



RESOLUTION NO. 2017-R- 22

RESOLUTION OF THE BOARD OF SUPERVISORS OF WARRINGTON TOWNSHIP, BUCKS COUNTY, PENNSYLVANIA, ADOPTING STANDARD SPECIFICATIONS AND DETAILS FOR SANITARY SEWER AND WATER FACILITIES CONSTRUCTED WITHIN WARRINGTON TOWNSHIP

BACKGROUND

A. The Board of Supervisors of Warrington Township ("Township") desires to establish standard specifications for all labor, equipment, materials and other facilities necessary and proper to construct sanitary sewer and water main extensions, sanitary sewer force mains and sewage pumping stations including the associated appurtenances and restoration work.

B. The Warrington Township Engineer, CKS Engineers, Inc., 88 South Main Street, Doylestown, PA 18901, has prepared Standard Specifications and Details for Sanitary Sewer and Water Facilities Situated in Warrington Township, Bucks County, PA, a copy of which is attached as Exhibit "A" ("Standard Specifications").


D. Adoption of the Standard Specifications will protect the health, safety and welfare of the citizens of the Township as well as of the public generally.

NOW THEREFORE BE IT AND IT IS HEREBY RESOLVED, by the Board of Supervisors of Warrington Township, Bucks County, Pennsylvania that the Standard Specifications, attached hereto as Exhibit "A", are hereby adopted

as the official Standard Specifications for the construction of water and sanitary sewer facilities within the public right-of-way and/or to be dedicated to the Township and as such shall, when applicable, be incorporated, in whole or in part, in all Land Development and Financial Security Agreements executed hereinafter and the Township will not accept dedication of any sanitary sewer and water facilities that do not conform with the Standard Specifications.

RESOLVED AND ENACTED this 28th day of March, 2017 by the Board of Supervisors of Warrington Township.

ATTEST:



Barry P. Lubber, Township Manager


**BOARD OF SUPERVISORS OF
WARRINGTON TOWNSHIP**



Shirley A. Yannich, Chair



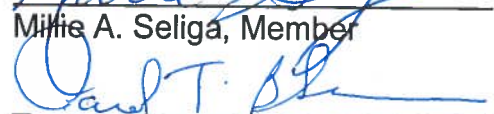
Fred R. Gaines, Vice Chair



Matthew W. Hallowell, Sr.,
Member



Millie A. Seliga, Member



Carol T. Baker, Member

**STANDARD SPECIFICATIONS AND DETAILS FOR
SANITARY SEWER AND WATER FACILITIES**

**SITUATED IN:
WARRINGTON TOWNSHIP, BUCKS COUNTY, PA**

**PREPARED FOR:
WARRINGTON TOWNSHIP
WATER AND SEWER DEPARTMENT**

MARCH 2017

**PREPARED BY:
CKS ENGINEERS, INC.
88 SOUTH MAIN STREET
DOYLESTOWN, PA 18901**

**Based on Standard Specifications and Details for Sanitary Sewer and Water Facilities, February 1996,
prepared for Warrington Township, by Carroll Engineering Corporation.
March 2017**

**STANDARD SPECIFICATIONS AND DETAILS
FOR
SANITARY SEWER AND WATER FACILITIES**

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FOR
SANITARY SEWER AND WATER FACILITIES**

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SPECIFICATIONS

DIVISION 1

GENERAL REQUIREMENTS

<u>SECTION</u>	<u>DESCRIPTION</u>
01010	General Requirements
01015	Special Requirements
01420	Preconstruction Audio-Video Documentation

**SECTION 01010
GENERAL REQUIREMENTS**

PART 1 - GENERAL

01010.1.01 DESCRIPTION

- A. The work to be covered by these Specifications consists of all labor, equipment, materials and other facilities necessary and proper to construct sanitary sewer and water main extensions, sanitary sewer force mains and sewage pumping stations including the associated appurtenances and restoration work. The Specifications in this document are written with the intention of, in whole or in part, to be included in the Contract executed by and between the Developer and the Contractor. The Township will not accept the sanitary sewer and water facilities provided by a Developer unless and until they conform to the requirements of the applicable portions of these Specifications. These Specifications are not intended to provide a complete description of the requirements for private water and sewer lines and facilities located outside of the public right-of-way or easement, or within the interior of the structure receiving water or sewer service. The International Plumbing Code, as amended by Warrington Township, shall apply in those locations.
- B. The Drawings and Specifications are intended to cover a complete project with respect to sewer and water facilities, and it shall be thoroughly understood that failure to mention specifically any work which would naturally be required to complete the project shall not relieve the Contractor of his responsibility to perform such work.
- C. The Standard Details at the end of this document represent the standards of construction of the Township. Where reference is made herein to "Detail Drawings" or "Standard Details", it shall be understood to mean these drawings. They are to be followed by the Developer and/or his Engineer in preparing plans for sewer extensions and laterals, sewage pumping stations, sewage force mains, water main extensions and water services and all appurtenant facilities.

01010.1.02 DEFINITIONS

Wherever in these Specifications the following words, terms, and expressions, or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

Township: WARRINGTON TOWNSHIP, acting directly or through any agent, officer or employee duly authorized to act for the said part in the execution of the legal functions of the Township.

Engineer: The Township Engineer, duly employed by Warrington Township as consultant and authorized to inspect the results of the performance of the work under Contract by the Contractor, acting directly or through properly authorized agents, engineers, assistants, inspectors, or other representatives acting severally within the scope of the particular duties entrusted to them. The word "Engineer" shall include the officers, agents or employees of the Engineer.

Developer: Party of the First Part or First Party to the Contract; the corporation, partnership, or individual intending to develop for residential or other purposes a certain tract of land situate within the sewer and water franchise areas of the Township, acting directly or through any authorized lawful agents, legal representatives or employees appointed to act for said party in the execution of the work of the Contract.

Contractor: Party of the Second Part or Second Party to the Contract, acting directly or through his authorized lawful agents, legal representatives, superintendents, or employees, appointed to act for said party in the performance of the work under contract. In the context of these Specifications, the term "Contractor" shall also be interpreted as the "Developer" in certain instances where specific responsibilities are not defined or can be performed by either party.

Contract: The written agreement executed by and between the Developer and the Contractor, covering the performance of the work and the furnishing of labor, materials and service in the construction of sewer and water facilities (including appurtenant facilities) within the sewer and water franchise areas of the Township.

Project: All the necessary performance, services and materials required for the satisfactory completion of the work under contract as described in the Specifications and shown on the Drawings.

Specifications: Collectively the Standard Specifications and Details for sanitary sewer and water facilities and all of the written technical descriptions of materials, equipment, construction systems, standards and workmanship pertaining to the construction of the project which are a part of the contract but not contained herein.

Drawings and Plans: Collectively, all of the drawings which show the character and scope of the work to be performed on the project and which have been prepared by an Engineer and approved by the Township; and also such supplementary drawings as may be issued from time to time in order to elucidate or clarify said Contract Drawings or show details which are not shown thereon.

01010.1.03 REFERENCED STANDARDS AND SPECIFICATIONS

All work shall comply with the current issues of the following codes, regulations and requirements, any or all references to earlier dated editions notwithstanding.

1. Pennsylvania Department of Labor and Industry, Regulations for Trenches and Excavations
2. Federal and State Air Pollution Regulations
3. NFPA - National Fire Protection Association
4. OSHA - Occupational Safety and Health Administration
5. AISC - American Institute of Steel Construction, Manual of Steel Construction
6. NEC - National Electric Code
7. NACE - National Association of Corrosion Engineers
8. ASTM - American Society of Testing and Materials
9. AWWA - American Water Works Association
10. ACI - American Concrete Institute
11. IPC - International Plumbing Code
12. PennDOT - Pennsylvania Department of Transportation Publications 203 and 408
13. DEP - Pennsylvania Department of Environmental Protection: Including, but not limited to, Erosion and Sediment Pollution Control Manual, Domestic Wastewater Facilities Manual, and Public Water Supply Manual
14. ANSI - American National Standards Institute
15. FS - Federal Specifications
16. AASHTO - American Association of State Highway and Transportation Officials
17. PTM - Pennsylvania Test Method

01010.1.04 EQUAL OR APPROVED EQUAL

- A. In the various detailed sections of the Specifications, where any item of material or equipment is specified by proprietary name, trade name, and/or name of one or more manufacturers, without the addition of such expressions as "or equal", it is to be understood that these items are so specified for reasons of standardization or for special requirements of the job. For items so specified, no substitute products will be acceptable.
- B. In the various detailed sections of the Specifications, where any item of equipment is specified by proprietary name, trade name, and/or name of one or more manufacturers, with the additions of such expressions as "or equal", it is to be understood that equal quality equipment or products, of either a manufacturer named or of a manufacturer not named, which meet the detailed requirements of the specifications, are intended and are subject to the acceptance of the Engineer as to the equality thereof. It is distinctly understood that: (1) the Engineer is to use his own judgment in determining whether or not any item of equipment or product proposed is equal to that specified; (2) the decision of the Township on all such questions of equality shall be final; and (3) in the event of any adverse decision by the Engineer, no claim of any sort shall be made or allowed against the Engineer or the Township.
- C. If, subsequent to the award of the Contract, and in normally rare occurrences, it becomes necessary (because of delays in delivery, strikes, discontinuance of the manufacture of items specified or the equal thereof, or any other similar reasons) for the Contractor to request the use of any item of equipment or product which is of a different type than the equipment or product specified, or the approved equal thereof, the Engineer at his discretion, may authorize the use of such different type equipment or product of the same, greater or less cost than that specified.
- D. In such cases as described in Paragraphs B and C above, the Contractor shall submit to the Engineer in writing (1) his request for permission to make a substitution, (2) a complete description of the proposed item, including dimensions, operational characteristics, changes (if any) that will be required to other related parts of the work, etc., and (3) full information as to the costs of the item specified, the cost of the different type item being proposed, as well as costs (additional or credits) or changes (if any) to any related parts of the work. Such information shall be in such form and detail as to permit the Engineer to check, to his satisfaction, the reason and costs involved. Upon acceptance of the substitution, in writing, the proper credits to be allowed the Township or the proper additional payments to be made to the Contractor represent the difference between the net cost to the Contractor of the substituted item or material, and the price at which he could have obtained the lowest priced item or materials specified.
- E. If any submitted equipment necessitates changing electrical, water, gas, vacuum, air or other utility services from the sizes, capacities, configurations and locations shown on the Drawings, it shall be the Contractor's responsibility to bear the construction cost of all changes. It shall also be the Contractor's responsibility to bear the cost of engineering fees to analyze, design, specify and formulate the construction changes necessitated by the proposed deviations from the specified equipment and/or the Drawings.
- F. The decision of the Engineer, from time to time, as to the proper credits to be allowed the Township or proper payments to be made the Contractor, shall be final and conclusive upon the Contractor.

01010.1.05 OBSERVANCE OF LAWS

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

01010.1.06 REGULATIONS OF THE DEPARTMENT OF LABOR AND INDUSTRY

Special attention is drawn to the regulations of the Pennsylvania Department of Labor and Industry relating to wage scales, trenches and excavations, tunnel construction, equipment, materials, labor, safety, sanitation, and other regulations on which the Contractor shall be fully informed and with which he shall fully comply. Observance of and compliance with said regulations shall be solely and without qualification the responsibility of the Contractor, without reliance on superintendence of or direction by the Township or Engineer. The duty of enforcing such laws and regulations lies with the said Department, not with the Township or Engineer.

01010.1.07 PERMITS AND LICENSES

The Contractor or Developer shall, unless otherwise specified elsewhere herein, procure all necessary permits and licenses, pay all charges and fees therefor, and shall give all notices necessary and incident to the proper and lawful prosecution of the work. This includes the requirement for all contractors to be registered with Warrington Township.

If the Pennsylvania Department of Transportation requires any of their personnel to be on hand during the construction of the work, payment for such personnel shall be borne by the Contractor, or Developer.

01010.1.08 NOTICE

The service of any notice by the Township or Engineer to the Developer or Contractor shall be considered accomplished upon completion of any one of the following procedures:

- A. When delivered, in writing, to the person in charge of the office used by the addressee to conduct business;
- B. In a writing, deposited in the United States Mail, postpaid, or transmitted by email or fax machine, and addressed to the party intended for such service to the addressee or any of his authorized agents in person;
- C. In a writing deposited in the United States Mail, postpaid, or transmitted by email or fax machine and addressed to the party at the address of the Engineer or Contractor of any of their agents at the office used by the addressee to conduct business of the Contract at or near the Site of the Work;

- D. When deposited in the United States Mail, postpaid, or transmitted by email or fax machine, and addressed to the party intended for such service at the office used for conducting the business of the Contract at the Site of the work, or his last known place of business; or
- E. When sent via FedEx, UPS or similar and addressed to the party intended for such service at his last known place of business or for conducting the business of the Contract at the Site of the work.

01010.1.09 ADVERTISING

No advertising will be permitted on any part of buildings, scaffolding, fences, materials, obstructions, barricades or work.

01010.1.10 CONTRACTOR'S INSURANCE REQUIREMENTS

- A. The Contractor shall carry Worker's Compensation Insurance, including Employer's Liability, during the life of the Contract to insure his statutory liability to his employees in the State of Pennsylvania. The minimum limits of liability shall be as follows:

	<u>Minimum Limits</u>
1. State:	Statutory
2. Applicable Federal (e.g. Longshoremen's):	Statutory
3. Employer's Liability:	
a. Bodily Injury By Accident (each accident):	\$100,000.00
b. Bodily Injury By Disease (policy limit):	\$500,000.00
c. Bodily Injury By Disease (each employee):	\$100,000.00

- B. The Contractor shall carry the Comprehensive Form of Automobile Liability and Property Damage Insurance during the life of the Contract covering the risks itemized in the form of "Certificate of Insurance" provided for in the Contract. The minimum limits of liability shall be as follows:

	<u>Minimum Limits</u>
1. Combined Single Limit (bodily injury and property damage)	\$2,000,000.00 Each Accident

- C. The Contractor shall carry the Comprehensive Form of General Liability and Property Damage Insurance during the life of the Contract in the amount of \$2,000,000.00 per occurrence and \$5,000,000.00 in the aggregate covering the risks itemized in the form of "Certificate of Insurance" provided for in the Contract. The Contractor's General Liability shall include environmental coverage covering contamination of streams, wetlands and other bodies of water and contamination of the ground at or below the surface from the discharge of sewage during bypass pumping or other work by the Contractor, either accidentally or on purpose. Policies shall be written in the name of the Contractor, Township and Engineer "as their respective interests may appear", subject to one hundred (100) percent co-insurance. They shall name as additional insureds the Township, its agents, servants and employees including the Township Engineer and other consultant employed by the Township who provide services on the project.

The Contractor shall insure the structures, when applicable, and improvements against loss or damage by explosion, collapse and underground hazards, fire, windstorm, aircraft perils (extended coverage perils), vandalism and malicious mischief, during the progress of the work, and until final acceptance of the work by the Township. Such insurance shall be written in **completed value form** for one hundred (100) percent of the completed value of the Contract **including stored materials connected therewith**, with the amount to be certified to the Contractor by the Engineer.

The Contractor's General Umbrella Liability shall include environmental coverage covering contamination of streams, wetlands and other bodies of water and contamination of the ground at or below the surface from the discharge of sewage during bypass pumping or other work by the Contractor, either accidentally or on purpose. The Contractor shall provide General Umbrella Liability with minimum limits of liability as follows:

	<u>Minimum Limits</u>
1. General Aggregate	\$5,000,000.00
2. Each Occurrence	\$5,000,000.00

- D. All policies will be subject to the approval of the Township and Engineer.
- E. Certificates of Insurance must be executed in quintuplicate and submitted to the Engineer prior to the execution of the Agreement. Certificates of Insurance will be required of all subcontractors documenting Workmen's Compensation Insurance coverage prior to performance of work on the site by subcontractors. The Township shall be the certificate holder of all Certificates of Insurance and all Certificates of Insurance shall **name the Township and the Township Engineer as co-insured**.
- F. Each certificate shall contain therein or have contained in a rider attached thereto and made a part thereof, a clause to the effect that the insurer will notify the Township in writing thirty (30) days prior to cancellation or expiration of the policy.
- G. The Surety on all bonds and insurance shall be rated "A" or better by A.M. Best Company and shall be licensed to conduct business in the Commonwealth of Pennsylvania.

01010.1.11 DRAWINGS AND SPECIFICATIONS

- A. In general, the Drawings and Specifications are complementary; what is called for by one is as binding as if required by all. All items necessary or incidental to completely construct or erect the work denoted shall be furnished as required to provide a complete operating facility whether specifically detailed by the Drawings and/or Specifications.
- B. Deviations from the Drawings or Specifications required by the exigencies of construction will be determined by the Engineer only, and authorized in writing.

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- C. Where dimensions or locations of existing facilities are of importance to the successful performance of any part of the work of this Contract, the Contractor shall verify the correctness of such dimension or location in the field before any other procedure, whether of manufacture of related equipment or construction of related structure, shall begin. Failure of the Contractor to follow the required verification procedure here specified shall cause him to waive all right to claim for additional cost by reason of the later discovery of inaccurate dimensions or locations of existing facilities as depicted on the Drawings and/or Specifications.

01010.1.12 CONSTRUCTION STAKEOUT

Construction stakeout shall be performed by the Contractor/Developer. The Contractor/Developer shall be responsible for protecting and preserving all reference points for the duration of the Project. Construction stakeout shall be performed by a Registered Professional Land Surveyor licensed in the Commonwealth of Pennsylvania.

PART 2 - PRODUCTS

01010.2.01 MATERIALS AND EQUIPMENT

- A. All materials and equipment supplied for use on this project shall be new and purchased specifically for incorporation into the work included in the Drawings and Specifications, except as noted.
- B. The Contractor shall furnish the Engineer, promptly after the award or execution of the Agreement, a complete statement of the origin, composition, and manufacture of all materials to be used in the construction of the Project. Only materials conforming to the requirements of these Specifications and approved by the Engineer shall be used in the work.
- C. Representative preliminary samples of the materials, of the character and quality prescribed in the Contract shall be submitted when indicated or directed, for advance examination or test. Written approval of the quality of such samples shall be received by the Contractor prior to obtaining materials from the respective sources of supply.
- D. Samples of all materials requiring laboratory tests shall be taken under the direction or supervision of, or in the manner prescribed by the Engineer. Such materials shall not be used until accepted as the result of such tests. Materials will be used only as long as the quality of the material remains equal to that of the accepted sample. The acceptance at any time of any material shall not be a bar to its future rejection, if it is subsequently found to be defective or inferior in quality to the material specified.
- E. Required laboratory tests of materials shall be made by a testing laboratory or agency selected or approved by the Engineer and in accordance with the methods indicated herein. When standard specifications and serial numbers of technical societies and associations are stipulated, the reference shall be construed to be the latest of such specifications and serial numbers.
- F. The Contractor shall furnish all labor, materials and equipment necessary for collecting, packaging and identifying representative samples of materials, and the shipping of such samples to the testing laboratory.
- G. For tests or inspections conducted by, and at the options of, the Engineer, at sites other than the testing laboratory and not under the jurisdiction thereof, the Contractor shall furnish or arrange with the producer to furnish all material, labor, tools, and equipment, and every facility for the verification of the accuracy of all scales, measures and testing equipment, necessary for such tests or inspections.
- H. The Contractor shall permit or arrange with the producer to permit the Engineer or any agent of the testing laboratory to inspect or test any and all material being used or to be used, at any time before, during or after its preparation, or while being used during the progress of the work or after the work has been completed.
- I. Materials shall be stored so as to insure preservation of their specified quality and fitness for the work. When considered necessary they shall be placed on wooden platforms or other hard and clean surfaces, and not on the ground, and shall be placed under cover when directed. Stored materials shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without permission of the owner or lessee of the property.

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- J. If any material intended for use in the construction of the Project has been inspected and rejected after such material has been delivered to the Site, all such rejected material shall be immediately removed from the property by the Contractor.

01010.2.02 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Proper and suitable tools, equipment, and appliances for the safe and convenient handling and placing of all materials and equipment shall be used.
- B. During loading, unloading and placing, care shall be taken in handling the equipment and materials so that no equipment or materials are damaged.
- C. Any precautions necessary to protect items of equipment and materials from damage while stored on the construction site shall be exercised.
- D. All mechanical and/or electrical equipment and paint delivered to the job site shall be stored under roof, protected on all sides and supported off the ground with pedestals. The resulting enclosure shall be weathertight in all respects.
- E. The Contractor shall follow all written instructions and recommendations of the equipment manufacturer and all requirements of the Engineer regarding the oiling, exercising, maintenance and protection of the equipment during storage. It shall be the Contractor's complete responsibility to satisfactorily store and care for equipment and materials.
- F. Equipment may be initially delivered to a warehouse, conveniently located in the vicinity of the site, with the approval of and under such conditions as may be further imposed by the Engineer.

01010.2.03 PROTECTION AGAINST ELECTROLYSIS

Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, non-metallic separators or washers, or other approved materials. When requested by the Engineer, the Contractor shall prove by acceptable test the effectiveness of the insulation.

PART 3 - EXECUTION

01010.3.01 PRELIMINARY INSPECTION

The Contractor is required to carefully examine the site of the work, Drawings, Specifications, and all applicable State, County and local codes for the work contemplated; and it will be assumed that he has familiarized and satisfied himself as to the conditions and obstacles to be encountered, as to the character, quality, and quantities of work to be performed and materials to be furnished, and as to the requirements of the Drawings and Specifications.

01010.3.02 PRECONSTRUCTION MEETING

- A. A preconstruction meeting will be held after formal acceptance of Escrow and Developer Agreements by the Township, but prior to beginning of work.
- B. The Contractor will be notified as to the date and time of this conference and will be expected to attend with the designated Project Superintendent.
- C. Contractor is required to submit a construction schedule showing the order in which the Contractor proposes to carry on the work, the dates on which he will start several of the more salient features and the contemplated dates for completing the same. The schedule shall be in the form of a progress chart of suitable scale as to approximately indicate the percentage of work completed at any time.

01010.3.03 PROGRESS MEETINGS

- A. During the construction period, progress meetings shall be held with the Engineer at the job site to discuss recent developments and future work plans as they relate to the schedule. Progress meetings will be held weekly in general, but the interval between meetings may be increased or decreased by the Engineer to suit the current circumstances.
- B. The Township, Engineer, Contractor and major Subcontractors shall be represented at every meeting by a responsible member of their respective organizations. All decisions and interpretations given by the Engineer at project meetings, shall be on behalf of the Township and shall be conclusive on each Contractor or Subcontractor affected.
- C. The proceedings of these meetings will be recorded by the Engineer, and each required representative at meetings will be furnished one copy. The Engineer's act of conducting meetings, recording and distributing meeting minutes on behalf of the Township, shall not be construed as coordinating or scheduling Contractor's work.
- D. If a change of meeting date/time is required due to causes beyond control of the Township or Engineer, the Engineer will advise each concerned party in advance of such change.

01010.3.04 SHOP DRAWINGS

- A. Shop drawings in this Specification are intended to mean fabrication and erection drawings. These drawings and pertinent data shall be complete and in such detail as the Engineer may require for providing information regarding the design, installation, and operation for such materials and/or equipment.

- B. Detailed shop drawings, data, and literature for fabricated materials or equipment to be incorporated in the Project shall be submitted to the Engineer for review before fabrication. The Contractor shall obtain and check manufacturer's shop drawings, certified prints, and other pertinent data for conformance with all requirements of the Drawings and Specifications in ample time to permit satisfactory progress of the work. After completion of such checking and verification by the Contractor, the Contractor shall sign and stamp such drawings, which stamp shall state as follows:

Specification Section:

Checked By:

(Contractor's Name)

Signed By:

(Checker's Name)

- C. All data, drawings, and correspondence from subcontractors, material men, or suppliers shall be routed through the Contractor. This procedure is required so that the Contractor's superintendent can familiarize himself with all information which the Contractor sends to the Engineer and also to prevent the Engineer from taking action upon something other than that which is desired by the Contractor. The Engineer shall consider for approval only such data and details as are verified and transmitted to him directly by the Contractor. Failure of the Contractor to note his approval on Shop Drawings will be reason for the Engineer to return such submission to the Contractor unchecked. If it appears that Shop Drawings submitted by the Contractor to the Engineer have not been properly checked, even though the Contractor's approval has been noted thereon, it will also be considered reason for the Engineer to return such submission to the Contractor unchecked.
- D. All correspondence between the Engineer and the Contractor, all shop drawings, and all data for review of drawings or materials will be handled by the Engineer. All such data shall be delivered directly to the Engineer's office and accompanied by a letter of transmittal giving a list of the number of drawings. The replies pertaining to these matters will be delivered to the Contractor's office or designated representative at the job site.
- E. A sufficient number of shop drawings and review data shall be submitted to the Engineer, who will be allowed to retain five (5) copies of each submittal if it is electrical in nature and four (4) copies otherwise. All additional copies, up to a maximum of four (4), received by him will be returned to the Contractor or his representative at the job site. The Engineer's notations of the action which he has taken will be noted on all the returned copies. Sufficient time for the review of all shop drawing submittals shall be allowed in the Contractor's schedule.

- F. Drawings of minor or incidental fabricated materials and/or equipment may not be required by the Engineer. The Contractor shall furnish the Engineer with tabulated lists of such fabrications, showing the names of the manufacturers and catalog numbers, together with samples of general data as may be required to permit intelligent determination as to their responsibility for incorporation in the work.
- G. The approval of shop drawings will be general and shall not relieve the Contractor from responsibility for errors and discrepancies in such drawings and for proper fit and construction of the work; nor from furnishing materials and work required by the Contract which may not be indicated on the shop drawings when approved.
- H. All review of shop drawings, data sheets and information, or literature are subject to the products fulfilling the specific requirements of the Drawings and Specifications. Review of items that do not conform in detail to the specified product shall place upon the Contractor the entire responsibility for successful operation of the proposed product. Should the item subsequently prove to be defective or otherwise unsatisfactory for the service for which it was intended, the Contractor shall, without cost to the Township and without obligation on the part of the Engineer, replace the item with the material originally specified. The Engineer's acceptance of shop drawings or layout for any material, apparatus, or device shall not relieve the Contractor from the responsibility of furnishing the same of proper dimension, size, quantity, quality, and all performance characteristics to efficiently perform the requirements and intent of the Drawings and Specifications. Such review shall not relieve the Contractor from responsibility for errors of any sort on the shop drawings. If the shop drawings deviate from the Drawings and Specifications, the Contractor shall advise the Engineer of the deviations in writing accompanying the shop drawings, including the reasons for the deviations, and shall request a deviation from the Contract as hereinafter described.
- I. The shop drawings are intended to be utilized by the Contractor for additional fabrication, assembly, and erection data. The shop drawings do not change or supersede the Drawings and Specifications. The Contractor's request for a change shall give, in detail, the specific change requested and shall state the reason for the change. Changes requested by the Contractor and reviewed by the Engineer shall not be construed to include acceptance of any change except the changed details specifically requested.
- J. It shall be the responsibility of the Contractor to make all the necessary changes in other items, which result from deviations or changes requested by the Contractor and accepted by the Engineer, so that all items perform the requirements and intent of the Drawings and Specifications.

01010.3.05 RESUBMITTALS

- A. Contractor shall make resubmittals under procedures specified for initial submittals and shall identify changes made since previous submittals.
- B. Each resubmittal shall contain the original submittal number plus a suffix letter after the original number such as "A" for the first resubmittal, "B" for the second resubmittal, "C" for the third, and so forth.

01010.3.06 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall furnish six (6) copies of a complete instruction manual for installation, operation, maintenance, and lubrication of each component of mechanical and electrical equipment. All copies shall be submitted to the Engineer. Each instruction manual furnished shall be fixed in hard back cover or file folder which is clearly labeled to designate the system or equipment for which it is intended with reference to the section and pages where the item is specified.
- B. Each instruction manual shall include but not be limited to the following: detailed description of the function of each principal component of the system; installation instructions; procedure for starting; procedure for operating; shutdown instructions; maintenance and overhaul instructions which shall include detailed assembly drawings with part numbers, parts list, and complete instructions for ordering spare parts; lubrication instructions which shall list points to be greased or oiled, and recommend frequency of lubrication; safety precautions, diagrams and illustrations; test procedures; and performance data. It is intended that the manual shall be complete in all respects for all equipment, controls, accessories, and associated appurtenances.
- C. Each instruction manual shall be transmitted to the Engineer according to the established schedule and prior to installation of the equipment and all equipment shall be serviced in accordance with the manufacturer's recommendations prior to operation. A service record shall be maintained on each item of equipment and shall be delivered to the Engineer prior to final acceptance of the project by the Township.
- D. Operating instructions for use by operating personnel shall be provided for each principal equipment component. The instructions shall be placed adjacent to the applicable equipment and shall be protected against weathering with a laminated plastic coating. The instructions shall include but not be limited to the following: start-up, proper adjustment, operation, shutdown, safety precautions, procedure in event of equipment failure, and any other necessary items of instruction as recommended by the manufacturer of the unit.

01010.3.07 CONDUCT OF WORK

- A. All work shall be subject to the control of the Engineer and the Township. In the performance of the work, the Contractor shall abide by all orders, directions and requirements of the Engineer and the Township and shall perform all work in such manner and sequence as the Township may require. The Engineer and Township shall determine the amount, quality, acceptability and fitness of all parts of the work; shall interpret the Drawings and Specifications; shall issue any extra work orders; and shall decide all other questions in connection with the work. The Contractor shall employ no plant, equipment, materials, or methods to which the Engineer or Township objects and shall remove no plant, materials, equipment or other facilities from the site of the work without the Engineer's or Township's permission. Upon request, the Engineer or Township shall confirm in writing, any oral order, direction, requirement or determination. If any person employed on the work by the Contractor shall appear to the Engineer or Township to be incompetent or to act in a disorderly or improper manner, such person shall be removed immediately upon request by the Engineer.

- B. The Contractor agrees to use, at all times on the work, only such labor as will in no way disturb or affect labor employed by the Township and/or other contractors on the project. The Contractor and each and every subcontractor performing work at the site of the project shall comply with all "Labor Laws" of the Government, and of the State, County, and Township in which the project is located.

01010.3.08 TEMPORARY FACILITIES

- A. The Contractor shall furnish and maintain all temporary telephone, gas, electric, water, and sewer utilities required for construction, start-up and performance testing of the Project. All costs for providing temporary utilities shall be borne by the Contractor up to and including the date of acceptance. The Contractor is not required to provide field facilities for the Engineer.
- B. The Contractor shall furnish and erect all necessary temporary fences required to provide adequate security for all materials, equipment and structures throughout the project.

01010.3.09 RECORD DRAWINGS

- A. Before the work will be accepted by the Township, the Developer shall submit to the Township one (1) set of reproducibles of all working drawings, as well as electronic copy in a format selected by the Engineer, modified as necessary to show as-constructed conditions. The Developer shall submit a certificate with the as-constructed reproducibles attesting to the correctness of all information shown on the Record Drawings. (The Township intends to use prints of the reproducibles to provide information to designers and contractors as required by the Commonwealth of Pennsylvania Act 38).
- B. The Contractor is required to maintain one (1) set of up-to-date Record Drawings, approved shop drawings and specifications on the project site at all times. Up-to-date is defined as containing modifications for work performed within the past 30 days.

01010.3.10 OPERATIONAL ACCEPTANCE TESTS

- A. After installation, the Contractor shall adjust and balance all equipment and systems, and shall demonstrate that all equipment is operating in a satisfactory manner. All rotating equipment shall be lubricated according to recommendations of the manufacturers and shall be made to suit anticipated operating conditions. Each piece of machinery shall be tested to show that it operates quietly, without vibrations, overheating, or sign of distress at full specified capacity. Adjustments shall be made as necessary. All defective parts on machinery shall be replaced.
- B. The Contractor shall make a request in writing at least ten (10) days in advance of starting each operational acceptance test. Such tests shall be conducted with qualified representatives of the equipment manufacturer present, and in accordance with the requirements of these Specifications. All pertinent Operation and Maintenance manuals must be in receipt of the Engineer prior to any operational acceptance test.

- C. All parts and components of mechanical equipment shall be designed for satisfactory service under continuous duty without wear under the specified and indicated operating conditions for a period of not less than one (1) year. Any part of mechanical equipment that shows undue or excessive wear or that fails due to wear under normal operating conditions within the first year of operation under operational acceptance shall be considered as evidence of defective material or defective workmanship, and it shall be replaced with equipment or parts to meet the specified requirements. This paragraph supplements subparagraph B.

01010.3.11 DEFECTIVE WORK

When any material not conforming to the requirements of the Specifications and Drawings has been delivered to the Site of the Project or incorporated in the work, or when any work performed is of inferior quality, such material or work shall be considered as defective and shall be immediately removed and renewed or made satisfactory as directed by the Engineer. Failure or neglect on the part of the Engineer to condemn or reject any bad or inferior work or materials shall not be so construed as to imply an acceptance of such work or materials, if such bad or inferior material or work becomes evident at any time prior to the delivery of the completion certificate by the Township to the Developer.

The Contractor shall remove any work or material condemned, and shall rebuild and replace the same.

The Contractor shall promptly remove from the premises all materials condemned by the Engineer as failing to conform to the Specifications, whether incorporated in the work or not, and the Contractor shall promptly replace his own work in accordance with the Contract.

01010.3.12 SAFETY REQUIREMENTS

- A. The Contractor shall furnish, erect and maintain at closures, intersections and throughout the Project, all necessary approved barricades, suitable and sufficient red lights, torches, approved reflectors, danger signals, warning, and closure signs, provide a sufficient number of watchmen and take all necessary and legal precautions for the protection of the work and safety of the public. All barricades, danger signals, warning signs and obstructions shall be illuminated at night and all lights shall be kept burning from sunset until sunrise. All materials and safety devices (i.e., barricades, flashing warning lights, torches, reflectors, signs) which the Contractor provides for the purpose of protecting the work and the safety of the public and for maintaining and protecting traffic must conform to the requirements specified in Section 901 of the current edition of the Commonwealth of Pennsylvania Department of Transportation Specifications Form 408 and to the requirements specified in the current edition of Bulletin 43 which complements Section 901.
- B. The safety provisions of applicable laws, and regulations of the Pennsylvania Department of Labor and Industry, and building and construction codes shall be observed. Machinery, equipment, and other hazards shall be guarded in accordance with the safety provisions of the "Manual of Accident Prevention in Construction", published by the Associated General Contractors of America, to the extent that such provisions are not in contradiction of applicable State and local laws.

- C. The provisions of the "OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970" of the U.S. Department of Labor and particularly Part 1926 - "Safety and Health Regulations for Construction" thereof, including all pertinent revisions of said provisions shall be complied with in the performance of all work. Observance of and compliance with the provisions of said act shall be solely and without qualification the responsibility of the Contractor, without reliance on superintendence of or direction by the Township or Engineer. The duty of enforcement of the provisions of the act lies with the U.S. Department of Labor, not with the Township or Engineer.

01010.3.13 WORKING CONDITIONS

- A. No night or Sunday work requiring the presence of the Engineer or his representative will be permitted except in cases of emergency.
- B. No work shall be done when, in the opinion of the Engineer, the weather is unsuitable for good and careful work to be performed. Should the severity of the weather continue such that the work cannot be prosecuted successfully, the Contractor, under order of the Engineer, shall cease all such work until directed to resume the same.
- C. The Contractor shall arrange for and be responsible for a sufficient amount of illumination at all times, subject to the approval of the Engineer, to carry on all phases of the work.

01010.3.14 CLEANING UP

- A. Continuously keep the work, the site and adjacent properties free from accumulations of waste materials, excess excavation, rubbish and windblown debris resulting from construction operations. Periodically remove waste materials, excess excavation, debris and rubbish from the site and dispose of at legal disposal areas away from the project site.
- B. Remove grease, mastics, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from site-exposed interior and exterior surfaces of structures. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds. Restore areas disturbed by construction. Provide continuous dust control during construction.
- C. At the completion of the work, or each major portion thereof, the Contractor shall remove surplus materials, tools, construction equipment and machinery, and leave the site clean and ready for occupancy by the Township.

01010.3.15 EIGHTEEN MONTHS RESPONSIBILITY

It shall be understood that the Developer/Contractor agrees to furnish such material and appliances to construct the whole work in such substantial and workmanlike manner that it shall be continuously stable and efficient, and the Contractor shall promptly make good, or replace, any or all parts of the materials or installation, including all details, which may be found to be unstable or defective in any particular, ordinary wear and tear excepted, for a period of guarantee of eighteen (18) months after the whole installation has been entirely completed, tested and accepted by the Township, except that a period of guarantee of two (2) years after acceptance by Pennsylvania Department of Transportation shall apply for restoration work within a State Highway right-of-way.

01010.3.16 EIGHTEEN MONTHS RESPONSIBILITY NOTWITHSTANDING INSPECTION

The acceptance, after inspection by the Engineer, or his representative, of any portion of the work or material, shall be subject to its freedom from the exhibition of any inherent or developed defect, or any failure to conform to these Specifications, between the time of its acceptance, and the expiration of the above named period of eighteen (18) months (two (2) years within a State Highway right-of-way).

01010.3.17 EIGHTEEN MONTHS RESPONSIBILITY FOR DIMENSIONS

The acceptance by the Engineer of any of the dimensions proposed by the Contractor shall always be understood to be with the proviso, whether stated at the time of acceptance or not, that the said dimensions shall be proved to be adequate and proper at all times until the expiration of the above named period of eighteen (18) months (two (2) years within a State Highway right-of-way).

END OF SECTION

**SECTION 01015
SPECIAL REQUIREMENTS**

PART 1 - GENERAL

01015.1.01 SPECIAL REQUIREMENTS

- A. Before any work is started, the Developer shall ascertain from the Township whether or not the latter intends to employ a consultant as Engineer for the Project. If the Township indicates that no Engineer will be employed, the word "Township" is substituted for the word "Engineer" throughout these Specifications, and the Developer and Contractor shall be guided accordingly.
- B. The Specifications for the Sewage Pumping Station are for a typical submersible pumping station and lack sizes and capacities. There may be circumstances where a wetwell-drywell type pumping station is more appropriate. The Township should be consulted prior to initiating design regarding the type of pumping station, sizes, capacities and emergency power requirements for the project. The Developer shall submit to the Engineer prior to start of construction, specifications and drawings of the pumping facility giving complete dimensions, sizes, capacities, loads, electrical wiring, and description and quality of materials, etc.
- C. Large projects or other projects of special concern as determined by the Township, shall provide a metering system to measure gravity sewer flows emanating from the project. The metering system shall be an ultrasonic open channel flowmeter consisting of a transducer continuously measuring the liquid level at the measuring point of a Pashall flume or Palmer-Bowles flume, and a microprocessor based flow transmitter providing liner flow rate conversions with totalization. The flowmeter shall be as manufactured by Polysonics, or Engineer-approved equal, and shall be installed in an approved concrete vault. The Developer shall submit to the Engineer prior to construction, specifications and drawings of the metering facility.
- D. If the sewer lines cross cable television, fiber optic, electric cables, gas, oil or water lines, no excavation or pipe laying shall be done at those crossings without the presence of an authorized representative from the office of the authority having jurisdiction. Attention is directed to the provisions of Act No. 38 of the Commonwealth of Pennsylvania, entitled "Excavation and Demolition Work Protection of Underground Utilities, and full compliance therewith is required.
- E. The Contractor should plan his work so as to provide adequate protection during storms. Certain portions of the work may be affected during storms and floods. Provisions for preventing damage should be made available at all times.

Sewer pipe and water lines, sewage force main lines, pumping stations, metering vaults, and other work shall be protected at all times against damage from uplift due to high ground water levels.
- F. The Contractor will be required to maintain at all times during construction of the work of the Contract, the flow of sewage in the existing sewerage systems to which connections are being made.

- G. Connections to existing sewers and manholes shall be made in such a manner as to provide a watertight installation. The Contractor shall take all necessary precautions to prevent cutting debris from entering the existing sewage flow. Lateral connections to existing sewers shall be made using a Sealtite sewer pipe saddle, as manufactured by Geneco, or approved equal. Sewer connections to existing manholes shall be made by carefully boring an opening no greater than two (2) inches around the new pipe. The existing bench and channel must be cut to invert to form a channel for the new pipe. An "A-Lok" field sleeve, as manufactured by Atlantic Concrete Products, or approved equal, shall be installed, and the inside face of the gasket shall be filled with non-shrink hydraulic cement. The newly cut channels shall be finished with non-shrink grout and troweled to meet the existing channel.
- H. Where sewers and water mains are to be constructed within State Highway rights-of-way, the Developer shall make necessary applications for permits to construct such sewers and water mains and shall pay all charges and fees required therefor. It shall be, however, the responsibility of the Contractor to construct the project in strict conformance with the requirements of the Pennsylvania Department of Transportation.
- I. Warrington Township requires that a "Road Opening Permit" must be obtained to perform any construction within the rights-of-way of Township streets. The Developer shall obtain all such Road Opening Permits and shall pay all fees and charges required therefor.
- J. Where sewers and water mains are to be constructed within the limits of paved streets, all removal and replacement of street paving shall be in strict conformance with the requirements of Warrington Township and of the Pennsylvania Department of Transportation, as applicable. The cost of Inspection by personnel of the Pennsylvania Department of Transportation will be paid by the Developer.
- K. Streets shall not be unnecessarily obstructed, the Contractor shall take such measures as may be necessary to keep the street or road open and safe for traffic.
- L. All driveways shall be restored to a condition equal to their original undisturbed condition using the same type and quality of materials as that of the particular driveway restored.
- M. All curbs, gutters and sidewalks damaged or disturbed shall be replaced with the same type of materials, as the original curb, gutter or sidewalk. The replaced curbs, gutters, and sidewalks shall be of the same shape, thickness and surface finish as the original curb, gutter or sidewalk.
- N. At the shut down of work at the end of the work day, all streets shall be left in such condition whereby they can be readily opened and safely traveled in cases of emergency such as a fire or for ambulance service.
- O. The Contractor shall provide a competent and reliable person who is delegated to be readily available and have full authority to act in the behalf of the Contractor in case it is necessary to deal with any emergency situations which may arise in connection with the project during off working hours, evenings, weekends, and holidays.

- P. The use of a "HYDRA-HAMMER" for compaction of backfill will not be permitted.
- Q. The use of calcium chloride in concrete is prohibited in the work of the project.
- R. Drawings of the sanitary sewer system and water distribution system which are to be submitted to the Engineer for approval in compliance with Article 01010.3.04 of these Specifications shall be drawn on sheets 24 by 36 inches to the following minimum scales:

- Key Sheet 1" = 100', or as approved by Engineer
- Detail Sheets - Plan and Profile
- Horizontal 1" = 50'
- Vertical 1" = 5'

The Key Sheet shall show the horizontal orientation of the project and the arrangement of plan and profile drawings. Pipe sizes shall be shown on the Key Sheet together with the names of all streets and the number designation of each sewer manhole. The scale should be 1" = 100', or other scale approved by the Engineer which legibly shows the project on one 24" x 36" size sheet. A vicinity map showing the entire development in relation to existing streets shall be provided on the Key Sheet. The scale of the vicinity map is optional.

On the detail sheets, the location of each existing or proposed building shall be shown on the Plan with the elevation of the existing or proposed basement. The sewers and water mains shall have ties to existing permanent or semi-permanent features. The sewers and water mains shall be referenced to stationing for the centerline of the roadway, easement, or pipe. Stationing shall be shown on both the Plan and Profile views.

The Plan view shall indicate the horizontal location of all sewer and water facilities in relation to pertinent features. The size and material of all pipe, fittings, and appurtenances shall be labeled. Manholes shall be designated by numbers corresponding to the Key Sheet, and the stationing for all manholes and laterals shall be labeled.

The Profile view shall indicate the vertical location of all sewer and water facilities in relation to pertinent features. The size and material of all sewers and water mains shall be labeled. For gravity sewers, the pipe distance between manholes, measured horizontally from center-to-center of the manholes, and the slope of each pipe shall be labeled. Manholes shall be designated by numbers corresponding to the Key Sheet, and the rim, invert in and invert out elevations shall be labeled. The existing and proposed profile of the roadway ground surface shall be shown. Where other utilities cross the proposed pipeline, the size and invert elevations (top and bottom elevation in the case of duct lines) shall be given. Limits of concrete and polyethylene encasement shall be indicated, where appropriate.

For details of manholes, bedding, encasement, service connections, water system appurtenances, etc. reference need only be made to the appropriate "Detail Drawing" included in these Specifications.

- S. Easement plans shall be provided on 8 1/2" x 11" drawings.

- T. Before the work will be accepted by the Township, the Developer shall submit to the Township reproducible and electronic copy, in a format approved by the Engineer, of all working drawings, modified to show as-built conditions. The actual location of all facilities, including water services and sewer laterals, shall be shown to scale on the as-built drawings. If the facility has not been installed at the design location, the symbol for the facility shall be deleted or "X-d" out and the symbol shall be redrawn to scale at the actual location. The Developer shall submit a certificate with the as-built reproducibles attesting to the correctness of all information shown on the Drawings.
- U. The Developer shall be responsible for cost associated with addition of as-built plans to the Township's digital database / geographic information system. These costs will be estimated and included in the projects escrow account.

END OF SECTION

**SECTION 01420
PRECONSTRUCTION AUDIO-VIDEO DOCUMENTATION**

PART 1 - GENERAL

01420.1.01 DESCRIPTION

The Contractor shall furnish all labor, materials and equipment necessary for audio-video documentation, in digital format, surface features located within the zone of influence of construction operations. For projects with extensive off-site sewer and water facilities and/or within the right-of-way limits of a state highway, or when required by the Engineer or Township, the Contractor shall engage the services of a professional videographer actively involved with color audio-video recordings, in digital format, for various municipalities and construction projects similar to the work included under this Project.

01420.1.02 QUALITY ASSURANCE

- A. The Engineer may make such investigation as he deems necessary to determine the ability of the Contractor or videographer to perform the work, and the Contractor shall furnish to the Engineer all such information and data for this purpose as the Engineer may request. The Engineer reserves the right to reject the Contractor or any videographer if the investigation fails to satisfy the Engineer that such Contractor or videographer is properly qualified to carry out the work specified herein. Upon rejection, the Contractor shall engage the services of another videographer, which shall undergo the review and approval process specified hereinbefore.
- B. No construction shall begin prior to the review and approval of the video disks covering the construction area. Any video coverage not acceptable to the Engineer shall be refilmed at no additional charge. All video and written records shall become the property of the Township.

01420.1.03 SUBMITTALS

One (1) complete set of project coverage video disks shall be submitted to the Engineer for approval. An additional copy is required for projects with work in state highway right-of-way limits.

01420.1.04 JOB CONDITIONS

All video work shall be done during times of good visibility. No video shall be done during periods of visible precipitation or when more than 10% of the ground area is covered with snow, unless otherwise authorized by the Engineer.

PART 2 - PRODUCTS

01420.2.01 EQUIPMENT

A. Mobile Unit:

When conventional wheeled vehicles are used, the distance from the camera lens to the ground shall not be less than twelve feet (12') to ensure proper perspective.

In some instances, audio-video coverage will be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking or special conveyance approved by the Engineer.

B. Audio-Video:

Audio-video shall be in digital format

C. Camera:

Video output from camera(s) used must be capable of producing NTSC-525 lines/60 field/s. Resolution in the Y channel, minimum 500 TV lines at center, utilizing a bias lit beam split prism, in combination with Professional and/or Industrial charge-coupled device (CCD) camera, for optimum color imagery and minimum lag through ten (10) foot candles, with Geometric Distortion not to exceed 1.5% of Picture Height at any point in picture area.

D. Lighting:

The Contractor shall provide, if required, all lighting and power therefor, to fill in all shadow areas caused by trees, signs, and other objects.

01420.2.03 RECORDED INFORMATION

A. Audio:

Each video disk shall begin with the current date, project name and municipality and be followed by the general location; i.e., name of the street or location of "cross-country" line, viewing side and direction of progress.

B. Video:

The engineering stationing numbers shall be continuous, be accurate, correspond to the project stationing and include the standard engineering symbols (for example 14+84). This transparent information shall appear in the lower half of the viewing screen.

Below the engineering stationing, periodic transparent alphanumeric information consisting of the name of the project, name of the area covered, direction of travel, viewing side, etc., shall appear. To preclude the possibility of tampering or editing in any manner, all video recordings shall, by electronic means, display continuously and simultaneously generated transparent digital information to include the date and time of recording, as well as the corresponding engineering stationing numbers. The date information shall contain the month, day and year (for example 10/5/72) and shall be placed directly below the time information. The time information shall consist of hours, minutes and seconds, separated by colons (for example 10:35:18). This transparent information shall appear on the extreme upper left-hand third of the screen.

PART 3 - EXECUTION

01420.3.01 AUDIO-VIDEO COVERAGE

- A. The entire project site shall be videoed. Zone of influence shall extend to 50 feet from each side of each pipeline to be installed.
- B. Audio-video coverage shall include all surface features located within the zone of influence of construction supported by appropriate audio description. Audio description shall be made simultaneously with video coverage. Such coverage shall include, but not be limited to, all existing driveways, sidewalks, curbs, ditches, roadways, landscaping, trees, culverts, headwalls, and retaining walls or buildings located within such zone of influence.
- C. Houses and buildings shall be identified visually by house number, when visible, in such a manner that structures of the proposed system; i.e., manholes on a sewer system, can be located by reference.
- D. The rate of speed in the general direction of travel of the conveyance used during recording shall not exceed 48 feet per minute. Panning rates and zoom-in, zoom-out rates shall be controlled sufficiently such that during playback will produce clarity of the object viewed.

01420.3.02 IDENTIFICATION

- A. All video disks shall be properly identified by disk number, location and project name and municipality in a manner acceptable to the Engineer.
- B. A record of the contents of each disk shall be supplied by a sheet identifying each segment on the disk by location; i.e., roll number, street or road viewing, counter number, viewing side, point starting from, traveling direction and ending destination point.

01420.3.03 ADDITIONAL AUDIO-VIDEO REQUIREMENTS FOR BLASTING

- A. Audio-video coverage shall include all surface features located within 250 feet of the blasting area and supported by appropriate audio description. Audio description shall be made simultaneously with video coverage. Building exterior coverage shall include, but not be limited to, all masonry features of the building, such as walls, foundations, chimneys, or porches. Building interior coverage shall include, but not be limited to, all outside basement walls and flooring. Videoing shall be performed twice to record "before" and "after" blasting conditions.
- B. Videoing of a structure shall commence with a 360-degree pan of the exterior with the building

address displayed. To maintain viewer orientation and video integrity, the camera shall run continuously as videoing proceeds from exterior view to interior view. The videographer shall pan and zoom in and out to control sufficiently the clarity of the objects being viewed, and will not exceed a rate of more than two (2") inches per second on telephoto zoom.

- C. Visual Orientation: In order to orientate the viewer, all recorded material shall contain in the video portion, a display showing the direction of North by means of an adequate number of highly visible arrows or place cards, on or near the walls, floors and structures mentioned above.
- D. Three (3) attempts must be recorded by the videographer to complete the video project at each location and a log sheet describing the day, time, and disposition of the contact.
- E. At no time will the Contractor be allowed to use any electrical circuits within the building structure in order to protect the electrical circuits from overloading. All video recording shall be done during regular business hours, unless otherwise specified by the property owner or Engineer. The Contractor shall be responsible for notifying building owners and occupants and for coordinating videoing hours. The Contractor must enter and leave property in a professional and orderly workmanship-like manner.

01420.3.04 TELEVISION INSPECTION OF GRAVITY SEWERS

See Section 02610.3.11

END OF SECTION

DIVISION 2

SITE WORK

<u>SECTION</u>	<u>DESCRIPTION</u>
02100	Clearing and Grubbing
02200	Earthwork
02270	Erosion and Sedimentation Control
02310	Boring and Jacking Operations
02511	Paving Restoration
02605	Manholes and Vaults
02610	Utility Pipe and Fittings
02660	Water Distribution Specialties
02730	Submersible Sewage Pumping Station
02735	Sanitary Sewage Specialties
02830	Chain Link Fence
02920	Finish Grading and Seeding

**SECTION 02100
CLEARING AND GRUBBING**

PART 1 - GENERAL

02100.1.01 DESCRIPTION

The Contractor shall furnish all labor, materials and equipment necessary for clearing the work area of all trees, down timber, snags, brush, rubbish, all other objectionable material, and other vegetation, except leaves, grass and weeds. All stumps and matted roots shall be grubbed.

02100.1.02 QUALITY ASSURANCE

The Contractor shall remove all obstructions within the permanent and construction right-of-ways except those indicated on the Drawings or specified to be saved or restored. If the Contractor removes extra material than is required on the Project, then all suitable material removed shall be replaced by the Contractor at his own expense. If the Contractor exceeds the clearing limits specified, he shall, if directed, restore such areas to their original condition.

02100.1.03 SUBMITTALS

Submit two (2) copies of the agreement with each property owner releasing the Township from responsibility in connection with the disposal of debris.

02100.1.04 JOB CONDITIONS

State and local code requirements shall control the disposal of all materials. This includes meeting all requirements, including obtaining all required permits, of the Bucks County Conservation District. Arrange for disposal of debris resulting from clearing and grubbing to locations outside the Township's right-of-way and obtain written agreements with the owners of the property where the debris will be deposited. On-site disposal or burning shall not be permitted.

PART 2 - PRODUCTS

This part not used.

PART 3 - EXECUTION

02100.3.01 PREPARATION OF GROUND SURFACE

- A. Grading operations shall not be started in any area until all clearing and grubbing has been completed. In areas where excavation is to be made, the ground shall be cleared of all living or dead trees, stumps, brush, or other objectionable material. All embedded stumps, root mats, etc. shall be removed to a depth not less than two feet below the subgrade or slope surfaces. All depressions made as the result of such removal shall be backfilled with suitable material and compacted.

02100.3.02 MATERIALS TO REMAIN

Before commencing the work, the Engineer or Township shall clearly mark trees, shrubs, or any other objects or materials which are to remain within the areas to be cleared. The Contractor shall provide fencing or other suitable protection devices, as directed by the Engineer or Township, to protect these objects from damage during the course of construction.

02100.3.03 STRIPPING AND STOCKPILING TOPSOIL

Strip topsoil to whatever depth it may occur from areas to be excavated, filled or graded, and stockpile at a location approved by the Township for use in finish grading. The topsoil is the property of the Township and shall not be used as backfill or removed from the site.

02100.3.04 TREE REMOVAL

- A. All individual trees, groups of trees or bushes shall be removed from all easements for the full width of the easement, with a minimum ceiling height of 15 feet. All stumps and roots larger than three inches (3") in diameter shall be excavated and removed.
- B. Trees requiring removal or trimming of roots and branches which interfere with construction or traffic shall not be removed without written permission of the Engineer or Township.
- C. In order to minimize damage to trees that are to be left standing, trees shall be felled toward the center of the area being cleared.
- D. Transplanting of trees and pruning procedures shall conform to the latest standards of the American Association of Nurserymen.

02100.3.05 DEBRIS DISPOSAL

Materials not required on the project or retained by the Township shall become the property of the Contractor and shall be legally disposed off-site.

02100.3.06 RESTORATION

- A. Remove protective fences, enclosures and guards upon the completion of the project.
- B. 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. Replace trees, shrubs and plants designated to be saved which are permanently injured or die during the life of the Contract as a result of construction operations with like species acceptable to the Township.
- C. Restore any obstructions removed to facilitate construction to the condition equal to that existing before construction operations.

END OF SECTION

**SECTION 02200
EARTHWORK**

PART 1 - GENERAL

02200.1.01 DESCRIPTION

The Contractor shall excavate, sheet, shore, dewater, backfill, and compact all excavation, and shall make all fills that may be necessary for constructing the work under this project. The above shall also include all subsurface explorations and rough grading. The Contractor shall furnish all labor, materials and equipment necessary for completion of the work. Excavation shall be unclassified.

02200.1.02 QUALITY ASSURANCE

- A. Employ, at Contractor's expense, soil testing laboratory to perform compaction tests. Five (5) tests shall be performed at 1'-0" depth intervals down to undisturbed soil. Conduct compaction tests at locations directed by the Engineer or Township during backfilling operations.
- B. Determine compaction in state highways and shoulders by the testing procedure contained in PTM No. 112 or PTM No. 402. Determine compaction in areas other than state highways and shoulders by the testing procedure contained in ASTM D1556 or ASTM D2922.

02200.1.03 SUBMITTALS

- A. Before proceeding with work, submit name and credentials of retained soil testing laboratory for review by the Engineer.
- B. Submit a Statement of Compliance together with supporting data from the materials supplier attesting the composition analysis of backfill materials meet specification requirements.
- C. Submit certified compaction testing results from the soils testing laboratory.

02200.1.04 JOB CONDITIONS

- A. Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
- C. Contractor to comply with O.S.H.A. requirements.

- D. The Contractor shall cooperate with other contractors holding contracts for certain phases of the work so as to assure the proper incorporation of or provisions for all items which will be furnished and placed by others.
- E. The Contractor shall be responsible for giving notice to the other contractors, utility companies, etc., so that their work may be placed in ample time to prevent any delay in this work.

02200.1.05 UNAUTHORIZED EXCAVATION

Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Engineer or Township. Unauthorized excavation, as well as remedial work directed by the Engineer or Township, shall be at the Contractor's expense.

PART 2 - PRODUCTS

02200.2.01 PIPE BEDDING MATERIAL AND SUBBASE

Pipe bedding material for PVC pipe shall be AASHTO No. 8 coarse aggregate conforming to Section 703.2 of PennDOT Publication 408. Pipe bedding for ductile iron pipe shall be 2A Material conforming to Section 703.2 of PennDOT Publication 408. Structural subbase shall be 2A Material conforming to Section 703.2 of PennDOT Publication 408. Pipe bedding for copper pipe shall be screenings, or Type B #3 fine aggregate conforming to Section 703.1 of PennDOT Publication 408, or as approved by the Engineer. Slag or cinders shall not be used for pipe bedding or structural subbase. Refer to Standard Detail M1 for limits of pipe bedding installation.

02200.2.02 CRUSHED STONE BACKFILL

Stone backfill material for utility trenches shall be 2A Material conforming to Section 703.2 of PennDOT Publication 408. Within State rights-of-way, stone backfill material shall be 2RC select granular material conforming to Section 703.3 of PennDOT Publication 408, or as required by PennDOT Occupancy Permit.

02200.2.03 SUITABLE BACKFILL MATERIAL

Shall be free from boulders, rocks larger than six (6) inches, frozen lumps, debris (bricks, masonry batts, plaster, etc.) vegetation or other organic or foreign material.

02200.2.04 FILL MATERIAL

Shall be inorganic soil, free from frozen lumps, debris, or vegetation and shall have a liquid limit not exceeding 45, and a plasticity index not less than 6 nor greater than 15.

PART 3 - EXECUTION

02200.3.01 EXCAVATION FOR STRUCTURES

- A. The Contractor shall proceed with caution in any excavation and shall use every means possible to determine the location and extent of underground structures, utilities, conduits, etc., prior to excavation and to protect such facilities from damage or displacement during excavation. The Contractor shall be held strictly responsible for the repair and/or replacement of any structure, pipeline or other facility, above or below the ground which may be damaged in any way by his operations.
- B. The excavation work shall be performed on an "unclassified basis"; that is, the removal of all earth or rock formations regardless of the type or hardness of such formations.
- C. Contractor shall make all the necessary excavations and fills on the premises necessary to bring the finished floors and grades to the levels shown on the Drawings; or if not so shown, then to the elevation as directed by the Engineer or Township.
- D. Excavation includes removal of any old foundations, stumps, paving, building construction or building materials which may be concealed beneath the present grade, (within building or outside of building) and filling of any old cisterns, cesspools, wells, etc.
- E. All excavated materials shall be segregated into suitable and unsuitable material. The suitability of all materials shall be determined by the Engineer or Township. Only suitable materials shall be used for backfilling. Unsuitable materials shall be promptly removed from the site by the Contractor.
- F. The bottoms of all excavations for foundations shall be properly leveled off and footings placed on undisturbed soil. All loose materials shall be removed and the excavations shall be brought into approved condition to receive concrete or other material. No earth filling shall be allowed under any foundations. Excavations shall not be carried lower than required for footings and foundations. If, through an error, any part of the excavation is carried below the depth shown on the Drawings, the Contractor shall maintain the excavation and shall start the footings or foundations from the excavated level and no extra compensation will be considered.
- G. Contractor shall notify the Engineer or Township as soon as excavations for footings or foundations are completed in order that the bearing quality of the bottoms may be inspected before concrete is poured.
- H. Protect bottom of excavation from frost. Do not place foundations, footings, or slabs on frozen ground.
- I. Sheet piling, wood or steel and all bracing, shoring, or sheeting as required or necessary to conduct the work safely, retain the excavations, and complete the work, shall be furnished and installed by the Contractor unless noted otherwise.

- J. The Contractor shall remove all water, including rainwater or subsurface water, encountered during the course of the excavation. Removal shall be by the use of pumps, drains, and other approved methods, and shall keep the excavation free from water until the construction is completed and the backfilling is finished. The water shall be discharged through sediment traps to catch basins, sewers, and other drainage points as directed.
- K. The Contractor shall, at his own expense, maintain all backfilled excavations in proper condition until the end of the guarantee period following the date of the final payment. All depressions appearing in the backfilled excavations shall be promptly refilled regardless of the extent of seeding performed. The Contractor shall be responsible for any injury or damage that may result from improper maintenance of any backfilled excavations at any time during the guarantee period.

02200.3.02 TRENCH LIMITS

- A. Trenches shall be excavated to the depths and widths as approved. The sides of the trenches will be as nearly vertical as possible. The trenches shall be excavated true to line so that a clear space of six inches (6") is provided on each side of the pipe barrel for pipes up to three inches (3") in diameter, eight inches (8") for pipes up to 20" in diameter, and twelve inches (12") for pipes 20" in diameter and larger, to a height not less than top of the pipe. The maximum allowable trench width shall be two feet (2') wider than the outside diameter of the pipe barrel. Where sheeting is used, the maximum width below top of pipe shall be measured between interior faces of sheeting as driven, but in no case shall stringers or whaling strips be so placed as to interfere with proper ramming of earth under and around pipe. If sheeting does not extend below a point six inches (6") above pipe as laid, the maximum width allowed shall be measured between faces of excavation below bottom of sheeting.
- B. Where a section of trench has been excavated to a greater depth than specified, it shall be brought to proper grade, using crushed stone, which type(s) shall be determined by the Engineer based on the depth of the required undercut.
- C. Where, in the opinion of the Township, the grade is suitable for foundation of work, the bottom of the trench shall be excavated flat to receive pipe bedding material, and the bedding under each joint or couplings hollowed out to allow for making joints. Trenches excavated below proper grade, shall be filled to proper grade at the Contractor's expense, with bedding material thoroughly rammed to ensure adequate support and stability of pipe or other structures.
- D. The Township shall have the right to limit the amount of trench opened in advance of the completed sewer. Excavation shall be completed at any location, except for final grading and shaping of the pipe bed, which shall be completed a minimum of twenty feet (20') in advance of pipe installation. The amount of pipe laid in advance of backfilling shall not exceed one hundred feet (100'). Trench excavation in wetlands shall be limited to a length which can be excavated, laid, backfilled, tamped and completed in one (1) working day.
- E. The Township shall be empowered at any time, to require backfilling of open trenches over completed pipelines. If, in their judgment, such action is necessary even though to accomplish said backfilling, the Contractor may be compelled to temporarily stop excavation or other work. If work is stopped on any trench, for any reason except by order of the Township, and excavation is left open for an unreasonable length of time in advance of construction, the Contractor, shall if so directed, backfill such trench, and shall not again open said trench until he is ready to complete structure therein. If the Contractor refuses or fails to backfill such trench completely within forty-eight (48)

hours, the Township shall be authorized to do the work, and charge expense thereof to the Contractor.

- F. Where the location of a trench must be changed from the proposed Drawings due to the presence of an obstruction or other causes, the Contractor shall be entitled to additional compensation.

02200.3.03 PREPARATION OF TRENCH FOUNDATION

All irregularities and cavities either in earth or rock excavation, in bottom of trenches or tunnels, shall be filled to required level with clean earth or other approved material, and firmly compacted before pipe lines are laid therein, all without extra compensation. However, where in the opinion of the Township the proper grade is unsuitable for foundation of the work, the bottom of the trench shall be excavated to an additional depth of six (6) inches minimum and backfilled with crushed stone to the proper elevation at the Contractor's expense. The type(s) of stone used shall be determined by the Engineer, based on the depth of the required undercut.

02200.3.04 ROADWAY EXCAVATION, BACKFILL AND COMPACTION

- A. This work consists of furnishing all labor, materials, and equipment for performing excavations and gradings for the construction of road sub-grades, including all ditches, gutters and shoulders; disposing of all excavated materials in embankments and fills; dressing, shaping, wetting, and compacting to the full width of pavement areas including shoulders; all in conformity with lines, grades, cross sections and dimensions shown on the Drawings, as staked by or as directed by the Engineer or Township.
- B. The rough excavation shall be carried to such depth that sufficient material will be left above the designated grade to allow for compaction. Likewise, on embankments, sufficient material shall be placed above the designated grade to allow for compaction and settlement. Should the Contractor, through negligence or other fault, excavate below the designated lines, he shall replace such excavation with approved materials, in an approved manner and condition, at his own expense.
- C. The Contractor shall be responsible for and shall take all necessary precautions to protect and preserve or provide necessary temporary services for existing drainage, conduits, utilities or similar underground structures or parts thereof. The Contractor shall also provide temporary access to the site. The Contractor shall, at his own expense, satisfactorily repair all damage to such facilities or structures which may result from any of his operations or from negligence during the period of the contract.

02200.3.05 DISPOSITION OF EXCAVATED MATERIAL

- A. The Contractor shall grub and clear surface and remove all surface materials, of whatever nature, over line of trench and site of other structures.

- B. Excavated materials shall be classified, separated and stored for use in backfilling, repaving or replacing topsoil. Otherwise, replacement materials shall be furnished of equal quantity and quality, as directed, to replace the displaced material.
- C. Excavated material shall be placed so as not to interfere with traffic on the streets and driveways in an unreasonable manner. All surplus excavated materials shall be removed from the site of the work, but none shall be deposited on private property unless written consent of the property owner has been obtained and a copy filed with the Township.
- D. In case more material is excavated than can be used for backfill or stored at the site without causing conflict with traffic or drainage problems, the excess material shall be removed, stored and returned as required, for re-use as backfill.
- E. The Contractor shall furnish approved equipment for transporting loose or wet material over streets or highways.
- F. The Contractor shall be responsible for any loss or damage to curb, gutter, sidewalk and flagstones, and to paving material through their careless removal or neglectful or wasteful storage, disposal or use.
- G. The Contractor shall perform all necessary work for the removal of trees or for excavation by hand or tunnel in the vicinity of trees that may be left standing. No trees shall be cut down or trimmed unless approved by the Township.

02200.3.06 ROCK EXCAVATION

- A. Rock excavation shall be accomplished by drilling and wedging or blasting as permitted. Should blasting operations in any way shatter rock below the specified grade or specified width, so that, in the opinion of the Township, the area is unfit for foundation, such rock shall be removed and the area backfilled with approved material, to the proper grade.
- B. All excavated rock material which is unfit for backfilling shall be immediately removed from the site.

02200.3.07 EXPLOSIVES AND BLASTING

- A. The use of explosives shall comply with Title 25, Rules and Regulations, set forth by DEP, Subpart D - Environmental Health and Safety, Article IV-Occupational Health and Safety, Chapter 211 - Storage, Handling and Use of Explosives, and Township Building Code Regulations. In the event of any conflict between the aforementioned regulations, the most stringent criteria shall apply.
- B. Blasting for excavation will be permitted only after securing the written permission of the Township and after securing required blasting permits, insurance and bonds.
- C. Prior to blasting, the Contractor shall conduct a survey of all water supply wells within 250 feet of the blasting area. As a minimum, the survey shall consist of monitoring the water supply wells for

water level, taking water samples from each well, and performing laboratory testing of the water samples for total coliform organisms and total suspended solids. Monitoring and testing results shall be provided to the Township prior to the start of blasting.

- D. All field blasting shall be field monitored using seismographic type equipment and shall be performed under the supervision of a blaster licensed to practice in the Commonwealth of Pennsylvania. The Contractor shall keep and submit to the Township an accurate record of each blast. The record shall show the general location of the blast, depth and number of drill holes, the kind and quantity of explosives used, ground velocity and displacements, and other data required for a complete record.
- E. The Contractor shall be solely responsible for injury to persons or property located within or beyond the area or scope of the project that may result from use of explosives. The Contractor shall use heavy timbers, blasting mats, or other suitable devices to prevent damages from flying debris.
- F. Rock excavation within 20 feet of sewers, water or gas mains shall be done by hand and with non-explosive methods including hydraulic rock splitting or jackhammer, and the utmost care shall be exercised to avoid disturbance of the main. All exposed sewers and special structures shall be carefully protected from the effects of blast; and any damage to them by blasting shall be promptly repaired by the Contractor at his expense, and in no case shall the blasting be done within 40 feet of newly laid pipe or within 48 hours of placement of concrete.
- G. All blasting operations are to extend a minimum of 10 linear feet beyond all terminal manholes, as well as beyond the right-of-way/easement line, and of all laterals.
- H. All explosives shall be stored and transported as directed in the DEP Regulation. The Contractor, prior to initiation of any drilling or blasting operations, shall thoroughly familiarize himself with all State, County, and Local Rules and Regulations pertaining to use and storage of explosives and methods of drilling. Under no conditions shall detonation devices, firing caps, priming cord, etc. be stored or transported in proximity to explosive materials.
- I. All explosives shall be stored and transported in a secure and safe manner. All such storage places and vehicles shall display proper signs or markings and shall be in the care of a competent watchman at all times. Explosives shall be kept on the site only in such quantity as may be needed for the work being done and only during such time as they are being used.
- J. Should any street paving adjoining any excavation be damaged in consequence of the Contractor's blasting operations, he shall immediately cease his blasting operations and repair the damaged street paving.
- K. Prior to blasting, sufficient warning shall be given all persons in the vicinity, and traffic shall be stopped at the proper distance from the site and controlled by flagmen.

- L. A permit must be secured from the Pennsylvania Fish Commission prior to the use of explosives within the waterways of the Commonwealth. The P.F.C. Waterways Patrolman must be notified when the project is started, when explosives are to be used, and when the project is completed for final inspection.

Wayne Imler (or current Waterways Patrolman)
New Hope, PA 19426
Telephone: (215) 862-5301

Southeast Region Office
PA Fish Commission
Box 8
Elm, PA 17521
Telephone: (717) 626-0228

02200.3.08 DEWATERING EXCAVATIONS

- A. There shall be provided and maintained at all time during construction of work, ample means and devices, including all necessary equipment, power, and labor to pump, bail, or otherwise promptly remove and properly dispose of all water and/or sewage entering, or found in the excavations and other parts of work. Well points shall be utilized wherever necessary to maintain dry conditions throughout working areas.
- B. All excavations shall be free of water during construction of structures and backfilling operations. Temporary flumes, channels or pipes shall be used to divert water from the excavation.
- C. All water from any source shall be pumped or bailed to provide a dry trench, and shall be discharged in such manner as not to cause injury to work completed, damage to property, health hazards or impediment to traffic.
- D. In no case shall water be permitted to rise into or flow through a completed pipeline unless permitted by Engineer or Township. In no case shall drainage through a completed pipeline be permitted until Engineer or Township has been satisfied that all precautions have been taken to prevent admission of sand or other material, and in no instance shall internal pressure be permitted at any point in lines. Adequate means shall be provided at all times and continually maintained to relieve any internal pressure that might otherwise be exerted. All methods used to accomplish dewatering must be approved by the Engineer or Township.

02200.3.09 SHEETING AND SHORING

- A. All work performed and materials used for sheeting, bracing and shoring shall be in conformity with the current requirements of the United States Department of Labor Occupational Safety and Health Administration (OSHA) requirements.
- B. Trenches shall be properly and adequately shored at all times. The prevention of accidents and protection of surrounding ground and adjacent structures is the responsibility of the Contractor. When directed by the Engineer or Township, tight wood sheeting (approved steel sheeting optional) shall be installed for the protection of the workmen, property and the work. Voids found behind sheeting shall be immediately filled with a granular material and compacted.

- C. All timbering or underpinning shall be placed or driven by men skilled in such work and shall be so arranged that it may be withdrawn as backfilling proceeds without injury to structures built or adjacent structures or properties. If, in the opinion of the Engineer or Township, the material furnished for timbering excavations is not of proper quality, size, or improperly placed, the Contractor shall repair or replace as required by the Engineer or Township.
- D. Contractor shall upon notice, procure and place satisfactory timbering, or place said timbering in a satisfactory manner. Upon his failure to do so, work may be ordered stopped until the Contractor has complied with said notice.
- E. Timbering in excavations may be withdrawn as the backfilling is being done, except to such extent as the Engineer or Township shall order that said timbering be left in place. The Contractor shall cut off any sheeting left in place at least two (2) feet below finished grade and shall remove cut-off material without compensation therefore.
- F. When in quicksand or soft ground, or for protection of any structure or property, sheeting shall be driven to a depth below bottom of excavation as may be required by the Engineer or Township.

02200.3.10 RESPONSIBILITY FOR CONDITION OF EXCAVATION

- A. The Contractor shall be solely responsible for the condition of all his excavations, and any slides or cave-ins shall be removed.
- B. Failure or refusal of the Engineer or Township to order the use of bracing or sheeting, to order better quality or larger sizes of timber; to order sheeting, bracing or shoring left-in-place; to give orders or directions on methods of placing or driving sheeting, brace or shores, shall not relieve the Contractor of any responsibility concerning the condition of excavations or his obligations under the contract. Any delay that requires keeping an excavation open longer than would otherwise have been necessary, shall not relieve the Contractor from his obligation to properly and adequately protect the excavation from cave-ins or slipping, or any of these obligations under the Contract relating to injury of persons or property.

02200.3.11 UNDERGROUND UTILITIES AND STRUCTURES

All utility services encountered, shall be supported by timber struts or by other suitable means. Utilities or other structures located transversely across the trench will be protected from damage or displacement.

02200.3.12 PROTECTION OF PROPERTY AND STRUCTURES

The Contractor shall, at his own expense, sustain in their places and protect from direct or indirect injury, all pipes, conduits, poles, tracks, walls, buildings, and other structures or property in vicinity of his work, whether above or below ground. He shall replace any drain pipe, even if apparently not used and damaged, and shall at all times have a sufficient quantity of material available for sheeting his excavations, and for sustaining or supporting any structures that are uncovered, underdrained, endangered, threatened, or weakened.

02200.3.13 OBSTRUCTION SHOWN ON DRAWINGS

The Drawings show, in addition to structures to be built, certain information regarding location of tracks, pipes, conduits and other structures which exist along lines of work, both at and below surface of ground.

The Township expressly disclaims any responsibility for the accuracy and completeness of information given on Drawings with regard to existing structures. Said structures are shown only for the convenience of the Contractor. The information does not relieve the Contractor of any of his obligation to protect said structures in every way as provided for in the Specifications.

02200.3.14 OBSTRUCTIONS AND MAINTENANCE OF SERVICES

- A. Any work on poles, pipes, conduits or other structures that, in the opinion of the Engineer or Township requires removal, realignment or change because of work to be done under the Contract, will be done by the Contractor or by the owner of the structure. The Contractor shall uncover and support said structures within the limits of the trench.
- B. There shall be maintained at all times a continuous flow in all existing gas, water, sewer, conduit, electric power, and telephone lines, or any other pipes or drainage structures encountered in prosecution of work under this project, whether above or below ground surface.
- C. For prosecution of the work, the Contractor shall arrange for any relocation, temporary removal and restoration of all utility company facilities when required or directed by the Engineer or Township.
- D. At track crossings, any expense to which the owner of the trackage has made in shoring up tracks or in maintaining traffic, shall be borne by the Contractor, whether same is billed directly to him or to the Township.

02200.3.15 MISCELLANEOUS EXCAVATION

- A. The Contractor shall do such miscellaneous excavating work as may be necessary and directed by the Engineer or Township. Such excavation shall be subject to the same conditions and requirement specified herein trench excavation.
- B. Miscellaneous excavation shall include extra excavation for any special structure or outside trench, that may not be shown on Drawings or described in Specifications, where such excavation is done at the direction of the Township.

02201.3.16 BACKFILLING AND COMPACTION - STRUCTURES

- A. No backfilling is to be done around any part of the structure, walls, piers, or columns until such parts have been inspected and the backfilling authorized by the Engineer. No filling inside the building or backfilling against foundations, walls, curbs, or footings shall be done until concrete forms have been removed. Filling and backfilling inside of the building and to a point five feet (5') outside the exterior of all structures shall be installed in six inch (6") layers, and tamped solid with pneumatic tampers. Filling greater than five feet (5') outside of all structures shall be installed in layers uniformly spread and tamped and then leveled or sloped as required. No backfilling shall be done until concrete and/or masonry walls are adequately braced. Compaction shall be 95% of maximum Modified Proctor Density under building slabs and 90% of maximum Modified Density Proctor elsewhere as determined by ASTM D1557.

- B. Compaction for Slabs on Fill: All fill under slabs on-grade, shall be in accordance with the following requirements.
1. Materials to be selected from an approved source and be free from debris and rocks six inches (6") and larger which shall be pulverized or removed.
 2. Placement of fill on frozen ground or fill which is frozen will not be permitted.
 3. Areas designated on the Drawings as original ground shall be rolled before any fill or embankment is placed. This shall be done with sheep's-foot roller having a minimum pressure of 350 pounds per square inch, and making four (4) passes over the area, when the soil is within 2% of optimum moisture content.
 4. All soil fill shall be compacted to 95% of the maximum Modified Proctor Density, as determined by ASTM D1557. Fill shall be spread in horizontal layers of six inches (6") maximum compacted thickness.
 5. Remove debris from excavation and area to be backfilled. All rock, paving material, trees, debris, stumps, and other unsuitable backfill material shall be removed from the site by the Contractor.
- C. Any excavations (e.g., utilities, walls, footing, etc.) made within the compacted fill area shall be replaced with compacted fill as previously designated. Where compacted fill is placed adjacent to walls, the difference in elevation of the top of the fill on either side of the wall can be no more than one foot (1') or the wall shall be adequately braced.

2200.3.17 BACKFILLING AND COMPACTION – TRENCHES

- A. Backfilling includes all refilling of excavations and the tamping and rolling required for satisfactory compaction. Backfilling shall be done as promptly as possible without damage to pipe or structure in place. Backfilling will be done following inspection and approval of the work by the Engineer or Township, and only with permission of the Engineer or Township.
- B. No part of a pipeline or other structure that needs to be tested, located, or measured, shall be filled over or around until required tests and measurements have been made or witnessed by the Engineer or Township, and their permission so given to backfill. Any backfilling without authorization shall be uncovered by the Contractor at his own expense.
- C. All pipes shall be laid on an even and uniform bedding surface. The bedding shall be installed from a depth of six inches (6") below the pipe barrel. Bell holes and depressions for joints of the pipes shall be dug after the bedding materials have been properly graded. The pipe shall then be laid to its true grade and alignment. The bedding materials shall then be shovel placed and hand tamped to fill all spaces under and adjacent to the pipe to hold the pipe in its true grade and alignment during the test. The lines, grades and joints of the pipes will be inspected before any further backfilling above the pipe is commenced. After the inspection is completed, the bedding shall be continued in layers not exceeding six inches (6") to a height above the top of the pipe as indicated on the Drawings. The materials shall be placed with hand shovels and shall be solidly rammed down.
- D. Backfill material shall be used above the bedding as shown on the Drawings. This material shall be carefully and manually deposited for an additional height of one foot (1'). The compaction shall be done for the full length of the pipe, and in such a manner as not to disturb or damage the pipe. Hand-operated mechanical tampers may be used for compaction.

- E. From one (1') foot above the top of the bedding, machine backfilling and compaction may be used. Above this level, except for the last two (2) feet, small stones not larger than six inches (6") in their greatest dimension will be permitted, but this should not be in excess of 15% of the total volume of the backfill materials in the entire depth. Such stones shall be evenly distributed throughout the entire mass.
- F. The excavated material removed from the trenches can be used for backfilling purposes provided it meets the material classifications. In the areas where the conditions require the removal of the excavated materials, all the backfilling shall be done using crushed stone backfill. The backfilling materials should compact readily by the usual method of tamping. Unsuitable materials, such as clay that will crumble under light pressure by hand, frozen materials, ashes, cinders, tree stumps and other organic and unsuitable materials shall not be used for backfilling. Organic soil will not be permitted as backfill except for the top 18" of trenches located in wetlands.
- G. The materials backfilled in trenches shall be deposited in layers not exceeding eight inches (8"). Each lift shall be compacted to 95% maximum Modified Proctor Density, as determined by ASTM D1557. The degree of compaction shall be checked by the soils engineer, and each successive lift shall not be placed or compacted until the previous lift is inspected and approved by the soils engineer. The fill shall be compacted to elevations and limits indicated on the Drawings.

02200.3.18 BACKFILLING OF TRENCHES UNDER STATE, COUNTY OR TOWNSHIP JURISDICTION

- A. Backfill material used for all utility lines in State, County, and Township roads shall be as specified by these governmental agencies. Where 2A Material or other special material is specified by the agency having jurisdiction, the Contractor shall install such backfill. The excavated material from the trench shall be removed and legally disposed of at suitable locations. The trench shall then be backfilled with the material and procedure specified by these agencies.
- B. When approved by the Township, retained suitable material may be used as backfill for trenches that are within a Township road right-of-way and are more than three feet outside of the existing road shoulder or paved cartway.
- C. Retained suitable material may be used as backfill for trenches located within proposed road rights-of-way that are to be dedicated to the Township.

02200.3.19 RESTORATION OF EASEMENTS

- A. The Contractor shall take necessary precautions to protect the property, trees, shrubs, etc. in the areas adjoining the right-of-way and/or easement lines. Any damages caused during construction to such areas shall be repaired or replaced at the Contractor's expense.
- B. All trees, stumps and debris shall be removed from the site in a satisfactory manner and disposed of at proper locations.
- C. The Contractor shall restore the area to its original condition. The restoration shall include, but not be limited to, regrading the area; placing of topsoil; seeding/sodding; replanting of shrubbery; landscaping; repair or replacement of sidewalks, driveways, and curbs; replacement of signs, lighting, spotlights and sprinklers; and any damage during construction.

- D. The restoration shall commence immediately after backfilling of trenches with proper conditions for paving or planting. If the Contractor fails or neglects to commence the restoration work as specified, he shall assume all responsibilities and expenses for all damages arising out of such non-compliance.
- E. As the restoration work is completed, all surplus earth and other materials shall be disposed of in a satisfactory manner.
- F. Refer to Standard Details TR1 and TR2 for trench restoration requirements in unpaved easement areas.

02200.3.20 RESTORATION OF WETLANDS

- A. Trenches located in wetlands shall be restored to the existing natural grade with suitable backfill material. The top eighteen inches (18") of all trenches in wetlands shall be backfilled with topsoil previously stripped from the trench, as shown in Standard Detail TR1.
- B. All excess excavated material, and any other miscellaneous material shall be removed from the wetlands.
- C. No fill, materials or debris may be stockpiled on wetlands areas, except for stripped wetlands soils.
- D. All heavy equipment shall use mats for operating and moving across wetland areas.
- E. Stockpiles shall be placed in approved locations, as close to the disturbance area as possible, and outside of the 100-year floodplain. Provide temporary stabilization of stockpile surfaces with mulch. The Contractor shall water stockpiled areas during summer months and as directed by the Engineer.

02200.3.21 ROUGH GRADING

- A. The Contractor shall rough grade all areas throughout the site to the limits shown on the Drawings, to a level at least six (6") inches below the finished grades shown on the Drawings. In the rough grading, basis for all terraces, banks, lawns, etc. shall be formed. Banks shall not exceed 4:1 except where specifically noted. Walks shall be graded to the depth required for the placing of fill and paving material.
- B. The Contractor will be held responsible for determining the true amount of cut and fill for supplying all earth fill that may be required to accommodate the grades noted.
- C. All fill shall be placed in six (6") inch layers (compacted thickness) and shall be compacted to 95% maximum Modified Proctor Density under buildings and 90% maximum Modified Proctor Density elsewhere, as determined by ASTM D1557.
- D. After placing or removing the final layer of material, the subgrade shall be brought to a smooth even finish conforming to the configuration of the finish grades at grass areas and to a depth as noted to receive other toppings.

- E. In achieving final subgrade, in addition to any handwork that may be necessary, a mechanical grader having its blade between the front and rear wheels shall be used. No final smoothing operations by bulldozers or other equipment having blade or bucket outside its wheelbase or track will be permitted.
- F. The maximum tolerance from the required grade at any point shall be 1-1/2" and wherever the deviation shall exceed this limit, it shall be corrected immediately by the removal or addition of sufficient material to make it so conform before proceeding further with the work.
- G. Control grade points shall be set-up and continuously maintained by the Contractor throughout the entire grading operation, and these points shall be close enough to each other to afford control of grades within the tolerances stated. They shall in no case be more than 100' apart, both longitudinally and laterally, and where the slope of finished grade is 2% or more, not more than 50' apart. The Engineer or Township may, at his discretion, require maintenance of special control wherever he may deem necessary to meet existing conditions.

END OF SECTION

**SECTION 02270
EROSION AND SEDIMENTATION CONTROL**

PART 1 - GENERAL

02270.1.01 DESCRIPTION

The Contractor shall provide labor, equipment, tools, materials, and services needed to accomplish work as described herein and as shown or called out on the Drawings.

PART 2 - PRODUCTS

02270.2.01 MATERIALS

All materials shall be in accordance with the description herein and as shown or called out on the Drawings.

PART 3 - EXECUTION

02270.3.01 PROCEDURES

- A. The Contractor shall obtain all necessary regulatory agency permits and approvals for earthmoving activities associated with the work, and shall strictly comply with the requirements of the agencies. The Contractor shall maintain at the work site, a copy of the Erosion and Sedimentation Control Plan for the project. The Contractor shall implement all controls indicated on the Plan, and will be responsible to implement any additional controls necessary to protect the environment from erosion and sedimentation.
- B. The Contractor shall schedule and conduct his operations to minimize erosion of soils and to prevent silting and muddying of wetlands, streams, rivers, irrigation systems and impoundments (lakes, reservoirs, etc.). Construction of drainage facilities and performance of the contract work which will contribute to the control of erosion and sedimentation shall be carried out in conjunction with earthwork operations, or as soon thereafter as practicable. The area of bare soil exposed at any one time by construction operations shall be kept to a minimum.
- C. Prior to the suspension of construction operations for appreciable lengths of time, the Contractor shall shape the earthwork in a manner that will permit storm runoff with a minimum of erosion. Temporary erosion and sedimentation control measures such as berms, dikes, or slope drains, deemed necessary by the Engineer or Township shall be provided and maintained until permanent erosion control features are completed and operative. Temporary erosion control measures will be considered as a subsidiary obligation of the Contractor during the course of his work.
- D. The Contractor shall also conform to the following practices and controls:
 - 1. Waste or disposal areas and construction roads shall be located and constructed in a manner that will keep sediment from entering streams.

2. When work areas are located in or adjacent to drainage facilities, such areas shall be separated from the easement by a dike or other barrier to keep sediment from entering a drainage easement. Care shall be taken during the construction and removal of such barriers to minimize the siltation of adjacent drainage facilities or streams.
 3. Pollutants such as fuels, lubricants, bitumens, raw sewage and other harmful materials shall not be discharged into or near rivers, streams, wetlands, and impoundments, or into natural or manmade channels leading thereto. Washwater or waste from concrete mixing operations shall not be allowed to enter live streams, or discharged in wetlands.
 4. All applicable regulations of fish and wildlife agencies and statutes relating to the prevention and abatement of pollution shall be complied with in the performance of the contract.
 5. Any area disturbed shall have a temporary seeding applied, in accordance with the requirements of the Bucks County Conservation District. If construction takes place during winter months when it is not practical to seed, the disturbed area shall be mulched. Temporary seeding and mulching shall be done in accordance with Section 02920.
 6. When drainage ways are crossed, they shall not be left blocked overnight if this blockage could cause siltation downstream, or flooding to adjacent property. All drainage ways shall be restored to existing conditions or improved as directed by the Engineer or Township.
 7. Dumping of excavated or spoil material into adjacent streams, or on the banks of the stream where it may wash or slide into stream waters shall not be permitted. Dumping of excavated material, other than for stockpiling for backfilling of trenches, shall not be permitted in wetlands.
 8. Pumping of silt-laden water from trenches into streams or wetlands shall not be allowed.
 9. All construction equipment shall be operated in such a manner as to prevent pollution of any streams.
 10. Temporary stream crossings will be used to convey equipment and materials from one stream bank to the other. Under no circumstances will construction equipment be permitted to cross natural stream channels.
 11. Excavated material or new backfill shall not be stored between trenches and bodies of water; rather they shall be stored on the opposite side of the trench.
 12. All restoration work shall proceed as the work progresses and not left until end of the project.
 13. Any sediment cleaned from the erosion and sedimentation controls must be legally disposed off site.
- E. When it becomes necessary, the Engineer or Township will inform the Contractor of unsatisfactory construction procedures and operations insofar as erosion control and water pollution are concerned. If the unsatisfactory construction procedures and operations are not corrected promptly, the Engineer or Township may suspend the performance of the construction until the unsatisfactory condition has been corrected.

END OF SECTION

**SECTION 02310
BORING AND JACKING OPERATIONS FOR HIGHWAY CROSSINGS**

PART 1 - GENERAL

02310.1.01 DESCRIPTION

The Contractor shall furnish all labor, materials and equipment required to install a steel casing for the proposed highway crossing as shown on the Drawings. The work shall include casing installations by specified methods, design of jacking pit sheeting and shoring, excavation and backfill, maintaining the tunnel and pits free of water, furnishing and installation of the steel casing pipe, grouting the outside of the casing pipe, furnishing and installation of ductile carrier pipe, backfilling between the casing and carrier pipes, end seals, and restoration of all disturbed areas following the satisfactory completion of work and required testing.

02310.1.02 QUALITY ASSURANCE

The Contractor or Subcontractor proposing to do the work shall demonstrate to the Township and the Engineer the successful completion of at least four (4) similar casing installations within the past five (5) years of comparable diameter and length.

02310.1.03 SUBMITTALS

The methods and materials for the construction of each crossing must be approved by the Engineer prior to the start of construction of the crossing. Contractor shall submit his proposed construction procedures and other information as may be necessary for review by the Engineer. Such submittals shall include drawings of jacking pits and method of construction prepared and sealed by a Registered Professional Engineer and a detailed narrative of proposed construction procedures.

02310.1.04 JOB CONDITIONS

- A. The Contractor shall give written notice to PennDOT, with copies to the Township and Engineer not less than fourteen (14) days in advance of when he or his subcontractor will start work within the highway right-of-way in order that work can be properly coordinated. Contractor should note that proposed work involves construction operations through the property owned or controlled by PennDOT and all work shall be performed in a manner satisfactory to their engineers or their authorized representatives and in accordance with the roadway occupancy permit. The road traffic shall be maintained at all times with safety and continuity and the Contractor shall conduct all of his operations on or under the highway right-of-way fully within the rules, regulations and requirements of PennDOT. The Contractor shall be responsible for acquainting himself with such requirements as PennDOT may demand. The Contractor shall be responsible for traffic safety. He shall be responsible for any injury to persons and damage to property.

- B. The Contractor shall be fully responsible for the design, safety and adequacy of the jacking and/or tunneling and for the proper construction, handling, placing, maintaining, operating and removing of all equipment materials and related services.

PART 2 - PRODUCTS

02210.2.01 CASING PIPE

- A. Steel Pipe Casing: Steel pipe casing shall be manufactured from steel conforming to ASTM Grade 2, as amended to date, with a minimum yield strength of 35,000 psi before cold forming.
1. Pipe may be straight seam or spiral welded. A protective coat will not be required. Spacers for installation of the carrier pipe shall be installed by the Contractor.
 2. The diameter and wall thickness of the steel piping shall be as listed in the following table:

Pipe Size (inches)	Outside Diameter of Bell (inches)	Casing Size (inches)	Casing Thickness (inches)
≤4	6.71	8	0.250
6	8.90	10	0.250
8	11.16	16	0.281
12	15.37	20	0.344
24	28.50	36	0.532
30	34.5	42	0.625

3. The thickness of casing shown in No. 2 are minimum thicknesses. Actual thicknesses shall be determined by the casing installer based on an evaluation of the required jacking forces. Any buckling of the casing due to jacking forces shall be repaired at no additional costs to the Owner.
- B. Casing Spacers: Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell, lined with a PVC liner, minimum 0.09-inch thick, also having a hardness of 85-90 durometer. Runners shall be attached to stainless steel risers which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float in the casing. Casing spacers shall be Cascade Waterworks Manufacturing Company or Advanced Products and Systems, Inc., or equal.

02310.2.02 GROUT

Grout shall be a uniform mixture of 1:6 cement grout.

PART 3 - EXECUTION

02310.3.01 GENERAL REQUIREMENTS

- A. The steel casing shall be installed by means of the Boring, Drilling or Jacking Method. All equipment and methods shall be approved by the Engineer or Township and PennDOT. All supervisory and operating personnel engaged in the operation of boring or drilling equipment shall be fully qualified for such work and shall have had at least twelve (12) months experience in the operation of the equipment being used.

The casing pipe shall be installed true to line and grade as shown on the Drawings. Bored installations shall have a bored hole essentially the same as the outside diameter of the pipe. If voids should develop or if the bored hole diameter exceeds the outside diameter of the casing, grouting or other approved methods shall be employed to fill such voids at the Contractor's expense.

When augers or similar devices are used for casing pipe placement, 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 and thereby assuring 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 face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material. Plans and descriptions of the auger stop arrangement to be used shall be submitted to the Engineer for approval, and no work shall proceed until such approval is obtained and the arrangement is inspected in the field by the Engineer or Township. Work started prior to this inspection will be halted and the installed casing abandoned in place.

- B. Sheeted and shored pits shall be constructed for boring or jacking the casing. The Contractor shall submit the proposed design for supporting the pit walls to the Engineer for review and approval. The sheeting/shoring design shall be prepared by a professional engineer, licensed to practice in the Commonwealth of Pennsylvania. If a jacking machine is used with an auger as a vehicle removing the material, the machine must be able to jack independent of the auger. The use of water or other liquids to facilitate casing placement and spoil removal is prohibited. Installation of the steel pipe casing shall start at the low end.
- C. The boring operation shall be continued without interruption, except to install new lengths of casing pipe. The lengths of the casing pipe shall be joined by bevel cut full penetration welds. The joints shall be welded completely around the circumference of the pipe so as to prevent water leakage from the casing throughout its length. After the joints are formed, the welds shall be coated with a bituminous coating at least two (2) mils in thickness.
- D. If groundwater is encountered during the installation of the casing and the carrier pipe, the Contractor shall take all steps necessary to maintain dry conditions in the boring pit including channels, water collection wells, embankments, and pumping. Extreme care must be taken by the Contractor so that soil and/or soil fines are not removed by erosion during the dewatering operation. The discharge water shall be clear. If during the dewatering operation unstable soil conditions occur, the Contractor shall take all necessary steps to rectify the problem by stabilizing the soil. The Contractor shall provide sedimentation and erosion controls. No water pumped from excavations will be permitted to be pumped directly to sewers, inlets, or to a creek, but must first be

filtered through a sedimentation trap or other approved sedimentation control device prior to discharge.

- E. The void space between the casing pipe and surrounding earth shall be pressure grouted through the tapped fittings in the casing pipe.
- F. After the casing has been installed, the carrier pipe shall be installed as follows:
 - 1. Unless otherwise approved by the Engineer, the carrier pipe shall be installed as shown on Standard Detail M7. Spacers shall be installed on the carrier pipe and arranged in accordance with the manufacturer's recommended instructions to maintain the proper horizontal and vertical alignment of the carrier pipe inside the casing.
 - 2. Gravity sewer pipe shall be permanently supported by the use of manufactured spacers.
 - 3. All carrier pipe shall be properly insulated to prevent electrolytic or galvanic corrosion through contact with other metals.
 - 4. The annular space between the carrier pipe and casing shall be filled with "pea gravel" as indicated on Standard Detail M7. When approved by the Engineer, cement grout may be used to fill the annular space between the carrier pipe and casing.
- G. The ends of the casing shall be permanently sealed with brick masonry construction after inspection and after all tests have been completed and accepted by the Engineer.
- H. If applicable, special requirements of PennDOT or the Railroad owning the right-of-way to be crossed shall apply.
- I. The Contractor shall provide a bulkhead and sandbags on site. Contractor shall provide a stockpile of gravel sufficient to make emergency restoration of undermined areas. Contractor shall also provide lights for night work. Lights are to be aimed into the excavation and must not be directed toward roadway traffic or buildings.
- J. Where jacking is to pass through grouted soil, no jacking shall proceed until satisfactory test reports are received by the Engineer and the Engineer provides written authorization to commence jacking operations.
- K. Objectionable debris shall be disposed of at approved locations, and the work areas left in a neat and slightly condition.

END OF SECTION

**SECTION 02511
PAVING RESTORATION**

PART 1 - GENERAL

02511.1.01 DESCRIPTION

- A. The Contractor shall furnish all labor, materials and equipment required to restore all paving removed or damaged by construction operations and place new paving as required.
- B. Repaving of Township roads shall be done in strict accordance with regulations and requirements of Warrington Township.
- C. Repaving of state roads shall be done in strict accordance with regulations and requirements of PennDOT.
- D. All openings or holes cut through any paving for test holes, borings, well points, etc. shall be replaced in accordance with these Specifications at the Contractor's expense.

02511.1.02 QUALITY ASSURANCE

- A. Use only materials which are furnished by a bulk bituminous concrete producer regularly engaged in production of hot-mix, hot-laid bituminous concrete and is listed in PennDOT Bulletin 41, List of Commercial Procedures of Bituminous Mixtures.
- B. Referenced Standards:

Pennsylvania Department of Transportation (PennDOT):

Regulations Governing Occupancy of Highways by Utilities (67 PA Code, Chapter 459)
Publication 408 Specifications, 2007 as Amended
Publication 408- Specification for Bituminous Materials (Section 409)
Publication 213 - Work Zone Traffic Control

02511.1.03 SUBMITTALS

Submit a Statement of Compliance, together with supporting data, bituminous and aggregate suppliers attesting that the materials conform to the State Specifications.

02511.1.04 JOB CONDITIONS

- A. Take measures to control traffic during repaving operations. Do not allow traffic on repaved areas until authorized by the Engineer or Township.
- B. All paving damaged by the Contractor's operations beyond the limits of work shall be restored to its original condition at the expense of the Contractor.

PART 2 - PRODUCTS

02511.2.01 CONCRETE

Refer to Section 03010.

02511.2.02 BITUMINOUS PAVING MATERIALS AND AGGREGATES

Refer to PennDOT Publication 408 Specifications. All bituminous materials and aggregates used in paving and resurfacing are designated and shall conform to the applicable portions of the State Specifications. All bituminous material shall be "Superpave" design. The required ESAL design shall be approved by the Engineer.

PART 3 - EXECUTION

02511.3.01 PAVEMENT RESTORATION IN STATE ROADS

- A. All paving removed or damaged by construction operations, shall be replaced in kind and/or repaired as specified herein. All paving damaged beyond limits herein specified, shall be replaced with new paving at the Contractor's expense.
- B. All work shall meet the requirements of PennDOT for replacing pavement over all excavated or disturbed areas of the improved surface within the right-of-way. Refer to Standard Detail TR3 for restoration of stabilized shoulders.
- C. Temporary paving shall be performed as shown on Standard Detail TR4. Temporary paving must be maintained until replaced by permanent paving.
- D. When temporary paving is removed, it shall be replaced with permanent paving as shown on Standard Detail TR6. The existing paving shall be squared so that the patch boundaries are either parallel or perpendicular to the trench line. Tack coat, as approved by PennDOT, shall be used between the new and existing pavement, and the edges shall be sealed with Class PG 64-22 asphalt cement.
- E. Overlay roads as required by PennDOT to the limits shown on the Drawings with one and one-half inch (1-1/2") Superpave 9.5 or 12.5 mm wearing course. Provide paving notches to ensure smooth transition between new and existing pavement.

02511.3.02 PAVEMENT RESTORATION IN TOWNSHIP ROADS

- A. All paving removed or damaged by construction operations, shall be replaced in kind and/or repaired as specified herein. All paving damaged beyond limits herein specified, shall be replaced with new paving at the Contractor's expense.
- B. All work shall meet the requirements of PennDOT for replacing pavement over all excavated or disturbed areas of the improved surface within the right-of-way.
- C. Temporary paving shall be performed as shown on Standard Detail TR4. Temporary paving must be maintained until replaced by permanent paving.

- D. When temporary paving is removed, it shall be replaced by permanent paving as shown on Standard Detail TR5. The existing paving shall be squared so that the patch boundaries are either parallel or perpendicular to the trench line.
- E. Prior to the permanent replacement of pavement, representatives of the Township and Engineer shall make a determination as to the suitability of the permanent pavement replacement specified herein.
- F. The placing of bituminous material for base and surface courses of permanent pavement replacement shall terminate between October 15 and October 31, and shall not be resumed prior to April 1 to April 15, as determined by the Engineer, depending upon weather conditions. Bituminous material for base and surface courses of permanent pavement replacement shall not be placed when the air temperature is 40 degrees F. or lower; nor when the temperature of the pavement, base or binder on which it is to be placed is 40 degrees F. or lower, as determined by the Engineer.
- G. At joints between existing pavements and repaving work, the edges of existing pavements shall be cut back parallel with the trench at right angles, neatly trimmed, and approved by the Engineer.

An application of Class PG 64-22 asphalt cement shall be provided at all locations where new bituminous pavement joints existing bituminous pavement; no separate or additional payment will be made for this work.

- H. For unpaved streets, provide Type 2A Material for the full width of the existing road.

02511.3.03 REPLACEMENT OF DRIVEWAYS, CURBING AND SIDEWALKS

- A. Curbing and sidewalks that have been damaged or removed during construction shall be replaced in kind as shown on the Drawings. All joints between existing curb and sidewalk and replacement work shall be saw cut at right angles and neatly trimmed. Provide 1/4", full-depth, premolded expansion joint material between old and new joints.
- B. For bituminous paved residential driveways, the replacement paving shall consist of a crushed stone base course and a bituminous surface course. Type 2A Material base course shall be minimum four inches (4") thick after compaction, or equal to the depth of the existing stone course, whichever is greater, and the top surface thereof shall be not less than three and one half inches (3 1/2") below the surface of the adjacent existing paving. The bituminous binder course shall consist of a two-inch (2") Superpave 19 mm binder course. The bituminous wearing course shall consist of a one and one half (1 1/2") Superpave 9.5 mm wearing course. The top surface of this surface course shall be flush with the surface of the adjacent existing paving.
- C. Concrete residential driveways shall be replaced by the Contractor using 6" of Class "A" concrete, with 6" x 6" wire mesh conforming to the requirements specified in PennDOT Publication 408, Section 704. The replaced driveway shall be of the same thickness, workmanship and surface finish as the original driveway unless otherwise required by the Engineer.
- D. Stone residential driveways shall be replaced in kind with crushed stone backfill material.

02511.3.04 TESTING

- A. Obtain a minimum of one 6" diameter core sample for each 1,000 linear feet of permanent paving, or fraction thereof, for test of depth of bituminous material courses.
- B. Take core samples at locations as directed by the Engineer after final compaction rolling.
- C. Bituminous or concrete courses deficient more than 1/4-inch from the specified depth in any one sample, or uniformly more than 1/8-inch in three or more samples, shall be removed and replaced to the correct depth.
- D. Refill and compact test holes with material acceptable to, and under direction of, the Engineer.

END OF SECTION

**SECTION 02605
MANHOLES AND VAULTS**

PART 1 - GENERAL

02605.1.02 DESCRIPTION

The Contractor shall furnish and install precast reinforced concrete manholes and vaults as indicated on the Drawings. All precast structures shall be of the same manufacturer and shall be subject to the Engineer's approval.

02605.1.02 QUALITY ASSURANCE

Design loading shall include dead load, live load, impact, loads due to water table, handling stresses before and during installation, and any other loads indicated on the Drawings. Live loading shall be for A-16 per ASTM C890. A live load shall be considered as that load which produces the maximum shear and bending moments in the structure.

02605.1.03 SUBMITTALS

- A. Submit certified dimensional shop drawings and manufacturer's product data on precast manhole/vault sections and bases, frames and covers, steps, resilient pipe connection gasket, waterstops, wall sleeves/wall seals, and joint sealant compound. Include details of reinforcing steel, joint design, concrete mix design, and loading calculations and antiflotation calculations.
- B. Submit a Statement of Compliance together with supporting data from the materials supplier attesting that the materials meet or exceed specification requirements.

PART 2 - PRODUCTS

02605.2.01 MATERIALS

- A. Crushed Stone Subbase: Type 2A Material in accordance with Publication 408 Specifications.
- B. Cement Concrete: Refer to Section 03010.
- C. Joint Sealant Compound: Provide a double ring of preformed plastic sealing compound conforming to ASTM C443 so that the joint will remain watertight under all conditions of service, including movement due to expansion, contraction and normal settlement. "Ram-Nek" as manufactured by K.T. Snyder Company, Inc., or equal.

02605.2.02 MANHOLES AND VAULTS

- A. Provide precast concrete manholes as required by Standard Details SS1 and SS2. Manholes shall consist of a base, riser sections, and cone section manufactured in accordance with ASTM C478. The cone section shall be an eccentric type with a minimum 24" access opening. Unless otherwise approved by the Engineer, the manhole base section shall be provided with precast flow channels sloped to provide a 2" drop across a 4' diameter manhole. The shelf shall slope to the channel at 1" per foot.
- B. Provide precast concrete drop manholes as required by Standard Detail SS4. Precast concrete integral drop base and precast concrete U-shaped collars shall be as manufactured by Atlantic Products of Tullytown, PA, or equal.
- C. Provide watertight precast concrete vaults as indicated on the Drawings. Vaults shall be manufactured in accordance with ASTM C913 and designed for A-16 live loading and installation conditions in accordance with ASTM C890. Honeycombed or retempered concrete will not be acceptable.

02605.2.03 APPURTENANCES

- A. Manhole Frames and Covers: Grey cast iron conforming to ASTM A48 Class 30 or better and suitable for A-16 live loading. Castings shall be free of bubbles, sand, air holes, and other imperfections. Contact surfaces shall be machined and matched. Identification wording ("SANITARY SEWER") shall be cast into the cover in 2" high letters. All frames and covers shall be coated with black asphaltic paint. Provide standard manhole frames and covers in accordance with Standard Detail SS6. Provide watertight frames and covers in accordance with Standard Detail SS7.
- B. Manhole Insert: Provide manhole inserts for prevention of storm water inflow. Inserts shall be manufactured of high density polyethylene copolymer conforming to ASTM D1248, Class A, Category 5, Type 11. Insert thickness shall be a minimum of 1/8". Liner shall have a closed cell neoprene gasket around the perimeter seating surface. Insert shall include a lifting strap and vent hole.
- C. Manhole Steps: Steel reinforced polypropylene fabricated in accordance with Standard Detail SS5.
- D. Resilient Pipe Connection Gasket: Conforming to ASTM C923 and cast into manholes and vaults as indicated on the Drawings. Gaskets shall be on A-Lok Connector, as manufactured by A-Lok Products, Inc. of Tullytown, Pennsylvania, or approved equal.
- E. Exterior Joint Sealant: Provide heat activated, high shrink membrane for prevention of groundwater infiltration. Apply per manufacturer's instructions to all manhole section joints, including grade adjustments. Exterior joint sealant shall be "Wrapid Seal", manufactured by CANUSA, or approved equal.
- F. Grade Adjustment Rings: Provide rubber composite grade adjustment rings in diameter and thicknesses as required. Grade rings shall be "Infra-Riser", as manufactured by GNR Technologies, or approved equal.

- G. PVC Interior Lining: Where required, provide manholes with integral PVC liner resistant to corrosive attack. Lining shall be "Dura-Plate 100", as manufactured by A-Lok Products, or approved equal.

02605.2.04 MATERIALS PROTECTION

All outside surfaces of manholes and vaults shall receive two (2) coats of Koppers 300-M epoxy coating, or approved equal, with a minimum dry film thickness of 16 mils. The concrete surfaces shall be cleaned and free from all loose concrete or soil particles before application of any coatings. The coating shall be placed on entire exterior surfaces from the top of bottom slab to bottom of the frame and cover. The protective coating may be shop coated.

The inside surfaces of manholes and vaults shall receive two (2) coats of Epoxoline Series 22 by Tremec, or approved equal, with a minimum dry film thickness of 16 mils. For manholes receiving force main connections, and the next two successive downstream manholes, a PVC liner, Dura-Plate 100 Liner System, or equal, will be required.

PART 3 - EXECUTION

02605.3.01 INSTALLATION

- A. The Contractor shall provide an excavation of sufficient size to accommodate the outside dimensions of the structure as shown on the Drawings. Prior to setting the unit, the Contractor shall prepare a stone subbase suitable for receiving the structure. The base material shall be compacted and leveled to the elevation and thickness shown on the Drawings.
- B. The Contractor shall provide sufficient labor and equipment to unload and place the units. Should rental of a crane be required for unloading and setting the unit, it shall be coordinated with the manufacturer's dispatch office in sufficient time to acquire the equipment.
- C. The bases for manholes shall be constructed of concrete. The inlet and outlet pipes shall be set to proper grade, with their ends flush with the inside of the manhole prior to placement of concrete. When casting the base, concrete shall be placed under the pipes for a minimum of three (3) feet from the manhole wall or within six (6) inches of the pipe joint.
- D. In wetland and floodplain areas, as well as all manhole joints in excess of 10 feet deep, all exterior manhole joints, including the grade adjustment course, shall be wrapped with "Wrapid Seal" (12-inch minimum width), as manufactured by CANUSA, or approved equal. All precast sections of manholes shall be lifted and moved by use of suitable lifting slings and lugs to prevent damage to the precast joint edge. If minor damage occurs to the precast sections, such damage will be repaired in the presence of, and to the satisfaction of the Engineer or Township.
- E. All manhole joints between sections shall receive a double ring of joint sealant compound. One ring of sealant shall be applied to both inside and outside flanges of the manhole section groove before lowering the precast unit in place.
- F. Pipes entering precast sections shall be set securely in the opening provided, to the correct line and grade shown on the Drawings. An "A-Lok" rubber gasket, or approved equal, shall be cast in the concrete.

- G. Leveling of structures by use of wedges or shims will not be permitted. Manholes shall not be backfilled without the permission of and the prior inspection by the Engineer or Township.
- H. Manholes and vaults shall be placed as promptly as practical to coincide with the adjacent sewer pipe construction. If the construction of manholes and vaults is unnecessarily delayed, the Township shall have the authority to stop trenching and pipe laying until the structures are satisfactorily installed to complete sections of sewer.
- I. The top of all precast manholes, excluding the top adjustment ring, shall be brought to proper grade for receiving manhole frames, by adding concrete riser rings. The joints between these rings shall be constructed to be watertight, and shall meet the specifications for joints as specified in Paragraph E above. A maximum of five (5) 2" high grade rings may be constructed above the cone. The top adjustment ring shall be "Infrar-Riser" type, as manufactured by GNR Technologies, or approved equal.
- J. Construct drop connections as indicated on Standard Detail SS4. A precast drop manhole base with an integrally cast 90° bend shall be used for all drop connections. Precast U-shaped collars shall be installed to support the riser. Class C concrete shall be used to encase the tee branch, and to fill the void space between the collars and the manhole wall.
- K. Construct doghouse manholes on existing pipelines as indicated on Standard Detail SS3. Carefully excavate around existing pipeline for placement of the new manhole base. Take all measures necessary to control flow through the existing pipeline and to prevent leakage into the new base. After completion of the manhole, carefully remove the top portion of the existing pipeline.

02605.3.02 VACUUM TESTING

- A. All manholes and enclosed vaults shall be vacuum tested using the following procedure:
 - 1. Perform testing after structure is brought to final grade and castings attached. For manholes located in roadways, testing shall be performed after the binder course has been installed.
 - 2. Plug all sewer openings, taking care to securely brace the plugs and the pipe.
 - 3. Connect the vacuum pump to the outlet port with the valve open.
 - 4. Draw a vacuum of 10" mercury and close the valve.
 - 5. The test shall pass if the vacuum remains at 10" of mercury or drops to 9" of mercury in a time greater than the test period specified below.

VACUUM TEST TABLE

<u>Manhole Depth (ft.)</u>	<u>Manhole Diameter and Test Period (Sec.)</u>		
	<u>48" dia.</u>	<u>60" dia.</u>	<u>72" dia.</u>
0-10	60	90	120
10-20	90	120	150
20-30	120	150	180

-
6. If the structure fails the initial test, the Contractor shall locate the leak and make proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material.
- B. The testing equipment shall be an NPC Manhole Vacuum Tester as supplied by NPC Systems, Inc., Milford, NH, or approved equal.

END OF SECTION

**SECTION 02610
UTILITY PIPE AND FITTINGS**

PART 1 - GENERAL

02610.1.01 DESCRIPTION

The Contractor shall supply all necessary labor, materials and equipment for the installation and testing of water mains and water service piping, sanitary sewer mains and lateral piping, and sewage force mains as indicated on the Drawings.

02610.1.02 QUALITY ASSURANCE

- A. Materials contaminated with gasoline, lubricating oil, liquid or gaseous fuels, aromatic compounds, paint solvent, paint thinner, or acid solder will be rejected.
- B. Pipe strengths specified shall be provided unless otherwise indicated on the Contract Drawings. Pipe fittings shall be of the same strength rating as the piping on which they are installed.
- C. Potable water system products shall bear the seal of approval of the National Sanitation Foundation (NSF).

02610.1.03 SUBMITTALS

- A. Submit a Statement of Compliance, together with supporting data, from each product supplier attesting that the pipe, pipe fittings, joints, joint gaskets and lubricants meet or exceed specification requirements.
- B. Submit manufacturer's instructions for installation of adapters and for assembly of mechanical, push-on and compression type joints, including the manufacturer's maximum recommended deflection per joint. Submit tightening torque requirements for anchor studs, set screws, and bell bolts.

02610.1.04 PRODUCT HANDLING, DELIVERY AND STORAGE

- A. A packing list shall accompany every delivery made to the site. Absence of such a list may cause refusal of shipment. The packing list shall contain complete information, including customer's order number, contract number, truck number, truck routing, kind and class of pipe, diameter, weight per pipe, length of pipe, and date or other plant identification of the particular lot of pipe contained in the shipment. A copy of the packing list shall be submitted to the Engineer or Township as soon as practicable after the delivery of the pipe to the job site.
- B. During loading and unloading, care shall be taken in handling all pipe and fittings so as not to damage in any way the exterior coating or the lining. Under no circumstances shall a pipe or fitting be dropped. In unloading, mechanical equipment should be used whenever possible.

- C. The hook - sling method of lifting pipe, in which hooks or similar devices are inserted into each end of the pipe for lifting, will not be permitted. One acceptable method would be the use of the single or double sling, which is placed around the barrel of the pipe. Pipe being unloaded on skids shall not be rolled or skidded against pipe already on the ground.
- D. PVC pipe shall be protected from exposure to ultraviolet light.

PART 2 - PRODUCTS

02610.2.01 DUCTILE IRON PIPE FOR WATER AND SEWAGE FORCE MAINS

- A. Pipe shall conform to ANSI A21.51/AWWA C151 Class 52, unless otherwise noted. Furnish pipe with double thickness cement mortar lining and seal coat in accordance with ANSI A21.4/AWWA C104. All piping shall have gasketed push-on type and/or mechanical joints conforming to ANSI A21.11/AWWA C111.
- B. Fittings shall be standard or compact size and of ductile iron in accordance with ANSI A21.10/AWWA C110 and ANSI A21.53/AWWA C153. Provide mechanical joints for water main piping and mechanical or push-on joints for sewage force main piping. Push-on joint fittings will not be permitted for water mains. Provide mechanical joint fittings with "Mega-Lug" thrust restraint, or "approved equal" for water mains. Furnish fittings with double thickness cement mortar lining and seal coat consistent with pipe.
- C. All ductile iron pipe and fittings located inside structures shall be flanged. Flanged ductile iron pipe shall conform to ANSI A21.15/AWWA C115 Class 53. Flanges shall be flat faced conforming to ANSI B16.1 Class 125. Raised face flanges will not be permitted. Gaskets shall be full-faced rubber, 1/8" thick conforming to ANSI A21.10/C110. Nuts and bolts for flanged joints shall be low alloy steel conforming to the requirements of ANSI B16.1
- D. All pipe and fittings located inside structures shall be primed with an epoxy polyamide exterior coating minimum 4 mils DFT (TNEMEC Series 66, or equal).

02610.2.02 POLYETHYLENE ENCASEMENT FOR DUCTILE IRON PIPE

In areas with corrosive soils or stray current, all pipe, fittings and appurtenances shall be installed with polyethylene encasement. In the event the Drawings do not indicate any encasement or the limits of the encasement, the decision of the Engineer or Township shall determine the location where the encasement shall be used. All costs related to soil sampling, analysis and inspection shall be borne by the Contractor. The polyethylene encasement shall be 8 mils thick and installed in accordance with Method A of ANSI A21.5/AWWA C105.

02610.2.03 DUCTILE IRON PIPE FOR GRAVITY SEWER MAINS

- A. Pipe shall conform to ANSI A21.51/AWWA C151 Class 52. Ductile iron pipe shall be used for all gravity sewer pipe installed at depths in excess of 14 vertical feet in depth. Furnish pipe with double thickness cement mortar lining, and seal coat in accordance with ANSI A21.4. All piping shall have gasketed push-on type joints conforming to ANSI A21.11/AWWA C111.

- B. Fittings shall be ductile iron or gray iron in accordance with ANSI A21.10/AWWA C110 and ANSI A21.11/AWWA C111 Standards. Furnish fittings with double thickness cement mortar lining and seal coat consistent with pipe.

02610.2.04 PVC PIPE FOR GRAVITY SEWER MAINS AND LATERALS

- A. Pipe and fittings shall conform to ASTM D3034, SDR-35.
- B. Elastomeric seal material shall comply with the requirements of ASTM F477. Joints shall be designed in accordance with ASTM D3212.

02610.2.05 SERVICE WEIGHT CAST IRON PIPE FOR BUILDING SEWERS

- A. Building sewers, as defined by the International Plumbing Code, shall be service weight cast iron pipe in accordance with ASTM A-74.

02610.2.06 PVC PIPE FOR SEWAGE FORCE MAINS

- A. Pipe and fittings shall conform to ASTM D2241. All joints shall be push-on type using flexible elastomeric seals meeting the requirements of ASTM D3139. Elastomeric seal material shall be in accordance with ASTM F477.
- B. The pressure class rating to be used for pipe and fittings shall be approved by the Engineer based on case specific calculations provided for the project by the Developer. The minimum rated pipe and fittings that will be accepted are Class 52 Ductile Iron Pipe or DR 18 (150 psi AWWA C900 pressure class).

02610.2.07 TUBING FOR WATER SERVICES

- A. Tubing: ASTM B88, Seamless, Soft Temper, Type K Copper
- B. Fittings for copper tubing shall be cast bronze with compression type joints. Soldered or flared joints will not be permitted.
- C. Polyethylene Tubing meeting the requirements of ASTM D2337, PE3408, SDR-9 200 psi, AWWA C901 and NSF Standard 14 may be used for water services over 100 feet in length. Polyethylene tubing shall be provided in continuous rolls. Shut-offs (curb stops) are to be provided at the right-of-way line and at every joint (connection) between rolls of tubing.

02610.2.08 TAPPING SLEEVES AND VALVES

- A. The tapping sleeve shall be mechanical joint type, Mueller Company Type H-615, or approved equal. The type of pipe and actual outside diameter of the main should be confirmed by the Contractor before placement of order for the sleeve.
- D. The tapping sleeve valve shall be Mueller Company Type H-667, or approved equal, having Class 125 flange inlet for connecting to the sleeve and mechanical joint end on the outlet.

02610.2.09 METALLIC WARNING TAPE

- A. Metallic warning tape shall be provided for all PVC piping, including gravity sewers, force mains and polyethylene water services.

PART 3 - EXECUTION

02610.3.01 PREPARATION

- A. Perform trench excavation to the line and grade indicated on the Drawings and as specified in Section 02200.
- B. Provide pipe bedding material around pipe as specified in Section 02200 and shown in Standard Detail M1. Place aggregate in a manner to avoid segregation and compact to the maximum density so that the pipe can be laid to the required tolerances.

02610.3.02 PIPE LAYING

- A. Pipe placement and alignment shall be accomplished only in the presence of the Engineer or Township. Adequate and suitable equipment and appliances for safe and convenient handling and laying of pipe shall be used. The Contractor shall give ample notice of the time scheduled for the pipe laying and inspection.
- B. Prior to being lowered into the trench, each pipe and fitting shall be carefully inspected, and those not meeting specifications or which are otherwise defective shall be rejected and removed from the project.
- C. If, in the opinion of the Engineer or Township, the materials furnished or the methods of installation are not in accordance with the Specifications or generally accepted practices for that type of work, such work may be stopped by the Township.
- D. Pipe shall be laid true to grades as shown on the Drawings. Each section of pipe shall rest on the pipe bed for the full length of its barrel, with recesses excavated to accommodate bells and joints. Any pipe which has its grade or joints disturbed after laying shall be taken up and re-laid. The pipe sections shall be inspected, and the interior and ends of all pipe will be cleaned before lowering into the trench. During construction, the Contractor shall use all precautions to keep the pipeline clean and clear of deposits and free from injury until finally inspected and accepted. The mouth of the completed pipeline shall be properly closed, at all times, with an expanding rubber plug or approved device, except when pipe laying is in progress.
- E. Pipe shall be laid so that when completed, the interior bore will conform accurately to grades and alignment indicated by the Drawings or as directed by the Engineer or Township.
- F. Before joints are made, each pipe shall be well bedded, and no pipe shall be brought into position until the preceding length has been thoroughly secured and placed. Coupling or bell holes shall be dug sufficiently large to ensure the making of a proper joint.
- G. The maximum length of pipe for all connections to precast manhole bases shall be 6 feet. The maximum length of pipe for all connections to poured-in-place bases and connections to existing manholes shall be 2 feet.

- H. The excavation into which the pipe is being laid shall be kept free from water, and no joints shall be made underwater. Water shall not be allowed to rise in the excavation until joint is complete. Care shall be used to secure watertightness and to prevent damage to joints during backfilling. All pipe joints shall be watertight within allowances established by these Specifications.
- I. No pipe shall be laid upon a foundation into which frost has penetrated, nor any time when the Engineer or Township shall deem that there is a danger of formation of ice or penetration of frost at the bottom of excavation. Where the foundation is unstable or consists of rock, a stone or gravel foundation shall be placed and tamped to form an acceptable bed for the pipe.
- J. Where sanitary sewer pipe crosses under water or gas lines, 18" of vertical separation shall be maintained. Where 18" of vertical separation cannot be maintained, the sanitary sewer shall be concrete encased 10 feet either side of the crossing. Refer to Standard Detail M2 for concrete encasement requirements. Also, when crossing water or gas lines, sewer joints shall be equidistant and as far as possible from the water or gas joints.
- K. If pipe must be cut to fit as closing pieces, such cuts shall be evenly and squarely made in a workmanlike manner with approved equipment. Injury to linings or coatings shall be satisfactorily repaired.
- L. Where pipe is laid on a radius or curvature, each section of pipe shall be deflected at its joint equally with each adjacent pipe.
- M. The minimum slope of 8" gravity sewers shall be 0.005 feet per foot, excluding terminal runs which shall have a minimum slope of 0.008 feet per foot. Minimum slopes for 10" gravity sewer shall be 0.003 feet per foot, and 0.0025 for 12" gravity sewers.

02610.3.03 STREAM CROSSINGS

- A. Construct small stream crossings in accordance with Standard Detail M8 using a temporary diversion pipe and rock filtration dams or other method approved by DEP Bureau of Dams and Waterway Management.
- B. For larger stream crossings, provide a plan prepared and stamped by a registered Professional Engineer licensed in Pennsylvania. Plan shall include method of crossing, sediment and erosion controls, soil borings, flood data information, HEC-2 analysis if stream is to be restricted as part of the plan, narrative and schedule for the crossing.
- C. All pipelines shall be ductile iron and encased in concrete as indicated on Standard Details M2 and M8. Do not backfill until concrete has achieved its initial set and concrete work is examined by the Engineer or Township.
- D. Prior to the start of any construction, all Erosion and Sedimentation Controls must be placed as per the rules, regulations and requirements of the Pennsylvania Department of Environmental Protection (DEP). The Contractor is advised that the DEP rules, regulations and requirements also apply to all other work on this project outside the Stream Crossing locations.

- E. Pipe trench subgrade shall be prepared a minimum of 6" below the bottom of the pipe. Unsuitable subgrade material shall be removed and backfilled with 2A Material.

After the trench subgrade has been prepared, the pipe shall be encased in Class C, 2,500 psi concrete; a minimum of 6" thick around the outside diameter of the pipe as per the Detail Drawings. The pipe may be supported in the trench by the use of solid concrete block.

- F. The Contractor may start the backfilling operation once the concrete has sufficiently set as determined by the Engineer. The backfilling shall be performed so as to avoid the formation of a permanent ridge in the streambed. After backfilling is complete, the Contractor shall remove all excess material and debris from the streambed.
- G. Construction of the stream crossings shall be completed in one operation. The Contractor may not start another operation until the stream crossing is completed, the streambed restored, and the temporary crossing removed, unless otherwise approved by the Engineer.
- H. The Contractor is responsible for dewatering the trenches throughout the construction of all stream crossings at no additional cost to the Township.
- I. The Developer or Contractor is responsible for all stream crossing permits. Engineer's approval of the stream crossing plan will not substitute for, and is not valid without, the required permits.

02610.3.04 SANITARY LATERAL INSTALLATION

- A. All laterals for single-family residences are to be 4" pipe unless otherwise noted. All other laterals are to be sized to accommodate the intended use of the facility, as determined by the Township. The pipe is to conform to Section 02610.2.04 of these Specifications.
- B. All laterals shall be laid on a minimum slope of 2 percent. No lateral may be deeper than 9 feet at its free end, measured to the invert, unless permitted by the Engineer. Laterals shall be connected to new sewer main by the installation of tee-wye fittings. For connection to existing PVC sewers, repair sleeves with tee-wye fittings shall be used. Approved saddle connections will be permitted for VCP and DIP piping. Laterals connected to manholes shall be a minimum of 6 inches above the highest invert elevation.
- C. The Contractor is to construct all laterals to the property line and extend a maximum of one foot beyond the property line. The free end of all laterals MUST end with a bell section of pipe. The laterals must be laid on a bedding of a minimum thickness of 6". The bedding material is to be 2A Material for ductile iron pipe and AASHTO #8 crushed stone coarse aggregate for PVC pipe.
- D. The free end of all laterals must be plugged with an approved push-on type plug. When the free end of the lateral is less than two (2) full pipe lengths from the sewer main, or when required by the Engineer, an approved mechanical expansion plug shall be used. All plugs must be capable of withstanding the required air test and must be watertight.
- E. Excavation and backfill for all laterals shall comply with Section 02200 of these Specifications. Rock in all lateral trenches must be removed to a point not less than two (2) feet beyond the end of the pipe.

- F. The lateral trench shall be backfilled with 2A Material for ductile iron pipe and AASHTO #8 crushed stone coarse aggregate for PVC pipe to a height of at least 1 foot above the top of the lateral pipe. The remainder of the trench shall be backfilled according to Section 02200 of these Specifications.
- G. The free end of all laterals must be marked by a 2" x 4" piece of lumber extending plumb from the invert of the lateral end to the top of existing grade. The marker shall be cut flush with the existing grade, painted green, and shall have reference location ties established from permanent structures. This is to be performed by the Engineer with assistance by the Contractor.
- H. If a lateral is deeper than 12 feet at the main, it is to be constructed as per the Detail Drawing for a deep sewer service connection.
- I. If water exists in the lateral trench, no lateral pipe may be placed until the water is removed.

02610.3.05 WATER SERVICE INSTALLATION (DOMESTIC AND FIRE)

- A. All new water service connections shall be 1" diameter minimum unless otherwise determined by Warrington Township. Provide each water service connection with a corporation stop and curb stop as shown on Standard Detail W1 and specified in Section 02660. The service connection beyond the curb stop shall be the responsibility of the consumer.
- B. All existing water service connections requiring repair or replacement may be repaired or replaced using the existing diameter service pipe provided that the use of the structure being served has not been changed. The minimum diameter service line for existing residential use shall be 1".
- C. The service line extension must be laid in a straight line at right angles to the street and at a depth necessary to secure proper alignment and avoid obstacles. Four feet of cover shall be maintained for the service piping. Service pipe located within a road right-of-way shall be bedded and backfilled in accordance with Section 02200 of these Specifications.
- D. All service connection piping shall be installed in continuous runs from the corporation stop to the curb stop and from the curb stop to the ball valve located inside the structure. Connections in service piping longer than 100 feet shall be made using an additional curb stop and box assembly. Buried couplings shall be prohibited.

02610.3.06 SERVICE ENTRANCE AT DWELLING UNIT

A protective sleeve, two pipe sizes greater than the service pipe, shall be provided where the service pipe enters the wall of the dwelling, in accordance with Warrington Township Plumbing Code. The annular space between the sleeve and pipe shall be caulked and sealed. A ball valve shall be installed immediately inside the entrance wall to the structure. The interior service piping for the meter setting and appurtenances shall be installed in accordance with Standard Detail W5 and these Specifications. A pressure-reducing valve shall be installed on the "house" side of the meter when the incoming system pressure is greater than 65 psi. Pressure reducing valve shall be Watts UB5, or approved equal.

02610.3.07 THRUST BLOCKS

Thrust blocks shall be provided by the Contractor where fittings are used to change the direction of pressure pipelines. Horizontal thrust blocks shall be in accordance with Standard Detail M3. Vertical thrust blocks shall be in accordance with Standard Details M4 and M6. The thrust block must be formed

against a solid trench wall which is excavated by hand so as not to damage the bearing surface. The thrust blocks must be constructed so the bearing surface is in direct line with the major force created by the pipe or fitting. The bearing surface for each fitting shall be in accordance with Standard Details M5 and M6. No coupling or joint shall be covered with concrete.

02610.3.08 PRESSURE MAIN TESTING

- A. Test each newly laid pipeline, including all water service connections, any valved section thereof, hydrostatically at a minimum of 100 psi or 125% above the normal operating pressure (whichever is greater) based on the elevation of the lowest point in the pipeline corrected to the elevation of the test gauge. The maximum test pressure shall be 175 psi for standard water mains and 200 psi for fire sprinkler connections. All testing is to be performed following the installation of all services to the right-of-way line.
- B. The pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. Slowly fill the section to be tested with potable quality water, expelling air from the pipeline at the high points if necessary. Contractor shall be responsible for installation of corporation cocks at all high points. After all air is expelled, close air vents and corporation cocks and raise the pressure to the specified test pressure.
- C. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings and valves showing visible leakage. Retest.
- D. After visible deficiencies are corrected, continue testing at the same pressure for an additional two hours to determine the leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as the quantity of water supplied to the pipeline necessary to maintain test pressure during the period of the test.
- E. Compute the maximum allowable leakage by the following formula:

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

Where: L is the allowable leakage in gallons/hour
S is the length of the section tested in feet
D is the nominal diameter of the pipe in inches
P is the average test pressure in psig

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

- F. If the test of the pipe indicates leakage greater than that allowed, locate the source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of the amount of leakage.
- G. The Township shall be present during all water main testing and shall operate all existing water main valves.

02610.3.09 DISINFECTION OF WATER DISTRIBUTION SYSTEM

- A. Each unit of completed water distribution system shall be thoroughly disinfected with chlorine before it is placed in operation. The amount of chlorine applied shall be such as to provide a dosage of not less than fifty (50) parts per million. The chlorinating materials shall be introduced to the water supply lines and/or distribution systems in a manner approved by the Engineer. Following a contact period of not less than twenty-four (24) hours, the heavily chlorinated water shall be flushed from the system with clean water until the residual chlorine content is not greater than the chlorine residual concentration present in the public water supply in that area.
- B. Materials
 - 1. Liquid Chlorine: Liquid Chlorine shall conform to United States Army Specifications 4-1.
 - 2. Hypochlorite: Liquid Hypochlorite shall conform to Federal Specifications 0-B-441, Grade A.
 - 3. Calcium Hypochlorite: Calcium Hypochlorite in tablet form, containing 70% available chlorine by weight.
- C. After disinfection, the Contractor will determine the bacteriological quality of the line by laboratory testing at no cost to the Township. Samples shall be collected for analysis on two (2) occasions at least 24 hours apart. The test results must be certified by the laboratory to assure that the water system is free from coliform bacteria contamination. The Township shall schedule and witness all tests. A laboratory representative is to be on site to collect all samples.
- D. If any of the above-referenced testing or disinfection produces unsatisfactory results, the Contractor will be responsible to perform any required corrective work and to re-test the subject line until satisfactory results are obtained.

02610.3.10 GRAVITY SEWER TESTING

- A. During construction and at the completion of the work, the Contractor shall make tests as directed by the Township to ascertain if the pipe is properly aligned and the joints are tight. The Township will witness all tests. The Contractor is responsible for providing a pressure gauge and a metering device (if required) for the test. The Contractor shall also furnish a suitable pump and all other apparatus required, and shall pay all costs connected therewith. Defective work shall be repaired or replaced immediately at the Contractor's expense.
- B. Test for proper alignment of PVC pipe by passing a mandrel through all gravity sewer mains. The mandrel shall be sized to allow for a maximum deflection of 5 percent.
- C. Test each newly installed section of gravity sewer including laterals for leakage between manholes by the low pressure air method. All sewers shall be backfilled to a depth of not less than 2 feet above the sewer, and all openings carefully plugged before start of a test. The testing procedure shall be as follows:
 - 1. The air compressors to be used for the tests must be equipped to control the air entry rate and prevent the pressure from exceeding 5 psig. The test shall be performed on pipe with a wet inside condition. All outlets in the section to be tested shall be fitted with airtight plugs and braced to withstand the applied pressure.

2. After the pipe has been wetted, the air shall be slowly admitted to the test section until a constant pressure of approximately 4.0 psig is reached. If ground water is present, determine its elevation above the springline of the pipe by means of a piezometric tube. For every foot of ground water above the springline of the pipe, increase the starting test pressure reading by 0.43 psig. Do not increase pressure above 10 psig. Allow temperature to stabilize for at least five (5) minutes. During this time all plugs shall be checked for tightness with a soap solution. If leaks are found, the pressure will be released and the plugs tightened to stop the leakage. This procedure shall be repeated until all of the plugged openings are found to be tight. Adjust pressure to 3.5 psig and start test.
3. Determine the test duration for a sewer section with a single pipe size from the following table. No allowance will be made for laterals.

AIR TEST TABLE
Minimum Test Time For Various Pipe Sizes

Nominal Pipe Size, inches	T(time), min/100 ft	Nominal Pipe Size, inches	T(time), min/100 ft
3	0.2	21	3.0
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6.0
15	2.1	18	2.4

Record the drop in pressure during the test period. If the air pressure has dropped more than 1.0 psig during the test period, the line is presumed to have failed. If the 1.0 psig air pressure drop has not occurred during the test period, the test shall be discontinued and the line will be accepted.

4. If the line fails, determine the source of the air leakage, make corrections and retest. The Contractor has the option to test the section in incremental stages until the leaks are isolated. After the leaks are repaired, retest the entire section between manholes. The Township reserves the right to require TV inspection on any section of pipe. Any pipe found broken shall be dug up and replaced by new pipe.
5. The air test shall not be accepted until all underground utilities (i.e., water, gas electric, phone, cable) have been installed.
6. Prior to the connection to the system, all sewer mains shall be flushed by the use of high-pressure water.
7. After successfully completing all required tests for alignment and leakage, sewer lines shall be televised in accordance with Section 02610.3.11.

02610.3.11 TELEVISION INSPECTION OF GRAVITY SEWERS

- A. The Contractor shall furnish all equipment, labor, materials and incidentals necessary for documenting the post construction conditions of newly installed sanitary sewers by the use of closed circuit television. All televisions shall be conducted in the presence of the Engineer or Township.
- B. The Contractor shall employ only competent personnel skilled in this type of work. The Contractor shall have not less than two years' experience with closed circuit television inspection and videoing of sewer lines. The Engineer may require evidence in the form of records from previous sewer inspections to substantiate any claims concerning the ability of the Contractor and his equipment to perform as required.
- C. Any video disk coverage not acceptable to the Engineer shall be refilmed. All video disks and written records submitted to the Township shall become the property of the Township.
- D. One complete set of project video disks and reports shall be submitted to the Engineer for approval.
- E. Each video disk shall have an audio description of the location, size and type of material of the sewer being inspected along with all laterals, defects, cracks, leaks, or cross connections identified. Manhole descriptions and conditions shall also be recorded. The audio-video shall in no way relieve the Contractor from preparing and submitting the written report.
- F. A written report of the closed circuit television inspection shall be submitted, in duplicate, outlining the locations and the conditions found which are indicative of leaks, breaks, growths or incrustations, debris, serious misalignment or other adverse conditions. The report shall include, but not be limited to, the following:
 - 1. Location of beginning and terminal structure (station and offset shown on the Drawings).
 - 2. Pipeline material and size.
 - 3. Length of run and stations.
 - 4. Locations of all laterals, pipe breaks, cracks, infiltration, debris, etc. by station.
- G. The television camera used shall be one specifically designed and constructed for pipeline inspection and shall be capable of rotating 90 degrees in all directions. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions, the camera shall have a minimum of 600 line resolutions. Picture quality and definition shall be to the complete satisfaction of the Engineer.
- H. A self-propelled transport shall be employed when a skid mounted television camera cannot be used or winched through the sewer line. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Radios, or other suitable means of communications, as required, shall be set up between the two manholes of the section being inspected.
- I. The cable or rod shall have a footage meter so that the location of the television camera and point of observation will be known at all times. The footage readings shall be automatically displayed on the video monitor in the television studio and shall be recorded on the permanent videotape log.
- J. To preclude the possibility of tampering or editing in any manner, all video recordings must, by electronic means, display continuously and simultaneously generated transparent digital information

to include the name of the project, month, day, year, hour, minute and seconds of the day. This transparent alphanumeric information will appear on the extreme upper left hand third of the screen.

- K. The locations of each manhole, identification of street in which each sewer is located and direction which televising is being done, shall be provided.
- L. Prior to televising, the Contractor shall clean the sewer line by the use of high-pressure water to permit passage of the camera. Any debris resulting from cleaning operations shall not be permitted to pass through the sewer system but shall be flushed down to and removed from the downstream manhole of the sewer line.
- M. The Contractor shall immediately repair or replace any defective work. Any pipe found broken or crushed shall be replaced by new pipe. Repaired or replaced pipe shall be retested as required by the Engineer. All sewer lines shall be re-televised after any repairs.

END OF SECTION

**SECTION 02660
WATER DISTRIBUTION SPECIALTIES**

PART 1 - GENERAL

02660.1.01 DESCRIPTION

Furnish and install all valves, valve boxes, and other piping specialties as specified herein and indicated on the Drawings to provide complete piping systems as intended.

02660.1.02 QUALITY ASSURANCE

- A. Products shall be new and the latest standard of reputable manufacturers with replacement parts available. Products contaminated with gasoline, lubricating oil, liquid or gaseous fuels will be rejected.
- B. Potable water system products shall bear the seal of approval of the National Sanitation Foundation (NSF).

02660.1.03 SUBMITTALS

- A. Submit certified dimensional shop drawings and manufacturer's product data on valve operators including assembled weight, construction details, materials of components, and installation instructions.
- B. Submit manufacturer's maintenance instructions and complete parts lists.

02660.1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver valves and accessories to the job site in the manufacturer's boxes or crates. Mark each valve as to size, type and installation location. Seal valve ends to prevent entry of foreign matter into valve body.
- B. Store valves and accessories in areas protected from weather, moisture, and possible damage. Do not store materials directly on ground.
- C. Handle valves and accessories to prevent damage to interior and exterior surfaces.

PART 2 - PRODUCTS

02660.2.01 CORPORATION STOPS

- A. Corporation stops shall be brass or red-brass alloy body in conformance with ASTM B62. Valve shall be ball type with T-head operator. Inlet shall be AWWA C800 thread, and outlet shall be compression connection. Corporation stops shall be Mueller Model No. B-25008, or Ford Model F1000-4.
- B. Refer to Standard Detail W1 for typical water service connection.

02660.2.02 CURB STOP AND CURB BOX

- A. Provide bronze body curb stop with solid bronze tee head, double Buna-N O-rings in stem, spherical ball or plug, and molded Buna-N rubber seals. Furnish with ends suitable for service piping. All curb stops shall be 1" unless otherwise noted on the Drawings. Curb stops shall be Mueller Model No. B-25209, or Ford Model B44.
- B. Provide cast iron extension type curb box with arch pattern base, one-piece lid, foot piece, and stationary rod. Furnish curb boxes with bituminous coating (2 coats). Curb boxes shall be Model H-10314 with 89982 lids in unpaved areas and Model H-10334 with 89376 lids in roadways and other paved areas as manufactured by Mueller Company, or Ford equivalent.
- C. Refer to Standard Detail W1 for typical water service connection.

02660.2.03 RESILIENT SEATED GATE VALVES AND VALVE BOXES

- A. Provide iron body, resilient seated, solid wedge type gate valves conforming to AWWA C509. Valve shall have a non-rising stem and mechanical joint ends. Furnish valves with a 2" square operating nut that opens by turning in a counterclockwise direction. Valve shall be Kennedy or Mueller resilient seat valve, as specified in Section 02660-2.05.B.
- B. Provide 5-1/4" diameter three-piece screw type, cast iron, screw-type adjustable valve boxes with one-inch riser ring for all buried gate valves. Valve boxes shall be of sufficient length to reach the surface of the ground, but not extend above the ground surface. The word "WATER" shall be cast in the top of the cover. Valve boxes shall be as manufactured by Tyler/Union Company 6860 Series, or approved equal.
- C. Refer to Standard Detail W2 for typical installation of gate valves and valve boxes.
- D. All exposed portions of the valve box and cover shall be painted blue.

02660.2.04 TEMPORARY BLOW-OFFS

- A. Refer to Standard Detail W11 for typical installation of temporary "blow-off" assembly.

02660.2.05 FIRE HYDRANTS

- A. Fire hydrants must comply with current AWWA Standard C-502. Hydrants shall have 6" mechanical joint inlet connection. Furnish each hydrant with a resilient seated gate valve and valve box to grade.
- B. The hydrants shall be 5-1/4" size with one (1) 4-1/2" National Standard Thread (NST) pumper nozzle and two (2) 2-1/2" NST hose nozzles. Size of the operating nut shall be 1-1/2" and shall open counterclockwise. Hydrants to have 5 feet depth of bury. Hydrant to be Mueller "Super Centurion" Model A-423 or Kennedy "Guardian", Model K81. The hydrant manufacturer will be determined by the Township based on the location of the hydrant.
- C. Fire hydrants shall be lubricated with Chevron H1 Lubricant FM grease (NSF61 certified, Food grade) or equal. Graphite or petroleum-based lubricants are not acceptable.
- D. Hydrants shall be painted with a primer coat of Sherwin Williams Kem-Bond H5 Universal metal primer. Hydrants shall receive a finish coat of silicone alkyd enamel, Sherwin Williams Steel Master 9500, Color 8733.
- E. Hydrants shall be installed complete with marker poles and reflective bands. Hydrant marker poles shall be 5' Hydrant Marker. Reflective Bands shall be Model #BSH-1.7528-DG-B, as manufactured by Lordon, Inc.
- F. Refer to Standard Detail W3 for typical installation of fire hydrants.

02660.2.06 TAPPING SLEEVES AND VALVES

Provide mechanical joint Type H-615 tapping sleeve as manufactured by Mueller Company, or approved equal. The type of pipe and actual outside diameter of the main should be confirmed by the Contractor before placement of order for the sleeve. Furnish resilient seated gate valve with flange inlet and mechanical joint outlet.

02660.2.07 BACKFLOW PREVENTERS

- A. For residential water services with interior meter location, provide backflow preventers on the domestic and fire sprinkler supply lines. Backflow preventer shall be Watts No. 7 double check valve assembly.
- B. A backflow preventer shall be installed on a water supply pipeline connecting to the Township's main used for commercial fire protection. Unless otherwise approved by the Township, the pipeline and appurtenances shall be used exclusively for fire protection. The backflow preventer assembly shall be a reduced pressure type, Watts Series 909, as approved by the Township Fire Marshal. A Sensus Fireline Meter Assembly with strainer and detector check valve, or approved equal, shall be installed upstream of the backflow preventer.
- C. For commercial fire protection, the size of the pipeline, detector check valve and the backflow preventer shall be approved by the Township and Fire Marshal. Submit copies of plans of the private fire protection system for approval.

- D. When the length of fire service main to a building is greater than 25 feet, and when approved by the Township, the potable service line for that building shall be connected immediately before the backflow preventer to eliminate the "dead spot" of water in the service main. This connection shall be approved by the Township.
- E. Backflow preventers are required on all water services. Backflow preventers shall be installed on residential service and sprinkler lines in accordance with Standard Details W4 and W6, as applicable. Backflow preventer for residential use shall be Watts No. 7, or approved equal.
- F. The Township reserves the right to require the installation of reduced pressure backflow preventers for applications where a direct cross-connection exists between potable water and non-potable water or a back siphon condition exists.

02660.2.08 AIR RELEASE VALVE

Air release valve shall close drop-tight and incorporate a renewable seat. All internal metal parts shall be of stainless steel. Body and cover shall be of cast iron conforming to ASTM A126, Class B. Valve body shall be rated to 200 psi W.O.G. and tested to 300 psi. Float shall be tested to 750 psi. Working pressure shall be 0-150 psi with a 3/32" orifice. Valve size shall be 3/4" N.P.T. Provide 3/4" isolation gate valve with a working pressure of 200 psi, double face solid wedge of bronze, bronze spindle and renewable bronze seat rings, and screw ends. A release valve shall be APCO Valve Model S-140C, or other approved equal.

02660.2.09 WATER METER YOKE FOR RESIDENTIAL SERVICE

- A. Provide copper meter yoke with integral lock wing angle ball valve for 5/8" x 3/4" water meter.
- B. Meter yoke shall be Mueller Company B-2470, or Ford Meter Company VB72.
- C. Water meter shall be provided and installed by the Township.
- D. Contact Township for approval of meter yoke for larger meter sizes.

02660.2.10 FREEZELESS YARD HYDRANT

Furnish and install an IOWA Model Y34 Freezeless Yard Hydrant, or equal, where shown on the Drawings. Hydrant to have 1" N.P.T. inlet with galvanized steel pipe casing. Brass nozzle to have 1" male threaded end. Drain hole to be 1/8" tapped N.P.T. Yard hydrant excavation shall have filter fabric installed before No. 2B stone is placed. Installation shall be in accordance with Standard Detail W11.

02260.2.11 METER PIT FOR EXISTING RESIDENCES

- A. Meter pit cover shall be a Ford Meter Box Co., Type W32-T double lid cover. Cover to have lifter worm lock. Provide foam insulating disc inside cover.
- B. Water meter shall be mounted in copper meter yoke, Mueller B-24701-6A, or Ford VBCHC72, with integral angle ball valve and ASSE 1024 dual check valve.
- C. Water meter to be supplied and installed by the Township.

- D. Water meter pits to be PVC, as manufactured by Mueller, and sized to match the service diameter.

02260.2.12 PRESSURE REDUCING VALVES

- A. A pressure reducing valve shall be installed on all water services receiving systems pressure of 65 psi or greater. Pressure reducing valve shall be Watts UB5, or approved equal. Pressure reducing valve for new residential connections shall be installed as shown on Standard Detail W4.
- B. When required by the Township, a pressure-reducing valve shall be installed on new water main construction to limit downstream system pressures to a desirable level. Pressure reducing valves installed on mains shall be Golden Anderson Fig. 4500-D, or approved equal, and shall be installed as shown on Standard Detail W9.

PART 3 - EXECUTION

02660.3.01 GENERAL

Inspect joint surfaces for structural soundness and thoroughly clean before installation. Install valves and accessories in accordance with manufacturer's instructions. Check and adjust valves and accessories for smooth operation.

02660.3.02 SETTING HYDRANTS, VALVES AND VALVE BOXES

- A. All gate valves shall be set with the stems vertically above the centerline of the pipe. Special care shall be taken to avoid closing valves with sand, stones, or other substances lodged in the valve seat. Hydrants, valves, and valve boxes shall be set plumb, with valve boxes placed directly over the valves. After being correctly positioned at street grade, stone fill shall be carefully compacted around the valve box for a distance of four (4) feet on all sides.
- B. Each hydrant shall be placed upon a solid cement block, not less than four (4) inches thick and fifteen (15) inches square or as directed. The back side of the hydrant opposite the pipe connection shall be firmly wedged against the vertical face of the trench with a thrust block. Additionally, the hydrant and hydrant valve shall be rodded from the flange of the hydrant through the valve to the flange of the hydrant tee. This shall be accomplished by the use of bridle rods and rod collars which shall not be less than 3/4" stock and shall be thoroughly protected by painting with two (2) coats of bituminous paint. See Drawings for detail.
- C. Around the base of each hydrant shall be placed not less than 1 cubic yard of 2B crushed stone to ensure the complete drainage of the hydrant when closed. All backfill around hydrants shall be in 4" layers or less and shall be thoroughly compacted to the surface of the ground. Before installing any hydrant or valve, care shall be taken to see that all foreign matter and material is removed from the interior of the barrel. The hydrant and valve shall be opened and closed to see that all parts are in working order and condition. Set hydrant so that ground bead is at or above finished grade, and safety flange is not less than 2" or more than 6" above finished grade. Hydrant shall be located 2 feet behind curb, or as directed by Township.
- D. Contractor shall paint hydrants in accordance with the Township's uniform color scheme based on flow tests performed by the Contractor and approved by the Engineer. Paint shall be Sherwin Williams Steel Master 9500.

- D. Water meter pits to be PVC, as manufactured by Mueller, and sized to match the service diameter.

02260.2.12 PRESSURE REDUCING VALVES

- A. A pressure reducing valve shall be installed on all water services receiving systems pressure of 65 psi or greater. Pressure reducing valve shall be Watts UB5, or approved equal. Pressure reducing valve for new residential connections shall be installed as shown on Standard Detail W4.
- B. When required by the Township, a pressure-reducing valve shall be installed on new water main construction to limit downstream system pressures to a desirable level. Pressure reducing valves installed on mains shall be Golden Anderson Fig. 4500-D, or approved equal, and shall be installed as shown on Standard Detail W9.

PART 3 - EXECUTION

02660.3.01 GENERAL

Inspect joint surfaces for structural soundness and thoroughly clean before installation. Install valves and accessories in accordance with manufacturer's instructions. Check and adjust valves and accessories for smooth operation.

02660.3.02 SETTING HYDRANTS, VALVES AND VALVE BOXES

- A. All gate valves shall be set with the stems vertically above the centerline of the pipe. Special care shall be taken to avoid closing valves with sand, stones, or other substances lodged in the valve seat. Hydrants, valves, and valve boxes shall be set plumb, with valve boxes placed directly over the valves. After being correctly positioned at street grade, stone fill shall be carefully compacted around the valve box for a distance of four (4) feet on all sides.
- B. Each hydrant shall be placed upon a solid cement block, not less than four (4) inches thick and fifteen (15) inches square or as directed. The back side of the hydrant opposite the pipe connection shall be firmly wedged against the vertical face of the trench with a thrust block. Additionally, the hydrant and hydrant valve shall be rodded from the flange of the hydrant through the valve to the flange of the hydrant tee. This shall be accomplished by the use of bridle rods and rod collars which shall not be less than 3/4" stock and shall be thoroughly protected by painting with two (2) coats of bituminous paint. See Drawings for detail.
- C. Around the base of each hydrant shall be placed not less than 1 cubic yard of 2B crushed stone to ensure the complete drainage of the hydrant when closed. All backfill around hydrants shall be in 4" layers or less and shall be thoroughly compacted to the surface of the ground. Before installing any hydrant or valve, care shall be taken to see that all foreign matter and material is removed from the interior of the barrel. The hydrant and valve shall be opened and closed to see that all parts are in working order and condition. Set hydrant so that ground bead is at or above finished grade, and safety flange is not less than 2" or more than 6" above finished grade. Hydrant shall be located 2 feet behind curb, or as directed by Township.
- D. Contractor shall paint hydrants in accordance with the Township's uniform color scheme based on flow tests performed by the Contractor and approved by the Engineer. Paint shall be Sherwin Williams Steel Master 9500.

END OF SECTION

**SECTION 02730
SUBMERSIBLE SEWAGE PUMPING STATION**

PART 1 - GENERAL

02730.1.01 DESCRIPTION

Furnish and install one prefabricated duplex sewage pumping station consisting of two (2) submersible pumps and motors, hydraulically sealed discharge flanges, discharge piping, discharge valves, precast concrete pump basin and valve pit, access hatches, lift-out rail system, grinder unit, portable hoist assembly, liquid level controls, electrical enclosure (or generator building when required), pump control panel, communications system, metering system, and all necessary wiring and appurtenances complete in place as schematically indicated on Standard Detail SS10.

02730.1.02 QUALITY ASSURANCE

- A. It is the intent of this Specification that the pumps and wetwell shall be supplied by the pump manufacturer as part of an integrated all in one pump station unit.
- B. The Contractor may supply an equal pump station unit, or may assemble a concrete wetwell and pump station in the field, on approval by the Engineer. If any redesign is required for an equal or field assembled pump station, the cost of said redesign shall be borne by the Contractor.
- C. The following design and performance criteria must be specified or shown on the Drawings:
 - System Curve Description (minimum 3 data points plus design point)
 - Static Head
 - Minimum Pumping Efficiency
 - Motor Speed
 - Motor Horsepower
 - Power Requirements
 - Pump Discharge Size
- D. Pumps shall be as manufactured by Barnes/Crane Pumps Inc., or approved equal.
- E. The manufacturer/supplier shall guaranty all new equipment for a period of two (2) years from the date of startup (fully operational).
- F. The manufacturer shall replace any faulty or failed equipment installed control panels (including material and installation labor) at no additional cost to the OWNER within one month of report of said failure.

02730.1.03 SUBMITTALS

- A. Complete design calculations computing discharge capacity, system head curve, wetwell volumes, float elevations, and anti-flotation requirements.

- B. Complete construction plans including pump station site plan, pump station section view, mechanical plan and electrical plan. Plans shall include elevations, pipe sizes and fittings, structure and mechanical dimensions, electrical equipment layout, conduit and wire sizing, and all other details as required by the Township Engineer.
- C. Complete shop drawings including dimensional drawings, descriptive literature, and wiring diagrams by the equipment manufacturer(s) for all equipment items as specified under Section 01010. Include pump characteristic curves.
- D. Complete operation and maintenance instructions including a detailed description of operation of each principal component, procedures for operation, instructions for overhaul and maintenance, lubrication schedule, safety precautions, test procedures, and parts list in accordance with Section 01010.
- E. Three (3) copies of certified pump performance curves for actual pumps to be supplied shall be submitted prior to delivery for each pump specified in this Section. Curves shall show head versus capacity, horsepower versus capacity, and efficiency versus capacity and NPSH. Drawings and curves shall be complete and shall show all information needed to demonstrate that the pumps to be furnished are in accordance with the conditions specified.
- F. Maintenance material (spare parts). Provide one complete set of the manufacturer's recommended spare parts for each pump. Provide 100% spare fuses, 100% spare pilot light and alarm light lamps, one (1) spare motor starter coil, and one (1) spare control transformer for control panel. Package each part individually or in sets in moisture proof containers or wrappings clearly labeled with part name and manufacturer's part/stock number. Provide any special tools required for equipment maintenance.
- G. Provide separate control diagram with each line numbered and relay contacts indicated and written description of control sequence.

02730.1.04 FIELD SERVICES

Provide the services of a manufacturer's representative experienced in the installation and operation of the pumping station supplied under this specification for not less than two 8-hour workdays on-site for installation inspection, start-up and performance testing, and instructing Township's operating personnel.

PART 2 - PRODUCTS

02730.2.01 SEWAGE PUMPS

- A. Heavy duty submersible non-clog sewage pumps. Field serviceable. Cast iron pumps case and motor housing. Integral stainless steel motor and pump shaft. Stainless steel fasteners.
- B. Cast iron impeller with back pressure vanes. Statically and dynamically balanced. Impeller size at design point shall not exceed 90% of non-overloading full size impeller over the full range of operation.

- C. Tandem silicon/carbide and carbon/aluminum oxide mechanical shaft seals with oil chamber between seals. Ceramic-faced seals are not acceptable. Mount an electrode between seals to detect water leaking into seal chamber and actuate a light on the control panel.
- D. Upper and lower ball bearings to support rotor. Lower bronze sleeve or ball bearing to take radial loads from impeller. Minimum ball bearing B-10 life of 15,000 hours.
- E. Casing and impeller shall be fitted with removable and replaceable wear rings.

02730.2.02 PUMP MOTORS

- A. The motor shall be listed with Underwriter's Laboratories as complying with National Electrical Code requirements for Class I, Division 1, Groups C and D locations, explosion-proof, for installation in raw sewage.
- B. NEMA Design B, Class H insulated, squirrel cage induction type, sealed submersible motor with open windings operating in dielectric oil and minimum 1.15 service factor. The motor shall be non-overloading through the entire range of the pump curve. Motor leads potted in epoxy compound to form leak-proof seal.
- C. Protect motor with a heat sensor thermostat to stop motor if overloaded. Thermostat to reset automatically when temperature drops to a safe level.
- D. All electric motors greater than five (5) horsepower shall be started by reduced voltage "soft" starters.
- E. Motors applied with variable frequency drives (VFD's) shall be specifically manufactured and labeled for inverter duty. De-rating of a standard motor for inverter duty shall not be approved.

02730.2.03 PUMP DISCHARGE VALVES AND PIPING

- A. Provide a hydraulically sealed quick disconnect discharge flange and 90° elbow for each pump.
- B. Provide flanged, cement-lined, ductile iron pipe and fittings from the pump discharge flange through the valve pit. Flanged ductile iron pipe shall conform to ANSI A21.15/AWWA C115 with pipe barrel meeting ANSI A21.51/AWWA C151. Fittings shall conform to ANSI A21.10/AWWA C110 with ANSI B16.1 Class 125 flanges. Cement lining shall conform to ANSI A21.4/AWWA C104. The minimum thickness class shall be Class 53.
- C. Provide each pump with an iron body, bronze mounted, horizontal swing type check valve with renewable bronze faced disc and adjustable lever and weight or outside lever and spring operator. Valve shall be in accordance with AWWA C508 and rated for 175 psi working pressure. Valve shall be Model A-260-6-01, as manufactured by Mueller Company, or equal.
- D. Provide each pump with an iron body, resilient seated, solid wedge type gate valve conforming to AWWA C509. Valve shall have a non-rising stem and flanged ends. Furnish valves with handwheel which opens by turning in a counterclockwise direction. Gate valves shall be Kennedy resilient seated valves, or approved equal.

- E. Provide a 4" bypass line connection on the combined pump discharge inside the valve pit. Bypass line shall be used for flushing and draining of force main. Furnish bypass line with resilient seated gate valve and threaded PVC cap.

02730.2.04 SEWAGE GRINDER

- A. Provide one dual shaft sewage grinder unit capable of continuous operation, processing wet or dry, through flow ranges from 0 gpm to the peak design flow of the sewage pumping station.
- B. Grinding unit shall be a removable unit mounted on slide rails within the sewage pumping station wetwell. Slide rail system and mounting shall be constructed of stainless steel.
- C. Grinder unit shall be powered by an immersible, explosion-proof, totally encased non-ventilated (TENV) 3-horsepower electric motor, with enclosed gear reduction.
- D. The grinder motor controller shall include auto load sensing to reverse the grinder automatically to clear obstructions. Control panel shall be housed in a NEMA 4X fiberglass enclosure, including a control power transformer, reversing contactors, overload relays, circuit breaker, indicator lights, and signal relay outputs.
- E. Sewage grinder shall be a Muffin Monster Model 3000 by JWC Environmental, or approved equal.

02730.2.05 ODOR CONTROL SYSTEM

- A. Provide complete chemical feed system for control of hydrogen sulfide. The system shall include a chemical feed system composed of chemical feed pumps, feed control system, liquid storage tank, and all piping and appurtenances.
- B. Liquid storage tank shall be a minimum volume of 1,000 gallons. Tank shall be dual walled, aboveground circular tank, constructed of cross-linked polyethylene, UV stabilized, with integral leak monitoring and alarms, overfill protection and mechanical level indicator.
- C. Chemical feed pumps shall be bellows type pump with adjustable flow rate. Pump shall be self-priming, capable of suction lifts up to 20 feet. Two feed pumps shall be provided. Feed pumps and feed control system shall be provided by a single manufacturer.
- D. Feed control system shall be capable of operation in a timer mode, an automatic mode tied to the sewage pumps, and a combination mode. The control system shall include a calibration column to measure the chemical being injected.
- E. The feed control system shall include all necessary electrical components, including timers, indicator lights, circuit breakers, cooling fan, heaters and thermostat, enclosed in a NEMA 3R stainless steel enclosure. The feed control system shall be Underwriters Laboratories listed.
- F. The odor control system shall be a Bioxide liquid phase odor control system, as manufactured by Eroqua Water Technology Corporation of Alpharetta, Georgia..
- G. The Developer shall be responsible for supply of Bioxide solution until dedication of the sewage pumping station to the Township.

02730.2.06 PRECAST CONCRETE STRUCTURES

A. Pump Basin:

Provide precast reinforced manhole sections conforming to requirements of ASTM C478. Precast riser sections shall have dimensions and orientation of piping cutouts as shown on the Drawings. Precast flange-type base shall have hopper-type bottom. Precast flat slab top section shall have cutouts for the access hatch frames.

B. Valve Pit:

Provide watertight precast reinforced concrete valve pit designed for ASTM C890 A-16 live loading and installation conditions, and manufactured to conform to ASTM C913. Honeycombed or retempered concrete will not be acceptable. Valve pit shall have flange-type base and flat slab top section with cutout for the access hatch and frame. Furnish with manhole steps or aluminum vertical ladder. Manhole steps shall be as indicated on Standard Detail SS5 or SS6.

C. Access Hatches:

Aluminum, flush frame type. Provide a double leaf and single leaf hatch for the pump station as recommended by the pump station manufacturer for pump and sewage grinding unit removal. Pump station access hatch shall open so as not to interfere with the operation of the portable hoist assembly during pump or sewage grinding unit lift-out. Provide a double leaf hatch for the valve pit sized to give clearance above the discharge valves and bypass line.

Valve pit hatch shall have 1" channel frame with anchoring flange. Provide 1-1/2" channel drain pipe discharging to ground. Channel drain piping shall be black steel with malleable iron fittings. Pump station hatches shall have 1/4" extruded aluminum frame.

Provide each hatch with minimum 1/4" thick diamond checkered aluminum plate cover designed for minimum 300 lbs./sq. ft. loading. Furnish hatch with heavy bronze hinges, stainless steel hinge pins, spring-operated lifting mechanism, automatic hold-open arm with release handle, stainless steel inside snap lock, and removable key-wrench lifting handle. Hatches shall be Halliday Type J or JD, or other approved equal.

Provide each hatch with hinged, full protection grating. Grating shall be aluminum I bar construction, with safety orange powder coat finish. Grating and supports shall be rated for 300 psf live load. Grating shall be hinged with tamper-proof stainless steel bolts and positive latching system to hold grating in open position. A padlock hasp for locking in the closed position shall be included. Safety nets or other non-rigid systems are not acceptable.

D. Coatings:

Exterior below grade surfaces of concrete wetwell and valve vault shall be shop coated with two (2) coats of Koppers 300-M coat for epoxy coating, or approved equal, with a minimum dry film thickness of 16 mils.

Interior surfaces of concrete wetwell and valve vault shall be field coated with three (3) coats of Spectra Shield.

Concrete structures shall be cured a minimum of 28 days prior to shop coating.

02730.2.07 APPURTENANCES

- A. Pump and Grinder Guide Rails: Non-sparking stainless steel.
- B. Pump and Grinder Mounting Plates and Guide Rail Braces: Stainless steel.
- C. Guide Rail Supports: Stainless steel.
- D. Pump and Grinder Lifting Cable: Stainless steel.
- E. Fasteners and Hardware: Stainless steel.
- F. Pump/Control Cable: Cable shall be supplied by the manufacturer for the entire circuit, starting at the pumps and terminating in the pump control panel. Provide junction boxes as required.
- G. Lights: Furnish valve pit with two (2) 100-watt lights which turn on when access hatch is opened. Provide switch with push rod and hardware.
- H. Vent Pipe: Provide 4" ductile iron vent with return bend and No. 8 bronze mesh insect screen between two flanges. Vent shall be painted with two (2) coats of epoxy paint, color dark green.

02730.2.08 PORTABLE HOIST

Provide a stainless steel portable hoist assembly with drop-in socket(s) mounted on the top slab of the wetwell. Hoist shall be capable of lifting each pump and rotating each pump so that it can be lowered. Hoist shall also be capable of lifting the sewage grinding unit. Furnish with self-locking winch to hold pump in position when crank is released. Furnish hoist with a shackle clamp to attach to pump lifting cable allowing continuous lifting beyond end of hoist cable.

02730.2.09 PUMP CONTROL PANEL

- A. The pump control panel shall be composed of two enclosures - the Power Enclosure and the Control Enclosure. The enclosures shall be separate enclosures with separate access doors.
- B. ARC FLASH PREVENTION: For the purpose of this specification the following terms are being used, low voltage which is 120 VAC and below and high voltage which is anything above 120 VAC, for example 240 VAC or 480 VAC.
- C. The power enclosure shall contain all high voltage equipment.
- D. The control enclosure shall contain all low voltage equipment.

- E. The entire pump control system enclosure shall be designed to limit operator contact with the high voltage by providing normal daily access to control enclosure while being separated from components installed in the power enclosure.
- F. The power and control enclosures shall be made of ASA61 grey powder coated 304 stainless steel, NEMA 3R, and sized to contain the equipment described in the sections below, with adequate space for incoming electrical service connections as well as outgoing field connections.
- G. The power and control enclosures shall be dead front.
- H. The power and control enclosures shall include a 6 inch high minimum bottom floor stand kit of sufficient height to allow for bottom entry conduit but limit the PLC/HMI and front panel devices to normal eye level.
- I. The following shall be mounted on the power and control enclosures as indicated on the Drawings, or at a location as approved by the ENGINEER:
 - 1. Power Enclosure and Control Enclosure labeling and power enclosure lockout mechanisms.
 - 2. Nameplates for each circuit breaker, pilot device, RVSS bypass starter, light switches and terminal block cutout, enclosure doors.
- J. The power and control enclosures shall be as manufactured by Hoffman Engineering Company, Schaeffer Electrical Enclosures or equal and shall be appropriately sized to accommodate the contained equipment.
- K. The power and control enclosures shall be floor stand mounted installed within a pad-mounted masonry structure. An overhang or roof, approved by the ENGINEER, shall be provided to protect the equipment and personnel from falling rain during servicing of the equipment. The pad mounted masonry structure with overhang shall be as indicated on the Drawings.
- L. Design electrical supply and control circuits to meet the requirements of the National Electric Code. A transformer with fused overload protection shall be installed as necessary to provide a maximum of 120V to all control circuitry and accessory uses.

02730.2.10 POWER ENCLOSURE

- A. The power enclosure shall include any and all components above 120 VAC including transformers, high voltage fuses, main, emergency breakers, power distribution blocks, motor starters, soft starters, surge protection, load center, etc.
- B. The power enclosure shall include a device that turns off all power to the Pump Control panel - both high voltage and low voltage - upon unauthorized entry unless overridden by qualified personnel.

- C. The power enclosure dead front shall include main and emergency circuit breaker toggles, pump circuit breaker toggles; motor starter overload reset buttons, RVSS Key Pads, cutout to allow complete access to load center breakers, all control/low voltage terminal blocks, and any and all high voltage interface devices.
- D. The power enclosure shall include, but not be limited to the following:
1. Main circuit breaker, pump main circuit panel breakers, emergency circuit breaker.
 2. Main circuit breaker/emergency circuit breaker lockout Mechanism
 3. Reduced voltage solid state starters with shorting contactor and FVNR Bypass starters. RVSS starters shall be manufactured by ABB Inc., for pumps 10HP and above.
 4. 120/240 Volt Load Center with breakers shown on drawings and additional breakers including bioxide pump feeder, space heater, light circuit spare 15 amp breakers 1 pole.
 5. Deragger II System including Deragger II control, breaker, and reversing motor starter
 6. SPD-1 TVSS Surge Suppressor with circuit breaker
 7. Enclosure Environmental Control
- E. NEMA Motor Starter (Primary for under 10 HP and ATL backup for 10 HP and above). The motor starter shall be of the FVNR (full voltage non-reversing) type. The unit shall be provided with a standard NO side mounted auxiliary contact. An overload relay with manual/ automatic selectable reset shall include single phase protection and Class 10 or 20 bimetallic ambient compensated heater elements. A reset button shall be provided on the inner door for each motor starter. Unit shall be Square-D or pre-approved equal.
- F. The power enclosure shall include proper ventilation, cooling and heating. The enclosure shall include cooling fans, louvers both intake and exhaust sized to sufficiently keep all components cool and operating in an environment temperature well within operating temperature limits. In winter months, cooling fans shall operate only when temperatures inside the enclosure reach predetermined limits. The cooling fans shall include matching louvers that maintain a NEMA 12/3R corrosion resistant rating, they must be stainless steel and powder coated white. The cooling fans shall not be directed toward the operator and must include easily cleanable filters. The cooling fans shall be industrial rated and shall continue to produce the same volume of air flow with clogged filters as with clean filters. An electric heater (fan type) and thermostat shall be provided for the enclosure as indicated on the Drawings.

02730.2.11 CONTROL ENCLOSURES

- A. The control enclosure side shall contain the PLC/HMI, Back Up Control through the Deragger with intrinsic safe relay, integrated radio Telemetry package with radio, polyphaser, radio connectors and cables, battery and charger, control relays and timers, pilot devices, light

switch, GFI, flow meter equipment, low voltage portion of the deragger equipment and any and all low voltage components required to allow the pump control system to operate.

- B. The control enclosure shall include but not limited to the following:
1. Pump Control both primary PLC/HMI and back up Level Control, relays timers etc.
 2. GFI Convenience Outlet (120V), interior light and switch.
 3. Communication Interface, radio telemetry package with radio, accessories, connectors, power supply, battery, telemetry-PLC/HMI level control interface, Antenna and all associated radio telemetry equipment.
 4. Flow Transmitter and related equipment.
 5. Proper ventilation, cooling and heating. The Enclosure shall include cooling fans, louvers both intake and exhaust sized to sufficiently keep all components cool and operating in an environment temperature well within operating temperature limits. In winter months, cooling fans shall operate only when temperatures inside the enclosure reach predetermined limits. The cooling fans shall include matching louvers that maintain a NEMA 12/3R corrosion resistant rating, they must be stainless steel and powder coated white. The cooling fans shall not be directed toward the operator and must include easily cleanable filters. The cooling fans shall be industrial rated and shall continue to produce the same volume of air flow with clogged filters as with clean filters. An electric heater (fan type) and thermostat shall be provided for the enclosure as indicated on the Drawings
- C. The control enclosure dead front shall include pilot devices and low voltage operator interface devices including light switch, pilot lights, hand off auto switches, GFI receptacle, flow meter display, PLC/OIT screen and any and all low voltage operator interface devices.
- D. Pump control system shall be based on the Flow Station 110 PLC. All standard and optional functions required by this system for pump down operations shall be provided.
- E. The control enclosure shall be furnished with a color OIT screen mounted on the inner door of the enclosure, (Flow Station 110 version 221).
- F. The Flow Station 110 unit shall be integrated with seal failure, thermistor, and conductive probe level sensing from the pump station wetwell. Flow Station interface shall provide status of the following on the main screen:
1. Level
 2. Set points for pump start/stop
 3. High and low level set points
 4. Pump status: running/stopped/Performing clean
 5. Pump available

6. Pump fault
7. Power status

G. The control panel shall include devices for monitoring, logging, and alarm output for under current, over current, phase failure, three-phase pump voltage, and three-phase current. Each pump module shall allow measurement and logging of electrical usage monitored by Clearwater controls Deragger II product. A Station device for Ground fault, phase rotation, three-phase will also be required. The Deragger shall be able to communicate with the Flowstation PLC thru Modbus RS485.

The pump control application built into the firmware must support at least the following set of features:

1. Selectable Pump up and Pump down operation
2. Selectable 2 or 3 pumps
3. Selectable Level transducer or Float switch well control
4. Selectable Fixed or Automatic pump alternation
5. Pump Logs, Event Logs, Alarm Logged to the controller file system
6. Alternate set points (for weekends or holidays, wet season/dry season, etc.)
7. Peak demand pumping
8. Seal wetting
9. Fat Ring reduction
10. Build up removal
11. The ability to locally monitor all inputs (analog and digital) and operate individual digital outputs during commissioning or trouble shooting.
12. Pump current monitoring calibration and alarming
13. User Interface and Communications
 - a. Out-of-the-box standalone configuration and operation with Local Display or laptop
 - b. Local configuration of communication parameters supported via Modbus/USB, Modbus RTU serial and ModbusTCP

- c. Remote IP communications allowing web access, FTP (when enabled), Modbus over IP communications (using optional GPRS modem)
- d. Internet Explorer Web browser connection.
- e. DHCP server (can be disabled)
- f. Using PC or laptop to FlowStation Ethernet port (FlowStation allocates IP addresses using DHCP) or via WAN IP
- g. Serial Data communication (e.g. via radio) is supported using Modbus RTU
- h. Remote Modbus IP (Modbus/TCP and Modbus RTU/UDP) communication is supported (via WAN IP or via Ethernet)
- i. VPN solution or public internet connection supported for WAN IP depending on telecommunications provider data plan
- j. Provide separate rosters for work-hours and out-of-hours such that the FlowStation will attempt to contact each person on the list in turn. After a (user selectable) amount of time, if the alarm has not been acknowledged, the FlowStation will attempt to contact the next person on the list.
- k. Pump Controller configuration can be saved to Memory Stick (Backup)
- l. Pump Controller configuration can be restored from Memory Stick (Restore)
- m. FTP connection to the FlowStation may be enabled for reading of log files from the controller.

H. PROGRAMMING SOFTWARE CAPABILITIES

1. The programming software shall allow downloading of Relay Ladder Logic and/or standard C++ programs from within one package. The software shall allow the user to develop and download the application and system configuration over the communication network via radios, Ethernet, leased and dial-up lines.
2. The RTU shall allow The Pump Application, Ladder and C++ applications to run concurrently. Any failure in the Ladder application shall not affect other applications running under C++.
3. The Relay Ladder Logic shall include the following functions:
 - a. PID feedback control
 - b. Data logging function with time and data
 - c. Modem dialing and control

- d. Timers, counters, mathematical functions, memory functions
 - e. Standard Ladder Logic functions such as coils and contacts
 - f. Boolean logic functions
 - g. Bit transfer functions
 - h. Block transfer functions
 - i. Scaling function
 - j. Totalizing function
 - k. Flow function
4. On-line monitoring of Relay Ladder Logic power flow shall be included to facilitate start-up and debugging of programs.
 5. Relay Ladder Logic program shall be up to 12K words in size, with no fixed limit on the number of networks.
 6. The programming software shall support on-line monitoring and forcing of any register in the protocol database when utilizing the built in protocol. Forcing shall write a value to the register and prevent modification of the register content by the communication protocol or the application software. A global command to remove all forcing must be included.
 7. In addition to forcing, the software shall be capable of writing a value to any register in the protocol database but continue to allow the protocol or application software to modify the contents of the register.
 8. The controller shall be capable of processing up to 32 PID loops with individual execution time bases from 0.1 to 25.5 seconds.
- I. Provide backup pump control of single pump during loss of primary level control function. This will be in the form of a high level float switch wired to one or both of the Deragger II modules. This will initiate a timed pumping operation.
 - J. All alarms shall be tied into a common alarm relay which when energized shall flash a red light mounted on the exterior of the panel or as mounted on outside of overhang structure as indicated on the Drawings. Red light shall flash only during an alarm condition. Provide reset switch and testing pushbutton for alarm circuit. Provide a test button for alarm light. Alarm light shall be LED type NEMA 4X, Federal Signal Corp, model SLM100, or equal.
 - K. Provide terminal strips in the control panel for all alarm circuits, controls, lighting, and power wiring.
 - L. The control enclosure shall be provided with a separate protected circuit.
 - M. Anti-ragging device shall be fitted to each pump to provide real time anti ragging protection. Upon detection will stop and reverse the pump. This device shall also perform the power monitoring and protection. Unit shall be Clearwater Controls Deragger II.

- N. The control enclosure shall be supplied with a "control power on" pilot light and a "control power on" auxiliary relay. Both the relay and the pilot light shall be energized when control power is present at the terminals of the level control processor. If the relay is de-energized, the relay shall signal the SCADA system (through a normally close relay that is held open when the relay is energized) that the control power has failed. The control power relay shall be connected into the control circuit downstream of the last overcurrent protection device/fuse/circuit breaker/disconnect switch.
- O. The control enclosure shall include proper ventilation, cooling and heating. The enclosure shall include cooling fans, louvers both intake and exhaust sized to sufficiently keep all components cool and operating in an environment temperature well within operating temperature limits. In winter months, cooling fans shall operate only when temperatures inside the enclosure reach predetermined limits. The cooling fans shall include matching louvers that maintain a NEMA 12/3R corrosion resistant rating, they must be stainless steel and powder coated white. The cooling fans shall not be directed toward the operator and must include easily cleanable filters. The cooling fans shall be industrial rated and shall continue to produce the same volume of air flow with clogged filters as with clean filters. An electric heater (fan type) and thermostat shall be provided for the enclosure as indicated on the Drawings

02730.2.12 LIQUID LEVEL CONTROLS

- A. Provide integrated electronic level sensing system, including 10 stainless steel sensors in a molded PVC probe rod. Level sensor shall be a MPE, as manufactured by Motor Protection Electronics, Inc. manufactured in the USA. MPE MPC420 converter shall be provided to convert to a 4-20ma signal back to control Flowstation PLC. Probe length shall be selected based on depth of the wetwell and the design pump start/stop set points.
- B. Heavy neoprene-jacketed weighted cords suspended from wiring channel. Level setting adjustable from top of pump station basin. Cable shall be supplied by manufacturer for the entire circuit, starting at the floats and terminating in the pump control panel.
- C. The high level alarm/backup float shall be a SJE Signal Master control switch catalog no. 30SGMWEN0 or approved equal. The float shall be supplied with a 30 ft. long cord.

02730.2.13 OPERATION OF LIQUID LEVEL CONTROLS

- A. On rise of liquid level, the pump stop switch energizes first. As liquid level increases, the lead pump switch starts the lead pump. With lead pump running, basin liquid level decreases to the pump stop setting.
- B. When lead pump stops, alternation take place from the PLC so that the lag pump will start on the next rise in liquid level.
- C. If the liquid level continues to rise while the lead pump is running, the lag pump start switch starts the lag pump. Both lead and lag pumps operate together until the pump stop switch stops both pumps.

- D. If the liquid level continues to rise, the high level alarm switch energizes the alarm signal. If the liquid level continues to rise further, the redundant high level float energizes the alarm signal.

02730.2.14 COMMUNICATION SYSTEM

- A. CONTRACTOR shall provide a fully functioning communications system compatible with the Township's most current SCADA/telemetry system.
- B. The mode of communications shall be selected by the OWNER and may include use of radio, cellular telephone, wired telephone, internet, or other data communications methods.
- C. CONTRACTOR shall be responsible for OWNER's costs incurred to integrate the sewage pumping station into the current SCADA/telemetry system, including cost of software revisions/upgrades.
- D. The OWNER will require the CONTRACTOR to obtain the services of Keystone Engineering Group, the OWNER's SCADA system vendor to ensure complete integration of communication system components into the OWNER's SCADA system
- E. The communication system shall monitor and transmit the following alarm conditions:
1. High Level (Stick)
 2. Redundant High Level (Float)
 3. Low Level (Stick)
 4. Pump No. 1 Failure
 5. Pump No. 2 Failure
 6. Pump No. 1 High Temperature
 7. Pump No. 2 High Temperature
 8. Pump No. 1 Seal Failure
 9. Pump No. 2 Seal Failure
 10. Power Outage
 11. Communication Fail
 12. Phase Monitor Failed
 13. Control Power Failure
- F. The communications equipment shall be provided with a separate protected circuit.

02730.2.15 EMERGENCY GENERATOR

- A. An emergency generator shall be provided at the pump station. The generator shall be housed in a masonry building constructed at the site or a portable generator shall be provided as determined by the Township. The Township shall approve the size, location, materials, and architectural treatment for the building on a case specific basis. Lighting, HVAC, and electrical

systems for the building shall be approved by the Engineer. Pump controls shall be located inside the building.

- B. Emergency generator systems shall include diesel driven engine-generator, fuel system, cooling system, automatic starting system, controls, wiring and all necessary accessories. No rotating parts or hazardous components shall be exposed and all normal adjustments and maintenance shall be accomplished without the use of special tools. Equipment shall be manufactured by Onan, or approved equal.
- C. The engine-generator shall be equipped with a factory installed and approved timing unit to exercise the unit as required to obtain a factory warranty. Warranty shall include all parts, labor and travel expenses to the site for the full two (2) year term.
- D. The rating of the engine-generator shall be based on a continuous rating. The engine-generator shall be capable of satisfactory operation with all present and future motors and respective starting equipment in the sequence required for proper operation of the facility. Load shedding to reduce generator capacity shall not be considered without approval of the Authority.
- E. Speed governor shall be electronic isochronous type. Sensing devices shall provide alarms for high and low coolant temperatures and low lubricating oil pressure. Shut down devices shall be included for low lubricating oil pressure, high coolant temperature, overspeed and overcrank. Gauges shall include coolant temperature, fuel pressure, oil pressure and battery charging ammeter.
- F. An engine mounted thermostatically controlled water jacket heater shall be provided.
- G. Cooling system shall include integral radiator, except where cooling air volume exceeds 20,000 cfm, in which case a remotely mounted radiator shall be considered. The radiator and engine coolant system shall be filled with a solution of 50% ethylene glycol and shall have a surge tank. Coolant line shall include flexible connections at the radiator and engine.
- H. Exhaust silencers shall be critical type. A flexible fitting shall be provided for the sections of the exhaust piping between the exhaust manifold and the exhaust pipes. Drip fitting shall be included at the proper location for draining the exhaust system. Exhaust piping shall be adequately supported at least 12 inches from any combustible materials. Exhaust piping shall be insulated and jacketed for its entire length. Supports shall permit movement due to expansion and contraction. A ventilation thimble, or air sleeve, shall be provided where the exhaust pipes penetrate any building wall, ceiling or roof, and proper caulking and waterproofing shall be included. Exterior end of the exhaust pipe shall be cut at a 45-degree angle to its axis, provided with a screen to prevent entrance of birds or animals and be directed away from residential areas.
- I. The generator control panel shall include voltmeter, ammeter, phase selector switch, frequency meter, circuit breaker, starting controls, fault indicating lights, voltage level controls and running time meter.
- J. Storage battery shall be of the heavy-duty diesel starting type. The battery system shall be of sufficient size to provide for five (5) consecutive full starts without recharging, but in no case less than 200-ampere hours. A floor standing battery rack shall be provided, arranged so that

the batteries are "in-line" and as close to the engine-generator as possible to provide maximum aisle space.

- K. Fuel oil storage tank capacity shall be designed to provide 24 hours of normal operation at full load. A subbase fuel tank integral to the generator unit shall be provided. All tanks shall have a gauge. When necessary, an elevated service platform shall be constructed along each side of the generator to limit the reach height to the top of the radiator fill cap to less than 5'-6". All tanks shall have a double wall and be equipped with overfill protection and an alarm, and an Underwriters' label. Provide flexible sections in fuel line connections at day tank and engine.
- L. Automatic transfer switch shall meet the requirements of UL 1008 and shall be furnished and warranted by the manufacturer of the engine-generator to ensure one source of responsibility and compatibility for the entire Emergency System. Transfer switch shall be quick-make, quick-break double throw type, positively interlocked mechanically and electrically to prevent simultaneous closing, either by accident or intent. Speed of opening and closing shall be independent of any manual operation. Time delays shall include an adjustable 2-30 second time delay in the starting circuit, an adjustable 2-25 minute delay on retransfer, with 5-minute unloaded period to permit the engine to cool down, and an adjustable programmed neutral time delay shall be provided to assure delay on retransfer to the utility normal supply. Transfer switch shall include built-in status LED's to assist in determining malfunction in the equipment. Cabinet door shall include indicating lights for Normal and Emergency and "TEST", "NORMAL", "RETRANSFER" key operated selector switch.
- M. A remote Emergency Stop button shall be provided which shall have red mushroom head and legend plate lettered "EMERGENCY STOP". Remote "emergency stop" buttons shall be provided in the control building to shut-off the generator. Red mushroom head switches and a legend plate lettered "EMERGENCY STOP" shall be used for this purpose. One switch shall be located within 4 inches of the door jam of each of two exterior doors provided for the building.
- N. Prior to acceptance of the installation, the engine-generator shall be subjected to four (4) hour full load test in the presence of the Engineer. Defects which become evident during this test shall be corrected by the Contractor and additional full load test(s) performed to the approval of the Engineer. After the acceptance and load tests have been completed, provide one (1) day of an authorized factory representative at the site to instruct the Township's operating personnel of the proper operation and maintenance procedures for this equipment.
- O. Water piping to a remote radiator shall be L type copper tubing with sweated connections. Fuel and exhaust piping in the building shall be black iron with threaded fittings. Install flexible connections at the engine and day tank.
- P. Ventilating air for the engine-generator shall be provided by a combination of intake louvers, operating louvers and exhaust fans. Motor operated louvers shall be arranged and connected so that the damper(s) will be open when the respective exhaust fans or generator are running and closed when they are shut down. Louvers which are integral with exhaust fans shall be arranged so that normal airflow will not be impeded by louver operation.

02730.2.16 PUMP STATION METER

- A. A pump station metering system shall be installed to meter flows emanating from the pump station. The metering system shall be an electromagnetic flowmeter with flow rate indicator and totalizer. The flowmeter shall be as manufactured by Endress & Hauser, or approved equal.
- B. The flowmeter shall be installed in accordance with the manufacturer's recommendations inside the station valve chamber or separate vault.

02730.2.17 ELECTRICAL REQUIREMENTS

- A. Design electrical supply and control circuits to meet the requirements of the National Electric Code and:
 - 1. NEMA ICS 1 General Standards for Industrial Control Systems
 - 2. NEMA ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies
 - 3. NEMA ICS 3 Enclosures for Industrials Controls and System
- B. Design electrical supply and control circuits to meet the requirements of the National Electric Code. A transformer with fused overload protection shall be installed as necessary to provide a maximum of 120V to all control circuitry and accessory uses.
- C. Protect the motor control panel by conduit seals or other appropriate sealing methods meeting the requirements of the National Electric Code for Class I, Division 1, Group D locations.

02730.2.18 MATERIALS

- A. Crushed Stone Subbase: Type 2A Material in accordance with Section 703.2 of PennDOT Publication 408 Specifications.
- B. Joint Sealant Compound: Provide a double ring of preformed plastic sealing compound conforming to ASTM C443 so that the joint will remain watertight under all conditions of service, including movement due to expansion, contraction and normal settlement. "Ram-Nek" as manufactured by K.T. Snyder Company, Inc., or equal.
- C. Resilient Pipe Connection Gasket: Conforming to ASTM C923 and cast into manholes and vaults as indicated on the Drawings.

02730.2.19 MATERIALS PROTECTION

- A. Blast clean the pumps and other ferrous metal surfaces to an SSPC-SP 10, near-white metal finish. Concrete surfaces shall be dry and free of all dust, oil, grease, laitance or other foreign matter. If required, etch with muriatic acid.
- B. All ferrous metal surfaces excluding stainless steel and galvanized components shall be shop coated with a minimum 2.0 mils DFT of epoxy polyamide primer followed by two (2) coats of epoxy polyamide paint each at 4.0 mils DFT. Provide pumps with manufacturer's standard baked-on epoxy coating.

- C. Shop coat the exterior of the pump basin and valve pit with two (2) 8.0 mil DFT coats of coal tar epoxy. Shop coat the interior of the pump basin with two (2) 8.0 mil DFT coats of white epoxy polyamide paint. Pennsbury 54-W-23, or equal.

PART 3 - EXECUTION

02730.3.01 BASIN AND VALVE PIT INSTALLATION

- A. Perform excavation to the line and grade indicated on the Drawings. Install a minimum of 8" of crushed stone subbase.
- B. Construct pump station basin of precast concrete sections of the size and configuration as shown on the Drawings. Seal joints watertight with joint sealant compound.
- C. Place backfill in approximately equal lifts on opposite sides of the structure to equalize opposing horizontal pressures.

02730.3.02 GENERAL SITE WORK

- A. Construct a 12-foot wide paved access road with a turnaround in accordance with Section 02511 for bituminous driveways.
- B. Provide a chain link fence with a vehicular gate surrounding the pump station area in accordance with Section 02830. All non-paved areas within the fencing shall be covered with 3" of 2A coarse aggregate.
- C. Provide trees and shrubs surrounding the fence of the size and type as shown on the Drawings.

02730.3.03 EQUIPMENT INSTALLATION

- A. Install the pumping equipment where indicated on the Drawings in accordance with the manufacturer's instructions and the approved shop drawings. Use resilient pipe connections gaskets to seal all pipe penetrations through precast concrete structures.
- B. Provide and connect accessories, power and control conduit and wiring as required to ensure a complete operable system as intended.

02730.3.04 PUMP START-UP AND PERFORMANCE TESTING

- A. Make the following checks before operating pumps:
 - 1. Assure that piping and basin are clear of debris which might clog pump.
 - 2. Check level switch settings.
 - 3. Check for proper motor rotation.
- B. Operate the pump station using clear water at the design point through two complete pumping cycles under the supervision of the manufacturer's representative and in the presence of the Engineer or Township. Check pump and motor for excessive vibration and high bearing

temperatures. Demonstrate correct sequence of pump operation. Check for motor overload by taking ampere readings.

- C. Verify pump performance by timing how long it takes to drawdown a specific volume of liquid and measuring the pump discharge head with a pressure gauge.
- D. Demonstrate provision for pump removal and replacement.

02730.3.05 EQUIPMENT ACCEPTANCE

Adjust, repair, modify or replace any components which fail to perform as specified and rerun the tests. Make final adjustments under the direction of the manufacturer's representative and to the satisfaction of the Engineer or Township.

END OF SECTION

**SECTION 02735
SANITARY SEWAGE SPECIALTIES**

PART 1 - GENERAL

02735.1.01 DESCRIPTION

Furnish and install all valves, valve chambers, and other piping specialties as specified herein and indicated on the Drawings to provide complete piping systems as intended.

02735.1.02 QUALITY ASSURANCE

Products shall be new and the latest standard of reputable manufacturers with replacement parts available. Products contaminated with gasoline, lubricating oil, liquid or gaseous fuels will be rejected.

02735.1.03 SUBMITTALS

- A. Submit certified dimensional shop drawings and manufacturer's product data on valves and valve operators including assembled weight, construction details, materials of components, and installation instructions.
- B. Submit manufacturer's maintenance instructions and complete parts lists.

02735.1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver valves and accessories to the job site in the manufacturer's boxes or crates. Mark each valve as to size, type and installation location. Seal valve ends to prevent entry of foreign matter into valve body.
- B. Store valves and accessories in areas protected from weather, moisture, and possible damage. Do not store materials directly on ground.
- C. Handle valves and accessories to prevent damage to interior and exterior surfaces.

PART 2 - PRODUCTS

02735.2.01 RESILIENT SEATED GATE VALVES

- A. Provide iron body, resilient seated, solid wedge type gate valves conforming to AWWA C509. Valve shall have a non-rising stem with a 2" square operating nut which opens by turning in a counter-clockwise direction. Buried gate valves shall be Kennedy or Mueller resilient seat valves, with mechanical joints.

Interior valves shall be Kennedy or Mueller resilient seat valves, or approved equal, with flanged ends.

- B. Provide 5-1/4" diameter three-piece, cast iron, adjustable valve boxes for all buried gate valves. Valve boxes shall be of sufficient length to reach the surface of the ground, but not extend above

the ground surface. The word "SEWER" shall be cast in the top of the cover. Valve boxes shall be as manufactured by Tyler/Union Company, or approved equal.

- C. Refer to Standard Detail W2 for typical installation of buried gate valves and valve boxes. Refer to Standard Detail SS11 for typical installation of force main cleanout chamber.

02735.2.02 SEWAGE AIR RELEASE VALVE

Sewage air release valve shall be designed to release small amounts of accumulated air during operation of a sewage force main. Valve shall close drop-tight. All internal metal parts shall be stainless steel. The linkage/lever mechanism shall be removable from the valve without disassembly of the mechanism. Body and cover shall be cast iron conforming to ASTM A126, Class B. Provide backwash attachments and valves. Air release valve shall be 2-inch size with a 3/16-inch orifice for a working pressure of 150 psi. Valve body shall be pressure rated to 200 psi WOG, 300 psi test pressure, and 1000 psi float test pressure. Sewage air release valve shall be GA Industries, Inc., Model 925F, or approved equal.

02735.2.03 SEWAGE COMBINATION AIR VALVES

- A. Provide single body, double orifice sewage combination air valves to allow large volumes of air to escape or enter through the large diameter air and vacuum orifice when filling or draining a pipeline. Sewage combination air valves shall have a small diameter air release orifice to allow small pockets of air to escape when the pipeline is filled and pressurized. Valves shall be manufactured by APCO Valve and Primer Corporation, or equal.
- B. Materials of construction shall be ASTM A126, Class B cast iron body and cover; ASTM A240 stainless steel float and stem; Buna-N needle and seat; ASTM B124 bronze plug; ASTM D1233 Delrin or cast iron leverage frame. Furnish each valve with inlet and outlet valves, quick disconnect coupling, and 5' of hose for flushing.

Inlet Size: 2" NPT
Outlet Size: 1" NPT

02735.2.04 CLEANOUT AND AIR VALVE CHAMBERS

Provide precast concrete manholes with flat slab tops and cast iron manhole frames, and covers as specified in Section 02605 and shown on the Drawings.

02735.2.05 HOSE END GATE VALVE

The gate valve to be installed in the Cleanout Chamber shall be a bronze hose end gate valve, with single wedge disc, non-rising stem, female inlet having American Standard taper pipe threads, and outlet having National (American) thread for Fire Hose Couplings and Fittings (ANSI B26) and provided complete with bronze cap and chain. Hose end gate valve shall be Figure 366 Hose Gate Valve with Figure 1309 cap and chain as manufactured by the Lunkenheimer Co., Cincinnati, Ohio, or similar hose end gate valve and cap and chain as manufactured by Walworth or Crane Co., or equal.

The valve shall be designed for a minimum water working pressure of 150 psi and shall be factory tested at a pressure of 300 psi; shall have clean waterway opening of the full nominal diameter of the valve; and shall be opened by turning to the left. The valve shall be handwheel operated and the operating wheel

shall have cast thereon an arrow indicating the direction of the opening. The valve shall have the maker's initials, pressure rating and year of manufacture cast on the body.

02735.2.06 AIR GAP BACKFLOW PREVENTER

Connection to drain lines for water softeners, dehumidifiers, washing machines, and other appliances shall be made with an air gap fitting as required by local plumbing code. Air gap fittings shall be as manufactured by Air Gap International, Inc., or approved equal.

PART 3 - EXECUTION

02735.3.01 INSTALLATION

Inspect joint surfaces for structural soundness and thoroughly clean before installation. Install valves and accessories in accordance with manufacturer's instructions. Check and adjust valves and accessories for smooth operation.

END OF SECTION

**SECTION 02830
CHAIN LINK FENCE**

PART 1 - GENERAL

02830.1.01 DESCRIPTION

- A. The work shall consist of furnishing and erecting the chain link fence complete, in accordance with the Specifications and within the limits shown on the Drawings, or as directed. This work includes the disposal of surplus excavated material. Fence shall be installed by a specialist experienced in fence construction.
- B. The fence shall consist of fabric 6 feet in height. Gates shall be as shown on the Drawings.
- C. The Contractor shall furnish all labor, materials and equipment necessary for completion of the work.

02830.1.02 SUBMITTALS

- A. Certificates shall be furnished, signed by the Contractor and the chain link fencing manufacturer, stating that proposed chain link fencing meets specified material requirements.
- B. Shop drawings of chain link fencing shall be submitted to the Engineer for approval in accordance with the General Requirements.

PART 2 - PRODUCTS

02830.2.01 MATERIALS

- A. All ferrous metal elements of the fence, except the fence fabric, shall receive a hot dip zinc coating of not less than 1.2 ounce per square foot of surface.
- B. Provide all hardware, expansion sleeves, caps, fittings and braces required for a complete installation.

02830.2.02 FABRIC

- A. The fabric shall consist of No. 9-gauge galvanized steel core wire woven into a 2-inch mesh. Minimum zinc coating shall be 0.30 ounces per square foot of wire surface. Fabric shall have dark green PVC coating conforming to ASTM F668. The fabric shall have a minimum breaking load of 1,290 pounds. Unless otherwise indicated on the Drawings or specified, the fabric shall be knuckled at one selvage and twisted at the other. Fabric shall be stretched so that there will be no slack edges or warped sections.
- B. The fabric width shall be 72", or the nominal fabric height shown on the Drawings, measured from the ends of the twists or knuckles with an allowable tolerance of ± 1 -inch.

02830.2.03 FASTENERS

Fasteners for attaching the fabric to line posts shall be No. 6-gauge aluminum wire or No. 9-gauge galvanized preformed clips. Fasteners for attaching the fabric to tension wires shall be either No. 10-gauge galvanized steel wire or aluminum hog rings of comparable gauge.

02830.2.04 END, CORNER AND FULL POSTS

End, corner and pull posts shall be 3-inch square or 2.875 inches O.D. tubular steel posts ASTM Designation A501 weighing 5.79 pounds per linear foot. Provide bracing (2 at corners, 1 at ends and gates) consisting of a single piece horizontal member, 1-5/8-inch O.D. steel pipe weighing 2.27 pounds per foot and a 3/8-inch diameter steel rod with drop forged turnbuckle for use as a diagonal tension member.

02830.2.05 LINE POSTS

Line posts shall be 2-1/2 inch diameter steel posts.

02830.2.06 TOP AND BOTTOM RAIL

Top rail shall be 1-5/8 inch O.D. steel pipe Schedule 40. Top rail lengths shall be coupled with a 6-inch long, self-centering, outside type sleeve coupling at intervals of approximately 20 feet.

02830.2.07 CONCRETE

The concrete for posts bases shall be Class "A" and conform to the requirements of Division 3 - "CONCRETE".

02830.2.08 GATES

Gate frames shall be tubular shaped, 1.90 inch outside diameter, with welded or steel fitted corners. Braces and trusses shall be furnished when necessary. Hardware shall be of adequate design and strength to provide satisfactory operation of gate. All gate components, except fabric, shall be galvanized as specified herein for fencing components. Gate shall swing 180° and be provided with double locking type latches and hold-open keeper.

PART 3 - EXECUTION

02830.3.01 GENERAL

- A. All dimensions and gauges of material are subject to accepted industry tolerance standards. Job site shall be cleared of excess spillage of concrete, cut wires, etc. and posthole excavation scattered uniformly away from posts.
- B. Upon request of the Engineer, samples of each component shall be submitted for approval prior to fabrication and shipment of fencing for this project. Mill certificates shall confirm compliance with these specifications and use of United States produced steel.

- C. Any material found not to be in compliance with the herein described specifications shall be removed and replaced at Contractor's expense.

02830.3.02 INSTALLATION

- A. All fence posts and gates shall be set to line and grade, and shall be erected in accordance with standard fence erecting practice, by trained installation crews and previous experience in fence installation. Finished fence shall be tight and without sags. Expansion sleeves shall be installed in a manner to provide a rigid connection and to allow for expansion.
- B. The bottom of the fence fabric, after erection, shall conform to the contour of the ground surface along the line of the fence, and at no point shall the bottom of the fabric be more than 2 inches above the ground surface.
- C. The Contractor shall perform the necessary clearing, excavation and filling required to provide clear "line of fence" runs. All site grading shall be complete prior to fence installation.

02830.3.03 POSTHOLES

- A. Postholes shall be of sufficient depth to allow for approximately 36 inches of posts to be set into concrete footings.
- B. Postholes shall be 10 inches in diameter for line posts, and 12 inches in diameter for terminal posts.
- C. All post footings shall be constructed by Class "A" concrete and shall be domed 1-1/2 inches above grade.

02830.3.04 LINE POST SPACING

Line post to be spaced at 10-foot centers except where guard rail beam is mounted on fence.

02830.3.05 TENSION WIRE

No. 7 gauge galvanized coil spring wire shall be stretched along the bottom of the chain link fabric approximately 6 inches above grade. The chain link fabric shall be attached to this wire with the attachments spaced 24 inches apart.

02830.3.06 HORIZONTAL BRACES

All end, corner, gate and pull posts for six-foot and higher fence shall be braced in accordance with standard fence erecting practice. Horizontal braces shall be spaced midway between the top rail and the ground and shall extend to the first line post. These braces shall be of the same size and weight as the top rail and shall be securely fastened to the posts by means of malleable iron or pressed steel connections. The braces shall then be trussed from the line post back diagonally to the end, corner, gate or pull post with a 3/8-inch diameter rod having a turnbuckle attachment for tension adjustment.

02830.3.07 FABRIC BANDS

Fabric bands, spaced at approximately 14 inches on centers, shall be used to fasten the fabric to the posts. Galvanized steel wire, spaced at approximately 24 inches on centers, shall be used to fasten fabric to the top rail.

END OF SECTION

**SECTION 02920
FINISH GRADING AND SEEDING**

PART 1 - GENERAL

02920.1.01 DESCRIPTION

A. The work of this Section includes, but is not limited to:

- Placing topsoil
- Soil conditioning
- Finish grading
- Seeding
- Sodding
- Maintenance
- Pump Station Landscaping

B. The Seeding Tables at the end of this Section list specific seeding requirements for temporary and permanent cover.

02920.1.02 QUALITY ASSURANCE

A. All areas to be seeded shall be inspected by the Contractor before starting the work. Any defects, such as incorrect grading, etc., shall be reported to the Engineer or Township prior to beginning the work. The commencement of work by the Contractor shall indicate his acceptance of the areas to be seeded and he shall then assume full responsibility for the work of this Section.

B. Soil and soil supplement testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor and approved by the Engineer. Collect soil samples under the direction of the Engineer or Township.

02920.1.03 SUBMITTALS

A. Prior to use or placement of material, submit a Statement of Compliance from the materials suppliers, together with supporting data, attesting that the composition of the following products meet specification requirements.

- Topsoil analysis
- Fertilizer
- Lime
- Seed mixture(s)

B. If soil tests are performed to justify decreased liming and fertilizer rates, submit certified soil sample analyses, including laboratory recommended soil supplement formulation.

02920.1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

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 will not be accepted.

02920.1.05 JOB CONDITIONS

- A. Any soil or similar material which has been brought onto paved areas by hauling operations or otherwise shall be removed promptly, keeping these areas clean at all times.
- B. Upon completion of work under this Section, all excess stones, debris and soil shall be cleaned up and removed from the site.

PART 2 - PRODUCTS

02920.2.01 TOPSOIL

- A. Having a pH of between 6.0 and 7.5; 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. Free of pests, pest larvae and matter toxic to plants.
- D. Grading analysis shall be as follows:

<u>Sieve</u>	<u>Minimum %</u>
2"	100
#4	90
#10	80

Sand, silt, and clay shall be as defined by AASHTO designation M-146, and shall be present within the following ranges:

	<u>Minimum %</u>	<u>Maximum %</u>
Sand	20	75
Silt	10	60
Clay	5	30

02920.2.02 FERTILIZER

Commercial fertilizer shall conform to all applicable state laws. It shall be uniform in composition, dry and delivered to the site in original unopened containers each bearing the manufacturer's guaranteed analysis.

02920.2.03 LIME

Raw ground limestone conforming to Section 804.2(a), Pub. 408 Specification.

02920.2.04 SEED AND SOD

- 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.

TABLE 1 - GRASS AND AGRICULTURAL SEEDS

<u>Species</u>	<u>Minimum Guaranteed Purity (Percent)</u>	<u>Minimum Guaranteed Germination (Percent)</u>
Kentucky Bluegrass (Domestic origin)	98	80
Pennfine Perennial Ryegrass	98	90
Kentucky 31 Tall Fescue	98	85
Penngift Crownvetch	99	90
Empire Birdsfoot Trefoil	98	80
Pennlawn Red Fescue (Turf Type)	98	85
Hounddog Tall Fescue (Turf Type)	98	85
Falcon Tall Fescue (Turf Type)	98	85
Mustang Tall Fescue (Turf Type)	98	85
Jamestown Fine Fescue (Turf Type)	98	85
Annual Ryegrass	98	90
Timothy	98	95
Spring Oats	98	85
Fylking Kentucky Bluegrass	98	85
Winter Rye	98	85
Winter Wheat	98	85
Red Top	92	90

- B. Sod shall be dense and well rooted, composed of 100% Bluegrass mix, Pennsylvania Certified. Sod shall be approximately two inches (2") high, grown in the general locality where it is to be used. Sod shall be cut in uniform stripe approximately 12" or 18" x 36", but no longer than is convenient for handling.

02920.2.05 SEED MIXTURES

See Temporary and Permanent Seeding Tables at the end of this Section.

02920.2.06 INOCULANT

- A. Inoculate leguminous seed before seeding with nitrogen fixing bacteria culture prepared specifically for the species. Do not use inoculant later than the date indicated by the manufacturer. Use inoculant in accordance with the manufacturer's specifications. Use four times the amount of inoculant when hydroseeding a leguminous seed.
- B. Protect inoculated seed from prolonged exposure to sunlight prior to sowing. Reinoculate seed not sown within 24 hours following initial inoculation.

02920.2.07 EROSION CONTROL NETTING

Biodegradable netting and paper soil stabilization material.

02920.2.08 MULCHING MATERIALS

Mulches for seeded areas shall be one, or a combination of, the following:

- 1. Straw:
Cured to less than 20% moisture content by weight. Containing no stems of tobacco, soybeans, or other coarse or woody material.
- 2. Wood Cellulose:
Containing no growth or germination-inhibiting substances. Green-dyed and air-dried. Packages not exceeding 100 pounds.

Moisture Content:	12% + 3%
Organic Matter (Dry oven basis):	98.6% + 0.2%
Ash Content:	1.4% ± 0.2%
Minimum Water-Holding Capacity:	1,000%
- 3. North American Green D575, or approved equal, shall be placed in all swale areas.
- 4. North American Green D5150, or approved equal, shall be placed on all slopes greater than 4:1.

PART 3 - EXECUTION

02920.3.01 TIME OF OPERATIONS

Seeding operations shall be conducted under favorable weather conditions during one of the preferred seeding seasons listed in the Seeding Tables. At the option of, and on the full responsibility of the Contractor, seeding operations may be conducted under unseasonable conditions, except as noted herein.

02920.3.02 PREPARATION OF SUBGRADE

A. "Hard pan" or heavy shale:

Plow to a minimum depth of 6". Loosen and grade by harrowing, discing, or dragging. Hand rake subgrade. Remove stones over 2" in diameter and other debris.

B. Loose loam, sandy loam, or light clay:

Loosen and grade by harrowing, discing, or dragging. Hand rake subgrade. Remove stones over 2" in diameter and other debris.

02920.3.03 FINISH GRADING

A. The finish grading work shall not be started until the installation of all underground utilities, sewers, clearing of site, etc., has been completed. The Contractor shall be responsible for giving notice to the other contractors whose work is affected regarding the installation of his work in order that such work may be in place in ample time to prevent any delay in the completion of the work on this contract.

B. Finish grading shall not be started until rough grading has been approved by the Engineer or Township, site has been cleared of rubbish and debris, and trucking operations over the area are finished.

C. The handling, moving or working of topsoil shall be performed only when, in the opinion of the Engineer or Township, it is in a normally friable condition, suitable for such operations, moist but not wet. Under no circumstances shall topsoil be worked when wet enough to "ball up" when worked.

D. Replace topsoil and spread over the prepared subgrade to obtain the required depth and grade elevation. Hand rake topsoil and remove all materials unsuitable or harmful to plant growth.

E. Final thickness of topsoil shall be not less than 6" thick after rolling with a handroller. Finished grades shall be within the following tolerance limits:

1. 3/4" deviation within a distance of 10'.
2. 1-1/2" maximum deviation.

F. In achieving the finish grades, control points shall be set up and maintained at all times, and whenever this requirement is not met in a particular area, corrections shall be made immediately and before proceeding further with the work.

02920.3.04 TILLAGE

A. After seed bed areas have been brought to proper compacted elevation, thoroughly loosen to a minimum depth of 5" by discing, harrowing, or other approved methods. Do not work topsoiled areas when frozen or excessively wet.

B. Distribute limestone uniformly at the rate indicated on the Seeding Tables. Thoroughly incorporate into the topsoil to a minimum depth of 4" as a part of the tillage operation.

C. Distribute fertilizer uniformly at the rate indicated on the Seeding Tables. Incorporate into soil to depth of 4" by approved methods as part of tillage operation.

- D. Liming and fertilizer rates may be decreased if lesser rates are indicated by soil tests provided by the Contractor.

02920.3.05 SEEDING

- A. Provide temporary seeding on areas where construction of permanent ground cover facilities will be delayed for 30 days or more. Areas of construction requiring temporary ground cover at an unfavorable time for seeding shall be protected with an organic mulching material such as straw, wood chips, or the like. Grass may then be established when the time is favorable. Provide permanent seeding on all areas not required to be developed otherwise.
- B. Uniformly sow specified seed mix by use of approved hydraulic seeder, power-operated seeder, or hand-operated seeder. Do not seed when winds are over 15 mph.
- C. Upon completion of sowing, cover seed to an average depth of 1/4" by hand raking or approved mechanical methods.
- D. Upon completion of seed covering, roll the area with a roller, exerting a maximum force of 100 pounds per foot width of roller.

02920.3.06 MULCHING

- A. In general, straw mulching may be used on less critical slopes for soil erosion. On slopes greater than 3:1, jute matting, woven fiber erosion control blanket, or approved equal, shall be used instead of straw mulch.
- B. Mulching shall be performed in conjunction with seeding at the conclusion of finish grading operations. Straw shall be placed uniformly in a continuous blanket at a minimum rate of three tons per acre. A mechanical blower may be used to apply mulch material, provided the machine has been specifically designed and approved for this purpose. Machines that cut mulch into short pieces will not be permitted.
- C. Straw shall be anchored by the use of twine stakes, wire staples, paper or plastic nets, or emulsified asphalt, provided it is applied uniformly to the mulch at a rate of not less than 31 gallons per 1,000 square yards, or by other approved methods. Mulch over topsoiled areas shall be incorporated into the soil by approved equipment.
- D. 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. Protect structures, pavements, curbs, and walls to prevent asphalt staining. Erect warning signs and barricades at intervals of 50 feet or less along the perimeter of the mulched area. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.
- E. Apply wood cellulose fiber hydraulically at a rate of 320 pounds per 1,000 square yards. Incorporate as an integral part of the hydroseed slurry after seed and soil supplements have been thoroughly mixed.
- F. Thoroughly water mulch and seed bed immediately after completion of mulching. Soil shall be moistened to a depth of not less than 4".

02920.3.07 JUTE AND PAPER MATTING

- A. Lime, fertilize and seed in accordance with the applicable seeding standard, except that for jute matting, one-half of the seed may be applied prior to laying the matting, and the remaining seed applied after laying the matting.
- B. Start laying the matting from the top of the channel or slope and unroll downgrade so that one edge of the strip coincides with the channel center. Lay a second strip parallel to the first on the other side of the channel and allow at least a two (2) inch overlap for jute matting. If one roll of matting does not extend the length of the channel, continue downhill with additional rolls.
- C. Secure the matting by burying the top end of jute strips in a trench four (4) inches or more deep. Tamp the trench full of soil. Reinforce with a row of staples driven through the jute about four (4) inches downhill from the trench. These staples should be about ten (10) inches apart. Then staple the overlap in the channel center. These staples should be three (3) or four (4) feet apart. The outside edges may be stapled similarly at any time after the center has been stapled. Closer stapling along the sides is required where concentrated water may flow into the channel.
- D. Succeeding strips of matting, further down the channel or slope, are secured in a similar manner. Strips of matting on the swale slopes should be laid and secured, as above, to a height of three (3) feet above base of swale.
- E. Where one roll of jute matting ends and another roll begins, the end of the top strip shall overlap the trench where the upper end of the lower strip is buried. Make the overlap at least four (4) inches and staple securely.
- F. Erosion Stops: At any point, jute matting may be folded for burying in slit trenches and secured as were the upper ends. This checks water flow and erosion that may begin under the matting. It also gives improved tie-down. The procedure is recommended on the steeper slopes of sandy soil and gentler slopes subject to seepage. Spacings vary from 25 to 100 feet as required by the Engineer or Township.
- G. Diversions: Where diversions outlet into a waterway, the outlet should be protected with matting used in the same manner as in the main channel. The matting for the outlet is laid first so that matting in the main channel will overlap the outlet strip.
- H. Matting Soil Contact: Get contact between matting and soil by rolling after laying, stapling and seeding are complete. Perfect contact is vital to keep water flow over (not under) the matting.
- I. Inspection: After job completion, make sure the matting is in contact with the soil at all places and that critical areas are securely stapled down.

02920.3.08 SODDING

- A. Sodding shall be required if the grades exceed two-to-one slope.
- B. Sod shall be planted only when the soil is moist and favorable to growth. The area to be sodded and shaped and finished to the lines and grades indicated on the Drawings, and the surface loosened prior to placing the sod. The grade shall be kept moist by sprinkling, if necessary, until the sod is placed. The sod shall be placed on the prepared surface with the edges in close contact and, as far as possible, in a position to break joints. Each piece of sod laid shall be fitted and rolled or tamped into place with hand tampers or rollers not less than one hundred (100) square inches in area.

- C. Sod strips in waterways shall be laid perpendicular to the direction of flow. Butt ends of strips tightly.
- D. After rolling or tamping, sod shall be pegged or stapled to resist washout during the establishment period. Jute or other netting may be pegged over the sod for extra protection in critical areas.
- E. A sufficient quantity of water shall be applied to all sod after laying, to ensure immediate growth.

02900.3.09 MAINTENANCE, GUARANTEE, AND CERTIFICATION OF ACCEPTABILITY

- A. Maintenance shall begin immediately after each portion of lawn is planted, and shall continue in accordance with the following requirements:
 - 1. The Contractor shall be held responsible for maintenance of lawns, including watering, weeding, sowing, cutting, and replanting as necessary for at least sixty (60) days after sowing and as much longer as is necessary to establish a uniform stand of the specified grasses and until certification of acceptability. No bare spots will be allowed. After the grass has started, all areas and parts of areas that fail to show a uniform stand of grass, for any reason whatsoever, shall be reseeded repeatedly until all areas are covered with a satisfactory growth of grass. At time of cutting, keep mower blades not less than two and one-half (2-1/2) inches high. The maintenance period shall continue after seeding and until the lawns are certified acceptable by the Engineer or Township, which date of certification shall not be earlier than the date of substantial completion of the entire work of this Contract.
 - 2. Damage resulting from erosion, gullies, washouts or other causes shall be repaired by filling with topsoil, tamping, re-fertilizing, reseeding or sodding and mulching by the Contractor at his expense if such damage occurs prior to certificate of acceptability by the Engineer or Township.
 - 3. The Contractor's responsibility for maintenance shall cease at the time of certification of acceptability by the Engineer or Township. During the guarantee period, the Contractor shall be held responsible for making replacements but no maintenance will be required.
 - 4. At the end of the guarantee period, inspection will be made by the Engineer or Township upon written notice requesting such inspection submitted by the Contractor at least ten (10) days before the anticipated date.
- B. Lawns shall be guaranteed for one (1) year after certification of acceptability by the Engineer or Township, and shall be in satisfactory condition at the end of the guarantee period, except for damage resulting from causes beyond the responsibility of the Contractor.
- C. Certification of Acceptability:
 - 1. Inspection of the work of lawns to determine completion of the work under this Section will be made at the conclusion of the maintenance period and upon written notice requesting such inspection submitted by the Contractor at least five (5) days prior to the anticipated date. The condition of lawns will be noted, and determination made by the Engineer or Township on whether maintenance shall continue in any part.
 - 2. After inspection by the Engineer or Township, the Contractor will be notified, in writing, by the Engineer or Township of acceptability of all work of this Section, or if there are any deficiencies of the requirements for completion of the work. Lawn maintenance remaining to be done shall be subject to re-inspection before being certified acceptable.

02900.3.10 PUMP STATION LANDSCAPING

A. Provide trees and shrubs around the pump station to provide a visual screen. The following trees and shrubs shall be provided:

<u>BOTANICAL NAME</u>	<u>COMMON NAME</u>	<u>QTY.</u>	<u>SIZE</u>
<u>Evergreen Trees</u>			
Pinus Strobus	White Pine	10	4' TO 5', B&B
Picea Excelsa	Norway Spruce	3	5' TO 6', B&B
Pinus Nigra	Austrian Pine	8	4' TO 5', B&B
<u>Deciduous Trees</u>			
Cornus Florida Rubra	Redflowering Dogwood	2	4' TO 5', B&B
Quercus Palustris	Pin Oak	2	1 3/4" TO 2", B&B
Acer Saccharum	Sugar Maple	1	1 3/4" TO 2", B&B
<u>Evergreen Shrubs</u>			
Rhododendron Maximum	Rosebay Rhododendron	3	2' TO 2 1/2', B&B
<u>Deciduous Shrubs</u>			
Myrica Pensylvanica	Northern Bayberry	6	18" TO 24", B&B

Provide a plan showing the arrangement of landscaping around the pump station for review and approval by the Engineer.

- B. The unpaved area surrounding the pump station and within the fencing shall be finish graded with three (3) inches of PennDOT 2A coarse aggregate.

TEMPORARY SEEDING TABLE

<u>Condition</u>	<u>Topsoil</u>	<u>Lime *</u>	<u>Fertilizer **</u>	<u>Seed Mix and Sowing Rate (% By Weight)</u>
Temporary Cover March to June	N/A	N/A	N/A	35% Spring Oats 35% Annual Ryegrass 30% KY 31 Tall Fescue Sow 85 Lbs./Acre
Temporary Cover July to August	N/A	N/A	N/A	15% Flyking KY Bluegrass 40% KY 31 Tall Fescue 45% Annual Ryegrass Sow 65 Lbs./Acre
Temporary Cover After August 30th	N/A	N/A	N/A	75% Winter Rye or Winter Wheat 12% Annual Ryegrass 10% KY 31 Tall Fescue 3% Red Top Sow 154 Lbs/Acre (Winter Wheat or Winter Rye In The Mix = 116 Lbs. Or 2 Bushels)

PERMANENT SEEDING TABLE

<u>Condition</u>	<u>Topsoil</u>	<u>Lime*</u>	<u>Fertilizer**</u>	<u>Matting</u>	<u>Seed Mix And Sowing Rate (% By Weight)</u>
Roadside, Non-Mowed Non-Swale	Yes	100# Per 1,000 Sq. Ft.	10-6-4 or 20-8-8	No	80% KY 31 Tall Fescue 20% Pennlawn Red Fescue Sow 21 Lbs./1,000 Sq. Yds. March to May/August to September
Roadside, Non-Mowed Swale	Yes	100# Per 1,000 Sq. Ft.	10-6-4 or 20-8-8	North American Green D575	80% KY 31 Tall Fescue 20% Pennlawn Red Fescue Sow 21 Lbs./1,000 Sq. Yds. March to May/August to September
Roadside, Mowed Non-Swale	Yes	100# Per 1,000 Sq. Ft.	10-6-4 or 20-8-8	No	50% KY Bluegrass 30% Pennlawn Red Fescue 20% Pennfine Perennial Ryegrass Sow 21 Lbs./1,000 Sq. Yds. March to May/August to September
Roadside, Mowed Swale	Yes	100# Per 1,000 Sq. Ft.	10-6-4 or 20-8-8	North American Green D575	50% KY Bluegrass 30% Pennlawn Red Fescue 20% Pennfine Perennial Ryegrass Sow 21 Lbs./1,000 Sq. Yds. March to May/August to September
Bank Areas, Non-Mowed Less than 4:1	Yes	100# Per 1,000 Sq. Ft.	10-6-4 or 20-8-8	North American Green D575	45% Crownvetch or Birdsfoot Trefoil 55% Annual Ryegrass Sow 9 Lbs./1,000 Sq. Yds. Anytime except September to October
Bank Areas Non-Mowed Greater than 4:1	Yes	100# Per 1,000 Sq. Ft.	10-6-4 or 20-8-8	North American Green D5150	45% Crownvetch or Birdsfoot Trefoil 55% Annual Ryegrass Sow 9 Lbs./1,000 Sq. Yds. Anytime except September to October
Lawns	Yes	100# Per 1,000 Sq. Ft.	10-6-4 or 20-8-8		80% Turf Type Fescue*** 20% Pennfine Perennial Ryegrass Sow 52 Lbs./1,000 Sq. Yds. March to May/August to September
Fields and Pasture, Non- Cultivated	No	No	10-6-4 or 20-8-8		100% Timothy Sow 9 Lbs./1,000 Sq. Yds. March to May/August to September
Fields, Cultivated	No	No	10-6-4 or 20-8-8		100% Annual Ryegrass Sow 9 Lbs./1,000 Sq. Yds. March to May/August to September
Woods, Sparse	No	No	10-6-4 or 20-8-8		Right-of-Way Woods Mix Ernst Conservation Seeds, ERNMX-132 Sow 9 Lbs./1,000 Sq. Yds.

<u>Condition</u>	<u>Topsoil</u>	<u>Lime*</u>	<u>PERMANENT SEEDING TABLE</u>		<u>Seed Mix And Sowing Rate (% By Weight)</u>
			<u>Fertilizer**</u>	<u>Matting</u>	
Woods, Dense	No	No	No		Stabilize soil with Biodegradable Netting and Paper Fabric Material March to May/August to September
Wetlands	Yes	No	No		Wetlands Meadow Mix Ernst Conservation Seeds, ERNMX-122 Sow 3 Lbs./1,000 Sq. Yds. March to May/August to September

* Unless lesser rate indicated by soils tests.

** Fertilizer shall be minimum 50% organic nitrogen, apply at a rate in accordance with the manufacturers specifications for new lawns.

*** Turf Type Fescue shall be supplied in two equal parts of different species (See Table 1).

END OF SECTION

DIVISION 3

CONCRETE

<u>SECTION</u>	<u>DESCRIPTION</u>
03010	Concrete for Utility Construction

**SECTION 03010
CONCRETE FOR UTILITY CONSTRUCTION**

PART 1 - GENERAL

03010.1.01 DESCRIPTION

- A. The work shall consist of all cast-in-place cement concrete construction associated with utility projects.
- B. The Contractor shall supply all necessary labor, materials, and equipment necessary for the completion of this work.

03010.1.02 SUBMITTALS

- A. Submit a Statement of Compliance from the concrete producer, together with supporting data, attesting that the cement concrete conforms to the State Specifications for the class of concrete being used.
- B. Submit detailed shop drawings of reinforcing steel.
- C. Submit technical data sheets on non-shrink grout including instructions for surface preparation, forming, mixing, application and cleanup.

PART 2 - PRODUCTS

03010.2.01 CEMENT CONCRETE

- A. Ready-mixed, conforming to Section 704, Pub. 408 Specifications.

Requirements for State approved batch plants design computations and plans inspection shall not apply. The acceptability of concrete will be based on conformance with the Cement Concrete Criteria specified below and the results of the specified tests.

- B. Cement Concrete Criteria:

Class A:

28-day compressive strength: 3,300 psi
Slump: 1 to 3 inches

Class C:

28-day compressive strength: 2,000 psi
Slump: 2 to 6 inches

High Early Strength:

3-day compressive strength: 3,000 psi
Slump: 1 to 3 inches

Cement Factor and Maximum Water-Cement Ratio conforming to Table A, Section 704.1(b), Pub. 408 Specifications.

03010.2.02 CONCRETE ACCESSORIES

- A. Reinforcement Bars: New billet-steel conforming to Section 709.1, Pub. 408 Specifications. Deformed, Grade 40.
- B. Steel Wire Fabric: Conforming to Section 709.3, Pub. 408 Specifications.
- C. Premolded expansion joint filler: Conforming to ASTM D1752.
- D. Non-Shrink Grout: Non-shrink, non-metallic Portland cement grout conforming to Federal Specification SS-081 and meeting the Corps of Engineers' Specification CRD C-621.

PART 3 - EXECUTION

03010.3.01 GENERAL

- A. Comply with Section 1001, Pub. 408 Specifications, for construction requirements including formwork, curing, protection and finishing of cement concrete.
- B. Excavate and shape trench bottoms and sides to accommodate thrust block forms, encasements, manhole bases, basins and vaults.
- C. Support pipe, valves and fittings at the required elevation with brick or concrete block. Do not use earth, rock, wood or organic material as supports.

03010.3.02 CONSTRUCTION

- A. Construct cast-in-place manhole bases, vault channels and miscellaneous reinforced structures of Class A concrete. Class A concrete may be from a mobile cement concrete plant or truck mixed.
- B. Construct thrust blocks, cradles, encasements, and miscellaneous mass concrete of Class C concrete. Class C concrete may be from a mobile cement concrete plant or truck mixed.
- C. Construct reinforced and plain cement concrete roadway pavements and base courses of High Early Strength concrete. High Early Strength Concrete shall be central-plant-mixed.
- D. Provide spacers, chairs, bolsters, ties and other devices for properly placing, spacing, supporting and fastening reinforcement in place.

- E. Place concrete utilizing all possible care to prevent displacement of pipe or fittings. Return displaced pipe or fittings to line and grade immediately.
- F. Ensure tie rods, nuts, bolts and flanges are free and clear of concrete.
- G. Do not backfill structures until concrete has achieved its initial set, forms are removed, and concrete work is inspected by the Engineer or Township.
- H. Mix and apply non-shrink grout in accordance with manufacturer's instructions.
- I. Perform backfilling and compaction as specified in Section 02200.

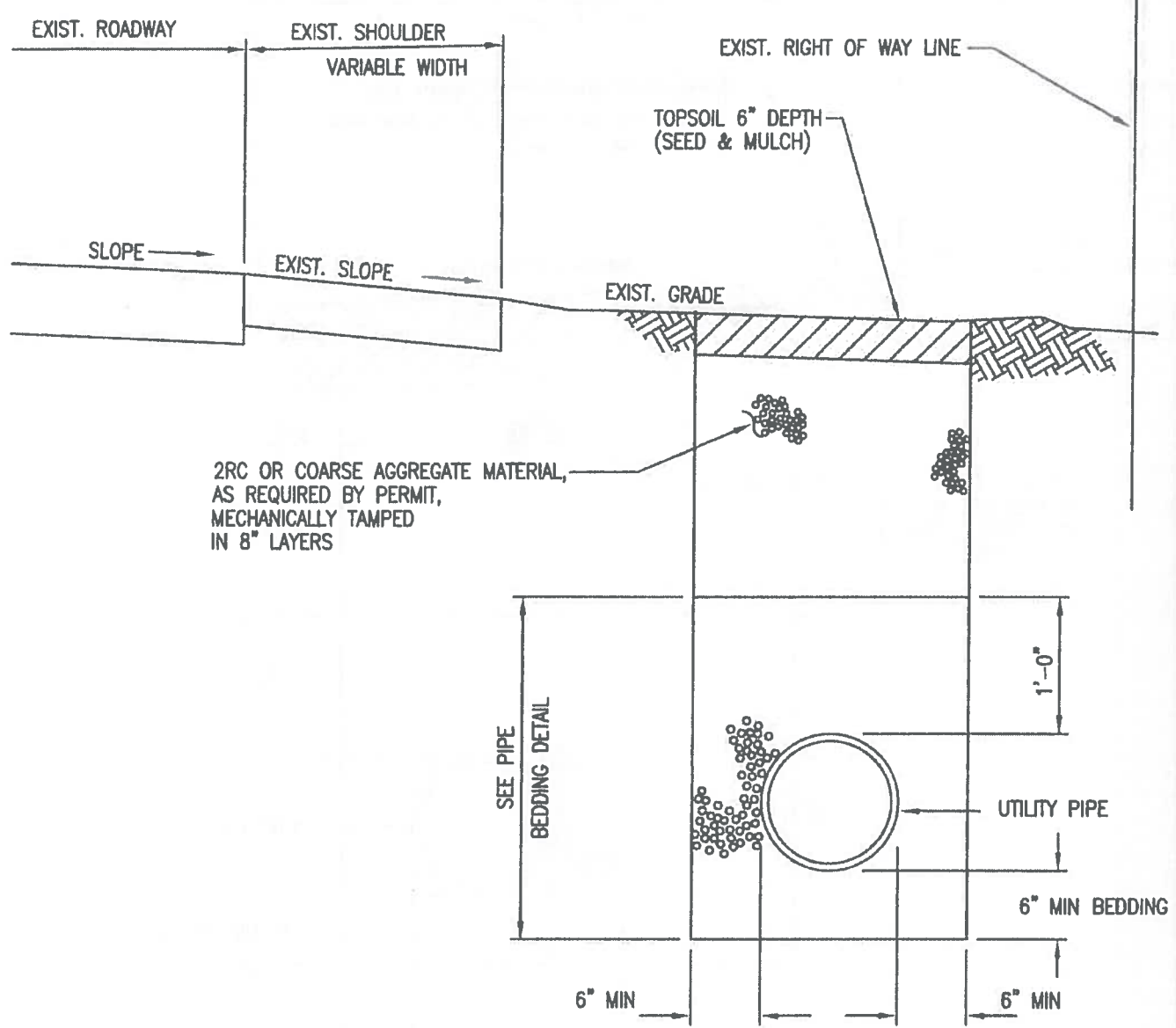
END OF SECTION

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- TR1 - Trench Restoration for Easements
- TR2 - Trench Restoration for Areas Outside Shoulders in State Highway Right-of-Way
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- TR4 - Temporary Pavement Trench Restoration for Township Roads and State Highways
- TR5 - Permanent Pavement Trench Restoration for Township Roads
- TR6 - Permanent Pavement Trench Restoration for State Highways
- TR7 - Trench Restoration for Unpaved Areas Within Township Road Right-of-Way

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2RC OR COARSE AGGREGATE MATERIAL,
AS REQUIRED BY PERMIT,
MECHANICALLY TAMPED
IN 8" LAYERS

NOTES:

1. ALL RESTORATION TO BE IN ACCORDANCE WITH PENNDOT PUBLICATION 408 AND PA CODE TITLE 67 CHAPTER 459.
2. SPECIAL CONDITIONS OF OCCUPANCY PERMIT MAY SUPERSEDE THIS DETAIL.

TRENCH RESTORATION FOR AREAS OUTSIDE
SHOULDER IN STATE HIGHWAY R.O.W.

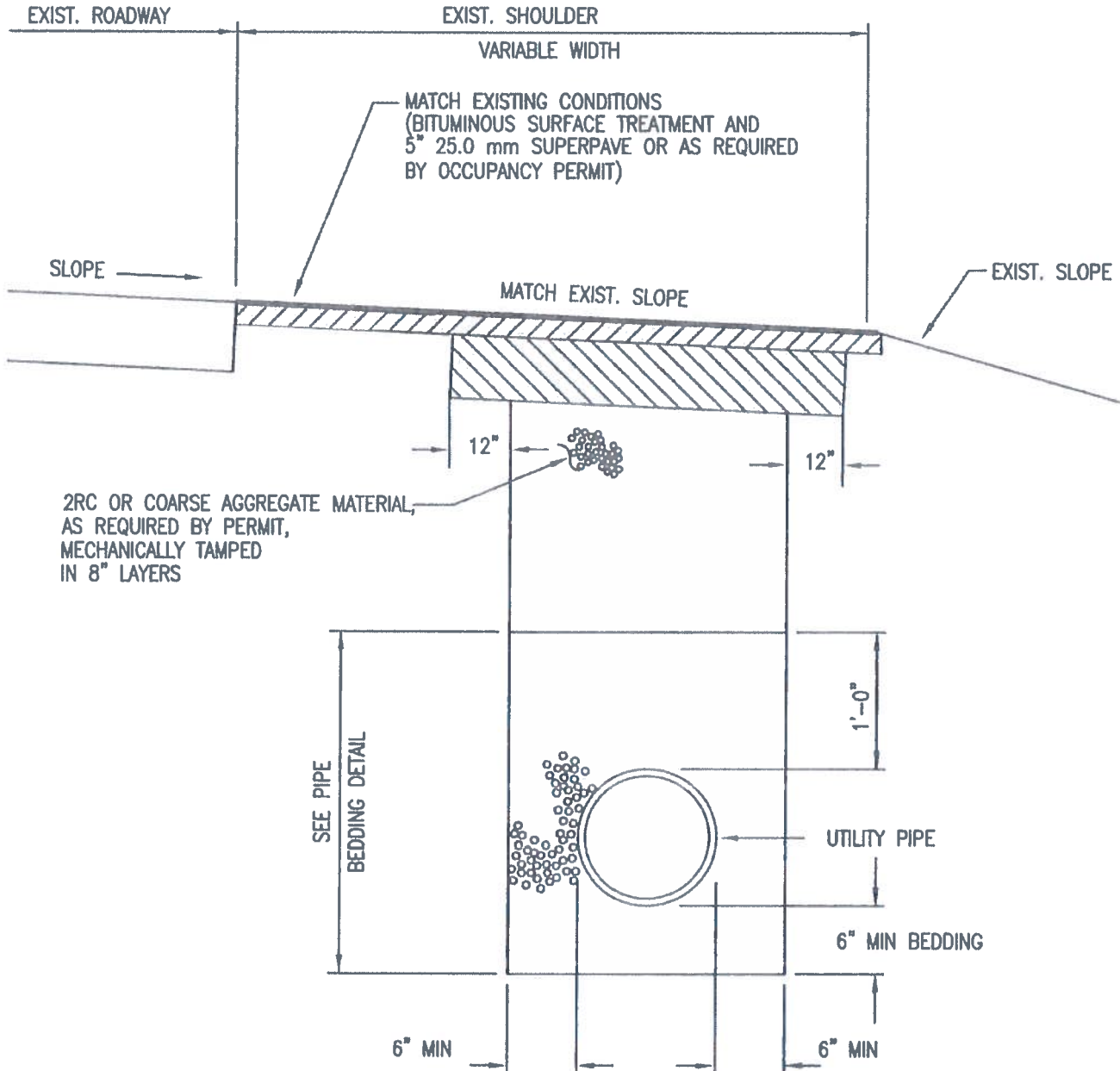
N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL TR2

CKS Engineers, Inc.

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REF. NO. 4102-66

REV. 3/2017



NOTES:

1. ALL RESTORATION TO BE IN ACCORDANCE WITH PENNDOT PUBLICATION 408 AND PA CODE TITLE 67 CHAPTER 459.
2. SPECIAL CONDITIONS OF OCCUPANCY PERMIT MAY SUPERSEDE THIS DETAIL.

**TRENCH RESTORATION FOR STATE
HIGHWAY WITH STABILIZED SHOULDER**

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL TR3

CKS Engineers, Inc.

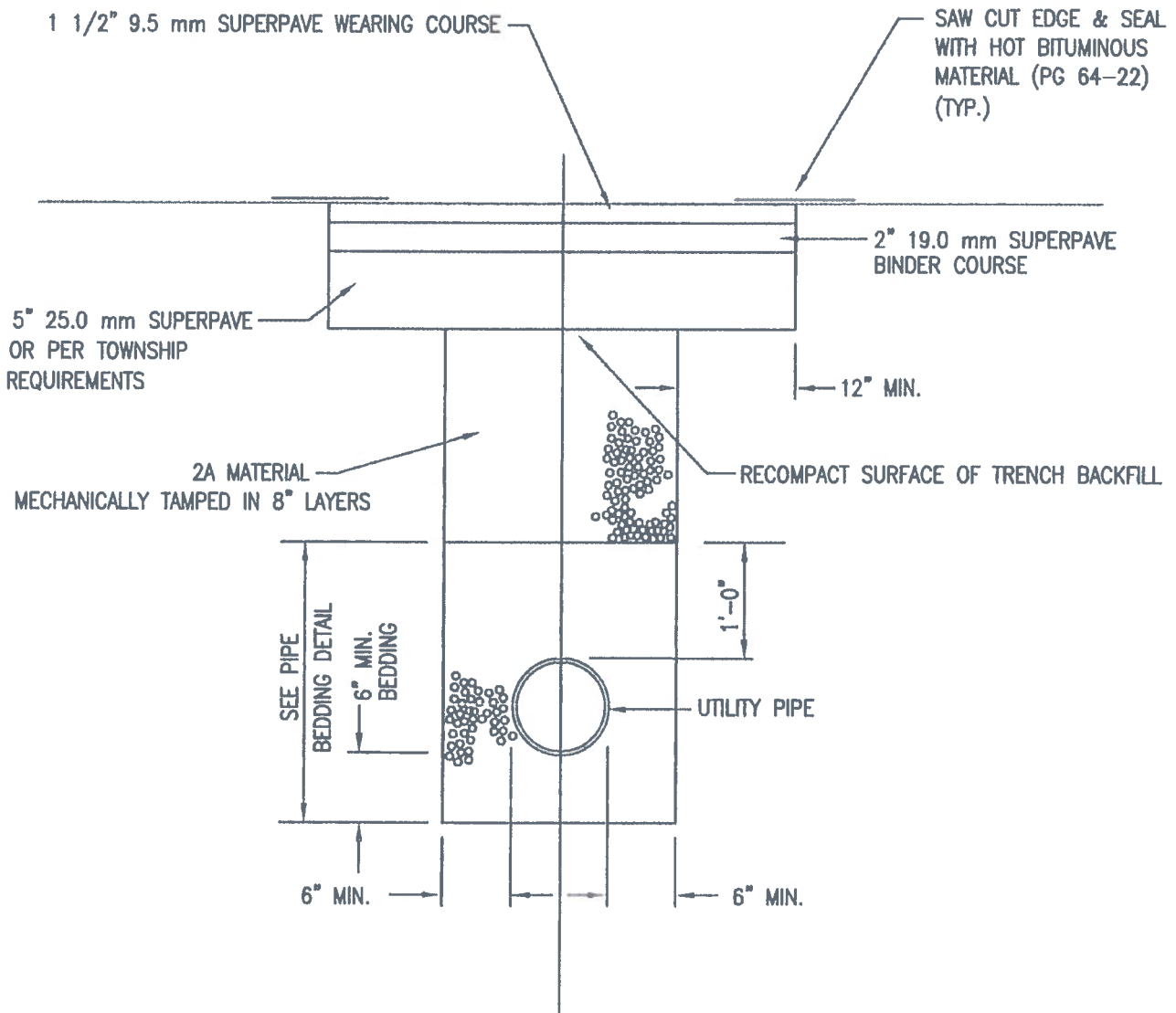


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REV. 3/2017



NOTES:

1. SPECIAL CONDITIONS OF ROAD OPENING PERMIT MAY SUPERSEDE THIS DETAIL.
2. RETAINED SUITABLE MATERIAL MAY BE USED AS BACKFILL FOR TRENCHES IN TOWNSHIP ROAD R.O.W. WHEN MORE THAN 3 FT. FROM EXISTING SHOULDER OR PAVED CARTWAY. RETAINED SUITABLE MATERIAL MAY BE USED AS BACKFILL FOR NEW ROADWAY CONSTRUCTION. COMPACTION REQUIREMENTS STILL APPLY.

PERMANENT PAVEMENT TRENCH RESTORATION
FOR TOWNSHIP ROADS

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL TR5

CKS Engineers, Inc.

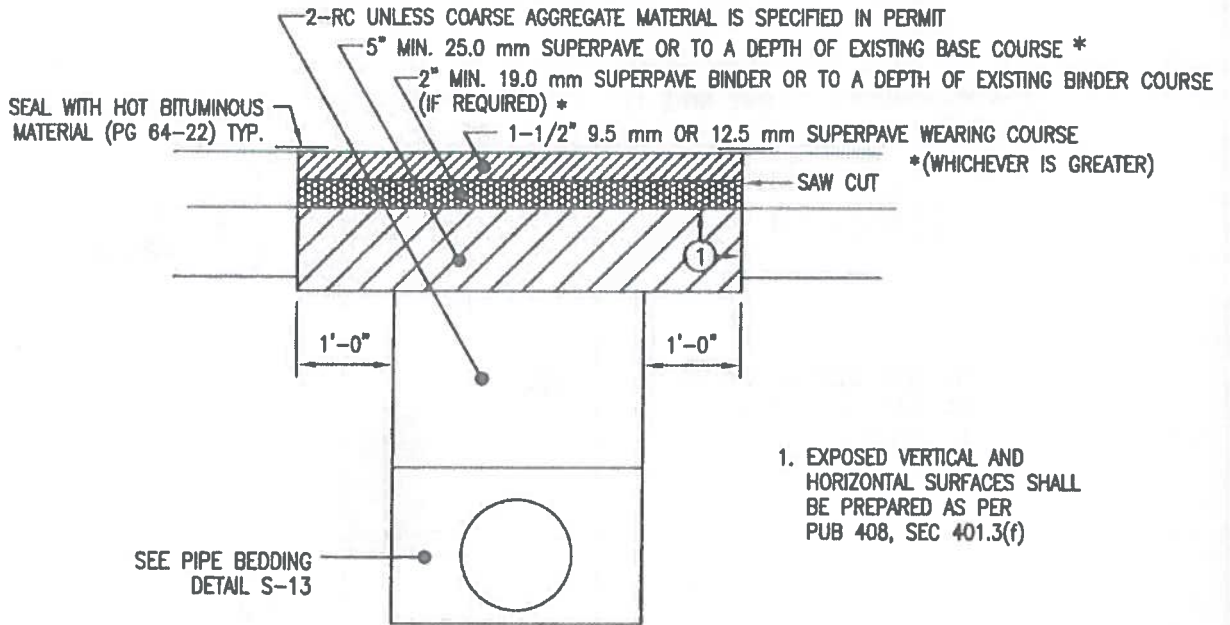
88 South Main Street, Doylestown, PA 18901
(215) 340-0800

REF. NO. 4102-66

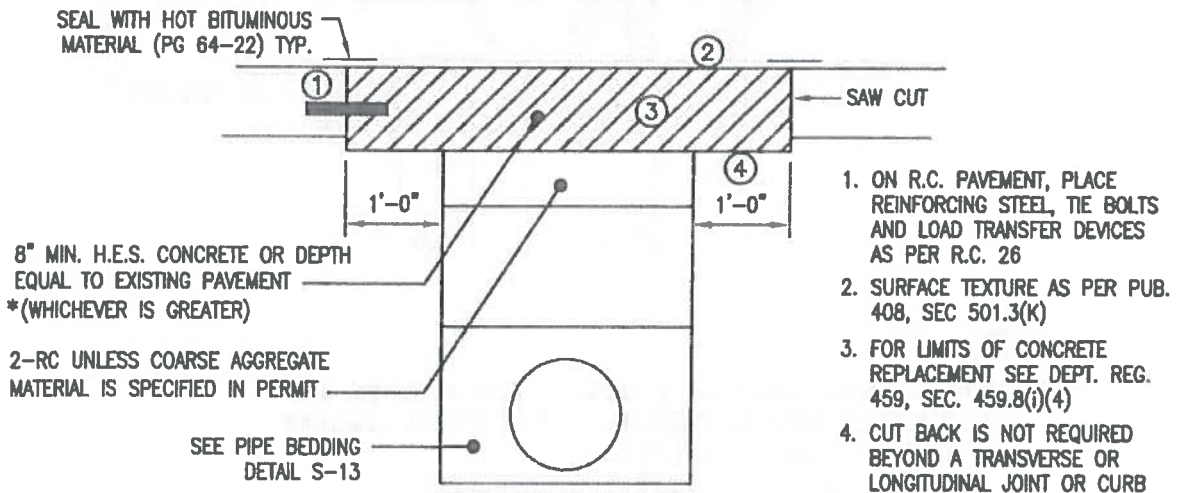


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FLEXIBLE PAVEMENT RESTORATION



RIGID PAVEMENT RESTORATION



NOTES:

1. ALL RESTORATION TO BE IN ACCORDANCE WITH PA DOT PUBLICATION 408 AND PA CODE TITLE 67 CHAPTER 459.
2. SPECIAL CONDITIONS OF OCCUPANCY PERMIT MAY SUPERSEDE THIS DETAIL.

PERMANENT PAVEMENT, TRENCH RESTORATION AND BACKFILL FOR STATE HIGHWAYS

N.T.S.

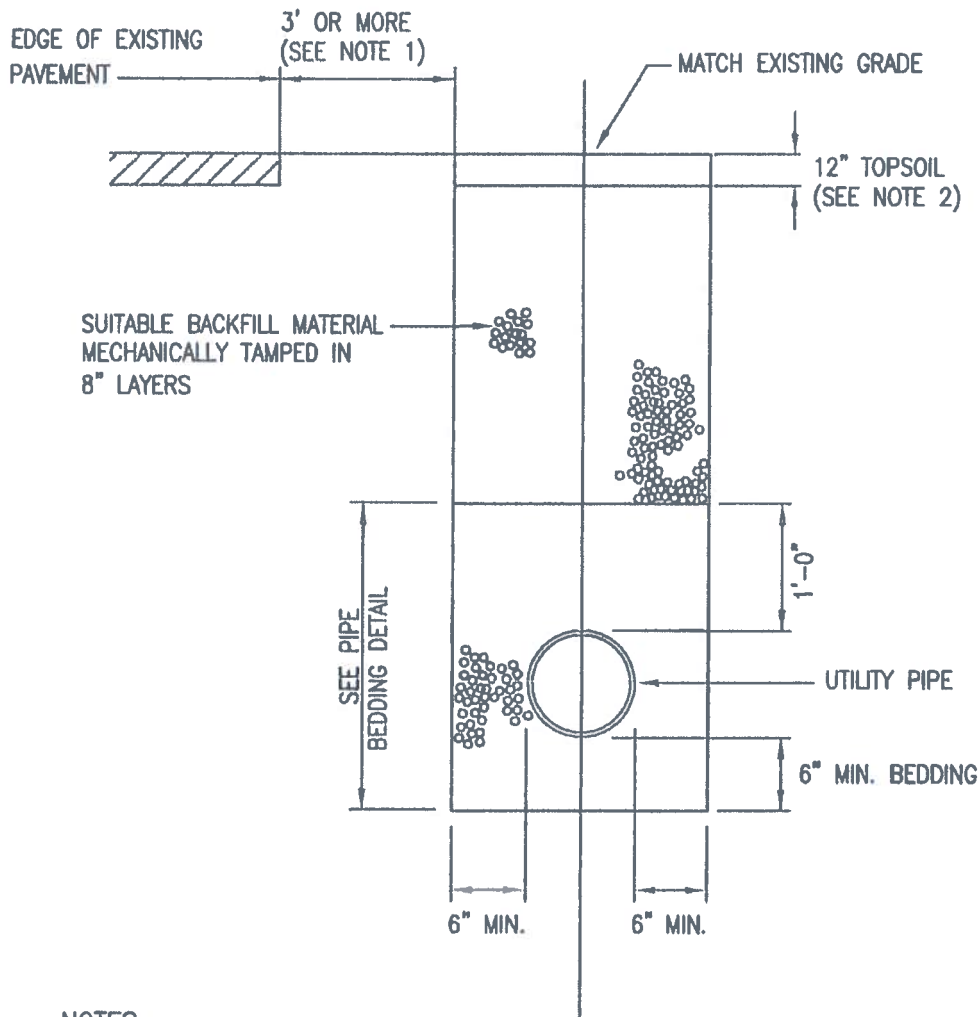
WARRINGTON TOWNSHIP
STANDARD DETAIL TR6

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REF. NO. 4102-66



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NOTES:

1. TRENCH OPENINGS LESS THAN 3' FROM THE EDGE OF AN EXISTING PAVED SURFACE SHALL BE BACKFILLED WITH 2A COARSE AGGREGATE MECHANICALLY TAMPED IN 8" LAYERS.
2. SURFACE RESTORATION SHALL BE IN ACCORDANCE WITH SECTION 02920 OF THE SPECIFICATIONS.

TRENCH RESTORATION FOR UNPAVED
AREAS WITHIN TOWNSHIP ROAD RIGHT-OF-WAY

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL TR7

CKS Engineers, Inc.



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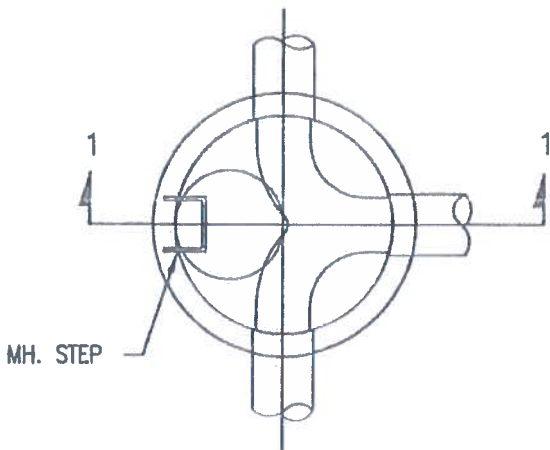
REF. NO. 4102-66

REV. 3/2017

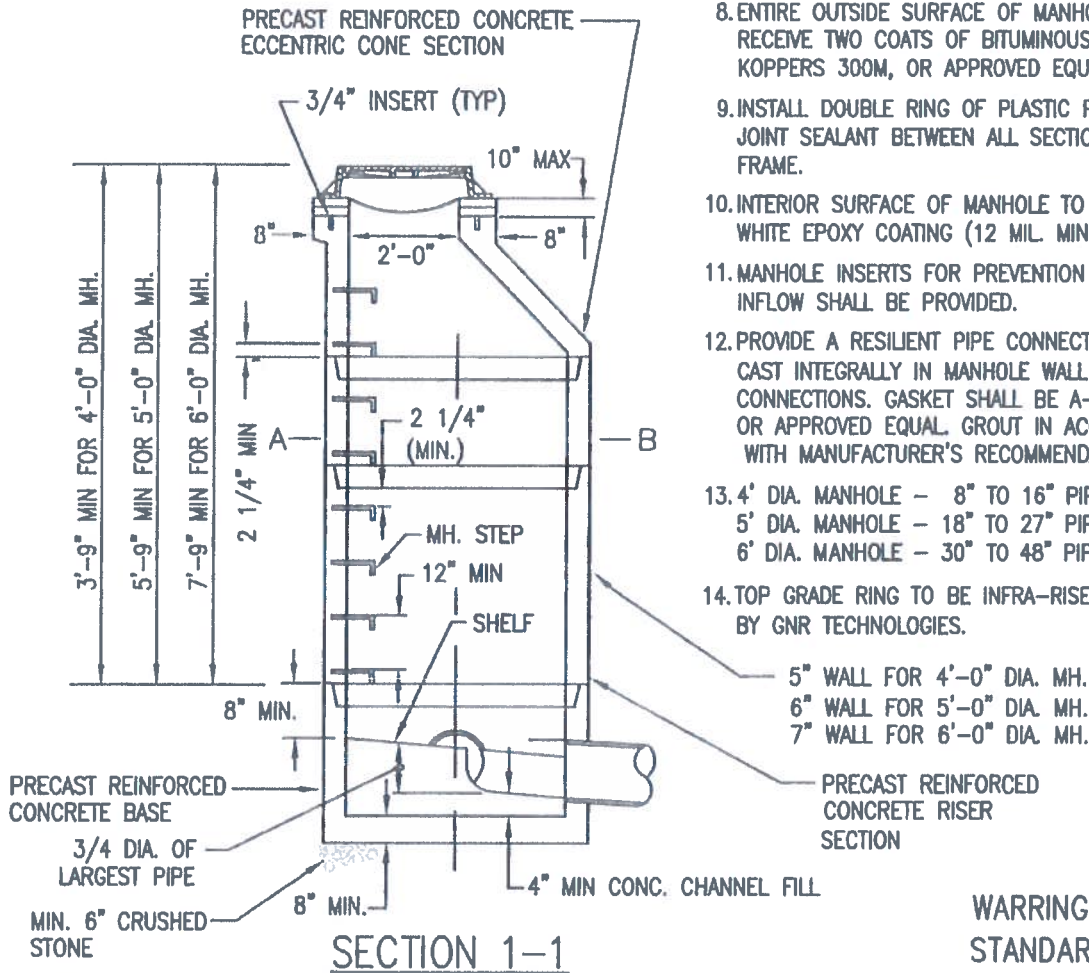
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- SS1 - Type "A" Standard Manhole
- SS2 - Type "B" Shallow Manhole
- SS3 - Doghouse Manhole Construction
- SS4 - Drop Manhole Connection
- SS5 - Polypropylene Manhole Step
- SS6 - Standard Manhole Frame and Cover
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- SS8 - Lateral Connection Shallow Sewer
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- SS10 - Typical Cross-Sections of Submersible Pumping Station with Valve Pit
- SS11 - Force Main Cleanout Chamber
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- SS13 - Typical Service Connection at Building for PVC Lateral
- SS14 - LPSS Connection Pit – Residential Grinder Pump
- SS15 - Connection Pit – Residential Force Main to Gravity Lateral Connection
- SS16 - Sampling Manhole
- SS17 - Grease Trap Detail



PLAN BELOW LINE A - B



SECTION 1-1

TYPE 'A' STANDARD MANHOLE

N.T.S.

NOTES:

1. THE DEPTH OF THE INVERT CHANNEL SHALL BE EQUAL TO 3/4 OF THE DIAMETER OF THE SEWER.
2. THE SHELF SHALL SLOPE TOWARD THE INVERT CHANNEL AT A RATE OF 1" PER FOOT.
3. TYPE "B" MANHOLES (SHALLOW TYPE) TO BE PROVIDED WHERE REQUIRED BY DEPTH CONDITIONS. ALL OTHER MANHOLES TO BE TYPE "A".
4. FOR MANHOLES HAVING 5' DIA. AND 6' DIA. BASE, REDUCTION IN DIAMETER TO 4' SHALL START AT THE FIRST JOINT ABOVE THE UPPERMOST PIPE CONNECTION TO WALL, WHERE DEPTH IS SUFFICIENT.
5. ALL MANHOLE FRAMES SHALL BE BOLTED TO THE CONE SECTION OR CONCRETE SLAB WITH 4-3/4" DIA. BOLTS WITH WASHERS AND NUTS. BOLTS TO BE AT 90° ON THE BOLT CIRCLE.
6. SEE THE SPECIFICATIONS FOR LENGTH OF PIPE CONNECTIONS TO MANHOLES.
7. ALL MANHOLES SHALL BE CONSTRUCTED IN ACCORDANCE WITH STANDARD SPECIFICATIONS SECTION 02605.
8. ENTIRE OUTSIDE SURFACE OF MANHOLE SHALL RECEIVE TWO COATS OF BITUMINOUS COATING, KOPPERS 300M, OR APPROVED EQUAL.
9. INSTALL DOUBLE RING OF PLASTIC PREFORMED JOINT SEALANT BETWEEN ALL SECTIONS AND UNDER FRAME.
10. INTERIOR SURFACE OF MANHOLE TO BE PVC LINED OR WHITE EPOXY COATING (12 MIL. MIN.) AS REQUIRED.
11. MANHOLE INSERTS FOR PREVENTION OF STORM WATER INFLOW SHALL BE PROVIDED.
12. PROVIDE A RESILIENT PIPE CONNECTION GASKET CAST INTEGRALLY IN MANHOLE WALL AT ALL PIPE CONNECTIONS. GASKET SHALL BE A-LOK CONNECTOR, OR APPROVED EQUAL, GROUT IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
13. 4' DIA. MANHOLE - 8" TO 16" PIPES
5' DIA. MANHOLE - 18" TO 27" PIPES
6' DIA. MANHOLE - 30" TO 48" PIPES
14. TOP GRADE RING TO BE INFRA-RISER AS MANUFACTURED BY GNR TECHNOLOGIES.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS1

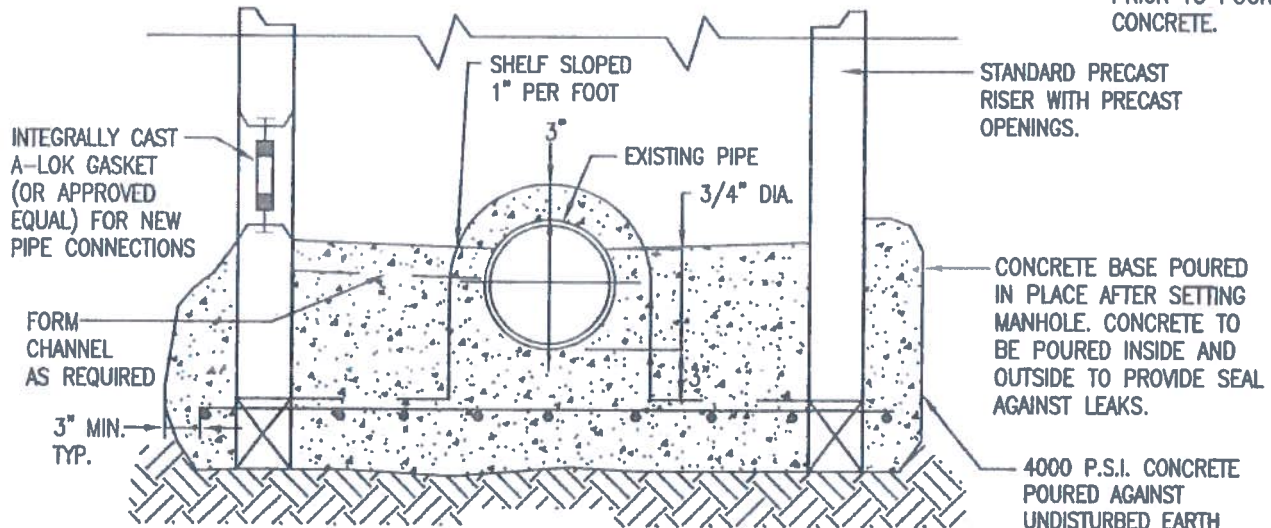
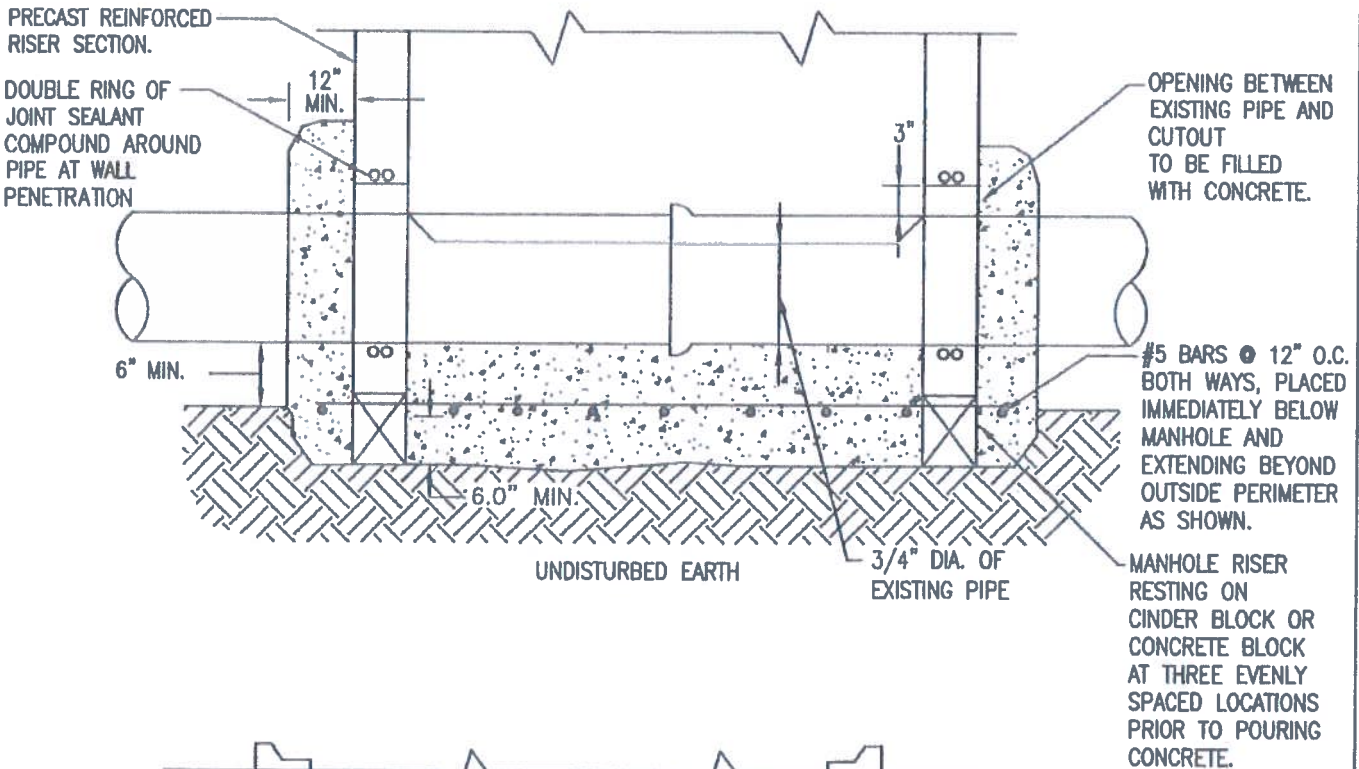
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NOTES:

1. EXISTING PIPE TO REMAIN UNTIL SATISFACTORY COMPLETION OF MANHOLE TESTING.
2. REMOVE CROWN OF EXISTING PIPE FLUSH WITH CONCRETE SHELF.

DOGHOUSE MANHOLE CONSTRUCTION

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS3

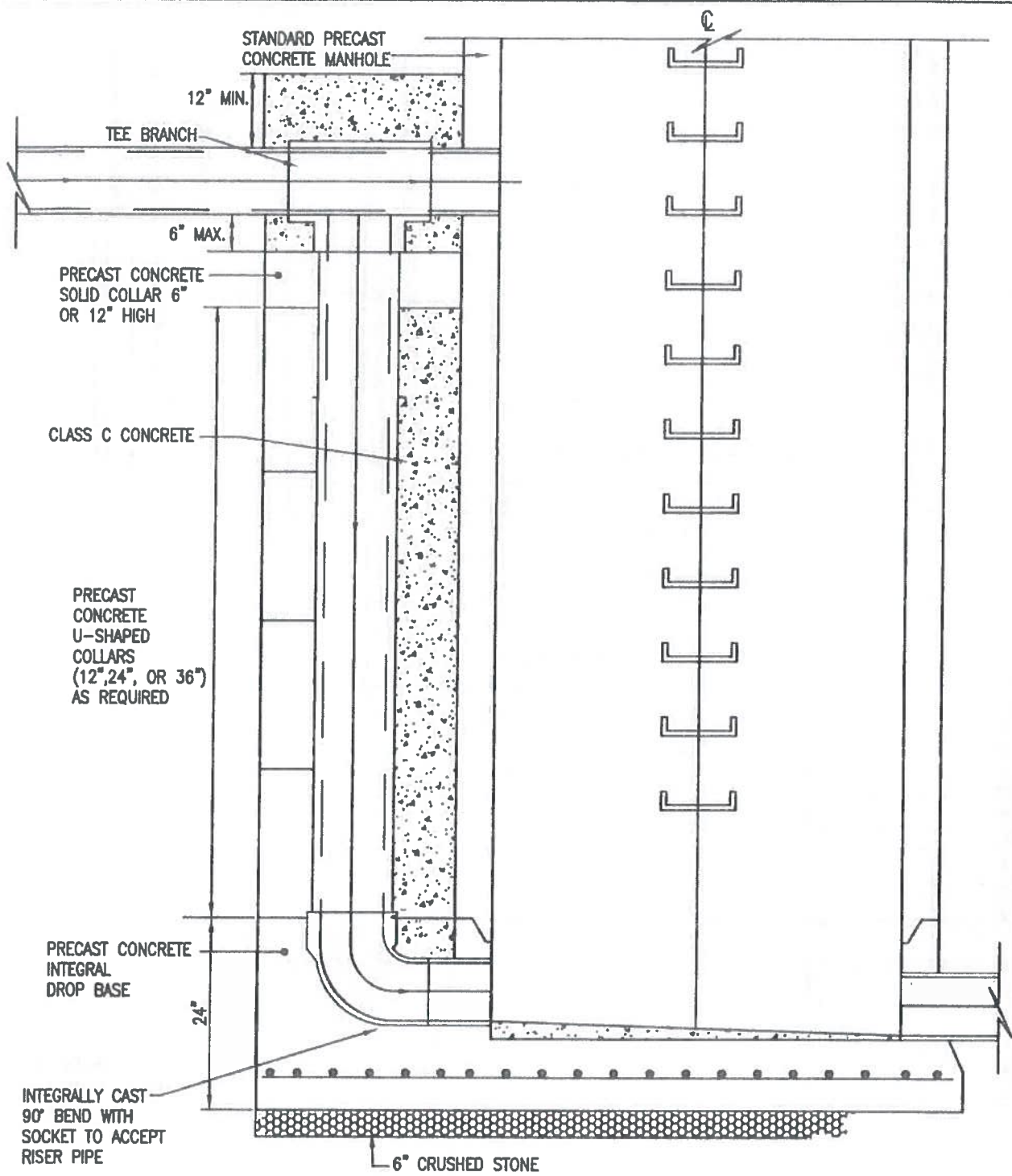
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- NOTES: 1. CONSTRUCTION TO BE SAME AS STANDARD MANHOLE EXCEPT AS NOTED.
 2. MINIMUM ALLOWABLE DROP TO BE IN ACCORDANCE WITH SECTION 02605 OF SPECIFICATIONS.
 3. EXTERNAL DROP CONNECTIONS REQUIRED FOR ALL INVERT ELEVATION DIFFERENCES IN EXCESS OF 18 INCHES.

DROP MANHOLE CONNECTION
 N.T.S.

WARRINGTON TOWNSHIP
 STANDARD DETAIL SS4

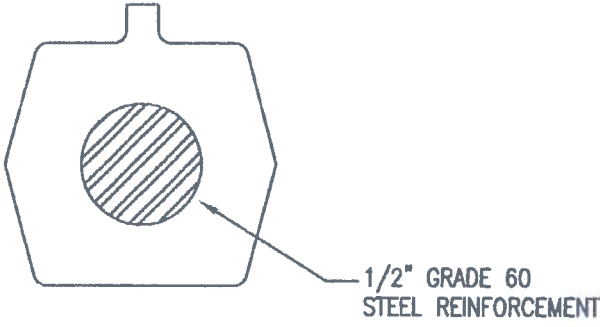
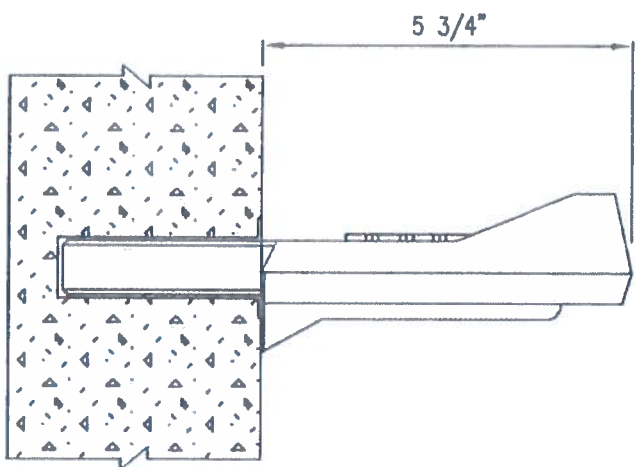
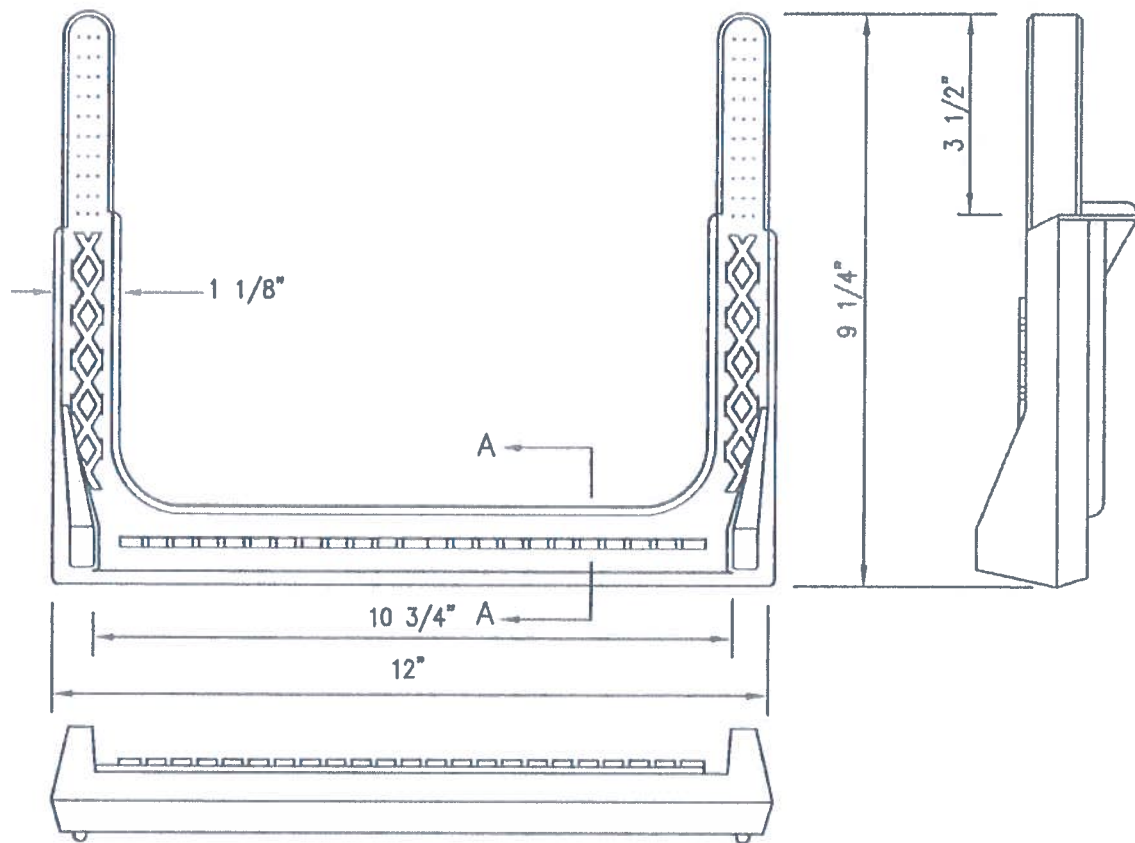
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SPECIFICATIONS

STEPS TO BE FABRICATED FROM COPOLYMER POLYPROPYLENE PLASTIC.

POLYPROPYLENE MANHOLE STEP
N.T.S.

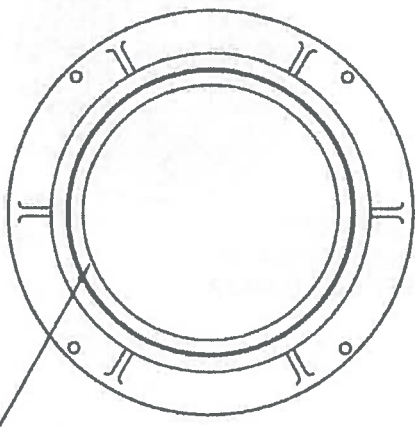
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STANDARD DETAIL SS5

CKS Engineers, Inc.

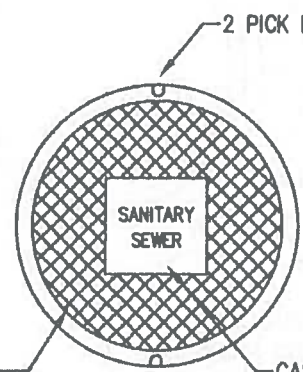
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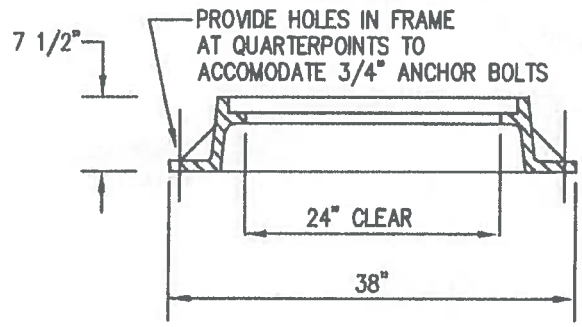


FULL SEAT
NO PROTRUDING
TABS OR LUGS

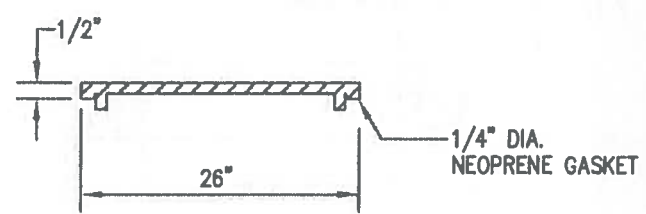


MFG. STANDARD
NON-SKID SURFACE AS
APPROVED BY ENGINEER.

CAST-IN LETTERS
AS SPECIFIED



FRAME



COVER

NOTES:

THE FOLLOWING MANUFACTURER'S STANDARD CASTING, OR APPROVED EQUAL, SHALL BE USED.
EAST JORDAN IRON WORKS PRODUCT NO. 00104172

STANDARD MANHOLE FRAME AND COVER
N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS6

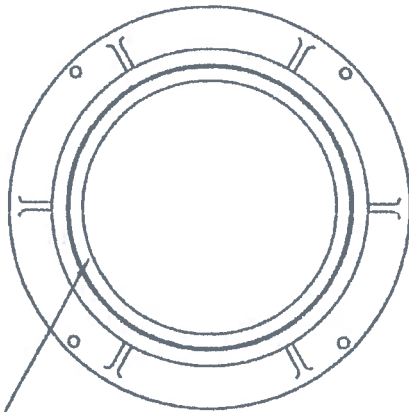
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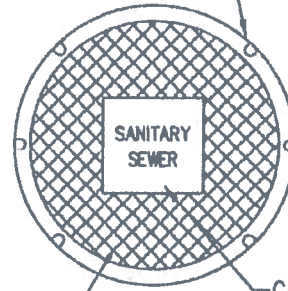


REV. 3/2017



FULL SEAT
NO PROTRUDING
TABS OR LUGS

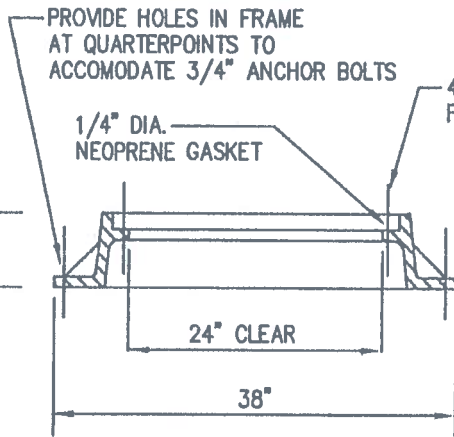
(4) 1/2-13 X 1 3/4" HEX
SS CAP SCREW W./ 1/2"
APPROVED ZINC PLTS & RUBBER
WASHERS



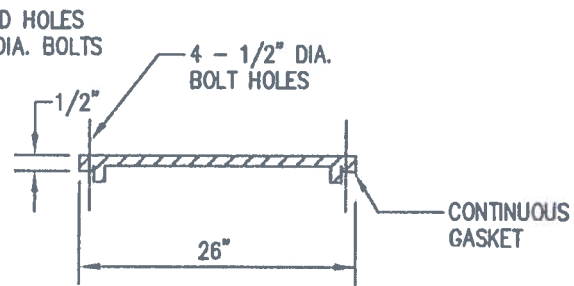
2 OPEN
PICK HOLES

MFG. STANDARD
NON-SKID SURFACE AS
APPROVED BY ENGINEER.

CAST-IN LETTERS
AS SPECIFIED



FRAME



COVER

NOTES:

1. THE FOLLOWING MANUFACTURER'S STANDARD CASTING, OR APPROVED EQUAL, SHALL BE USED.
2. EAST JORDAN IRON WORKS PRODUCT NO. 00104509
3. BOLT COVER TO FRAME WITH FOUR (4) 1/2" COUNTERSUNK STAINLESS STEEL BOLTS WHICH MAKE A SEAL WITH A RUBBER "O" RING GASKET.

WATERTIGHT MANHOLE FRAME AND COVER

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS7

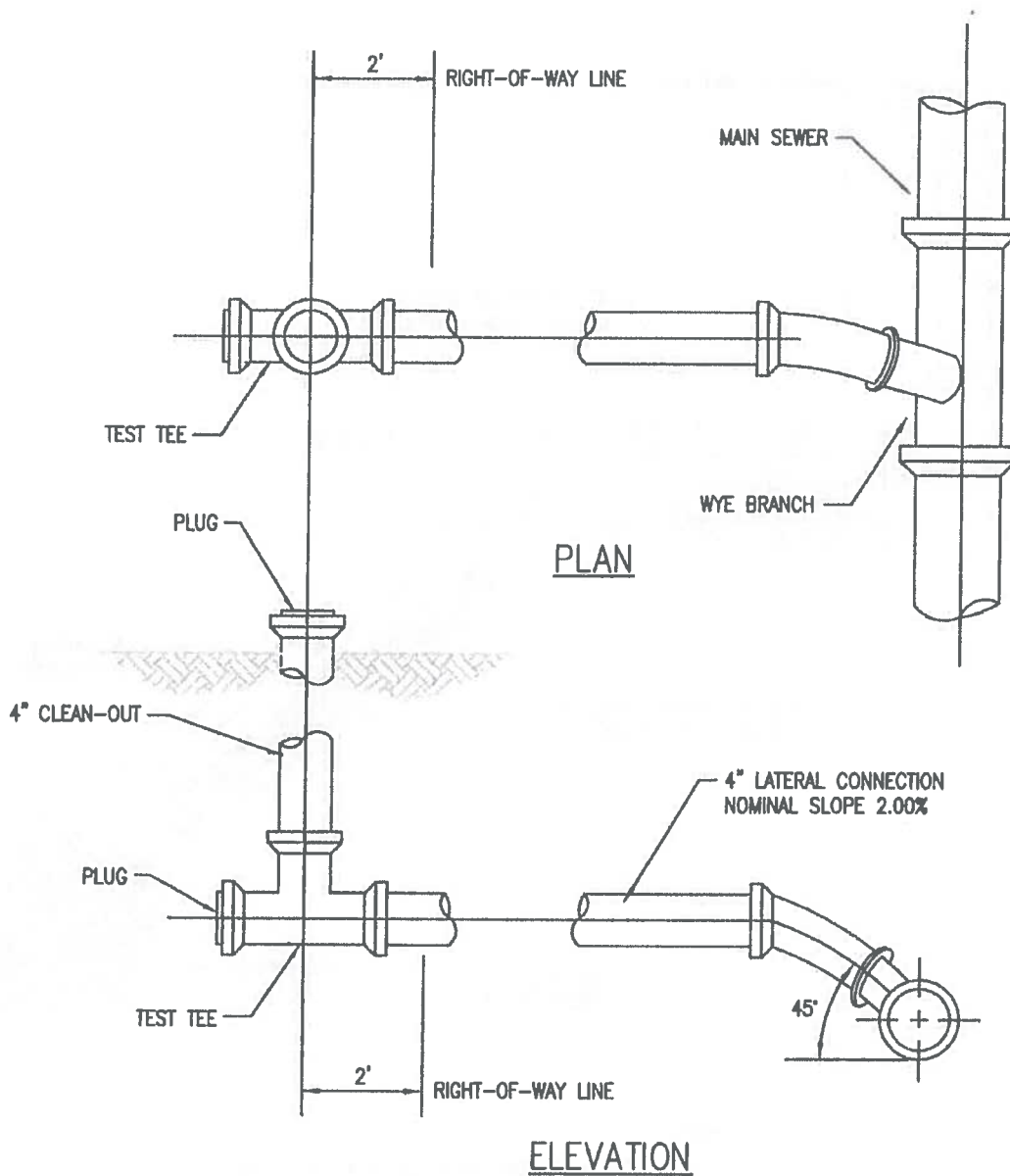
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NOTE:

SIZE OF LATERAL BEYOND RIGHT-OF-WAY LINE TO BE DETERMINED BY WARRINGTON TOWNSHIP.

LATERAL CONNECTION

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS8

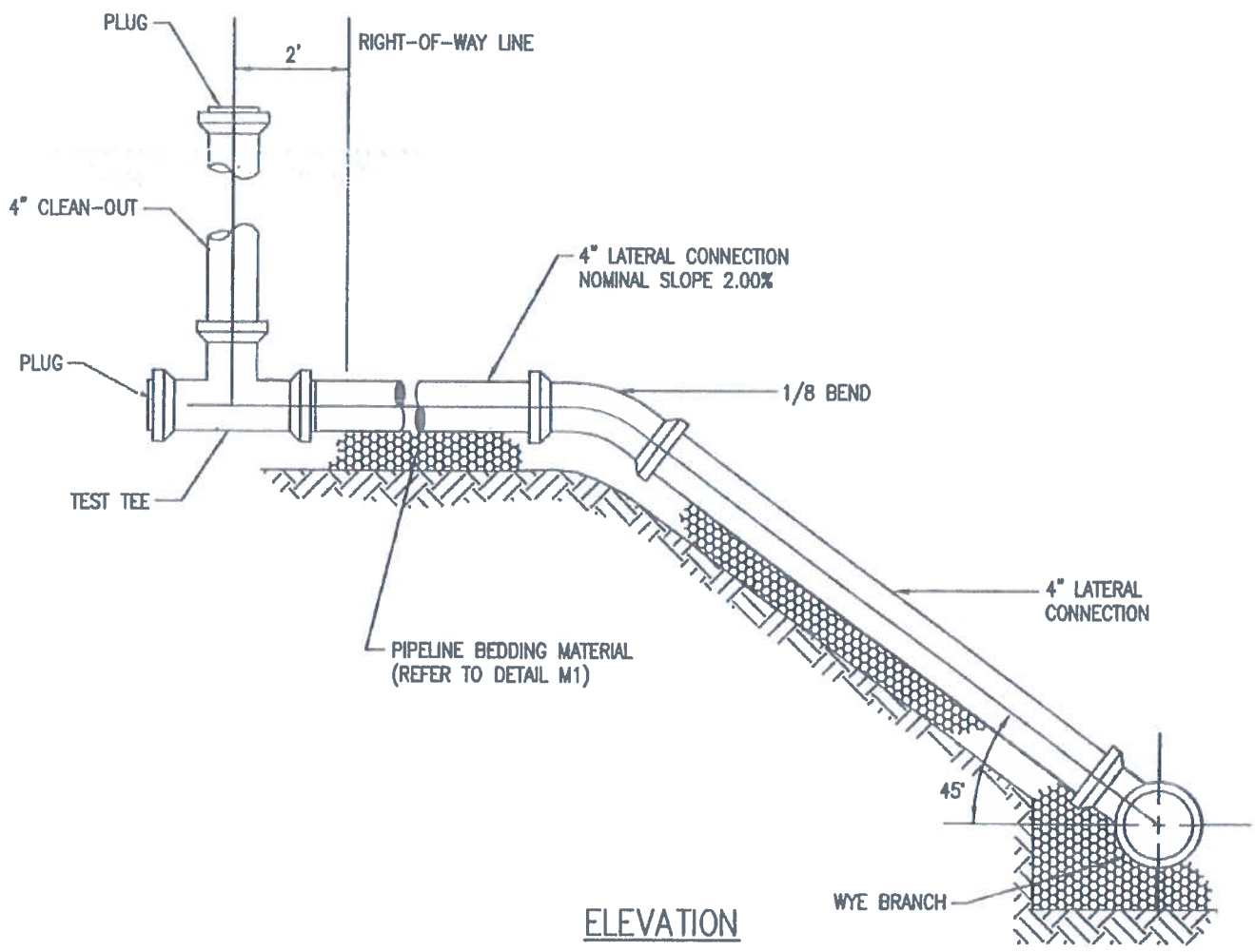
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ELEVATION

NOTE:
 SIZE OF LATERAL BEYOND RIGHT-OF-WAY LINE TO BE
 DETERMINED BY WARRINGTON TOWNSHIP.

LATERAL CONNECTION – DEEP SEWER

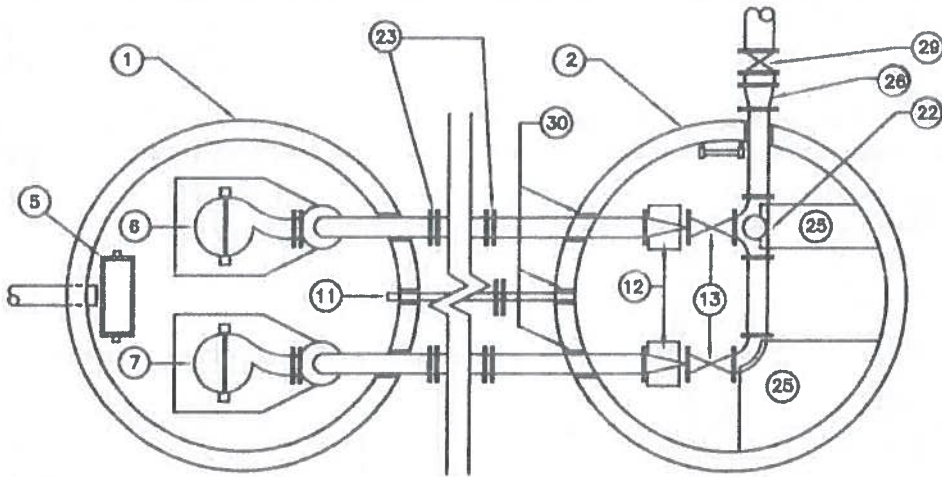
N.T.S.

WARRINGTON TOWNSHIP
 STANDARD DETAIL SS9

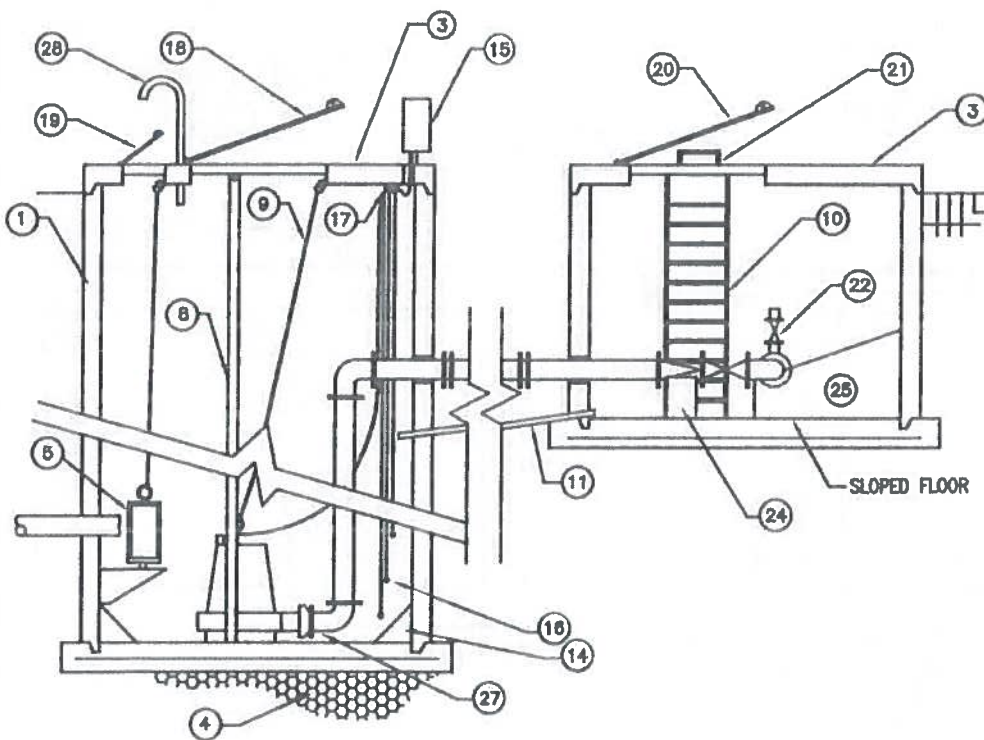
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SECTIONAL PLAN OF PUMPING STATION W/ VALVE PIT



CROSS SECTION OF PUMPING STATION W/ VALVE PIT

TYPICAL CROSS-SECTIONS OF SUBMERSIBLE
PUMPING STATIONS WITH VALVE PIT

N.T.S.

KEY NOTES:

- 1 Precast concrete pump basin
ASTM Spec. C478
- 2 Precast concrete valve pit
ASTM Spec. C478 or C913
- 3 Precast concrete top
ASTM Spec. C478 or C913
- 4 Subbase aggregate
- 5 Sewage Grinder w/ Slide Rails
- 6 Pump No.#1
- 7 Pump No.#2
- 8 Pump lifting rail
- 9 Stainless Steel lifting chain
- 10 Aluminum ladder or manhole steps
- 11 3" N.P.T Flap Valve Drain
- 12 Horizontal Swing Check Valves
- 13 Gate Valve
- 14 Concrete Grout
- 15 Nema 7 junction box w/watertight
cable connectors- exterior of Wet Well
- 16 Level Controls
- 17 Aluminum bracket w/adjustable
Cable Connectors
- 18 AL Hatch W/Flush Type handle
and lock. (Size as required for
Pump Removal).
- 19 AL Hatch W/Flush Type Handle & Lock
(size as required for grinder removal).
- 20 AL Hatch W/Flush Type
Handle & Lock
- 21 AL Grab Bar
- 22 Bypass Line W/Gate Valve
- 23 Coupling/size (as required by pump
discharge)
- 24 Concrete Pipe Support at each Check
Valve
- 25 Concrete Reaction Blocking to be
Constructed allowing enough clearance
for bolt removal
- 26 Reducer (if required)
- 27 Quick Disconnect Coupling
- 28 Goose Neck Vent Pipe
- 29 Discharge Gate Valve W/Valve Box
- 30 Link Seal

WARRINGTON TOWNSHIP
STANDARD DETAIL SS10

CKS Engineers, Inc.

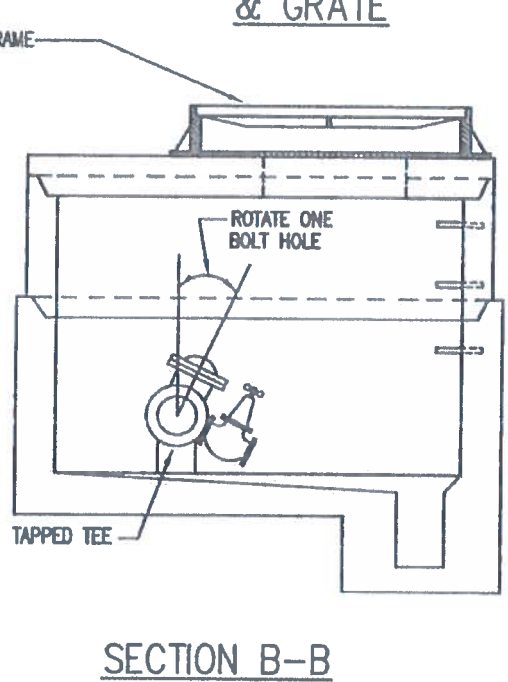
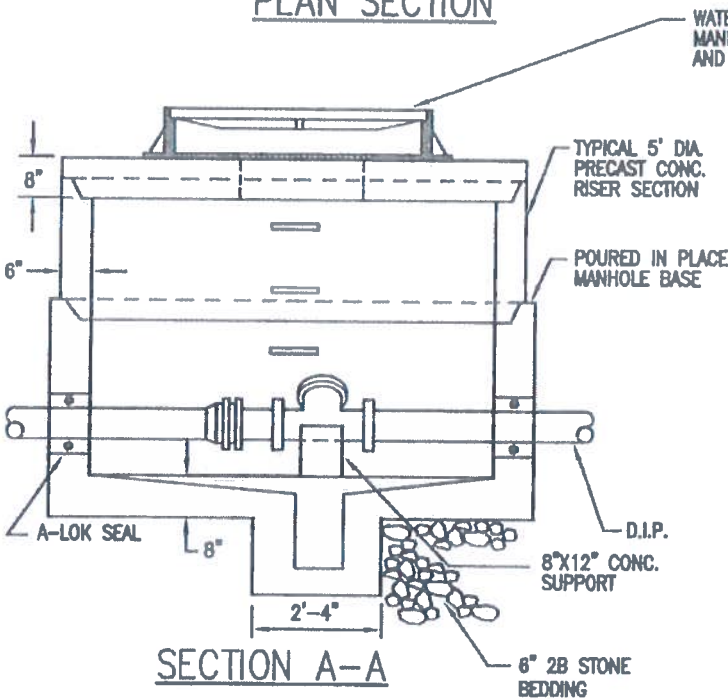
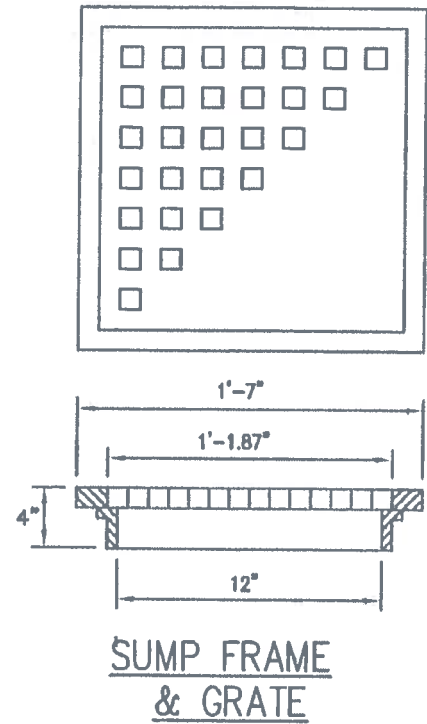
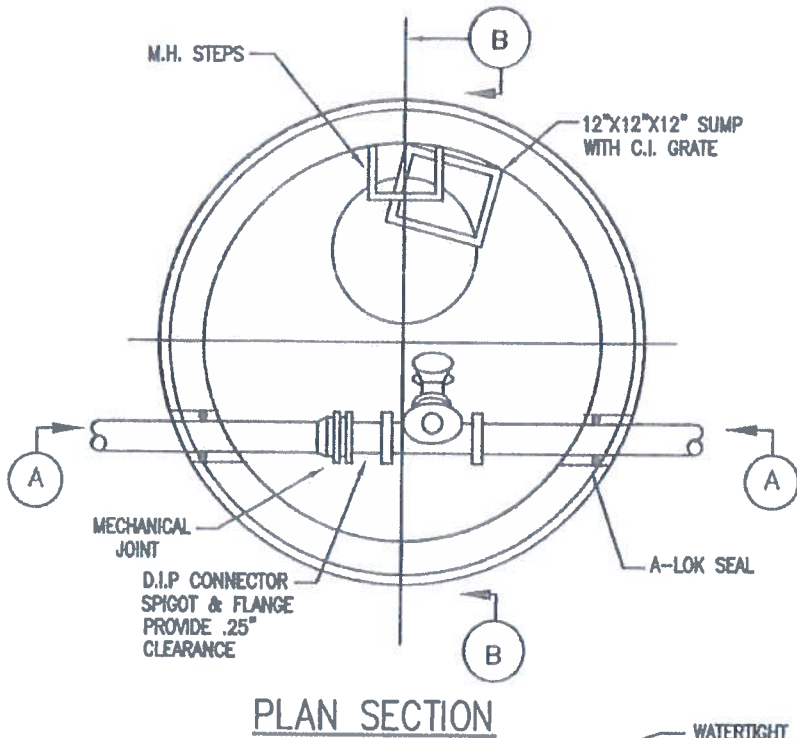
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NOTE:
CHAMBER TO BE CONSTRUCTED IN ACCORDANCE REQUIREMENTS NOTED
ON STANDARD DETAIL SS1.

FORCE MAIN CLEANOUT CHAMBER

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS11

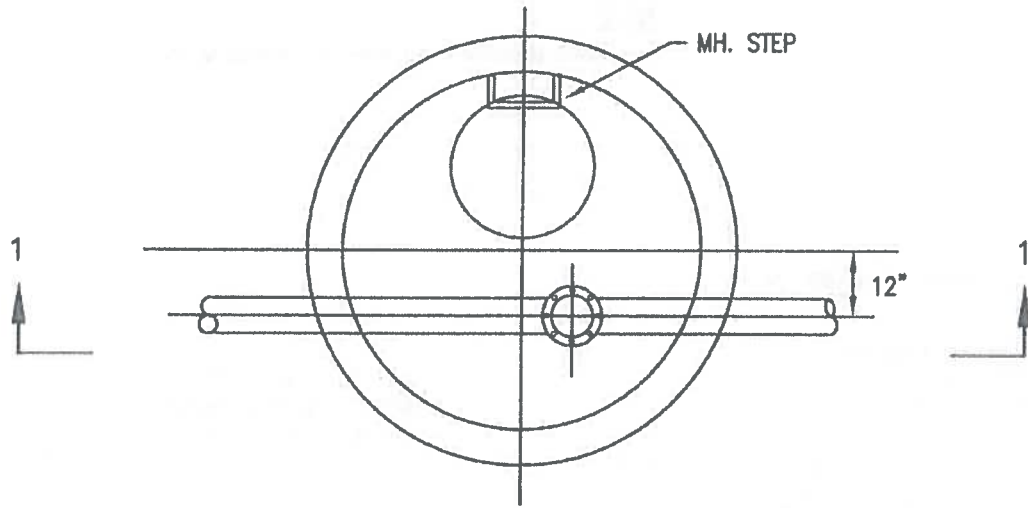
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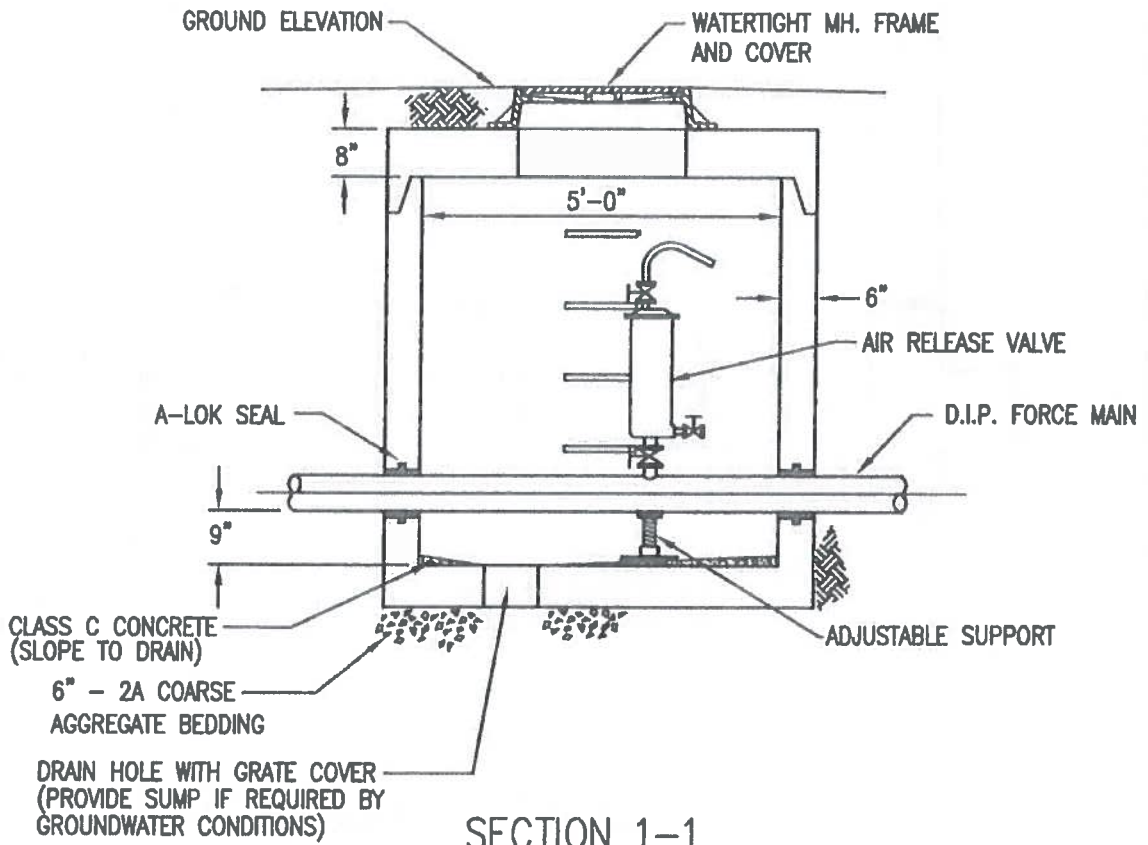
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PLAN VIEW



SECTION 1-1

FORCE MAIN AIR RELEASE CHAMBER

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS12

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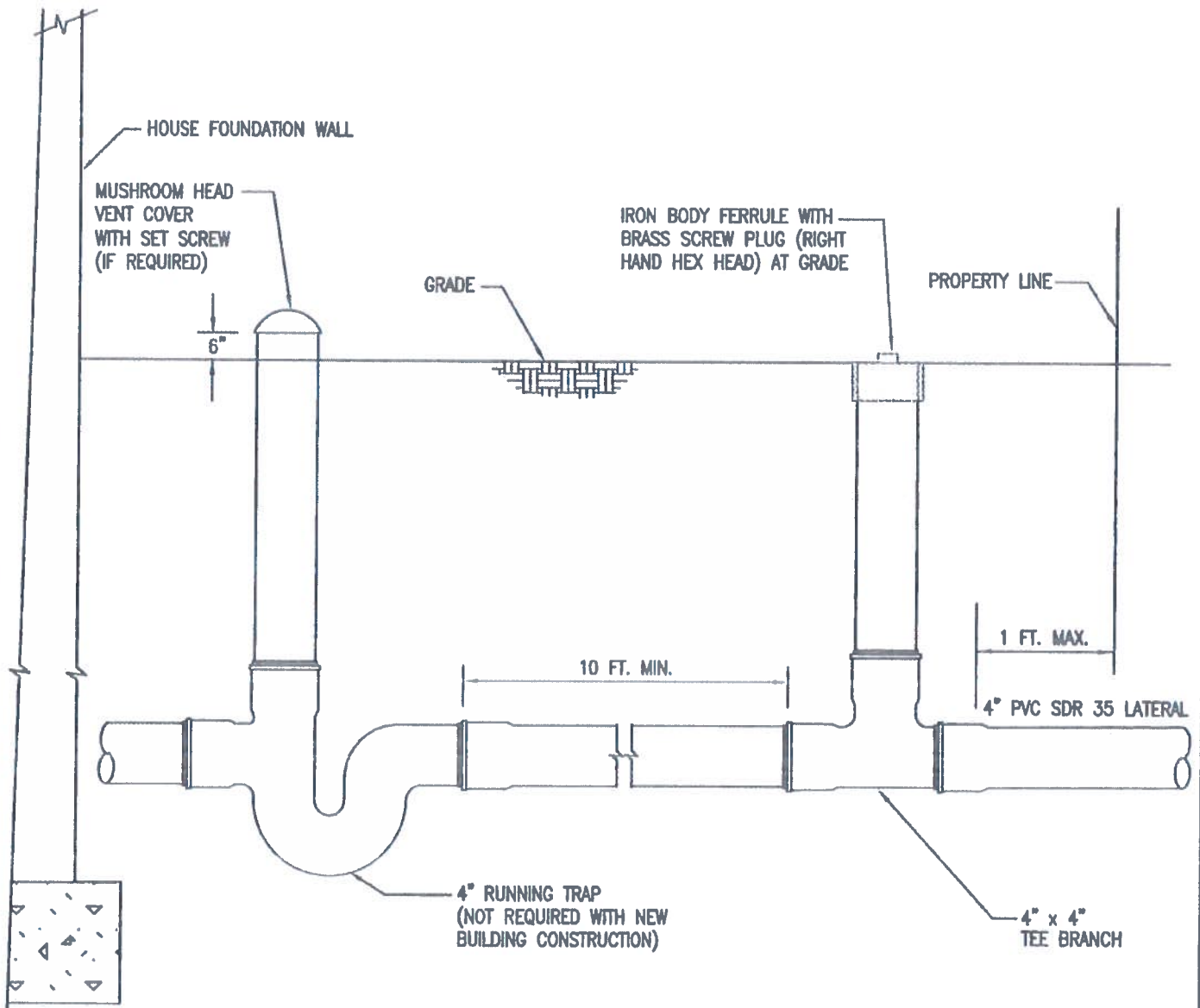


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NOTE:

- 1. LOCATE CLEANOUTS AND VENTS IN UNPAVED AREAS.



**TYPICAL SERVICE CONNECTION AT
BUILDING FOR PVC LATERAL**

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS13

CKS Engineers, Inc.

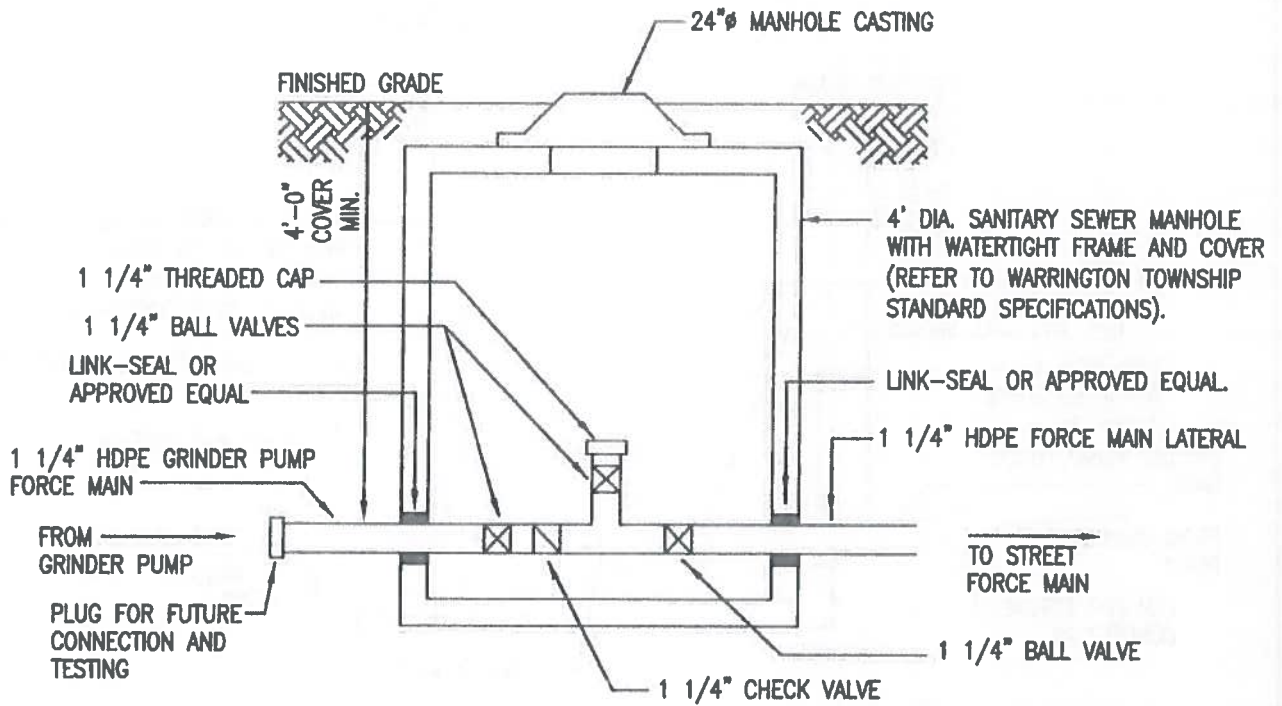


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NOTES:

1. LOCATE IN UNPAVED AREA WITHIN PUBLIC RIGHT-OF-WAY.
2. PIPING INSIDE CONNECTION PIT SHALL BE HDPE OR SCHEDULE 80 PVC.
3. PIPE SIZE TO BE DETERMINED BY WARRINGTON TOWNSHIP BASED ON FLOW.

LPSS CONNECTION PIT
RESIDENTIAL GRINDER PUMP

N.T.S.

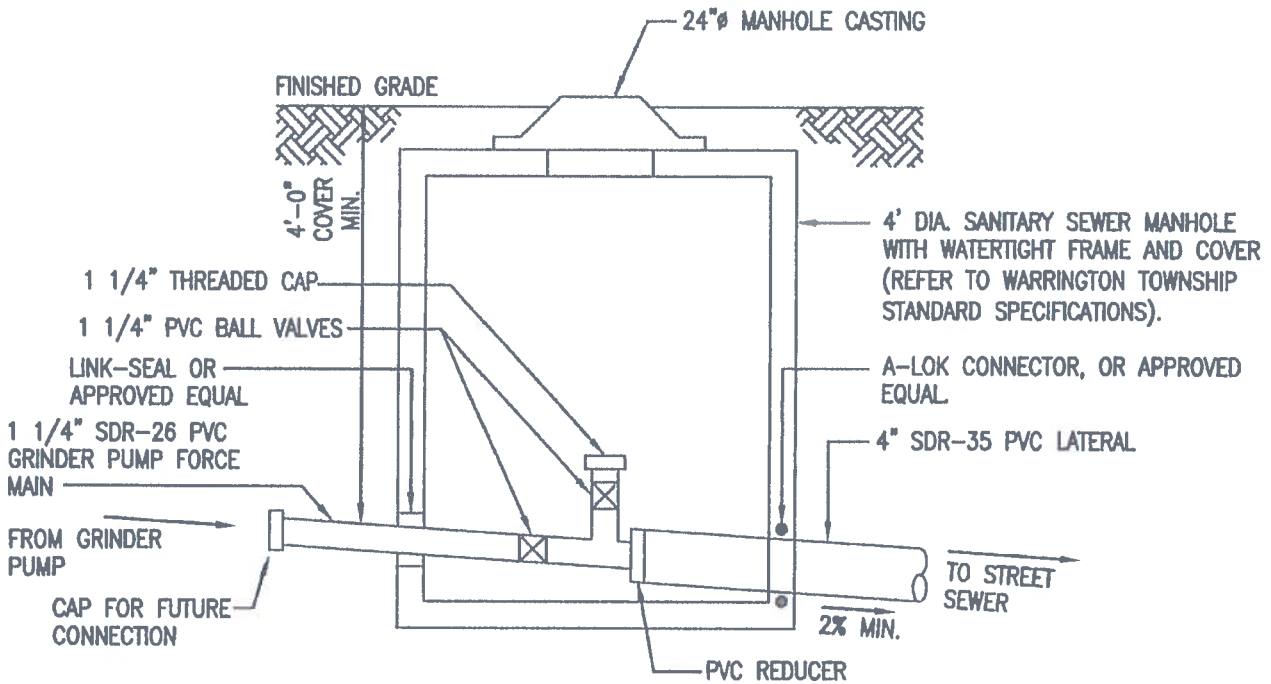
WARRINGTON TOWNSHIP
STANDARD DETAIL SS14

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NOTES:


1. LOCATE IN UNPAVED AREA WITHIN PUBLIC RIGHT-OF-WAY.
2. PIPING INSIDE CONNECTION PIT SHALL BE HDPE OR SCHEDULE 80 PVC.
3. PIPE SIZE TO BE DETERMINED BY WARRINGTON TOWNSHIP BASED ON FLOW.

**CONNECTION PIT
RESIDENTIAL FORCE MAIN TO
GRAVITY LATERAL CONNECTION**

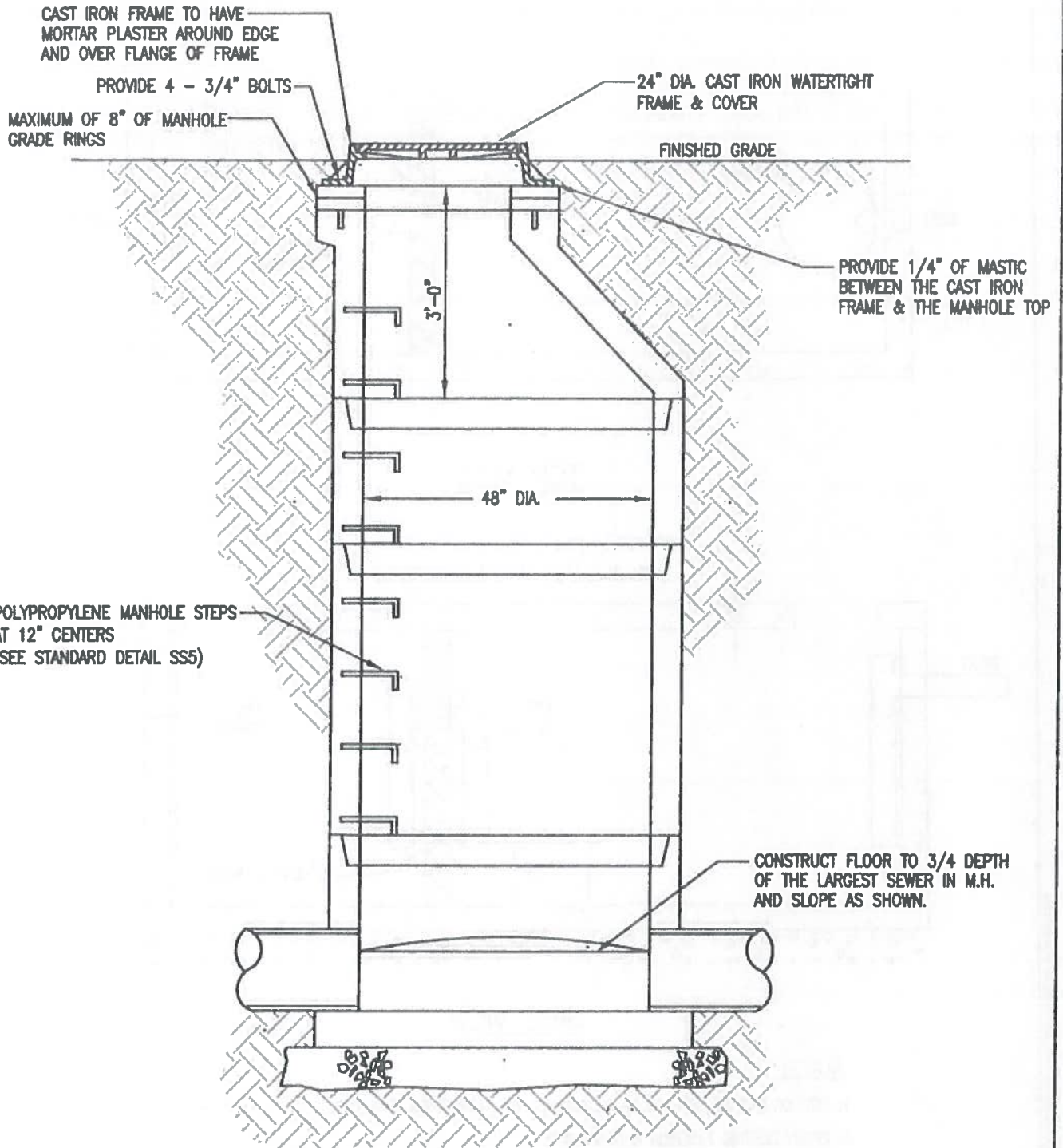
N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS15

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SANITARY SEWER SAMPLING MANHOLE DETAIL

NOTES:

- 1.) MANHOLE CONSTRUCTION SHALL COMPLY WITH THE REQUIREMENTS OF THE WARRINGTON TOWNSHIP STANDARD SPECIFICATIONS FOR CONSTRUCTION OF SANITARY SEWERS, FORCE MAINS, PUMP STATIONS AND WASTEWATER TREATMENT PLANTS, LATEST EDITION.
- 2.) FINAL LOCATION OF SAMPLING MANHOLE TO BE DETERMINED IN FIELD BY WARRINGTON TOWNSHIP.
- 3.) WHERE MANHOLE DEPTH FROM FINISHED GRADE TO INVERT IS LESS THAN 5 FT., A FLAT REINFORCED CONCRETE TOP WITH ECCENTRIC OPENING SHALL BE USED.

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS16

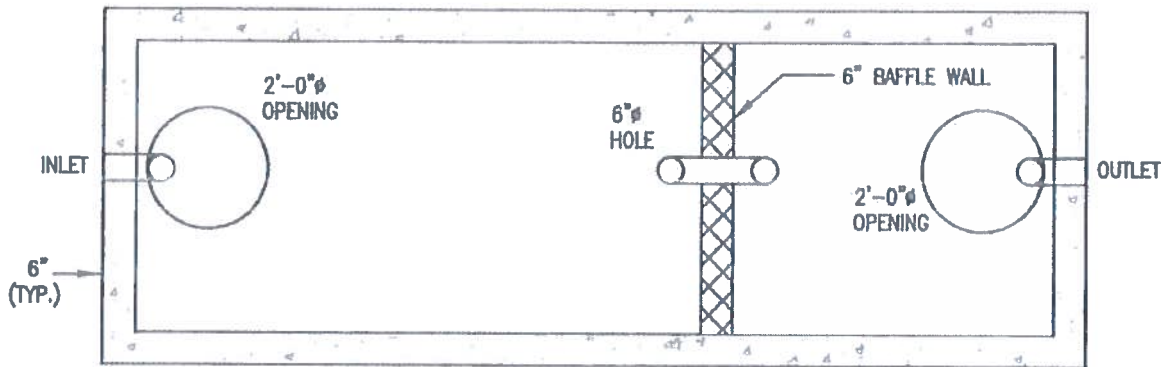
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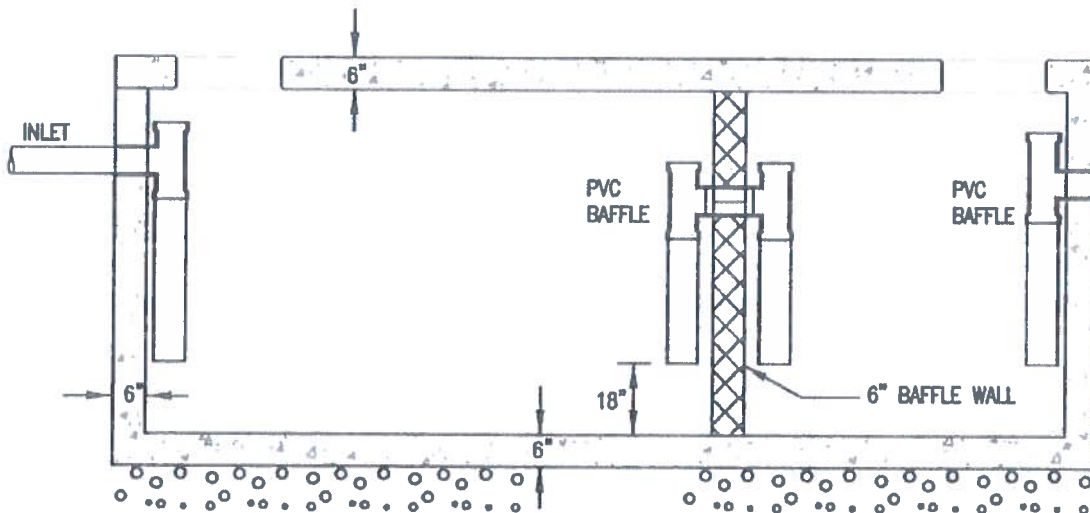
REF. NO. 4102-86

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TOP VIEW



SIDE VIEW

NOTES:

1. SIZE OF GREASE TRAP TO BE DETERMINED BY WARRINGTON TOWNSHIP.
2. EPOXY COATING EXTERIOR AND INTERIOR.

GREASE TRAP

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL SS17

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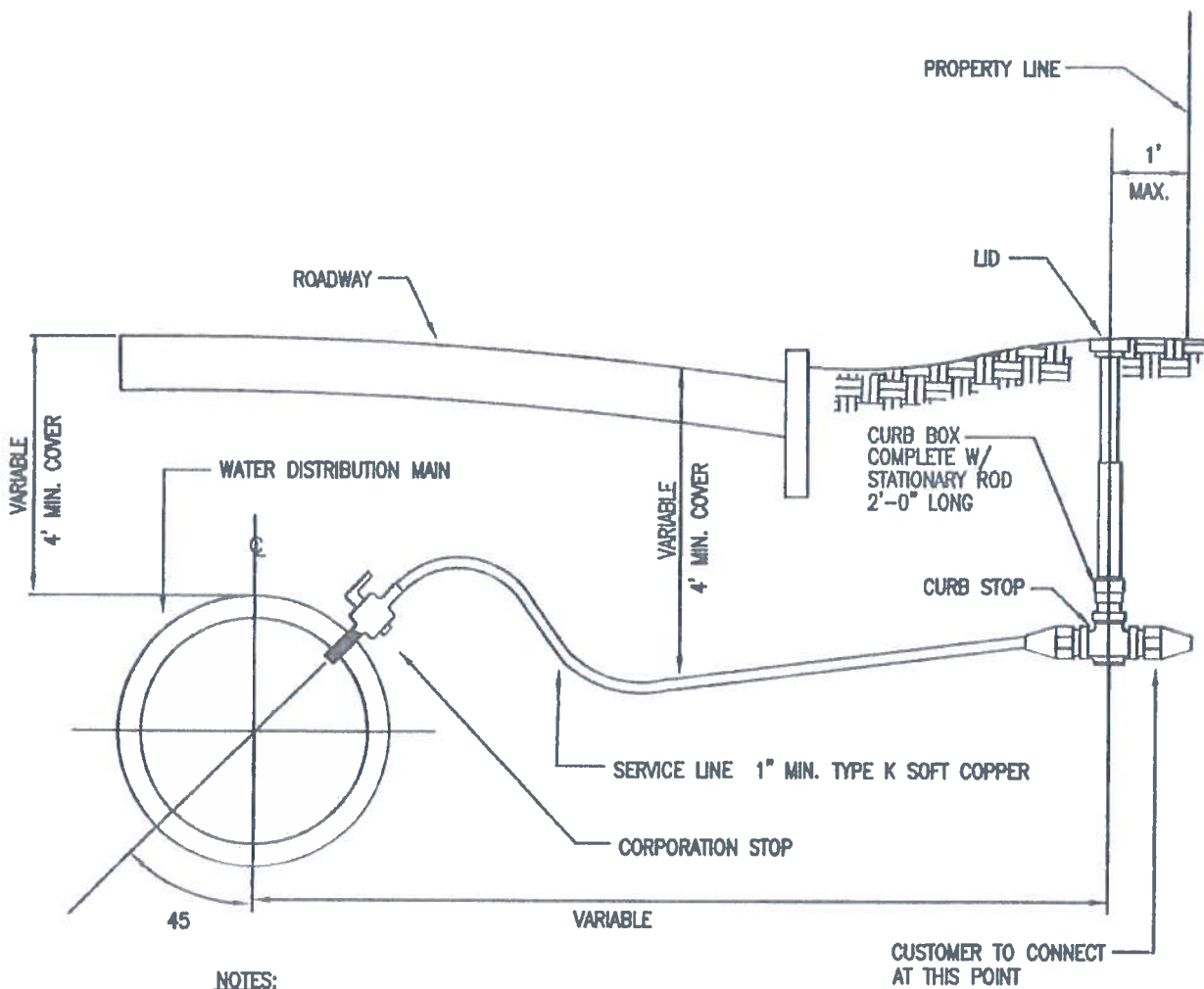
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- W3 - Fire Hydrant Connection Detail
- W4 - Typical Residential Meter and Sprinkler Installation
- W5 - Backflow Preventer for Commercial Fire Service
- W6 - Typical Meter Pit (Residential)
- W7 - Water Meter Chamber for Irrigation and Yard Hydrant Service
- W8 - Yard Hydrant Detail
- W9 - Pressure Reducing Valve Chamber
- W10 - Air Release/Air & Vacuum Valve Detail
- W11 - Temporary Blow-Off Detail



NOTES:

1. SERVICE CONNECTION AT THE MAIN SHALL BE MADE IN ACCORDANCE WITH SECTION 02610 OF THE SPECIFICATIONS.
2. DO NOT PLACE CURB BOX IN PAVED AREAS.
3. ALL SERVICE CONNECTIONS SHALL BE LOCATED AT THE MIDPOINT BETWEEN LOT LINES.
4. FOR SERVICE CONNECTIONS TO EXISTING BUILDINGS LOCATE CURB BOX 2'-6" FROM EDGE OF CARTWAY. WHERE SIDEWALK EXISTS, LOCATE CURB BOX BETWEEN CURB AND SIDEWALK. WHERE NO CURB EXISTS, THE LOCATION OF THE CURB BOX SHALL BE AS DIRECTED BY TOWNSHIP.
5. PROVIDE PIPE BEDDING AS SHOWN ON STANDARD DETAIL M1

TYPICAL WATER SERVICE CONNECTION

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL W1

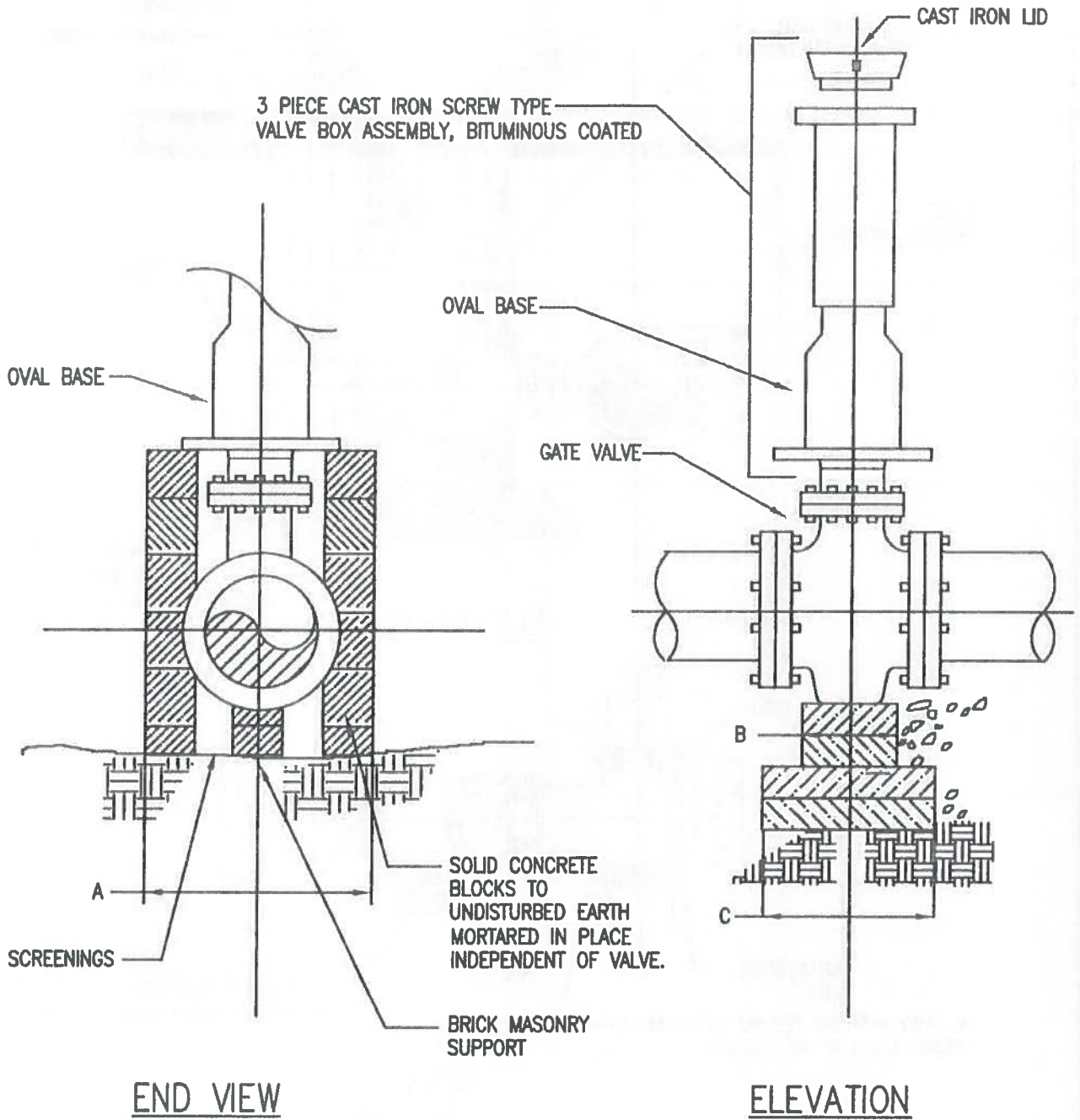
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TYPICAL GATE VALVE WITH VALVE BOX

N.T.S.

SIZE OF VALVE	DIMENSIONS		
	A	B	C
12"	24	8	14
10"	24	8	14
8"	20	6	12
6"	8	4	10
4"	8	4	10

WARRINGTON TOWNSHIP
STANDARD DETAIL W2

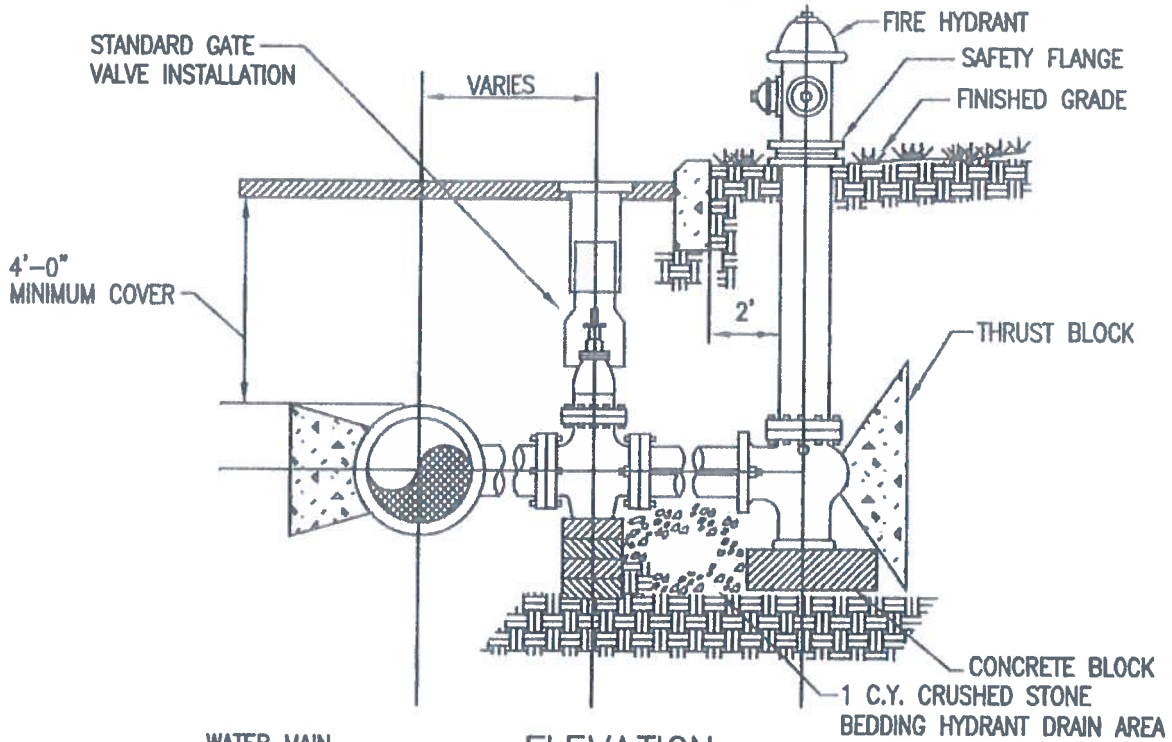
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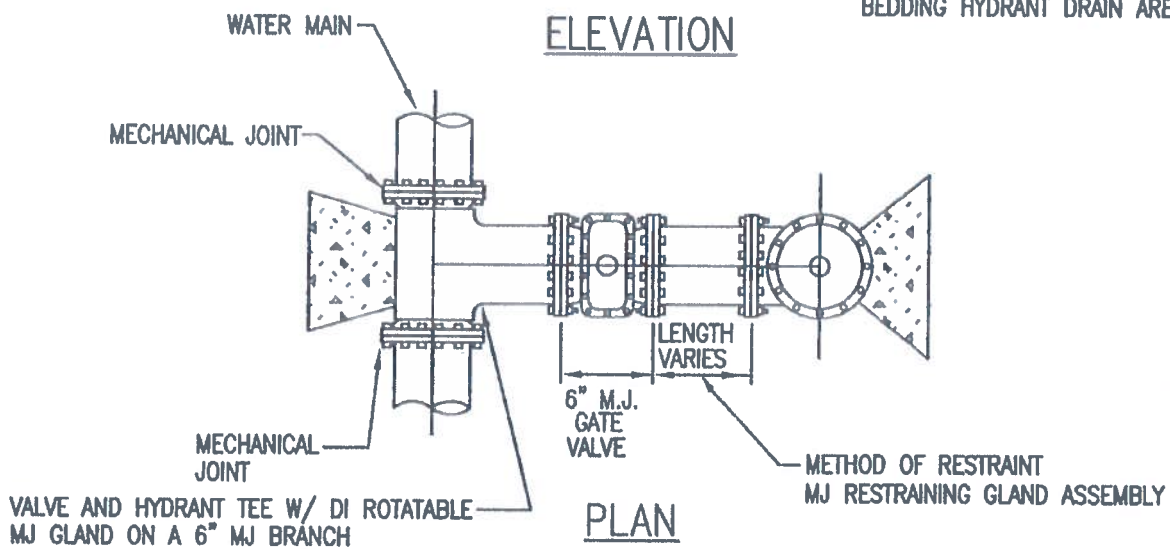


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ELEVATION



PLAN

NOTES:

1. WHERE SIDEWALK EXISTS, LOCATE HYDRANT BETWEEN CURB AND SIDEWALK. WHERE NO CURB EXISTS, HYDRANT SHALL BE LOCATED AS DIRECTED BY TOWNSHIP.
2. LOCATE SAFETY FLANGE 2" TO 6" ABOVE FINISHED GRADE.
3. HYDRANTS SHALL BE PAINTED IN ACCORDANCE WITH TOWNSHIP UNIFORM COLOR SCHEME.

FIRE HYDRANT CONNECTION

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL W3

CKS Engineers, Inc.

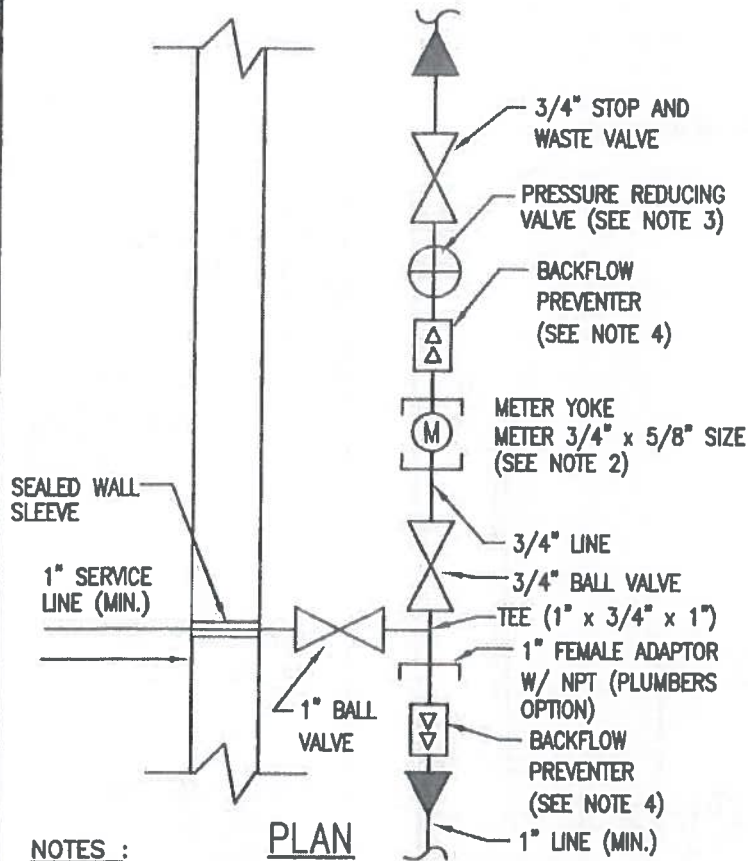
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REF. NO. 4102-66



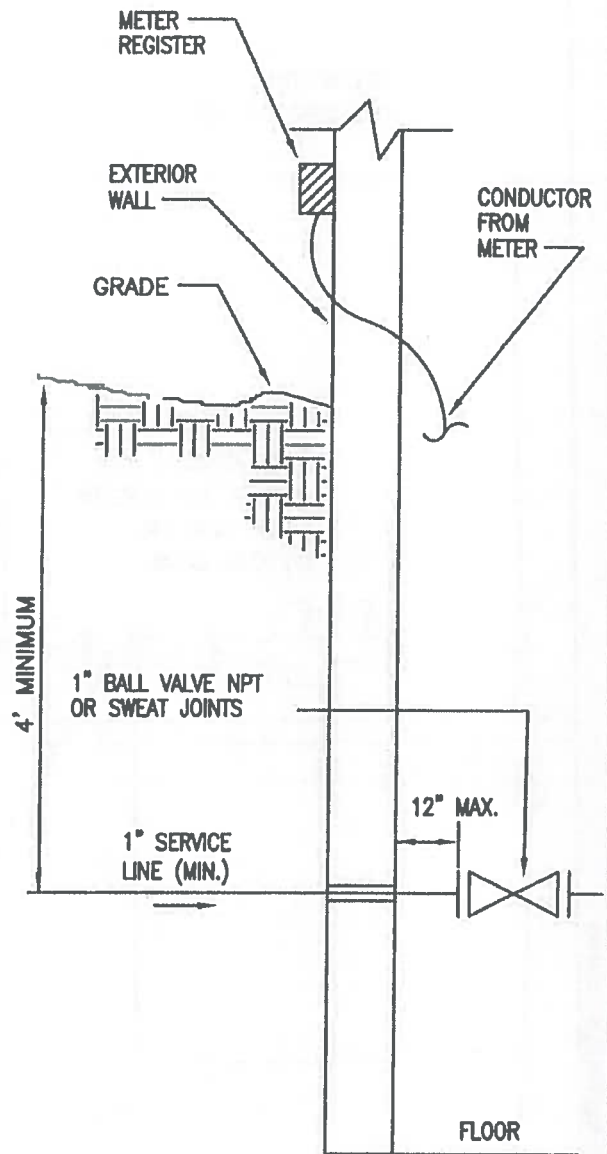
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NOTES :

1. NOTIFY TOWNSHIP AT 343-9350 WHEN WATER SERVICE IS READY FOR INSPECTION & TESTING. DO NOT BACKFILL TRENCH UNTIL INSPECTION IS COMPLETED.
2. THE LOCATION OF THE METER AND REMOTE READER SHALL BE APPROVED BY THE TOWNSHIP. TOWNSHIP WILL INSTALL METER AND REMOTE READER.
3. PRESSURE REDUCING VALVES SHALL BE INSTALLED BY PLUMBER ON ALL SERVICES RECEIVING PRESSURES OF 65 P.S.I. OR GREATER. PRESSURE REDUCING VALVE SHALL BE WATTS U5B, OR EQUAL. SUBMIT MANUFACTURER'S CUT SHEET TO TOWNSHIP PRIOR TO INSTALLATION.
4. BACKFLOW PREVENTERS SHALL BE INSTALLED BY PLUMBER. BACKFLOW PREVENTER SHALL BE WATTS NO. 7, OR EQUAL. SUBMIT MANUFACTURER'S CUT SHEET TO TOWNSHIP PRIOR TO INSTALLATION.
5. SERVICE LINE SHALL BE MINIMUM 1" TYPE K SOFT COPPER CONFORMING TO ASTM SPECIFICATION B88. A CONTINUOUS RUN OF PIPE, FREE OF COUPLINGS, SHALL BE INSTALLED BETWEEN THE 1" BALL VALVE AND THE CURB STOP.



RESIDENTIAL METER INSTALLATION

N.T.S.

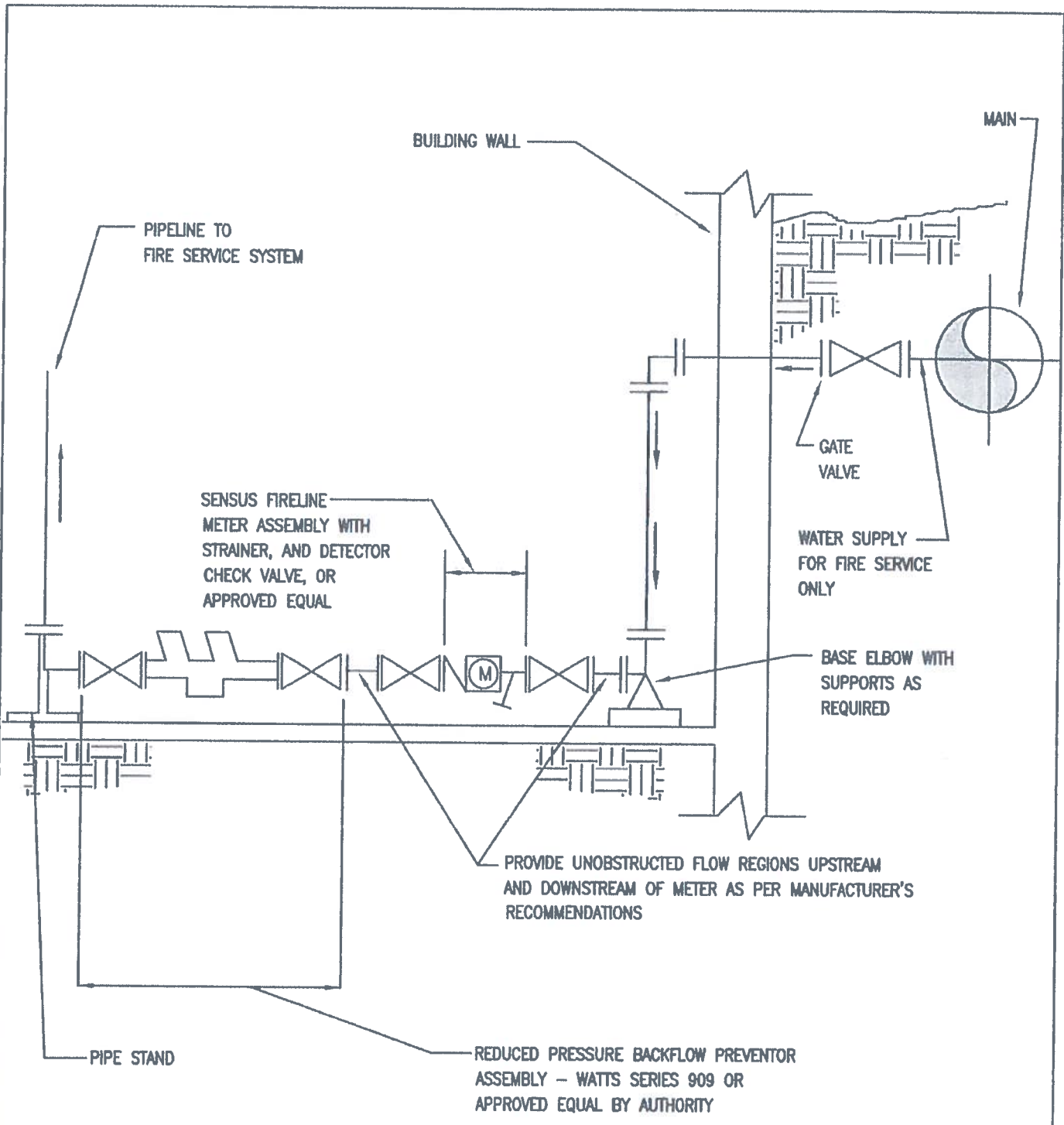
WARRINGTON TOWNSHIP
STANDARD DETAIL W4

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**BACKFLOW PREVENTER FOR
COMMERCIAL FIRE SERVICE**

N.T.S.

**WARRINGTON TOWNSHIP
STANDARD DETAIL W5**

CKS Engineers, Inc.

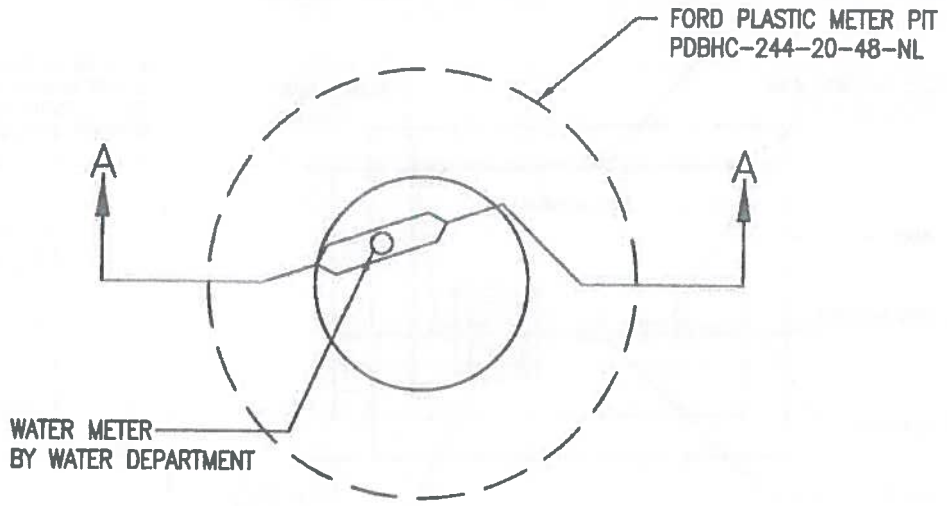
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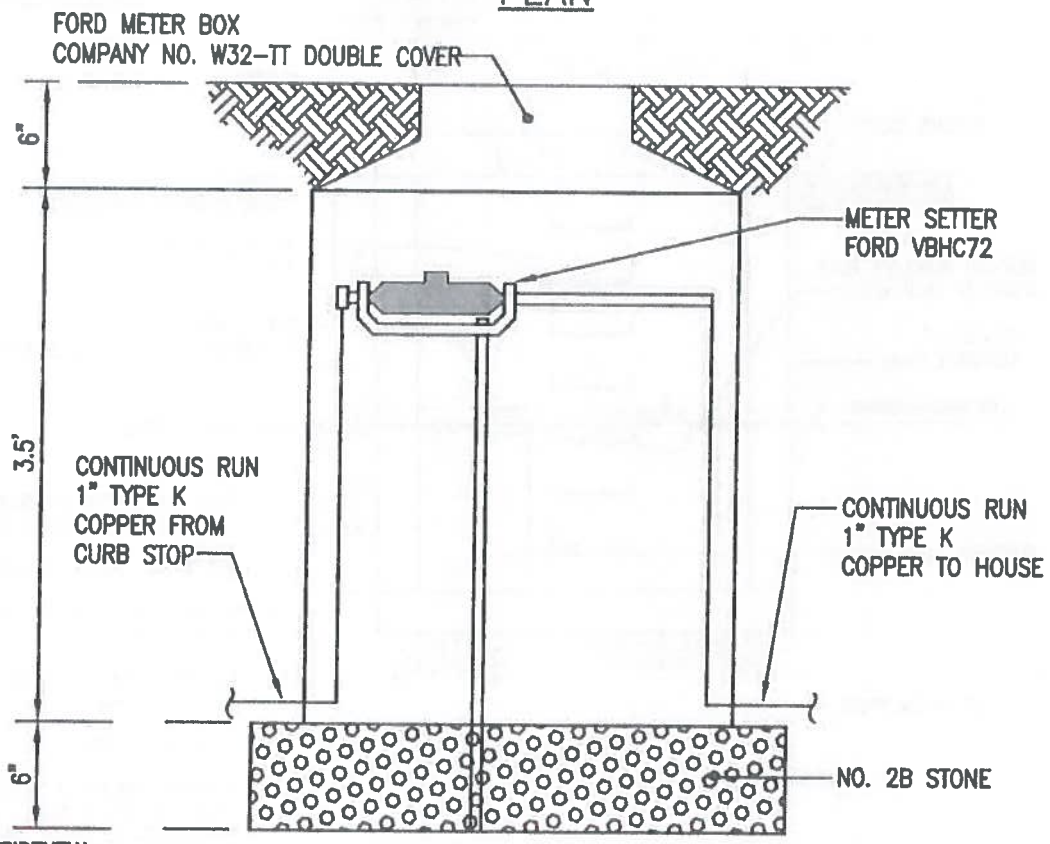


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PLAN



SECTION A-A

RESIDENTIAL METER PIT

N.T.S.

NOTES:

1. ALL NEW RESIDENTIAL CONSTRUCTION SHALL BE PROVIDED WITH 1" SERVICE LINE AND INDOOR METER INSTALLATION IN ACCORDANCE WITH STANDARD DETAIL W4.
2. OUTDOOR METER PIT SHALL ONLY BE USED FOR CONNECTING EXISTING RESIDENTIAL UNITS OR AS APPROVED BY THE TOWNSHIP.
3. LOCATE PIT AT PROPERTY LINE.

WARRINGTON TOWNSHIP
STANDARD DETAIL W6

CKS Engineers, Inc.

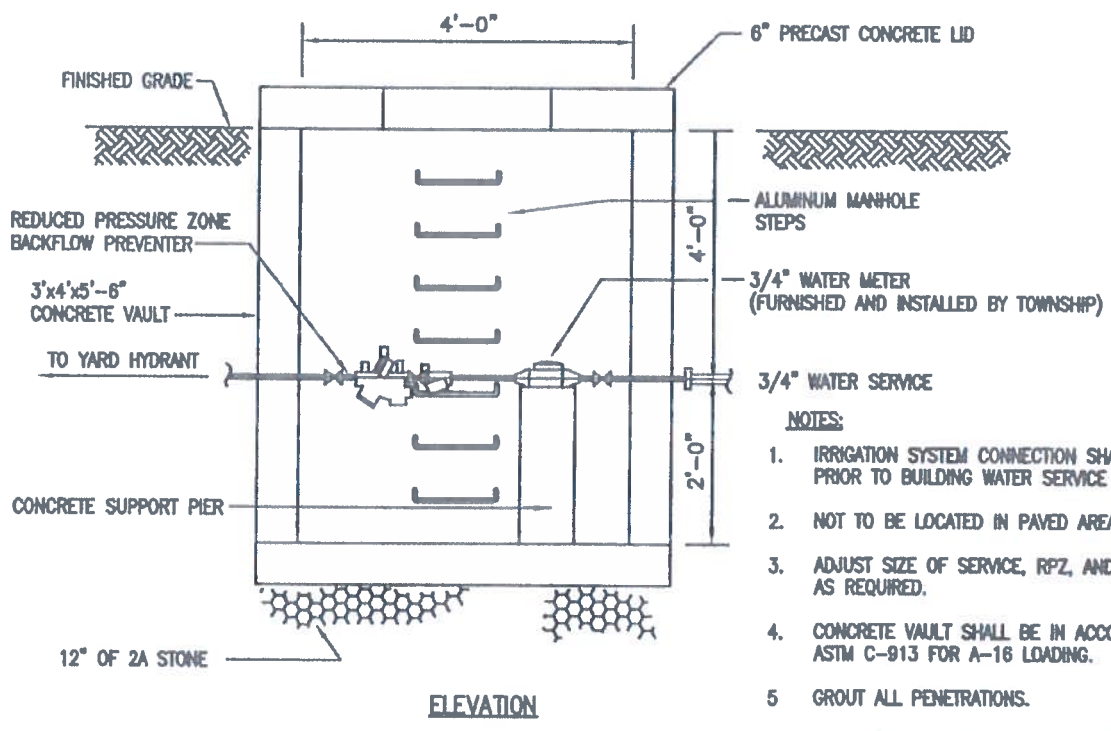
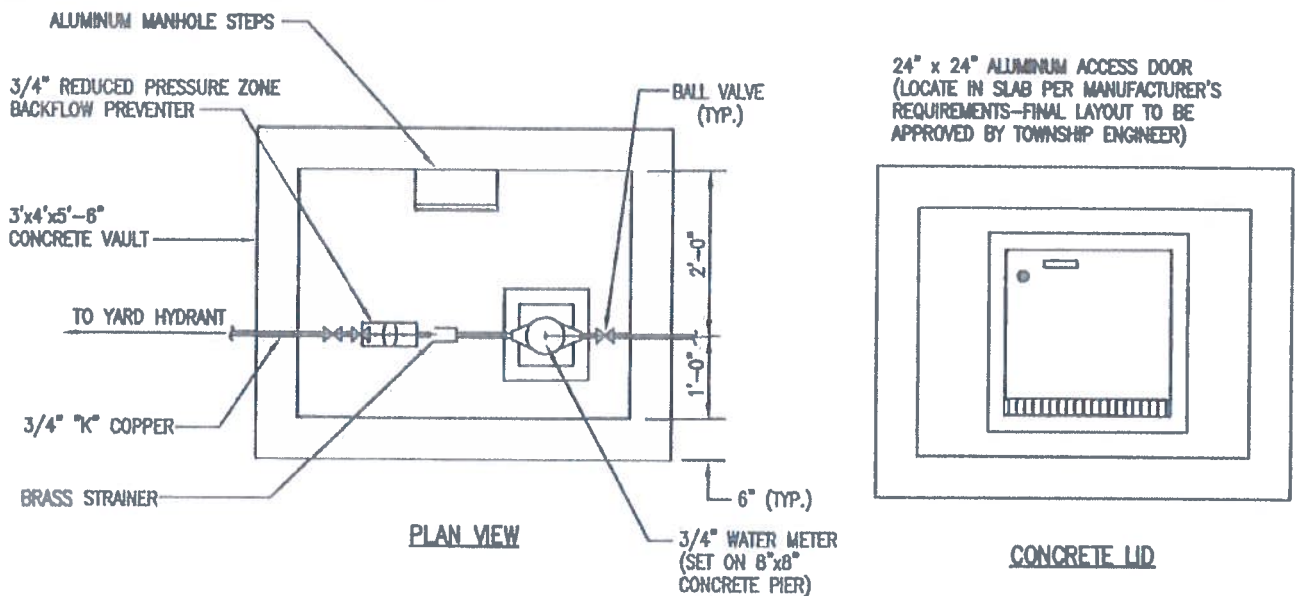
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- NOTES:**
1. IRRIGATION SYSTEM CONNECTION SHALL BE MADE PRIOR TO BUILDING WATER SERVICE METER.
 2. NOT TO BE LOCATED IN PAVED AREAS.
 3. ADJUST SIZE OF SERVICE, RPZ, AND METER AS REQUIRED.
 4. CONCRETE VAULT SHALL BE IN ACCORDANCE WITH ASTM C-913 FOR A-18 LOADING.
 5. GROUT ALL PENETRATIONS.
 6. BACKFLOW PREVENTER SHALL BE REDUCED PRESSURE ZONE DEVICE OR DOUBLE CHECK VALVE ASSEMBLY AS APPROVED BY THE TOWNSHIP BASED ON SPECIFIC USE.

WATER METER CHAMBER FOR IRRIGATION AND YARD HYDRANT SERVICE

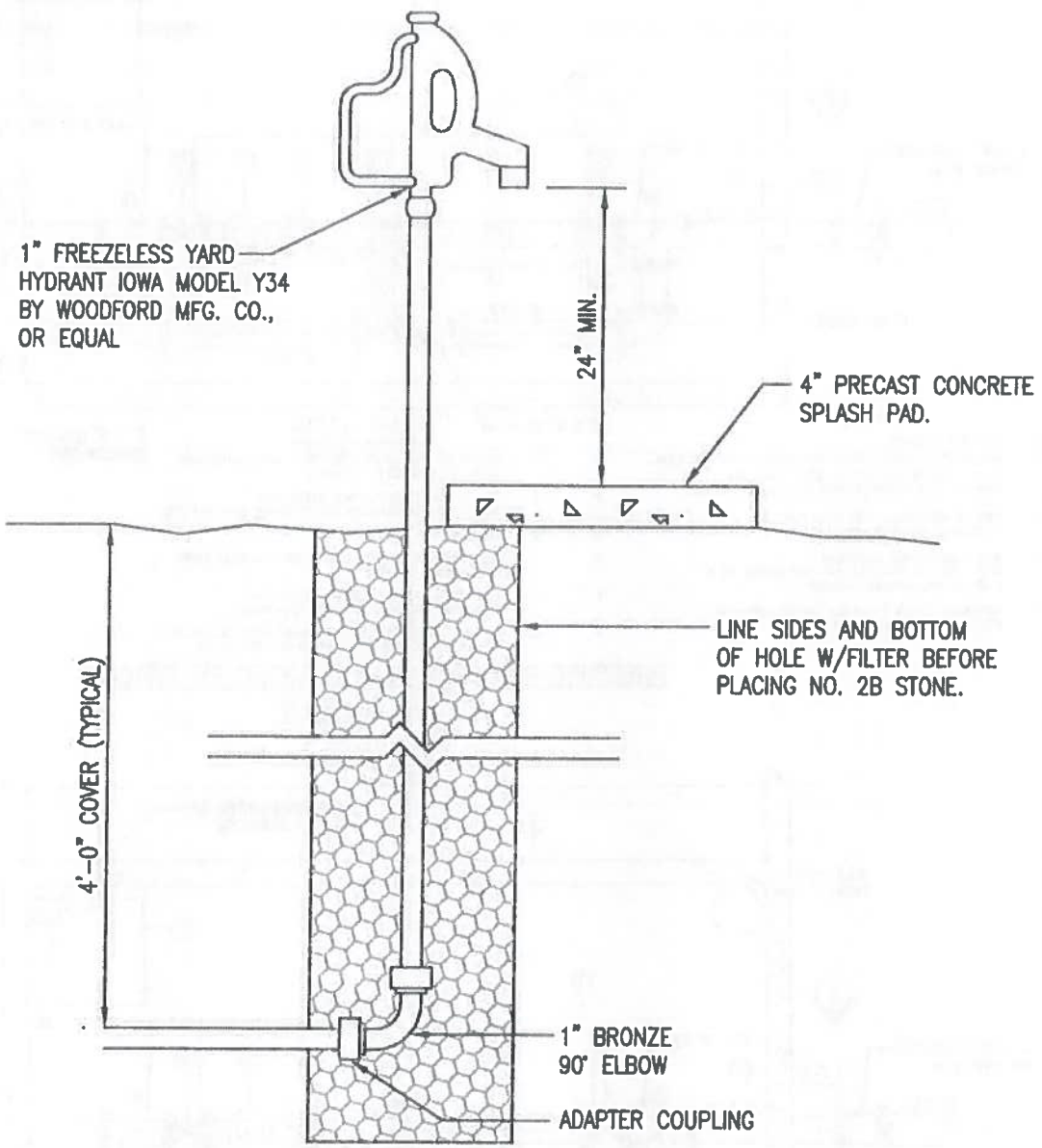
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WARRINGTON TOWNSHIP
STANDARD DETAIL W7

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YARD HYDRANT

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL W8

CKS Engineers, Inc.

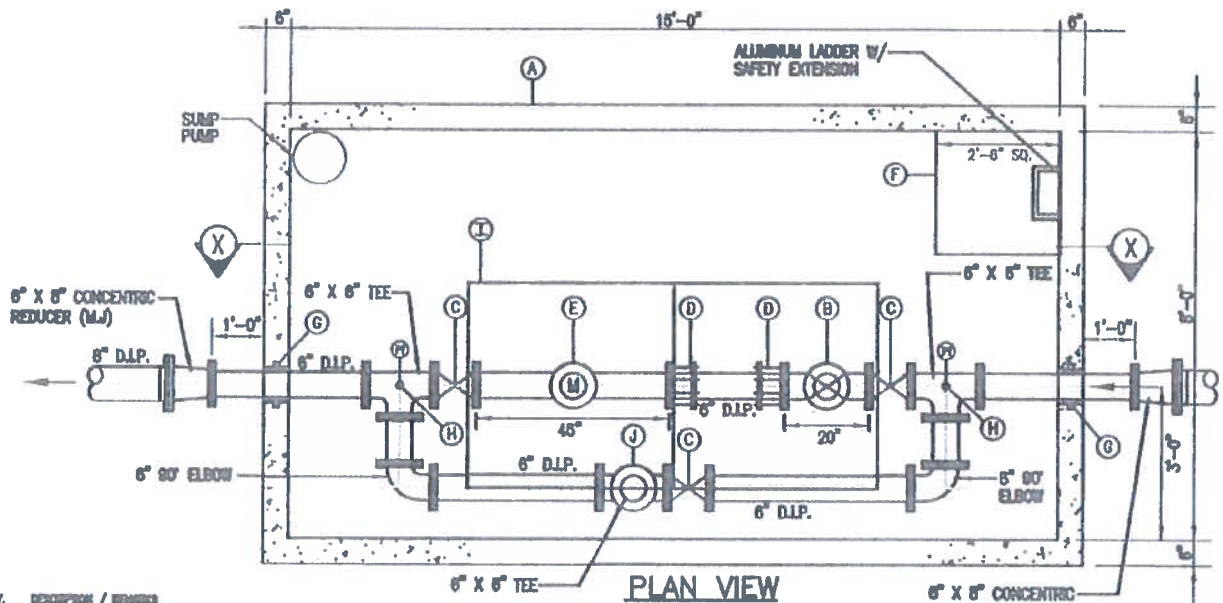
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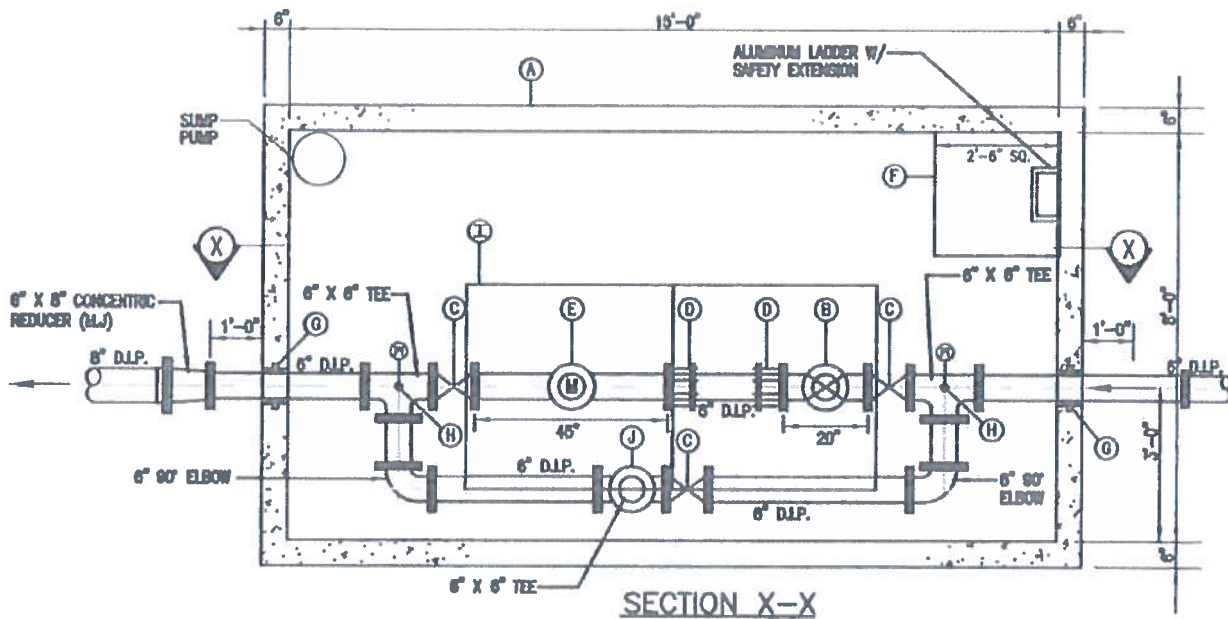
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TDG NO.	QTY.	DESCRIPTION / REMARKS	E	1	6" FLOW METER W/ STRAINER SUPPLIED BY NORTH WILKS WATER AUTHORITY. INSTALLED BY CONTRACTOR
A	1	A. C. MILLER CONCRETE PRODUCTS CORP. CONCRETE VAULT OR EQUAL HS-20 LOADING DESIGN. EXTERIOR SHOP COATED WITH BITUMASTIC WATERPROOFING. INTERIOR COATED WITH EPOXY PAINT.	F	1	30" x 30" SINGLE LEAF ALUMINUM ACCESS HATCH 300 LBS./S.F. LOADING DESIGN, WITH PENTAGONAL HEAD BOLT LOCK.
B	1	PRESSURE REDUCING VALVE W/ CHECK FUNCTION BRADCO MODEL 202-PR-C 6"	G	2	"LINK SEAL" PIPE SEAL.
C	3	AWMA C-509 RESILIENT SEATED GATE VALVE, CLASS 125, ANSI B16.1 FLAT FACED FLANGES, OS & Y WITH INTEGRAL HANDWHEEL ACTUATOR.	H	1	PRESSURE TRANSDUCER AND PRESSURE GAUGE ASSEMBLY TAPPED BOSS IN TEE - SEE DETAIL.
D	2	SMITH-BEAR, STYLE 812 CAST IRON FLANGED ADAPTER WITH HIGH STRENGTH STEEL ANCHOR STUDS.	I	1	80" X 48" DOUBLE LEAF ALUMINUM ACCESS HATCH, 300 LBS./S.F. LOADING DESIGN, WITH LOCKING DEVICE.
			J	1	6" BLIND FLANGE TAPPED WITH 2" THREADED NIPPLE, 2" BALL VALVE, 2" NIPPLE AND 2" HOSE QUICK CONNECT MALE END AND CAP.

**PRESSURE REDUCING VALVE & METER PIT TYPICAL
FOR 6" DIAMETER
SCALE : 1/2" = 1'-0"**



NOTES:

1. ALL MATERIALS AND CONSTRUCTION METHODS EMPLOYED SHALL CONFORM TO THE LATEST CONSTRUCTION SPECIFICATIONS OF THE WARRINGTON TOWNSHIP WATER AND SEWER DEPARTMENT.
2. ALL INTERNAL VAULT PIPING SHALL BE CLASS 53 DIP WITH FLANGED ENDS UNLESS OTHERWISE NOTED. ALL EXTERIOR PIPING SHALL HAVE MECHANICAL JOINT ENDS UNLESS OTHERWISE NOTED.
3. ALL MECHANICAL JOINT CONNECTIONS SHALL BE ADEQUATELY RESTRAINED BY USE OF RODS OR CONCRETE THRUST BLOCKS. CONCRETE THRUST BLOCK DESIGN SHALL CONFORM TO WARRINGTON TOWNSHIP CONSTRUCTION SPECIFICATIONS.
4. LOCATE WATER METER PIT AS SHOWN ON CONSTRUCTION PLAN.
5. CONCRETE PENETRATIONS SHALL BE CAST-IN OR MADE BY CORE BORING ONLY, AND SHALL BE CLOSED WITH LINK SEALS.
6. SEE SPECIFICATIONS FOR COATING REQUIREMENTS.

**PRESSURE REDUCING VALVE & METER PIT
TYPICAL FOR 6" DIAMETER
SCALE : 1/2" = 1'-0"**

**WARRINGTON TOWNSHIP
STANDARD DETAIL W9**

CKS Engineers, Inc.

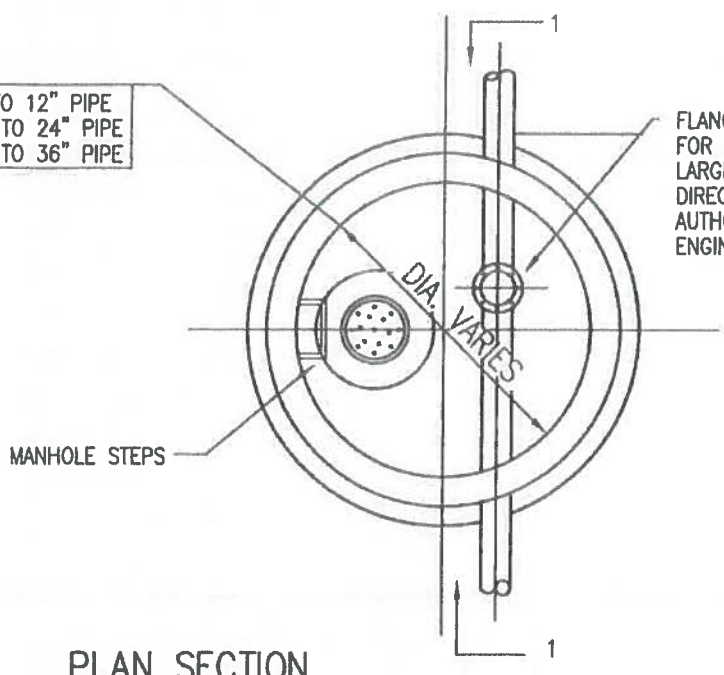
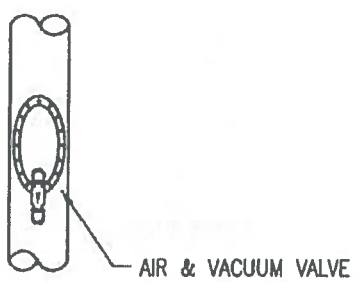
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REF. NO. 4102-66

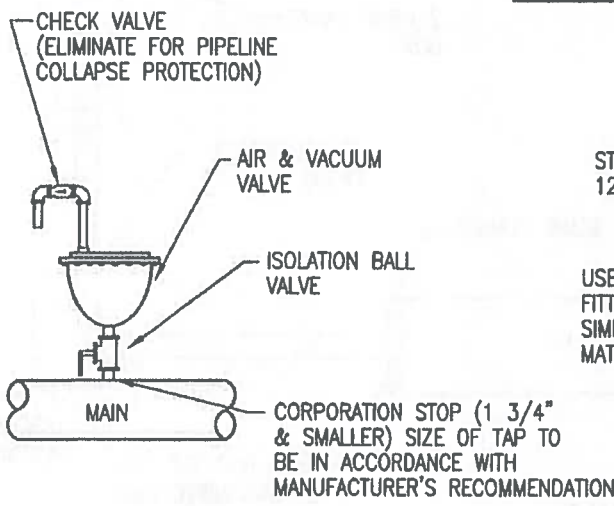
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48" DIA. FOR 4" TO 12" PIPE
 60" DIA. FOR 16" TO 24" PIPE
 72" DIA. FOR 30" TO 36" PIPE

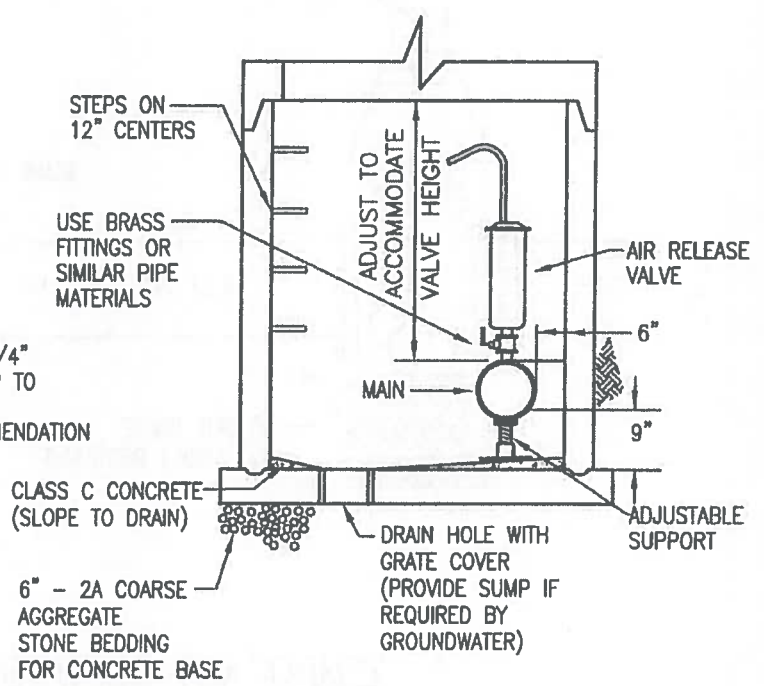
FLANGED OUTLET FOR 2" INLET & LARGER OR AS DIRECTED BY AUTHORITY'S ENGINEER



PLAN SECTION



COMBINATION VALVE ARRANGEMENT



SECTION 1-1

AIR RELEASE / AIR & VACUUM VALVE DETAIL

N.T.S.

WARRINGTON TOWNSHIP
 STANDARD DETAIL W10

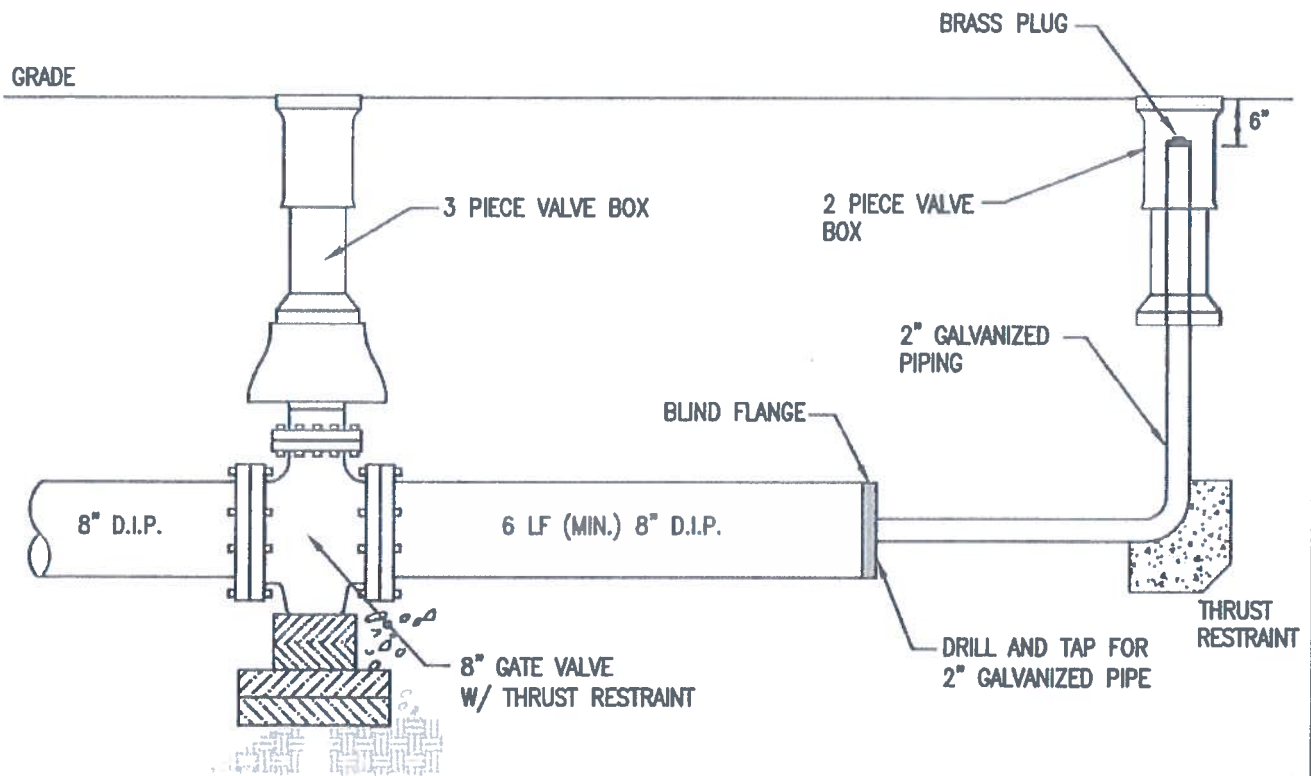
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TEMPORARY BLOW-OFF DETAIL

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL W11

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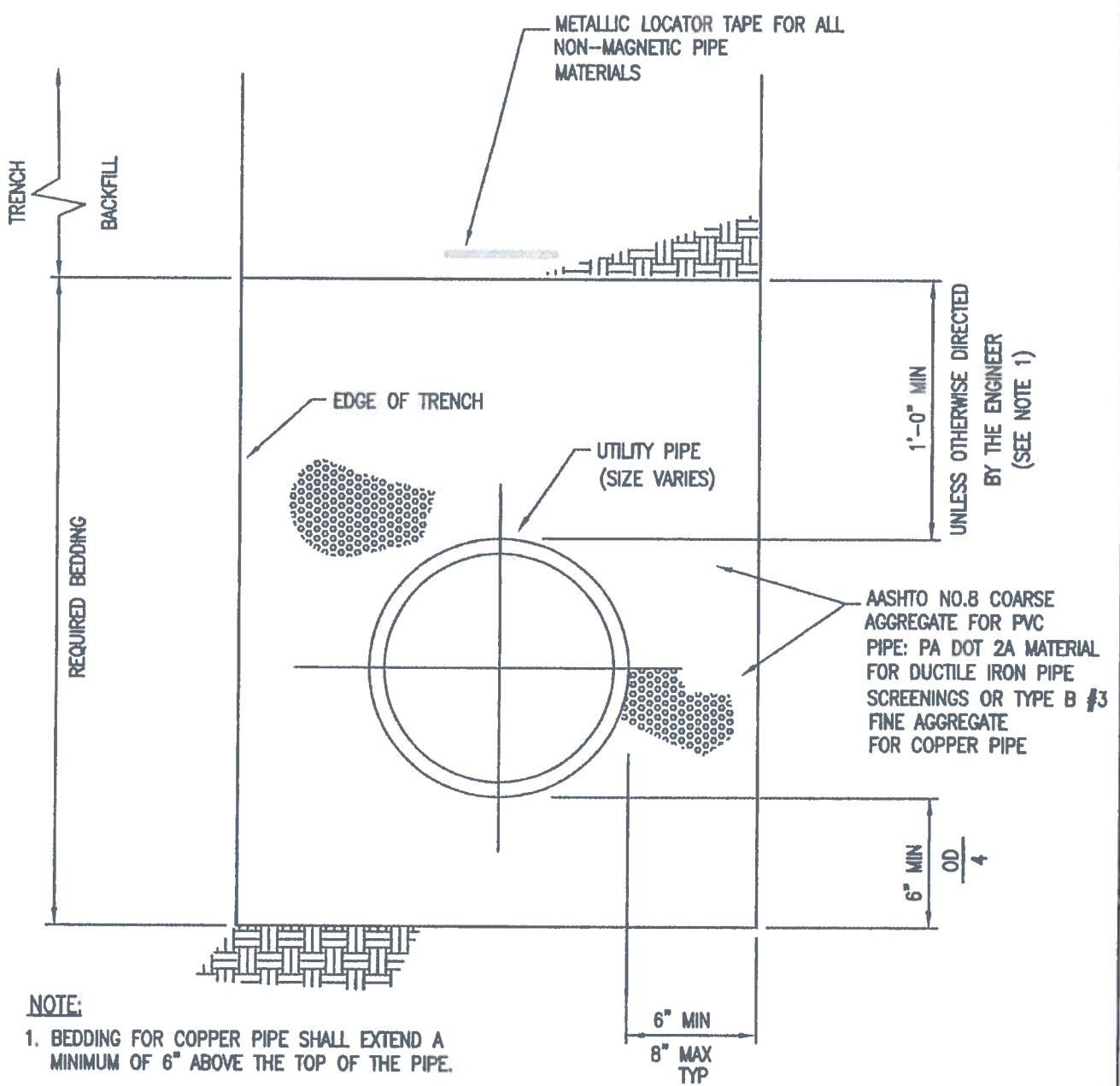
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- M1 - Standard Pipe Bedding
- M2 - Concrete Encasement
- M3 - Horizontal Thrust Block Details
- M4 - Vertical Downward Thrust Block Detail
- M5 - Thrust Block Bearing Surface Requirements
- M6 - Vertical Upward Thrust Block Detail
- M7 - Encasing Conduit Detail for Boring and Jacking
- M8 - Construction Details for Stream Crossing

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NOTE:
 1. BEDDING FOR COPPER PIPE SHALL EXTEND A MINIMUM OF 6" ABOVE THE TOP OF THE PIPE.

STANDARD PIPE BEDDING
 N.T.S.

WARRINGTON TOWNSHIP
 STANDARD DETAIL M1

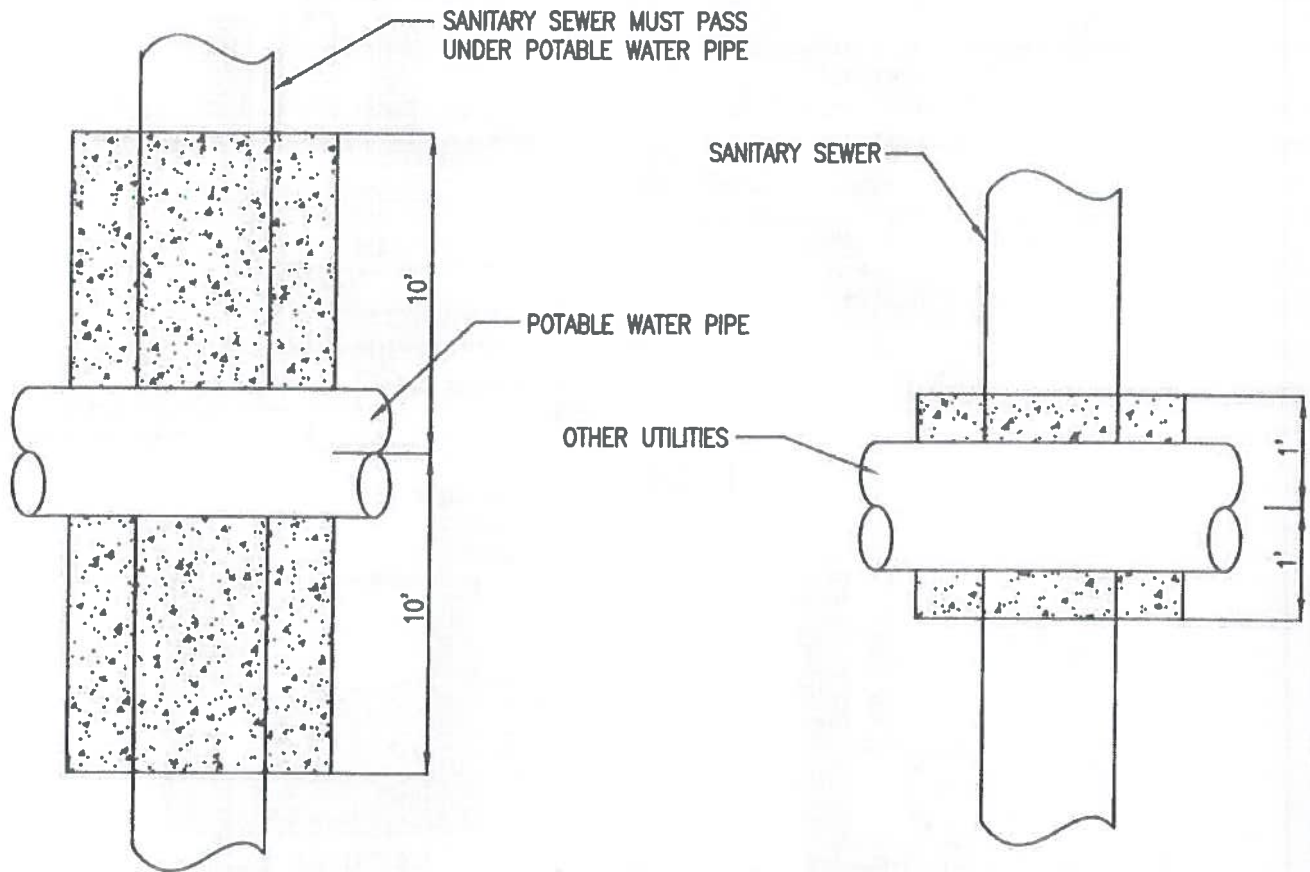
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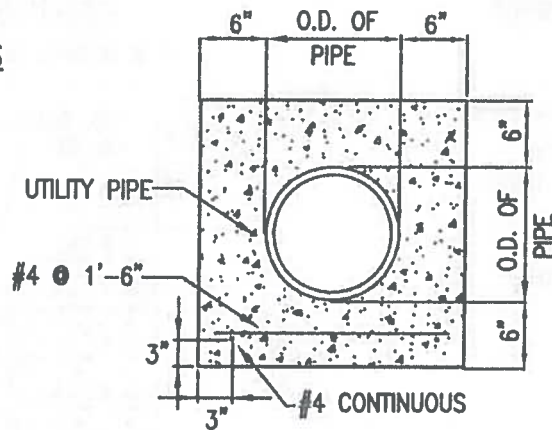


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WATER CROSSINGS

UTILITY CROSSINGS



ENCASEMENT SECTION

NOTE:
 PROVIDE REINFORCEMENT AT UTILITY CROSSINGS
 OR AS DIRECTED BY THE TOWNSHIP'S ENGINEER

CONCRETE ENCASEMENT

N.T.S.

WARRINGTON TOWNSHIP
 STANDARD DETAIL M2

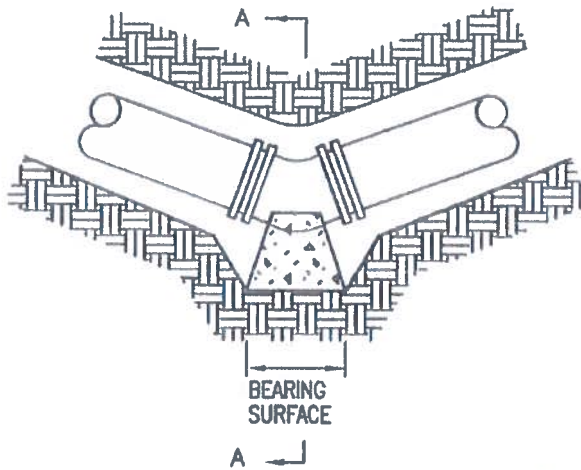
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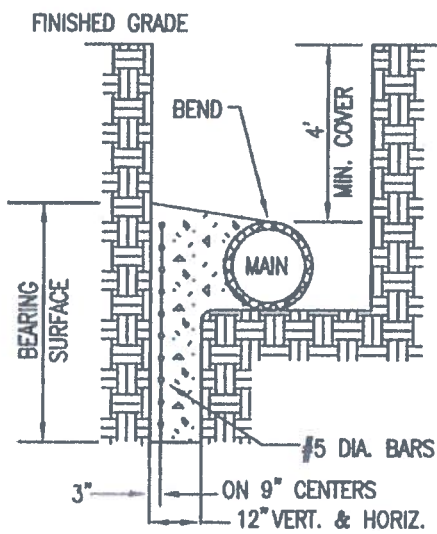
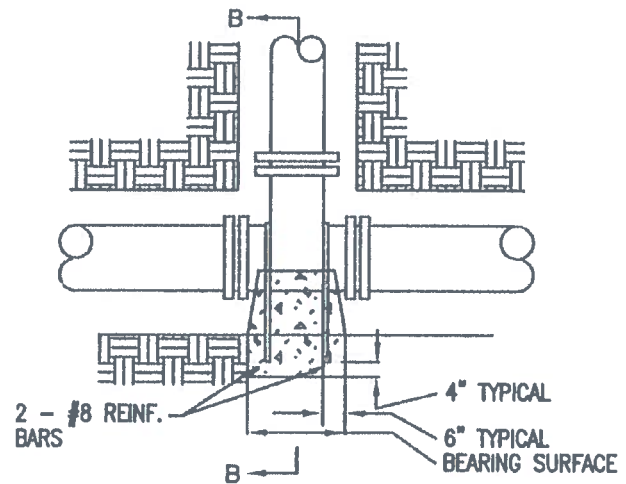


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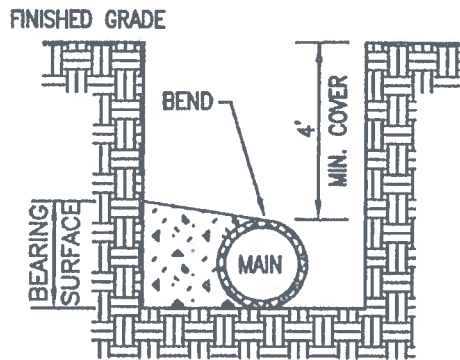
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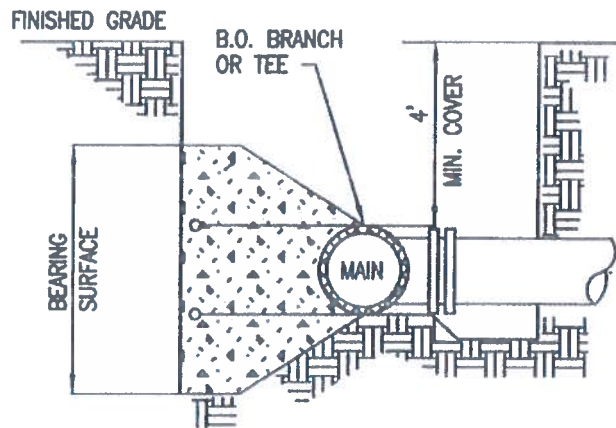
PLAN



SECTION A-A
(FOR BEARING SURFACE > 10SF)



SECTION A-A
(FOR BEARING SURFACE ≤ 10SF)



SECTION B-B

HORIZONTAL THRUST BLOCK DETAILS

N.T.S.

NOTES:

1. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSION STRENGTH OF 2500 P.S.I.
2. ALL REINFORCING STEEL SHALL BE DEFORMED BARS U-SHAPED AROUND PIPE.
3. ALL FITTINGS AND JOINTS SHALL BE COVERED WITH POLYETHYLENE FILM BEFORE PLACING CONCRETE.
4. PAINT ALL EXPOSED STEEL WITH TWO COATS OF VALDURA PAINT OR APPROVED EQUAL.
5. FOR THE REQUIRED BEARING SURFACE SEE STANDARD DETAIL.

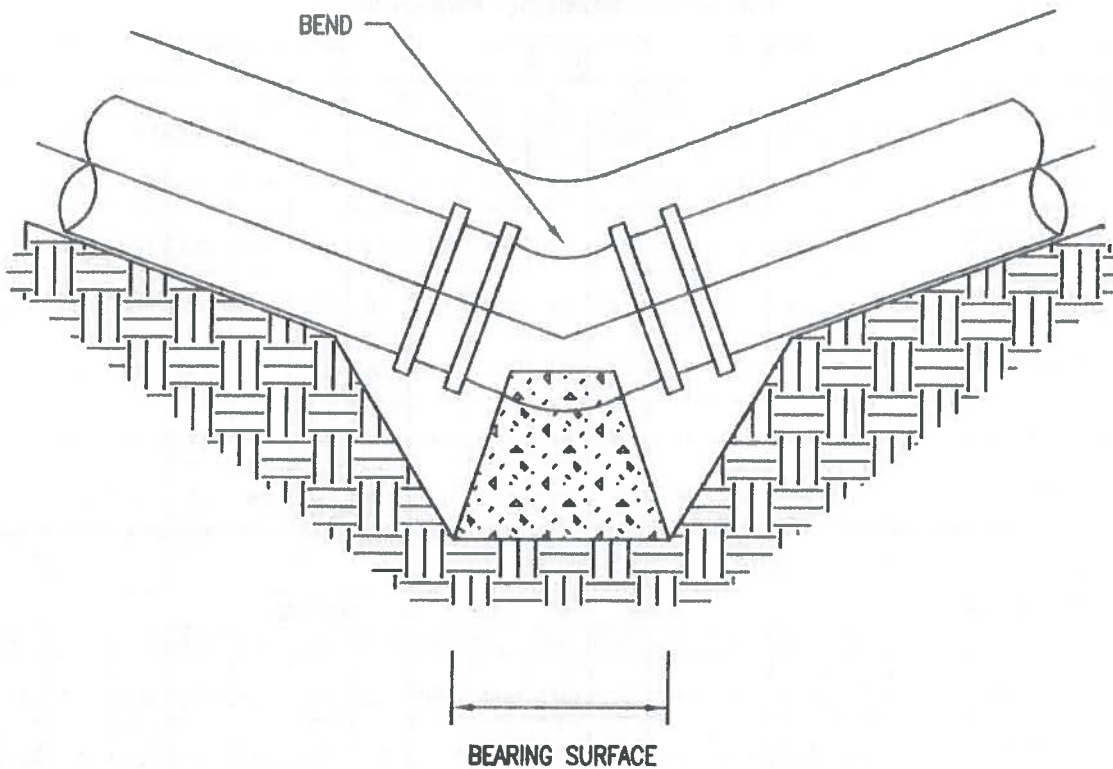
WARRINGTON TOWNSHIP
STANDARD DETAIL M3

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TYPICAL SECTION
VERTICAL THRUST DOWNWARD
N.T.S.

NOTES:

1. ALL CONCRETE SHALL HAVE A MIN. COMPRESSIVE STRENGTH OF 2500 P.S.I.
2. ALL FITTINGS AND JOINTS SHALL BE COVERED WITH POLYTHELENE FILM BEFORE PLACING CONCRETE.
3. PAINT ALL EXPOSED STEEL WITH TWO COATS OF VALDURA PAINT OR APPROVED EQUAL.
4. FOR THE REQUIRED BEARING SURFACE SEE STANDARD DETAIL.

WARRINGTON TOWNSHIP
STANDARD DETAIL M4

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**BEARING SURFACE REQUIRED – Sq. Ft.
HORIZONTAL THRUST BLOCKING & VERTICAL THRUST DOWNWARD
100 P.S.I. WORKING PRESSURE**

PIPE SIZE	6" & 8"				10" & 12"				16" 18" 20"				24"			
TYPE OF BEARING MATERIAL AND ALLOWABLE LOADS	DEGREE OF BEND OR DEFLECTION															
	22.5°	45°	90°	D.E.	22.5°	45°	90°	D.E.	22.5°	45°	90°	D.E.	22.5°	45°	90°	D.E.
SAND 0.75 TON/SQ.FT.	3.4	6.0	11.0	6.4	6.7	12.8	23.4	14.2	14.8	28.8	52.9	34.4	28.1	48.3	89.7	64.0
SOFT CLAY 1 TON/SQ.FT.	2.6	4.6	8.2	4.8	5.0	9.6	17.5	10.7	11.2	21.7	39.7	28.2	19.6	38.3	67.3	48.0
SAND AND GRAVEL 2 TON/SQ.FT.	1.3	2.3	4.1	2.4	2.5	4.8	8.8	5.3	5.6	10.8	20.0	14.1	9.8	13.1	33.6	24.0
CLAY 4 TON/SQ.FT.	1.0	1.2	2.1	1.3	1.3	2.4	4.4	2.7	2.8	5.4	10.0	7.2	4.9	9.1	18.8	12.0
SOFT ROCK 5 TON/SQ.FT.	1.0	1.0	1.8	1.0	1.0	1.9	3.5	2.2	1.6	4.4	8.0	5.7	3.9	7.3	13.5	9.8
ROCK 15 TON/SQ.FT.	—	—	1.0	0.4	—	1.0	1.2	0.8	1.0	1.4	2.6	1.9	1.3	2.4	4.5	3.2

PIPE SIZE	30"				36"				42"				48"			
TYPE OF BEARING MATERIAL AND ALLOWABLE LOADS	DEGREE OF BEND OR DEFLECTION															
	22.5°	45°	90°	D.E.	22.5°	45°	90°	D.E.	22.5°	45°	90°	D.E.	22.5°	45°	90°	D.E.
SAND 0.75 TON/SQ.FT.	40.3	76.5	139	99.1	55.5	107.5	197.5	140.0	74.3	144.7	266.5	188.7	83.2	182.3	336.2	238.0
SOFT CLAY 1 TON/SQ.FT.	30.2	57.4	104.3	74.3	41.6	80.6	148.0	105.0	55.7	108.5	200.0	141.6	70.0	136.7	252.2	178.0
SAND AND GRAVEL 2 TON/SQ.FT.	15.1	28.7	52.1	37.2	20.8	40.3	74.0	52.5	27.9	54.3	100.0	70.8	35.0	68.3	126.1	89.2
CLAY 4 TON/SQ.FT.	7.6	14.6	26.0	18.6	10.4	20.2	37.0	26.3	14.0	27.0	50.0	35.3	17.5	34.2	63.0	44.8
SOFT ROCK 5 TON/SQ.FT.	6.0	11.5	20.9	14.9	8.3	16.1	29.6	21.0	11.2	21.7	40.0	28.3	14.0	27.3	50.4	35.7
ROCK 15 TON/SQ.FT.	2.0	3.8	7.0	5.0	1.4	2.8	5.4	7.0	3.7	7.2	13.3	9.4	4.7	9.1	16.8	12.0

NOTE: D.E. DENOTES DEAD END OR TEE

THRUST BLOCK
BEARING SURFACE REQUIREMENTS
N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL M5

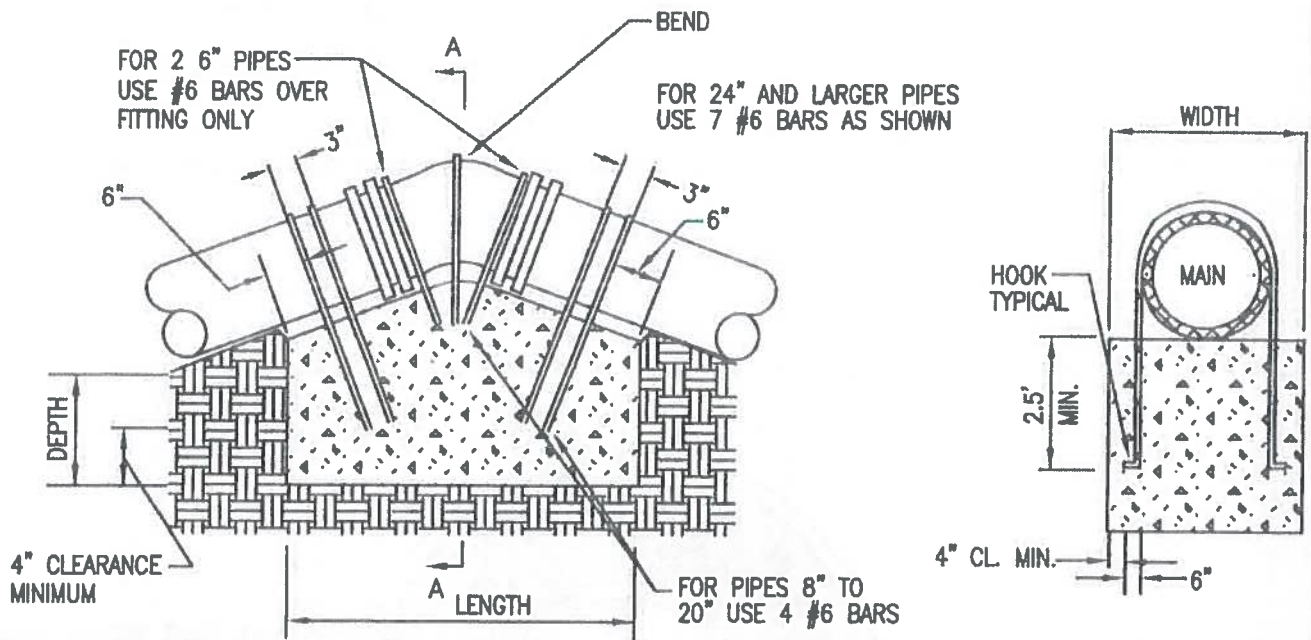
CKS Engineers, Inc.

88 South Main Street, Doylestown, PA 18001
(215) 340-0800
REF. NO. 4102-66



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SECTION A-A

NOTES:

1. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2500 P.S.I.
2. ALL REINFORCING STEEL SHALL BE DEFORMED BARS U-SHAPED AROUND PIPE.
3. ALL FITTINGS AND JOINTS SHALL BE COVERED WITH POLYETHYLENE FILM BEFORE PLACING CONCRETE.
4. PAINT ALL EXPOSED STEEL WITH TWO COATS OF VALDURA PAINT OR APPROVED EQUAL.

**CONCRETE BLOCKING DIMENSIONS, VERTICAL THRUST UPWARD
100 P.S.I. WORKING PRESSURE**

PIPE SIZES	LENGTH			WIDTH			DEPTH		
	11.25°	22.25°	45°	11.25°	22.25°	45°	11.25°	22.25°	45°
6" & 8"	3'	4'	6'	3'	3'	3'	2'	3'	4'
10" & 12"	3.5'	4'	7'	4'	4'	4'	2.5'	3'	4'
14" & 16"	4'	6'	9'	4.5'	4.5'	4.5'	3.5'	4'	5'
18" & 20"	5'	6.5'	11.5'	5'	5'	5'	4'	5'	5.5'
24"	5'	9'	12.5'	5'	5'	6'	4.5'	5'	6'
30"	5.5'	9'	13.5'	5.5'	6'	7'	5.5'	6'	7'
36"	6.5'	11'	14'	5.5'	6.5'	7'	6'	6.5'	7'
42"	9'	13.5'	15'	6'	7'	7'	6'	7'	7'
48"	10'	14'	16'	6'	7'	7'	6'	7'	7'

**TYPICAL SECTION
VERTICAL THRUST UPWARD**

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL M6

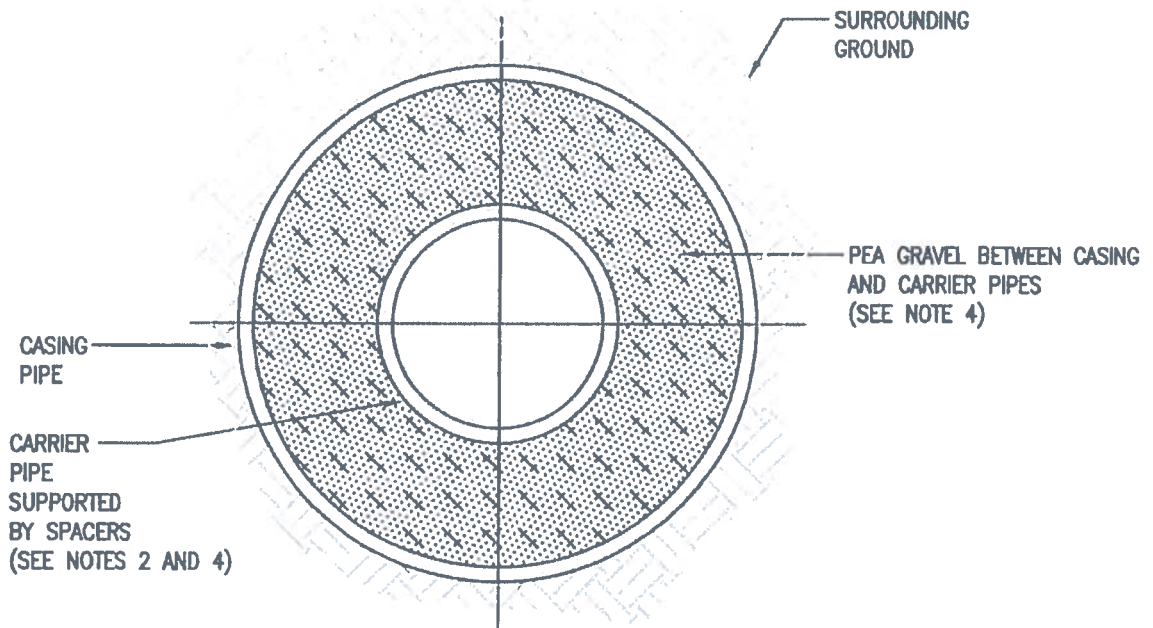
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NOTES:

1. PENNDOT OR RAILROAD REQUIREMENTS CONTROL AS APPROPRIATE.
2. PROVIDE SPACERS AS REQUIRED TO MAINTAIN PROPER ALIGNMENT OF CARRIER PIPE.
3. ENDS OF CASING SHALL BE SEALED WITH BRICK MASONRY CONSTRUCTION AFTER ALL TESTS HAVE BEEN COMPLETED AND ACCEPTED BY ENGINEER.
4. REFER TO SECTION 02310.3 F OF SPECIFICATIONS.

JACKING CONDUIT

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL M7

CKS Engineers, Inc.

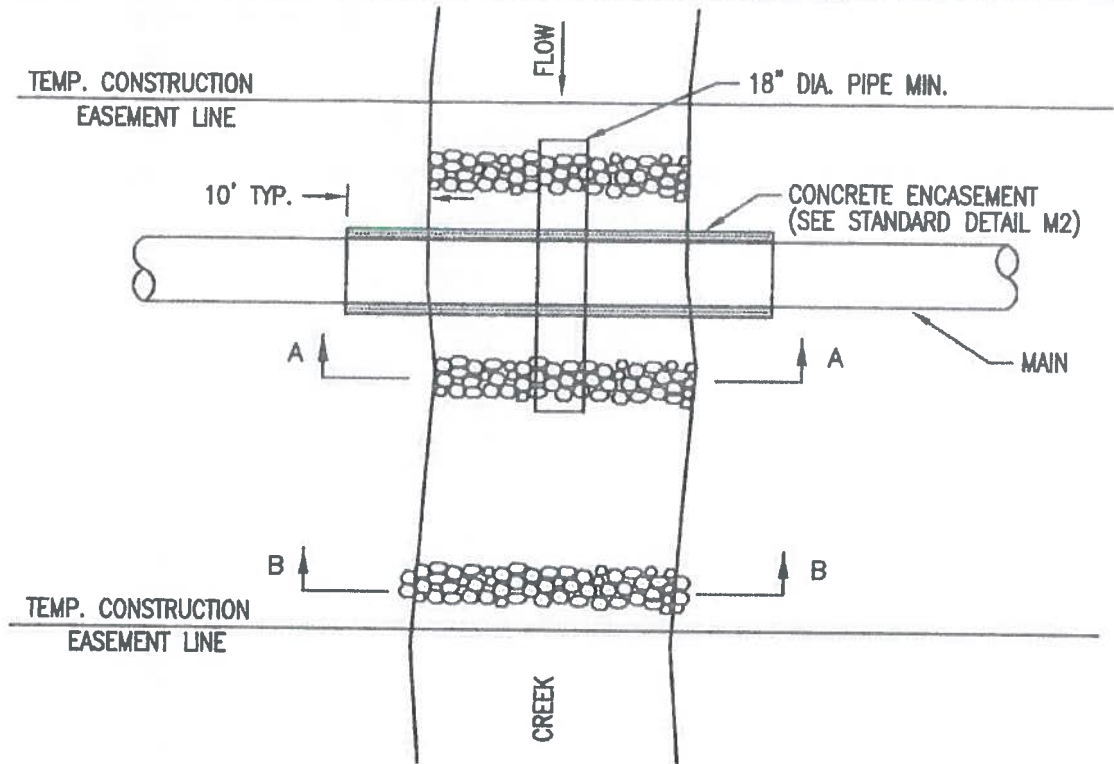


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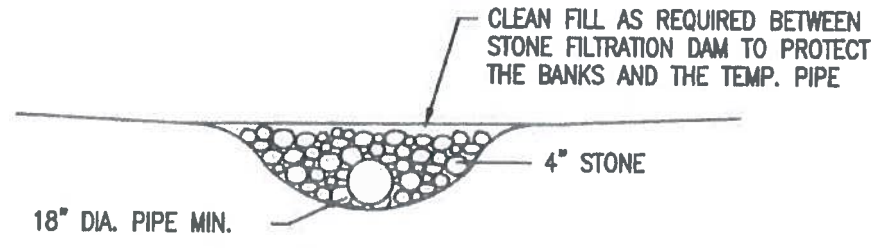
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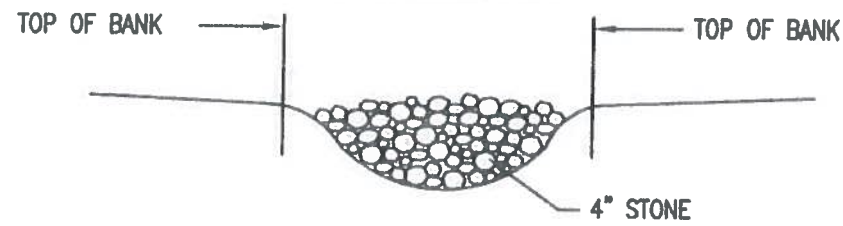
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PLAN VIEW



SECTION A-A



ROCK FILTRATION DAM

SECTION B-B

CONSTRUCTION DETAILS FOR STREAM CROSSING

N.T.S.

WARRINGTON TOWNSHIP
STANDARD DETAIL M8

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