, streets, roads, highways and adjacent properties free from accumulations of waste materials, excess excavation, rubbish and windblown debris resulting from construction operations.

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Wet broom to control dust while cleaning improved surfaces, remove surplus B. materials, tools, construction equipment and machinery as each work area is completed. Provide maintenance of temporary paving during the period prior to permanent paving and/or placement of concrete.

1.08 TEMPORARY CONSTRUCTION FOR MAINTENANCE OF UTILITIES

A. The Developer shall install all necessary temporary construction required to maintain the operation of any water, gas, electric, wastewater and any other utilities encountered during construction including bulkheads, blind flanges, pipelines, pipe connections, flumes, cofferdams, plumbing equipment, valves, pumping, etc.

1.09 PAVED SURFACE AND SHOULDER RESTORATION

Α. The repair responsibility shall extend 10' beyond the existing pavement and improved surface, which may be damaged as a result of trench settlement of construction requirements. Any such repairs shall be done in conformance with the specifications, the requirements as mandated by either the Pennsylvania Department of Transportation or Municipal Officials.

DISPOSAL OF SPOIL MATERIALS 1.10

All excess or spoil material, including rock, from the excavation shall be disposed of A. by the Developer in accordance with a local, state and federal requirements. The Developer shall submit to the owner letters of permission from all property owners where spoil material is disposed of.

EROSION AND SEDIMENTATION CONTROL PLAN 1.11

- A. The Developer shall implement the Erosion and Sedimentation Control (E&SC) Best Management Practices (BMPs) during construction. The E&SC BMPs must be made available at the construction site. Construction foreman shall be aware of the erosion and sedimentation control. The Developer shall provide the Authority with a copy of the Conservation District's approval letter for the E&SC Plan.
- B. Existing vegetation shall be protected as much as possible during construction.
- C. Construction sequencing shall be planned to minimize the size and time of exposure of disturbed areas. Scheduling of clearing, grading and stabilization shall reflect the construction capabilities of the Developer as well as climate factors.
- D. Discharge of pumped groundwater during construction is a potential erosion and sedimentation hazard. Pumped groundwater shall be discharged to a stabilized outlet through filtered devices including a filter bag or the silt control fence outlets before such water is permitted to leave the construction site.
- E. Dust, as a potential source of sediment, should be controlled by sprinkling or other means acceptable to the Authority.
- F. Unless otherwise specified, all planting and seeding shall be completed in

conformance with the latest edition of the Penn State Agronomy Guide.

1.12 UNNECESSARY NOISE, DUST AND ODORS

- A. The Developer's performance of this Contract shall be conducted so as to eliminate all unnecessary noise, dust, and odors due to construction of this project.
- B. All equipment shall be maintained in compliance with all standards as required by the Occupational Safety and Health Administration.

1.13 WATER

A. The Developer shall be responsible for an adequate supply of water suitable for his use for construction and drinking. At the Developer's expense, the Developer shall provide and maintain adequate supplies and supply lines in such locations and installed in such a manner as may be satisfactory to the Township.

1.14 WORK TIME

- A. Developer shall not be permitted to undertake any work on public roads before 7:00 A.M. or after 6:00 P.M. in order to avoid conflict with heavy traffic or businesses.
- B. No work will be permitted at night, Sunday or legal holidays except in the case of emergency and then only upon written authorization of the Township. Where such an emergency exists, but the Developer feels it advantageous to work at night, Sunday or legal holidays, the Developer shall notify the Township at least two (2) days in advance, requesting written permission. Any work performed during the absence of the Authority will be done at the Developer's risk and responsibility, and may be subject to rejection upon later inspection.

1.15 PUBLIC RELATIONS

- A. Developer's attention is directed to the fact that, in the eyes of the general public, his conduct and attitude will be closely associated with that of the Authority and Township. Accordingly, where operations of the Developer require personal contact with the public, the Developer and all his employees shall conduct themselves in a courteous and respectful manner. Any violation of this section shall be considered sufficient cause for the Authority to order discharge of the employee involved, and he shall not be employed again on the work without written permission from the Authority.
- B. The Developer's attention is also directed to the fact that some of the construction may occur adjacent to private property. The Developer shall take appropriate action in order to minimize the impact of his work on the private property. Developer shall adequately protect excavations, equipment and materials so as to minimize the possibility of any injury occurring to private citizens while work is not underway. Special care is required to protect residents from construction activities. Equipment shall not be run before 7:00 a.m. or after 7:00 p.m.
- C. Developer will be responsible to coordinate and inform public of any utility outage.

- D. Developer shall use all means necessary to control dust on and near the work, including off-site borrow and stockpile areas if such dust is caused by the Developer's operations. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the site.
- E. In carrying out the work, the Developer shall interfere as little as possible with traffic. The Developer shall provide and maintain ingress and egress for all residents along the construction route.
- F. Developer shall provide for emergency vehicle access at all times.
- G. Developer shall be responsible for notifying all affected residents, businesses, local emergency services, school districts, and other public agencies with regard to control and maintenance of traffic in the work area.
- H. The Developer shall obey and follow all posted speed limits.

1.16 UTILITY NOTIFICATION

A. Notify PA One Call System, Tel. No. 1-800-242-1776 or 811, at least 3 days prior to any excavation in order that all utility locations may be marked.

PART 2 – SPECIAL REQUIREMENTS

2.01 RIGHT-OF-WAYS

- A. The sanitary sewer right-of-way is centered atop and spans the respective sewer line, or is contained within the public road right-of-way (or both).
- B. Care shall be taken to avoid injury to the premises entered which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials, and the general conditions as pertained at the time of entry for work to be performed under this contract.
- C. The Developer shall not (except after consent from the proper parties) enter or occupy with employee's, tools or equipment, any land outside the right-of-way or property of the Authority or Township.
- D. When the Developer performs construction within 10 ft. of a right-of-way or easement line, he shall place tall stakes properly identified at points of change in width or direction of the right-of-way or easement line and at points along the line so that at least two stakes can be seen distinctly from any point on the line.

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2.02 EASEMENTS

- A. Easements will be secured by Developer in favor of Authority.
- B. Where the work is to be constructed upon easements, such easements will be secured by the Developer. The Developer shall not enter upon or occupy any private property outside the limits of the easements furnished.
- C. Care shall be taken to avoid injury to the premises entered which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed.

2.03 PROTECTING EXISTING BUILDING, STRUCTURES AND ROADWAYS

A. The Developer shall, at his own expense, shore up and protect any building, roadway, utility or other public or private structure which may be encountered or endangered in the prosecution of the work, and that may not be otherwise provided for, and he or she shall repair and make good any damages caused to any such property by reason of his operations. All existing fences removed due to the prosecution of the work shall be replaced by the Developer.

2.04 RESTORATION

A. The Developer shall restore all areas disturbed through the Contract work to the preconstruction/contract condition within 20 days of disturbance.

END OF SECTION

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DIVISION 1 - GENERAL REQUIREMENTS SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SCOPE

This section applies to the project construction facilities, temporary controls, and field offices.

1.02 RELATED SECTIONS

A. Section 02270 - Erosion Control

1.03 REGULATORY REQUIREMENTS

- A. Comply with all 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.

1.04 RESPONSIBILITIES

- A. Developers controls shall include dust control, sediment and erosion control, storm water control, flood prevention, wastewater, traffic control, temporary fencing/security and progress cleaning.
- C. Maintenance and Protection of Traffic
 - 1. The Developer will endeavor to minimize disturbance to the local residents.
 - 2. The Developer shall provide any necessary flagman, signs, lights, barriers, etc. for traffic control.

D. Storm Water Control

- 1. Developer shall be responsible for the permitted Erosion and Sedimentation Control measures and procedures.
- 2. Maintain flow of site storm water. Grade site to drain. Maintain excavations free of water. Provide, operate and maintain needed pumping equipment for dewatering.
- 3. Protect site from puddling or running water. Developer shall be responsible for flood damages to the Work. All flood damages shall be repaired to the satisfaction of the Authority.
- F. Developer assumes responsibility for damages to property caused by flooding due to blocking or restriction of storm water passages, natural waterways, and wastewater facilities.

G. Temporary Fencing / Security

1. Project area shall be temporarily fenced.

1.05 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary above-grade or buried utilities, equipment, facilities, materials, prior to mobilizing from site.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.06 SITE ACCESS

A. Developer is responsible for establishing access to the site of his work. Any requirements for additional land during construction for storage of material, locating trailers, or other temporary facilities, shall be provided by the Developer at his cost. The Developer shall obtain and provide for all necessary access to the property and rights-of-way shown on the Drawings. Developer shall be responsible for acquiring, constructing, maintaining, and the restoration of any temporary access facilities required for this construction.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

A. Serviceable, new, adequate for required purpose.

PART 3 - EXECUTION

3.01 PREPARATION

A. Fill and grade sites for temporary structures to provide drainage away from building(s).

3.02 REMOVAL

A. At completion of Work remove buildings, foundations, utility services, and debris. Restore Area.

END OF SECTION

DIVISION 1 - GENERAL REQUIREMENTS SECTION 01610 - DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

1.02 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work; does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Authority.
- C. Provide interchangeable components of the same manufacturer, for similar components.

1.03 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, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.04 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 weathertight, climate controlled enclosures.
- B. Cover products subject to deterioration when site does not permit onsite storage or protection.
- C. 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 USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

DIVISION 2 – SITE WORK SECTION 02071 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

1.01 **DESCRIPTION**

- Α. Demolition of existing structures and removal of sidewalks, Work included: pavement and piping as necessary to clear space for new construction and/or to rehabilitate existing construction.
 - 1. The Authority expressly disclaims any responsibility for the accuracy and completeness of the information given on any drawings with regard to existing structures. The Developer shall support and protect all pipes, conduits, and other structures, which may be encountered during the construction.

B. Related work:

1. All applicable Divisions of the Technical Specifications.

QUALITY ASSURANCE 1.02

A. State and local requirements shall control the disposal of debris resulting from the removal operation.

JOB CONDITIONS 1.03

The Developer shall walk the project with the Authority and identify all structures Α. and obstructions, which are to be removed prior to beginning the demolition.

PART 2 - PRODUCTS - NOT APPLICABLE TO THIS SECTION.

PART 3 – EXECUTION

3.01 PAVEMENT, SIDEWALKS, CURBING & SIMILAR STRUCTURES

- A. The Developer shall not remove any pavement, sidewalk or curbing in excess of the area in which construction will occur during a single work day without the approval of the Authority and Township.
- B. Removal of existing pavements, sidewalks, curbing, and similar structures shall end at an existing joint or a sawed joint. Sawed joints shall be straight, neat, and free from chipped or damaged joints. If work encroaches onto sidewalk areas and it is affected, then the Developer needs to get permission from the Township.
- C. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel.
- D. If the concrete is coated with a bituminous surface or other material, the depth shall be sufficient to cut into the concrete, not including the coating depth, as

specified above.

3.02 EXCAVATION OF RIGID PAVEMENT

- A. The Developer shall excavate rigid pavement, consisting of concrete or concrete base with a wearing surface of brick or bituminous concrete, where such excavation is required.
- B. Pavement shall be excavated to neat lines and, only to widths required for trenches for pipe laying and for construction of structures. Adequate provision shall be made to prevent settlement and breakage of pavement beyond the approved limits of excavation. Concrete pavement shall be cut with a concrete saw.
- C. All pavement broken or damaged beyond the limits above stated, or the approved extension thereof, shall be replaced by the Developer at his expense.

3.03 MANHOLES, CATCH BASINS, INLETS & SIMILAR STRUCTURES

- A. Existing drainage structures designated by the Authority to be removed shall be completely removed.
- B. Manholes, catch basins, inlets, and similar structures designated to be abandoned shall be abandoned as shown/stated on the Standard Details.
- C. Live sewers connected to structures removed or abandoned shall be rebuilt through the area with new pipe. Sewer flow shall be maintained between removal and replacement operations. Abandoned sewers shall be sealed and made watertight with approved precast stoppers or masonry bulkheads.
- D. All castings salvaged from abandoned or removed drainage structures shall remain the property of the Authority and shall be cleaned and transported by the Developer to a site designated by the Authority or incorporated in the work where called for on the Drawings.

3.04 GUARDRAIL

- A. Where so required by the Drawings, existing guardrail shall be carefully dismantled and stored for reuse or for salvage by the Authority or Township.
- B. The Developer will be required to replace, at no cost to the Authority, material lost or damaged by negligence or by the use of improper methods.

3.05 SUPERSTRUCTURES, TANKS, CHAMBERS & SIMILAR STRUCTURES

- A. Care shall be used in demolishing structural elements that are continuous with structural elements remaining in service. Concrete and masonry shall be cut with masonry or concrete saw before removing the unwanted portions.
- B. Methods and equipment used in demolition work shall be chosen so the structural integrity and water-tightness of both newly constructed and existing structures

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- C. Existing structures and equipment, which are damaged in appearance and/or function by performance of demolition work, shall be replaced or repaired to approved first-class condition by the Developer.
- D. Extreme care shall be used when removing existing concrete from around reinforcing steel, which must be used for securing new concrete. If this reinforcing steel is damaged, the Developer shall remove additional existing concrete until sufficient existing reinforcing steel is exposed to provide adequate embedment length in the new concrete.

3.06 SELECTIVE DEMOLITION

- A. Developer shall determine the location and extent of selective demolition to be performed and advise the Authority. Unless otherwise specified, demolition shall extend a minimum of three (3) feet below final grade.
- B. In company with the Authority, visit the site and verify the extent and location of selective demolition required.
 - 1. Carefully identify limits of selective demolition.
 - 2. Mark interface surfaces as required to enable workmen also to identify items to be removed and items to be left intact.
- C. Prepare and follow an organized plan for demolition and removal of items.
 - 1. Shut off, cap, and otherwise protect existing lines in accordance with the requirements of the public agency or utility having jurisdiction.
 - 2. Completely remove items scheduled to be so demolished and removed, leaving surfaces clean, solid, and ready to receive new materials specified elsewhere.
 - 3. In all activities, comply with pertinent regulations of governmental agencies having jurisdiction.
 - 4. Demolished material shall be considered to be property of the Developer and shall be completely removed from the job site.
 - 5. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
 - 6. In the event of demolition of items not so scheduled to be demolished promptly replace such items to the approval of the Authority.

END OF SECTION

DIVISION 2 - SITE WORK SECTION 02100 - CLEARING AND GRUBBING

PART 1 – GENERAL

SECTION INCLUDES 1.01

- Α. Clearing
- B. Grubbing
- C. Stripping and stockpiling topsoil
- D. Debris disposal

1.02 **DEFINITIONS**

- A. Clearing is defined as 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 and replacement of fences, walls, guideposts, guide rail, signs, and other obstructions interfering with the proposed work.
- B. Grubbing is defined as the removal from below the surface of the natural ground of stumps, roots and stubs, brush, topsoil, organic materials and debris.
- C. State and local code requirements shall control the disposal of trees, stumps, vegetation and debris. The Developer shall also comply with the requirements of the following:
 - 1. Pennsylvania Department of Environmental Protection.

SUBMITTALS 1.03

- Α. Permits for Disposal of Debris:
 - Arrange for disposal of debris resulting from clearing and grubbing to 1. locations outside the Authority's right-of-way and obtain written agreements with the owners of the property where the debris will be deposited.
 - 2. Submit to Owner two (2) copies of the agreement with each property owner releasing the Authority from responsibility in connection with the disposal of the debris.

1.04 **JOB CONDITIONS**

- A. The Developer may clear any obstructions within the PERMANENT RIGHT-OF-WAY and the CONSTRUCTION EASEMENT AS NECESSARY for the work as approved by the Authority.
- B. The Developer shall not remove any yard walkway, building access stairs, stone or concrete support wall in excess of the trench width.

- C. Streets, roads, adjacent property and other facilities to remain shall be protected against damage throughout the work.
- D. Existing trees, shrubs and other objects located outside the trench width shall not be disturbed.

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 or plastic fencing specifically manufactured for this use
 - 2. Soil-set fence posts, studded "T" type, 6' high.
- B. Tree Wound Dressing:
 - 1. Antiseptic and waterproof, asphalt base.

2.02 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 02937. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Notify the Authority at least 48-hours prior to beginning any clearing work. Mark areas to be cleared and grubbed with stakes, flags or plastic colored ribbon for the approval of the Authority. The Authority reserves the right to order additional trees or shrubs removed at no additional cost to the Authority, if, in its opinion, they cannot be maintained or have been damaged by the Developer's operation.
- B. Protect benchmarks, utilities, existing trees, shrubs and other landscape features designated for preservation with temporary fencing or barricades satisfactory to the Authority. No material shall be stored or construction operation carried on within 4' 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 10 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.

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- D. When working within temporary or permanent rights-of-way, use every means possible to protect from injury and damage all property, including trees, shrubbery, lawns, fences, buildings, walls, roads, water courses, natural features or any improvements thereto which may exist. Do not willfully or maliciously injure or destroy trees, shrubs, or vegetation, and do not remove or cut them without permission of the property owner.
- E. All operations must be confined inside the limits of construction. All damage done to property resulting from the Developer's negligence shall be repaired without charge to the satisfaction of the property owner with the exception of those items (trees, shrubbing, etc.) that must be removed for construction and have been agreed upon beforehand, in writing, between the Authority and property owner.

3.02 UTILITY RELOCATIONS

- A. 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 Developer's operations.
- B. Comply with the provisions of PA Legislature Act 187 (1996) or as amended, also known as the Pennsylvania One Call System (POCS).

3.03 CLEARING

- A. Confine clearing to within the limits of the right-of-way or easement.
- B. Fall trees in a manner that will avoid damage to trees, shrubs, and other installations, which are to be retained.
- C. Remove trees and shrubbery only when authorized by Authority.
 - 1. Perform authorized tree removal, including stumps and debris.
 - 2. Perform authorized shrubbery removal; store shrubs in protected manner and replant or replace such shrubbery.
 - 3. Trim merchantable timber of limbs and tops, and unless otherwise ordered by the Authority, saw timber into 8' lengths. Stockpile timber at locations designated on the site by the Authority. Merchantable timber is timber larger than 6" in smallest diameter from which saw logs, pulpwood, posts, poles, ties or cordwood can be produced.
 - 4. Dispose of tree removal debris in a lawful manner.

3.04 GRUBBING

- A. Grub areas to remove roots and other objectionable material to a minimum depth of 8" below the existing ground.
- B. Remove all stumps within the cleared areas to a depth of at least 1' below subgrade.

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3.05 STRIPPING AND STOCKPILING TOPSOIL

- A. Strip topsoil, if to be reused, to whatever depth it may occur from areas to be excavated, filled, or graded and stockpile at a location for use in finish grading.
- B. The topsoil is the property of the Authority and shall not be used as backfill or removed from the site unless imported top screened topsoil is to be utilized.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles to 72".
 - 2. Do not stockpile topsoil within drip line of remaining trees.
 - 3. Dispose of excess topsoil as specified for waste material disposal.
 - 4. Stockpile surplus topsoil and allow for respreading deeper topsoil.

3.06 DEBRIS DISPOSAL

- A. Unless informed otherwise by the Authority, debris resulting from clearing and grubbing operations shall become the property of the Developer and shall be legally disposed of.
- B. Do not deposit or bury on the site debris resulting from the clearing and grubbing work.
- C. Debris shall not be burned on site.

3.07 SITE IMPROVEMENTS

A. Remove existing above and below grade improvements as indicated and as necessary to facilitate new construction.

3.08 RESTORATION

- A. 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.
- B. Replace trees, shrubs and plants designated to be saved which are permanently injured or die during construction operations with like species acceptable to the property owner. Do not replant trees and shrubs in the easement.
- C. Remove protective fences, enclosures and guards upon the completion of the project.
- C. Restore guard posts, guardrail, signs and other interferences to the condition equal to that existing before construction operations.

END OF SECTION

DIVISION 2 - SITE WORK SECTION 02150 - SHORING AND BRACING

PART 1 – GENERAL

1.01 RELATED WORK

A. Section 02221 - Trenching, Backfilling and Compacting

1.02 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 - 1. Shoring materials and installation work shall conform to Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees.
 - 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, or to maintain the trench widths specified in Section 02221 regardless of whether the same is or is not considered necessary by the Developer.

1.03 SITE CONDITIONS

- A. Responsibility for Condition of Excavation:
 - The failure or refusal of the Authority 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 in no way or extent relieve the Developer of his responsibility concerning the condition of excavation or of his obligations under the Contract, nor impose liability on the Authority, whether caused by an action or want of action on the part of the Developer, or by an act of the Authority or their agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve the Developer from the necessity of properly and adequately protecting the excavation from caving or slipping.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wood Materials: Use wood sheeting, sheet piling, bracing and shoring which is in good serviceable condition and timbers of sound condition, free from large or loose knots and of proper dimensions.
- B. Steel Materials: Steel sheet piling and bracing of equal strength may be substituted for wood.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Using skilled labor, 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 injury to piping and structures, and without injury to or settlement of adjacent structures and pavements.
- B. When tight plank or steel sheeting is required, drive such sheeting in advance of the excavation. Make joints of tongue and groove or interlocking type and as watertight as possible.
- C. Where the maximum width of trench may be exceeded under these Specifications and where permitted by Federal and State regulations, the sides of the trench may be sloped in-lieu of providing sheeting and bracing. If the sloping of trench banks is permitted, the slope shall begin at a point of 12" above the top of the pipe. Install sheeting to support the vertical part of the excavation as required by Federal and State regulations.
- D. Remove sheeting, bracing and shores as trenches and other excavations are being backfilled, except where and to such an extent as the Authority shall require, in writing, that same be left in place or where the Authority shall permit the Developer to leave same in place at the Developer's own request and cost.
 - 1. In withdrawing sheeting and sheet piling, exercise care to ensure that all voids or holes left by planks as they are withdrawn are backfilled and thoroughly rammed with thin rammers provided especially for that purpose.
 - 2. Exercise care to carry backfill up evenly on all sides of items installed in excavations.
- E. Cut off sheeting or sheet piling left in place whenever and at such points as the Authority shall require and remove from the work the portion cut off.

END OF SECTION

DIVISION 2 - SITE WORK SECTION 02221 - TRENCHING, BACKFILLING AND COMPACTING

PART 1 – GENERAL

1.01 SECTION INCLUDES

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

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T 99, Moisture-Density Relations of Soils, Using a 5.5-lb Rammer and a 12" Drop.
 - AASHTO T 191, Standard Method of Test for Density of Soil In-Place by the Sand Cone Method.
- B. American Society for Testing and Materials:
 - 1. ASTMD698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - 2. ASTMD1556 Test method for Density and Unit Weight of Soil in Place by Sand Cone Method.
 - ASTMD2216 Test Method for Laboratory Determination of Water (Moisture)
 Content of Soil and Rock.
 - 4. ASTMD2321 Practice for Underground Installation of Flexible Thermosplastic Sewer Pipe.
 - 5. ASTMD2977 Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - ASTMD3017 Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 - 7. ASTMD4643 Test Method for Determination of Water Moisture Content of Soil by the Microwave Oven Method.
- C. Pennsylvania Department of Transportation:
 - PennDOT Publication 408, Current edition at time of project advertisement.
 - a. PennDOT Section 703.2, Coarse Aggregate.
 - b. PennDOT Section 703.3, Select Granular Material.

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- 2. PennDOT Chapter 459, Occupancy of Highways by Utilities, latest edition.
- 3. PennDOT Chapter 213, Work Zone Traffic Control, Current edition at time of project advertisement.

1.03 DEFINITIONS

A. Definitions:

- 1. Unclassified Excavation: Removal of materials of any kind in the excavation, including rock excavation.
- Miscellaneous Unclassified Excavation: Unclassified Excavation.
- 3. Miscellaneous Aggregate Backfill: Aggregate backfill required.
- 4. Miscellaneous Earth Backfill: Earth backfill required.
- 5. Subgrade: Trench bottom prepared as specified to receive first class bedding, concrete cradle or concrete encasement or the bottom of excavations prepared to receive pipe line structures.
- 6. Utility: Any buried pipe, duct, conduit or cable.
- 7. Final Surfacing Elevation: Elevation of bottom of final surfacing operation such as bottom of topsoil depth or paving subgrade.

1.04 QUALITY ASSURANCE

A. Source Quality Control:

- 1. Laboratory Tests: Aggregate materials specified herein under Products require advance examination or testing according to methods referenced.
 - Testing laboratory shall furnish both Authority and Developer two (2) copies of test result reports. Same reports will be considered as sufficient evidence of acceptance or rejection of materials represented.
 - b. Conduct aggregate quality tests in accordance with requirements of appropriate Referenced Standard for such materials.
 - c. The Authority reserves the right to accept aggregate materials based on certification from supplier that the aggregate originates from a source approved by PennDOT and that the aggregate complies with specified PennDOT requirements.

B. Regulatory Requirements

 Work performed within the public right-of-ways shall be completed according to all requirements of Harborcreek Township, the Authority and/or State/ Commonwealth in which the work is being completed.

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Classification of Excavated Materials: Excavated materials are classified as Α. "Unclassified" unless otherwise specified by the Authority.

B. Removal of Obstructions:

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

C. **Environmental Requirements:**

- Do not perform trenching, backfilling or compacting when weather conditions 1. or the condition of materials are such, in the opinion of the Developer, that work cannot be performed satisfactorily.
- 2. Do not use frozen materials as backfill nor wet materials containing moisture in excess of the amount necessary for satisfactory compaction.
- 3. Prior to use, moisten dry backfill material not having sufficient moisture to obtain satisfactory placement or compaction.
- 4. Plan work so as to provide adequate protection during storms with provisions available for preventing flood damage. Protect installed piping and other work against damage from uplift due to high ground water levels.
- 5. Accommodation of Drainage: Keep gutters, sewers, drains and ditches open for surface drainage. No damming or ponding or water in gutters or other waterways will be permitted, except where stream crossings are necessary. Do not direct water flows across or over pavements except through approved pipes or properly constructed troughs. When so required, provide pipes or troughs of such sizes and lengths as required, and place the same as required. Perform grading in the vicinity of trenches so that the ground surface is properly pitched to prevent water running into the trenches.
- 6. Pumping: Keep excavations free from water. Build dams and other devices necessary for this purpose, and provide and operate pumps of sufficient capacity for dewatering the excavations. Provide for the disposal of the water removed from excavations in such manner as not to cause injury to the public health, to public or private property, to the work of others, to the

- portion of the work completed or in progress or produce an impediment to the use of streets, roads and highways.
- 7. When it is necessary to haul soft or wet soil material over roadways, use suitably tight vehicles to prevent spillage. Clear away spillage of materials caused by hauling on roadways.
- 8. Provide effective dust and mud control.
- 9. Do not dispose of water in trenches by draining through completed portions of piping.
- D. Protection: Assume the risks attending and presence or proximity of overhead or underground public utility and private lines, pipes, conduits and support work for same, existing structures and property of whatever nature. Damages and expenses for direct or indirect injury to such structures or to any person or property rest solely with the Developer.
 - 1. Outside Rights-of-Way: Take necessary precautions to protect trees, shrubs, lawns and such other landscaping from damage. Complete restitution work for damages at no cost to the Authority.
 - 2. Pipe Supports: Adequately support underground pipes or conduits exposed as a result of excavations. Provide adequate support along their entire exposed length. Install such supports in such manner that backfilling may be performed without dislodging such pipes or conduits. Place and carefully compact Aggregate Backfill around the supports and leave such supports in place as a guard against breakage due to backfill settlement.
 - 3. Temporary Protective Construction:
 - a. Temporary Fence Barricade: Erect and maintain substantial temporary fences surrounding excavation to prevent unauthorized persons from entering such areas.
 - b. Barricades: Furnish and erect substantial barricades at crossings of trenches, or along trenches, to protect the traveling public.
 - c. Excavation Covers: Cover open excavation when work therein is suspended or left unattended, including the end of a work day. For such covers, use materials of sufficient strength and weight to prevent their removal by unauthorized persons.
 - d. Remove temporary protective construction at the completion of work on the Project.
 - e. Comply with all Federal, State and Local requirements.
- E. Structure Supports: Where passing buildings or any structure which by their construction or position might bring a great pressure upon the trenches, the Developer shall underpin or support and protect or use special driven sheeting or limit trench lengths of trench to be open for shorter durations as appropriate.

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- F. Accommodation of Traffic: Employ traffic control measures in accordance with PennDOT, Title 67, Chapter 213.
- G. Explosives and Blasting:
 - 1. Blasting is not permitted unless approved by the Authority.
- H. Removal of Rock by Means Other Than Blasting: Where removal of rock by means other than blasting is required, in accordance with the requirements of State and local laws, rules and regulations, and utility owner requirements, remove by the use of mechanical surface impact equipment, or by drilling and hydraulic rock splitting equipment, or by other methods.
- Responsibility for Condition of Excavation: Condition and results of excavation are solely the responsibility of the Developer. Remove slides and cave-ins at whatever time and under whatever circumstance they occur.
- J. Advance Trenching: Where existing utilities or other suspected underground obstructions are within close proximity of proposed pipelines, uncover and verify the exact location of utilities and other underground obstructions far enough in advance of pipe laying to allow any changes in pipe alignment or grade required to bypass the obstructions to avoid removing sections of pipe already installed.

PART 2 - PRODUCTS

2.01 FILL MATERIAL

A. Backfill

- 1. Refer to the Standard Details. If description is not provided, comply with the following:
 - a. Suitable Trench Backfill Material: On site excavated soil or soil-rock mixed materials free of topsoil, vegetation, lumber, metal and refuse; and free of rock or similar hard objects larger than six inches in greatest dimension. Rock to soil ratio shall not exceed one part rock to three parts soil.
 - b. Paved Area: Limestone backfill meeting the sieve requirements of PennDOT 2A conforming to PennDOT Publication 408, Section 703, commonly called B19.

B. Pipe Bedding

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- 1. Refer to the Details. If description is not provided, comply with the following:
 - a. First Class Bedding (to one foot above top of pipe): Coarse Aggregate conforming to PennDOT Publication 408, Section 703.2
 - Use AASHTO No. 57 Crushed Coarse Aggregate. Washed and rounded river gravel is not permitted.

- b. Backfill (on top of Bedding): Coarse Aggregate conforming to PennDOT Publication 408. Section 703.2
 - 1. Use B19 limestone in vehicular traveled areas and to 5' outside edge of traveled road, driveway or parking lot.
 - 2. Use suitable backfill material with no boulders greater than 6" in diameter in non-traveled areas to within 5' of traveled road, driveway or parking lot.
- C. Concrete Cradle and Encasement: Conforming to Section 03300 Cast-in-Place Concrete with a 28-day compressive strength of 3,000 psi.
- D. Unsuitable Bearing Material: Use AASHTO No. 1 Coarse Aggregate at an appropriate thickness.

PART 3 - EXECUTION

3.01 PREPARATION

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

3.02 EXCAVATING

- A. Perform soil erosion and sedimentation control work in accordance with the Erosion and Sedimentation Control BMP's.
- B. General:
 - 1. Excavation shall be performed to conform to the new facilities lines and grades.
 - 2. Perform excavation and backfilling using machinery except where hand excavation and backfilling is required or is necessary to protect existing structures, utilities, or other private or public properties.
 - 3. Begin excavation in trenches at the control point having the lower invert and proceed upward.
 - 4. Remove pavement as necessary.
 - 5. Remove rock to subgrade at least 25' in advance of pipe laying.

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- 6. Do not interfere with 45 degree bearing splay of foundations.
- 7. Excavation for manholes, catch basins, inlet and special structures shall be made to the depth and dimensions necessary for the proper installation of all structures. Care shall be taken that the foundation area of the structure is not excavated below grade except when rock is encountered. Where masonry is built directly against the sides or bottom of the excavations, the final trimming shall be done just before the masonry is placed.

C. Subgrade Preparation:

- 1. Do not excavate below depths indicated or specified except where unsuitable material is encountered at subgrade.
- 2. Remove unsuitable material found below subgrade with unsuitable bearing replacement material.
- 3. Remove rocks or other hard matter protruding through trench bottom at subgrade which could damage pipe or impede consistent backfilling or compaction. Backfill with first class bedding to required subgrade. Compact backfilling material in 8" lifts.
- 4. Remove rock below subgrade if shattered due to excessive drilling impact or splitting operations. Backfill to subgrade with concrete or other material as appropriate.
- 5. When appropriate, excavated areas shall be strengthened for foundation purposes by furnishing and placing crushed rock or gravel refill, concrete cradle or encasement, timber cradles, timber piling or a combination of these materials.

E. Excavated Material Storage:

- 1. Separate and stockpile in designated area, excavated materials suitable for use as backfill. Remove from the site, excess materials and excavated materials not suitable for backfill.
- 2. In no case shall excavated materials be stockpiled outside of the construction easements or the permanent right-of-way if construction easements are not secured.

F. Trench Width:

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

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<u>Table A</u>				
Diameter of Pipe	Minimum Trench Width (Outside Diameter of Pipe at the Barrel Plus)	Maximum Trench Width (Outside Diameter of Pipe at the Barrel Plus)		
4 through 24 inches	12 inches	16 inches		
27 through 36 inches	20 inches	24 inches		
42 through 72 inches	26 inches	30 inches		
Larger than 72 inches	30 inches	36 inched		

- 2. From a point 12" above the top of the outside barrel of the pipe, maintain trench banks as follows:
 - a. Vertical as possible for trenches in paved or unpaved roadways.
 - b. In open areas, trenches may be sloped at angles required to make trench stand; however, in no case shall the angle be more steep than one-half (½) horizontal to one (1) vertical. (e.g. one-fourth (¼) horizontal: one (1) vertical would not be permissible).
 - c. Top of trench shall not exceed limits of right of way or construction easement if such is secured.
 - d. Maintain trenches such that there is no conflict with State or OSHA regulations.

G. Length of Open Trench:

- 1. Complete trench excavation not more than 100' 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.
- 2. The Developer shall limit all trench openings to a distance commensurate with all rules of safety.
- 3. If the work is stopped either totally or partially, the Developer shall refill the trench and temporarily repave over the same at his expense. The trench shall not be opened until he is ready to proceed with the construction of the pipeline.

3.03 PIPE BEDDING

A. Place Pipe Bedding and Initial Backfill as specified on the Standard Details. Place material in trench for full width. Place on each side of pipe and fittings simultaneously.

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- B. Bedding shall have a minimum compacted thickness, below the bottom of the pipe of 6" and shall be extended upward to the elevation of the longitudinal centerline of the installed pipe.
- C. Initial Backfill: From pipe springline to 12" above outside of pipe barrel carefully place initial backfill in 4" layers. Place carefully so as not to disturb pipe.
- D. The trench shall be excavated to a minimum depth of 4" below the bottom of the pipe barrel and this space refilled with pipe bedding material.

3.04 BACKFILL

- A. Backfill trenches to final grade contours and elevations.
- B. Maintain optimum moisture content of fill materials to attain required compaction density.
- C. Do not use frozen backfill materials or place backfill on frozen subgrades or trench subgrades.
- Perform backfilling by methods which will result in thorough compaction of backfill material.
- E. Backfill to Final Restoration Elevation: Backfill from 1' above the top of pipe to Final Restoration Elevation using backfill materials specified. Consolidate backfill materials evenly from center to side of trench to prevent arching.
- F. If there is a deficiency of backfill material, provide borrow material as required.
- G. No backfill shall be placed around or over any sewers until they have been inspected and the elevations, alignment, and pipe joints have been checked, inspected and approved by the Authority.

3.05 COMPACTION

Compact subgrade for paved surfaces (i.e., roadway, driveway, shoulder) to 100% Α. Standard Proctor and compact subgrade for non-paved surfaces (i.e., lawn, field, pasture) to 95% Standard Proctor. Dry-mass density for material in place in the field will be determined, according to ASTM D-698 and AASHTO T-99. In-place density or compaction will be determined, according to AASHTO T-191 or T-310 where directed, at least three (3) field density tests for every 200 L.F. of backfilled trench layer, for the first 1,000 L.F. and at least two (2) field density tests for every 1,000 L.F. thereafter of completed subgrade. When material is too coarse (more than 20% retained on the 19 mm (3/4-inch) sieve and less than 35% passing the 75-µm (No. 200) sieve, or more than 30% retained on the 19 mm (3/4-inch) sieve) to use these methods, compaction will be determined based on no movement of material under compaction equipment of the type and condition that meets the qualifications necessary for the proper execution of the work as specified under the contract documents. Maintain the equipment in good condition, subject to acceptance, before and during use in connection with the project. Compact until material does not rut under a loaded triaxle (75,000 pounds).

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- B. Maintain material to within minus 3% of optimum and the optimum moisture content at the time of compaction. For subgrades displaying pronounced elasticity or deformation under rolling, maintain a moisture content not greater than optimum at the time of compaction or at the time of placing the overlaying construction. When unable to obtain the specified stability, excavate material in the area to a depth that, when replaced and recompacted with a moisture content not exceeding optimum, the subgrade will have the required stability.
- C. No Hydra-Hammers shall be used until 2' over top of pipe is reached. Use compacting equipment to consolidate backfill placed over the top of the pipe per manufacturer's recommendation. The Developer shall provide the equipment manufacturer's recommendation in writing, on the manufacturer's letterhead to the Authority upon request.
- D. The use of puddling or jetting for compacting backfill in trenches is prohibited.
- E. Compaction Tests: During the course of backfilling and compacting, the Authority may at various locations and depths of trenches request that the Developer make field tests to verify that specified compactions are being achieved.
- F. All test sites and procedures shall be approved and witnessed by the Authority's Engineer.
- G. If compaction tests indicate that work does not meet specified requirements, remove and replace backfill material, compact and retest at no additional cost to the Authority.

3.06 CLEAN-UP AND MAINTENANCE

- A. General: During construction, the surfaces of all areas including, but not limited to, roads, streets, and driveways shall be maintained on a daily basis to produce a safe, desirable, and convenient condition. Streets shall be swept and flushed after backfilling, and recleaned as dust, mud, stones and debris caused by the work, or related to the work again accumulates.
- B. Remove surplus excavated materials, rubbish and other construction debris from the site after backfilling is completed.
- C. Construction site shall be left clean at end of each working day to satisfaction of Owner.
- D. Any settlement of the backfill below the original ground surface shall be remedied by the Developer.
- E. If private land is used by the Developer as a spoil site, the Developer shall obtain written permission from the Owner or Agent of the land agreeing to its use for this purpose and provide the Owner with a certified copy of such agreement.

3.07 CLAY DIKES

A. Clay dikes to be installed as specified on the Plan.

3.08 RELATING TO WATER MAINS

- A. Horizontal separation Whenever possible, sewers should be laid at least 10', horizontally, from any existing or proposed water mains. Should local conditions prevent a lateral separation of 10', a sewer may be laid closer than 10' to a water main if the water main is encased in concrete.
- B. Vertical separation Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18" below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation, for a distance of 10' extending on each side of the sewer. If possible, one (1) full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible. Both services shall be pressure tested to assure water tightness prior to backfilling. Where less than 18" vertical separation exists between the water and sewer line, the sewer line may be concrete encased 10' on either side of the water main.
- C. If possible, sewers crossing water mains shall be constructed so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main.

END OF SECTION

DIVISION 2 - SITE WORK SECTION 02270 - EROSION CONTROL

PART 1 - GENERAL

1.01 EROSION AND SEDIMENTATION CONTROL

- A. Description: This section of the specification shall serve as the specified base parameters of Erosion and Sedimentation Control (E&SC) Plan for the construction of this project. The Developer shall prepare and submit his own E&SC plan for this project to the local conservation district as required.
 - This Plan was intended to be developed in accordance with the requirements of the Erosion and Sediment Control Manual published by the Pennsylvania Department of Environmental Protection, Bureau of Soil and Water Conservation.
 - This Plan consists of the narrative, as contained in this section, along with the details and locations, and intended to support the Developer's construction plans approved by the Authority or other governing regulators.
- B. Purpose: The purpose of this E&SC Plan is to provide the Developer with general guidelines as well as specific techniques for minimizing erosion and sedimentation control during and after construction of the project.
- C. Project location is in Harborcreek Township, Erie County, Pennsylvania.
- D. Without intending to limit or restrict the extent of work required, the work generally consists of the installation of a new sanitary sewer facility.
- E. Additional controls may be required at problem areas that develop during construction above and beyond those that are described in this narrative.

1.02 QUALITY ASSURANCE

- A. Regulatory agency requirements:
 - The Developer is advised that all work will be completed in compliance with the requirements of this Plan and the rules and regulations of the Pennsylvania Department of Environmental Protection and the County Conservation District. Any fines and associated costs resulting from the Developer's failure to provide adequate protection against soil erosion and sedimentation control shall be borne by the Developer.
 - 2. Upon the anticipated initiation of construction, the Developer's program for carrying out this Plan may be reviewed in the field with representatives of the

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County Conservation District, the Developer, Authority and/or PennDOT.

3. These specifications, the Soil Erosion and Sedimentation Control Handbook for Erie County and PADEP Chapter 102 provide additional information relative to the construction and installation details for erosion and sedimentation control measures.

1.03 SUBMITTALS

A. A staging schedule of earthmoving activities shall be submitted to the Authority for their approval before any earthmoving is commenced. The staging schedule shall identify the disturbed project areas that will be controlled by specified control measures/facilities. Deviations from the schedule may invalidate the entire Erosion and Sedimentation Control Plan.

1.04 EROSION AND SEDIMENT CONTROL

A. Site conditions:

- 1. Do not disturb ground cover areas beyond those necessary to satisfactorily complete the required work.
- 2. Establish temporary cover as soon as the area is brought to grade.
- 3. Establish permanent ground cover as soon as possible.
- B. Earthmoving activities for the construction of general strip-like sanitary sewer projects are to proceed as follows:
 - 1. Clearly mark areas that are not to be disturbed by flag signs or other appropriate markings.
 - 2. Install erosion and sedimentation control devices as required, and as dictated by field conditions.
 - 3. Schedule construction so that grading operations can begin and end as quickly as possible.
 - 4. Where applicable, install sediment-trapping measures as a first step in grading.
 - 5. Where applicable, remove and stockpile soil cover and provide protection of same as indicated below.
 - 6. Install pipe or structures as indicated on the contract drawings.

- 7. Backfill around new pipe installations, manholes and points of connection.
- 8. Conduct all clean-up and site restoration.
- 9. Once non-paved restoration is restored 80%, remove E&SC control devices.
- C. The installation of materials and devices in addition to the requirements outlined above may be directed by the Authority, the Township, or the County Conservation District if project conditions so warrant. These items may include, but are not limited to:
 - 1. Silt fence.
 - 2. Straw mulch.
 - Riprap protection.
 - 4. Pumped water filtered bag.
 - 5. Silt Sacks.
- D. Time requirements include:
 - During the peak erosion season of April through September ground cover installation, temporary or permanent, shall follow earthmoving activities as closely as possible.
 - 2. If construction is disrupted for a period of more than ten (10) days, provide temporary cover immediately. Establish a permanent vegetative cover in areas where construction is halted for more than one (1) year.
 - 3. Do not strip vegetation and topsoil more than two (2) days in advance of earthwork. Where topsoil is stockpiled for use for final grading, provide a temporary protective covering.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Straw bails shall consist of straw stocks of thresh grain or tall hay grass as may be available locally in commercial quantities.
- B. Wood stakes shall be solid, rough-sawed, red or white cedar or hard wood measuring 2" x 2", length as may be required, with one (1) pointed end.
- C. Sandbags shall be synthetic material, tightly woven fibrous waterproof bags filled with fine aggregate.

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- D. Filter fabric shall be a continuous pervious sheet of propylene, nylon, ethylene, or polyester. The manufacturer, as conforming to the following requirements, shall certify the filter fabric:
 - 1. Filtering efficiency according to test of ETM-51-75% minimum.
 - 2. Tensile strength at 20% elongation Test VTM-52 50 lbs. per linear inch minimum extra strength, 30 lbs. per linear inch standard stream.
 - 3. Flow rate according to Test VTM-51-0.3 gallons per square foot per minute minimum.
 - 4. The requirements for the tensile strength shall be reduced by 50% after 60 months of installation.
 - 5. The filter fabric shall contain ultra-violet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120°F.
- E. Stakes for filter barriers shall consist of nominal 1" x 2" hardwood or equivalent steel reinforcing bars with a minimum length of 3'.
- F. Wire fence reinforcement for silt fences using standard strength filter cloth shall be a minimum of 42" in height and a minimum of 14 gauge, and shall have a maximum mesh spacing of 6".
- G. Riprap shall consist of fieldstone or rough unhewn quarry stone of approximately rectangular shapes. Stones shall not disintegrate on exposure to water or weathering.
 - 1. Riprap shall be NCSA No. 4 or larger in size as may be advised by the local conservation district.
- H. Agricultural liming materials shall consist of products containing calcium and magnesium compounds capable of neutralizing soil acidity and not less than 80% of total carbonates.
- I. Fertilizers shall be commercially obtainable chemical fertilizer of the uniform composition, free flowing, and in conformity with applicable state fertilizer laws.
- J. Grass seed shall be new crop grass seed, furnished in sealed packages with proof of correct mixture evidenced on bag, age of seed indicated, in compliance with applicable state regulations noted as required. Seeds and mixtures shall consist of annual rye grass (lolium multiflorum, PennDOT formula E), 100% mix by weight, 98% purity, 90% germination, with a maximum percent weed seed of 0.15.

K. Mulch shall conform to Section 805, PennDOT Publication 408.

PART 3 - EXECUTION

3.01 PREPARATION

A. General

1. Install erosion and sedimentation control measures in accordance with this specification section, the approved E&SC Plan drawings, the approved staging schedule, and the requirements of field conditions. Maintain these measures during construction and until permanent ground cover are established in the disturbed areas.

3.02 INSTALLATION

A. General

- Excavation for construction operations shall be closely controlled. The
 material removed from the excavation shall be selectively stockpiled in areas
 where a minimum of sediment will be generated and where other damage
 will not result from the piled earth. Drainage-ways shall be protected at all
 time and the piling of soil in drainage-ways will not be allowed.
- 2. All excavated material shall be stored in such a manner as to prevent loss due to rain, wind, and/or other natural or construction caused activities. Trenches will be backfilled immediately upon sewer line installation.
- 3. The Developer shall maintain stockpile areas. Stockpile design shall incorporate erosion and sediment control considerations to prevent the potential direct production and delivery of sediment to waterways and damage to vegetation that is part of the total sediment and erosion control plan. Temporary or interim stabilization of soil stockpiles shall be promptly instituted. If a stockpile is to remain for over 20 days, it shall be stabilized by soil stabilizing chemicals, temporary vegetation, interim structures, and other special practices.
- 4. Temporary vegetative measures planned for implementation of stockpile areas shall be established immediately after the stockpile operation is completed. Proper mulching and soil stabilization in conjunction with these seeding operations shall also be carried out.

- 5. Topsoil shall be stripped, stockpiled and protected from loss for later use as the top layer of backfill. Topsoil stockpile heights shall not exceed 6' and must have side slopes of 2:1 or flatter.
- 6. Erosion and sedimentation control devices must be constructed, stabilized, and functional before site disturbance within the tributary areas of those controls. The total length of excavated trench open at any one time should not be greater than the total length of pipeline that can be placed in the trench and backfilled in one working day. No more than 50 lineal feet of open trench should exist when pipeline installation ceases at the end of the workday.
- 7. After permanent site stabilization has been achieved, temporary erosion and sedimentation control devices must be removed. Areas disturbed during removal of the controls must be stabilized immediately. Permanent site stabilization is defined as uniform erosion resistant perennial vegetation established to the point where the surface soil is capable of resisting erosion during runoff events and has uniform coverage or density of 70% across the entire area.

B. Pumped Water Filter Bags

- 1. Pumped water filter bags shall be placed and constructed on the site as shown on the approved erosion and sedimentation details.
- C. Temporary Seeding shall generally consist of the following:
 - 1. All areas annual Ryegrass 10 lbs. per 1,000 S.Y. Site Preparation apply uniformly 413 lbs. per 1,000 S.Y. of ground limestone or according to soil test. Apply uniformly 5-5-5-analysis fertilizer according to soil test or at the rate of 207 lbs. per 1,000 S.Y.; work in lime and fertilizer to a depth of 4". Establishment apply annual ryegrass uniformly at the rate of 10 lbs. per 1,000 S.Y. by broadcasting, drilling and hydraulic application. Cover ryegrass seeds with ¼" of soil.
- D. Permanent Seeding shall generally consist of the following:
 - 1. All seeding mixtures (formulas) shall be as set forth in Table A. Subsection 804.2 (b), Section 804 ("Seeding and Soil Supplements") of PennDOT Publication 408 (latest edition), Commonwealth of Pennsylvania Department of Transportation and in the drawings.
- E. Mulching shall generally consist of the following:
 - 1. Mulch shall be hay or straw applied at a rate of three (3) tons per acre (approximately 1.2 lb. per S.Y. or 1,240 lbs. per 1,000 S.Y.)

2. Mulch shall be anchored by means of wood cellulose fiber uniformly applied at the rate of 1,000 lbs. per Acre (0.21 lbs. per S.Y.).

F. Silt Sacks

1. Silt sacks shall be placed in all storm water inlets on the site as shown on the erosion and sedimentation details.

G. Pipeline Construction Adjacent to Streams

- 1. Excess materials temporarily left in the right-of-way for a period of 24 hours or longer shall be protected with silt fence.
- 2. Remove excess soil materials from the tires and tracks of construction vehicles prior to their leaving off street right-of-ways. All construction entrances shall be stabilized.
- 3. Install stabilized construction entrances per PADEP Chapter 102. Remove these entrances as soon as they are no longer required and grade and reseed the area as necessary to restore original condition.

H. Excess Materials and Spoil Areas

- Dispose of excess excavated materials in an approved spoil area outside the flood plain and wetland areas in a manner that minimizes erosion and sediment control. Grade excess excavated material areas to a slope of 3% or less. It is the Developer's responsibility to attain all required permits, owner consents, etc., required to dispose of excess materials.
- Adequately protect materials against erosion when deposited in such spoil area. Protection should include mulching and seeding of materials immediately upon completion of grading and/or the installation of a silt fence on down slope sides of stockpiled materials. Such silt fence to be adequately maintained.

I. Temporary Sediment Barrier

- 1. The temporary sediment barrier shall consist of filter fabric stretched across and attached to supporting stakes with fabric edged and trenched.
- 2. The purpose of the sediment barrier is to intercept and contain small amounts of sediment from disturbed areas during construction operations in order to prevent sediment from leaving the site. The barrier also serves to decrease the velocity of sheet flows in low to moderate level channels.

- 3. Install sediment barriers below disturbed areas where erosion would occur in the form of sheet or rill erosion. Limit the use of sediment barriers to areas less than 1 quarter acre per hundred feet of silt fence length. The maximum slope length behind the barrier shall not exceed 100' and the maximum gradient behind the barrier shall not exceed 50%.
- 4. The barrier may be used in minor swales or ditch lines where the maximum contributing drainage area is no greater than 2 acres.
- 5. The barrier shall not be constructed in live streams or in swales or ditch lines where flows are expected to exceed 1 cubic foot per second.
- 6. The filter of the barrier shall have an expected usable life of three (3) months. They may be used in ditch lines, around drop inlets, and at temporary locations where low or moderate flows not exceeding one cubic feet per second (cfs) are expected.
- 7. Flow barrier shall be constructed of burlap or standard strength synthetic filter fabric. They shall have a height not less than 15" or more than 18". Stakes shall be spaced a maximum of 3'. of part along the barrier and driven into the ground a minimum of 8". The filter fabric shall be stapled to wooden stakes and extend 8" into a 4" x 4" trench with backfill. Filter fabric may not be stapled to live trees. The filter barrier is to be constructed along a dishline or swales to provide a barrier of sufficient length of eliminate endflow and a plan configuration to resemble an arch or horseshoe with ends oriented upslope.
- 8. Silt fence shall be constructed of standard strength or extra strength synthetic filter fabrics and design for situations in which only sheet or overland flows are expected.
- 9. Silt fence shall have a height not exceeding 36" and shall be provided in a continuous roll cut to the length required for the barrier. Stakes shall be spaced a maximum of 10' apart in the barrier and driven into the ground a minimum of 12". If wire support fence is not utilized, the stake spacing shall be reduced to not exceed 5'. Silt fence shall be stapled to wooden stakes and extend 8" into a 4" x 4" trench with backfill over the fabric.

3.03 MAINTENANCE

- A. Check all erosion and sediment control measures weekly and after each significant rainfall.
- B. Excavate, spread and dry sediment for use in onsite grading.
- C. Remove unsuitable material from the site for proper disposal.
- D. Clean sediment traps where sediment accumulates to one-half (1/2) of the design

depth of the trap.

- E. Check seeded areas regularly to see that good vegetative stand is maintained. Fertilize and reseed areas as needed.
- F. Frequently check and closely monitor mulched areas with respect to their effectiveness in controlling erosive storm runoff velocities and sediment transport. Remulch areas as necessary until adequate ground cover is established.
- G. Temporary sediment barrier shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Required repairs shall be made immediately. If the fabric should decompose or become ineffective during its required life, the barriers shall be replaced as promptly as possible. Sediment deposits shall be removed from temporary sediment barriers after each storm event. Sediment deposits removed shall be graded to conform to the existing grade and prepared and seeded in accordance with the requirements of these specifications.

END OF SECTION

DIVISION 2 - SITE WORK SECTION 02446 – BORED, JACKED & DIRECTIONAL DRILLING PIPELINE INSTALLATION

PART 1 – GENERAL

1.01 SCOPE

- A. This work shall consist of the underground construction of a pipeline across the state right-of-way, or other facility as indicated on the plans and as specified herein without interruption to the use of the roadway. The work shall be performed in accordance with all permits issued by the owner of any facility being crossed by the pipeline. Also included is the excavation by horizontal drilling or by tunneling casing, and the furnishing of all labor, superintendence, tools, equipment, and materials necessary to completely construct the carrier pipe inside jacked casing pipe. All pits which are constructed to facilitate this work shall be excavated, sheeted, braced, maintained, backfilled, etc. in complete accordance with the provisions of the construction specification for the pipeline of which the pipeline crossing is a part.
- B. The Contractor may use a larger casing pipe than specified; however, all related extra costs shall be borne by the Contractor.

1.02 SUMMARY

- A. Section Includes:
 - 1. Excavation for approach trenches and pits.
 - 2. Casing pipe.
 - Carrier pipe.

1.03 DEFINITIONS

- Carrier Pipe: Sanitary Sewer Pipe.
- B. Casing Pipe: Sleeve through which carrier pipe will be placed.
- C. Boring and Jacking: Method of installing casing pipe.
- D. Casing Spacer: Fabricated item for positioning a carrier pipe inside a casing pipe.
- E. Township: Harborcreek Township, Erie County.
- F. Authority: Harborcreek Township Sewer Authority.

1.04 REFERENCES

- A. ASTM International.
 - 1. ASTM A53/A53M: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

- 2. ASTM C32: Standard Specification for Sewer and Manhole Brick.
- 3. ASTM C76: Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- 4. ASTM C270: Standard Specification for Mortar for Unit Masonry.
- B. PennDOT Publication 408.

1.05 SUBMITTALS

- A. Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel.
- B. Installation Plan: Submit description of proposed construction plan, dewatering plan, and plan to establish and maintain vertical and horizontal alignment.
- C. Submit emergency response procedures to handle situations when conduit is compromised and jeopardizes integrity of installation or safety.
- D. As requested by the Township or Authority, submit written report results of visual check prior to installation of carrier of entire length of casing to verify there are neither voids nor defective joints.
- E. If modifications to methods are required during construction, submit working drawings, delineating modifications including reasons for them.

1.06 PROTECT CONDITIONS

- A. Arrange for inspection and traffic control as required.
- B. Bore so as not to interfere with, interrupt, or endanger surface and activity thereon.
 - 1. Minimize subsidence of surface, structures, and utilities above and in vicinity of bore.
 - 2. Support ground continuously to prevent loss of ground and keep perimeters stable.
 - 3. Be responsible for settlement resulting from operations.
 - 4. Repair and restore damaged property to its condition before being disturbed at no cost to the Township or Authority.
- C. Comply with applicable ordinances, codes, statues, and regulations of State of Pennsylvania, applicable County building codes.

1.07 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of casing, carrier pipe, and invert elevations.

 Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.08 QUALITY ASSURANCE

A. Perform work in accordance with Township and Authority regulations.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- B. Protect piping system pieces systems from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.
- C. Accept system components on site in manufacturer's original containers or configuration. Inspect for damage.
- D. Use wooden shipping braces between layers of stacked pipe. Stack piping lengths no more than three (3) layers high.
- E. Store field joint materials indoors in dry area in original shipping containers. Maintain storage temperature to 60° to 85° F.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.11 FIELD MEASUREMENTS

- A. Verify invert elevations prior to excavation and installation of casing.
- B. Verify sanitary sewer lateral and manhole elevations prior to excavation and installation of casing.

1.12 COORDINATION

A. Coordinate work with the Township and the Authority.

PART 2 - PRODUCTS

2.01 MATERIAL

A. The casing pipe shall be welded steel pipe (8" larger than carrier pipe O.D.) meeting or exceeding the requirements of ASTM A53, Grade B Specifications of the thickness and size indicated on the drawings. The casing must be of adequate thickness to withstand all dead and live loads plus the forces exerted during the jacking process. All joints of the casing shall be full circumference welded.

- B. Pressure treated 4" x 4" or preformed PVC of HDPE skids shall be securely attached to the carrier pipe with stainless steel bands (wood only) and shall be used as skids and/or pipe supports. Skids and their supports are subject to the Engineer's approval.
- C. At each end of the encasement, the annular space between the casing and carrier pipe shall be filled with 8" minimum thickness masonry with the low end provided with a drainage hole and felt wrapping which is ¼" thick shall be provided between each annular masonry closure and the carrier pipe or the end shall be sealed watertight with a rubber/neoprene cap secured to the carrier and casing pipe.

2.02 ACCESSORIES

- A. Cohesionless Fine Sand: Fine Aggregate: As per PennDOT Pub. 408, Section 703.1, Type A.
- B. Mortar: Non-shrink mortar shall conform to ASTM C270, Type N.
- C. PennDOT Class A Concrete.

PART 3 - EXECUTION

3.01 GENERAL CONSTRUCTION

- A. Notify Township and Authority immediately if obstruction stopping forward motion of operation is encountered during installation.
 - If during installation an obstruction is encountered which prevents installation
 of the pipe in accordance with this specification, the pipe shall be abandoned
 in place and immediately filled with grout. A new installation procedure and
 revised plans must be submitted tom and approved by Township and
 Authority before work can resume.

3.02 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify connection to existing piping system size, location, and invert elevations are in accordance with Drawings.

3.03 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities indicated to remain from damage.
- C. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

- D. Protect bench marks, survey control points, property corners, existing structures, fences, sidewalk, paving, and curbs from excavating equipment and vehicular traffic.
- E. Establish elevations of casing with not less than 10' of cover.
- F. All operations shall be conducted so as not to interfere with, interrupt, or endanger the public. All work on or near the Township Right-of-Way shall be conducted in accordance with Township rules and regulations. Operations shall be subject to Township and Authority inspection at any and all times.
- G. At all times when the work is being progressed, a field supervisor for the work with no less than 12 months experience in the operation of the equipment being used shall be present. If boring equipment or similar machines are being used, the machine operator also shall have no less than 12 months experience in the operation of the equipment being used.

3.04 DEWATERING – GENERAL

- A. Intercept and divert surface drainage precipitation and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps, or other means.
- B. Develop substantially dry subgrade for prosecution of subsequent operations.
- C. Comply with Pennsylvania Department of Environmental Protection requirements for dewatering to any watercourse, prevention of stream degradation, prevent well degradation, and erosion and sediment control.

3.05 DEWATERING – WELL POINT DEWATERING SYSTEM (As Required)

- A. Install well points deep enough and at such intervals to provide a dry trench to install the Work.
- B. Located combustion engines and generators as far from homes and businesses as practical.
- C. Install Dewatering System outlet(s) in accordance with applicable permits, laws, and regulations.
- D. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site. Provided the contractor has received approval from the railroads to operate them. Pumps in operation shall be constantly attended on a 24-hour basis until in the sole judgment of railroads, the operation can be safely halted. When dewatering, close observation shall be maintained to detect any settlement or displacement of railroad embankment, tracks, and facilities.
- E. Operate pumps for at least 24-hours before excavating.
- F. If silt or sand is produced from the well, cease operation and modify dewatering system design to minimize silt or sand removal through the wells.

- G. Route pumped groundwater through a filter bag, settling basin, or other device to remove sediment before discharging to streams or other natural watercourses, ditches, sewers, ponds, or lakes.
- H. Monitor the dewatering system at frequent intervals, including nights, weekends, and holidays as necessary, so that equipment failure will not delay the Work. Provide back-up equipment in case of equipment failure.
- When dewatering, a process for monitoring shall be maintained by the Contractor to detect any settlement or displacement of railroad embankment tracks and facilities. The process for monitoring the railroad tracks must be submitted to the engineer and be in place prior to dewatering.
- J. Lower ground water table to at least 2' below the bottom of the excavation.
- K. Operate the Dewatering System to maintain a continuously lowered water table until the utilities are completed to a point to withstand hydrostatic pressures, flotation, and other effects of being below the water table without damage.
- L. Remove Dewatering System and all appurtenances upon completion of work associated with excavation and dewatering.

3.06 PITS OR APPROACH TRENCHES

- A. Excavate approach trenches or pits in accordance with installation plan and as site conditions require.
- B. Ensure casing entrance face as near perpendicular to alignment as conditions permit.
- C. Establish vertical entrance face at least 1' above top of casing.
- D. Install dewatering measures and excavations supports.
- E. Install sheet piling to shore pits and trenches.

3.07 BORING AND JACKING

- A. The pipeline crossing shall be constructed by installing the casing pipe and inserting the carrier pipe as specified herein. Installation of the casing pipe shall be by a jacking-tunneling or by a jacking-boring method. No water jetting will be permitted.
- B. If construction is by horizontal boring, it shall be by using an auger inside of the casing and by advancing the casing through the use of jacks of adequate capacity. If by jacking and tunneling, the casing shall be advanced as the earth is excavated and removed by accepted tunneling methods through the use of jacks of adequate capacity.
- C. The casing shall be carefully aligned and jacked to grade as called for the drawings.

- D. If the Contractor elects to install a larger casing pipe, the required minimum cover requirements and/or clearance requirements specified by the owners of the roadway or railroad and/or other facilities adjacent to the pipeline crossing shall be met.
- E. When augers, or similar devices, are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than ½". The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.
- F. Bored or jacked installations shall have a bore hole essentially the same as the outside diameter of the pipe. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe by more than approximately 1", grouting or other methods approved by the Engineer shall be employed to fill such voids. Cost of such grouting shall be at the Contractor expense.
- G. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site, and upon approval to operate them, they shall be in constantly attended operation on a 24-hour basis until their operation can be safely halted. When dewatering, close observation shall be maintained to detect any settlement or displacement of roadway or railroad embankment, tracks, and facilities.
- H. All operations shall be conducted so as not to interfere with, interrupt, or endanger the operation of traffic, trains, nor damage, destroy or endanger the integrity of roadway or railroad facilities. All work on or near railroad property shall be conducted in accordance with railroad safety rules and regulations. The Contractor shall secure and comply with the railroad and shall give written acknowledgment to the Railroad that they have been received, read, and understood by the Contractor and his employees. Operations will be subject to Railroad inspection at any and all times.
- When unstable soil is encountered during boring retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quality of soil.
- J. All cranes, lifts, or other equipment that will be operated in the vicinity of the Railroad's electrification and power transmission facilities shall be electrically grounded as directed by the Railroad's Chief Engineer.
- K. At all times when the work is being performed, a field supervisor for the work with no less than 12 month experience in the operation of the equipment being used shall be present. If boring, drilling, or similar machines are being used, the machine operator also shall have no less than 12 months experience in the operation of the equipment being used.
- L. Blasting will not be permitted under or near roadway and railroad tracks and facilities.

- M. Whenever equipment or personnel are working closer than 15' to the centerline of an adjacent milroad track, that track shall be considered as being obstructed. Insofar as possible, all operations shall be conducted no less than this distance. Operations closer than 15' to the centerline of a track shall be conducted only with the permission of, and as directed by, a duly qualified railroad employee present at the site of the work.
- N. Crossing of milroad tracks at grade by equipment is prohibited except by prior arrangement with, and as directed by, the Railroad's Chief Engineer.
- O. The Contractor shall provide for the maintenance of flow of existing ditches during the installation of the new bored and jacked pipe. Temporary ditches shall be constructed to assure maintenance of the existing drainage. As required by the previous section, pumps of sufficient capacity shall be available to maintain a dewatered boring site.
- P. The pipe shall be carefully aligned and jacked to grade as called for the drawings. Contractor shall check to insure line and grade are maintained throughout the boring and jacking operation. Line and grade shall be checked at least a minimum of the 1/3 points of the total length of the bore.
- Q. Install carrier pipe at required slope and depth.
- R. Clean, inspect, and handle carrier pipe in accordance with manufactures instructions.
- S. Exercise care to prevent damage to carrier pipe joints when carrier pipe is placed in casing. Carrier pipe is not to be installed so that it is in tension.
- T. Support pipeline within casing so no external loads are transmitted to carrier pipe. Attach supports to barrel of carrier pipe; do not rest carrier pipe on bells.
- U. Install casing spacers per manufactures recommendations.
- V. Fill void between casing pipe and carrier pipe with cohesionless sand.
- W. Seal ends of casing pipe as required by the drawings.

3.08 SPECIAL CONSTRUCTION CONDITIONS

- A. All permits pertaining to the pipeline crossing which have been issued by any roadway, railroad or utility company, and/or other agency (private or governmental) shall be obtained by the Owner. All labor, materials, equipment, special inspection services, and special construction conditions necessary to this work shall be included as part of this specification.
- B. The excavation of all pits shall not be started more than three (3) working days prior to the commencement of actual casing placement or tunneling operations except in the case of working within state highway right-or-ways, pits shall not be excavated until absolutely necessary.

- C. In any event, no pits shall be left open longer than three (3) working days unless tunneling, casing installation, or carrier pipe installation are actively in progress. All pits shall be protected with steel plating when within state highway right-of-ways. Other areas protected with construction fencing.
- D. The Contractor shall maintain uninterrupted roadway and railroad traffic flow by providing all necessary signs, signals lights and barricades as may be required. Watchmen, flagmen and railroad inspection personnel, as required, shall be paid for the by the Contractor and included in the unit price. Any and all insurance required by the Railroad or Pennsylvania Department of Transportation shall also be provided by the Contractor.
- E. The Contractor shall provide notice of construction to PennDOT and the railroad with 72-hours notice for flagmen and inspection personnel. Work shall not commence until such time as said flagmen and inspectors are at the site or that a waiver of this requirement is made in writing by PennDOT or the Railroad.
- F. The Contractor shall engage the services of workmen thoroughly knowledgeable and experienced in such work.

3.09 HORIZONTAL DIRECTIONAL DRILLING

- A. Horizontal directional drilling methods shall be utilized for installation of all low pressure sewer laterals. Where horizontal directional drilling methods cannot be utilized, Contractor shall submit to the Engineer a request to install said section of low-pressure sewer main or low-pressure sewer lateral by means of excavation, backfilling, and compacting or boring.
 - 1. No consideration will be given to the nature of the materials encountered in drilling operations or for difficulties encountered during excavation or handling of materials (see Unclassified Excavation in this Section).
- B. A complete detailed design procedure and method shall be submitted for each such installation and shall contain as a minimum:
 - 1. Layout Sketches, indicating pit dimensions and locations
 - 2. Proposed line and grade of the drilling
 - 3. Complete details and specifications of the materials and equipment to be used to complete the drilled installation
 - 4. Size and type of drill pipe
 - 5. Drilling fluid information
 - 6. Drilling fluid disposal plan
 - 7. Sequence of operations

- C. The Contractor shall retain the services of a horizontal directional drilling specialist in an effort to preclude the necessity for a restart at a second location due to inadequacies that could be foreseen through the use of a specialist. Any such costs associated with a restart at a new location shall be borne by the Contractor.
- D. If an obstruction is encountered that prohibits the forward action of the drilling operation or pipe installation, and it becomes evident that it will be impossible to advance the drill head or the pipe, operations shall cease and the pipe will be abandoned in place and filled completely with grout. Drilling shall restart at a second location. Any such additional cost associated with such a restart at a new location shall be borne by the Contractor.
- E. The horizontal directional drilling (HDD) operation, once commenced, shall be continuous until such time as the HDD is completed.
- F. The rig shall be capable of the push/pull capacity, rotational speed, torque, and horsepower requirements, including size and capacity of the drilling fluid pump, to successfully complete the HDD.
- G. The mud motor shall be capable of delivering sufficient amount of drilling fluid to maintain borehole integrity. The Contractor shall be responsible for providing the right mixture of drilling fluid to fit the characteristics of the soil conditions. The Contractor shall be responsible for the disposal of the drilling fluid in accordance with all applicable regulations.
- H. The Contractor shall keep drilling logs. These logs shall include specific dates, time and locations (x, y, z positioning), soil conditions, drilling data such as depth, angle, rate of penetration, and utility crossings. Drilling logs shall be accurate to facilitate the production of as-built drawings / Record Drawings in accordance with Section 01700, with "x, y, z" locations no further than 30' apart. Six (6) copies of the drilling logs shall be provided to the Engineer.
- I. The minimum radius of curvature of any drilling operation shall be limited to 100 times the diameter of the drill pipe, or the diameter of the product line, whichever is larger.
- J. All drilling operations shall include reaming of the pilot hole prior to installation of the product line. The pilot hole shall be reamed to a minimum size of 1-1/2 times the outside diameter of the product line. Reamer shall be chosen to match the soil conditions encountered.
- K. A wireline steering tool system shall be used for all drilling over 500', or drilling beneath a watercourse. Short, shallow drilling operations may be guided via a walkover system subject to approval of the Engineer.
- L. The driller shall use two-way radio or cellular phone communication between the drill rig operator and the pipe pullback crew to assure that the pipe begins moving immediately upon the operator's commencement of the pullback operation.

- M. The drill pipe shall be connected to the product line using a pull head or pulling eye and swivel. A reamer shall be placed between the drill pipe and pull head to insure that the hole stays open during the pullback.
- N. The HDPE pipe shall have a minimum safe pull strength of as listed below and meet the pipe requirements of Section 02610:
 - 1. \leq 1-1/2" SDR 9 = 1,200 pounds
- O. The Contractor shall employ the services of a certified fuser.
- P. The entire length of the pipe, for the drilling operation, shall be fused prior to installation.
- Q. Contractor shall provide all necessary rollers to accommodate movement of the pipe aboveground during the pullback operation. Contractor shall provide necessary means (i.e. scaffold mounted rollers with a minimum vertical clearance of 14') to maintain access roads and driveways during the pullback operations.
- R. All restoration for pits, service access, etc. shall be in accordance with Division 2 of these specifications.
- S. All facilities shall be installed in such a way that their location can be readily determined by electronic designation after installation. For non-conductive installations, this shall be accomplished by attachment of a continuous conductive material either externally or integrally with the product. Either a copper coated wire line or coated conductive tape for this material may be used. Any break in the conductor must be connected by electrical clamp of brass or solder and coated with rubber or plastic insulator to maintain the integrity of the connection from corrosion. Contractor will verify conductivity of electronic designation material after HDD operation is completed and any costs for repairs or replacements shall be borne by the Contractor.

3.10 EXPERIENCE

A. Horizontal drilling, boring, tunneling, and jacking is a specialized type of construction, and the Contractor shall demonstrate that he is fully qualified and has satisfactorily completed at least three (3) such projects.

END OF SECTION

DIVISION 2 - SITE WORK SECTION 02605 – MANHOLES AND PRECAST STRUCTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Manholes, metering manhole, catch basins, junction boxes, valve chambers and related appurtenances.
- B. Manhole Coring When a new pipe is to connect to the manhole, the manhole is to be cored.

1.02 REFERENCES

- A. American Society for Testing and Materials.
 - 1. ASTM A 48, Gray Iron Castings.
 - 2. ASTM A 276, Stainless and Heat-Resisting Steel Bars and Shapes.
 - 3. ASTM A 307, Carbon Steel Externally Threaded Standard Fasteners.
 - 4. ASTM A 615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 5. ASTM C 270, Mortar for Unit Masonry.
 - 6. ASTM C 361, Reinforced Concrete Low-Head Pressure Pipe.
 - 7. ASTM C 443, Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 8. ASTM C 478, Precast Reinforced Concrete Manhole Sections.
 - 9. ASTM C 923, Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.
 - 10. ASTM D 2146, Polypropylene Plastic Molding and Extrusion Materials.
 - 11. ASTM D 2240, Rubber Property-Durometer Hardness.
- 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).

1.03 QUALITY ASSURANCE

- A. Initial Structure: Construct first structure in the Project to demonstrate the following, and serve as the minimum acceptable conditions of construction throughout the Project. No additional compensation allowed for initial manhole requirement.
 - 1. Demonstrate manhole base construction methods.
 - 2. Demonstrate manhole component sealing in the case of precast reinforced concrete manholes.
 - 3. Demonstrate manhole step alignment.
 - 4. Demonstrate pipe opening sealing.
 - 5. Demonstrate method of adjustment of manhole frame and cover to grade and manhole frame and cover attachment.
 - 6. Demonstrate successful manhole acceptance test.

B. Shop Inspection:

 All materials furnished by the Developer 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 Developer.

C. Field Inspection:

 All materials furnished shall be tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the Authority.

D. 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 C 478 from the precast reinforced concrete manhole manufacturer.
- 3. Obtain sworn certification from manufacturer that manholes were constructed using Type II Portland cement.
- Obtain certificate of material compliance with ASTM A 48, Class 30 tensile strength from the manhole frame and cover manufacturer. Furnish certification to Authority, that tensile test bars were from same pour as castings.
- 5. Obtain certification from manufacturer that manhole frame and cover meets.

or exceeds AASHTO HS-20 highway loading requirements.

1.04 DELIVERY, STORAGE AND HANDLING

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

1.05 PROJECT CONDITIONS

- A. **Environmental Requirements:**
 - 1. In no instance set or construct manhole bases on subgrade containing frost.
 - 2. To improve workability of Preformed Plastic Sealing Compound during cold weather, store such at temperature above 70°F or artificially warm compound according to product specifications.

PART 2 - PRODUCTS

2.01 **BASIC MATERIALS**

- Α. Cast-In-Place Concrete Products: Formwork, Reinforcement, and Cast-In-Place Concrete conforming to requirements of Division 3 Concrete. Type II Portland cement shall be used.
 - 1. Manhole concrete waterproofing:
 - The complete exterior surfaces of all precast concrete manholes a. shall be coated with coal-tar epoxy a thickness of 16 mils. Approved manufacturers are Koppers Co., Inc.

B. Waterproofed Mortar:

- Manufacturers: 1.
 - The Euclid Chemical Company; Integral Waterpeller® Admixture. a.
 - b. Grace Construction Materials; Hydratite.
 - Chem-Master Corporation; Hydrolox. C.

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- d. Or approved equal.
- 2. Material composition meeting ASTM C 270, Type M with waterproofing admixture included.
- C. Epoxy Bonding Compound:
 - Manufacturers:
 - a. A. C. Horn EPOXTITE BINDER.
 - b. Sika Chemical SIKADUR-HI-MOD.
 - c. Or approved equal.
- D. Manhole Steps: Design as indicated on Drawings.
 - Reinforced Plastic Step: Composed of a 1/2-inch Grade 60, ASTM A 615 deformed steel reinforcing bar completely encapsulated in Grade 49108, ASTM D 2146 polypropylene copolymer compound, Type II; M. A. Industries, Inc., Type PS2-PF or PS2-PFS; or approved equal.
 - 2 Manhole step dimensions shall meet requirements of OSHA standard 1910.27 for fixed ladders.
- E. Manhole Frame and Cover:
 - 1. Manufacturers:
 - a. Standard frame and cover:
 Jamestown Iron Works, Inc.
 Pattern No. 42-7 and 42A respectively.
 - b. Water-tight frame and cover:Jamestown Iron Works, Inc.Pattern No. 44 and 44A respectively.
 - 2. General: Gray iron castings conforming to ASTM A 48, Class No. 30, designed for AASHTO Highway Loading Class HS-20. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects.
 - a. Finish: Bearing surfaces machined to prevent rocking and rattling under traffic.
 - b. Identification: Cast the letters "SANITARY SEWER" for sanitary manholes.
 - c. Frame Hold-down Bolts: 3/4" diameter Type 316 stainless steel bolts and washers.
 - d. Frame Sealant: Use double row ConSeal CS-102, CS-202 or

approved equal between cast iron frame bottom and manhole top.

F. Joint Sealing Compound:

- Manufactures:
 - a. K. T. Snyder Company, Inc.; RAM-NEK.
 - b. ConSeal CS 102/202.
 - c. Hamilton Kent Manufacturing Company; KENT-SEAL NO. 2.
 - d. Or approved equal.
- 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 (2) piece wrapper. Size cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.
- G. Manhole Adapters: Gasket type waterstop composed of elastomeric polyvinyl chloride (PVC) such as manufactured by Fernco Joint Sealer Co.; CMA Concrete Manhole Adapter. (CMA Waterstop distributed by The General Engineering Company, Frederick, Maryland) or approved equal.
- H. Manhole Coring
 - 1. Kor-N-Seal flexible Pipe-to-Manhole Connector or approved equal
 - 2. Non-shrink grout to comply with ASTM C270, type M, with waterproofing admixture included.

2.02 PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS

- A. Materials and Construction: Conforming to requirements specified in ASTM C 478 except as follows:
 - Concrete: Composition and compressive strength conforming to ASTM C 478 except use Type II sulfate resistant Portland cement in manhole components and increase compressive strength to 4500 psi (at 28 days) in precast bases.
 - Steps: Factory installed in structure components, prealigned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on Drawings. Materials as previously specified.
 - 3. Precast Component Seals: Component joints shall be factory formed for self-centering concrete-to-concrete bearing utilizing sealing compound

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materials as previously specified.

- 4. Precast Component Design: Base, tapered and straight riser section, and top section dimensions and diameters, consistent with ASTM C 478, are as indicated on Drawings.
- B. Precast Bases and Riser Sections: Design, materials and construction as specified previously.
- C. Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe and pipe opening seal provided.
 - 1. Resilient Gasket Type Pipe Opening Seals:
 - Manufacturers:
 - 1) NPC Kor-N-Seal
 - 2) A-Lok Products Corporation; A-LOK Manhole Pipe Seal.
 - 3) Dual Seal Gaskets Inc.; DUAL SEAL II.
 - 4) Or approved equal.
 - b. Cast integrally with manhole component conforming to requirements specified in ASTM C 923.
 - Expandable Sleeve Type (for connections to existing manholes only): ASTM C 923, consisting of a power sleeve, gasket and two (2) take up clamps. Power sleeve is mechanically expanded to compress gasket against receptacle hole in manhole wall. Install at precast plant. Use Press Seal Gasket Corp. PSX Positive Seal Gasketing System, NPC Kor-N-Seal, or approved equal.
 - a. Power Sleeve: Type 304 stainless steel, 85,000 psi yield strength.
 - b. Gasket: Compound Polyisoprene suitable for use with raw sewage.
 - c. Take Up Clamps: Type 304 stainless steel with stainless steel screw.
- D. Precast Top Sections: Design as required, 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 2-¾" threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Threaded inserts of 3" depth. Both insert types designed for an ultimate load in tension of 12,500 pounds. Inserts factory plugged for shipping. Coordinate insert location with manhole component manufacturer to assure proper location in top sections.
 - 2. Flat Slab Tops: Thickness versus diameter as indicated on Drawings. Tops

factory formed to properly accept and support required manhole frame and cover HS-20 Highway Loading and formed to join riser section in a matching joint.

3. Eccentric Cone Tops: Manufactured to same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections.

E. Grade Rings:

- 1. Precast Concrete: Leveling and adjusting units of 3" or 4" thickness of materials and constructions as specified previously. Factory cast grade rings with hold down bolt holes matching location of holes in manhole frame. Design must provide for the full bearing of the manhole frame casting.
 - a. Traffic Rating: Adjustment risers shall be designed for heavy duty street traffic and shall meet or exceed minimum load capacity requirements of the American Association of State Highway Transportation Officials (AASHTO).
 - b. Certification: A manufacturer certification shall be furnished to the purchaser upon request stating that the product meets the requirements of this specification. Applicable supporting documentation shall be independent and conducted by an accredited testing laboratory that conforms to ANSI/150/ASQ 9001-2000.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C 478 regarding repairable defects and defects subject to rejection by the Authority or Township.
- 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 Authority or Township. All defective materials furnished by the Developer shall be promptly removed from the site.

3.02 PREPARATION

- A. Keep pipe and manhole interiors cleared of debris as construction progresses.
- B. Earthwork: Perform earthwork as previously specified in Section 02221 Trenching, Backfilling and Compacting.

3.03 INSTALLATION

A. Manholes – General

1. Manholes shall be installed at all changes in grade and size, changes in alignment for sewers less than 24" in diameter, at all intersections and at distances not greater than 400' for sewers 15" or less and 500' for sewers

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18" to 30".

- 2. Manholes for pipe sizes 27" or smaller shall be 4' inside diameter and Manholes for pipe sizes 30" or larger shall be 5' inside diameter.
- 3. Precast manhole bases shall be carefully set to insure that the floor is level, and to insure that all pipe inlets and outlets shall be at the correct elevation. All openings shall be formed at the time the base is cast and shall be the correct size and location. Manhole joints shall be of the tongue and grove type with a 2" row of butyl resin sealant placed on the tongue and groove. All joint surfaces shall be thoroughly clean and wet prior to setting the sections. Joints shall be set in mortar as specified.
- 4. The space around the pipes through the pre-formed openings shall be carefully and neatly closed with non-shrink grout.
- 5. Poured concrete bases shall be constructed as shown on the approved drawings with floors and channels as hereinabove specified for precast bases. Channels may be poured concrete, or may be constructed by laying the sewer lines continuously through the manhole, and breaking out the top exposed section after the floor concrete has hardened, and neatly trimming the edges. Changes of direction of flow within the manholes shall be made with a smooth curve with as long a radius as possible. The floor shall be concrete. It shall be carefully poured so as not to disturb the elevation or alignment of the channels. Before pouring the floor concrete, the floor and wall surfaces of the precast base shall be coated with a thin coat of mortar. The finished floor shall reach the edges of split pipe, or the halfway mark of whole pipe. The floor shall be finished smooth and shall slope toward the channel not less than one inch (1") per foot.
- For precast reinforced concrete manhole bases, the maximum diameter of the excavation at the bottom shall be the diameter of the base plus 16". All manhole bases shall be installed on an AASHTO No. 57 compacted angular bedding 6" in thickness.
- 7. Where the subgrade soil is found to be unstable, the unstable soil shall be removed to a suitable depth, and shall be replaced by imported backfill material. Subgrade soil for all concrete structures, regardless of type or location, shall be firm, dense and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen engaged in subgrade surfacing, laying reinforcing steel, construction forms, and depositing concrete thereon.
- 8. Installing cast iron frames: Frame castings shall be set on top of a double row of bituminous mastic. The frame shall be fastened to the manhole cone and grade ring using the specified stainless steel anchor bolts. Each casting's top elevations shall conform to those shown on the approved drawings.
- B. Precast Concrete Bases: Install bases on a 6" deep compacted layer of AASHTO

No. 57 coarse aggregate.

1. When using prefabricated pipe opening seals (i.e., A-LOK, RES-SEAL, PRES-WEDGE II or approved equal) for connecting pipes into manholes and such seals create an annular space on interior and exterior of manhole wall pipe openings after pipe connection is made, fill such annular spaces with non-shrink grout flush to interior wall.

C. Length of Pipe Connections into Structures:

- 1. Use pipes no longer than 5' in length when connecting into manholes through resilient gasket type pipe opening seals.
- 2. 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' in length for first pipe joined thereto.

D. Concrete Channel Fill:

- 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 interior diameter will permit.
- 5. Make slopes gradual outside the invert channels.
- 6. Use 2000 psi Type II sulfate resistant cement.
- E. 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 water-tight jointing and true vertical alignment of manhole steps.
 - Install sealing compound (double row of mastic sealant) 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.
 - If sealing compound is installed in advance of section joining leave exposed half of two-piece protective wrapper in place until just prior to section joining.
 - c. Use preformed sealing compound as the sole element utilized in

sealing section joints from internal and external hydrostatic pressure.

- d. To improve workability of "Preformed Plastic Sealing Compound" during cold weather, store such at temperature above 70° F or artificially warm compound in a manner satisfactory to the Owner.
- e. During warm weather stiffen "Preformed Plastic Sealing Compound" by placing under cold water or by other means as recommended by the compound manufacturer.
- f. Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.
- g. Make pipe connections into catch basin and manhole walls as specified previously for pipes connecting into catch basin and manhole bases.
- h. Remove all interior excessive plastic sealing compound after all manhole sections have been set.
- F. Sealing Lifting Recess: Seal any recesses with properly designed tapered rubber plugs. Drive plugs into recesses in such manner to render them completely water and air tight. Sealing of lifting recesses with grout is not permitted.
- G. Frame and Cover Installation: Make final adjustment of frame to elevation using a minimum of one (1) precast grade rings.
 - 1. Set precast grade rings:
 - a. Preformed Mastic Sealing Compound: When frame is to be set level, use preformed mastic sealant. Two (2) continuous rings of mastic sealant along the inner and outer diameter of grade ring top and bottom.
 - b. Waterproof Mortar: When frame must be set at a specific grade, use mortar in-lieu-of mastic sealant. Mortar thickness shall not exceed ³/₄" maximum and 3/8" minimum. Wet, but do not saturate precast grade rings immediately before laying.
 - 2. Preset grade rings to proper plane and elevation using wedges or blocks of cementitious material not exceeding one square inch wide on all sides. No more than four (4) wedges or blocks per grade ring permitted. Incorporate wedges or blocks in fresh mortar only in a manner to completely encase each. Crown fresh mortar to produce squeeze-out between grade rings. Tool exposed joints with appropriately shaped tool and compact mortar edge into joints. Clean off excess mortar prior to initial mortar set.
 - 3. Bolt manhole frames in place on manhole top section, or on leveling units if required, after installing mastic sealing compound on bearing surface of manhole frame. Remove excess sealing compound that is squeezed out after manhole frame is bolted in place.

- 4. Use bolts of sufficient length to properly pass through leveling units, if any, engage full depth of manhole top section inserts and allowing enough threaded end to pass through manhole frame to properly tighten nut and washer. If using mortar, tighten fastening nuts after mortar has cured.
- H. Drop Structure: Construct in accordance with Type indicated in Details on Drawings. Use same type pipe and fittings in drop connection as used in sewer line from which drop connection is made. Interior drop connections are not permitted.
 - 1. Drop manhole assemblies shall be installed when the difference in inverts of the pipes are over 2'.
 - 2. Drop manholes shall have the same specifications as the standard manholes except for the drop assembly.
 - 3. Drop manholes shall have an outside drop assembly which shall enter the manhole at the same centerline as the largest main sewer line.
 - 4. Drop manholes shall be encased with 8" of 4000 PSI concrete.
 - 5. The drop pipe assembly will be cast integral with the manhole sections.
 - 6. The drop pipe shall be a minimum of 8" and shall not be less than 2 nominal diameters than the top pipe.
 - 7. Special backfill shall be placed in the trench a distance of 6' from the drop assembly.
- I. Connections to Existing Structures: Cut required opening by core boring to prevent cracking and spauling. Make openings of sufficient size to accommodate pipe with expandable sleeve manhole adapter. Make connection watertight. Form a new flow channel in the existing manhole base to properly conduct all flows through the existing manhole. Do not permit ground water, surface water or debris to enter the existing facilities. Maintain all existing flow during construction.
- J. Manhole Coring: Core the existing manhole to prevent cracking and spalling. Chipping hammers and saws are not to be used to make the opening. Core a minimum of 6" to and maximum of 12" above the invert of the manhole. Do not damage the existing invert. Make openings of sufficient size to accommodate pipe with expandable sleeve manhole adaptor. Kor-N-Seal flexible Pipe-to-Manhole Connector or approved equal. Install per manufacturer's instructions. The space around the pipes through the cored opening shall be carefully and neatly closed with non-shrink grout. Non-shrink grout to comply with ASTM C270, type M, with waterproofing admixture included. Form a new flow channel in the existing manhole base to properly conduct all flows through the existing manhole. Do not permit ground water, surface water or debris to enter the existing facilities. Maintain all existing flow during construction. Insure that connection is water tight when done.

3.03 Manhole Coring - Execution

- A. Core the existing manhole to prevent cracking and spalling. Chipping hammers and saws are not to be used to make the opening.
- B. Core a minimum of 6" to and maximum of 12" above the invert of the manhole. Do not damage the existing invert.
- C. Make openings of sufficient size to accommodate pipe with expandable sleeve manhole adaptor. Kor-N-Seal flexible Pipe-to-Manhole Connector or approved equal. Install per manufacturer's instructions.
- D. The space around the pipes, at the cored opening, shall be carefully and neatly closed with non-shrink grout.
- E. Form a new flow channel in the existing manhole base to properly conduct all flows through the existing manhole.
- F. Do not permit ground water, surface water or debris to enter the existing facilities. Maintain all existing flow during construction.
- G. Insure that connection is water tight when done.
- H. Clean up and remove all debris in the manhole. Do not wash debris downstream.

3.04 FIELD QUALITY CONTROL

- A. General: Test each manhole constructed in the Project by one of the methods specified herein. If the manhole is constructed on an existing sewer where sewage flow must be maintained, the test will be visual.
 - 1. Conduct tests in presence of and to complete satisfaction of the Authority.
 - 2. Should a manhole not satisfactorily pass testing, discontinue manhole construction in the Project until such manhole does test satisfactorily.
 - 3. Provide tools, materials (including water), equipment and instruments necessary to conduct manhole testing specified herein.
 - 4. Prior to testing manholes, thoroughly clean and seal openings. 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 tests of the manholes for acceptance shall be conducted after the backfilling has been completed.

B. Vacuum Testing

- 1. Vacuum Testing Equipment:
 - a. Use vacuum apparatus equipped with necessary piping, control valves and gauges to control air removal rate from manhole and to

monitor vacuum.

- b. Provide an extra vacuum gauge of known accuracy to frequently check test equipment and apparatus.
- c. Vacuum testing equipment and associated testing apparatus is subject to Authority's approval.
- d. Provide seal plate with vacuum piping connections for inserting in manhole frame.
- 2. Vacuum Test Procedure:
 - a. Perform vacuum testing in accordance with the testing equipment manufacturer's written instructions.
 - b. Draw a vacuum of ten" of mercury and close the valves.
 - c. Consider manhole acceptable when vacuum does not drop below 9" of mercury for the following manhole sizes and times.
 - 1) Four (4) foot diameter 60 seconds
 - 2) Five (5) foot diameter 75 seconds
 - 3) Six (6) foot diameter 90 seconds
- C. Repair and Retest: Determine source or sources of leaks in manholes failing acceptable limits.
 - 1. Repair or replace defective materials and workmanship, as is the case, and conduct such additional Manhole Acceptance Tests and such subsequent repairs and retesting as required until manholes meet test requirements.
 - 2. Materials and methods used to make manhole repairs must meet with Authority's approval prior to use.
 - 3. Make repairs, replacements and retests as required.

END OF SECTION

DIVISION 2 – SITE WORK SECTION 02610 – SEWER PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewer pipe, force mains, low-pressure sewers, low-pressure laterals, fittings and related appurtenances.

1.02 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM A 307, Carbon Steel externally and Internally Threaded Fasteners.
 - 2. ASTM F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 3. ASTM A 536, Ductile Iron Castings.
 - 4. ASTM F 1417, Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
 - 5. ASTM D 1784, Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds.
 - 6. ASTM D 1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80 and 120.
 - 7. ASTM D 2241, Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).
 - 8. ASTM D 2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
 - 9. ASTM D 2467, Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 10. ASTM D 2564, Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
 - 11. ASTM D 2672, Joints for IPS PVC Pipe Using Solvent Cement.
 - 12. ASTM D 2837, High Density Polyethylene Sewer Pipe.
 - 13. ASTM D 3212, Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 14. ASTM F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

- 15. ASTM F 679, Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- 16. ASTM F 789, Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings.
- 17. ASTM F 794, Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Flow Sewer Pipe and Fittings Based on a Controlled Inside Diameter.
- 18. ASTM F 949, Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings.
- 19. ASTM F 1417, Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

B. American National Standards Institute:

- 1. ANSI A 21.10, Gray-Iron and Ductile-Iron Fittings, 2" through 48", for Water and Other Liquids.
- 2. ANSI A 21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
- 3. ANSI A 21.50, Thickness Design of Ductile-Iron Pipe.
- 4. ANSI A 21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
- 5. ANSI B 18.2.1, Square and Hex Bolt and Screws Inch Series.
- 6. ANSI B 18.2.2, Square and Hex Nut (Inch Series).

C. American Water Works Association:

- 1. AWWA C104, Cement-Mortar Lining for Ductile Iron and Gray-Iron Pipe and Fittings for Water.
- 2. AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- 3. AWWA C153, Ductile-Iron Compact Fittings, 3" through 24" and 54" through 64".

1.03 QUALITY ASSURANCE

A. Design Criteria:

1. Use only one (1) type and class of pipe in any continuous line of sewer between structures, unless otherwise approved.

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2. Use pipe and fittings designed to withstand imposed trench loadings and conditions at the various locations.

1.04 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.

1.05 SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Keep trenches dewatered until initial bedding has been placed, pipe joints have been made, and initial bedding and concrete cradle and encasement, if any, have cured.
 - 2. Under no circumstances lay pipe in water or on bedding containing frost.
 - 3. Do not lay pipe when weather conditions are unsuitable, for pipe laying work.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC) Gravity Sewer Pipe and Fittings
 - 1. PVC pipe used for gravity sewer construction shall equal or exceed the requirements of ASTM D 3034 for 4" through 15" pipe and ASTM F 679 for 18" through 27" pipe. All lateral lines are nominal 6" minimum diameter and all collector lines are a minimum nominal 8" diameter. The PVC gravity sewer pipe shall have a minimum standard dimension ratio (SDR) of 35 and the minimum pipe stiffness, as tested in accordance with ASTM D 2412, shall be 46 psi when measured under 5% deflection at 73° Fahrenheit. Pipe shall be manufactured with integral wall bell and spigot joints in standard lengths not exceeding 20'.
 - 2. All PVC pipe and fittings shall utilize elastomeric gasketed joints assembled in accordance with the manufacturer's recommendations. Gaskets shall have a minimum cross sectional area of 0.20 square inches and conform to ASTM F 477 specifications. Provide elastomeric gaskets that have been tested as suitable for continuous contact with domestic sewage.
 - 3. PVC wye branches, repair couplings, tees, pipe stoppers, and other fittings shall be manufactured in accordance with the same specifications and shall have the same thickness, depth of socket, and annular space as the pipe. PVC sewer fittings shall conform to ASTM D-3034 specifications with a minimum wall thickness of SDR 35. PVC material

shall have a cell classification of 12454-B or C as defined in ASTM D 1784.

B. Ductile Iron Gravity Sewer Pipe and Fittings:

- Ductile iron pipe, for gravity sewer construction, shall be centrifugally cast 1. with push-on joints, not less than 12' nor more than 20' in length. Ductile iron sewer pipe shall be Pressure Class 350 and meet the requirements of ANSI A21.51 and ANSI 21.50.
- 2. Fittings and specials for ductile iron pipe shall be mechanical joint fittings made of ductile iron in accordance with ANSI A21.10 and rated for 350psi working pressure. All nuts, bolts and washers shall be COR-TEN.
- 3. Buried Joints: Use rubber-gasketed joints for pipe and fittings installed underground. Push-on: Per ANSI/AWWA C111/A21.11 requirements.
- 4. Cement Lining: Ductile iron pipe and fittings shall be coated inside with double thickness cement mortar lining (1/8") and seal coated in conformance with ANSI A21.4 and AWWA C104.
- 5. Pipe and Fittings Coating: Factory coated inside and out with bituminous material, minimum 1 mil dry thickness. Bituminous material and finished coat shall conform to seal coat requirements of ANSI A21.4 and AWWA C151.
- All buried ductile iron piping shall be completely wrapped with 8-mil 6. polyethylene sheeting.

C. Forcemain Pipe:

- 1. Forcemain: PVC SDR-21 (200 PSI) or Ductile Iron Pipe, Pressure Class
 - PVC pipe, for sewer force main, shall be suitable for use as a a. pressure conduit, meeting or exceeding the requirements of ASTM D 2241. Pipe shall be manufactured with integral wall bell and spigot joints in standard lengths not exceeding 20'. All polyvinyl chloride (PVC) pipe shall utilize elastomeric gasketed joints assembled in accordance with the manufacturer's recommendations. Gaskets shall have a minimum cross sectional area of 0.20 square inches and conform to ASTM F 477 specifications. Provide elastomeric gaskets that have been tested as suitable for continuous contact with domestic sewage.

2. Forcemain Fittings

Fittings for use with ductile iron pipe shall be ductile iron with a. mechanical joint ends conforming to AWWA C153 and AWWA C111 (ANSI A21.10 and ANSI A21.11), rated for 350-psi working

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pressure, cement mortar lined in accordance with AWWA C104, (ANSI A21.4) and seal coated in accordance with AWWA C104 (ANSI A21.4) and to be completely wrapped with 8 mil polyethylene sheeting.

- b. Fittings for use with polyvinyl chloride (PVC) pipe shall be as follows:
 - i. Fittings 3" and smaller shall be PVC with push-on joint or approved equal.
 - ii. Fittings 4" and larger shall be ductile iron with mechanical joint ends conforming to AWWA C153 and AWWA C111 (ANSI A21.11), cement mortar lined in accordance with AWWA C104 (ANSI A21.4) and to be completely wrapped with 8 mil polyethylene sheeting.
- Mechanical joints (for use in buried locations): Shall conform to AWWA C153 and AWWA C111. All nuts, bolts and washers shall be COR-TEN. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR).
- 2. Flanged Joints (for use in areas other than buried locations): Shall conform to AWWA C110 and C115, Class 125. Gaskets shall be vulcanized natural or vulcanized synthetic rubber that is free of porous areas, foreign material, and visible defects. Gasket materials shall conform to AWWA C111. Factory cut gaskets shall be used. Bolts shall be black steel machine bolts with heavy hexagon heads conforming to ANSI B18.2.1. Nuts shall conform to ANSI B18.2.2. The bolts shall be tightened uniformly to distribute the bolt stress evenly and bring the pipe into alignment.
- 3. Cement Lining: Ductile iron fittings shall be coated inside with double thickness cement mortar lining (1/8") and seal coated in conformance with ANSI A21.4 and AWWA C104.
- 4. Fittings Coating: Factory coated inside and out with bituminous material, minimum 1 mil dry thickness. Bituminous material and finished coat shall conform to seal coat requirements of ANSI A21.4 and AWWA C151.
- 5. All buried mechanical joint nuts, bolts and washers shall be COR-TEN.

D. Thrust Restraint for Forcemain

- Developer has option of any of the restraint means specified below. Restraint shall be provided at all fittings, bends, tees, changes in direction, etc.
 - a. Concrete Thrust Blocks and Tie Rods: Concrete shall be as specified in PennDOT Publication 408, Section 704 for Class A

Concrete - 3,000 psi compressive strength (at 28 days). Tie rods shall be constructed of a minimum of A36 steel. Metal harness of tie rods shall be galvanized or otherwise rust proofed and shall be painted with bituminous coating after installation. Thrust block designs shall comply with standard details. Under no circumstance shall concrete cover mechanical joint fasteners.

b. Retainer Glands: Mechanical joint restraint consisting of follower gland which when actuated imparts multiple wedging actions against the pipe, increasing its resistance as the pressure increases. ASTM A 536-80 ductile iron follower gland of dimensions such that it can be used with AWWA C153 mechanical joints. Restraining devices shall be of ductile iron, heat-treated to a minimum hardness of 370 BHN. Twist-off nuts shall be used to insure proper actuating of the restraint device. Restraint device shall have a 250-psi minimum working pressure with 2:1 minimum safety factor. Retainer Glands shall be installed in accordance with manufacturer's instructions and procedures.

2.02 FORCEMAIN VALVES AND APPURTENANCES

- A. General: All valves and appurtenances shall comply with the following:
 - 1. 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 (2) coats of an asphalt varnish shall be applied in accordance with AWWA C500. Finished painting for exposed valves shall have the surface prepared and painted in accordance with manufacturer shop and finish coat painting requirements.
 - Spare Parts and Tools: Repair or service parts for one (1) of each type and size of valve used in this work shall be furnished and stored as directed by the Owner. The equipment shall include, in general, the following items: special tools required for maintenance, including seat replacement, or operation of valves, gaskets, rings, seals, lubricants, bolts, washers, and miscellaneous accessories required to maintain valves in proper operating service.
 - 3. Flanges: All flanged valves shall be drilled and faced to the ASA 125 pound standard template, and in accordance with ANSA B16.1.
 - 4. All direct bury valves shall be completely wrapped with 8-mil polyethylene sheeting.
 - 5. All air-release values shall be designed and sealed and their drawing signed and sealed by a Pennsylvania Professional Engineer to suit the project needs.

B. PLUG VALVES

- 1. Valves shall be non-lubricated, eccentric type with resilient faced plugs and mechanical joint ends. Port access shall be at least 80% of full pipe area. Bodies shall be semi-steel with raised seats. Seats shall have a welded-in overlay of high nickel content on all surfaces contacting the plug face. Valves shall have permanently lubricated stainless steel bearings in the upper and lower plug stem journals. Each valve shall be of the bolted bonnet design. Each valve shall be designed so that they may be repacked without removing the bonnet, the packing shall be adjustable. All exposed nuts, bolts, springs and washers shall be stainless steel.
- 2. Each valve shall have resilient plug facings of chloroprene suitable for use with raw sewage.
- 3. Valves for buried service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.
- 4. Eccentric plug valves shall be as manufactured by DeZurik series 100 Iron Body, or approved equal.

C. GATE VALVES

- The valves, described in this section shall be resilient seated gate valves manufactured to meet or exceed AWWA C509 and ANSI/NSF61. Valves shall be of compression type seal design, providing bubble tight shut-off with bi-directional seating ability for pressures up to 200 psi.
- 2. The valve shall have a smooth, unobstructed waterway free from any sedimentation pockets. Valve shall provide a 100% port of nominal pipe size when fully open. Valves shall open to left.
- Body style shall be mechanical joint type to meet or exceed ANSI/AWWA
 C111, for buried service, flange joint type for exposed service and when
 required, to include special end connections for tapping requirements or
 otherwise if indicated on the contract drawings.
- 4. The interior and exterior coating shall be epoxy manufactured to meet or exceed ANSI/AWWA C550 and certified to ANSI/NSF61.
- 5. Valve shall have non-rising stem with 2" square wrench nut and be delivered with three (3) operating "T" wrenches 9'0" in length.
- 6. All exposed valve equipment shall have the following additional (painted surface after installation): one (1) coat of primer 2.5 mils thick Tnemec Series 77 Chem Primer or approved equal and two (2) finish coats 4.0

mils thick Tnemec Series 66 Hi-build Epoxoline or approved equal (color gray).

- 7. All exposed nuts, bolts and washers shall be standard black steel. Buried nuts, bolts and washers shall be COR-TEN.
- 8. Valve shall be Mueller Model No. A2360 or approved equal.

CHECK VALVES D.

- 1 Check valves shall be controlled closing swing type, and installed in the approved locations noted on the drawings. The valve shall permit flow in only one (1) direction, close tightly when its discharge side pressure exceeds its inlet pressure and closes without a slam. The valve body shall be cast iron ASTM A126-B, with outside lever and counterweight, flanged connections, and has a hinge shaft of Type 303 commercial stainless steel.
- 2 A single cushioning device mounted on the external side of the valve shall control the valve closure.
- 3 The valve's counterweight shall initiate the valve closure at an unrestricted rate until the valve disc reaches the valve's point of closure. The closing speed shall be adjustable in the field. The valve, when closed, shall be tightly sealed by way of a resilient replaceable seat against a bronze seat ring in the body.
- 4. Check valves shall be Golden-Anderson Industries Figure 250-D controlled swing check valve, or approved equal.
- 5. All check valve designs shall be designed and sealed by a Pennsylvania Professional Engineer.

E. VALVE BOXES

The valve boxes shall be made of cast iron and shall be of two (2) piece 1. construction, in accordance with ANSI/AWWA C110/A21.10-82, ASTM A438-62 and screw type, with 5" inside diameter or larger shaft for roadway installation. The length of the shaft shall vary depending upon the depth of the valve at each valve installation. The valve box shall be as manufactured by the Tyler Manufacturing Co., Inc., or approved substitute. The valve box shall be furnished with the word "Sewer" cast thereon.

2.03 TRANSITION COUPLINGS

Transition couplings shall be used where PVC and Ductile Iron piping is to be Α. interconnected. The couplings shall consist of a sleeve, gaskets, follower flanges, and the necessary hardware to complete the coupling.

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- B. The sleeve shall be Ductile Iron meeting the requirements of ASTM A-536. Ends shall have a smooth inside taper for uniform gasket seating.
- C. Gaskets shall be standard, Grade 60, compounded rubber of new material. The gaskets shall provide a permanent seal and be suitable for a temperature range of -40° F to 212° F.
- D. Follower flanges shall be Ductile Iron meeting ASTM A-536. The flanges shall be designed with a high strength/weight ratio. The flange thickness shall be as recommended by the manufacturer for the coupler size.
- E. Transition couplings shall be Smith Blair 441 Cast Couplings as manufactured by Omni, or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Clean piping interior and mating surfaces of bell, spigot and gasket before laying. Maintain clean until completed work is accepted.
- B. Perform trenching for sewer pipe and place pipe bedding as specified in Section 02221 Trenching, Backfilling and Compacting.
- C. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.

3.03 LAYING PIPE

A. General Requirements:

- 1. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade unless shown otherwise required. Lay all pressure piping with the bell end toward pump discharge.
- 2. The Developer shall use care in setting lasers or the other means that he plans to utilize for construction of the sewers to establish pipe grades. If not constructed at the required grade, the Authority shall have the option of directing the Developer to relay the pipe to the required grade.

- 3. Exercise care to insure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs along inside bottom half of pipeline.
- 4. Center spigot end in bell or socket end of previously laid pipe, shove tight and secure.
- 5. No wedging or blocking permitted in laying pipe.
- 6. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.
- 7. Walking or working on completed pipe line, except as necessary in tamping and backfilling, not permitted until trench is backfilled 1' deep over top of pipes.
- 8. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.
- 9. Take up and replace with new, such in-place pipe sections found to be defective.
- 10. Take necessary precautions to prevent newly laid pipe from floating as a result of water accumulation in the trench; or the collapse of the pipe line from any cause. Restore or replace pipe as necessary.
- 11. Bed pipe using materials specified in Section 02221 Trenching, Backfilling and Compacting.
- 12. At the close of each day's work, and at such other times when pipe is not being laid, protect open end of pipe with a close fitting stopper.
- 13. Cut pipe using only equipment specifically designed for that purpose such as an abrasive wheel, rotary wheel cutter, a guillotine pipe saw or a milling wheel saw. The use of chisels or hand saws will not be permitted. Grind smooth cut ends and rough edges. Bevel slightly, cut end for pushon connections.
- 14. Where cutting of pipe is necessary, minimum laying length shall be 5'
- 15. Sanitary gravity and pressure sewers shall be covered with backfill material, a minimum depth of 4'.

B. Specific Requirements:

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- 1. Install plastic pipe and fittings, and assemble joints according to ASTM D 2321 for the specified stone bedding material.
- 2. Ductile Iron Pipe and Fittings Install per AWWA 600. Pipe cutting, where necessary to field cut pipe use an approved pipe cutter, milling

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- cutter or abrasive wheel. Pipe sections must have a minimum laying length of 5'.
- 3. Reinforced Concrete Pipe Installation Installation shall conform to ASTM C12 when pipes enter or pass through concrete walls, manholes, sewers or other structures, holes shall be provided and the pipes properly cemented in place so as to form a watertight joint.
- 4. Refer to Section 02221 "Trenching, Backfilling, and Compaction" for backfilling requirements.
- 5. Pipeline detectable tape shall be installed continuously along all sewer lines. The tape shall be installed directly above each pipeline 1-1/2' beneath the ground surface.
- 6. Service Connection Fittings:
 - a. Make connections to sewer using fittings of same material and joint configuration as the sewer at the planned point of branch connection.
 - b. Use commercially manufactured wye fittings and one-eighth (1/8) bends.
 - c. Set wye branches at proper vertical angles as required to bring service connections to the proper depth.
 - d. Fitting locations shall be determined in the field by the Authority.

C. Joints:

- 1. Make pipe and fitting joints according to pipe manufacturer's specifications and to specifications previously specified for pipe.
- 2. Make joints watertight. Immediately repair detected leaks and defects. Methods of repair are subject to the Authority's approval.

D. Alignment and Grade:

- Lay and maintain all pipe at the required lines and grades as shown on the drawings. Place fittings and valves at the required locations with joints centered, spigots forced home, and all valve stems plumb. Do not deviate from the required line and grade.
- 2. Deflect pipe joints where indicated on the approved project drawings. Deflections shall not exceed pipe manufacturer's recommended maximum allowable deflection.

E. Drop Connections:

1. Make drop connections where the drop between inlet and outlet inverts is 2' or more. Construct drop connection in accordance with Section 02605 and the standard detail drawings.

3.04 THRUST RESTRAINTS

- A. Temporary Thrust Restraint: Provide temporary thrust restraint at temporary caps or plugs.
- B. Permanent Thrust Restraint: Provide as previously specified and as may be shown on the approved project drawings.

3.05 FIELD QUALITY CONTROL

- A. General Requirements: Conduct tests specified herein so that each pipe line installed in the Project is tested to the Authority's satisfaction.
 - 1. Provide tools, materials (including water), apparatus and instruments necessary for pipe line testing.
 - 2. Conduct tests in the presence of and to the satisfaction of the Authority.
- B. Alignment: After the gravity mains have been laid and backfilled, a light will be flashed between manholes or manhole locations to determine whether the alignment of the sewer is true and whether any pipe has been displaced, broken or otherwise damaged subsequent to laying. This test will again be conducted before final acceptance of the sewer.
 - 1. Horizontal Alignment: Each section (manhole to manhole) of sewer shall show no less than a three-quarter (3/4) pipe light circle throughout its length and any and all defects shall be corrected by the Developer, before the work shall proceed and before acceptance of and/or payment shall be made.
 - 2. Vertical Alignment: No vertical displacement or misalignment will be accepted. The Developer, shall correct all defects before the work shall proceed and before acceptance of and/or payment shall be made.
- C. Initial Section Test: To demonstrate acceptability of installed pipe materials and workmanship, construct and air test one sewer section from manhole to manhole using the pipe provided in the Contract. Pretesting such section prior to actual Initial Section Test not permitted.
 - 1. Conduct Initial Section Test in same manner as Line Acceptance Test specified in following paragraph.
 - 2. Conduct said Initial Section Test for each size and type pipe material used in the Project prior to continued installation of same pipe.

- 3. Provide pipe manufacturer's representation during laying, backfilling and testing of Initial Sections Tests.
- 4. Failure of an Initial Section Test will be sufficient cause for the Authority to reject manufacturer and supplier of pipe regardless of cause of failure.
- 5. Sewer sections successfully tested as Initial Section Test will be retested under Line Acceptance Test.

D. Deflection Test for Gravity Lines

- 1. All line sections will be tested.
- 2. In addition to air test, conduct deflection tests on PVC pipe. Test all PVC sewer main installed not less than 30 days following backfill.
- 3. Mandrel shall be cylindrical in shape, 95% of nominal pipe diameter and 4' long. Mandrel diameter achieved with no less than 8" arms evenly spaced at each end and in the middle of the mandrel.
- 4. Pull mandrel through pipe section manually. Powered pulling devices not allowed.
- 5. Pipe fails test if mandrel cannot be pulled through pipe. Note location of failure, excavate, replace pipe section that failed, and re-test.

E. Low Pressure Air Test for Gravity Lines

- 1. After a section of sewer is constructed between adjacent manholes, backfilled and successfully cleaned, perform a low pressure air Line Acceptance Test in accordance with ASTM C 828 and the following:
 - a. Seal and brace sewer piping at upstream and downstream manholes and at all laterals. Test plug seal before actual use by testing plugs outside the trench in one length of pipe pressurized to maximum anticipated testing pressure. Plugs shall hold without bracing and show no movement. After plug is placed in pipe and sealed, brace or protect as insurance against blow out. Protect workers from potential of plug blow out.
 - b. Introduce low pressure air slowly into sealed sewer section until the internal air pressure is four psig greater than the average ground water pressure acting on the pipe, but in no case higher than 10 psig.

c. To determine the internal air pressure for the test, add 3.5 psig to the height in feet of the ground water above the invert of the pipe divided by 2.3. However, the test pressure should not exceed 10 psig.

For example, if ground water height is 6.9: 3.5 + (6.9/2.3) = 6.5 psig

- d. Allow no less than three (3) minutes for air temperature and pressure to stabilize. Add air only to maintain required test pressure.
- e. After the stabilization period, adjust the test pressure to the required test pressure, and disconnect the air supply. Then measure the time that is required to achieve a 1.0 psig pressure drop.
- f. The line passes if the time required for a 1-psig pressure drop exceeds the value listed in Table 1 included at the end of this Section. Interpolate values for intermediate distances from those shown. If the time for 1 psig pressure loss is less than that reported in the table, then the line fails and shall be repaired prior to re-test.
- g. For conditions not reflected in the Table, utilize the following equation:

Where:

T=shortest time, in seconds, allowed for the air pressure to drop 1.0 psig.

K=0.000419D*L, but not less than 1.0

Q=0.0015 cubic feet/minute/square feet of internal surface

D=nominal pipe diameter in inches

L=Length of pipe being tested in feet

- 2. After laterals are installed, re-test line in accordance with the above procedure if line is initially tested before the installation of laterals.
- F. Hydrostatic Testing for Pressure Lines:
 - 1. Leakage Test Requirements

- a. After the pipe has been installed as specified, all newly laid pipe, or any valved section thereof, shall be subjected to a pressure of 150 pounds per square inch, or 50% in excess of the normal working pressure.
- b. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
- c. No pipe installation will be accepted if leakage is detected.
- d. Duration of Test: The duration of the test under pressure shall be two hours.
- e. Procedure: Each valved section 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. The pump, pipe connections, and all necessary apparatus, including gauges, shall be furnished by Developer. Developer will make all taps into the pipe, and furnish all necessary assistance for conducting the tests.
- f. Expelling Air Before Test: Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants or blowoffs are not available at high places, Developer shall make the necessary taps at points of highest elevation before the test is made and insert the plugs after the test has been completed.
- g. Should any test of pipe laid disclose leakage greater than that specified above, Developer shall, at his own expense, locate, repair and replace the defective joints, pipe or fittings until the leakage is within the specified allowance.

G. Time for Making Test:

- Where any section of a main is provided with thrust blocking, the hydrostatic pressure test shall not be made until at least five days have elapsed after the thrust blocking was installed. If high early strength cement is used in the thrust blocking, the hydrostatic pressure test shall not be made until at least two days have elapsed.
- 2. Authority shall be present during the operating of valves required to fill mains for pressure and leakage test.
- 3. Developer shall advise Engineer of any pressure test and leakage test at least 48-hours in advance. No testing will be authorized unless ambient air temperature is 35° F or higher.

- 4. The pressure and leakage tests shall be witnessed by Engineer.
- 5. Developer shall furnish laboratory calibrated test gauges and measuring devices for the leakage test.
- 6. The section under test shall be brought back to test pressure at one-half hour intervals during the testing. Authority will record both the makeup water amount and pressure at each one-half hour re-pressurization.

H. Alignment Test for Pressure Lines:

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

I. Acceptance:

- Observation of successful testing of low-pressure sewers and appurtenances by the Authority's Engineering does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Authority's Engineer may recommend final acceptance. Only upon final inspection by the Authority's Engineer and upon written acceptance for same will the system or portion thereof be considered substantially completed.
- 2. If, during this final inspection, any irregularities are observed, the condition must be corrected.

TABLE 1

MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

1 Dina	2 Minimum	3 Length for Minimum	Time for	SPECIFICATION TIME FOR LENGTH (L) SHOWN (MIN:SEC)							
Pipe Diameter (in.)	Time (min:		Longer Length (sec)	100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

END OF SECTION

DIVISION 2 - SITE WORK SECTION 02611 - SEWER PIPE AND FITTINGS (Low Pressure Sewers)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnishing, laying, and testing of all sanitary sewer pipes, low pressure pipes, fittings, and related appurtenances.

1.02 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. Use one (1) type and class of pipe.
 - 2. Use pipe and fittings designed to withstand imposed trench loadings and conditions at the various locations.
 - 3. Provide a minimum depth of cover 4', to top of pipe, for all pipe.
 - 4. Use pipe with a pull strength equal or greater than the values listed in this specification.
- B. Horizontal Directional Drilling (HDD): The Developer shall employ the services of a certified and experienced pipe fuser.

1.03 REFERENCES

- A. American Society for Testing and Materials.
 - 1. ASTM A 48, Gray Iron Castings.
 - 2. ASTM F 412, Standard Terminology Relating to Plastic Piping Systems.
 - 3. ASTM F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 4. ASTM A 536, Ductile Iron Castings.
 - 5. ASTM F 679, Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
 - 6. ASTM F 714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 - 7. ASTM F 789, Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings.
 - 8. ASTM F 794, Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

- 9. ASTM F 1417, Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
- 10. ASTM D 1693, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
- 11. ASTM D 1784, Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- 12. ASTM D 1785, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
- 13. ASTM D 2122, Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
- 14. ASTM D 2239, Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
- 15. ASTM D 2241, Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).
- 16. ASTM D 2321, Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- 17. ASTM D 2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- 18. ASTM D 2447, Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
- 19. ASTM D 2466, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- 20. ASTM D 2467, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- 21. ASTM D 2737, Polyethylene (PE) Plastic Tubing.
- 22. ASTM D 2774, Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
- 23. ASTM D 2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
- 24. ASTM D 3034, Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- 25. ASTM D 3035, Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

- 26. ASTM D3212, Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals.
- 27. ASTM D 3350, Polyethylene Plastics Pipe and Fittings Materials.

1.04 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.

1.05 SITE CONDITIONS

- A. Environmental Requirements (Open-Cut Installation):
 - 1. Keep trenches dewatered until initial bedding has been placed, pipe joints have been made, and concrete cradle, thrust block, anchor and encasement (as required) have cured.
 - 2. Do not lay pipe in water or on bedding containing frost.
 - 3. Do not lay pipe when weather conditions are unsuitable for pipe laying work.

PART 2 - PRODUCTS

2.01 POLYETHYLENE PIPE AND FITTINGS (HDD)

- A. 4" nominal pipe size and smaller: IPS SDR-9, PE 3408, ASTM F 714.
- B. Fittings:
 - 1. Tees and Elbows: Full bore construction compression or fusion fittings ASTM working pressure 224 psi outside diameter tolerances according to ASTM F 412 3.2.4.
 - Electrofusion Fittings: Electrofusion Fittings shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D 3350-02 and is the same base resin as the pipe. Electrofusion Fittings shall have a manufacturing standard of ASTM F 1055.
 - 3. Flanged and Mechanical Joint Adapters: Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D 3350-02 and be the same base resin as the pipe. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D 3216. All adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.
 - Mechanical Restraint: Mechanical restraint for HDPE may be provided by mechanical means separate from the mechanical joint gasket-sealing gland. The restrainer shall provide wide, supportive contact around the full

circumference of the pipe and be equal to the listed widths. Means of restraint shall be machined serrations on the inside surface of the restrainer equal to or greater than the listed serration's per inch and width. Loading of the restrainer shall be by a ductile iron follower that provides even circumferential loading over the entire restrainer. Design shall be such that restraint shall be increased with increases in line pressure.

Serrated restrainer shall be ductile iron ASTM A536-80 with a ductile iron follower; bolts and nuts shall be corrosive resistant, high strength alloy steel.

The restrainer shall have a pressure rating of, or equal to that of the pipe on which it is used or 150-PSI, which ever is lesser. Restrainers shall be JCM Industries, Sur-Grip or pre-approved equal.

Nominal Size	Restraint Width	Serration's per inch
4", 6"	1-1/2"	8
8", 10", 12"	1-3/4"	8

Pipe stiffeners shall be used in conjunction with restrainers. The pipe stiffeners shall be designed to support the interior wall of HDPE. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed of 304 or 316 stainless steel to the HDPE manufactures published average inside diameter of specified size and DR of the HDPE. Stiffeners shall be by JCM Industries or pre-approved equal.

- 5. Connection to PVC Pipe (Plain End): IPS Bell MJ Adapter with Kit shall be used at all transitions between HDPE and plain end PVC pipe. The IPS Bell MJ Adapter Kit shall be as manufactured by Independent Pipe Products, or equal. Retainer glands shall be as manufactured by Star Harnessing System, Mega Lug by EBAA Iron, etc. shall be used in conjunction with each IPS Bell MJ Adapter Kit. The restraint system shall be painted with two (2) heavy coats of coal tar epoxy after installation.
- 6. Connection to PVC Pipe (Bell End): PVC Slip Joint Anchor Fittings shall be used at all transitions between HDPE and bell end PVC pipe and shall include pipe stiffeners. The PVC Slip Joint Anchor Fittings shall be manufactured by Independent Pipe Products, or equal. Retainer glands, threaded-rods, friction clamps and other proprietary systems such as the Star Harnessing System, Mega Lug by EBAA Iron, etc. shall be used in conjunction with each IPS Bell MJ Adapter Kit. The restraint system shall be painted with two (2) heavy coats of coal tar epoxy after installation.

2.02 POLYVINYL CHLORIDE PIPE AND FITTINGS

A. Polyvinyl Chloride (PVC) SDR Pipe, 1-1/2" Through 4" Diameter: Provide pipe which is permanently marked with manufacturer's trademark, size and ASTM conformance designation. Pipe design and material requirements shall conform to ASTM D 2241, SDR-21 for 200-psi pressure. PVC material shall conform to ASTM 1784 requirements for Cell Classification 12454-B. Utilize elastomeric O-ring gasketed joints assembled in accordance with the manufacturer's recommendations. Gaskets

- shall have a minimum cross sectional area of 0.20 square inches and conform to ASTM F 477 specifications. Provide elastomeric gaskets that have been tested as suitable for continuous contact with domestic sewage.
- B. Polyvinyl Chloride (PVC) Schedule 80 Pipe, ½" Through 16" Diameter: Provide pipe which is permanently marked with manufacturer's trademark, size and ASTM conformance designation. Pipe design and material requirements shall conform to ASTM D 1785 for Schedule 80 pipe. PVC material shall conform to ASTM 1784 requirements for Cell Classification 12454-B.
- C. All polyvinyl chloride (PVC) Schedule 80 pipe and fittings shall utilize solvent weld joints assembled in accordance with the manufacturer's recommendations.

2.03 COMBINATION AIR VALVES

- A. Combination air valves shall be dual body type suitable for wastewater applications. The valves shall open to exhaust quantities of air during the filling of the piping and close upon liquid entry. The valve shall also open during draining or if negative pressure occurs within the piping system.
- B. Combination air valves shall consist of one sewage air release valve and one (1) sewage air and vacuum valve. The valves shall be piped into a compact assembly and include backwash accessories.
- C. Sewage air release valves shall have full size NPT inlets and outlets. The valve inlet shall be 2" with a 2" bronze, full flow ball valve. The valve outlet shall be 1". The orifice size shall be 3/16".
- D. Sewage air and vacuum valves shall have full size NPT inlets and outlets. The valve inlet shall be 2" with a 2" bronze full flow ball valve. The valve outlet shall be 1".
- E. Backwash accessories shall be provided for each combination air valve assembly. The accessories shall consist of inlet shut off valves (size as specified above), ½" full flow ball valves with quick disconnect couplings, blow off valves clear water inlet valves, and a rubber hose and quick disconnect couplings at each end.
- F. The valve body and cover shall be constructed of ASTM A126 Class B cast iron. The floats, plugs, guide shafts and bushings shall be Type 304 Stainless Steel. Resilient seats shall be type Buna-N.
- G. The exterior of the valve shall be coated with a universal alkyd primer.
- H. Valves shall be manufactured and tested in accordance with AWWA C512.
- I. Acceptable Manufacturer: Val-Matic Valve and Manufacturing Corp. or Equal.

2.04 VALVES AND APPURTENANCES

A. General: All valves and appurtenances shall be designed for use by a Pennsylvania Professional Engineer as specified herein.

B. Gate Valves Two (2) Inch and Larger:

- 1. All gate valves 2" and larger shall conform in all respects to AWWA C509 as revised to-date, with a working pressure rating of 200 psi. All valves shall be of the iron body, non-rising bronze stem, resilient seated wedge type.
- 2. Valves shall open left (counter-clockwise) and shall be supplied with operators as shown on the Drawings and specified herein.
 - a. Exposed manually actuated valves shall be handwheel actuated. Handwheel operators shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering.
 - b. Buried valves shall have 2" square cast iron operating nuts. Each valve shall also be supplied with a roadway type valve box.
 - c. All operating nuts and handwheels shall have the direction of opening cast on them.
 - d. Gate valves installed in buried vertical pipe lines shall be provided with bevel gears and enclosed gear cases. Gearing shall be in accordance with the valve manufacturer's recommendations as required to permit easy operation of the valve by one man without excessively large handwheel or cranks.
- 3. Gate valves above grade or exposed shall be supplied with flanged ends in accordance with ANSI Class 125, and shall be of the non-rising stem type.
- 4. Buried valves shall be supplied with mechanical joint end connections.
- 5. Valves shall be as manufactured by U.S. Pipe, America Darling, Mueller or equal.

C. Gate Valves Smaller Than Two (2) Inches:

- 1. All gate valves smaller than 2" shall have a working pressure rating of 200 psi. All valves shall be of the PVC body, non-rising stem, and tapered wedge type.
- 2. Valves shall open left (counter-clockwise) and shall be supplied with operators as shown on the Drawings and specified herein.
 - a. Exposed manually actuated valves shall be handwheel actuated unless otherwise shown 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.
 - b. Buried valves shall have 2" square cast iron operating nuts. Each valve shall also be supplied with a roadway type valve box.

- c. All operating nuts and handwheels shall have the direction of opening cast on them.
- 3. Gate valves shall be supplied with true union connections.
- 4. Valves shall be as manufactured by Spears or equal.
- D. Ball Valves Two (2) Inch and Smaller:
 - 1. Ball valves shall conform to AWWA C800-89 and ASTM B-62.
 - 2. Ball Valves shall be of polypropylene construction with polyethylene seat, EPDM O-ring seals and full port design. Valves shall be supplied with true union and compression fittings. Valves shall have a pressure rating of 200 psi.
 - 3. Valves shall be as manufactured by Cepex, or equal.

E. Curb Stop Valves:

1. Curb Stop Valves shall be of polypropylene construction with polyethylene seat, EPDM O-ring seals and full port design. Valves shall be supplied with true union, 2" square operating nut and compression fittings. Valves shall have a pressure rating of 200 psi. Each valve shall also be supplied with a roadway type valve box. Valves shall be provided with extension stems where appropriate. Valves shall be as manufactured by Cepex, or equal.

F. Check Valves:

1. Plastic Check Valves shall be of PVC construction horizontal use, full port design and shall be supplied with true union. The valves shall be designed for a pressure rating of 200 psi and shall be of the swing check type. Valves shall be suitable for direct burial.

G. Valve Boxes:

- All valve boxes shall be placed so as not to transmit shock or stress to the valve and shall be centered and plumb over the operating nut of the valve. The ground in the trench upon which the CMU and valve boxes rest shall be thoroughly compacted to prevent settlement. The boxes shall be fitted together securely and set so that the cover is flush with the finished grade of the adjacent surface. A concrete pad as detailed on the Drawings shall be provided around the valve box, sloped outwards.
- 2. All valve boxes shall be two (2) piece cast iron, sliding type 5-1/4" shaft, with heavy-duty traffic collar and the lid marked with the appropriate carrier product (i.e.: SEWER). Boxes shall be as manufactured by East Jordan Iron Works, Inc., Tyler / Union, Charlotte Pipe and Foundry Company, or equal.

2.05 PIPING SPECIALTIES

A. Manhole Adapters: Gasket type waterstop composed of virgin polyvinyl chloride (PVC) such as manufactured by Fernco Joint Sealer Co.; CMA Concrete Manhole Adapter (CMA Waterstop distributed by The General Engineering Company, Frederick, Maryland); and NPC Kor-N-Seal, Milford, New Hampshire.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Inspect each section of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.
- B. Remove rejected pipe from the Project.
- C. General.
 - 1. Clean piping interior prior to laying pipe and following pipe laying.
 - 2. Keep open ends of piping and pipe attachment openings capped or plugged until actual connection or actual pipe testing. Prevent water and debris from washing into the pipe.
 - 3. Excavate trenches in rock at least 25' in advance of pipe laying. Protect pipe ends from excavation.
- D. Earthwork: Perform earthwork for sewer installation as specified in Section 02221.
- E. Coating Touch-Up: Touch-up chipped, cracked, or abraded surfaces and finished joints with two (2) coats of the particular coating material.

3.02 SEWER CONSTRUCTION METHODS (Open-Cut Installation)

- A. General Requirements: Use proper and suitable tools and appliances for the proper and safe handling, lowering into trench and laying of pipes.
 - 1. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade. Lay tongue and groove pipe with groove end upgrade.
 - 2. Exercise care to ensure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs along inside bottom half of pipeline.
 - 3. No wedging or blocking permitted in laying pipe unless by written order of Engineer.
 - 4. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe

- previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.
- 5. Dig bell holes sufficiently large to permit proper joint making and to ensure pipe is firmly bedded full length of its barrel.
- 6. Walking or working on completed pipe line, except as necessary in tamping and backfilling, not permitted until trench is backfilled 1' deep over top of pipes.
- 7. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.
- 8. Take necessary precautions to prevent newly laid pipe from floating as a result of water accumulation in the trench; or the collapse of the pipeline from any cause. Restore up and replace with new, such in-place pipe sections found to be defective.
- 9. Where cutting of pipe is necessary, minimum-laying length shall be 5'.
- 10. Bedding materials and concrete work for pipe bedding as specified in Section 02221.

B. Specific Requirements:

- 1. Install pipe and fittings, and assemble joints according to the following standards and in strict accordance with the manufacturer's installation instructions:
 - a. PVC Pipe and Fittings ASTM D 2321 for Class I Bedding Materials contained herein.
 - b. Polyethylene Pipe and Fittings IPS SDR-9, PE 3408, F714.
- 2. Make joints absolutely watertight and immediately repair detected leaks and defects. Methods of repair shall be subject to Authority's approval.
- 3. Refer to Section 02221 "Trenching, Backfilling, and Compaction" for backfilling requirements.
- Open Cut Installation Pipeline detectable tape shall be installed continuously along each sewer. The tape shall be installed directly above each pipeline 18" beneath the finish ground surface. Refer to Section 02661.
- 5. Service Connection Fittings:
 - a. Make connections to sewer using fittings of same material and joint configuration as the sewer at the planned point of branch connection.
 - b. Use commercially manufactured fittings.

- c. Compression type saddle fittings shall not be accepted for use.
- d. Fitting locations shall be determined in the field by the Engineer.
- 6. All PVC pipe located within well encroachment areas (within 50' of residential wells) shall be encased in concrete. HDPE pipe will not require concrete encasement within the well encroachment area.

3.03 BUTTRESSING (Open Cut Installation - PVC)

- A. Concrete for buttresses on sanitary low pressure main pipe shall be 3000 psi concrete using Type II Portland Cement.
- B. Buttresses shall be placed behind all caps, horizontal bends, and branches. Anchorages shall be placed beneath all vertical bends. They shall extend to solid, undisturbed soil.
- C. Install megalug retainer gland according to manufacturer's instructions.
- D. Temporary Thrust Restraint: Provide temporary thrust restraint at temporary caps or plugs.

3.04 HORIZONTAL DIRECTIONAL DRILLING (HDD) SEWER CONSTRUCTION METHODS

- A. Horizontal directional drilling methods shall be utilized for installation HDPE sewage force main.
 - 1. Materials encountered in drilling operations are unclassified.
 - 2. The maximum allowable drill length, between launch and receiving pits, is 800'.
- B. A complete detailed design procedure and method shall be submitted for each such installation and shall contain as a minimum:
 - 1. Layout Sketches, indicating pit dimensions and locations.
 - 2. Proposed line and grade of the drilling.
 - 3. Complete details and specifications of the materials and equipment to be used to complete the drilled installation.
 - 4. Size and type of drill pipe.
 - 5. Drilling fluid information.
 - 6. Drilling fluid disposal plan.
 - 7. Sequence of operations.

- C. The Developer shall retain the services of a horizontal directional drilling specialist in an effort to preclude the necessity for a restart at a second location due to inadequacies that could be foreseen through the use of a specialist. The HDD specialist's foreman shall have a minimum of 10 years experience operating the drilling machinery for installation of pressure sewer lines.
- D. If an obstruction is encountered that prohibits the forward action of the drilling operation or pipe installation, and it becomes evident that it will be impossible to advance the drill head or the pipe, operations shall cease and the pipe will be abandoned in place and filled completely with grout. Drilling shall restart at a second location.
- E. The HDD operation, once commenced, shall be continuous until such time as the HDD is completed. The number of boring and receiving pits shall be kept to a minimum and shall be no closer than 250'.
- F. The rig shall be capable of the push/pull capacity, rotational speed, torque, and horsepower requirements, including size and capacity of the drilling fluid pump, to successfully complete the HDD.
- G. The mud motor shall be capable of delivering sufficient amount of drilling fluid to maintain borehole integrity. The Developer shall be responsible for providing the right mixture of drilling fluid to fit the characteristics of the soil conditions. The Developer shall be responsible for the disposal of the drilling fluid in accordance with all applicable regulations.
- H. The Developer shall keep drilling logs. These logs shall include specific dates, time and locations (x, y, z positioning), soil conditions, drilling data such as depth, angle, rate of penetration, and utility crossings. Drilling logs shall be accurate to facilitate the production of as built drawings. Record Drawings shall contain "x, y, z" locations of the pipe no further than 5' apart. Six (6) copies of the drilling logs shall be provided to the Authority.
- I. The minimum radius of curvature of any drilling operation shall be limited to 100 times the diameter of the drill pipe, or the diameter of the product line, whichever is larger.
- J. All drilling operations shall include reaming of the pilot hole prior to installation of the product line. The pilot hole shall be reamed to a minimum size of 1.5 times the outside diameter of the product line. Reamer shall be chosen to match the soil conditions encountered.
- K. A wireline steering tool system shall be used for all drilling over 500', or drilling beneath a water course. Short, shallow drilling operations may be guided via a walkover system subject to approval of the Engineer.
- L. The driller shall use two-way radio or cellular phone communication between the drill rig operator and the pipe pull-back crew to assure that the pipe begins moving immediately upon the operator's commencement of the pull-back operation.

- M. The drill pipe shall be connected to the product line using a pull head or pulling eye and swivel. A reamer shall be placed between the drill pipe and pull head to insure that the hole stays open during the pull-back.
- N. The Developer shall use a minimum safe pull strength commensurate with the approved HDPE pipe type safe pulling limitations.
- O. Contractor shall provide all necessary rollers to accommodate movement of the pipe aboveground during the pull-back operation. Developer shall provide necessary means (i.e. scaffold mounted rollers with a minimum vertical clearance of 14') to maintain access roads and driveways during the pull-back operations.
- P. All restoration for pits, service access, etc. shall be in accordance with Division 2 of these specifications and any superseding permit requirements. Following the drilling operations, the Developer will demobilize his equipment and remaining materials and restore disturbed areas to pre-construction condition. All excavations will be backfilled using the excavated native soils and placed in the stratum they were found then compacted to 95% of their dry density. All landscaping disturbed during construction shall be restored to preconstruction condition. Refer to planting and seeding specifications. All mud shall be removed from site and disposed of properly by the Developer.
- Q. All facilities shall be installed in such a way that their location can be readily determined by electronic detection after installation. For non-conductive installations, this shall be accomplished by attachment of a continuous conductive material either externally or integrally with the product. A solid AWG #8 copper coated wire line shall be used. Any break in the conductor must be connected by an approved electrical clamp and coated with rubber or plastic insulator to maintain the integrity of the connection from corrosion. Developer will verify conductivity of electronic detection material after HDD operation is completed and complete any repairs or replacements.

3.05 FIELD QUALITY CONTROL

- A. General Requirements: Conduct all hydrostatic and appropriate alignment testing specified in Section 02610 to the Authority's satisfaction in the presence of the Authority's Engineer.
 - 1. Provide tools, materials (including water), apparatus and instruments necessary for pipeline testing.
- B. Cleaning Prior to Tests: Before tests are conducted, clean piping including sewers, branches and service connections until free of dirt or silt or construction debris.

3.06 PIPING SCHEDULE

DESCRIPTION	PIPE MATERIAL	JOINT TYPE
Low Pressure Sewers	HDPE SDR 9	Compression, Electrofusion, Butt Fusion
	PVC C-900 Class 200	Gasketed bell and spigot push-on joints

END OF SECTION

DIVISION 2 – SITE WORK SECTION 02661 - TRACER TAPE & WIRE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work Included:

- 1. A magnetic detectable tracer tape and No. 14 coated copper wire shall be installed in the same trench with every non-metallic wastewater forcemain.
- 2. The Developer shall supply all labor, materials, tools, and equipment required to furnish and install in good workmanlike manner the magnetic locating tape as specified herein.

B. Related Work:

1. All applicable Divisions of the Technical Specifications.

PART 2 - PRODUCTS

2.01 MATERIAL

A. All detector tape shall be at least 3" wide, shall be detectable with conventional pipe location equipment, and shall be color coded on both sides in accordance with the following schedule:

<u>Type of Service</u> <u>Color</u> <u>Legend (if required)</u>
Wastewater Forcemain Green Buried Sewer Line Below

2.02 MANUFACTURER

A. Detector tape shall be Alarm Tape, Terra Tape, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. For sewer lines, the detector tape shall be continuous and installed in the trench approximately 18" below the final grade.

END OF SECTION

DIVISION 2 – SITE WORK SECTION 02740 – FLEXIBLE PAVEMENT

PART 1 - GENERAL

1.01 **RELATED DOCUMENTS**

Α. Standard Detail Drawings apply to this Section.

1.02 SECTION INCLUDES

- A. Hot-mix asphalt paving.
- B. Hot-mix asphalt patching.
- C. Hot-mix asphalt paving overlay.
- D. Pavement-marking paint.
- E. Cold milling of existing asphalt pavement.

1.03 **REFERENCES**

- The "PennDOT Sections" noted herein refer to sections contained in the current Α. Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented or revised. 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.
- B. Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, latest edition.
 - 1. PennDOT Section 210 Subgrade.
 - PennDOT Section 309/409 Superpave Asphalt Mix Design, Standard 2. Construction, HMA Base Course.
 - 3. PennDOT Section 350 Subbase.
 - PennDOT Section 401 Plant Mixed HMA Courses. 4.
 - 5. PennDOT Section 409 Superpave Mixture Design, Standard & RPS Construction of Plant-Mixed HMA Courses.
 - 6. PennDOT Section 460 Bituminous Tack Coat.
 - 7. PennDOT Section 470 Bituminous Seal Coat.
 - PennDOT Section 480 Bituminous Surface Treatment. 8.
 - 9. PennDOT Section 491 Milling of Bituminous Pavement Surface.

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- 10. PennDOT Section 703 Aggregates.
- 11 PennDOT Section 704 Cement Concrete.
- 12. PennDOT Section 962 Painting Traffic Lines and Markings.
- C. Commonwealth of Pennsylvania Department of Transportation Bulletin 25.
- D. Commonwealth of Pennsylvania Department of Transportation Bulletin 27.
- E. Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities, as supplemented or revised.
- F. Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 213, Work Zone Traffic Control.
- G. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- H. Street: Unless otherwise specifically qualified herein, the term "Street" as used in this Section shall be understood to mean a street, highway, avenue, boulevard, road, alley, lane, driveway, parking lot, or any other area used as a way for vehicles.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by PennDOT.
- B. Regulatory Requirements: Comply with Publication 408 PennDOT for asphalt paving work.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the weather conditions listed in PennDOT Publication 408 are not met.

B. Protection:

- 1. Protect paved surfaces outside of the pavement removal limits. Repair pavement outside removal limits damaged by constructing operations.
- 2. Use all means necessary to protect and maintain pavement materials before, during, and after installation. Protect installed work and materials of all other contractors.

C. Environmental Requirements:

- 1. Do not install aggregate courses when ambient temperature is below or is expected to fall below freezing.
- 2. Do not use aggregate containing frost nor place aggregate courses on frozen subgrade.
- 3. Terminate placement of bituminous concrete surface courses of permanent pavement between October 15 and 31, and do not resume placement prior to April 1 to 15, interim days between date limits may be used for placement as determined by the Township Engineer depending upon weather conditions.
- 4. Do not place bituminous concrete surface courses of permanent pavement when the ambient temperature is 40° F or lower; not when the temperature of the pavement, base or binder on which it is to be placed is 40° F or lower.

PARTS 2 - PRODUCTS

2.01 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations and are PennDOT approved.
- B. Coarse Aggregate: PennDOT Section 703.2.
- C. Fine Aggregate: PennDOT Section 703.1.
- D. Mineral Filler: PennDOT Section 703.1(c).
- E. Aggregate Subbase: Limestone PennDOT 2A Section 703.1(c), Type C stone or better meeting the sieve requirements of PennDOT 2A.

2.02 ASPHALT MATERIALS

- A. Asphalt Cement: PG 64-22 conforming to PennDOT Bulletin 25.
- B. Asphalt Rubber Sealing Compound: Conforming to PennDOT Bulletin 25.
- C. 25mm Superpave Asphalt Mix Design, HMA Base Course: Conforming to PennDOT Section 309; mixture limited to asphalt cement.
- D. Bituminous Tack Coat: Class E-1, E-6 or E-8 emulsified asphalt conforming to PennDOT Bulletin 25.
- E. 19mm Superpave Binder Course: Superpave Mix Design, HMA Courses conforming to PennDOT Section 409.

- F. Bituminous Wearing Course: Hot mixed, hot laid, 9.5mm Superpave Wearing Course (SRL-L), or as appropriate based on proper pavement design conforming to PennDOT Section 409.
- G. Bituminous Surface Treatment: Two (2) applications of bituminous material each followed by application of coarse aggregate conforming to PennDOT Section 480.
- H. Bituminous Seal Coat: Single application of bituminous materials followed by application of aggregate conforming to PennDOT Section 470.

2.03 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by PennDOT; designed according to procedures in Al MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Leveling Course: Section 400 of PennDOT Publication 408.
 - 3. Base Course: Bituminous Concrete Base Course Section 309 & Section 409 of PennDOT Publication 408.
 - 4. Surface Course: 9.5mm Superpave HMA Wearing Course.

2.04 TRAFFIC PAINT

A. Traffic Paint: State Highways and Township Roads: Conforming to PennDOT Section 962.2 (b).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated. Complete in accordance with PennDOT Section 491.

1. Repair or replace curbs, manholes, and other construction damaged during cold milling.

3.03 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12" into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Re-compact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillage and clean affected surfaces.
- C. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.04 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1" in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3" thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4".
 - 1. Clean cracks and joints in existing asphalt pavement.
 - 2. Use hot-applied joint sealant to seal cracks and joints more than ¼" wide. Fill flush with surface of existing pavement and remove excess.

3.05 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

- B. Tack Coat: Prior to overlay of existing pavement, apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
 - 3. Tack coat shall only be placed at a maximum of 50 lineal feet ahead of the paver at any given time.

3.06 HOT-MIX ASPHALT PLACING

A. All paving must conform to Section 309.3, or 409.3 of PennDOT Publication 408.

3.07 JOINTS

A. Construct joints ensure a continuous bond between adjoining paving sections. Construct joints shall be free of depressions with same texture and smoothness as other sections of hot-mix asphalt course. All joints shall be constructed according to Section 401 of PennDOT Publication 408.

3.08 SEALING

- A. When wearing course is placed against existing pavement, notches, curbs, inlets, or utility openings, seal joint with hot, bituminous material of the class and type designated for the wearing course (PG 64-22). Apply sealant evenly and extend 3" in both directions from joint, in a straight line creating a neat appearance. Prior to sealing, clean and remove harmful material from the area to be sealed. Control the application rate so residual asphalt completely fills surface voids and provides a watertight joint. If necessary, apply emulsified asphalt, in two (2) or more applications. Remove excess bituminous material. Immediately cover with a light application of acceptable dry sand.
- B. Joints sealed with PG 64-22 must be resealed six (6) months after initial sealing.

3.09 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185° F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness.

- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 98% of reference laboratory density according to AASHTO T 245, but not less than 94% nor greater than 100%.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus ½".
 - 2. Surface Course: Plus 1/4", no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10' straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4"
 - 2. Surface Course: 1/8"
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4".

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Developer will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

- 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements in PennDOT Publication 408 Section 401.3.
- 2. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041 and compacted according to job-mix specifications.
- 3. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D 2726.
 - a. Full depth replacement or new paving: One (1) core sample will be taken for every 1000 sq. yd. Or less of installed pavement, with no fewer than three (3) cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
 - i. Use for milled and overlayed pavement area.
- B. Remove and replace placed asphalt material where test results or measurements indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Developer's expense, will be performed to determine compliance of replaced or additional work with specified requirements as required by the Township or Authority.

3.12 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in accordance with Federal, State & local regulations. Do not allow excavated materials to accumulate on-site.

END OF SECTION

DIVISION 2 - SITE WORK SECTION 02937 - FINISH GRADING, SEEDING, AND SODDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Restoration of disturbed, non-paved areas including the following:
 - 1. Placing topsoil
 - 2. Soil conditioning
 - 3. Finish grading
 - 4. Seeding
 - 5. Sodding
 - Maintenance

1.02 REFERENCES

- A. American Association of State Highways and Transportation Officials (AASHTO).
 - 1. Pennsylvania Department of Transportation Publication 408 Specifications.
 - 2. Pennsylvania Seed Act of 1965, Act 187, as amended.
 - 3. Agricultural Liming Materials Act of 1978, P.L. 15, No. 9 (3 P.S. 132-1), as amended.
 - 4. 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.
 - 5. Rules for Testing Seeds of the Association of Official Seed Analysts.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Seed:

 Deliver seed fully tagged and in separate packages according to species or seed mix. Seed that has become wet, moldy, or otherwise damaged in transit or storage shall be rejected.

B. Sod:

 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.

2. 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.

1.04 PROJECT CONDITIONS

A. Restore non-paved surfaces to a condition similar to that prior to excavation. Where areas rough or uneven exist, the Developer shall grade the surface level and install topsoil, seed, fertilize and mulch or sod as specified herein.

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.
- E. Topsoil shall be screened.

2.02 FERTILIZER

A. Fertilizer:

1. Analysis 10-20-20 and as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.

2.03 LIME

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

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 nine (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.
- B. For seeding work on public right-of-ways or for work on land not owned by Developer but affected/disturbed by construction of said project, use Penn State B seed mix.

2.05 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.

2.06 MULCHING MATERIALS

- A. Mulches for seeded areas shall be one (1), 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: $98.6\% \pm 0.2\%$ on the oven dry basis.

Ash content: $1.4\% \pm 0.2\%$

Minimum Water-Holding Capacity: 100%

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

2.07 SOD

- A. At least three (3) 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 seedbed preparation may commence as soon after February 15 as ground conditions permit.
- B. Fall Seeding:
 - 1. Preliminary operations for seedbed 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. Handrake 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. Handrake 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 4".
- B. Handrake 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.

FERTILIZING 3.04

A. 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".

B. Basic Fertilizer:

- Distribute basic fertilizer uniformly at a rate of 50 pounds per 1,000 square 1.
- 2. Incorporate into soil to depth of 4" by approved methods.
- 3. Incorporate as part of tillage operation.
- C. Liming and Fertilizer rates may be decreased if lesser rates are indicated by soil tests provided by the Developer.

3.05 **FINISH GRADING**

- Remove unsuitable material larger than 2" in any dimension. Α.
- 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. Rerake.
- D. Incorporate starter fertilizer into the upper 1" of soil.

3.06 **SEEDING**

- Uniformly sow specified seed mix by use of approved hydraulic seeder, power-drawn Α. 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 reraking or approved mechanical methods.

3.07 MULCHING

- Α. 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.

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- 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 ½" or to the depth indicated on the drawings.
- 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' or less along the perimeter of the mulched area.
 - 3. Do not spray asphalt and chemical mulch binders onto any area within 100' of a stream or other body of water.

3.08 SODDING

- A. Prior to sod placement, complete soil preparation or topsoiling.
- 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 ensure 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 one (1) wood stake for each 2 square feet of sod. Stakes shall be ½" 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 or grass within 14 days of seeding or sodding shall be reseeded or resodded until complete grass catch occurs.
- C. Mow sod in the field to a height of not more than 2-1/2" within 5 days prior to lifting.
- D. Cut sod to a depth equal to the growth of the fibrous roots, but in no case less than 1-1/2", exclusive of grass and thatch. Do not cut sod when the ground temperature is below 32°F.

END OF SECTION

DIVISION 3 - CONCRETE SECTION 03100 - CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
- B. Openings for other work.
- Form accessories.
- D. Form stripping.

1.02 RELATED SECTIONS

A. Section 03301 – Cast-in-Place Concrete.

1.03 REFERENCES

- A. ACI 117 Standard Tolerances for Concrete Construction and Materials.
- B. ACI 301 Structural Concrete for Buildings.
- C. ACI 318 Building Code Requirements for Reinforced Concrete.
- D. PS 1 Construction and Industrial Plywood, U.S. Department of Commerce.

1.04 DESIGN REQUIREMENTS

A. Design, engineer, and construct formwork, shoring, and bracing to conform to code requirements; resultant concrete to conform to required shape, line, and dimension.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with ACI 117, 301, and 318.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable codes for design, fabrication, erection, and removal of formwork.

1.07 COORDINATION

A. Coordinate this Section with other sections of work, which require attachment of components formwork, and with all other prime contracts requiring embedment or attachment to formwork.

PART 2 - PRODUCTS

2.01 WOOD FORM MATERIALS

- A. Plywood for Finish Concrete Exposed to View:
 - 1. Conform to U.S. Product Standard PS-1, B-B Plywood for Concrete Forms, Class I, exterior grade, sound undamaged sheets with clean, true edges. Each piece shall bear legible inspection mark.
 - 2. Use largest practicable sizes to minimize number of joints.
 - 3. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Plywood for Finish Concrete Not Exposed to View: Conform to U.S. Product Standard, PS-1, C plugged, exterior grade, sound sheets.
- C. Lumber: Sound members of sufficient size and strength to support intended weight, straight edges for tight fit.

2.02 PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
- C. Tubular Column Type:
 - 1. Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable.
 - 2. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

2.03 FORMWORK ACCESSORIES

- A. Form Ties: Removable or Snap-off type, 2" from surface, adjustable length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1½" in concrete surface.
- B. Form Release Agent: Colorless mineral oil which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Corners: Chamfer, rigid plastic or wood strip type; 1" x 1" size; maximum possible lengths.

- D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- E. Waterstops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50° F to plus 175° F working temperature range, 6" wide, 3/8" thick, maximum possible lengths, ribbed profile preformed corner sections, heat welded jointing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and center before proceeding with formwork. Ensure that dimensions agree with the approved project drawings.

3.02 EARTH FORMS

A. Earth forms are not permitted.

3.03 ERECTION - FORMWORK

- A. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Construct forms to produce concrete of sizes, shapes, lines, and dimensions shown, and obtain accurate alignment, location, grades, level, and plumb work in finished structures.
- C. Provide for openings, offsets, sinkages, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work.
- D. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of concrete.
- E. Provide form ties so the portion remaining within concrete after removal is at least 1½" inside concrete, and will not leave holes larger than 1" in diameter in concrete surface.
- F. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- G. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- H. Align joints and make watertight. Keep form joints to a minimum.
- I. Obtain approval before framing openings in structural members which are not indicated on Drawings.

J. Provide chamfer strips on all external corners to produce uniform smooth lines and tight edge joints.

3.04 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. If steel forms are used, use non-straining, rust preventative form oil. Rust stained steel formwork is not acceptable.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections and other prime contracts in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Install waterstops continuous without displacing reinforcement. Seal joints watertight.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

- A. Clean forms as erection proceeds to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through cleanout ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing slats. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.08 FIELD QUALITY CONTROLS

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.09 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the Work, may be removed after curing at no less than 50° F for 12-hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and providing curing and protection operations are maintained.
- C. Formwork supporting weight of concrete, such as beam soffits, joints, slabs, and other structural elements, may not be removed in less than seven (7) days or until concrete has attained a minimum compressive strength of 2,500 psi, whichever occurs later. Determine potential compressive strength of in-place concrete by testing field-cured specimen's representative of concrete location or members. The costs of testing to verify the minimum compressive strength is achieved shall be borne by Developer. If no testing is undertaken, forms may not be removed for 14 days.
- D. Form facing material may be removed four (4) days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.
- E. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- F. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

3.10 FORM REUSE

A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces.

- B. Apply new form coating compound as specified for new formwork.
- C. 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.
- D. Do not use "patched" forms for exposed concrete surfaces.

END OF SECTION

DIVISION 3 - CONCRETE SECTION 03301 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED WORK

1. All applicable Divisions of the Technical Specifications.

1.02 QUALITY ASSURANCE

- A. Testing Agency: Meeting requirements of The American Society for Testing and Materials Recommended Practice for Inspection and Testing Agencies for Concrete and Steel in Construction ASTM E 329.
 - 1. Submit to the Authority for approval the name of the Testing Agency proposed for laboratory testing of concrete work.

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials, AASHTO M 182 Burlap cloth made from Jute or Kenaf.
- B. American Concrete Institute:
 - 1. ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
 - 2. ACI 301, Specifications for Structural Concrete for Buildings.
 - 3. ACI 304R, for Measuring, Mixing, Transporting and Placing Concrete.
 - 4. ACI 305R, Hot Weather Concreting.
 - 5. ACI 306R, Cold Weather Concreting.
 - 6. ACI 308, Standard Practice for Curing Concrete.
 - 7. ACI 318, Building Code Requirements for Structural Concrete.
 - 8. ACI 350R, Environmental Structures.
- C. American Society for Testing and Materials.
 - 1. ASTM C 31, Standard Method of Making and Curing Concrete Test Specimens in the Field.
 - 2. ASTM C 33, Specification for Concrete Aggregates.
 - 3. ASTM C 39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

- 4. ASTM C 42, Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- 5. ASTM C 94, Standard Specification for Ready-Mixed Concrete.
- 6. ASTM C 143, Standard Test Method for Slump of Portland Cement Concrete.
- 7. ASTM C 150, Standard Specification for Portland Cement.
- 8. ASTM C 156, Test Method for Water Retention by Concrete Curing Materials.
- 9. ASTM C 171, Standard Specification for Sheet Materials for Curing Concrete.
- 10. ASTM C 172, Standard Method of Sampling Freshly Mixed Concrete.
- 11. ASTM C 173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- 12. ASTM C 231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- 13. ASTM C 260, Standard Specification for Air-Entraining Admixtures for Concrete.
- 14. ASTM C 309, Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete.
- 15. ASTM C 494, Standard Specification for Chemical Admixtures for Concrete.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cement:
 - Portland Cement: ASTM C 150, Type II.
- B. Concrete Aggregates: ASTM C 33. Do not use aggregates containing spalling-cowing, deleterious substances.
- C. Water: Potable quality, free from deleterious amounts of acids, alkalis, and organic substances.
- D. Concrete Admixtures:
 - 1. Calcium Chloride: Not permitted.

- 2. Provide admixtures produced and serviced by established, reputable manufacturers and use in compliance with manufacturer's recommendations.
- 3. Air-Entraining Admixture: Use a product conforming to requirements of ASTM C 260.
- 4. Water-Reducing Admixture: Use a product conforming to requirements of ASTM C 494 Type A and that contains less than 0.1% chloride ion.
- 5. Water-Reducing and Retarding Admixture: Use a product conforming to requirements of ASTM C 494 Type D and that contains less than 0.1% chloride ion.
- 6. Water-Reducing and Accelerating Admixture: Use a product conforming to requirements of ASTM C 494 Type E and that contains less than 0.1% chloride ion.
- E. Curing Materials: Use curing materials that will not stain or affect concrete finish or lessen the concrete strength and comply with the following requirements:
 - 1. Burlap: Use materials conforming to AASHTO M 182.
 - 2. Sheet Materials: Use material conforming to ASTM C 171.
 - 3. Liquid Membrane-Forming Compounds: ASTM C 309, Type 1, free of wax or other adhesive bond breaking ingredients, such as Master Builders MASTERSEAL 66; L & M Construction Chemicals, Inc. DRESS & SEAL; or equal.
- F. Epoxy Bonding Compound: Use product such as A. C. Horn, Inc. EPOXTITE BINDER; Sika Chemical SIKADUR-HI-MOD or equal.

2.02 CONCRETE QUALITY

- A. Developer Note: In general, provide normal weight concrete having the following 28-day compressive strengths as indicated on drawings or specified herein.
 - 1. 4000 psi 28 day compressive strength: Use for all structures and cast-inplace base and walls.
 - 2. 3000 psi 28 day compressive strength: Use for pipe cradles, thrust blocks and flushing station pads.
 - 3. 2000 psi 28 day compressive strength: Use for pipe anchors and pipe encasement.
- B. Selection of Proportions for Normal weight Concrete: ACI 211.1.
- C. Proportions of Ingredients: Establish proportions on the basis of field experience, with the materials specified herein.

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- 1. Field Experience: ACI 301, Method 2 and ACI 318.
- D. Water-Cement Ratio: Maximum permissible water-cement ratio will be as follows:
 - 4000 psi concrete maximum w/c = 0.43.
 - 3000 psi concrete maximum w/c = 0.50.
 - 2000 psi concrete maximum w/c = 0.66.
- E. Minimum Cement Content:
 - 4000 psi concrete: 610 pounds minimum per cubic yard.
 - 3000 psi concrete: 564 pounds minimum per cubic yard.
 - 2000 psi concrete: 395 pounds minimum per cubic yard.

2.03 ADMIXTURES

- A. Add air-entraining agency to normal weight concrete mix for work exposed to exterior. Design the mix to have an air content of 6 + 1%.
- B. Water-Reducing Admixture: Unless high temperatures occur and/or placing conditions dictate a change, all concrete shall contain the water-reducing admixture.
- C. Water-Reducing and Retarding Admixture: When high temperatures occur and/or placing conditions dictate, the Developer may change from the water-reducing admixture (Type A) to a water-reducing and retarding admixture (Type D).
- D. Water-Reducing and Accelerating Admixture: When low temperatures occur and/or placing conditions dictate, the Developer may change from the water-reducing admixture (Type A) to a water-reducing and accelerating admixture (Type E).
- E. Slump: Proportion and produce concrete to have a slump, not to exceed 4" if consolidated by vibration. Slump, not to exceed 5" if consolidated by rodding, spading or other manual methods.
- F. Coarse Aggregate Size: maximum size of coarse aggregate shall not exceed:
 - 1. 1/5 narrowest dimension between sides of forms within which concrete is to be cast.
 - 2. 1/3 the slab or mass concrete thickness.

PART 3 - EXECUTION

3.01 GENERAL

- 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.

- Apply Epoxy Bonding Compound over prepared surfaces of embedded items 1. where required under other Sections of these Specifications.
- C. Production of Concrete (Ready-Mixed):
 - 1. Batched, mixed and transported in accordance with ASTM C94.
 - 2. 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.

3.02 **PLACING**

- Α. General: Conduct placement work in accordance with ACI 304.
- B. Preparation:
 - 1. Prepare formwork in advance and remove snow, ice, water and debris from within forms.
 - 2. Sprinkle subgrades sufficiently to eliminate water loss from concrete.
 - 3. Do not place concrete on frozen ground.

C. 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 approval of the Authority.

D. Depositing:

- 1. Do not allow concrete to drop vertically more than 4'.
- 2. Deposit in approximately horizontal layers of 12" to 18".
- 3. Do not allow concrete to flow laterally more than 3'.
- 4. Make placement continuously to produce monolithic unit.
- Carry on placing at such a rate that concrete which is being integrated with 5. fresh concrete is still plastic.
- 6. Do not deposit concrete on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within sections.

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- 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.

E. Consolidation:

- Consolidate concrete by mechanical vibration equipment, supplemented by 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.
- F. Cold Weather Concreting: In general, perform cold weather concrete work in accordance with ACI 306R; additional requirements as follows:
 - 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.
- G. Hot Weather Concreting: In general, perform hot weather concrete work in accordance with ACI 305R; additional requirements as follows:
 - 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.

Make provisions for windbreaks, shading, fog spraying, sprinkling or wet 3. cover when necessary.

3.03 **FINISHING**

- A. General: Finish exposed concrete surfaces true and even, free from open or rough areas, depressions or projections. In vertical pours, place concrete to the required elevation, and strike-off with a straight edge and float surface to a level plane.
 - 1. Comply with section requirements or PennDOT standards.

3.04 **CURING AND PROTECTION**

- Α. General: Immediately after placement, protect concrete from premature drying, excessive hot or cold temperatures and mechanical injury. Curing shall be by either water curing or sealing methods in accordance with ACI 308. Cure concrete continuously for a minimum of seven (7) days at ambient temperatures above 40° F.
- B. Hot Weather Curing: See Hot Weather Concreting this Section.
- C. Cold Weather Curing: See Cold Weather Concreting this Section.
- D. Application Rate of Liquid Membrane-Forming Compounds: Compound shall restrict the loss of water to not more than 0.055 q/sq. cm of surface in 72-hours when tested in accordance with ASTM C 156.

3.05 FIELD QUALITY CONTROL

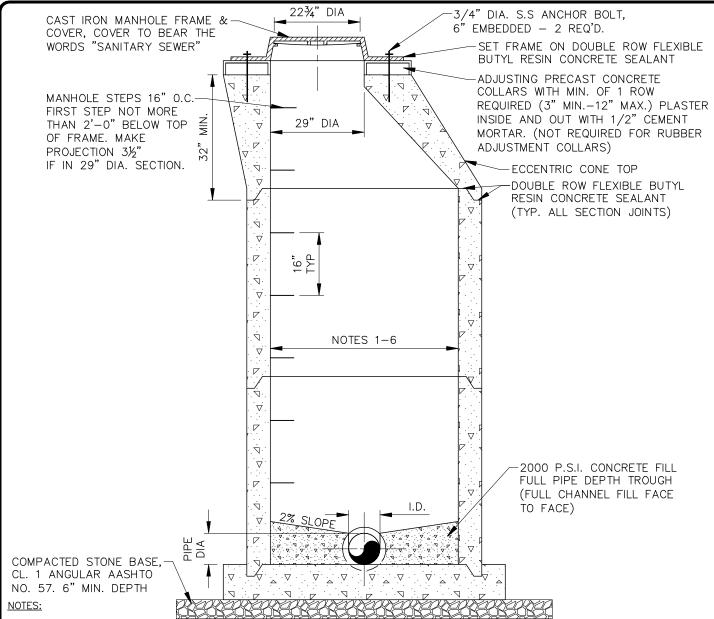
- Α. Testing and Inspection: As required, perform field testing in accordance with ACI 301 and the following requirements:
 - 1. Secure composite sample in accordance with ASTM C 172.
 - 2. Mold and cure six test specimens for each strength test in accordance with ASTM C 31.
 - 3. Test specimens in accordance with ASTM C 39. Test two (2) specimens at seven (7) days, two (2) at 28 days, and retain two (2) specimens in reserve for later testing if required.
 - 4. Make one (1) strength test for each 50 cu. yd. of concrete but not less than one (1) test for each structure.
 - 5. Make slump tests for each strength test and whenever consistency of concrete appears to vary in accordance with ASTM C 143.
 - 6. Make air content test for each strength test in accordance with ASTM C 231 or ASTM C 173 except if aggregate with high absorptions are used. use the latter test method.

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B. Evaluation and Acceptance:

- 1. The strength level of the concrete will be considered satisfactory if the averages of all sets of three (3) consecutive strength test results equal or exceed specified strength and no individual test result is below specified strength by more than 500 psi.
- 2. If the strength of cylinders falls below specified compressive strengths, the Authority shall have the right to order a change in the mix proportions for the remaining concrete being poured.
- 3. If required by the Authority, obtain and test core specimens from hardened concrete in accordance with ASTM C 42.

END OF SECTION



- 1. EXCEPT AS NOTED ALL STANDARD MANHOLE FRAMES AND COVERS SHALL BE JAMESTOWN IRON WORKS, INC. FRAME AND COVER PATTERN No's. 42-7 AND 42A RESPECTIVELY. WATERTIGHT MANHOLES DESIGNATED AS "WT" SHALL BE JAMESTOWN IRON WORKS, INC FRAME AND COVER PATTERN No's. 44 AND 44A RESPECTIVELY.
- 2. ALL PRECAST CONCRETE SHALL BE REINFORCED IN ACCORDANCE WITH THE LATEST REVISIONS OF A.S.T.M. DESIGNATION C-478; ALL PRECAST CONCRETE SECTIONS SHALL BE MANUFACTURED AND FURNISHED AS SOLID SECTIONS WITHOUT LIFT HOLES OF ANY KIND.
- 3. INTERIOR THOROSEAL INSIDE OF SANITARY MANHOLES ONLY, FULL DEPTH. (ANY COLOR BUT GRAY). ALL JOINTS AND CONNECTIONS TO BE PLUGGED WATER-TIGHT.

EXTERIOR - 16 MIL. COAL TAR EPOXY EXTERIOR COATING.

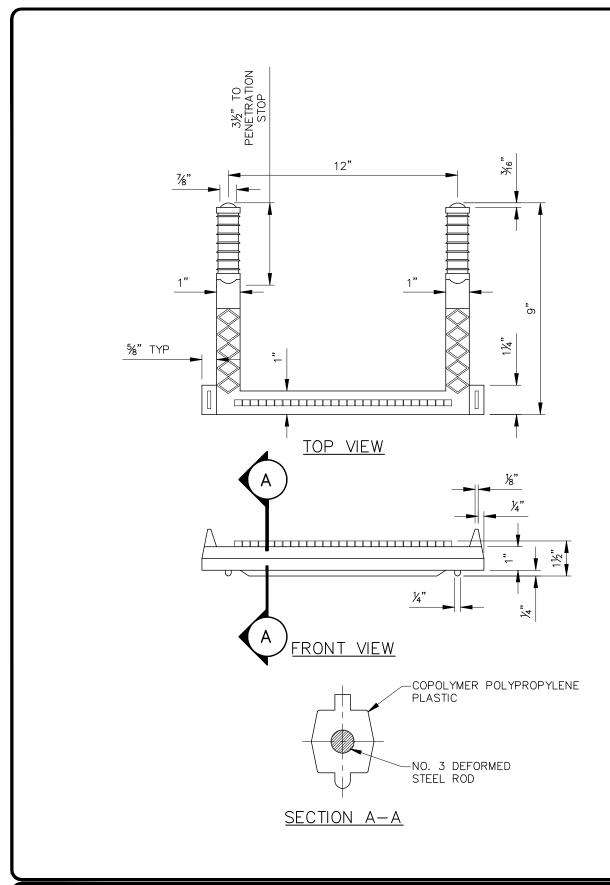
- 4. ALL MANHOLE FRAME TOPS SHALL BE ADJUSTED TO MATCH SURROUNDING FINISH GRADE UNLESS OTHERWISE SPECIFIED.
- 5. ABANDONED (ABD) MANHOLES FILL TROUGH & BASE WITH 2000 P.S.I. CONCRETE TO 4" ABOVE CROWN OF PIPES. REMOVE CONE SECTION, FRAME AND COVER. BACKFILL WITH B-19 PENNDOT No. 2A TYPE A OR C AND COMPACT TO 100% MAX. DENSITY. RESTORE SURFACE OF ROAD OR LAWN CONDITION AS APPROPRIATE FOR LOCATION.
- 6. WHERE MANHOLE DEPTH IS LESS THAN OR EQUAL TO 15'-0", MANHOLE DIAMETER SHALL BE 48". WHERE MANHOLE DEPTH EXCEEDS 15'-0", MANHOLE DIAMETER SHALL BE 60" AND APPROVED BY AUTHORITY.
- 7. CONSTRUCT TROUGH WITH A 0.1-FOOT GRADE FROM INLET TO OUTLET.

STANDARD TYPE 'A' ECCENTRIC MANHOLE (24" I.D. OR LESS) FOR HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-1

HARBORCREEK TOWNSHIP

ERIE COUNTY

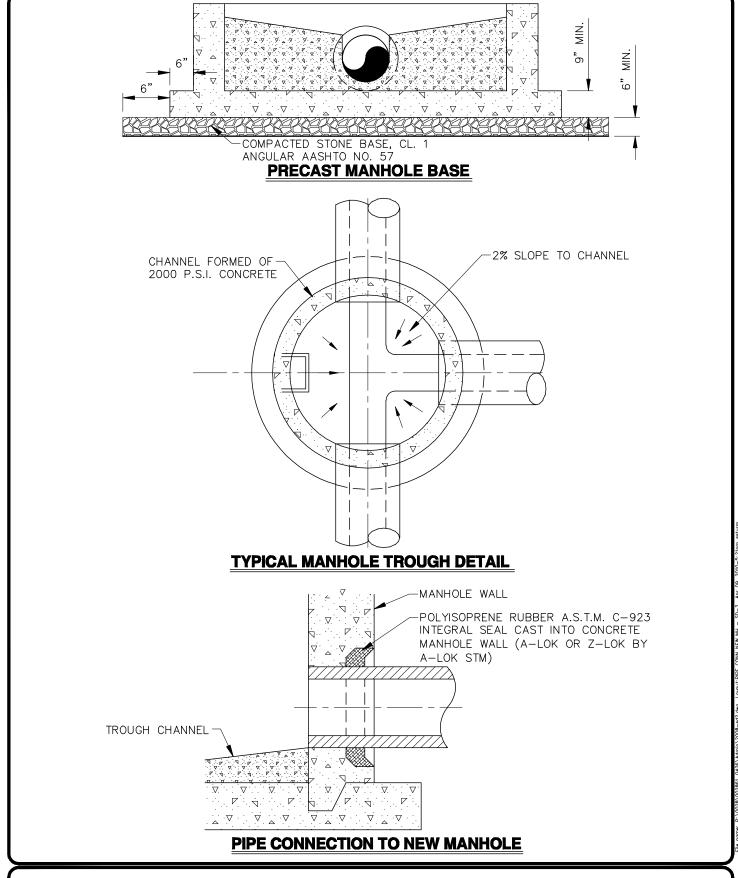


TYPICAL MANHOLE STEP DETAIL FOR HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-2

HARBORCREEK TOWNSHIP

ERIE COUNTY

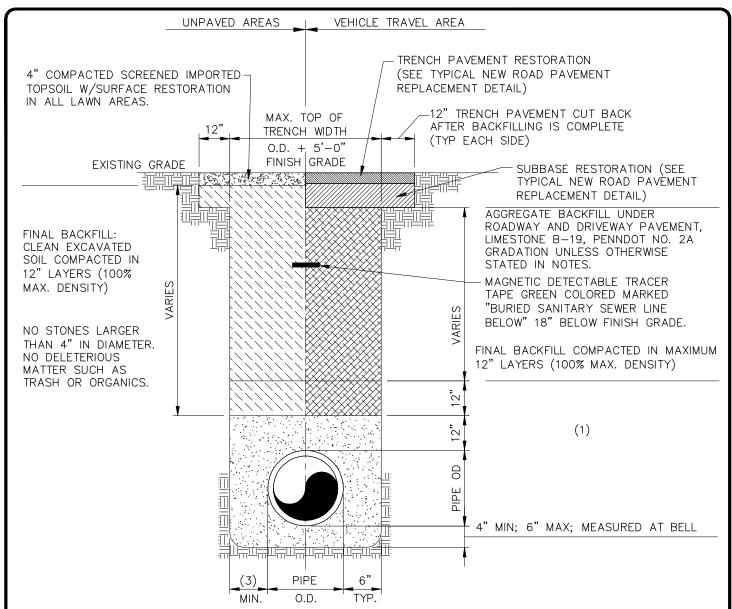


MANHOLE DETAILS FOR HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-3

HARBORCREEK TOWNSHIP

ERIE COUNTY



- 1. APPROVED BEDDING & BACKFILL: FLEXIBLE GRAVITY CONDUITS PVC & HDPE: PENNDOT TYPE 'C', AASHTO No. 57 OR 67 TO 12" ABOVE PIPE. PARTICLE SIZE SHALL BE SMALLER THAN RIBBED OPENING FOR RIBBED PVC OR HDPE USE EITHER AASHTO No.57 OR 67.
- 2. PRESSURE CONDUITS PVC (C-900), DIP: GRAVEL OR STONE (AASHTO No.67) SAND CLASS II OR III PENNDOT TYPE A TO 12" ABOVE PIPE.

RIGID CONDUIT RCP: GRAVEL OR STONE (AASHTO No.57 OR 67) TO 12" ABOVE PIPE CROWN O.D.

ALL PIPING: SLAG NOT PERMITTED. ALL BEDDING SHALL BE COMPACTED TO ITS MAXIMUM DRY.

ALL DIP TO BE ENCASED W/8 MIL PE

- 3. 6" MIN SIDE BEDDING EXCEPT IN STATE ROADS, USE 24" MINIMUM SIDE BEDDING.
- 4. COMPACTION LAYERS IN STATE ROADS SHALL CONFORM TO PENNDOT PUB 408. A MAXIMUM LIFT OF 8" IF VIBRATORY COMPACTED AND 4" MAXIMUM LIFT IF BY HAND OR MECHANICAL TAMPER.

TRENCH BACKFILL DETAIL FOR HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-4

HARBORCREEK TOWNSHIP

ERIE COUNTY

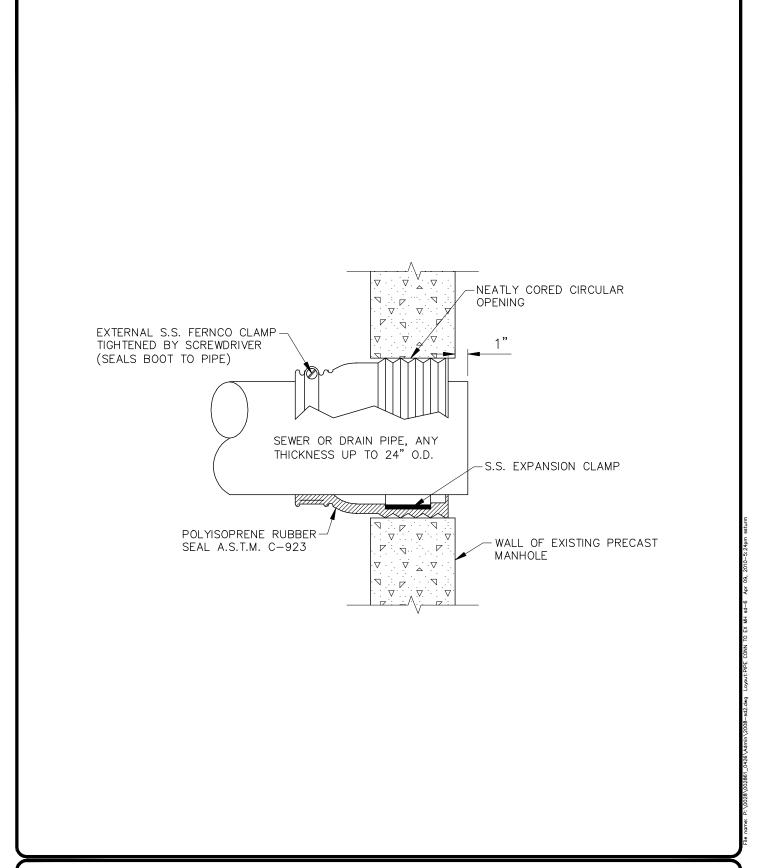
- 1. SUPERPAVE ASPHALT MIX DESIGN:
 HMA WEARING COURSE PG64-22, 0.3 TO 3.0 MILLION ESALs, 9.5MM MIX, SRL-L, OR AS REQUIRED BY PROPER PAVEMENT DESIGN
 HMA BINDER COURSE PG64-22, 0.3 TO 3.0 MILLION ESALs, 19MM MIX
 HMA BASE COURSE PG64-22, 0.3 TO 3.0 MILLION ESALs, 25MM MIX
- 2. PAINT FACE OF ALL CURBS, PAVEMENT NOTCHES, MANHOLES AND CATCH BASINS W/ PG 64-22.
- 3. SLOPE TRENCH PAVEMENT TO MATCH EXISTING PAVEMENT SURFACE SLOPE.
- 4. FOR ROAD PAVEMENT REPLACEMENT REQUIREMENTS ON ROADS NOT CLASSIFIED BY THE TOWNSHIP AS RESIDENTIAL, CONSULT WITH TOWNSHIP.

ROAD PAVEMENT REPLACEMENT DETAIL
FOR THE
HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-5

HARBORCREEK TOWNSHIP

ERIE COUNTY

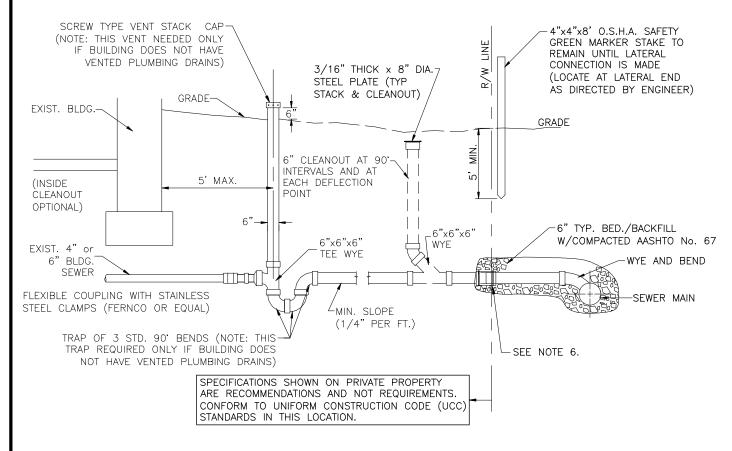


PIPE CONNECTION TO EXISTING MANHOLE FOR HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-6

HARBORCREEK TOWNSHIP

ERIE COUNTY



NOTES:

- 1. 6" DIA SDR 35 PVC PIPE MUST BE BEDDED AND SURROUNDED WITH FIRMLY PACKED AASHTO No. 67 ANGULAR STONE. THE BEDDING SHALL EXTEND 4" MIN. BELOW PIPE.
- 2. STONE BEDDING TO CROWN OF PIPE MAY BE DELETED FOR SCH. 40 PVC, DUCTILE IRON PIPE OR TRUSS PIPE AT THE DISCRETION OF THE AUTHORITY ENGINEER.
- 3. DO NOT DEFLECT PIPE TO ACHIEVE REQUIRED SLOPE, UTILIZE REQUIRED FITTINGS.

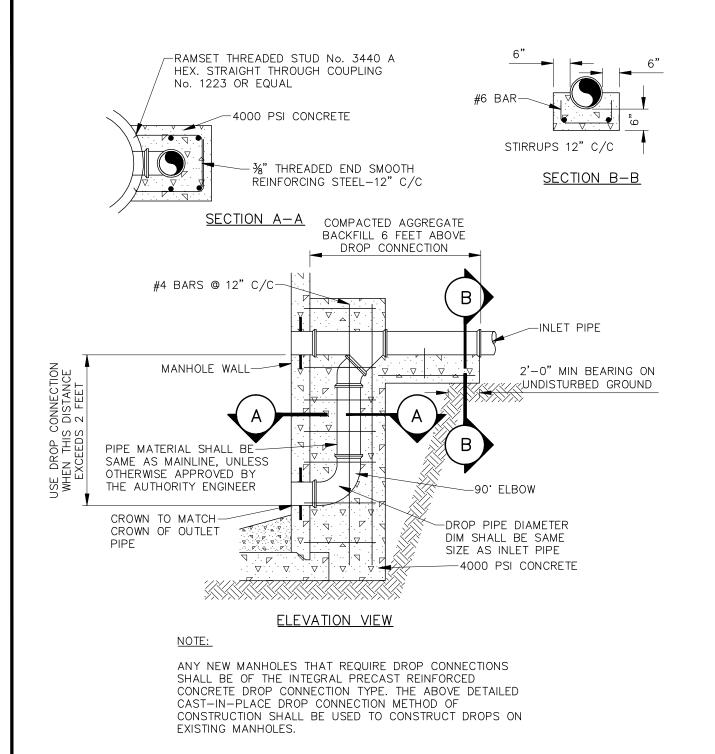
 4. ALL BACKFILL MATERIAL AND BACKFILL INSTALLATION PROCEDURES FROM WYE CONNECTION TO INSPECTION STACK TO CONFORM TO TRENCH BACKFILL DETAIL.
- 5. LATERALS SHALL BE INSTALLED FROM LATERAL WYE FITTING TO THE CONNECTION POINT
- AT A SPECIFIED GRADE MIN CONSTANT OF $\frac{1}{4}$ " PER 1'. 6. INSTALL SOLVENT WELD WATERTIGHT ENDCAP TO END OF 12" LONG STUB SECTION IF NO PRIVATE SEWER LATERAL EXISTS. IF PRIVATE SEWER LATERAL DOES EXIST, CONNECT TO NEW LATERAL AFTER APPROVAL FROM HARBORCREEK TOWNSHIP SEWER AUTHORITY.

BUILDING SEWER & LATERAL DETAIL FOR HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-7

HARBORCREEK TOWNSHIP

ERIE COUNTY



REINFORCED CONCRETE DROP MANHOLE CONNECTION DETAIL FOR HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-8

HARBORCREEK TOWNSHIP

ERIE COUNTY

INTERNAL RUBBER (ASTM C-923) MANHOLE
CHIMNEY SEAL W/S.S. TYPE 304 RING
FASTENERS. (CRETEX SPECIALTY PRODUCTS
OR APPROVED SUBSTITUTE). REQUIRED IN ALL
PAVED AREAS AND HIGH GROUND WATER AREAS.

29" DIA

48" DIA

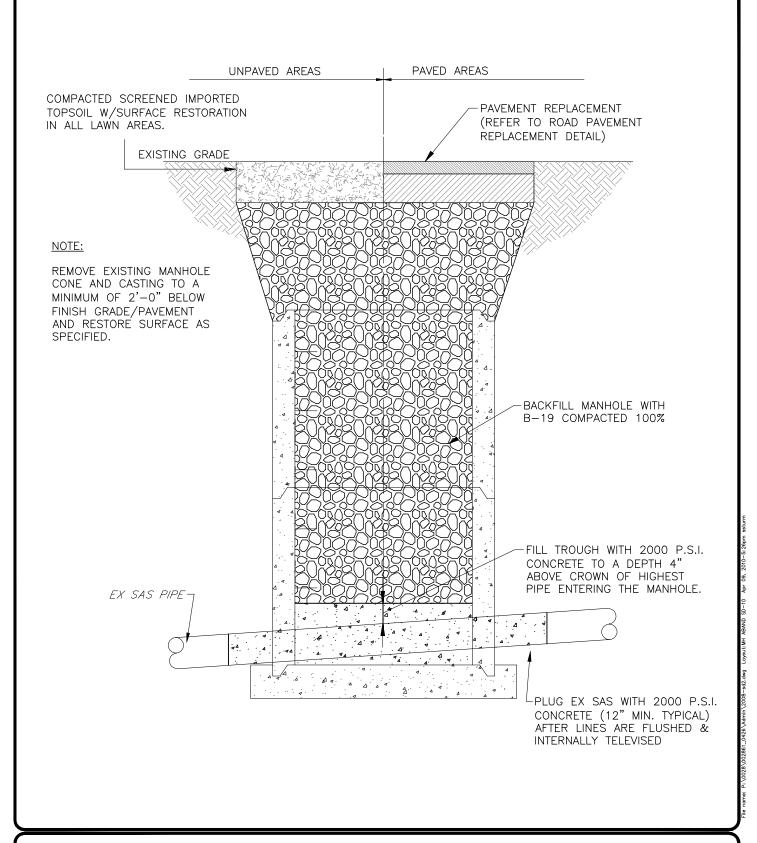
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PAVED AREA - MANHOLE COLLAR FOR HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-9

HARBORCREEK TOWNSHIP

ERIE COUNTY

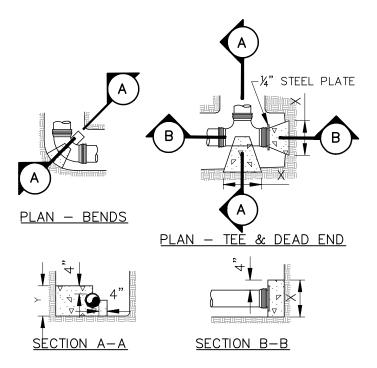


MANHOLE ABANDONMENT DETAIL FOR HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-10

HARBORCREEK TOWNSHIP

ERIE COUNTY



SIZING SCHEDULE BEARING FACE (x*y) IN SQUARE FEET CONCRETE VOLUME IN CUBIC YARDS												
PIPE SIZE	22 1/2 BEND			45' BEND			90. BEND			TEE or DEAD END		
	SOIL BEARING CAPACITY			SOIL BEARING CAPACITY			SOIL BEARING CAPACITY			SOIL BEARING CAPACITY		
	1000 PSF 3000 PSF 5000 PSF			1000 PSF 3000 PSF 5000 PSF			1000 PSF 3000 PSF 5000 PSF			1000 PSF 3000 PSF 5000 PSF		
4"	1.40	0.46	0.28	2.70	0.90	0.54	4.90	1.63	0.96	3.50	1.16	0.70
	0.14	0.09	0.06	0.12	0.06	0.06	0.14	0.09	0.06	0.12	0.08	0.06
6"	2.80	0.93	0.56	5.50	1.83	1.10	10.20	3.40	2.04	7.20	2.40	1.44
	0.15	0.10	0.07	0.15	0.10	0.07	0.22	0.14	0.09	0.17	0.11	0.07
8"	4.90	1.60	0.96	9.60	3.20	1.92	17.70	5.54	3.54	12.50	4.16	2.50
	.020	0.13	0.09	0.23	0.15	0.09	0.35	0.23	0.15	0.25	0.16	0.14
10"	7.90	2.63	1.99	15.70	5.23	3.14	28.90	9.60	5.78	20.40	6.80	4.08
	0.55	0.34	0.22	0.34	0.20	0.13	0.54	0.35	0.23	0.38	0.25	0.16
12"	11.30	3.76	2.26	22.30	7.43	4.46	41.10	13.70	8.22	29.10	9.70	5.82
	0.62	0.40	0.26	0.75	0.49	0.32	1.31	0.85	0.55	0.97	0.63	0.42
14"	15.30	5.10	3.06	30.20	10.06	6.04	55.80	18.60	11.16	39.50	13.16	7.90
	0.74	0.48	0.31	0.96	0.64	0.42	1.70	1.11	0.72	1.22	0.79	0.51
16"	19.80	6.60	3.96	39.10	13.03	7.82	72.20	24.06	14.44	51.10	17.03	10.22
	1.17	0.76	0.49	1.21	0.79	0.51	2.14	1.39	0.90	1.54	1.00	0.65

NOTES:

- 1. ALL CONCRETE BLOCKING MUST HAVE ITS ENTIRE FACE (X * Y) BEARING AGAINST UNDISTURBED SOIL AND ALL VERTICAL NON—BEARING SURFACES SHALL BE FORMED SO AS TO KEEP CONCRETE FROM JOINTS. BLOCKING DESIGN BASED ON COMBINED WORKING PRESSURE PLUS WATER HAMMER OF 240 P.S.I. AND BEARING CAPACITY OF SAND 1000 PSF, SAND AND GRAVEL 3000 PSF, AND SHALE 5000 PSF.
- 2. THRUST BLOCKING SHALL BE PROVIDED FOR ALL PRESSURE SEWERS, FORCEMAIN SEWERS, POTABLE WATER LINES AND ALL PROCESS LINES. UNLESS OTHERWISE APPROVED BY THE AUTHORITY'S ENGINEER WHERE RESTRAINT JOINTS ARE USED.
- 3. THRUST BLOCK CONCRETE SHALL NOT COVER THE PIPE FITTING FASTENERS OF MECHANICAL JOINT DUCTILE OR CAST IRON FITTINGS.

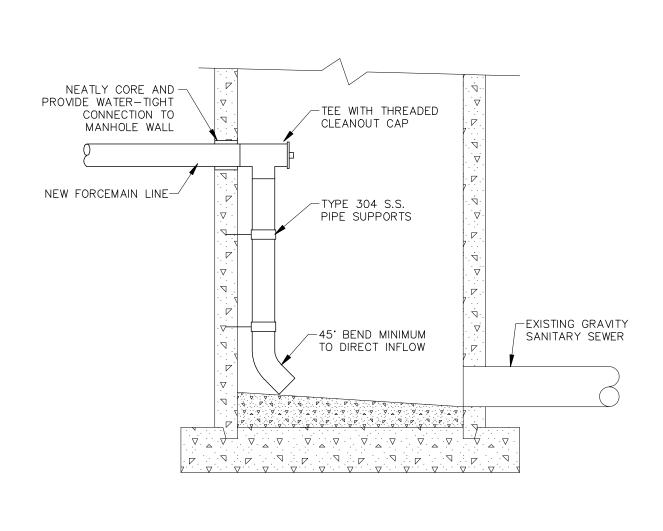
TYPICAL THRUST BLOCKING DETAIL FOR THE HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-11

HARBORCREEK TOWNSHIP

ERIE COUNTY

PENNSYL<u>VANIA</u>



FORCEMAIN CONNECTION DETAIL FOR HARBORCREEK TOWNSHIP SEWER AUTHORITY

SD-12

HARBORCREEK TOWNSHIP

ERIE COUNTY