STANDARD CONSTRUCTION AND MATERIAL SPECIFICATIONS

WATER PRODUCTION, DISTRIBUTION AND TREATMENT SYSTEMS, SEWAGE COLLECTION PUMP STATION, FORCE MAIN TREATMENT SYSTEMS

PREPARED FOR:

WARWICK TOWNSHIP WATER & SEWER AUTHORITY P.O. Box 315 JAMISON, PA 18929

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CONSTRUCTION SPECIFICATIONS

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CONSTRUCTION SPECIFICATIONS

PART 1- GENERAL

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, sewage pumping stations and related sewer and water facilities, 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 DEVELOPER and CONTRACTOR. AUTHORITY 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 Uniform Construction Code, as amended by Warwick Township, shall apply in those locations unless specifically indicated otherwise in this Standard Specification or on the Standard Details.
- 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 CONTRACTOR of his responsibility to perform such work.
- C. The Standard Details at the end of this document represent the standards of construction of AUTHORITY. 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 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.

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:

<u>AUTHORITY</u>: Warwick Township Water and Sewer Authority, 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 AUTHORITY.

<u>ENGINEER</u>: AUTHORITY Engineer, duly employed by Warwick Township Water and Sewer Authority as consultant and authorized to inspect the results of the performance of the work under Contract by 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 ENGINEER.

<u>DEVELOPER</u>: 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 AUTHORITY, 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.

<u>CONTRACTOR</u>: 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.

<u>Contract</u>: The written agreement executed by and between DEVELOPER and 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 AUTHORITY.

<u>Project</u>: 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.

<u>Specifications</u>: 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.

<u>Drawings and Plans</u>: 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 AUTHORITY; 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.

<u>Resident Project Representative</u> - The authorized representative of ENGINEER who may be assigned to the site of the Work.

<u>Township</u> - Township acting directly or through any agent, officer or employer authorized to act for Township in the execution of the legal functions of Township. 01010/2

<u>Inspection</u> - The examination of the Work performed by CONTRACTOR to determine its conformity with the Drawings and the Specifications.

<u>Work</u> - The entire completed construction of the water and/or sanitary sewerage facilities to be dedicated to AUTHORITY as shown on the Drawings and described in the Specifications. The Work includes and is the result of performing or furnishing labor and incorporating materials and equipment into the construction and performing or furnishing services and furnishing documents, all as required by the Drawings and the Specifications.

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. AASHTO American Association of State Highway and Transportation Officials
- 4. ACI American Concrete Institute
- 5. AISC American Institute of Steel Construction, Manual of Steel Construction
- 6. ANSI American National Standards Institute
- 7. ASME American Society of Mechanical Engineers
- 8. ASTM American Society of Testing and Materials
- 9. AWWA American Water Works Association
- 10. BOCA Plumbing Code Building Officials and Code Administrators National Plumbing Code
- 11. DEP Pennsylvania Department of Environmental Protection: Erosion and Sediment Pollution Control Manual, Domestic Wastewater Facilities Manual, and Public Water Supply Manual
- 12. FS Federal Specifications
- 13. ISO Insurance Services Office
- 14. NACE National Association of Corrosion Engineers
- 15. NEC National Electric Code
- 16. NEMA National Electrical Manufacturer's Association
- 17. NFPA National Fire Protection Association
- 18. OSHA Occupational Safety and Health Administration
- 19. PennDOT Pennsylvania Department of Transportation Publications 203 and 408
- 20. PTM Pennsylvania Test Method
- 21. UCC Uniform Construction Code

1.04 EASEMENT/PROPERTY DEDICATIONS

- A. DEVELOPER shall be responsible to acquire all necessary off-site easements and property prior to start of construction. The DEVELOPER shall pay all costs associated with easement and property acquisition.
- B. AUTHORITY may assist in acquiring an off-site easement or property utilizing its right of eminent domain if such easement of property is deemed in the best interest of the public.
- C. DEVELOPER shall provide dedications of easements and property within the development site at the execution of the Financial Agreement to be recorded by the AUTHORITY.
- D. Easements shall be a minimum of twenty (20) feet in width where only a single utility is involved and a minimum of thirty (30) feet of width there two (2) utilities are involved.
- E. Any sewage pumping station site including access shall be provided to AUTHORITY in the form of fee simple ownership. The necessary site area and configuration shall be acceptable to AUTHORITY.

1.05 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, <u>without</u> 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 ENGINEER as to the equality thereof. It is distinctly understood that: (1) 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 AUTHORITY on all such questions of equality shall be final; and (3) in the event of any adverse decision by ENGINEER, no claim of any sort shall be made or allowed against ENGINEER or AUTHORITY.
- C. If, 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 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, 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, CONTRACTOR shall submit to 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 ENGINEER to check, to his satisfaction, the reason and costs involved.
- 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 CONTRACTOR's responsibility to bear the construction cost of all changes. It shall also be CONTRACTOR's responsibility to bear the construction changes necessitated by the proposed deviations from the specified equipment and/or the Drawings.
- F. The decision of ENGINEER, from time to time, as to the proper credits to be allowed AUTHORITY or proper payments to be made to CONTRACTOR, shall be final and conclusive upon CONTRACTOR.

1.06 OBSERVANCE OF LAWS

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 Township or jurisdiction over the work, materials, equipment, employees or the Contract; such observance and compliance shall be solely and without qualification the responsibility of CONTRACTOR without reliance on superintendence or direction by AUTHORITY 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 AUTHORITY or ENGINEER.

1.07 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 CONTRACTOR shall be fully informed and with which he shall fully comply. Observance or and compliance with said regulations shall be solely and without qualification the responsibility of CONTRACTOR, without reliance on superintendence of or direction by AUTHORITY or ENGINEER. The duty of enforcing such laws and regulations lies with the said Department, not with AUTHORITY or ENGINEER.

1.08 PERMITS AND LICENSES

A. DEVELOPER shall be responsible for securing all necessary governmental permits/applications for the Work <u>prior</u> to start of construction and shall give all notices necessary and incident to the proper and lawful prosecution of the work. DEVELOPER shall pay all application fees, charges and costs associated with the required submissions for permits and approvals. A copy of all permits /approvals shall be provided to AUTHORITY prior to start of construction.

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 CONTRACTOR, or DEVELOPER.

- B. Permits/approvals may include but are not limited to the following:
 - 1. PA Department of Environmental Protection
 - Planning Module Approval (Act 537)
 - Water Quality Management Permit
 - BDWM-GP-5 (Utility Line Stream Crossing)
 - 2. PennDOT

Highway Occupancy PermitMinimum Use Driveway

- 3. Bucks County-Conservation District
 - Soil Erosion and Sedimentation Control Plan Approval
- 4. Warwick Township

•Road Opening Permit •Blasting Permit

- 5. Philadelphia Electric Company
 - Service and Metering Permit 01010/6

- Service Agreement
- 6. Verizon
- C. DEVELOPER/CONTRACTOR is responsible for complying with all relevant conditions of any governmental permits or approvals for the Work, including giving all necessary notices.

1.09 NOTICE

The service of any notice by AUTHORITY or ENGINEER to DEVELOPER or CONTRACTOR shall be considered accomplished upon completion of anyone 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. When delivered, in writing, to the addressee or any of his authorized agents in person;
- C. When delivered, in writing, to the addressee or any of his 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 fax machine, and addressed to the party intended for such service at his 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 filed at any company operated office of the Western Union Telegraph Company 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.

1.10 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 ENGINEER only, and authorized in writing.

C. Where dimensions or locations of existing facilities are of importance to the successful performance of any part of the work of this Contract, 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 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.

PART 2 – PRODUCTS

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. CONTRACTOR shall furnish 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 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 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 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 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. 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 option of, ENGINEER, at sites other than the testing laboratory and not under the jurisdiction thereof, 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. CONTRACTOR shall permit or arrange with the producer to permit 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.
- 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 CONTRACTOR.

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 weather tight in all respects.
- E. CONTRACTOR shall follow all written instructions and recommendations of the equipment manufacturer and all requirements of ENGINEER regarding the oiling, 01010/9

exercising, maintenance and protection of the equipment during storage. It shall be 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 ENGINEER.

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 ENGINEER, CONTRACTOR shall prove by acceptable test the effectiveness of the insulation.

PART 3 – EXECUTION

3.01 PRELIMINARY INSPECTION

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.

3.02 PRECONSTRUCTION MEETING

- A. AUTHORITY or ENGINEER will schedule a conference prior to commencement of construction of the work. This conference will normally include the DEVELOPER, CONTRACTOR(s), ENGINEER and Resident Project Representative.
- B. Agenda for the Preconstruction Conference will include the following items as a minimum:
 - 1. Designation of representatives for various parties
 - 2. Construction schedule submission
 - 3. Submittal requirements
 - 4. Escrow drawdown application procedures
 - 5. Inspection notifications
 - 6. Connection(s) to existing water and/or sanitary sewer systems
 - 7. Testing requirements

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- 8. Permit requirements/notifications
- 9. Erosion control plan implementation
- 10. Record drawings
- C. CONTRACTOR is required to submit a construction schedule showing the order in which 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.
- D. A field visit of the construction area of the Work shall be conducted at the discretion of AUTHORITY or ENGINEER when it is determined to be necessary to observe pertinent conditions related to easements, right-of-ways, existing structures or obstructions and/or features to be removed, or changed.

3.03 PROGRESS MEETINGS

- A. During the construction period progress meetings shall be held with 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 ENGINEER to suit the current circumstances.
- B. AUTHORITY, 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 ENGINEER at project meetings shall be on behalf of AUTHORITY and shall be conclusive on CONTRACTOR and Subcontractor's affected.
- C. The proceedings of these meetings will be recorded by ENGINEER, and each required representative at meetings will be furnished one copy. ENGINEER's act of conducting meetings, recording and distributing meeting minutes on behalf of AUTHORITY, 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 AUTHORITY or Engineer. ENGINEER will advise each concerned party in advance of such change.

3.04 SHOP DRAWING SUBMITTALS

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 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 ENGINEER for review before fabrication. 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 CONTRACTOR, 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 CONTRACTOR. This procedure is required so that CONTRACTOR's superintendent can familiarize himself with all information which CONTRACTOR sends to ENGINEER and also to prevent ENGINEER from taking action upon something other than that which is desired by CONTRACTOR. ENGINEER shall consider for approval only such data and details as are verified and transmitted to him directly by CONTRACTOR. Failure of CONTRACTOR to note his approval on Shop Drawings will be reason for ENGINEER to return such submission to CONTRACTOR to ENGINEER have not been properly checked, even though CONTRACTOR's approval has been noted thereon, it will also be considered reason for ENGINEER to return such submission to CONTRACTOR's approval has been noted thereon, it will also be considered reason for ENGINEER to return such submission to CONTRACTOR unchecked.
- D. All correspondence between ENGINEER and CONTRACTOR, all shop drawings, and all data for review of drawings or materials will be handled by ENGINEER. All such data shall be delivered directly to 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 CONTRACTOR's office or designated representative at the job site.
- E. A sufficient number of shop drawings and review data shall be submitted to 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 CONTRACTOR or his 01010/12

representative at the job site. 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 CONTRACTOR's schedule.

- F. Drawings of minor or incidental fabricated materials and/or equipment may not be required by ENGINEER. CONTRACTOR shall furnish 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 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 is 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 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, CONTRACTOR shall, without cost to AUTHORITY and without obligation on the part of ENGINEER, replace the item with the material originally specified. ENGINEER's acceptance of shop drawings or layout for any material, apparatus, or device shall not relieve 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 CONTRACTOR from responsibility for errors of any sort on the shop drawings. If the shop drawings deviate from the Drawings and Specifications, CONTRACTOR shall advise 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 CONTRACTOR for additional fabrication, assembly, and erection data. The shop drawings do not change or supersede the Drawings and Specifications. 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 CONTRACTOR and reviewed by ENGINEER shall not be construed to include acceptance of any change except the changed details specifically requested.

J. It shall be the responsibility of CONTRACTOR to make all the necessary changes in other items, which result from deviations or changes requested by CONTRACTOR and accepted by ENGINEER, so that all items perform the requirements and intent of the Drawings and Specifications.

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.

3.06 CONSTRUCTION STAKEOUT

A. Construction stakeout shall be performed by CONTRACTOR. CONTRACTOR shall be responsible for protecting and preserving all reference points for the duration of the Project. Reference points for vertical control and all elevations shall be based on U. S. Geological Survey datum.

3.07 CONDUCT OF WORK

- A. All work at the site shall normally be performed during regular working hours except as otherwise required for the safety or protection of persons, the Work, or property at or adjacent to the site. CONTRACTOR shall give prior notice to AUTHORITY and ENGINEER if performance of Work on an overtime basis or on weekends of legal holidays is scheduled.
- B. No work shall be done when, in the opinion of 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, CONTRACTOR, under order of ENGINEER, shall cease all such work until directed to resume the same.
- C. CONTRACTOR shall arrange for and be responsible for a sufficient amount of illumination at all times, subject to the approval of ENGINEER, to carry on all phases of the work.
- D. All work shall be subject to the control of ENGINEER and AUTHORITY. In the performance of the work, CONTRACTOR shall abide by all orders, directions and requirements of ENGINEER and AUTHORITY and shall perform all work in such manner and sequence as AUTHORITY may require. ENGINEER and AUTHORITY shall determine the amount, quality, acceptability and fitness of all parts of the work; shall interpret the Drawings and Specifications; shall issue any 01010/14

extra work orders; and shall decide all other questions in connection with the work. CONTRACTOR shall employ no plant, equipment, materials, or methods to which ENGINEER or AUTHORITY objects and shall remove no plant, materials, equipment or other facilities from the site of the work without permission of ENGINEER or AUTHORITY. Upon request, ENGINEER or AUTHORITY shall confirm in writing, any oral order, direction, requirement or determination. If any person employed on the work by CONTRACTOR shall appear to ENGINEER or AUTHORITY to be incompetent or to act in a disorderly or improper manner, such person shall be removed immediately upon request by ENGINEER or AUTHORITY.

E. CONTRACTOR agrees to use, at all times on the work, only such labor as will in no way disturb or affect labor employed by AUTHORITY and/or other contractors on the project. 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.

3.08 CONTRACTOR'S PERSONNEL

- A. CONTRACTOR shall keep a competent resident superintendent on the Project at all times during its progress. This individual will be CONTRACTOR'S representative at the site of the Work and shall have Township to act on behalf of CONTRACTOR.
- B. CONTRACTOR shall be available at all times, including nights, weekends, and holidays, an emergency maintenance crew and a person of Township and responsibility to act in cases of emergency such as flooding, cave-ins, etc., resulting from construction associated with the Work. CONTRACTOR shall submit to DEVELOPER and AUTHORITY, the names and location of emergency personnel prior to the start of construction.
- C. CONTRACTOR shall provide competent, suitably qualified personnel to construct the Work as required by these Drawings and Specifications.
 CONTRACTOR shall at all times maintain good discipline and order at the site. The CONTRACTOR shall remove any employees found under the influence of drugs or alcohol from the site.

3.09 SAFETY REQUIREMENTS

A. 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, 01010/15

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, torches, reflectors and signs) which 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 Publication 408, as supplemented and to the requirements specified in the current edition of P A Code Title 67, Transportation Chapter 203 - Work Zone Traffic Control which complements Sections 901.

B. The safety provisions or 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.

Observance of, and compliance with, said regulations shall be solely and without qualification, the responsibility of CONTRACTOR, without any responsibility whatsoever on the part of AUTHORITY or ENGINEER. The duty of enforcing such laws and regulations lies with the said Department, not with AUTHORITY or ENGINEER.

C. The provisions of the "OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970" of the U.S. Department of Labor shall be complied with in the performance of the Work. Observance of, and compliance with, said Act shall be solely and without qualification the responsibility of the CONTRACTOR, without reliance on superintendence of, or direction by, AUTHORITY or ENGINEER. The duty of enforcement of the provisions of the Act lies with the U.S. Department of Labor, not with AUTHORITY or ENGINEER.

3.10 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

- A. CONTRACTOR shall take all necessary precautions to protect and prevent damage to overhead and underground utilities, structures, streets and driveways, culverts, street signs, fences, trees/shrubs, property markers, pins/monuments and other existing features within or adjacent to the area of the Work.
- B. CONTRACTOR shall comply with the requirements of PA Act 287, December 10, 1974 as last amended by PA Act 38 on December 12, 1991 with regard to underground utilities prior to performing excavation or demolition activities.

- C. CONTRACTOR shall be responsible for damage to public and private property and shall restore any damaged property to a condition at least as good as which existed prior to construction.
- D. CONTRACTOR shall videotape with accompanying narrative, any off-site construction Work areas along rights-of-ways or easements prior to construction.
- E. CONTRACTOR shall protect all property markers, and/monuments to be affected by construction until have been properly referenced. Any disturbed property markers, pins and/or monuments shall be correctly reset following construction activities.
- F. CONTRACTOR shall take special care to avoid interference with the operation of any existing utilities. Of particular concern are any proposed connections to AUTHORITY's existing water distribution and sewage collection systems. A sequence of construction relative to any connection to AUTHORITY's water distribution and/or sanitary sewerage systems shall be reviewed with and approved by ENGINEER prior to construction of any connection which impacts upon operation of AUTHORITY's existing systems.

3.11 BLASTING REQUIREMENTS

- A. Blasting will be permitted except in areas where the proximity of structures, underground facilities, or public safety precludes the use of explosives.
 CONTRACTOR shall observe the utmost care in the use of explosives so as not to endanger life or property. Nothing in this section shall relieve CONTRACTOR of his responsibilities for damages, nor shall it result in any responsibility to AUTHORITY or ENGINEER.
- B. DEVELOPER/CONTRACTOR shall comply with all local, State and Federal laws relating to the transportation, storage, handling and use of explosives, blasting agents and caps.
- C. Blasting requirements are more completely addressed elsewhere in these specifications; the following requirements are among those imposed on DEVELOPER/CONTRACTOR.
 - 1. Obtain permit from Township.
 - 2. Obtain permit from PennDOT relative to any predrilling and/or blasting within the State highway right-of-way.
 - 3. Submit any blasting bonds, insurance certificate (public liability and property damage) or other financial security required by Township, PennDOT or other involved governmental agency. 01010/17

4. Conduct a Preblasting Survey of nearby buildings relative to structural conditions and water supply wells.

3.12 TRAFFIC CONTROL

- A. CONTRACTOR must maintain safe and efficient movement of traffic In the vicinity of construction.
- B. CONTRACTOR shall implement the Traffic Control Plan and any associated requirements as approved by PennDOT's Highway Occupancy Permit and/or the Township's Road Opening Permit relative to Work in and along Highways and Streets.
- C. CONTRACTOR shall furnish, erect, and maintain traffic cones, drums, barricades, flashing danger signal lights, directional signs and provide trained and equipped flagmen as required by the Traffic Control Plan and State and local permit requirements to restrict the movement of traffic within the construction areas and to clearly indicate the restrictions well in advance to vehicular traffic. (See Section 01010.3.09 SAFETY REQUIREMENTS).
- D. CONTRACTOR shall consult with authority having jurisdiction in establishing public thoroughfares to be used for haul routes and public access.
- E. CONTRACTOR shall provide advance notification to any parties so noted in PennDOT's Highway Occupancy Permit or Township's Road Opening Permit in accordance with the required time schedule. In any event, the Township Police Department shall be notified at least ten (10) days prior to the date CONTRACTOR desires to restrict traffic in or along any highways or roads.
- F. CONTRACTOR shall obtain advance approval from the authority having jurisdiction (PennDOT, Township) should it be necessary to temporarily close a road. The following parties shall be notified at least twenty four (24) hours in advance.
 - 1. Township Police
 - 2. Local Fire Company
 - 3. Local School District
 - 4. Local Ambulance Service
 - 5. All affected residents

At least one lane must be open for traffic during non-working periods and CONTRACTOR must be prepared to allow passage of emergency vehicles at any time.

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- G. CONTRACTOR shall control parking of construction equipment and construction personnel vehicles to prevent interference with public traffic and parking access by emergency vehicles and AUTHORITY 's operations.
- H. CONTRACTOR shall prevent parking on or adjacent to public streets or in nondesignated areas unless prior approval is obtained from the Township.
- I. Access must be maintained at all times during non-working periods and to the maximum extent feasible during working periods to all driveways and entrances of adjacent properties. In this regard, the construction and maintenance of steel plates or other decking across the trench may be necessary to reduce to a minimum interference with access to the adjacent properties.

Open trenches in or along highways or roads shall be safely decked during non-Work periods by the use and maintenance of steel plates or other decking, which shall have sufficient strength to safely support all traffic including truck loads.

When the work, including repaying, has been completed, the temporary measures of the Traffic Control Plan shall be removed, any damage caused by installation of the temporary measures shall be repaired, and traffic shall be restored to its former condition.

J. CONTRACTOR shall not obstruct access to fire hydrants.

3.13 TEMPORARY FACILITIES

- A. 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 CONTRACTOR up to and including the date of acceptance. CONTRACTOR is not required to provide field facilities for ENGINEER.
- B. CONTRACTOR shall furnish and erect all necessary temporary fences required to provide adequate security for all materials, equipment and structures throughout the project.

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, CONTRACTOR shall remove surplus materials, tools, construction equipment and machinery, and leave the site clean and ready for occupancy by AUTHORITY.

3.15 TESTS AND INSPECTIONS

- A. In addition to all other tests and inspections required by these specifications, an audio-videotape of the inside of all sanitary sewer lines shall be submitted to AUTHORITY. Refer to specification section 02734 for detailed requirements.
- B. In addition to all other tests and inspections required by these specifications, a Leak Detection Survey shall be completed for all water lines. DEVELOPER shall be responsible for completing a leak detection survey in accordance with current AUTHORITY approved methods.
- C. AUTHORITY, ENGINEER, Resident Project Representative, and other representatives and personnel of AUTHORITY, independent testing laboratories and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's site safety procedures and programs so that they may comply therewith as applicable.
- D. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspect tests.
- E. CONTRACTOR shall pay for all tests required as set forth in the Specifications.
- F. If any Work that is to be inspected, tested or approved is covered by CONTRACTOR, it must, if requested by ENGINEER, be uncovered for observation. Uncovering Work shall be at CONTRACTOR's expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR's intention to cover the same and ENGINEER has not acted reasonable promptness in response to such notice. If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER's observation and replaced at CONTRACTOR's expense.

3.16 STARTUP OF MECHANICAL AND/OR ELECTRICAL EQUIPMENT/SYSTEMS

- A. 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 ENGINEER prior to any operational acceptance test.
- B. CONTRACTOR shall insure that each piece of equipment or system is ready for operation and execute start-up under supervision of manufacturer's authorized representative in accordance with manufacturers' instructions. Operative products and equipment shall be adjusted to insure smooth and unhindered operation.
- C. CONTRACTOR shall submit a written installation certificate, signed by CONTRACTOR and by manufacturer's representative, that equipment or system has been properly installed and is functioning correctly.
- D. CONTRACTOR shall demonstrate operation and maintenance of equipment to AUTHORITY's personnel two (2) weeks prior to date of final inspection. This demonstration shall include start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at equipment location. For equipment or systems requiring seasonal operation, the demonstration for the other season(s) shall be performed within six (6) months.
- E. 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 eighteen (18) months, unless otherwise noted for specific equipment elsewhere in these specifications. 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.

3.17 DEFECTIVE WORK

- A. Prompt notice of all defective Work of which AUTHORITY or ENGINEER have actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected or accepted as provided in this section.
- B. If Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform Work in such a way that the completed Work will conform to the Drawings or the Specifications, AUTHORITY may order CONTRACTOR to stop Work, or any portion thereof, 01010/21

until the cause for such order has been eliminated; however, this right of AUTHORITY to stop Work shall not give rise to any duty on the part of AUTHORITY to exercise this right for the benefit of CONTRACTOR or any surety or other party.

- C. If required by ENGINEER, CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by ENGINEER, remove it from the site and replace it with Work that is not defective. CONTRACTOR shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs or repair).
- D. If within one year after the date of acceptance any Work is found to be defective, CONTRACTOR shall promptly without cost to AUTHORITY and in accordance with AUTHORITY's written instruction: (i) correct such defective Work, or, if it has been rejected by AUTHORITY, remove it from the site and replace it with Work that is not defective, and (ii) satisfactorily correct or remove and replace any damage to other Work or the worth of others resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, AUTHORITY may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs or repair or replacement of Work of others) will be paid by CONTRACTOR.

In special circumstances where a particular item of equipment is placed in continuous service before AUTHORITY accepts the Work, the correction period for that item may start to run from an earlier date as established by ENGINEER.

Where defective Work (and damage to other Work resulting there from) has been corrected, removed or replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. If, instead of requiring correction or removal and replacement of defective Work on the Project, AUTHORITY prefers to accept it, AUTHORITY may do so. CONTRACTOR shall pay all claims, costs, losses and damages attributable to AUTHORITY's evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness).

3.18 OPERATION AND MAINTENANCE MANUALS

- A. CONTRACTOR shall initially furnish two (2) 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 ENGINEER for review and comment. Each instruction manual furnished shall be bound in 8-1/2 x 11 inch text pages, three ED side ring binders with durable plastic covers. CONTRACTOR shall revise contents of manual as required based on ENGINEER's comments and submit four (4) copies of revisions within 15 days thereafter.
- B. Binder cover shall be prepared with printed title "OPERATION AND MAINTENANCE MANUAL", and title of Project Binder contents shall be internally subdivided with permanent page dividers, logically organized, with tab titling clearly printed under reinforced laminated plastic tabs.
- C. Each operation and maintenance manual shall be transmitted to 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 ENGINEER prior to final acceptance of the project by AUTHORITY.
- D. Each operation and maintenance manual shall include a directory, listing names, addresses, and telephone numbers of CONTRACTOR, subcontractors, and major equipment suppliers.
- E. Each operation and maintenance 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.
- F. Each operation and maintenance manual shall include installation certificates, and warranties associated with the Work.
- G. 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.

3.19 RECORD DRAWINGS

- A. CONTRACTOR shall maintain on-site, one (1) copy of Drawings in which shall be recorded all field changes concurrent with construction progress to accurately show the "as-built" conditions of the constructed Work.
- B. Prior to acceptance by AUTHORITY of the Work, DEVELOPER shall provide to AUTHORITY a set of reproducible drawings showing the "as-built" conditions of the constructed Work. Each drawing shall be noted as a Record Drawing and dated along with a certification letter from DEVELOPER/CONTRACTOR stating that the Record Drawings represent a true and accurate record of the constructed Work (AUTHORITY intends to use prints of the reproducibles to provide information to designers and contractors as required by the Commonwealth of Pennsylvania Act 38). Two paper copies shall first be submitted to ENGINEER for review and comment. After all appropriate Record Drawings are reviewed and approved by ENGINEER, three (3) paper copies and one (1) mylar reproducible of each drawing shall be submitted to AUTHORITY. A digital Auto CADD electronic file shall also be provided of all Record Drawings, in Release 2004 format.
- C. All as-built features shown on Record Drawings shall be surveyed by Registered Professional Surveyor, licensed to practice in the Commonwealth of Pennsylvania. All as-built Electrical Drawings shall be sealed by a Registered Professional Electrical Engineer, licensed to practice in the Commonwealth of Pennsylvania. Each paper copy of Drawings shall have the original seal and signature of the Registered Professional Surveyor and/or engineer responsible for the specific Drawing.
- D. The Record Drawings shall incorporate but not necessarily be limited to the following as built features:
 - 1. Sanitary Sewer Project
 - Lateral locations (stationing, offset to R-O-W or easement)
 - Lateral cleanout locations (with survey ties to front corners of building)
 - Manhole data (location, rim & invert elevations) Original design information relating to rim and invert elevations shall be crossed out and as-built information shall be added in parentheses.
 - As-built plan and profile of sewer. Original design information relating to size, material, length and slope of gravity sewers shall

be crossed out and as-built information shall be added in parentheses.

- Concrete encasements (location & length)
- Utility locations
- Location of sewers and manholes within easements
- 2. Water Distribution Project
 - Service connection locations (stationing and length)
 - Curb stop & box (with survey ties to front comers of building)
 - Fire hydrant locations
 - Valve locations (from fixed reference points)
 - Utility locations
 - Size and material of water mains
 - Horizontal and vertical alignment of water mains
 - Depth of cover over water mains
 - Location of water mains within easements
- 3. Sewage Force Main Project
 - Horizontal and vertical alignment of force main
 - Size and material of force main
 - Utility locations
 - Special chambers (air release, cleanout)
 - Depth of cover over force main
 - Location of force mains within easements
- 4. Sewage Pumping Station, Sewage Treatment Facilities, Water Booster Station, Water Treatment or Storage Facilities
 - Internal building as-built conditions, including electrical, plumbing, HV AC and mechanical process equipment
 - Survey location, dimensions and elevations of manholes (including rim & invert elevations), buildings (including finished floor elevations), subsurface utilities (including depth), wet wells and chambers (including top slab, inside bottom and pipe centerline elevations),
 - Survey location of site features including paved areas, utility poles, equipment and equipment pads, fence, gates, trees and shrubs.
 - Surveyed as-built topographic features, using same elevation datum used for original plan submission.
 - Location and size of electrical/communication conduits

3.20 EIGHTEEN MONTHS RESPONSIBILITY

Unless specifically superceded by agreement between DEVELOPER or CONTRACTOR and AUTHORITY, it shall be understood that DEVELOPER and CONTRACTOR agrees to furnish such material and appliances, and to construct the whole work in such substantial and workmanlike manner that it shall be continuously stable and efficient, and 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 AUTHORITY, 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.

3.21 EIGHTEEN MONTHS RESPONSIBILITY NOTWITHSTANDING INSPECTION

The acceptance, after inspection by 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).

3.22 DEDICATION

- A. Developers requesting dedication of water and sanitary sewer facilities shall notify the Township in writing of their intent to dedicate facilities.
- B. The following information is required for dedication of DEVELOPER constructed water and sanitary sewer facilities to AUTHORITY:
 - 1. Working Punchlist Prior to final road paving the ENGINEER shall review the condition of the subject facilities and prepare a "Working Punchlist". All testing of water and sewer facilities shall be completed and approved prior to final paving. Final Paving shall not be completed until a working punchlist has been prepared and all facilities within the roadway have been repaired to the satisfaction of ENGINEER.
 - 2. Final Punchlist After final road paving the ENGINEER will prepare a "Final Punchlist". All items on Final Punchlist shall be completed and approved by ENGINEER prior to dedication.
 - 3. Legal Descriptions shall be submitted to AUTHORITY for the following:
 - Land with facilities to be transferred directly to AUTHORITY.
 - Road Right-of-Ways with water and/or sewer facilities.

• Easements with water and/or sewer facilities.

All Legal Descriptions shall have an attached sketch detailing the area described. Sketch shall be 8.5" x 11" or 11" x 17" foldout and shall have described area highlighted. After legal descriptions and sketches are reviewed and approved by ENGINEER, three (3) copies of each (with original seal/signature) shall be submitted to AUTHORITY.

- 4. Record Drawings shall be submitted to an approved by AUTHORITY and ENGINEER. Paper copies, reproducible mylar and digital AutoCADD electronic file shall be provided in accordance with this specification.
- C. Prior to dedication, an audio-videotape of the inside of all sanitary sewer lines shall be submitted to AUTHORITY. Refer to specification section 02734 for detailed requirements.
- D. Prior to dedication, DEVELOPER shall be responsible for completing a leak detection survey in accordance with current AUTHORITY approved methods.
- E. At the time of dedication, a maintenance bond shall be submitted to the AUTHORITY in an amount as specified in the Financial Security Agreement and in a form satisfactory to the AUTHORITY Solicitor.

END OF SECTION

SECTION 01560 EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. CONTRACTOR shall implement and maintain the Soil Erosion and Sedimentation Control Plan prepared for the Project and/or Work.
 - 2. CONTRACTOR shall carry out the construction operations in such a manner that soil erosion and resulting turbid stormwater runoff and sedimentation are minimized.

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 02110 Clearing and Grubbing
 - 2. Section 02170 Stream Crossing
 - 3. Section 02220 Excavation, Backfill and Compaction
 - 4. Section 02229 Rock Removal
 - 5. Section 02300 Boring or Jacking Operations
 - 6. Section 02905 Landscaping

1.03 QUALITY ASSURANCE

- A. Reference Standards: The most current requirements of the following Standards shall govern.
 - 1. Pennsylvania Department of Environmental Protection Soil Erosion and Sedimentation Control Manual, (Chapters 102 and 105).
 - 2. Bucks County Conservation District requirements.
 - 3. Pennsylvania Department of Transportation Publication 408 Specifications.

1.04 JOB CONDITIONS

- A. The associated work activities include but are not limited to the following items:
 - 1. Temporary and permanent measures will have to be undertaken before, during and after construction to control sediment from being carried onto

SECTION 01560 EROSION AND SEDIMENTATION CONTROL

adjoining properties and into swales or watercourses as a result of storm water runoff.

- 2. The use of temporary control devices as shown on the Drawings and as described in these Specifications are for providing the trapping of sediment resulting from construction activities and to reduce the velocities of the temporary storm water courses to minimize erosion.
- 3. The erosion and sediment control devices shall be regularly inspected and maintained throughout the life of this project. These shall include, but are not limited to, temporary sediment basins and traps, stabilized construction entrances, perimeter dikes, perimeter swales and silt fences, as shown on the Drawings or other measures that are required for the construction of the Project and for Work.
- 4. Upon completion of the Project and/or Work, and stabilization of disturbed areas, the temporary devices shall be removed by CONTRACTOR.
- 5. Soil erosion and sedimentation control practices shall be consistent with the procedures outlined in the latest edition of the "Soil Erosion and Sedimentation Control Manual", Commonwealth of Pennsylvania, Department of Environmental Resources.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Silt Fence
 - 1. Section 865, Publication 408 Specifications.
- B. Coarse Aggregate (Stabilized Construction Entrance)
 - 1. AASHTO #1, Table C, Section 703.2, Publication 408 Specifications.
- C. Straw Bales
- D. Temporary Seeding
 - 1. See Section 02905
- E. Permanent Seeding
 - 1. See Section 02905

SECTION 01560 EROSION AND SEDIMENTATION CONTROL

PART 3 – EXECUTION

3.01 TEMPORARY AND PERMANENT CONTROL MEASURES

- A. CONTRACTOR shall implement and maintain the temporary control measures set forth in the Soil Erosion and Sedimentation Control Plan prepared for the Project and/or Work. In addition, CONTRACTOR shall comply with following items:
 - 1. Limit the removal of natural ground cover to the minimum area required for construction.
 - 2. Perform temporary seeding and mulching as soon as possible, within seasonal constraints, of disturbed areas which are expected to remain bare of vegetation for over twenty (20) days until final grading and stabilization can be accomplished. Temporary seeding is covered in Section 02905.
 - 3. Dewatering or pumping out of excavated areas directly into existing storm ditches or natural channels which causes silt deposition, turbidity and/or possible erosion of banks is prohibited. CONTRACTOR must make use of sediment traps, filters, or other methods acceptable to the Resident Project Representative.
 - 4. Excavated material resulting from the installation of off-site utilities shall be completely surrounded by straw bales or completely covered with a plastic sheet during non-work periods.
 - 5. The crossing of a creek or water course is covered In Section 02170 of these Specifications.
 - 6. Perform permanent seeding and mulching of any disturbed areas immediately following final grading of any non-paved areas within seasonal constraints. Seeding is covered in Section 02905.

3.02 FIELD MODIFICATIONS

A. AUTHORITY reserves the right to require modifications to any or all sediment control measures provided in order to establish proper soil erosion and sedimentation control. In addition, any measures recommended or required by the Bucks County Conservation District shall be promptly implemented.

END OF SECTION

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SECTION 02110 CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Clearing
 - 2. Grubbing
 - 3. Stripping and stockpiling topsoil
 - 4. Debris disposal
- B. Definitions:
 - 1. Clearing is defined as the removal of trees, brush, down timber, rotten wood, rubbish, any other vegetation, and objectionable material at or above original ground elevation not designated to be saved. Clearing also includes removal of fences, walls, guard posts, guard rail, signs, and other obstructions interfering with the proposed work.
 - 2. Grubbing is defined as the removal from below the surface of the natural ground of stumps, roots and stubs, brush, organic materials and debris.

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01560 Soil Erosion and Sedimentation Control
 - 2. Section 02220 Excavation, Backfill and Compaction
 - 3. Section 02229 Rock Removal
 - 4. Section 02660 Water Mains
 - 5. Section 02730 Gravity Sanitary Sewer Pipe
 - 6. Section 02732 Sanitary Force Main and Appurtenances
 - 7. Section 02905 Landscaping
 - 8. Section 11306 Sewage Pumping Station

1.03 JOB CONDITIONS

A. CONTRACTOR may clear all obstructions within the permanent and temporary construction easements and within the DEVELOPER'S property as absolutely necessary to perform the construction work. CONTRACTOR shall leave as many trees as possible particularly within the temporary construction easements. Removal of trees shall be coordinated with the Resident Project Representative and the AUTHORITY.
SECTION 02110 CLEARING AND GRUBBING

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Temporary Fencing:
 - 1. Undamaged picket snow fence, 4' high, formed of wooden slats, tightly woven with wire cable.
 - 2. Soil-set fence posts, studded "T" type, 6' high.
- B. Tree Wound Dressing:
 - 1. Antiseptic and waterproof, asphalt base.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Notify ENGINEER at least 48 hours prior to beginning any clearing work.
- B. Protect benchmarks, utilities, existing trees, shrubs and other landscape features designated for preservation with temporary fencing or barricades satisfactory to the Resident Project Representative. No material shall be stored or construction operation carried on within four (4) feet of any tree to be saved or within the tree protection fence.
- C. When a private enclosure fence encroaches on the work area, notify the property owner at least five (5) days in advance of the clearing/grubbing operations to permit the property owner to remove it, construct a supplemental fence, or make such other arrangements as may be necessary for security purposes. Upon failure of the property owner to reasonably proceed with the work required to secure his property, carefully remove the fence, in whole or in part, and neatly pile the materials onto the property owner's property.

3.02 UTILITY RELOCATIONS

- A. Inform all companies, individuals and others owning or controlling facilities or structures within the limits of the work which have to be relocated, adjusted or reconstructed in sufficient time for the utility to organize and perform such work in conjunction with or in advance of CONTRACTOR operations.
- B. Comply with the provisions of Pennsylvania "One Call" Act 287, most current requirements.

SECTION 02110 CLEARING AND GRUBBING

3.03 CLEARING

- A. Confine clearing as required to within the limits of the easements, right-of-ways, and property owner's. Attention is called to Section 02110.1.03.A.
- B. Fell trees in a manner that will avoid damage to trees, shrubs, and other installations which are to be retained.
- C. Where stumps are not required to be grubbed, they shall be flush cut with ground elevation.
- D. In areas of fill or embankment where the depth of fill or embankment is to be 5 feet or more in depth, trees and stumps shall be cut off not more than 6 inches above existing grade. If the fill is to be less than 5 feet, all trees, stumps, roots, brush, root mat and debris shall be removed completely.

3.04 GRUBBING

- A. Grub areas within the construction limits to remove roots and other objectionable material to a minimum depth of 2 feet below the surface.
- B. Remove all stumps within the cleared areas unless otherwise authorized by the Resident Project Representative.
- C. All depressions made as the result of grubbing operations shall be backfilled with suitable material and compacted.

3.05 STRIPPING AND STOCKPILING TOPSOIL

- A. Strip topsoil to whatever depth it may occur from areas to be excavated, filled, or graded and stockpile at a location approved by the Bucks County Conservation District, for use in finish grading.
- B. Topsoil within easements or right-of-ways shall not be used as backfill or removed from the site.

3.06 DEBRIS DISPOSAL

A. Trees, logs, branches, brush, stumps, and other debris resulting from clearing and grubbing operations associated with the Work on the Project site and/or within off-site easements/public right-of-ways shall become the property of CONTRACTOR and shall be disposed of in conformance with all applicable Federal, State and local regulations.

SECTION 02110 CLEARING AND GRUBBING

- B. Debris resulting from the clearing and grubbing work shall not be deposited or buried on the Project site, easements or right-of-ways.
- C. Debris may NOT be burned within Warwick Township limits.

3.07 RESTORATION

- A. Repair all injuries to bark, trunk, limbs, and roots of remaining plants by properly dressing, cutting, tracing and painting, using approved arboricultural practices and materials.
- B. Replace trees, shrubs and plants designated to be saved which are permanently injured or die within one (1) year as a result of construction operations with like species acceptable to the property owner.
- C. Remove protective fences, enclosures and guards upon the completion of the project.
- D. Restore guard posts, guard rail, signs and other interferences to the condition equal to that existing before construction operations.
- E. 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.
- F. If the CONTRACTOR exceeds the clearing limits specified, he shall, if directed, restore areas to their original condition.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Construction of a ductile iron pipe utility line with a concrete encasement at a stream crossing location.
 - 2. Construction of the stream crossing in dry conditions, which includes maintaining the excavation free of water.
 - 3. Restoration of the affected streambed and bank areas to preconstruction conditions.

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01560 Soil Erosion and Sedimentation Control
 - 2. Section 02220 Excavation, Backfill and Compaction
 - 3. Section 02229 Rock Removal
 - 4. Section 02660 Water Mains
 - 5. Section 02730 Gravity Sanitary Sewer Pipe
 - 6. Section 02732 Sanitary Force Main and Appurtenances
 - 7. Section 02905 Landscaping
 - 8. Section 03302 Concrete Work for Utilities
- B. Associated Construction Details:
 - 1. G-2 Concrete Easement
 - 2. G-3 Stream Crossing

1.03 WORK REQUIREMENTS

- A. The Work includes, but is not limited to the following principal items:
 - 1. Construction of a stream diversion structure and the dewatering, maintenance and pumping of the area enclosed thereby for construction of the utility line in dry conditions, to the line and grade shown on the design plans for the Project.
 - 2. When permanent construction is complete within the stream diversion structure, the stream diversion structure shall be removed.

- 3. Prosecution of the Work in such a manner as to avoid depositing any material of any nature in the stream outside the stream diversion structure.
- 4. Providing soil erosion and sedimentation control measures as specified In Section 01560.
- 5. Complying with the stream crossing permit issued by the Bucks County Conservation District or the PA Department of Environmental Protection.
- Β. Unless otherwise specified or authorized, all work or construction that forms a part of the permanent structures shall be done in areas free from water. CONTRACTOR shall construct and maintain the necessary stream diversion structure, channels, sumps, or embankments and similar temporary construction and shall furnish and operate all necessary pumps and other facilities for dewatering and maintaining the various areas of the work free from water as required by the ENGINEER. CONTRACTOR shall, at all times during construction, provide and maintain proper equipment and facilities to promptly remove and properly dispose of all water that may enter the excavation, and keep the excavation dry so as to obtain a satisfactory undisturbed sub grade. Any water pumped from the area to be dewatered which is turbid and/or carrying sediment shall be directed to sediment traps, filters or other methods acceptable to the Resident Project Representative prior to release to the stream. Furthermore, the dewatering operation shall be carried out in such a manner that the discharge does not create an erosion problem in the receiving stream or watercourse. Dewatering operations shall prevent boiling and detrimental under-seepage at the bottom of the excavation. CONTRACTOR shall, on completion of the work, remove the stream diversion structure, equipment, and temporary construction material. Objectionable debris shall be disposed of, and the work area shall be left in a neat and sightly condition to the satisfaction of the Resident Project Representative. Disposal of any material in the stream will not be permitted.
- C. CONTRACTOR shall be fully responsible for the design, safety and adequacy of the stream diversion structure, for the proper construction, handling, placing, maintaining, operating and removing of all items of the stream diversion structure; and for all related services. CONTRACTOR shall be responsible for the maintenance of the area within the stream diversion structure in a dewatered condition until the Resident Project Representative acknowledges that the work has been satisfactorily accomplished and that the stream diversion structure may be flooded and removed. Any and all damage caused by, resulting from, or attributable to the failure, flooding or overtopping of the stream diversion structure shall be repaired or replaced to the satisfaction of the Resident Project Representative by CONTRACTOR and at the expense of CONTRACTOR.
- D. CONTRACTOR shall design, furnish, install, maintain, and operate all necessary pumping and other equipment including electrical facilities, pipe lines, flumes,

collection and sedimentation basins, drainage facilities for constructing and dewatering the various parts of the work and for maintaining the work within the stream diversion structure free from water and as required, after any part of the work is completed, for inspection, safety, or for any reason determined due to weather, labor strikes, power failures, or other circumstances. Adequate diesel or gasoline powered standby pumping units shall be provided by CONTRACTOR for this purpose, including standby reserve, which shall be maintained in firstclass operating condition at all times. CONTRACTOR shall pump all water from the appurtenant works and shall keep the excavation free of water while excavating, preparing the subgrade, and while placing concrete, pipe, fittings, accessories or as otherwise required for completing the work, and shall be entitled to no claim for damages or additional compensation by reason of any amount of water that may leak through, under, or around the stream diversion structure. To help minimize siltation, all water pumped or drained from the stream diversion structure area shall be pumped to a sedimentation basin before being discharged back into the stream. At no time shall water containing sediment be discharged directly into the stream. In the event that the pumps fail for any reason, CONTRACTOR shall be fully responsible for all damage resulting from such failure.

E. CONTRACTOR shall submit literature and/or plans showing his method of construction of the stream diversion structure which shall be submitted for approval before construction can proceed. CONTRACTOR shall at all times maintain the natural flow and water elevations of the stream and shall keep water elevations to normal levels unless weather or high seasonal conditions prevail.

1.04 SUBMITTALS

A. CONTRACTOR shall submit to ENGINEER a detailed Sequence of Construction for each stream crossing including a soil erosion control plan if an alternate other than the recommended sequence of construction as may be noted on the design plans is selected. CONTRACTOR is advised that an alternative sequence of construction may require a review by the Bucks County Conservation District and/or the Pennsylvania Department of Environmental Protection prior to approval and accordingly should submit any alternative sequence of construction at least thirty (30) days before the anticipated start of construction of the stream crossing.

PART 2 – PRODUCT

2.01 MATERIALS

A. The permanent materials to be incorporated in the construction shall be as follows:

- 1. Gravity Sewer Stream Crossings: Concrete encased, mechanical joint, thickness class 50 ductile iron pipe, with cement lining and asphalt coating (interior & exterior). All crossings shall provide a minimum of three (3) feet of cover over the pipe as measured from the stream bed elevation.
- 2. Pressure Pipe Stream Crossings: (water main and sewage pump station force mains) Concrete encased, mechanical joint, thickness class 52 ductile iron pipe, with cement lining and asphalt coating (interior and exterior), Megalug® joint restraints shall be used at all stream crossing fittings.

Notes:

- a) Concrete encasements shall provide a minimum of 6" of concrete cover on all sides of the pipe.
- b) SDR-21 PVC pipe encased in concrete, may be used for pressure pipe stream crossings where the nominal pipe diameter is less than three (3) inches.
- B. The temporary construction materials furnished by CONTRACTOR shall be as shown in the design plans or the shop drawings submitted by CONTRACTOR and approved by the ENGINEER.
- C. Temporary cofferdam shall be as provided by Portadam, Inc. or approved equal.

PART 3 – EXECUTION

3.01 PURPOSE

A. The purpose of the Recommended Sequence of Construction is to provide for construction of each stream crossing in a workmanlike and satisfactory manner while minimizing soil erosion and the resulting sediment load and turbidity downstream during and following construction activities.

3.02 SCHEDULING

- A. The proposed stream crossing(s) should be planned for construction during periods of relatively low stream flow conditions.
- B. Once construction activities associated with a stream crossing have commenced, the work should proceed as expeditiously as practicable to completion in order to minimize the time construction activities are occurring within the stream.

3.03 PROTECTION OF STREAM BANKS DURING CONSTRUCTION

A. Construction activities should be conducted to minimize destruction of trees and vegetation in the immediate vicinity of the stream crossing which assist in stabilizing the stream banks.

3.04 RECOMMENDED SEQUENCE OF CONSTRUCTION

- A. The following sequence of construction is recommended; however, CONTRACTOR may propose an alternate sequence of construction subject to prior approval by ENGINEER.
 - 1. Install and maintain a temporary silt fence along both sides of the stream at the stream crossing location of sufficient length and configuration to serve any tributary areas to be disturbed during the construction activities.
 - 2. Divert the stream flow around or through the stream crossing construction location by means of a temporary flume or pipe(s) and a sand bag diversion structure in accordance with Construction Detail G-3. An earthen diversion shall not be used. The flume or pipe(s) shall have ample capacity to convey the normal stream flow. The sandbag diversion structure should have sufficient freeboard to protect against the entry of stream water resulting from normal rainfall and must provide a sufficient area to allow for construction activities. Any stream water seepage to be removed during construction must be pumped to an onshore sedimentation pond or equivalent for removal of sediment prior to release to the stream.
 - 3. Excavate the proposed trench for the utility line within the sandbagged area to a point approximately ten (10) feet beyond the normal edge of stream, install the utility line as shown on the design plans, and pour the required concrete encasement in accordance with Construction Detail G-2.
 - 4. After the concrete has cured for 24 hours, carefully backfill the trench. Rock removed from the excavation of the trench shall be used to create the new stream bed which should be at the approximate elevation prior to construction. Placement of rock shall continue to a short distance beyond the normal edge of water.
 - 5. Remove the temporary flume or pipe(s) and the sandbag diversion structure thereby allowing the stream flow to return to the stream channel.
 - 6. Install a temporary silt fence near the edge of the stream on both sides across the backfilled trench area which becomes a part of the temporary silt fence under Item 1.

- 7. Following installation, conduct necessary grading to restore stream banks to prior condition, provide topsoil and seed all disturbed areas in the vicinity of the stream consistent with seasonal constraints.
- 8. Remove the temporary silt fences once stabilization of the trench area and stream banks has been achieved.
- B. For a crossing involving a larger stream, a temporary cofferdam system may be employed in which case the crossing procedure would occur in two (2) separate stages still incorporating all relevant steps of the above noted sequence of construction.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. Excavation, backfill and compaction associated with utility construction, including such related features as protection of adjacent utilities and structures, maintenance and protection of traffic, cutting paved surfaces, blasting, support of excavation, control of excavated materials, dewatering, pipe bedding, disposal of excavated materials, rough grading and restoration.
- B. Excavation, backfill and compaction associated with construction or installation of structures including such related features as protection of adjacent utilities and structures, blasting, support of excavation, control of excavated materials, dewatering, structure bedding, disposal of excavated material, rough grading and restoration.

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01560 Soil Erosion and Sedimentation Control
 - 2. Section 02110 Clearing and Grubbing
 - 3. Section 02170 Stream Crossing
 - 4. Section 02229 Rock Removal
 - 5. Section 02300 Boring and Jacking Operations
 - 6. Section 02575 Restoration of Paved Surfaces
 - 7. Section 02660 Water Mains
 - 8. Section 02663 Water Service Connections
 - 9. Section 02730 Gravity Sanitary Sewer Pipe
 - 10. Section 02731 Sanitary Manholes
 - 11. Section 02732 Sanitary Force Main and Appurtenances
 - 12. Section 02905 Landscaping
 - 13. Section 03302 Concrete Work for Utilities
 - 14. Section 11306 Sewage Pumping Station
- B. Associated Construction Details
 - 1. G-1 Pipe Embedment
 - 2. G-2 Concrete Encasement
 - 3. G-3 Stream Crossing
 - 4. G-5 Temporary Pavement for Township Road and State Highway
 - 5. G-6 Permanent Pavement and Trench Restoration for Township Road
 - 6. G-7 Trench Restoration for Unimproved Shoulder of Township Road or Easement

- 7. G-8 Permanent Pavement and Trench Restoration for State Highway
- 8. G-9 Trench Restoration for Stabilized Shoulder of State Highway
- 9. G-10 Trench Restoration for Unimproved Shoulder of State Highway (≤ 3' from edge of pavement)
- 10. G-11 Trench Restoration in Lawn and Field Areas

1.03 QUALITY ASSURANCE

- A. Testing Agent:
 - 1. Compaction testing for this Work shall be performed by and at the discretion of the ENGINEER except if required by the PennDOT Highway Occupancy Permit or Township Road Opening Permit. Where compaction testing is required by permit, such compaction testing shall be performed by a soils testing agent engaged and paid for by CONTRACTOR and approved by AUTHORITY.
- B. Reference Standards:
 - 1. Pennsylvania Department of Transportation

Regulations Governing Occupancy of Highways by Utilities (67 PA Code, Chapter 459)

Publication 408 Specifications Pennsylvania Test Method, PTM 106 Pennsylvania Test Method, PTM 402 Publication 203, Work Zone Traffic Control

2. American Society for Testing and Materials (ASTM):

ASTM E1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3)

ASTM D2922 Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

- C. Compaction Testing:
 - 1. Conduct compaction tests at locations during backfilling operations as required by the PennDOT Highway Occupancy Permit or Township Road Opening Permit.

- 2. Determine compaction in state highways and shoulders by the testing procedure contained in Pennsylvania Test Method, PTM 106, Method B or PTM 402 or as noted in the PennDOT Highway Occupancy Permit.
- 3. Determine compaction in areas other than state highways and shoulders by the testing procedure contained in ASTM 02922 based on previously determined compaction curve data as established by ASTM 01557.

1.04 SUBMITTALS

- A. Certificates:
 - 1. Submit certification attesting that the composition analysis of pipe embedment and select material stone backfill materials meet specification requirements.
 - 2. Submit certified compaction testing results from the soils testing agency for any required compaction testing.

1.05 JOB CONDITIONS

- A. Rock Excavation:
 - 1. See Section 02229 relative to rock removal.
- B. Compaction of Backfill:
 - 1. Excavations shall be backfilled in layers which are individually compacted.
 - 2. The following compaction densities (based on modified Proctor Curve) shall be achieved:

Building Foundation and Structural Slab-on Grade: 95%

Exterior Side of Structure Walls: 95% to a point 5' from building wall, then 90%

Trench Backfill and Fill under Asphalt Pavement: 95% (not including base course materials)

Trench Backfill within unpaved areas: 90%

- 3. CONTRACTOR shall maintain optimum moisture content of backfill materials to attain the required compaction density.
- C. Control of Traffic:
 - 1. Employ traffic control measures in accordance with Pennsylvania Department of Transportation Publication 203, "Work Zone Traffic Control".
 - 2. See Section 01000.1.11 on Traffic Control.
- D. Protection of Existing Utilities and Structures:
 - 1. Take all precautions and utilize all facilities required to protect existing utilities and structures. In compliance with Act 172 of the General Assembly of Pennsylvania, advise each Utility at least three (3) working days in advance of intent to excavate, do demolition work or use explosives and give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.
 - 2. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.
 - 3. Immediately report to the Utility and the Resident Project Representative any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
 - 4. Provide access by Utility personnel at all times for purposes of maintenance, repair and inspection.

PART 2 – PRODUCTS

2.01 PIPE BEDDING OR EMBEDMENT MATERIAL

- A. PVC Pipe:
 - 1. AASHTO No.8 (former PennDOT No. 1B) coarse aggregate, Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.
- B. Ductile Iron Pipe:

- 1. PennDOT Select Granular Material (2RC), Section 703.3, Publication 408 Specifications (required for State Highways); PennDOT No. 2A coarse aggregate, Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.
- C. Copper Service Line:
 - 1. Screenings or PennDOT Fine Aggregate, Type B Bituminous Concrete Sand #3, Section 703.1, Publication 408 Specifications. Do not use slag or cinders.

2.02 SLAB OR BASE MATERIAL

- A. Concrete Slab or Precast Base:
 - 1. PennDOT No. 2A coarse aggregate, Table C, Section 703.2, Publication 408 Specifications.

2.03 BACKFILL MATERIAL

- A. State Highways, Shoulders and Rights of Way
 - 1. From top of pipe bedding or embedment material to subgrade elevation: PennDOT 2A modified, Section 703.2, Publication 408 Specifications, or in accordance with PennDOT Highway Occupancy Permit requirements.
- B. Existing Township Streets, Parking Areas and Driveways (All Paved Surfaces):
 - 1. From top of pipe bedding or embedment material to subgrade elevation: Same as for State Highways and Shoulders or PennDOT No. 2A modified, Section 703.2, Publication 408 Specifications.
- C. New Township Streets, Parking Areas and Driveways (All Paved Surfaces):
 - 1. From top of pipe bedding or embedment material to 12" over top of pipe: Use PennDOT 2A modified stone.
 - 2. From top of pipe embedment or 12" over top of pipe to subgrade elevation: Excavated material may be used if free of stones larger than 8" in size and free of wet, frozen, or organic materials.
- D. Unimproved Areas:

- 1. From top of pipe bedding to 12" over top of pipe: PennDOT 2A modified stone.
- 2. From top of pipe embedment or 12" over top of pipe to sub grade elevation: Excavated material if free of boulders or stones larger than 6" in size, frozen lumps, debris (bricks, masonry batts, plaster, etc.), vegetation or other organic or foreign material.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Notify ENGINEER of unexpected subsurface conditions and discontinue work in area until notified to resume work.
- C. Maintain and protect existing utilities identified by utility users within the Work area (See Section 02220.1.05.D).
- D. Verify that structure walls are braced to support surcharge forces imposed by backfilling operations.

3.02 PROTECTION OF ADJACENT WORK

- A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.
- B. Grade excavation top perimeter to prevent surface water runoff into excavation or to adjacent properties.

3.03 MAINTENANCE AND PROTECTION OF TRAFFIC

- A. Coordinate the work to insure the least inconvenience to traffic and maintain traffic in one or more unobstructed lanes unless closing the roadway is authorized.
- B. Maintain access to all streets and private drives.
- C. Provide and maintain signs, flashing warning lights, barricades, markers, and other protective devices as required to conform with construction operations and to keep traffic flowing with minimum restrictions.
- D. Comply with State and Warwick Township codes, permits and regulations.

E. See Section 01000.1.11 on Traffic Control.

3.04 CUTTING PAVED SURFACES

- A. Where installation of pipelines, structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the edge of the excavation. Cut offsets at right angles to the edge of the excavation.
- B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.
- C. The requirement for neat line cuts, in other than state highways, may be waived if the final paving restoration indicates overlay beyond the width of the excavation.

3.05 EXCAVATION

- A. Depth of Excavation:
 - 1. Gravity Pipelines:
 - a. Excavate trenches to the depth and grade shown on the profile drawings for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.
 - b. Excavation for laterals to shallow sewers shall provide a straight uniform grade from the main pipeline to the required elevation at the right-of-way line, plus that excavation necessary for placement of pipe bedding material.
 - c. Excavation for laterals to deep sewers shall provide a straight grade at 45° from horizontal from the main pipeline to the required elevation, then continuing at a straight uniform grade to the required elevation at the right-of-way line, plus the excavation necessary for placement of pipe bedding material.
 - 2. Pressure Pipelines:
 - a. Excavate trenches to the minimum depth necessary to place required pipe bedding material and to provide four (4) feet from the top of the pipe to the finished ground elevation, except where specific depths are otherwise shown on the design plans.
 - 3. Structures:

- a. Excavate to the minimum depth necessary to install footings, concrete slab or precast base plus that excavation necessary to place the required base material as shown on the design plans.
- 4. Where unsuitable bearing material including shattered rock due to drilling or blasting operations is encountered in the bottom of the excavation, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete/concrete cradle can be placed. If no concrete/concrete cradle is to be installed, refill the excavation to required grade with pipe bedding/embedment or slab/base material as appropriate.
- 5. Where CONTRACTOR, by error or intent, excavates beyond the minimum required depth, backfill the excavation to the required depth with pipe bedding/embedment or slab/base material as appropriate.
- B. Width of Excavation:
 - 1. Gravity and Pressure Pipelines:
 - a. Excavate trenches, including laterals, to a width necessary for placement and jointing of the pipe, and for placing and compacting pipe embedment under, around and over the pipe, but not less than 6" or more than 8" on each side of the pipe.
 - b. Shape trench walls completely vertical from trench bottom to at least two (2) feet above the top of the pipe.
 - c. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.
 - 2. Structures:
 - a. Excavate to the minimum distance necessary for placement/installation of the footings, concrete slab, walls or prefabricated structures and to permit proper backfill procedures to be performed.
- C. Length of Open Trench:
 - 1. Do not advance trenching operations more than 200' ahead of completed pipeline provided the PennDOT Highway Occupancy Permit and/or

Township road opening permit does not impose a more restrictive requirement.

3.06 SUPPORT OF EXCAVATION

- A. Support excavations with sheeting, shoring, and bracing or in the case of pipeline construction, a "trench box" as required to comply with Federal and State laws and OSHA requirements.
- B. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of CONTRACTOR in any other manner, shall be repaired at CONTRACTOR's expense.
- C. Withdraw shoring, bracing, and sheeting as backfilling proceeds unless otherwise directed by the Resident Project Representative.
- D. The neglect, failure or refusal of the Resident Project Representative to order the use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to order sheeting, bracing, struts, or shoring to be left in place, or the giving or failure to give orders or directions as to the manner or methods of placing or driving sheetings, bracing, jacks, wales, stringers, etc., shall not in any way or to any extent relieve CONTRACTOR of any responsibility concerning the condition of excavation or of any of his obligations under the Contract, nor shall any delay, whether caused by any action or want of action on the part of CONTRACTOR, or by any act of AUTHORITY and ENGINEER or their agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve CONTRACTOR from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of their obligations relating to injury of persons or property.

3.07 CONTROL OF EXCAVATED MATERIAL

- A. Keep the ground surface, within a minimum of 2 foot of the sides of the excavation free of excavated material.
- B. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.
- C. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural water courses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the Work.

D. In areas where excavations parallel or cross streams, ensure that no material slides or ashes are dumped into the stream course. Remove diversion structures and/or cofferdams immediately upon completion of construction within the stream. (See Section 02170 – Stream Crossing).

3.08 DEWATERING

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- B. Maintain pipe trenches dry until pipe has been joined, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- D. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control. (See Section 01560 Erosion and Sedimentation Control).

3.09 PIPE LAYING

- A. Provide required pipe bedding placed in accordance with Construction Detail G- I and these Specifications (Section 02220.2.01). A minimum bedding of 6" shall be provided.
- B. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.
- C. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

3.10 STRUCTURE PLACEMENT/INSTALLATION

A. Provide required base material in accordance with the design plans and Specifications (Section 02220.2.2).

3.11 BACKFILLING EXCAVATIONS

A. Pipeline Trench:

After pipe installation and inspection, provide material to complete the pipe embedment in accordance with Construction Detail G-1 and these Specifications.

The following bedding or embedment requirements using the material noted In Section 02220.2.1 shall apply:

- 1. Water Mains: pipe bedding to 12 inches over top of pipe.
- 2. Sanitary Sewers, Laterals and Force Mains (PVC): pipe embedment to 12" above the crown of the pipe.
- 3. Sanitary Sewers, Laterals, and Force Mains (DIP); pipe bedding to invert of pipe.
- 4. Copper Service Lines: pipe embedment to 1" above the crown of the pipe.

The material shall be hand placed and carefully compacted with handoperated mechanical tampers in layers of suitable thickness to provide specified compaction around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material in accordance with Construction Details G-5 through G- 11 and any relevant permit conditions. Employ a placement method so not to disturb or damage the utility line in the trench. Use of a Hydra-hammer or jumpingjack type compaction device is not permitted. A vibratory plate type compaction device is acceptable. Any settlement which occurs because of consolidation of the backfill during the construction period or during the maintenance period as stipulated by DEVELOPER's Agreement with AUTHORITY shall be corrected by DEVELOPER.

B. Structure Excavation:

After structure installation and inspection, backfill the excavation with specified backfill material. Employ a placement method so not to disturb or damage foundation perimeter drainage, foundation damp proofing or water proofing and protective cover or utility lines. Backfill against supported foundation walls; backfill simultaneously on each side of unsupported foundation walls. Pipelines entering the structure must be provided with the specified bedding material hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified compaction around and under the haunches of the pipe. Use of a Hydra-hammer or jumping-jack type compaction device is acceptable. Any settlement which occurs because of consolidation of the backfill during the construction period or during the maintenance period as stipulated by

DEVELOPER's Agreement with AUTHORITY shall be corrected by DEVELOPER.

- C. Lift Thickness Limitations:
 - 1. Lift thicknesses shall be limited to four (4) inches for pipe embedment, eight (8) inches maximum for pipeline trenches within paved areas and twelve (12) inches maximum for pipeline trenches in non-paved areas and for structure excavations. Lift thicknesses shall also comply with requirements proposed by any PennDOT Highway Occupancy Permit. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations for the compaction equipment to be utilized. Compaction equipment shall not be used over the pipe until sufficient backfill has been placed to insure that such equipment will not damage or disturb the pipe.
 - 2. Lift thickness limitations specified for State highways, shoulders, or embankments govern over the compaction equipment manufacturer's recommendations.
- D. Unsuitable Backfill Material:
 - 1. Where the Resident Project Representative deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with suitable backfill material.

3.12 COMPACTION REQUIREMENTS

- A. Trench backfill compaction, shall be 95% of Standard Proctor, for the backfill material used.
- B. Structure sub grade compaction, shall be 100% of modified Proctor, for the backfill material being used.
- C. Structure backfill compaction, shall be 95% of Standard Proctor, for the backfill material being used.

3.13 DISPOSAL OF EXCAVATED MATERIAL

A. Excavated material remaining after completion of backfilling shall remain the property of CONTRACTOR, removed from the construction area, and disposed of legally.

3.14 ROUGH AND FINE GRADING

- A. Grade areas disturbed by construction to a uniform finish. Form the bases for terraces, banks, lawns and paved areas.
- B. Grade areas to be paved to depths required for placing subbase and paving materials. Top surface of exposed subgrade to be plus or minus one inch.
- C. Grade areas to be top soiled and seeded to 4" below indicated finish contours.
- D. Slope grade away from structures at a minimum 2 inches in 10 feet unless otherwise noted on design plans.

3.15 RESTORATION OF UNPAVED SURFACES

- A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.
- B. Restore grassed areas in accordance with Section 02905 Landscaping.

3.16 RESTORATION OF PAVED SURFACES

A. See Section 02575 - Restoration of Paved Surfaces.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Removal of rock during excavation.
 - 2. Mechanical methods and explosive methods to assist rock removal.

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01000 Basic Requirements: Blasting Requirements
 - 2. Section 02220 Excavation, Backfill and Compaction
 - 3. Section 02300 Boring and Jacking Operations

1.03 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. National Fire Protection Association (NFPA):

NFP A 495 - Explosive Materials Code

2. PA Department of Environmental Protection

Title 25, Chapter 210, Blaster's Licenses; Chapter 211 Storage, Handling and Use of Explosives.

- B. Seismic Monitoring Firm: Company specializing in seismic surveys with five (5) years documented experience.
- C. Explosives Firm: Company specializing in explosives for disintegration of rock, with five (5) years documented experience. All blasting shall be performed by or under the supervision of an individual with a valid Commonwealth of Pennsylvania blaster's license.

1.04 DEFINITIONS

A. Rock: Solid mineral material, with a volume in excess of ½ cubic yard or material that cannot be removed with a "Trac-Hoe" style machine with a minimum manufacturers operating weight of 41,000 pounds, a 1.5 cubic yard capacity

bucket equipped with rock teeth, (without use of drilling and wedging, blasting, and/or mechanical surface impact equipment).

1.05 REGULATORY REQUIREMENTS

- A. Conform to "Regulations for the Storage, Handling and Use of Explosives" of the Pennsylvania Department of Labor and Industry; and to NFPA 495 for handling explosive materials.
- B. Obtain permit from the Township Fire Marshal's Office including submission of a bond or insurance certificate before explosives are brought to site or drilling is started. Comply with all permit conditions including timely notifications to all required agencies/officials. Comply with Township Fire Prevention Code (BOCA 1990) and accumulative supplement Article 26 (Sections F2600-2607 and F106). Blasting will be permitted only after securing the written permission of the Township and after securing required blasting permits, insurance and bonds.
- C. Obtain approval from PennDOT relative to any predrilling within the State highway right-of-way. If blasting will be necessary within the State highway right-of-way, DEVELOPER/CONTRACTOR will submit the necessary application to PennDOT to blast along with any required insurance for public liability and property damage and/or blasting bond.
- D. Obtain a permit from the Pennsylvania Fish and Boat Commission relative to blasting in a water course or body of water.

1.06 PROJECT CONDITIONS

- A. DEVELOPER/CONTRACTOR shall advise owners of adjacent buildings or structures in writing, prior to performing any blasting operations to explain planned blasting operations, and pre-blast survey.
- B. Conduct a pre-blasting survey and document conditions of buildings within 250 feet of the trench or site requiring rock removal, prior to blasting, in order to assess, record and photograph existing structural conditions (interior and exterior) identifying existing irregularities. The CONTRACTOR shall perform a preconstruction audio-video and submit a copy of the videotape to the AUTHORITY prior to commencing Work.
- C. Monitor water supply wells for water level along with samples for total coliform organisms and turbidity. Monitoring and sample results from the water supply wells and structural observations of buildings shall be immediately forwarded to AUTHORITY and ENGINEER at least one week prior to the start of blasting.

- D. Store all explosives in a secure and safe manner in strict conformance to all State and Warwick Township regulations; storage locations shall be clearly marked "DANGEROUS EXPLOSIVES". and shall be in care of a competent watchman at all times. In no case shall caps or other detonators be stored or transported with explosives. Explosives shall be kept on the site only in such quantities as anticipated to be required for the Project and only during the time when being used.
- E. Rock excavation within ten (10) feet of underground utilities or structures shall be done by hand or with light charges of explosives with exercise of utmost care to avoid disturbance. AUTHORITY reserves the right to direct that rock be removed by methods other than blasting in such cases
- F. No blasting shall be performed within 50 feet of the utility lines being constructed as part of the Work or for a period of at least 48 hours after concrete has been placed within 100 feet of the blasting operation.
- G. Special care shall be exercised in areas where high tension power lines are located.
- H. Paving shall be pre-cut before blasting within roads to prevent paving from heaving beyond normal trench width.
- I. No blasting shall be done within 40 feet of a newly laid sewer.

1.07 PRECONSTRUCTION VIDEOTAPING REQUIREMENTS FOR BLASTING

- A. Taped coverage shall include all surface features located within 250 feet of the blasting area and supported by appropriate audio description. Also 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. Taping shall be performed twice to record "before" and "after" blasting conditions.
- B. Taping of a structure shall commence with a 360 degree pan of the exterior with the building address displayed. To maintain viewer orientation and taping integrity, the camera shall run continuously as taping proceeds from exterior view to inside taping. The electrographer shall pan and zoom in and out to control sufficiently to clarify of the objects being viewed, and will not exceed a rate of more than two (2") inches per second on telephone 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 electrographer 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 be CONTRACTOR be allowed to use any electrical circuits within the building structure in order to protect the electrical circuits from overloading. All videotaping 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 taping house. The CONTRACTOR must enter and leave property in a professional and orderly workmanship-like manner.

1.08 SCHEDULING

- A. Schedule Work under the provisions of Section 01000.1.13 concerning the submittal for a Construction Progress Schedule.
- B. Schedule Work to avoid disruption to occupied buildings nearby.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Explosives: Type recommended by explosives firm.
- B. Delay Device: Type recommended by explosives firm.
- C. Blast Mat Materials: Type recommended by explosives firm.
- D. Mechanical Disintegration Compound: Grout mix of materials that expand on curing.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify site conditions and note subsurface irregularities affecting Work of this Section.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.03 ROCK REMOVAL BY A MECHANICAL METHOD

- A. Excavate and remove rock by the mechanical method.
- B. Drill holes and utilize expansive tools, wedges, and/or mechanical disintegration compound to fracture rock.
- C. Cut away rock at bottom of excavation to form level bearing.
- D. Remove shaled layers to provide sound and unshattered base for footings and foundations.
- E. In utility trenches, excavate to 6 inches below invert elevation of pipe and 12-16 inches wider than pipe outside diameter (minimum 6 inches on each side).
- F. Shattered or fractured rock may be allowed by AUTHORITY as trench backfill where native backfill material is permitted provided that the size requirement in Section 02220.2.3 is achieved. Otherwise, excavated rock must be removed from site.
- G. Correct unrequired rock removal in accordance with the requirements of Section 02220.

3.04 ROCK REMOVAL BY EXPLOSIVE METHODS

- A. If rock is uncovered requiring the explosives method for rock disintegration, notify ENGINEER and execute as follows.
- B. Provide seismographic monitoring during progress of blasting operations. Keep and submit to AUTHORITY upon request an accurate record of each blast which includes the general location of the blast, the depth and number of drill holes, .the kind and quantity of explosive used, particle velocity and displacement, decibels, and other data as required for a complete record.
- C. Drill blasting holes, prepare blasting charges and cover area with blasting mats.
- D. Perform blasting to disintegrate rock and remove from excavation. Use such quantities and strengths of explosives and perform blasting in such manner as will break the rock approximately to the desired lines and grades, yet will leave rock not requiring excavation in an unshattered condition.

- E. Remove rock at excavation bottom to form level bearing.
- F. Remove shaled layers to provide a sound and unshattered base for footings, foundations, and utility construction.
- G. Inutility trenches, excavate to 6 inches below invert elevation of pipe and 12-16 inches wider than pipe outside diameter (minimum 6 inches on each side).
- H. Shattered or fractured rock may be allowed by AUTHORITY as trench backfill where native backfill material is permitted provided that the size requirement is in Section 02220.2.3 is achieved. Otherwise, excavated rock must be removed from site.
- I. Correct unrequired rock removal in accordance with the requirements of Section 02220.
- J. Repair any damage from blasting operations including damaged paving beyond trench width.

3.05 FIELD QUALITY CONTROL

A. CONTRACTOR shall provide for visual inspection by the ENGINEER, trench bottoms, foundation bearing surfaces and cavities formed by removed rock prior to further construction.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of this section describes CONTRACTOR's Responsibilities Associated with Erosion and Sedimentation Control as well as noise and dust control:
 - 1. CONTRACTOR shall implement and maintain the Soil Erosion and Sedimentation Control Plan prepared for the Project and/or Work.
 - 2. CONTRACTOR shall carry out the construction operations in such a manner that soil erosion and resulting turbid storrnwater runoff and sedimentation are minimized.
 - 3. CONTRACTOR shall use dust control applications and minimize noise levels adjacent to inhabited areas, on roadways and where directed by ENGINEER or AUTHORITY.

1.02 RELATED INFORMATION

- A. Related Work Specified Elsewhere:
 - 1. Section 02110: Clearing and Grubbing
 - 2. Section 02170: Stream Crossing
 - 3. Section 02220: Excavation, Backfill and Compaction
 - 4. Section 02229: Rock Removal
 - 5. Section 02300: Boring or Jacking Operations
 - 6. Section 02905: Landscaping

1.03 QUALITY ASSURANCE

- A. Reference Standards: The most current requirements of the following Standards shall govern.
 - 1. Pennsylvania Department of Environmental Protection Erosion and Sediment Pollution Control Manual, March 2000 or latest Revision (Chapters 102 and 105).
 - 2. Bucks County Conservation District requirements.
 - 3. Pennsylvania Department of Transportation Publication 408 Specifications, latest Edition.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Silt Fence
 - 1. Type B, Class 3 as described In Section 735 of PennDOT, Publication 408 Specifications, latest Edition.
- B. Coarse Aggregate (Stabilized Construction Entrance)
 - 1. AASHTO #1, Table C, Section 703.2, Publication 408 Specifications.
- C. Stabilized Fabric
 - 1. Type A, Class 2 geotextile fabric as described In Section 735 of PennDOT, Publication 408 Specifications, latest Edition.
- D. Straw Bales
- E. Temporary Seeding
 - 1. See Section 02905
- F. Permanent Seeding
 - 1. See Section 02905
- G. The jute matting for stream bank stabilization shall be of heavyweight or approved yarn type material with a plain weave mesh having a 0.5" to 1" square opening and weighing a minimum of 14 ounces per square yard.
- H. Calcium chloride shall be as described in Section 721 of PennDOT Publication 408, latest Edition.

PART 3 – EXECUTION

3.01 GENERAL PROCEDURES

A. All work shall conform to the Bucks County Conservation District approval requirements and to the Pennsylvania Department of Environmental Protection (PA DEP) regulations.

- B. CONTRACTOR is responsible for providing and maintaining effective temporary erosion and sediment control measures during construction or until final controls become effective.
- C. CONTRACTOR shall exercise care to preserve the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work area. CONTRACTOR shall restore, all areas unnecessarily destroyed, scarred or defaced.
- D. Construction shall not impair surface drainage, constitute a potential erosion hazard, or act as a source of sedimentation to any adjacent property or watercourse.
- E. 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 CONTRACTOR's work.
- F. CONTRACTOR shall ensure that noise levels and dust are maintained within acceptable limits when working adjacent to inhabited areas and on roadways, as described herein. Acceptable limits shall be as defined by ENGINEER, and as specified in this section.
- G. If and when it becomes necessary, the AUTHORITY will inform CONTRACTOR of unsatisfactory construction procedures and operations insofar as dust control, erosion control, noise control, and water pollution are concerned. If the unsatisfactory construction procedures and operations are not corrected promptly, AUTHORITY may suspend the performance of the construction until the unsatisfactory condition has been corrected.

3.02 EROSION, SEDIMENT AND DUST CONTROLS

- A. CONTRACTOR shall schedule and conduct operations to minimize erosion of soils and to prevent silting and muddying of 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.
- B. Prior to the suspension of construction operations, if required, CONTRACTOR shall shape the earthwork in a manner that will allow a minimum of erosion from storm runoff. Temporary erosion and sediment control measures such as berms, dikes, slope drains, or sedimentation basins deemed necessary by ENGINEER

shall be provided and maintained until permanent facilities are completed and operative.

- C. CONTRACTOR shall provide sedimentation basins, filter fabric sedimentation collectors or other approved methods for the filtering of water pumped from cofferdams and/or trenches at the locations designated by ENGINEER. It shall be CONTRACTOR's responsibility to conform to the DEP "Erosion and Sediment Pollution Control Program Manual," March 2000.
- D. CONTRACTOR shall use dust control applications when required in disturbed areas and by ENGINEER. Dust control shall be accomplished by spraying water on the surface of the disturbed ground or roadway, or by the use of calcium chloride or by other method, as approved by ENGINEER.

3.03 EROSION AND SEDIMENT CONTROL PROCEDURES

- A. Schedule: The general erosion and sedimentation control schedule shall be as follows:
 - 1. Install stabilized construction entrances, silt fences, sediment traps, hay bales, stone filters, and sedimentation traps or basins, as required by the Drawings.
 - 2. Excavate trench, install piping, and backfill trench.
 - 3. Excavate and install structures, and backfill.
 - 4. Restore existing grades and temporarily stabilize.
 - 5. Remove stabilized construction entrances and sedimentation traps or basins, restore disturbed areas, and permanently stabilize.
 - 6. Remove silt fences, hay bales, and stone filters.
- B. When borrow material is obtained from other than commercially operated sources, erosion of the borrow site shall be controlled both during and after completion of the work such that erosion will be minimized and sediment will not enter streams or other bodies of water. Waste or disposal areas and construction roads shall be located and constructed in a manner that will keep sediment from entering the streams.
- C. Siltation control shall be provided during construction, and bank stabilization shall be undertaken by planting of grasses, shrubbery, or trees immediately after completion of each phase of the project.

- D. When work areas or gravel pits are located in or adjacent to live streams, such areas shall be separated from the main streams by a dike or other barrier to keep sediment from entering a flowing stream. Care shall be taken during the construction and removal of such barriers to minimize the muddying of a stream.
- E. All waterways shall be promptly cleared of false work, piling, debris, temporary stream crossings, stone and earth berms, or other obstructions placed during construction operations and not a part of the finished work. All removed materials shall be hauled to approved locations for disposal. No materials shall be deposited on floodplains or wetlands.
- F. Water from aggregate washing or other operations containing sediment shall be treated by filtration, a settling basin or other means sufficient to reduce the sediment content to not more than that of the stream into which it is discharged.
- G. Pollutants such as fuels, lubricants, bitumens, raw sewage and other harmful materials shall not be discharged into or near rivers, streams, and impoundments or into natural or manmade channels leading thereto. Wash water to waste from concrete mixing operations shall not be allowed to enter live streams.
- H. Erosion and sedimentation control practices including installation of silt fences shall be consistent with procedures outlined in "Erosion and Sediment Pollution Control Program Manual", Commonwealth of Pennsylvania, Department of Environmental Protection Bureau of Water Quality Protection - dated March 2000 or latest edition.
- I. Should any of the temporary or permanent erosion and sediment control measures employed by CONTRACTOR fail to produce results which comply with the requirements of the Commonwealth of Pennsylvania and local agencies, CONTRACTOR shall immediately take whatever steps are necessary to correct the deficiency at his own expense.
- J. CONTRACTOR shall clean sedimentation facilities and dispose of accumulated material as specified in Section 02220 for excess material. It shall be CONTRACTOR's responsibility to ensure sedimentation facilities perform as intended and are maintained to handle required capacity. Sediment shall at no time be permitted to accumulate in sedimentation basins to a depth sufficient to limit storage capacity or interfere with the settling efficiency thereof. The sediment removed shall be handled and disposed of in a manner that will not create pollution problems and so that every reasonable and practical precaution is taken to prevent the said material from reaching the Waters of the Commonwealth.

- K. Remove all temporary erosion and sedimentation controls as soon as final grading is completed and permanent seeding and landscaping are established.
- L. Any area that is disturbed and is to be left bare for 20 days or more shall have a temporary seeding applied or other approved interim stabilization. If construction takes place during the winter months when it is impossible to seed, the disturbed area shall be mulched. Temporary seeding and mulching shall be done within 14 days after the area is disturbed.
- M. 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 initial conditions or improved as required by the Owner.
- N. Dust control shall be applied when required in disturbed areas, by spraying water on the surface of the disturbed ground or roadway or by other methods as approved.
- O. Stabilized construction entrances shall be placed at all construction access points from roadways to the construction site.
 - 1. Ballast shall be replenished when choked with mud from construction traffic.
 - 2. Install stabilization fabric underneath ballast for construction entrances with a minimum of two (2) feet of overlap.
 - 3. Wheel loading will not be permitted until stone is placed.

3.04 NOISE CONTROL

- A. CONTRACTOR shall provide adequate silencers or noise baffles on equipment so that noise levels measured at nearest property line are less than 50 dB. Additional noise baffles or silencer changeouts shall be used by CONTRACTOR to reduce equipment noise to levels that will meet this requirement. ENGINEER will use noise-measuring equipment to determine the actual decibel levels at points selected by ENGINEER. The decibel readings obtained by ENGINEER shall be accepted by CONTRACTOR. All noise abatement facilities shall be removed on completion of construction.
- B. If required by ENGINEER, CONTRACTOR shall, within twenty-four (24) hours of notice, either shut down and remove his equipment or provide adequate noise abatement. If the unsatisfactory condition persists, AUTHORITY may suspend performance of construction until the condition is corrected.

3.05 FIELD MODIFICATIONS

A. AUTHORITY reserves the right to require modifications to any or all sediment control measures provided in order to establish proper soil erosion and sedimentation control. In addition, any measures recommended or required by the Bucks County Conservation District shall be promptly implemented.

END OF SECTION

SECTION 02300 BORING AND JACKING OPERATIONS

PART I-GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Approach trench excavation
 - 2. Installation of casing pipe or liner
 - 3. Installation of carrier pipe

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 02220 Excavation, Backfill and Compaction
 - 2. Section 02660 Water Mains
 - 3. Section 02730 Gravity Sanitary Sewer Pipe
 - 4. Section 03302 Concrete Work for Utilities
- B. Associated Construction Details:
 - 1. G-4 Casing and Carrier Pipe Arrangement

1.03 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):

A139 Specification for Electric-Fusion (ARC) -Welded Steel Pipe (NPS4 and Over)

A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

C32 Specification for Sewer and Manhole Brick (made from Clay or Shale) C 150 Specification for Portland Cement C270 Specification for Mortar for Unit Masonry

- 2. Pennsylvania Department of Transportation: Publication 408 Specifications
- B. CONTRACTOR Qualifications:
- 1. Construction operations shall be undertaken only by a CONTRACTOR well experienced in operations of similar magnitude and conditions under transportation arteries and surface areas which cannot be disturbed.
- C. Design Criteria:
 - 1. Pipe and joints of leak proof construction, designed for the earth and/or other pressures present, plus highway H-20 loading or railway E-80 loading as appropriate with the associated recommended impact loading.
 - 2. Design bracing, backstops, and use jacks of sufficient rating so that the jacking can proceed without stoppage, except for adding pipe sections and as conditions permit, to minimize the tendency of the ground material to "freeze" around the casing pipe.
- D. Allowable Tolerances:
 - 1. Do not over cut excavation by more than I" greater than the outside diameter of the casing pipe.
 - 2. Install casing pipe with the determined vertical and horizontal alignment prior to installation of the carrier pipe.

1.04 SUBMITTALS

A. Submit description of proposed construction methods, including methods to establish and maintain vertical and horizontal alignment.

1.05 JOB CONDITIONS

- A. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger the integrity of surface or subsurface structures or utilities, and landscape in the immediate or adjacent areas.
- B. When boring or jacking under State highways and/or railroads, comply with applicable right-of-way occupancy permits. CONTRACTOR should note that if proposed Work involves construction operations through the property owned or controlled by PennDOT, all Work shall be performed in a manner satisfactory to them, the ENGINEER or their Resident Project Representative and in accordance with the Highway Occupancy Permit.
- C. If boring is obstructed, relocate or jack crossing as approved by ENGINEER.

PART 2 – PRODUCTS

2.01 STEEL CASING PIPE

- A. ASTM A139, Grade B 35,000 psi minimum yield strength.
- B. Full circumference welded joints.
- C. Diameter (36" minimum) as shown on the design plans for the project.
- D. Wall thickness shall be a minimum of 0.532-inch for 36-inch diameter and 0.626inch for 48- inch diameter, and shall be sufficient for the loadings noted under Design Criteria (Section 1.03C).
- E. Bitumastic coating of either coal tar or asphalt base shall be applied to inside and outside of casing pipe including field welded joints (after field welding takes place); minimum 50 mil thickness.

2.02 BASIC MATERIALS

- A. Concrete: PennDOT Class A per Section 03302.
- B. Brick: ASTM C32, Grade MS.
- C. Mortar: ASTM C270, Type M with water proofing admixture included.
- D. Grout: One part Portland cement (ASTM C150) and 6 parts of sand (PennDOT Type A) mixed with water to a consistency applicable for pressure grouting.
- E. Hold Down Bar: Reinforcement Bar #3, ASTM A615, Grade 60, deformed.

PART 3 – EXECUTION

3.01 APPROACH TRENCH

- A. Excavate approach trench using methods as site conditions require.
- B. Ensure pipe entrance face as near perpendicular to alignment as conditions permit.
- C. Establish a vertical entrance face at least I foot above top of casing.
- D. Install adequate excavation supports as specified in Section 02220.

3.02 CASING PIPE INSTALLATION METHODS

- A. Boring:
 - 1. Push the pipe into the ground with a boring auger rotating within the pipe to remove the spoil. Do not advance the cutting head ahead of the casing pipe except for that distance necessary to permit the cutting teeth to cut clearance for the pipe. The machine bore and cutting head arrangement shall be removable from within the pipe. Arrange the face of the cutting head to provide a barrier to the free flow of soft material.
 - 2. If unstable soil is encountered during boring, retract the cutting head into the casing to permit a balance between the pushing pressure and the ratio of pipe advancement to quantity of soil.
 - 3. If voids should develop greater than the outside diameter of the pipe by approximately one inch, grout to fill voids. Grouting to fill voids will be at the expense of the CONTRACTOR.
- B. Jacking:
 - 1. Construct adequate thrust wall normal to the proposed line of thrust.
 - 2. Impart thrust load to the pipe through a suitable thrust ring that is sufficiently rigid to ensure distribution of the thrust load on the pipe.
- C. Drilling and Jacking:
 - 1. Use on oil field type rock roller bit or plate bit made up of individual roller cutter units solidly welded to the pipe which is turned and pushed for its entire length by the drilling machine to give the bit the necessary cutting action.
 - 2. Inject a high density slurry (oil field drilling mud) to the head as a cutter lubricant. Inject slurry at the rear of the cutter units to prevent jetting action ahead of the pipe.
- D. Mining and Jacking:
 - 1. Utilize manual hand-mining excavation from within the casing pipe as it is advanced with jacks, allowing minimum ground stand-up time ahead of the casing pipe.

2. Should blasting be necessary permission shall be obtained from the party holding the right-of-way and the Township as required. (See Section 02229).

3.03 DEWATERING

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

3.04 PRESSURE GROUTING

A. Pressure grout the annular space between the casing pipe and carrier pipe.

3.05 CARRIER PIPE INSTALLATION

- A. All provisions regarding cleaning, inspection and handling specified under pipe material sections apply to this Work.
- B. Place the carrier pipe within the casing pipe as shown on the design plans for the project. Exercise care to prevent damage to pipe joint when carrier pipe is placed in casing. Provide supports to support carrier pipe at the proper horizontal and vertical alignment.
- C. Provide a bedding of concrete within the casing pipe to permanently support and retain the carrier pipe in accordance with Construction Detail G-4. For pressure lines, use field bent hold down bars on each side of every pipe joint to retain carrier pipe in position and field coat hold down bars with a bitumastic coating.
- D. Pipe shall be inspected by Resident Project Representative and be tested in accordance with the applicable items in Section 02734.
- E. Close ends of casing with .brick masonry construction only after the inspection and testing results are satisfactory to the Resident Project Representative.

END OF SECTION

02300/5

SECTION 02510 ASPHALTIC CONCRETE PAVING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Asphalt paving for access road to AUTHORITY's facilities.

1.02 SYSTEM DESCRIPTION

A. Paving: Designed for parking and light duty commercial vehicles.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with the latest edition of Penn DOT Publication 408.
- B. Mixing Plant: Conform to PennDOT Bulletin 27, Chapter 1 Standards.
- C. Conform to applicable Township standards for paving work on public property.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when base surface temperature is less than 40 degrees F or base surface is wet or frozen.

PART 2 – PRODUCTS

2.01 PAVING MATERIALS

- A. Wearing Course: PennDOT ID-2 (Section 420 of Publication 408).
- B. Binder Course: PennDOT ID-2 (Section 421 of Publication 408).
- C. Bituminous Concrete Base Course: PennDOT (Section 305 of Publication 408).
- D. Joint Seal: Hot, bituminous material [Class AC-20] (Section 702 of Publication 408).

2.02 SUBBASE COURSE MATERIALS

A. Coarse Aggregate: PennDOT No. 2A (Section 703 of Publication 408).

SECTION 02510 ASPHALTIC CONCRETE PAVING

PART 3 – EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify gradients and elevations of area to be paved.
- B. Proof roll subgrade (10 ton roller) and replace any soft or unsuitable material with PennDOT 2A coarse aggregate. Verify compacted subgrade is dry and ready to support paving and imposed loads.
- C. Apply tack coat in accordance with PennDOT Publication 408 requirements prior to placing an overlay over existing paving or prior to placing a wearing course over a previously placed binder course.
- D. Coat surfaces of any manhole or catch basin frames with oil to prevent bond with asphalt paving.
- E. Where proposed asphalt paving will meet existing asphalt paving, saw cut the existing pavement to create a clean cut edge.

3.02 SUBBASE COURSE

A. Place PennDOT No. 2A coarse aggregate in continuous layer not exceeding 8 inches loose depth and compact (10 ton roller) to required contours and elevations.

3.03 PLACING ASPHALT PAVEMENT

- A. Place bituminous concrete base course on surface of compacted subbase course to compacted thickness of 4- 1/2 inches (10 ton roller).
- B. Place binder course to compacted thickness of $1-\frac{1}{2}$ inches (10 ton roller).
- C. Place wearing course to compacted thickness of 1 inch (10 ton roller).
- D. Compact pavement by rolling to achieve even and smooth finish, without roller marks. Hand compact in areas inaccessible to rolling equipment.
- E. Where proposed asphalt paving adjoins existing asphalt paving, seal the joint with hot bituminous material in accordance with PennDOT Publication 408 requirements.

SECTION 02510 ASPHALTIC CONCRETE PAVING

3.04 TOLERANCES

- A. Flatness: Maximum variation of ¹/₄ inch measured with 10 foot straight edge.
- B. Compacted Scheduled Thickness: Within ¹/₄ inch of design thickness.
- C. Variation from True Elevation: Within ¹/₂ inch.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - l. Temporary Paving
 - 2. Permanent Paving
 - 3. Shoulder Restoration
 - 4. Curb, Gutter, Driveway Apron and Sidewalk Restoration
- B. The Construction Details note the specific paving requirements.

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01000 Traffic Control
 - 2. Section 02220 Excavation, Backfill and Compaction
 - 3. Section 03302 Concrete Work for Utilities
- B. Associated Construction Details:
 - 1. G-5 Temporary Pavement for Township Road and State Highway
 - 2. G-6 Permanent Pavement and Trench Restoration for Township Road
 - 3. G-8 Permanent Pavement and Trench Restoration for State Highway
 - 4. G-9 Trench Restoration for Stabilized Shoulder of State Highway

1.03 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Pennsylvania Department of Transportation:
 - a. Publication 408 Specifications
 - b. Publication 27 Specification for Bituminous Mixtures (Bulletin 27)
 - c. Publication 37 Specification for Bituminous Materials (Bulletin 25)
 - d. Publication 203 Work Zone Traffic Control

1.04 SUBMITTALS

- A. Certificates:
 - 1. Submit certification from bituminous and aggregate suppliers attesting that materials conform to the PennDOT Specifications.

1.05 JOB CONDITIONS

- A. Control of Traffic:
 - 1. Take measures to control traffic during repaving operations. Do not allow traffic on repaved areas until authorized by the Resident Project Representative.
 - 2. Employ traffic control measures in accordance with the requirements of Section 01000.1.11 including pertinent permits by PennDOT and/or the Township.
- B. Restore existing paving outside the limits of the Work that is damaged by CONTRACTOR's operations, to its original condition at the expense of CONTRACTOR.

PART 2 – PRODUCTS

- 2.01 CONCRETE
 - A. See Section 03302.
- 2.02 BITUMINOUS PAVING MATERIALS AND AGGREGATES
 - A. Wearing Course: PennDOT ID-2 (Section 420 of Publication 408).
 - B. Bituminous Concrete Base Course: PennDOT (Section 305 of Publication 408).
 - C. Joint Seal: Hot, bituminous material [Class AC-20] (Section 702 of Publication 408).
 - D. Tack Coat: Bituminous Material Emulsified Asphalt [E-l, E-6, E-8] (Section 702 of Publication 408).
 - E. Coarse Aggregate: Penn DOT No. 2RC (State Highways) or 2A (Section 703 of Publication 408).

PART 3 – EXECUTION

3.01 TEMPORARY PAVING

- A. Provide temporary paving immediately upon completion of trench backfilling. Unpaved trenches shall not remain unpaved longer than ten (10) working days after backfilling.
- B. Complete trench backfill with coarse aggregate in accordance with Construction Detail G-5.
- C. Place temporary paving material. Compact to the required minimum thickness of 2 inches with trench roller (5 ton).
- D. Continuously maintain temporary paving to the satisfaction of the Resident Project Representative, PennDOT and Township road department. Temporary paving on State roads must remain in place for a minimum of ninety (90) days.

3.02 PERMANENT PAVING

- A. Trim existing paving with minimum one (1) foot cutbacks to remove damaged areas. Cut straight joint lines and right angle offsets.
- B. Remove temporary paving material. Construct permanent base and surface courses to the required compacted thicknesses shown on Construction Details G-6 and G-8 and in accordance with Publication 408 Specifications. Construct wearing course to match existing road profile. Compact each course individually using a trench roller (minimum 5 ton) for the base course and binder course and a roller (10 ton) for the wearing course. In the case of a Township road which is of "tar and chip" construction, the paving restoration shall involve 5" BCBC and 1-1/2" wearing course within the cut back area with a "tar and chip" application over the entire width of the Township road.
- C. Where proposed asphalt paving adjoins existing asphalt paving, seal the joint with hot bituminous material in accordance with Publication 408 Specifications.
- D. Replace pavement markings in their former location which were covered or destroyed.
- E. Maintain permanent paving to the satisfaction of the Resident Project Representative, PennDOT, and the Township road department throughout the required maintenance period.

3.03 BITUMINOUS OVERLAY

- A. Where indicated on the design plans, or directed by the Resident Project Representative, place a bituminous overlay.
- B. Construct in accordance with Publication 408 Specifications (Section 401.3).
- C. Replace pavement markings in their former location which were covered or destroyed.

3.04 SHOULDER RESTORATION

A. Restore shoulders in accordance with Construction Detail G-9.

3.05 DRIVEWAYS

- A. Trim concrete and bituminous driveway surfaces to remove damaged areas. Saw cut straight joint lines parallel to the centerline of the trench. Cut offsets at right angles to the trench centerline.
- B. Restore existing concrete driveways trenches through with a 6'' layer of concrete reinforced with $6 \times 6 10/10$ wire mesh.
- C. Restore existing blacktop driveways trenched through in kind or with minimum 6" layer of 2A aggregate, 1 1/2" layer wearing course and 4" bituminous concrete base course.
- D. Restore earth driveways with a 6" layer of 2A stone backfill.
- E. Restore stone or gravel driveways in kind.
- F. Restore brick driveways with like bricks placed on a 4" thick wet sand bed. Place bricks in like pattern and spacing.

3.06 CONCRETE CURB, GUTTER AND SIDEWALK REPAIRS

- A. Replace curbs, gutters and sidewalks damaged by construction to match existing.
- B. Reconstruct curbs, gutters and sidewalks to the first expansion joint on either side of the damaged portion. Install expansion joint material.
- C. Reconstruct sidewalks to 4" thickness of concrete placed on a 4" base of compacted 2A crushed aggregate.

3.07 STORMWATER INLETS AND PIPING

- A. Repair or replace stormwater inlets and piping damaged by construction to match existing inlets.
- B. The Resident Project Representative will determine whether the frame and grate assembly of each affected storm water inlet is suitable for reuse once it has been removed by CONTRACTOR.
- C. Construct or repair storm water inlets and piping in accordance with relevant section of Publication 408 Specifications.

END OF SECTION

PART I – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Water distribution piping and finings.

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01560 Erosion and Sedimentation Control
 - 2. Section 02170 Stream Crossings
 - 3. Section 02220 Excavation, Backfill and Compaction
 - 4. Section 02229 Rock Removal
 - 5. Section 02300 Boring end Jacking Operations
 - 6. Section 02575 Restoration of Paved Surfaces
 - 7. Section 02661 Water Main Valves
 - 8. Section 02662 Fire Hydrants
 - 9. Section 02664 Water Main Air Release Chamber
 - 10. Section 02675 Testing and Disinfecting Water Mains
 - 11. Section 02905 Landscaping
 - 12. Section 03302 Concrete Work for Utilities
- B. Associated Construction Details
 - I. G-1 Pipe Embedment
 - 2. G-2 Concrete Encasement
 - 3. W-3 Blow-off Assembly
 - 4. G-12 Horizontal Thrust Block Arrangements
 - *S.* G-13 Horizontal and Vertical Downward Thrust Block Bearing Surface Area Schedule
 - 6. G-14 Vertical Thrust Block Arrangement and Dimensions Schedule

1.03 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Water Works Association (AWWA):

C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fillings for Water

C105 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids

C110 Ductile-iron and Gray-Iron Fittings, 3-inch Through 48-inch, for Water and Other Liquids

C111 Rubber-Gasket Joints fur Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

C115 Flanged Ductile-Iron Pipe with Threaded Flanges C 150 Thickness Design of Ductile-Iron Pipe

C151 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water Of Other Liquids

C153 Ductile-Iron Compact Fillings, 3-inch through 16-inch, for Water and Other Liquids

- B. Reject materials contaminated with gasoline, lubricating oil, liquid Of gaseous fuel, aromatic compounds, paint solvent, paint thinner, or acid solder.
- C. Acceptable Manufacturer:
 - 1. Ductile iron pipe and fittings shall be as manufactured by Atlantic Slates Cast Iron Pipe Company, U.S. Pipe and Foundry Company, Griffin Pipe Products Company, or approved equal.

1.04 SUBMITTALS

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- A. Manufacturers' Literature:
 - 1. Submit shop drawings to the ENGINEER for the following items:
 - Pipe
 - Pipe fittings
 - Joints and gaskets
 - Couplings
 - Adapters

The ENGINEER may request additional submittals as necessary for a specific project. Under no circumstances shall construction begin until all submittals have been approved in writing by the ENGINEER.

- 2. Submit manufacturer's certificate certifying that the following items were manufactured and tested in accordance with the applicable standards:
 - Pipe and pipe fittings

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling:
 - 1. Materials shall not be placed on private property without written permission of the property owner.
 - 2. During loading, transporting and unloading, exercise care to prevent damage to materials.
 - 3. Pipe or fittings shall be handled with care to avoid shock or damage at all times.
 - 4. Measures (i.e., use padded slings, hooks and tongs) shall be taken to prevent damage to the exterior surface or internal lining of the pipe.
- B. Storage:
 - 1. Pipe may be strung along alignment where approved by the ENGINEER.
 - 2. Pipe shall not be stacked higher than maximum stacking heights shown in AWWA C600 or as recommended by the pipe manufacturer.
 - 3. Interior of pipe and fittings shall be kept free from din or other foreign matter.
 - 4. Gaskets for mechanical and push-on joints shall be stored in a cool, dry location out of direct sunlight and not in contact with petroleum products.

PART 2 – PRODUCTS

2.01 DUCTILE IRON PIPE

- A. General:
 - 1. ANSI/AWWA C151/A21.51, Ductile-Iron Pipe.
 - 2. <u>Below Grade:</u> Thickness Class 52, with double cement-mortar lining, internal seal coat and external asphalt seal coat in accordance with AWWA C 104.
 - 3. <u>Above Grade, or Within Structures:</u> Thickness Class 53, with double cement mortar lining and internal seal coat in accordance with AWWA C104. The pipe exterior shall be painted in accordance with Section 09900.

- 4. **Special Applications:** As directed by the ENGINEER.
- B. Fittings:
 - 1. <u>Below Grade:</u> Mechanical Joint Ductile Iron Fittings: ANSI/AWWA C1531/A21.53 and ANSI/AWWA C111/A21.11 standards.
 - 1. Fittings shall have a working pressure rating of 350 psi.
 - 2. Fittings shall be asphalt coated on the exterior, comment lined and seal coaled on the interior. The cement lining shall conform to ANSI/AWWA C104/A21.4 standards.
 - 2. <u>Above Grade Inside of Structures:</u> Flanged Class 125 Ductile Iron Fittings: ANSI/AWWA C110/A21.10
 - 1. Fittings shall have a working pressure rating of 250 psi.
 - 2. Fittings shall be asphalt coated or painted on the exterior, and cement lined and seal coated on the pipe interior.
 - 3. **Special Applications:** As directed by the ENGINEER.
- C. Joints:
 - 1. <u>Below Grade:</u> May be either mechanical or push-on Tyton joints conforming with ANSI/AWWA C111/A21.11. Fittings in buried service shall have mechanical joints conforming with ANSI/AWWA C111/A21.11, and joint retainer glands at each connection. (See Section 02660.2.2C).
 - a. Rubber gaskets, lubricants, glands, bolts and nuts: ANSI/AWWA C111/A21.11.
 - 2. <u>Above Grade Inside of Structures:</u> Flanged joints conforming with ANSI/AWWA C111/A21.11 and AWWA C115.
 - 3. **Special Applications:** As directed by the ENGINEER.

2.02 SPECIAL FITTINGS

- A. Cut-in Sleeve:
 - 1. Ductile cast iron construction, mechanical joints, suitable for 200 psi working pressure.

- 2. Includes stop screw within outer sleeve and set screws within gland.
- 3. Manufactured by U.S. Pipe, or approved equal.
- B. Mechanical Joint Tapping Sleeve:
 - 1. Tapping sleeve shall have ductile cast iron body with test plug, suitable for 200 psi working pressure.
 - 2. Mechanical joint ends complying with AWWA C111; outlet flange complying with ANSI B16.1, Class 125.
 - 3. Manufactured by U.S. Pipe, or approved equal.
- C. Mechanical Joint Retainer Glands:
 - 1. Shall be manufactured of ductile iron conforming to ASTM A536-80 grade 60-42-10. Setscrews shall be of hardened ductile iron and require the same torque in all sizes. The retainer glands shall have a stated pressure rating with 2:1 safety factor. Glands shall be listed with Underwriters Laboratories and/or approved by Factory Mutual.
 - 2. Manufactured by EBAA Iron Inc., Megalugs®, or approved equal

PART 3 – EXECUTION

3.01 **PREPARATION**

- A. Water lines must be staked out in the field prior to construction, with stakes at intervals of 50 feet or less and elevations indicating cuts or fill to finish grade. Fire hydrants and water service curb stops must also be field staked, and elevations indicating top-of-curb or finished grade shown on the stakes.
- B. Unless otherwise indicated on the design plans, provide for a minimum cover of four (4) feet above the top of piping laid in the trench based on the finished grade elevation.
- C. Provide pipe bedding as specified in Section 02220 and as shown on Construction Detail G-1 for ductile iron pipe. Place aggregate in a manner to avoid segregation, and compact to the maximum practical density so that the pipe can be adequately supported.

3.02 LAYING PIPE IN TRENCHES

A. Give ample notice to the ENGINEER in advance of pipe laying operations.

- B. Clean and inspect each length of pipe or fitting before lowering into the trench. Do not lower pipe into the trench except that which is to be immediately installed.
- C. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.
- D. Lay pipe with bell pointing toward the direction of construction.
- E. Lay pipe to a uniform line with the barrel of the pipe resting solidly in bedding material throughout its length. Excavate recesses in bedding material to accommodate joints, fittings and appurtenances. Do not subject pipe to a blow or shock to achieve solid bearing or grade.
- F. Lay each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to avoid offsets.
- G. Lubricate pipe and gaskets as recommended by the manufacturer. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement. If unusual joining resistance is encountered or if the pipe cannot be fully inserted into the bell, disassemble joint, inspect for damage, reclean joint components, and reassemble joint.
- H. Assemble joints in accordance with recommendations of the manufacturer.
 - 1. Push-on Joints:
 - a. Clean the inside of the bell and the outside of the spigot. Insert rubber gasket into the bell recess prior to lowering of pipe into trench.
 - b. Apply a thin film of gasket lubricant to either the inside of the gasket or the spigot end of the pipe, or both.
 - c. Insert the spigot end of the pipe into the socket using care to keep the joint from contacting the ground. Complete the joint by forcing the plain end to the bottom of the socket. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot is fully inserted.
 - 2. Mechanical Joints:
 - a. Wash the socket and plain end. Apply a thin film of soapy water. Slip the gland and gasket over the plain end of the pipe. Apply soapy water to gasket.

- b. Insert the plain end of the pipe into the socket and seat the gasket evenly in the socket.
- c. Slide the gland into position, insert bolts, and finger-tighten nuts.
- d. Bring bolts to uniform tightness. Tighten bolts 180-degrees apart, alternately.
- e. Coat all bolts and nuts with bitumastic paint after installation.
- 3. Coupled Joints: In accordance with manufacturer's recommendations.
- I. Disassemble and remake improperly assembled joints using a new gasket.
- J. Check each pipe installed as to alignment in place. Correct deviation immediately. A deviation from the alignment as shown on the design plans, or unneccessary deflection of pipe joints, will be cause for rejection.
- K. Place sufficient compacted embedment material on each section of pipe, as it is laid, to hold firmly m place.
- L. Install fittings and valves as pipe laying progresses. Do not support weight of fittings and valves from pipe.
- M. Install service connections as specified in Section 02663.
- N. Keep trenches and excavations free of water during construction.
- O. When the work is not in progress, and at the end of each work day, securely plug open ends of pipe and fittings with push-on plugs or mechanical joint plugs, to prevent trench water, earth, or other substances from entering the pipes or fittings.

3.03 CUTTING PIPE

- A. When ductile iron pipe is to be cut in the field, it should be ordered as "GAUGED FULL LENGTH".
- B. Full gauged pipe should not be cut any closer than 2 feet of the face of the bell.
- C. Grind cut ends and rough edges smooth. Bevel end approximately 1/4 inch at an angle of 30 degrees for push-on joints.

3.04 DEFLECTION

- A. When it is necessary to deflect a water main from a straight alignment horizontally or vertically, the water main shall be laid in a smooth arc and the deflection of joints shall not exceed the following limits:
 - 1. Ductile Iron ripe:

Laving Length	Laying Max. Deflection - Inches Per Length Length 3" Through 12" Diameter
18 feet	19
20 feet	21

B. Where required, fittings will be used to obtain deflections greater than noted above.

3.05 BLOW-OFF ASSEMBLY

- A. Whenever possible, a dry-barrel fire hydrant shall be used in lieu of a flow-off assembly.
- B. Install a blow-off assembly on the dead ends of all water mains where shown on the design plans.
- C. Locate blow-off assembly within the paved area wherever possible.
- D. Construct blow-off assembly in accordance with Construction Detail W-3.
- E. Slimline Hydrant as Manufactured by Gil Industries, Inc or approved equal.

3.06 AIR RELEASE VALVES

A. Construct air release valve chamber(s) where shown on the design plans in accordance with Section 02664.

3.07 THRUST RESTRAINT

- A. Provide all tees, bends, caps, and plugs with concrete thrust blocks as indicated on the design plans and in accordance with Construction Details W-8, W-9 and W-10. Concrete thrust blocks shall be poured against undisturbed earth. Locate thrust blocks to contain the resultant force and so pipe and fitting joints will be accessible for repair.
- B. Furnish and install, tie rods, clamps, set screw retainer glands, or restrained joints as indicated on the design plans. Protect metal restrained joint components against corrosion by applying a bituminous coating, or encasing the entire assembly with an 8-mil thick polyethylene wrap in accordance with AWWA C105.

3.08 CONCRETE ENCASEMENT

A. Provide concrete encasement for pipeline where indicated on the design plans, or as directed by the Resident Project Representative, and in accordance with Construction Detail G-2.

3.09 CAST-IN PLACE CONCRETE CONSTRUCTION

A. Conform to the applicable requirements of Section 03302.

3.10 STREAM CROSSINGS

A. Construct water main stream crossings in accordance with Section 02170.

3.11 CONNECTIONS

- A. Wherever an existing water main is to be cut and closed, or extended or connected to the proposed new lines, construct connections as shown on the design plans. A sequence of construction relative to any connection to the existing water distribution system which impacts upon operation of the existing system shall be reviewed with and approved by ENGINEER prior to construction of the connection.
- B. For connecting pipe of different materials, use transition fittings as recommended by the manufacturer and approved by ENGINEER.
- C. For connecting a pipe perpendicular to an existing pipe, use a cut-in tee for a "dry" connection, and a tapping sleeve and valve for a "wet" connection. All tapping sleeves and tapping valves must be air tested, using a method approved by the ENGINEER.
- D. Provide pipes passing through concrete or masonry construction with sleeve or wall pipe fittings of type and size indicated.
 - 1. Provide sleeves two pipe sizes larger than the water main unless otherwise shown on the design plans.
 - 2. The annular space between the sleeve and the water main shall be scaled, in a method approved by the ENGINEER.

3.12 HIGHWAY AND RAILROAD CROSSINGS

- A. Install water mains crossing highways and railroads as shown on design plans. Comply with Railroad Company, Pennsylvania Department of Transportation, and Warwick Township permits.
- B. When casing pipe is required, comply with requirements of Section 02300.

3.13 BRIDGE OR AERIAL CROSSINGS

A. For an above-the-ground water main attached to a bridge or other structure, furnish and install all supports, hangers and fastenings, insulation, and protection jacket as shown on the design plans.

3.14 BACKFILLING TRENCHES

- A. Backfill concurrently with pipe laying to held installed pipe in place.
- B. Backfill pipeline trenches only after examination of pipe laying by the Resident Project Representative.
- C. When pipe laying is terminated for any reason, provide at least 2 feet of backfill over all pipe except the last piece laid.
- D. Backfill trenches as specified in Section 02220.

3.15 COMPLETION

A. Test and disinfect water mains as specified in Section 02675.

END OF SECTION

PART 1- GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of this Section Includes:
 - 1. Water Valves Below Grade

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01560 Erosion and Sedimentation Control
 - 2. Section 02220 Excavation, Backfill and Compaction
 - 3. Section 02229 Rock Removal
 - 4. Section 02660 Water Mains
- B. Associated Construction Details:
 - 1. W-1 Gate Valve and Box

1.03 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American National Standards Institute (ANSI):

A21.10 Ductile Iron und Gray Iron fittings. 3" through 48" for water and other liquids.

2. American Water Works Associations (AWWA):

C509 Resilient-Seated Gate Valves for Water Supply Service

C550 Protective Interior Coatings for Valves and Hydrants

- B. Acceptable Manufacturer(s):
 - 1. As indicated in Section 02661.2.01.

1.04 SUBMI'ITALS

A. Manufacturer's Literature:

- 1. Catalog data shall be submitted in sufficient detail to serve as a guide in the assembly and disassembly of the valve and for ordering repair parts.
- 2. Shop drawing submittals shall include drawings showing the principal dimensions, construction details and materials.
- 3. An affidavit shall be submitted stating that the valve and all materials used in its construction conform to the applicable requirements of AWWA C509 and that all tests specified in the standard have been performed and test requirements have been met.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Prepare valves and accessories for shipment according to AWWA Standards and:
 - 1. Seal valve ends to prevent entry of foreign matter into product body.
 - 2. Box, crate, completely enclose, and protect products from accumulations of foreign matter.
- B. Store products in areas protected from weather, moisture, or possible damage.
- C. Do not store products directly on ground.
- D. Handle products to prevent damage to interior or exterior surfaces.

PART 2 – PRODUCTS

2.01 RESILIENT SEAT BURIED GATE VALVES (3" Through 12")

- A. Ductile Iron body, bonnet and gate, bronze trim conforming to AWWA C509.
 - 1. Resilient seated gate valves.
 - 2. Non-rising stem; O-ring stem seals.
 - 3. 2" square operating nut; open counterclockwise unless otherwise indicated.
 - 4. Mechanical joint connections.
 - 5. Manufactured by U.S. Pipe "Metroseal" 250, or approved equal. Other manufacturers: Kennedy, Mueller Co.
 - 6. Minimum design working pressure shall be 200 psig.
 - 7. Interior.,

2.02 VALVE BOXES

- A. For 12" valves and smaller:
 - 1. Domestic cast iron, two-piece, screw type,

- 2. Cast iron cover shall contain the inscription "Water".
- 3. Manufactured by Bingham & Taylor, or approved equal. Other manufacturers: Tyler Co., Mueller Co., and East Jordan Iron Works.

2.03 TAPPING SLEEVE VALVE (4" Through 12")

- A. Conform to requirements of Gate Valve Section 02661.2.01, except as noted below:
 - 1. Tapping sleeve valve shall have one end flanged to attach to tapping sleeve and other end mechanical joint with a special flange to permit attachment of drilling machine and adapter.
 - 2. Flanged end to comply with ANSI BI 6.1, Class 125.
 - 3. Manufactured by U.S. Pipe "Metroseal" 250, or approved equal. Other Manufacturers: Mueller Co. and Kennedy.

2.04 MECHANICAL JOINT RESTRAINTS

- A. Shall be installed on all below grade mechanical joint gate valves.
 - 1. The restraints shall be "Megalugs® " as manufactured by EBAA Iron, Inc.

PART 3 – EXECUTION

3.01 GENERAL

- A. Determine the exact location, size, and construction details of valves from the design plans for the project.
- B. Perform trench excavation, backfilling and compaction in accordance with Section 02220.
- C. Install pipe in accordance with Section 02660.

3.02 GATE VALVES

- A. Gate valves shall be installed in accordance with Section A.5 of AWWA C509 and the manufacturer's printed instructions.
- B. Install valves in conjunction with pipe laying in accordance with Construction Detail W-1. Set valves plumb. Install valves in closed position to minimize possibility of foreign materials entering the valve.
- C. Install mechanical joint restraints as specified in Section 02661.2.4.

- D. Provide buried valves with valve boxes installed flush with finished grade.
- E. All valves shall be provided with valve operating nut extensions when the valve to grade distance is greater than 4.0 feet.
- F. Each valve shall be operated through one complete operating cycle. If the stem operation is tight, the operation should be repeated several time, until proper operation is achieved.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Fire Hydrants

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01560 Erosion and Sedimentation Control
 - 2. Section 02220 Excavation, Backfill and Compaction
 - 3. Section 02219 Rock Removal
 - 4. Section 02660 Water Mains
 - 5. Section 02661 Water Main Valves
 - 6. Section 03302 Concrete Work for Utilities
- B. Associated Construction Details
 - 1. W-2 Fire Hydrant Assembly

1.03 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Water Works Association (AWWA): C502 Dry-Barrel Fire Hydrants

C550 Protective Interior Coatings for Valves and Hydrants

- 2. Pennsylvania Department of Transportation: Publication 408 Specifications
- B. Acceptable Manufacturer:
 - 1. Fire hydrants shall be manufactured by Kennedy Valve Company K-81

1.04 SUBMITTALS

A. Manufacturer's Literature:

- 1. Catalog data shall be submitted in sufficient detail to serve as a guide in the assembly and disassembly of the hydrant (including top and bottom extension pieces).
- 2. Shop drawing submittals shall include drawings showing the principal dimensions, construction details and materials.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store products in areas protected from weather, moisture, or possible damage.
- B. Do not store products directly on ground.
- C. Handle products to prevent damage to interior or exterior surfaces.

PART 2 – PRODUCTS

2.01 FIRE HYDRANTS

- A. Dry-barrel break-away type conforming to AWWA C502.
 - 1. Bury depth: 5'-0" or as indicated on the design plans.
 - 2. Inlet Connection: 6" Mechanical Joint
 - 3. Valve Opening: 5-1/4"
 - 4. Operating Nut: 1-1/2" pentagon, open counterclockwise.
 - 5. Corrosion resistant bolts and nuts.
 - 6. One 4- 1/2" pumper nozzle, two 2-1/2" NST hose nozzles.
 - a. Attach nozzle caps by separate chains.
 - b. National (American) Standard fire hose coupling screw threads as approved by AUTHORITY and local Fire Marshal (for 2 ¹/₂: hose coupling, 7.5 threads per inch).
 - 7. Color: Red body, White bonnet, White cap. (See Section 02662.3.03).
 - 8. Minimum working pressure150 psig.

PART 3 – EXECUTION

3.01 GENERAL

- A. Determine the exact location, size and construction details of hydrants from the design plans and Construction Detail W-2. Obtain all necessary clarification and directions from AUTHORITY or ENGINEER prior to the execution of work. Written approval from Township Fire Marshal shall be obtained regarding hydrant spacing and location prior to installation.
- B. Perform trench excavation, backfill and compaction in accordance with Section 02220.
- C. Install pipe and valve in accordance with Sections 02660 and 02661.

3.02 INSTALLATION

- A. Install fire hydrants in accordance with Construction Detail W-2.
 - 1. All gate valves shall be set with stems vertically above the centerline of the pipe. Care shall be taken to avoid sand, stones, or other material from being lodged in the valve seat.
 - 2. After setting valve boxes, stone fill shall be tamped around the valve box for a diameter of 4" on all sides of the valve box.
 - 3. Hydrant shall be placed on a solid cement block not less than 4" thick and 15" square.
 - 4. Hydrant should be set plumb with pumper nozzle facing the street. A thrust block should be poured against undisturbed earth to support the force on the hydrant base elbow. Care should be taken to not obstruct the hydrant drain hole opening in the base elbow.
 - 5. Thrust block should be poured behind the hydrant tee or elbow in conformance with Construction Details W-8 and W-9.
 - 6. Hydrant nozzles shall be at least 12" above finished grade. The ground line head shall be at or above finished grade such that the safety flange is between 2" and 6" above finished grade.
- B. After hydrostatic testing, flush hydrants and check for proper drainage from the hydrant barrel.

3.03 PAINTING

A. All ferrous metal parts of the hydrant, inside and outside shall be coated. Coatings used on interior surfaces of the hydrant that are in contact with water in or flowing through the hydrant shall be suitable for contact with drinking water and

in conformance with AWWA C550. Primer used in coating hydrant shall meet or exceed the requirements of Federal Specifications TT-C-4946. All interior ferrous surfaces, except mechanical surfaces, shall be coats with asphaltic coatng, primer on its equipment.

B. Exterior ferrous surfaces of the hydrant top section shall be painted with a coat of primer prior to the final coat. Exterior surfaces of the hydrant shall be painted in conformance with the following:

Hydrant body: Red Hydrant bonnet and cap: White

C. Exterior ferrous features below the ground line shall be covered with two coats of asphaltic coating. The first coat shall be allowed to dry before the second coat is applied.

END OF SECTION

PART 1- GENERAL

1.01 SECTION DESCRJPTION

- A. The Work of This Section Includes:
 - 1. Tapping water mains by installation of corporation stops or other suitable fittings or couplings.
 - 2. Connection of service pipe and fittings up to and including curb stops and boxes.
 - 3. Installation of water meter yoke assembly, external meter pit and ` accessories.
- B. All water service connections shall be of sufficient size to furnish water to the building in the quantities and at the pressures required in accordance with The International Plumbing Code (latest edition adopted by Warwick Township).
 Water service connections shall not be less than 1 ½ inch diameter, unless otherwise authorized by the AUTHORITY and approved by the Township Fire Marshal in writing.
- C. If a fire service line is necessary, the design shall comply with the requirements of The International Plumbing Code (latest edition adopted by Warwick Township), National Fire Protection Association, and the Insurance Services Office with review by AUTHORITY. Components shall be located in a heated utility room.
 Fire services four (4) inches and smaller not equipped with a flow meter, shall have a detector check valve installed.

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01560 Erosion and Sedimentation Control
 - 2. Section 02220 Excavation, Backfill and Compaction
 - 3. Section 02229 Rock Removal
 - 4. Section 02575 Restoration of Paved Surfaces
 - 5. Section 02660 Water Mains
 - 6. Section 02661 Water Main Valves
 - 7. Section 02675 Testing and Disinfecting Water Mains
 - 8. Section 02905 Landscaping

- B. Associated Construction Details:
 - 1. W-4 Corporation Stop
 - 2. W-5 Curb Stop and Box
 - 3. W-7 Residential Water Meter Installation and Accessories
 - 4. W-15 Residential Water Meter Pit Installation and Accessories

1.03 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American National Standard. Institute (ANSI):

B16. 1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800

2. American Society for Testing and Materials (ASTM):

B62 Specification for Composition Bronze or Ounce Metal Castings

B88 Specification for Seamless Copper Water Tube

3. American Water Works Association (AWWA):

C104 Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water

C11O Gray-Iron and Ductile-Iron Fittings, 3-inch through 48-inch for Water and Other Liquids

C111 Rubber-Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings

C115 Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flange.

C150 Thickness Design of Ductile-Iron Pipe

C151 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

C500 Gate Valves, 3 through 48 inch NPS, for Water and Sewerage Systems

C509 Resilient-Seated Gate Valves for Water and Sewerage Systems

C800 Underground Service Line Valves and Fittings

1.04 SUBMITTALS

A. Manufacturer's Literature:

- 1. Submit manufacturer's descriptive literature for the following items :
 - Corporation stop
 - Curb stop and box
 - Pipe, fittings and gaskets
 - Meter boxes (if applicable)

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Product Delivery:
 - 1. Deliver valves and accessories to the job site in the manufacturer's boxes or crates.
 - 2. Mark each valve as to size, type and installation location. Seal valve ends to prevent entry of foreign matter into valve body. During loading, transporting and unloading of all materials and products, exercise care to prevent any damage.
- B. Storage:
 - 1. Store all products and materials off the ground and under protective coverings and custody, and in a manner to keep products clean and in good condition until used.

PART 2 – PRODUCTS

2.01 COPPER SERVICE TUBING

- A. Copper Tubing:
 - 1. Services: 1 1/2 inch Type K, Soft copper conforming to ASTM B88, unless otherwise authorized by the AUTHORITY. The water service between the corporation stop and curb stop shall be one continuous length of pipe with no couplings or fillings. Couplings or fittings located beyond curb stops, toward the residence or building, shall only be permitted at intervals equivalent to the maximum tubing coil length available. The Authority, at its discretion, may require placement of a curb stop and box at each coupling.

- B. Connection Fittings:
 - 1. Three (3) part unit with compression connections; manufactured by A. Y. McDonald Company, or approved equal.
- C. Meter Boxes:
 - 1. In accordance with Construction Detail W-13.

2.02 DUCTILE IRON PIPE

- A. Pipe:
 - 1. AWWA C150 and 0151.
 - 2. Double cement-mortar lining in accordance with AWWA C104.
 - 3. Thickness Class 52 (minimum), or better if specified on the construction drawings.
- B. Fittings:
 - 1. Ductile-iron in accordance with AWWA C110, with minimum 350 psi pressure rating.
 - 2. Provide with double cement-mortar lining and asphalt coating (interior) and asphalt exterior coating as for ductile-iron pipe in accordance with AWWA C104.
 - 3. Provide all fittings with restraint glands, as manufactured by EBAA Iron "Megalug®", or approved equal.
- C. Joints:
 - 1. Mechanical or push-on "Tyton" joint conforming with AWWA C111.
 - 2. Flanged joints (within chambers/structures) conforming with AWWA C111and AWWA C115.
- D. Special Connection Fittings:
 - 1. For cut-in sleeve or tapping sleeve, refer to Section 02660 (Item 2.2).
 - 2. For tapping sleeve valve, refer to Section 02661 (Item 2.4).

2.03 CORPORATION STOP ASSEMBLY

A. Corporation Stops:

- 1. Brass or Red Brass alloy body conforming to ASTM B62.
- 2. Inlet end threaded for tapping according to AWWA C800.
- 3. Outlet end with compression connection suitable for service pipe specified.
- 4. Ball type valve manufactured by A. Y. McDonald Series #470IBT, or approved equal.
- 5. Refer to Construction Detail W-4 Corporation Stop.

2.04 CURB STOP ASSEMBLY

- A. Curb Stops:
 - 1. Brass or Red Brass alloy body conforming to ASTM B62.
 - 2. Ball Typo Valve with compression connections.
 - 3. Positive Pressure Sealing.
 - 4. Manufactured by A. Y. McDonald Series #6100T, or approved equal.
 - 5. Refer to Construction Detail W-5 Curb Stop and Box.
- B. Curb Boxes and Covers:
 - 1. Cast Iron body, Extension Type, two coats of bituminous coating on box exterior.
 - 2. Arch Pattern Base.
 - 3. One-piece lid (2 hole pattern) with inscription "Water".
 - 4. Manufactured by A. Y. McDonald Series # 5603 and 5601 lid, or approved equal.
 - 5. Refer to Construction Detail W-5 Curb Stop and Box.

2.05 METER TEST TEE

A. All water services 1 1/2 inches or larger shall be provided with a meter test tee. The test tee shall be number 20-HT (1 1/2 inches) as manufactured by A. Y. McDonald Manufacturing Company, or approved equal.

2.06 BUILDING PLUMBING VALVES

- A Pressure Reducing Valve (residential):
 - 1. Manufactured by Watts Regulator (Series N35B) or approved equal, furnished with union inlet connection with NTP threaded outlet.
- B. Ball Valve (residential):

1. Manufactured by Watts Regulator (No. B-6000), or approved equal with NPT ends.

2.07 RESIDENTIAL WATER METER PITS (UP TO 1 1/2 INCH)

A. In accordance with Construction Detail W-13, as supplied by MeterPro Services.

2.08 COMMERCIAL WATER METER PITS (1 INCH AND LARGER)

A. Commercial water meter pits one (1) inch and larger shall have a meter bypass, and shall be submitted to the ENGINEER for review and approval prior to construction.

PART 3 – EXECUTION

3.01 PREPARATION

- A. All service connections shall be located where shown on the design plans or otherwise as directed by AUTHORITY with input by DEVELOPER.
- B. Establish location of curb stop and box for each service connection which shall generally be located at the right-of-way line or easement boundary. Where no curb exists, the curb stop and box setback distance from edge of road shall be as directed by AUTHORITY, If the curb stop must be placed in a paved area, a curb box sleeve shall be used. (See Construction Detail S-13).
- C. Water service line shall be located a minimum of ten (10) feet from a building sewer and sewer lateral, cesspool, septic tank, and sewage absorption area, in accordance with PA DEP guidelines.
- D. Excavate trench to the line and grade shown on the design plans and as specified in Section 02220.
- E. Install service connection tubing/pipe with a minimum cover of 4'-0".
- F. Provide pipe bedding as noted in Section 02220. Place aggregate in a manner to avoid segregation and compact to the maximum practical extent.

3.02 TAPPING WATER MAINS

- A. Each water main connection shall be tapped using suitable materials, equipment and methods approved by the ENGINEER.
- B. Screw corporation stop directly into a tapped and threaded iron main at a position 45° from vertical on the main's circumference in accordance with Construction Detail W-4. Locate corporation stops at least 12" apart longitudinally and
SECTION 02663 WATER SERVICE CONNECTIONS

staggered. No corporation stop shall be installed within 18 inches of any pipe, valve or fitting joint.

- C. If the tapping process is not successful in providing a watertight seal, a double band ductile iron service saddle must be installed. The saddle shall be a PowerSeal Products Model 3417 service saddle, or approved equal.
- D. Operate each corporation stop before and after installation,
- E. Use proper seals or other devices to ensure that no leaks are left in the water mains at the points of tapping. Do not backfill and cover the service connection until approved by the ENGINEER or the Resident Project Representative.

3.03 CONNECTIONS AT MAIN

A. Service connections at the main shall be made in accordance with the table and where service clamps are required they shall be Adams, Rockwell, or Mueller Service Clamps (double strap), or as approved by the AUTHORITY, Service clamps shall be bronze. Straps, nuts, and washers for service clamps shall be Type 304 stainless steel. Service clamps shall be required for taps in Class 52 ductile iron pipe. An engagement of three full threads is required on connections where no service clamps are used.

Pipe	1"	1 ¼"	1 ¼2"	2"	2 ¼"	3"	3 1/2"	4"
Dia.								
6"	D.S.	D.S.	D.S.	D.S.	D.S.	NTP	NTP	NTP
8"	None	D.S.	D.S.	D.S.	D.S.	NTP	NTP	NTP
10"	None	D.S.	D.S.	D.S.	D.S.	D.S.	NTP	NTP
12"	None	None	None	D.S.	D.S.	D.S.	D.S.	

D.S. - Double Strap NTP – No taps permitted None – No service clamp required

3.04 CURB STOP AND BOX

- A. Install curb stop and box in accordance with Construction Detail W-5.
- B. Operate each curb stop before and after installation.
- C. Install a temporary marker stake extending from the end of the curb stop and box to one (1) foot above finished glade. The top of the marker stake shall be painted blue and/or labeled "Water".

3.05 COPPER SERVICE LINE AND FITTINGS

SECTION 02663 WATER SERVICE CONNECTIONS

- A. Use bends to connect the service tubing to the corporation Stop in accordance with Construction Detail W-4 to provide flexibility to counteract the effects of settlement or expansion/contraction in the line.
- B. All service connection lines shall be installed in continuous runs from the corporation stop to the curb stop. Connections in service tubing beyond the curb stop must use the maximum tubing coil length. If the service is longer than the maximum coil length a straight union shall be installed. Intermediate curb stops and boxes will be required at each union unless this requirement is specifically waived by AUTHORITY.
- C. Lay each section of the service line in a manner to form a tight joint with the adjoining section. Avoid offsets, kinks or awkward bends to ensure a smooth flow line.
- D. Place sufficient compacted embedment material on each side of the water service line, as it is laid to hold the service line firmly in place.
- E. When the work is not in progress and at the end of each work day, securely plug the ends of pipe and fittings to prevent any dirt or foreign substance, from entering the lines.
- F. Provide all service lines passing through concrete or masonry construction with wall sleeves. The annular space between the sleeve and the service line shall be sealed with a bitumastic sealer.

3.06 DUCTILE IRON SERVICE LINE AND FITTINGS

A. Refer to Part 3 of Section 02660 relative to installation requirements.

3.07 BACKFILLING TRENCHES

- A. Backfill service line trench only after examination of service line laying by the Resident Project Representative.
- B. Backfill trench as shown on the design plans and as specified in Section 02220.

3.08 METER SETTING AND ASSOCIATED PLUMBING

- A. DEVELOPER/CONTRACTOR is required to obtain the current "Procedures for Water Meter Installation" as established by AUTHORITY which may supersede the following items.
- B. Install water meter yoke assembly in an easily accessible location (not in a crawl space and which meets the AUTHORITY's requirements for meter readings and

SECTION 02663 WATER SERVICE CONNECTIONS

maintenance. Residential meter pits shall be in accordance with Construction Detail W-13.

- C. Acquire from AUTHORITY and install a meter yoke assembly with angle ban valve and backflow preventor and spacer assembly. Install meter yoke assembly on a horizontal piping run centered no more than twelve (12) inches from the building wall, no higher than five (5) feet above the floor and in an alignment such that the meter will be on a full upright position.
- D. Clean joint surfaces prior to soldering with lead free solder.
- E. All water supply plumbing shall conform to the requirements of The International Plumbing Code (latest edition adopted by Warwick Township).
- F. AUTHORITY representative will provide and install water meter and remote touch pad. CONTRACTOR to run remote wire if in finished or remote areas.

3.09 TESTING AND DISINFECTION

- A. Test service line and building plumbing for leakage.
- B. Only AUTHORTTY authorized personnel shall turn the water off and on at the corporation and/or curb stop.
- C. Flush and disinfect the piping with water from the water distribution system.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. CONTRACTOR shall furnish all materials, labor and equipment necessary to install air release chamber(s) on the water main as and where shown on the design plans and as hereinafter specified.
 - 2. The air release chamber shall consist of a precast reinforced concrete structure with manhole frame and cover and manhole steps. The equipment contained within the air release chamber shall contain piping, and an automatic air release valve with associated piping, fittings and corporation stops.
 - 3. This Section applies to situations involving a pipe diameter of 8 inches or less and a maximum working pressure of 175 psi. Other situations must be discussed with the air release valve manufacturer relative to valve selection.

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01560 Erosion and Sedimentation Control
 - 2. Section 02110 Clearing and Grubbing
 - 3. Section 02220 Excavation, Backfill and Compaction
 - 4. Section 02229 Rock Removal
 - 5. Section 02660 Water Mains
 - 6. Section 02734 Sanitary Sewer System Testing
 - 7. Section 02905 Landscaping
 - 8. Section 03302 Concrete Work for Utilities
 - 9. Section 03411 Precast Concrete
- B. Associated Construction Details
 - 1. W-6 Air Release Chamber
 - 2. S-5 Manhole Frame and Cover-Standard
 - 3. S-7 Manhole Step

1.03 QUALITY ASSURANCE

- A. Reference Standards
 - 1. American Society for Testing and Materials (ASTM):

A48 Specification for Gray Iron Castings

A240 Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

B62 Specification for Composition Bronze or Ounce Metal Castings

C270 Specification for Mortar for Unit Masonry

C478 Specification for Precast Reinforced Concrete Manhole Sections

C923 Specification for Resilient Connections between Reinforced Concrete Manhole Structures and Pipes

2. Federal Specification:

SS-S-00210 Joint Sealant Compound

3. PA Department of Transportation:

Publication 408 Specifications

4. American Association of State Highway and Transportation Officials (AASHTO):

Standard Specification for Highway Bridges

5. American Water Works Association (AWWA)

C800 Underground Service Line Valves and Fittings

- B. Acceptable Manufacturer:
 - 1. The air release chamber structure, and frame and cover shall be provided by a firm regularly engaged in the manufacture of such projects of the types, material, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

- 2. The precast reinforced chamber Structure(s) shall be provided by one of the following manufacturers, or approved equal.
 - a. Atlantic Concrete Products, Inc.
 - b. Monarch Precast Concrete Corporation
 - c. Terre Hill Precast Concrete Corporation
 - d. Modern Concrete Septic Tank Company
- 3. Frame(s) and cover(s) shall be provided by one of the following manufacturers, or approved equal.
 - a. Neenah Foundry Company
 - b. E.A. Quirin Machine Shop, Inc.
 - c. East Jordan Iron Works, Inc.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit detail shop drawings of the precast reinforced concrete chamber.
- B. Manufacturer's Literature:
 - 1. Submit manufacturer's descriptive literature for the following items:
 - Manhole Frame and Cover
 - Manhole Steps
 - Pipe to Manhole Flexible Connections
 - Air Release Valve and associated fittings
 - Sump Frame and Grate
 - Joint Sealant Compound
 - Corporation Stops

PART 2 – PRODUCTS

2.01 PRECAST CONCRETE CHAMBER

- A. Structure: (Also see Section 03411 Precast Concrete)
 - 1. The chamber shall have an inside diameter of five (5) feet and an overall height as shown on the design plans. The vertical walls shall be 6 inches thick while the bottom slab shall be 8 inches thick.
 - 2. The chamber shall be constructed of precast reinforced concrete sections which shall conform to ASTM C-478.

- 3. Openings for the water main shall be provided with integral flexible resilient connections which shall conform to ASTM C-923.
- B. Joint Sealing Compound:
 - 1. Provide two rows of preformed sealing compound, conforming with Federal Specification SS-S-00210 shall be provided to seal the joints of the precast sections.
 - 2. The preformed scaling compound shall be as manufactured by A-Lok Products Inc. ("Butyl-Lok"), K.T. Snyder Company, Inc. ("Ram-Nek"), or approved equal.
- C. Exterior Protective Coating
 - 1. See Section 09900 for exterior coatings.
- D. Steps (See Construction Detail S-7):
 - 1. Steel reinforced polypropylene with serrated thread and end lugs as manufactured by M.A. Industries, Inc., or approved equal.
- E. Frame and Cover (See Construction Detail S-5):
 - 1. Domestic cast iron castings: ASTM A48, Class 30 or better; free of bubbles, sand and air holes, and other imperfections.
 - 2. Heavy duty traffic, AASHTO loading Class HS-20.
 - 3. Contact surfaces machined and matched.
 - 4. All covers shall be inscripted "WTWSA-WATER" with raised letters. Letters shall have a height and width of not less than two (2) inches.
 - 5. Manufactured by Neenah Foundry Company (Model R-1642), or approved equal.
- F. Sump Frame and Vented lid:
 - 1. Domestic cast iron castings: ASTM A48, Class 30 or better, free of bubbles, sand and air holes and other imperfections.
 - 2. Provide type and design in accordance with Construction Detail W-6.
 - 3. Manufactured by Neenah Foundry Company (Model R-1748), or approved equal.

2.02 PIPING AND VALVES

- A. Corporation Stop:
 - 1. Brass or red brass alloy body conforming to ASTM B862
 - 2. Inlet end threaded for tapping according to AWWA C800
 - 3. Outlet end suitable for brass nipple
- B. Piping/Fitting
 - 1. Brass construction
- C. Air Release Valve
 - 1. The air release valve shall be designed specifically for use on a water main and shall automatically release accumulated air under pressure during system operation at 175 psi maximum working pressure. The air release valve shall be hydrostatically tested to 1.5 times the rated working pressure.
 - 2. The air release valve shall be of the simple lever type with an orifice button to seal the valve discharge orifice and thus assure drop tight shut-off when the valve is in a closed position. The air release valve shall incorporate a renewable seat.
 - 3. The air release valve shall involve the following materials of construction:

Body and Cover Cast Iron (ASTM A48, Class 30) Float and Leverage Stainless Steel (ASTM A240) Mechanism

Orifice Button or Needle Viton or Buna-N

- 4. The valve shall have a 1 inch NPT inlet with a 1/2 inch NPT outlet and a 3/32 inch orifice size.
- 5. The air release valve shall be Factory Mutual System approved. Valve body shall be rated to 200 psi and tested to 300 psi.
- 6. The air release valve shall be as manufactured by APCO Valve & Primer Corp. (Model 50), Valmatic Valve and Manufacturing Company (Model 22), Golden Anderson, or approved equal.

2.03 OTHER MATERIALS

- A. Coarse Aggregate:
 - 1. PennDOT No. 2A or AASHTO No.8 in accordance with Table C, Section 703.2, Publication 408 Specifications.
- B. Concrete:
 - 1. PennDOT Class A, Section 03302.

PART 3 – EXECUTION

3.01 GENERAL

A. Refer to the design plans for location and pertinent elevations of water main air release chamber.

3.02 CLEARING AND GRUBBING

- A. Clear and grub each water main air release chamber site as required for construction in accordance with the design plans and as specified in Section 02110.
- B. A site inspection will be made with the Resident Project Representative to determine which of the existing trees are to remain which shall be suitably protected.

3.03 EXCAVATION

A. Excavate at the location of each water main air release chamber to the depth and area required as shown on the design plans and as specified in Section 02220.

3.04 SUBBASE

A. Provide a minimum 6" compacted coarse aggregate subbase for each precast water main air release chamber.

3.05 CONSTRUCTION

- A. Water Main Air Release Chamber:
 - 1. Construct the chamber of precast section, as shown on Construction Detail W-6 with steps in proper orientation and vertical alignment.

- 2. Seal joints between precast concrete sections with two (2) rings of a preformed joint sealant compound.
 - a. Place joint sealant compound on lower section to be squeezed by the weight of the upper section.
- B. Piping and Miscellaneous Structural Work:
 - 1. Install frame and cover to the elevation shown on the design plans by anchoring to the eccentric cone section at four (4) locations. Use precast grade rings to achieve elevation shown for frame and cover. Do not adjust elevation more than one (1) foot with precast grade rings. Seal joint between frame and top slab or grade ring with joint sealant compound.
 - 2. Provide a concrete floor in the chamber sloped to a sump pit with a frame and grate.
 - 3. Install the water main as specified in Section 02732 through the integral resilient connections within the precast base section of the chamber.
 - 4. Install air release valve in accordance with manufacturer's printed instructions with associated pipe, fittings and corporation stops as shown on Construction Detail W-6. Set air release valve plumb and provide piping support as required.
- C. Leakage Test:
 - 1. A vacuum test shall be performed on each water main air release chamber once the piping connections have been completed.
 - 2. The vacuum test shall be performed as specified in Section 02734.

3.06 BACKFILLING AND COMPACTING

- A. Backfill around each water main air release chamber only after approval is received from the Resident Project Representative.
- B. Backfill and compact in accordance with the design plans and as specified in Section 02220.

3.07 SITE RESTORATION WORK

A. Once the Water main air release chamber and related water main work have been completed, the following site restoration work shall be completed in accordance with the design plans and as specified in the noted Section(s).

- 1. Finish Grading Section 02905.
- 2. Replace Topsoil and Seed Section 02905.

3.08 STARTUP

A. After the water main air release chamber is completed and the water main is pressurized, CONTRACTOR shall conduct an inspection for leakage, perform a complete functional check of the air release valve and make all necessary adjustments for regular service.

END OF SECTTON

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Testing Water Main Pipeline:
 - a. Hydrostatic pressure testing.
 - b. Leakage testing.
 - 2. Disinfecting:
 - a. Bacteriological testing:

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 02660 Water Mains
 - 2. Section 02661 Water Main Valves
 - 3. Section 02662 Fire Hydrants
 - 4. Section 02663 Water Service Connections

1.03 QUALITY ASSURANCE

- A. Testing Agency:
 - 1. Bacteriological testing shall be performed by a certified testing laboratory engaged and paid for by CONTRACTOR.
- B. Reference Standards:
 - 1. American Water Works Association (AWWA):

C600-99 Standard for Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances, Section 4

C651-99 Standard for Disinfecting Water Mains

B300 Standard for Hypochlorites

B301 Standard for Liquid Chlorine

- C. Test Acceptance:
 - 1. The Resident Project Representative shall be notified in advance when testing and disinfection of the completed water main are to be performed.
 - 2. No test will be accepted until the results are below the specified maximum limits.
 - 3. CONTRACTOR shall, at his own expense, determine and correct the sources of leakage and retest until successful test results are achieved.

1.04 SUBMITTALS

- A. Test Procedures:
 - 1. Submit a testing sequence schedule including a list of testing equipment to be used.
- B. Certificates:
 - 1. Submit, prior to starting testing, certification attesting that the pressure gauges to be used have been calibrated and are accurate to the degree specified in Part 2, Products.
 - 2. Submit certification attesting that the chlorine form composition is as specified.
- C. Test Reports:
 - 1. Submit two copies of laboratory test reports of each bacteriological test.

PART 2-PRODUCTS

2.01 HYDROSTATIC TEST EQUIPMENT

- A. Typical hydrostatic test equipment:
 - Water pump
 - Pressure hose
 - Test connections
 - Water meter
 - Pressure gauge, calibrated to 0.1 lbs/sq. in.
 - Pressure relief valve
 - All other equipment and accessories as required

2.02 DISINFECTING CHEMICALS

A. Liquid chlorine, calcium hypochlorite, or sodium hypochlorite conforming to AWWA Standards B300 and B301.

PART 3- EXECUTION

3.01 **PREPARATION**

- A. Backfill trenches in accordance with Section 02220.
- B. Provide the water line under test with reaction thrust blocking. Hydrostatic testing shall not begin until the concrete thrust blocking has set. Allow 3,000 psi 28-day strength concrete to set (cure) for a minimum of 7 days prior to testing. If high early strength 3,000 psi 3-day strength concrete is used, hydrostatic testing may not begin until the concrete has set a minimum of 2 days.
- C. Provide pumps, piping, tanks, connections, polyurethane plugs and appurtenance. Water can be obtained from AUTHORITY's existing water distribution system only by an AUTHORITY representative.
- D. Preliminary Flushing:
 - 1. Prior to testing and disinfecting, except when the tablet chlorination method is used, fill the line to eliminate air pockets and flush the line at a rate of flow of 2.5 feet per second to remove particulates. Refer to AWWA C651-99 for rate of flow to produce 2.5 fps in pipe of various sizes.
 - 2. Dispose of flushing water, in method pre-approved by the ENGINEER. (Refer to AWWA 651-99). Do not discharge directly to the "Waters of The Commonwealth", including discharge to storm sewer systems.

3.02 TESTING WATER LINES

- A. Hydrostatic Testing:
 - 1. After the pipe has been laid, corporation stops installed, and the trench backfilled, the line shall he filled with water. Thereafter, each section between valves and, where practical, a section not over 1,000 feet shall receive the following hydrostatic test. The CONTRACTOR shall not install any service lines until after a successful test. **The entire system** shall be retested a second time after the services have been installed.
 - 2. The pipe shall be completely filled with potable quality water and tested to a pressure of not less than 1.25 times the working pressure at the highest

point along the test section. The pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the ENGINEER. The pump, pipe connections, taps into the pipe, and all necessary apparatus shall be furnished by the CONTRACTOR, subject to approval by the ENGINEER.

- 3. Before applying the specified test pressure, all air shall be expelled from the pipe. The CONTRACTOR shall furnish and install corporation stops as may be required at all high points and leave these points exposed so that air may be expelled as the line is filled with water. After air has been expelled, corporation stops shall be closed and test pressure applied.
- 4. Where any section of a main is provided with concrete thrust blocking, the pressure lest shall not be performed until at least five (5) days have elapsed after the concrete trust blocking was installed.
- 5. The test pressure shall be maintained for a period of not less than two (2) hours. The test pressure shall not vary by more than +/- 5 psi for the duration of the test. Should any pressure test disclose an inability to the test pressure, the CONTRACTOR shall locate and correct all defects and retest the line to the satisfaction of the ENGINEER.
- B. Leakage Tests:
 - 1. After completion of successful pressure testing, conduct the leakage test for a 2-hour period at a test pressure of not less than 1.25 times the working pressure based upon the elevation of the lowest point in the line under test corrected to the elevation of the test gauge. Leakage testing shall be conducted in accordance with AWWA C600-99 Standard.
 - 2. Expel air from the line under test, close the air vents and/or corporation stops and raise pressure to the specified test pressure. The leakage in the section under test is defined as the quantity of water supplied to maintain pressure within 5 psig of the specified test pressure during the entire testing period. Water pipe installation is deemed to have failed the leakage test if the leakage obtained is greater than that determined by the formula:

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

Where:

L is testing allowance (makeup water) in gallons/hour S is length of pipe tested in feet D is nominal diameter of pipe in inches P is average test pressure during hydrostatic test in pounds per square inch gauge

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

- 3. If test results indicate that the pipe laid has leakage greater than specified, locate and repair the defective joints, fittings, pipe or valves and retest until leakage is within allowable limits. Repair visible leaks regardless of the amount of leakage.
- 4. When hydrants arc in the test section, the test shall be made against the main valve in the hydrant.

3.03 **DISINFECTION**

- A. General:
 - 1. After completion of satisfactory pressure and leakage testing, disinfect the water pipelines in accordance with the recommended practice established in AWWA Standard C651-99. Conduct water line disinfection in the following steps:
 - a. Inspecting all materials to be used to ensure the integrity of the materials
 - b. Preventing contaminating materials from entering the water main during storage, construction, or repair and noting potential contamination at the construction site.
 - c. Removing, by flushing or other means, those materials that may have entered the water main.
 - d. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.
 - e. Protecting the existing distribution system from backflow caused by hydrostatic pressure test and disinfection procedures.
 - f. Documenting that an adequate level of chlorine contacted each pipe to provide disinfection.
 - g. Determining the bacteriological quantity by laboratory test after disinfection.
 - h. Final connection of the approved new water main to the active distribution system.

B. During construction, place calcium hypochlorite granules or tablets at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500 ft. intervals. Refer to AWWA C651-99 for quantity of chlorine to be used. In addition, one tablet shall he placed in each hydrant, hydrant branch and other appurtenances.

WARNING: This procedure must not be used on solvent welded plastic pipe or in screwed joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

- C. Chlorine Form:
 - 1. The chlorine form to be applied to the system shall be either calcium hypochlorite or sodium hypochlorite solutions. The ENGINEER must approve of the chlorine form to be used.
- D. Chlorine Application:
 - 1. Continuous Feed Method:
 - a. The continuous feed method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to remove air pockets, flushing with potable water chlorinated so that after a 24-hour holding period in the main there will be a free chlorine residual of not less than 10mg/L.
 - b. Feed water and chlorine to the line at a constant rate such that the water will have not less than 25 mg/L free chlorine. Chlorine application shall not cease until the entire line is filled with heavily chlorinated water.
 - c. During chlorine application, take precautionary measures to prevent the concentrated treatment solution from flowing back into the existing distribution system and/or supply source.
 - d. All valves and hydrants in the treated section shall be operated during the 24-hour holding period to ensure disinfection of the appurtenances.
 - 2. Tablet Method:
 - a. The tablet method consists of placing calcium hypochlorite tablets in the water main as it is being installed and then filling the main with potable water when installation is completed.

NOTE: Since the preliminary flushing step must be eliminated, this method may be used only when scrupulous cleanliness has been exercised and only with approval of the ENGINEER It shall not be used if trench water or foreign material has entered the main, or if the water temperature is below 41 degrees Fahrenheit.

- b. During construction, place sufficient number of 5 gram calcium hypochlorite tablets in each section of pipe, in hydrants, hydrant branches, and other appurtenances to obtain a minimum of 25 mg/L available chlorine. Attach tablets to the crown of pipe sections with adhesive approved for use with potable water. Apply adhesive only to the broad side of the tablet next to the pipe surface. Refer to AWWA C651-99 for the proper number of 5g calcium hypochlorite tablets required.
- c. When pipeline installation is complete, fill the main with water at a maximum velocity of one foot per second. This water shall remain in the pipe for at least 24-hours. Manipulate valves so that the chlorine solution does not flow back into the line supplying the water (AUTHORITY will operate valves).
- 3. During the 24-hour treatment, operate all valves, curb stops, and hydrants in the section treated.
- 4. At the completion of the 24-hour treatment, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine.
- 5. Repeat the disinfection process until the minimum available chlorine is present at the end of the treatment sequence. The tablet method cannot be used in these subsequent disinfections. No additional compensation will be provided Contractor for repeat treatment or testing.
- E. Final Flushing:
 - 1. After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with the pipe to prevent damage to the pipe lining and corrosion to the pipe. Flush the heavily chlorinated water from the main fittings, valves and branches under treatment until the chlorine concentration in the water leaving the system is no higher than that generally prevailing in the system or is acceptable for domestic use.
 - 2. The environment to which the chlorinated water is to be discharged should be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, a neutralizing chemical, such as sulfur dioxide, sodium bisulfite, sodium sulfite or sodium thiosulfate, shall be

applied to the water to be wasted in order to neutralize thoroughly the residual chlorine. Where necessary, federal, state and local regulatory agencies shall be contacted to determine special provisions for the disposal of heavily chlorinated water. The heavily chlorinated water shall not be directly discharged to a stream, pond, or water course.

- F. Bacteriological Testing:
 - 1. After final flushing is completed and before the water main is placed in service, two consecutive sets of acceptable samples taken at least 24 hours apart shall be collected from the new main. Each sample shall be tested for fecal coliform, turbidity, pH and standard heterotrophic plate count.
 - 2. Collect a minimum of one sample at the end of each line for each test, one sample of the incoming water from the existing water system for comparison, and at least one set of samples from every 1,200 ft. of the new water main.
 - 3. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by Standard Methods for the Examination of Water and Wastewater.
 - 4. Sampling tap shall consist of corporation stop installed in the main with copper tube goose neck assembly. When testing is successfully completed, sample laps shall have the corporation stop removed and a brass threaded plug installed.
 - 5. Bacteriological test results certifying that the water sampled from the new water main is free of coliform bacteria contamination and is equal to or better than the bacteriological water quality in the distribution system should be provided in writing to the AUTHORITY and the ENGINEER. In addition, the other sampled parameters should be equivalent or less than the levels present in the distribution system. Failure to meet state health standard requirements will be cause for CONTRACTOR to rechlorinate and retest the system.
 - 6. If the initial disinfection fails to produce satisfactory bacteriological results or if other water quality is affected, the new main shall be reflushed and resampled. The main shall be rechlorinated by the continuous feed or slug method until satisfactory results are obtained.

END OF SECTION

PART 1- GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section includes:
 - 1. Furnish and erect one water storage tank constructed of factory prefabricated glass coated, bolt-together steel panels. The tank structure shall include a foundation and other accessory components as shown on the detail drawings W-11 and W-12, and as described herein.
 - 2. All required tank materials and principal appurtenances shall be supplied by the tank manufacturer.
 - 3. Installation shall be executed by a qualified and experienced erection crew, trained and certified by the tank manufacturer.
 - 4. Tank structures and appurtenances shall be new and not previously used.
 - 5. Tank shall be designed and produced in the United States of America, by a manufacturer specializing in the production of glass-coated, bolt-together steel tank systems. Steel utilized in the tank structure shall be produced in the United States of America and meet the requirements of the Pennsylvania Steel Procurement Act.

1.02 QUALITY ASSURANCE

A. ANSI/AWWA D103-87

Tank steel panel fabrication and glass coating shall conform to all pertinent sections of the AWWA Standard for Bolted Steel Tanks (AWWA D103) unless otherwise specified herein.

B. ANSI/NSF Standard 61

The tank system including glass steel panels, sealing compound, encapsulated bolt heads, etc., shall be certified and listed by the National Sanitation Foundation (NSF) to meet ANSI/NSF Additive Standard No.61.

- C. ANSI/AWWA C652-02 Standard for Disinfection of Water-Storage Facilities
- D. The tank system shall be approved and certified by Factory Mutual (F.M)

E. The tank shall be as manufactured by A. O. Smith Harvestore Products. Inc. of DeKalb, IL. or approved equal.

1.03 SUBMITTALS

- A. The tank manufacturer shall submit for approval job specific tank foundation, general arrangement drawings and specifications for the tank structures and all appurtenances.
- B. Submittals shall include certification that each applicable Section of AWWA D103 is met. Any exceptions taken shall be noted with full explanation given for the deviation.
- C. Structural calculations shall be submitted for tank structures and foundations. The calculations shall be reviewed and the submittals sealed by a Professional Engineer licensed and registered in Pennsylvania.
- D. Copy of Mill Test Reports for steel sheets shall be submitted.
- E. Submittals shall include certification of erection crew training in the most recent erection procedures. Certification shall include: names of personnel having received such training, date and location where conducted, and a statement of competence. The document shall be executed by an officer of the tank manufacturer.

1.04 WARRANTY

- A. If within a period of one (1) year from date of completion (or 14 months after delivery), the tank structure or any\ part thereof shall prove to be defective in material or workmanship upon examination by the manufacturer, the manufacturer will supply a replacement part, will repair, or allowa credit for same.
- B. If the glass coating chips, cracks, spills, or under-cuts during normal municipal water service within a period of five (5) years from completion (or 62 months after delivery), the manufacturer will allow the same warranty.

PART 2 - PRODUCTS AND MATERIAL

2.01 GENERAL

A. Tank structures shall be or glass coated vertical, cylindrical sides and bottom, with bolt-together steel construction. The tank diameter and height shown below may be changed by the AUTHORITY, to meet the requirements of a specific project.

2.02 DESIGN CRITERIA

- A. Nominal Capacity (minimum) Gallons: 400,000
- B. Nominal Tank Diameter- Feet: 53
- C. Nominal sidewall Height Feet: 25
- D. Water Depth Feet: 24
- E. Tank Color Outside: Cobalt Blue
- F. Floor Type: Glass Coated Steel
- G. Roof Type: Glass Coated Steel or Aluminum depending upon tank diameter.
- H. Specific Gravity: 1.0
- I. Wind Force MPH: 100
- J. Soil Bearing PSF: Dependent upon proposed tank site conditions or 2000 PSF
- K. Roof Live Load PSF: 30
- L. Earthquake Seismic Per AWWA D103, Zone: I

2.03 MATERIALS

- A. Plates and Sheets
 - 1. Plates and sheets used in the construction of the tank sidewall, floor or roof shall comply with the minimum standards of AWWA D103, Section 2.4.
 - 2. The annealing effect created from the glass coated firing process shall be considered in determining ultimate steel strength. In no event shall a yield strength greater than 50,000 psi be utilized for calculations detailed in AWWA D103, Sections 3.4 and 3.5.
 - 3. Multiple vertical bolt line sheets (ASTM A607 Grade 50 only) shall be manufactured such that holes are staggered in the vertical bolt lines and that no two adjoining holes are in-line horizontally (except at the center of the sheet or plate).
 - 4. Sheet edges of sidewall and floor plates shall be mechanically removed and coated with a corrosion resistant material prior to glass coating so as

to ensure glass coating of the sheet edges. The process shall be equal to "EDGECOAT" by A.O. Smith Harvestore Products, Inc.

- 5. Bolt seam design shall generally be in accordance with the requirements of AWWA D103 Section 3.5.2; bolt spacing may be adjusted in the vertical bolt tines to increase the net section and improve joint efficiency to a maximum of 85%.
- 6. Double steel sheeting shall not be permitted to achieve structural requirements.
- B. Rolled Structural Shapes
 - 1. Material shall conform to minimum standards of ASTM A36 or AISI 1010.
- C. Horizontal Wind Stiffeners
 - 1. Design requirements for intermediate horizontal wind stiffeners shall be of the "web truss" design.
 - 2. Web truss stiffeners shall be of steel with hot dipped galvanized coating.
 - 3. Rolled angle stiffeners shall not be permitted for intermediate stiffeners.

D. Bolt Fasteners

- 1. Bolts used in tank lap joints shall be 1/2-13 UNC-2A rolled thread, and shall meet the minimum requirements of AWWA D103, Section 2.2.
- 2. Bolt Head Encapsulation
 - a. The entire bolt head shall be encapsulated up to the splines on the Shank with high impact polypropylene co-polymer.
 - b. Resin shall be black in color.
 - c. Bolt encapsulations shall be approved by NSF
- 3. Tank sidewall bolts shall be installed such that the head portion is located inside the tank, and washer and nut are on the exterior.
- 4. All lap joint bolts shall be properly selected such that threaded portions will not be exposed in the "shear plane" between the sheets. Also, bolt lengths shall be sized as to achieve a neat and uniform appearance. Excessive threads extending beyond the nut will not be permitted.

- 5. All lap joint bolts shall include a minimum of four (4) splines on the underside of the bolt head at the shank in order to resist rotation during torque wrench application.
- E. Sealants
 - 1. The lap joint sealant shall be a one component, moisture cured, polyurethane compound. The sealant shall be suitable for contact with potable water and meet applicable FDA Title 21 regulations, as well as NSF Standard No. 61.
 - 2. The sealant shall be used to seal lap joints, bolt connections and sheet edges. The sealant shall cure to a rubber-like consistency, have excellent adhesion to the glass coaling, have low shrinkage, and be suitable for interior and exterior exposure.
 - 3. The sealant shall be Harvestore Products, Inc., System Sealer No. 79.

2.04 GLASS COATING

- A. The glass coating system shall be in full accordance with the requirements of AWWA DI03 Section 10.4.
- B. Surface Preparation
 - 1. Following the decoiling and shearing process, sheets shall be steel grit blasted on both sides to the equivalent of SSPC-10. Sand blasting and chemical pickling of steel sheets are not acceptable.
 - 2. The surface anchor pattern shall be not less than 1.0 mils.
 - 3. These sheets shall be evenly oiled on both sides to protect them from corrosion during fabrication.
- C. Cleaning
 - 1. After fabrication and prior to application of the coating system, all sheets shall be thoroughly cleaned by a caustic wash and hot rinse process followed immediately by hot air drying.
 - 2. Inspection of the sheets shall be made for traces of foreign matter or rust. Any such sheets shall be recleaned or grit blasted to an acceptable level of quality.
- D. Coating Application

- 1. All sheets shall receive one coat of nickel-oxide pre-coat to both sides, prior to air drying. Furnace drying of the pre-com shall not be acceptable.
- 2. A final coat of cobalt blue glass frit shall be made to both sides of the sheets.
- 3. The sheets shall then be fired at a minimum temperature of 1500°F in strict accordance with quality process control procedures, including firing time, furnace humidity, temperature control, etc.
- 4. The finished coating thickness shall be not less than 7.0 mils not more than 11.0 mils.
- 5. The finished inside color shall be Cobalt Blue.
- 6. The standard finished outside color shall be Cobalt Blue.
- 7. Finished outside color shall not vary noticeably among tank panels. Off color panels will be rejected; replacement panels of matching color shall be supplied by the tank manufacturer.
- E. Inspection
 - 1. All coaled sheets shall be inspected for mil thickness Mikro test or equal.
 - 2. All coated sheets shall be checked for color and match by electronic colorimeter.
 - 3. An electrical leak detection test shall be performed on the inside surface of each panel after fabrication. Panels with more than 5 electrical leaks shall be rejected.
 - 4. Tank panels showing evidence of "fish scaling", "orange peel", "copper heads", or uneven glass coating shall be rejected.
- F. Packaging
 - 1. All approved sheets shall be protected from damage prior to packing for shipment.
 - 2. Heavy paper or plastic foam sheets shall be placed between panels to eliminate abrasion during handling.
 - 3. Individual stacks of panels will be wrapped in heavy 101 black plastic and steel banded to special wooden pallets built to the roll radius of the tank

panels, eliminating contact and movement of finished panels during shipment.

4. Shipment from the factory to the job site shall be by special truck, hauling the tank components exclusively.

2.05 FLOORS

- A. General
 - 1. The tank floor shall be constructed of glass-coated steel panels.
- B. Glass-coated Steel Floors
 - 1. Tank floors shall be fabricated of radially sectioned, glass-coated, bolttogether steel panels. Floor panel fabrication shall be similar to that for sidewall panels, employing the same scaling and bolting techniques. Exposed bolt ends, nuts and washers shall be covered with polyethylene co-polymer caps and sealant on the inside of the floor.

2.06 ROOF

- A. General
 - Tank roofs shall be furnished by the tank manufacturer and be constructed of either glass-coated steel panels or triangular aluminum panels, depending upon tank diameter. Roofs shall be clear span and selfsupporting. Center post supports are not permitted. Roof live loads and dead loads shall be carried by tank sidewalls, without additional support. A roof hatch, with hinged and gasketed cover, shall be provided near the outside tank ladder.
- B. Glass-coated Steel Roofs
 - 1. Glass-coated steel roofs shall be fabricated of radially sectioned, glasscoated bolt together steel panels. Roof panel fabrication shall be similar to that for sidewall panels, employing the same sealing and bolting techniques.
- C. Aluminum Dome Roofs
 - 1. Aluminum dome roofs shall be constructed of non-corrugated, triangular aluminum panels which are sealed and firmly clamped in an interlocking manner within a fully triangulated aluminum space truss system.

Materials

- a. Trusses and Tension Ring: 6061-T6 aluminum
- b. Panels: 0.05 inch thickness 3003-HI6 aluminum
- c. Fasteners: 7075-T73 aluminum or series 300 stainless steel
- d. Sealant and Gaskets: silicone rubber

Supplier

a. TEMCOR of Torrance, California

2.07 APPURTENANCES

- A. Roof Vent
 - 1. A properly sized vent assembly in accordance with AWWA D103 shall be furnished and installed above the maximum water level of sufficient capacity so that at maximum possible rate of water fill or withdrawal, the resulting interior pressure or vacuum will not exceed 0.5 inch water column.
 - 2. The overflow pipe shall not be considered to be a tank vent.
 - 3. The vent shall be constructed of aluminum.
 - 4. The vent shall be so designed in construction as to prevent the entrance of birds, animals, or insects, by including an expanded aluminum screen with 1/2 inch openings. An insect screen of 23-25 mesh polyester monofilament shall be designed to open, should the screen become plugged by ice formation.
- B. Pipe Connections
 - 1. Where pipe connections are shown to pass through tank panels, they shall be field located, saw cut, (acetylene torch cutting or welding is not permitted) and utilize an interior and exterior flange assembly. Harvestore Systems Sealer No. 79 shall be applied on any cut panel edges or bolt connections.
 - 2. Overflow piping shall be schedule 80 PVC pipe, with stainless steel birdinsect screen. A minimum of 18 inches free air gap shall be provided at the overflow outlet.
 - 3. All tank fill piping (flanged ductile through the tank bottom then schedule 80 PVC) shall be installed inside the tank structure, with piping provisions made to promote water circulation within the tank. Exterior fill lines with heal tracing will not be acceptable.

- 4. Tank discharge piping shall be Thickness Class 53 flanged ductile iron pipe, with the size determined on a case by case basis.
- 5. A center floor tank drain shall be provided, with fire hydrant outlet for flushing. Adequate provisions shall be made for handling water discharged during tank flushing to prevent erosion to the surrounding site.
- C. Outside Tank Ladder
 - 1. An outside tank ladder shall be furnished and installed as shown on the contract drawings.
 - 2. Ladders shall be fabricated of aluminum and utilize grooved, skid resistant rungs.
 - 3. Safety cage and step-off platforms shall be fabricated of galvanized steel, and shall have provisions for locking.
- D. Access Doors
 - 1. One bottom access door shall be provided ss shown on detail drawings per AWWA D-103 Section 5.1.
 - 2. Access door shall be 24" in diameter and shall include a properly designed reinforcing frame and cover plate.
- E. Identification Plate
 - 1. A manufacturers nameplate shall list the tank serial number, tank diameter and height, maximum design capacity, intended storage use, and date of installation. The nameplate shall be affixed to the tank exterior sidewall at a location approximately one foot from grade elevation in a position of unobstructed view.

PART 3 – EXECUTION

3.01 ERECTION

- A. General
 - 1. Supervisory personnel of the erection crew shall identify themselves to responsible personnel of the Engineer or Owner upon initially entering the job site. These names shall be checked against the certification of training submitted by the tank manufacturer, prior to performance of any work of

installation. Only such trained and certified personnel will be allowed on site.

- B. Tank Foundation
 - 1. The tank foundation shall be built in accordance with the contract drawings and/or approved Shop Drawings.
 - 2. Leveling of the starter ring shall be required and the maximum differential elevation with the ring shall not exceed 1/8 inch, nor exceed 1/16 inch within any 10 feet of circumference.
 - 3. In no case shall the backfill elevation vary more than one (1) foot around the periphery of the tank shell.
- C. Floors
 - 1. Glass-coated bolted steel floor panels shall be assembled over a 3 inch compacted sand base contained by either a steel or concrete ring wall. Alternately, if the panels are to be set on a concrete slab, a non-extruding and resilient bituminous type of filler may be used, meeting the requirements of ASTM D1751.
- D. Tank Structure
 - 1. Field erection of the glass-coated, bolted-steel structures and components shall be in strict accordance with the procedures established by manufacturers and performed by an authorized dealer of the tank manufacturer regularly engaged in erection of these tanks.
 - 2. Specialized erection jacks and building equipment developed and supplied by the tank manufacturer shall be used to erect the tanks.
 - 3. Particular care shall be taken in handling and bolting of the glass-coated steel tank panels and members to avoid abrasion of the coating system. Prior to liquid test, all surface areas shall be visually inspected. Chips or scrapes in the glass coating shall be repaired per the tank manufacturer's recommended procedure.
 - 4. The placement of the sealant on each panel may be inspected prior to placement of adjacent panels. However, the inspection shall not relieve any responsibility for liquid tightness.
 - 5. No backfill is to be placed against the tank sidewall without prior written approval and design review of the tank manufacturer. Any backfill shall be

placed strictly in accordance with the instructions of the tank manufacturer.

3.02 FIELD TESTING

- A. Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling to its overflow elevation.
- B. Any leaks disclosed by this test shall be corrected by the erector in accordance with the manufacturer's recommendations.
- C. Water required for testing will be furnished and disposed of by the CONTRACTOR following completion of tank erection.
- D. Labor and equipment necessary for tank testing shall be the responsibility of the CONTRACTOR.
- E. The ENGINEER shall be present during tank flushing, and disinfection.

3.03 **DISINFECTION**

- A. The tank structure shall be disinfected at the time of testing by chlorination in accordance with AWWA C652-02, or latest revision, "Disinfection of Water Storage Facilities".
- B. Acceptable Form of Chlorine for Disinfection:
 - 1. Sodium Hypochlorite, Section 3.2.
 - 2. Chlorination Method 3, Section 4.3.
- C. Disinfection shall not take place until the tank sealant is fully cured (10 to 12 days at 73°F. and 50% relative humidity or equivalent).
- D. The CONTRACTOR shall be responsible to provide water for disinfection, leakage, and flushing including proper disposal of super chlorinated disinfection water. The method of disposal shall be approved by the ENGINEER, 48 hours prior to performing the work.

3.04 INSPECTION

A. On or near the (l) year anniversary date of initial tank use (but not more than (14) months from date of delivery of tank materials to job site), the manufacturer's authorized dealer shall make a visual inspection of the tank interior coating and appurtenances, tank exterior coating and appurtenances, and the immediate area

surrounding the tank for evidence of leakage. A written summary of the inspection report will be filed with the tank owner and the tank manufacturer.

END OF SECTION

SECTION 02693 WELL ABANDONMENT PROCEDURES

PART 1-GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Proper well abandonment accomplishes the following:
 - a. Eliminates the physical hazard of the well (the hole in the ground)
 - b. Eliminates the pathway for migration of contamination
 - c. Prevents hydrologic changes in the aquifer system

1.02 QUALITY ASSURANCE

- A. Reference Standards: The most current requirements of the following Standards shall govern.
 - 1. American Water Works Association (AWWA) Standards A-100.
 - 2. Pennsylvania Department of Environmental Protection (PA DEP) Groundwater Monitoring Guidance Manual
 - 3. Water Well Drillers License Act (Act 610)

1.03 JOB CONDITTONS

- A. A well will be abandoned when anyone of the following conditions are encountered:
 - 1. The well is causing the spread of contamination from one aquifer horizon to another.
 - 2. The well has been out of use for more than one year and has no future plans of being used or its water level monitored.
 - 3. Within 30 days of date when AUTHORITY provides public water service to the property.

PART 2 - SEALING OF WELLS

2.01 PROCEDURE AND MATERIALS

A. The CONTRACTOR shall submit a "Well Abandonment Form" to PA DEP and Water-Well Drillers Licensing Service of the PA Geological Survey, at least 10 days prior to the well being sealed or filled and prior to site grading activities. A

SECTION 02693 WELL ABANDONMENT PROCEDURES

copy of the completed form shall be provided to the AUTHORITY and its ENGINEER.

- B. The casing and any liner piping within the well shall be left in place. Under no conditions will be outer casing be removed unless it is shown that the casing or grout is leaking. Casing can be cut flush with the ground surface.
- C. All equipment within the well such as pumps, supply pipes and wires, shall be removed before sealing the well.
- D. The total depth of the well will be measured and recorded on the Well Abandonment application. Using the well diameter and depth, the anticipated volume of sealing material will be prepared.
- E. The sealing material, being a concrete, cement grout or neat cement, shall be used as the primary sealing material. Under no conditions shall well cuttings, soil or stone be dumped into a well. The sealant shall be placed into the well in a "tremie" manner. This will be accomplished by pumping a premixed sealant under pressure, from the bottom of the hole through a pipe located at the base of the well. Pumping of sealant will continue until it flows to the surface.
- F. Accurate records of the abandonment work shall be recorded and submitted on the Well Abandonment application.
- G. Under no circumstances will a hole or void of any kind be left remaining in the ground that could risk future collapse or improper entry nor allow the vertical movement of water.

END OF SECTION

SECTION 02730 GRAVITY SANITARY SEWER PIPE

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Gravity sanitary sewer pipe
 - 2. Sanitary sewer laterals

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01560 Erosion and Sedimentation Control
 - 2. Section 02170 Stream Crossing
 - 3. Section 02220 Excavation, Backfill & Compaction
 - 4. Section 02229 Rock Removal
 - 5. Section 02300 Boring or Jacking Operations
 - 6. Section 02575 Restoration of Paved Surfaces
 - 7. Section 02731 Sanitary Manholes
 - 8. Section 02734 Sanitary Sewer System Testing
 - 9. Section 02905 Landscaping
 - 10. Section 03302 Concrete Work for Utilities
- B. Associated Construction Details:
 - 1. G-1 Pipe Embedment
 - 2. G-2 Concrete Encasement
 - 3. S-8 Service Connection Shallow Sewer
 - 4. S-15 Cleanout Protection Sleeve

1.03 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American National Standards Institute (ANSI):

A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

A21.5 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids

A21.1 0 Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids

SECTION 02730 GRAVITY SANITARY SEWER PIPE

A21.11 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

A21.50 Thickness Design of Ductile-Iron Pipe

A21.51 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water and Other Liquids

A21 .53 Ductile-Iron Compact Fittings, 3-inch through 16-inch, for Water and Other Liquids

2. American Society for Testing and Materials (ASTM):

D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D2466 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

D3034 Specification for Type PMS Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679 Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

- B. Acceptable Manufacturer:
 - 1. The pipe, fittings and associated items shall be provided by a firm regularly engaged in the manufacture of such products of the types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
 - 2. Ductile iron pipe shall be provided by one of the following manufacturers, or approved equal
 - a. U.S. Pipe and Foundry Company
 - b. Griffin Pipe Products Company
 - c. Atlantic States Cast Iron Pipe Company

SECTION 02730 GRAVITY SANITARY SEWER PIPE

- 3. Polyvinyl chloride (PVC) pipe shall be provided by one of the following manufacturers or approved equal.
 - a. J-M Manufacturing Company, Inc.
 - b. ETI Pipe
 - c. CertainTeed Corporation
 - d. Bristol Pipe
- C. Reject materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner, or acid solder.

1.04 SUBMITTALS

- A. Manufacturer's Literature:
 - 1. Submit manufacturer's descriptive literature for the following items:
 - a. Pipe, pipe fittings, joints, joint gaskets and lubricants.
 - 2. Submit manufacturer's certificate certifying that the following items were manufactured and tested in accordance with the applicable standards:
 - a. Pipe and pipe fittings

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling:
 - 1. Do not place materials on private property without written permission of the property owner.
 - 2. During loading, transporting and unloading, exercise care to prevent damage to materials.
 - 3. Do not drop pipe or fittings. Avoid shock or damage at all times.
 - 4. Take measures to prevent damage to the exterior surface or internal lining of the pipe.
- B. Storage:
- 1. Pipe may be strung along alignment where approved by the ENGINEER.
- 2. Do not stack pipe higher than recommended by the pipe manufacturer.
- 3. Store gaskets for mechanical and push-on joints in a cool, dry location out of direct sunlight and not in contact with petroleum products.

PART 2 – PRODUCTS

- 2.01 DUCTILE IRON PIPE
 - A. Pipe:
 - 1. ANSI A21 .51, Thickness Class 50 (minimum).
 - 2. For trenches > 15 deep.
 - 3. Double cement-mortar lining with seal coat, ANSI A21.4.
 - B. Fittings:
 - 1. Ductile-iron, ANSI A21.1 0, class 350.
 - 2. Provide double cement-mortar lining with seal coat as for ductile-iron pipe, ANSI A21.4.
 - C. Joints:
 - 1. Where not specifically shown on the Drawings, pipe joints may be either mechanical joint or push-on joint, ANSI 21.11. Fittings shall have mechanical joints only conforming to ANSI 21.11.
 - a. Rubber gaskets, lubricants, glands, bolts and nuts: ANSI A21.11

2.02 POLYVINYL CHLORIDE (PVC) PIPE

- A. Pipe:
 - 1. Pipe 15" diameter and smaller: ASTM D03034, SDR-26.

- B. Fittings:
 - 1. PVC gasketed sewer fittings, suitable for use with SDR 26 PVC pipe, as manufactured by The Harrington Corporation (Harco). No other fittings shall be permitted.
- C. Joints:
 - 1. Flexible Elastomeric Seals: ASTM D3212 Seal Material: ASTM F477

PART 3 - EXECUTION

3.01 PREPARATION

- A. Perform trench excavation to the line and grade indicated on the design plans and as specified in Section 02220.
- B. Unless otherwise indicated on the design plans, provide for a minimum cover of 4- 1/2 feet above the top of piping laid in the trench based on the finished grade elevation.
- C. Provide pipe bedding as specified in Section 02220 and as shown on the Construction Detail G-1 for each type of pipe used. Place aggregate in a manner to avoid segregation, and compact to the maximum practical density so that the pipe can be laid to the required tolerances.
- D. All laterals shall be located where shown on the design plans or otherwise directed by AUTHORITY with input by CONTRACTOR.
- E. Sewer pipe material shall be as follows:
 - 1. 0 15 feet deep PVC SDR 26
 - 2. > 15 feet deep Thickness Class 50 Ductile Iron Pipe.

A sewer segment between manholes shall consist of the same type of pipe material based on the maximum depth encountered.

3.02 LAYING PIPE IN TRENCHES

A. Give ample notice to the ENGINEER in advance of pipe laying operations.

- B. Use laser alignment instruments, to maintain proper alignment and slope.
- C. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.
- D. Lay pipe proceeding up-grade with the bell or groove pointing upstream.
- E. Lay pipe to a true uniform line with the barrel of the pipe resting solidly in bedding material throughout its length. Excavate recesses in bedding material to accommodate joints, fittings and appurtenances. Do not subject pipe to a flow or shock to achieve solid bearing or grade.
- F. Lay each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.
- G. Clean and inspect each section of pipe before joining. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement. Use lubricant recommended by the pipe or fitting manufacturer for making joints. If unusual joining resistance is encountered or if the pipe cannot be fully inserted into the bell, disassemble joint, inspect for damage, re-clean joint components, and reassemble joint.
- H. Assemble joints in accordance with recommendations of the manufacturer.
 - 1. Push-on Joints:
 - a. Clean the inside of the bell and the outside of the spigot. Insert rubber gasket into the bell recess.
 - b. Apply a thin film of gasket lubricant to either the inside of the gasket or the spigot end of the pipe, or both.
 - c. Insert the spigot end of the pipe into the socket using care to keep the joint from contacting the ground. Complete the joint by forcing the plain end to the bottom of the socket. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot is fully inserted.
 - 2. Mechanical Joints:
 - a. Wash the socket and plain end. Apply a thin film of soapy water. Slip the gland and gasket over the plain end of the pipe. Apply soapy water to gasket.

- b. Insert the plain end of the pipe into the socket and seat the gasket evenly in the socket.
- c. Slide the gland into position, insert bolts, and finger-tighten nuts.
- d. Bring bolts to uniform tightness. Tighten bolts 180-degrees apart, alternately.
- e. Coat all bolts and nuts with bitumastic paint after installation.
- I. Disassemble and remake improperly assembled joints using a new gasket.
- J. Check each pipe installed as to line and grade in place. Correct deviation from line and grade immediately. A deviation from the designed grade as shown on the design plans, or deflection of pipe joints, will be cause for rejection.
- K. Place sufficient compacted embedment material on each section of pipe, as it is laid, to hold firmly in place.
- L. Clean interior of the pipe as work progresses. Where cleaning after laying is difficult because of small pipe size, use a suitable swab or drag in the pipe and pull forward past each joint immediately after the jointing has been completed.
- M. Keep trenches and excavations free of water during construction.
- N. When the work is not in progress, and at the end of each work day, securely plug open ends of pipe and fittings to prevent trench water, earth, or other substances from entering the pipes or fittings.

3.03 WYE AND TEE-WYE BRANCHES

- A. Install wye or tee-wye branches concurrent with pipe laying operations for each proposed lateral. Use standard fittings of the same material and joint type as the pipeline into which they are installed. Rotate wye or tee-wye branch such that sanitary lateral elevation will be at or higher than the crown of the sewer line.
- B. For taps into an existing pipeline, use a saddle wye with stainless steel clamps in accordance with Construction Detail S-10, and as manufactured by Romac, or approved equal. Layout holes with a template and cut holes with a mechanical hole cutter.
- C. Connection of a proposed lateral to a manhole will not be permitted without prior approval.

3.04 LATERALS

- A. Construct laterals from the wye or tee-wye branch to a terminal point in accordance with Construction Details S-8 and S-9. Laterals shall be of the following diameter:
 - Single family residential unit 4"
 - Multi-family residential or commercial building 6" unless otherwise shown on the design plans.
- B. Cleanout(s) must be installed at the right-of-way line, at every bend and every 50 feet thereafter for 4 inch PVC and 100 feet for 6 inch PVC, regardless of the length of lateral. The cleanout must be physically located in the right-of-way.
- C. Where the depth of the main pipeline exceeds ten (10) feet, construct laterals from the wye or tee-wye branch in accordance with Construction Detail S-9 unless the elevation of the building to be served precludes this option. The determination as to the type of riser, slope, and depth of lateral pipe at the termination point will be made by the CONTRACTOR in the field.
- D. Install an approved watertight plug, braced to withstand pipeline test pressure thrust, at the termination of the lateral. Install a temporary marker stake extending from the end of the lateral to one (1) foot above finished grade. The top of the marker stake shall be painted green and/or labeled "sewer".
- E. Cleanouts which are located in paved areas or sidewalks, shall be provided with a cleanout protection sleeve in accordance with sanitary sewer Construction Detail S-15.

3.05 BUILDING SEWER

- A. Construct building sewer from lateral to building in accordance with edition of the International Plumbing Code adopted by Warwick Township.
- B. PVC pipe shall be embedded in coarse aggregate as specified in Section 02220 and as shown on Construction Detail G-1.
- C. Provide a minimum of 2- 1/2 feet of cover at the building with increasing depth approaching sewer main.

3.06 CAST-IN-PLACE CONCRETE CONSTRUCTION

A. Conform to the applicable requirements of Section 03302.

3.07 CONCRETE ENCASEMENT

A. Provide concrete encasement for pipeline where indicated on the design plans, or as directed by the ENGINEER, and in accordance with Construction Detail G-2.

3.08 STREAM CROSSINGS

A. Construct sanitary sewer stream crossings in accordance with Section 02170.

3.09 HIGHWAY AND RAILROAD CROSSINGS

- A. Install sewer lines crossing highways and railroads as shown on design plans. Comply with Railroad Company, Pennsylvania Department of Transportation, and Warwick Township permits.
- B. When casing pipe is required, comply with requirements of Section 02300.

3.10 BRIDGE OR AERIAL CROSSINGS

A. For an above-the-ground sewer line attached to a bridge or other structure, furnish and install all supports, hangers and fastenings, insulation, and protection jacket as shown on the design plans.

3.11 BACKFILLING TRENCHES

- A. Backfill pipeline trenches only after examination of pipe laying by the ENGINEER.
- B. Backfill trenches as specified in Section 02220.

3.12 TESTING

- A. Gravity sewers shall be tested for leakage in accordance with Section 02734.
- B. PVC Gravity sewers shall be tested for deflection in accordance with Section 02734.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Precast Concrete Manholes
 - 2. Concrete Manhole Bases
 - 3. Manhole Steps
 - 4. Manhole Covers and Frames
 - 5. Manhole inflow prevention inserts

1.02 RELATED INFORMATION

- A. Related Work Specified Elsewhere:
 - 1. Section 01560 Erosion and Sedimentation Control
 - 2. Section 02220 Excavation, Backfill & Compaction
 - 3. Section 02229 Rock Removal
 - 4. Section 02575 Restoration of Paved Surfaces
 - 5. Section 02730 Gravity Sanitary Sewer Pipe
 - 6. Section 02734 Sanitary Sewer System Testing
 - 7. Section 02905 Landscaping
 - 8. Section 03302 Concrete Work for Utilities
- B. Associated Construction Details
 - 1. S-1- Standard Manhole Type 'A'
 - 2. S-2 Standard Manhole Type 'B'
 - 3. S-3 Drop Manhole Type 'A'
 - 4. S-4 Doghouse Manhole
 - 5. S-5 Manhole Frame and Cover Standard
 - 6. S-6 Manhole Frame and Cover Watertight
 - 7. S-7 Manhole Step

1.03 QUALITY ASSURANCE

- A. Reference Standards
 - 1. American Association of State Highway and Transportation Officials (AASHTO): Standard Specifications for Highway Bridges
 - 2. American Society for Testing and Materials (ASTM):

A48 Specification for Gray Iron Castings C270 Specification for Mortar for Unit Masonry

C478 Specification for Precast Reinforced Concrete Manhole Sections

C923 Specification for Resilient Connections between Reinforced Concrete Manhole Structures and Pipes

3. Federal Specification:

SS-S-00210 Joint Sealant Compound

4. Pennsylvania Department of Transportation:

Publication 408 Specifications

- B. Acceptable Manufacturer:
 - 1. The sanitary manhole structure, and frame and cover shall be provided by a firm regularly engaged in the manufacture of such products of the types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
 - 2. Sanitary manhole structures shall be provided by one of the following manufacturers or approved equal.
 - a. Atlantic Concrete Products, Inc.
 - b. Monarch Precast Concrete Corporation
 - c. Terre Hill Precast Concrete,
 - d. Modern Concrete Septic Tank Company
 - 3. Frames and covers shall be provided by one of the following manufacturers or approved equal.
 - a. Neenah Foundry Company
 - b. E.A. Quirin Machine Shop, Inc.
 - c. East Jordan Iron Works, Inc.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit certified dimensional shop drawings of the following items:
 - Manhole sections and precast bases

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- Manhole frames and covers
- Manhole steps
- B. Manufacturer's Literature:
 - 1. Submit manufacturer's descriptive literature for the following items:
 - Pipe to manhole flexible connections
 - Gasket material used to seal manhole sections
 - Reinforcing steel
 - Joint design
 - Concrete mix design/loading calculations
- C. 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

- 2.01 BASIC MATERIALS
 - A. Coarse Aggregate Subbase:
 - 1. PennDOT No. 2A or AASHTO No. 8 in accordance with Table C, Section 703.2, Publication 408 Specifications.
 - B. Masonry Mortar: ASTM C270, Type S.
 - C. Concrete: See Section 03302 Concrete Work for Utilities
 - D. Joint Sealant Compound: FS-S-00210, preformed, flexible, self-adhering, coldapplied, as manufactured by A-Lok Products Inc. ("Butyl-Lok"), K.T. Snyder Company, Inc. ("RamNek"), or approved equal to provide a watertight joint under all conditions of service.
 - E. Resilient Pipe-to-Manhole Connection: ASTM C923

2.02 FABRICATED PRODUCTS

- A. See Section 03411 Precast Concrete, for precast concrete requirements
- B. Manhole Steps: (See Construction Detail S-7):
 - 1. Steel reinforced polypropylene with serrated tread and end lugs as manufactured by M.A. Industries Inc., or approved equal.

- C. Manhole Frames and Covers (See Construction Details S-5 and S-6):
 - 1. Domestic cast iron castings: ASTM A48, Class 30 or better, free of bubbles, sand and air holes, and other imperfections.
 - 2. Heavy duty traffic, AASHTO Highway Loading Class HS-20.
 - 3. Contact surfaces machined and matched.
 - 4. All manhole covers shall be inscripted "WTWSA-SEWER" with raised letters. Letters shall have a height and width of not less than two (2) inches.
 - 5. All manhole covers shall have two (2) concealed pick holes.
 - 6. Watertight covers when required shall include an O-ring gasket, four (4) bolt holes in frame and cover, and "/2 inch diameter stainless steel hex head bolts.
 - 7. Manufactured by Neenah Foundry Company, or approved equal.

Standard: Model R- 1642 Watertight: Model R-1916-F

- D. Manhole Inflow Prevention Inserts:
 - 1. The Authority may require that inflow prevention inserts be provided and installed in manholes which absolutely must he located in flood prone areas, or cannot have the top of manhole raised above maximum flood elevation. The inserts may also be required prior to system dedication to in manholes which have previously been installed as part of the project where an inflow problem has been noted by the Engineer.
 - 2. The inflow prevention insert shall be the Kutson manhole insert as supplied by J.C. Utility Sales of Dallas, Texas (1-800-966-5147), or approved equal.

PART 3 – EXECUTION

3.01 EXCAVATION

- A. Perform excavation to the line and grade shown on the design plans and as specified in Section 02220.
- B. Location and depth of manholes as shown on the design plans.

3.02 CONSTRUCTION

- A. Construct watertight manholes of precast concrete sections and of the type noted on the design plans in accordance with Construction Details S-1, S-2 and S-3 and ASTM C478. Drop manholes shall be provided where the invert drop is two (2) feet or more.
- B. Install precast base on a minimum of six (6) inches of coarse aggregate subbase.
 - 1. An integral resilient connection shall be provided at each pipe location which will serve as a watertight seal.
- C. Install sewer connections to manhole base.
 - 1. Where soft or unstable soil conditions exist, undercut, install and compact stone until base is stable.
 - a. Five (5) feet for new precast base.
 - b. Two (2) feet for new cast-in-place base and connections to existing base.
 - 2. Pipe shall not project more than 2" into the manhole.
 - 3. The bottom portion of the annular space around the sewer pipe within the inside of the manhole shall be filled with non-shrink grout to match the channel. No grout shall be used on the upper portion of the annular space or in the exterior annular space.
- Form flow channels in manhole bases as shown on the design plans. Slope channels uniformly from influent invert to effluent invert. Slope bench towards channel at one (1) inch per foot. Construct bends of the largest possible radius. Form channel sides and invert smooth and uniform, free of cracks, holes or protrusions.
- E. Seal joints between precast concrete manhole sections with two (2) rings of preformed joint sealant compound.
 - 1. Place joint sealant compound on lower section to be squeezed by the weight of the upper section.
- F. Install manhole sections with steps in proper vertical alignment.
- G. Use precast concrete grade rings to achieve elevation shown for frame and cover, do not adjust elevation more than one (1) foot with precast rings. Provide the exterior of the grade rings with a 1/2" thick coat of mortar.

- H. Install manhole frames and covers.
 - 1. Set top of frames at finished grade elevation or other elevation shown on the design plans.
 - 2. Anchor manhole frame to the precast structure at four (4) locations.
 - 3. Seal joint between manhole frame and manhole with joint sealant compound. Provide watertight and vented covers where shown on the design plans.
- I. Where new manholes are to be constructed on existing pipelines, carefully excavate around existing pipeline for placement of the new cast-in-place manhole base in accordance with Construction Detail S-4. Take all measures necessary to control flow through the existing pipeline and to prevent leakage into the new base. After completion and testing of the manhole, carefully remove the top portion of the existing pipeline.
- J. For connections to an existing manhole, provide an opening in the manhole wall no larger than two (2) inches around the new pipe and modify the existing bench to create a new channel which shall be finished with non-shrink grout. Install a waterstop around the new pipe and position the pipe to the correct alignment; fill and seal the annular space between the gasket and the existing manhole wall with non-shrink grout.

3.03 BACKFILLING

- A. Backfill only after examination of the manhole by the Resident Project Representative.
- B. Perform backfilling as specified in Section 02220.

3.04 TESTING

A. Manholes shall be tested for leakage in accordance with Section 02734.

3.05 SITE RESTORATION WORK

- A. Once the manholes and related sanitary sewer construction has been completed in an area, the following site restoration work shall be completed in accordance with the design plans and as specified in the noted Sections:
 - 1. Finish Grading, Section 02905
 - 2. Replace Topsoil and Seed, Section 02905
 - 3. Pavement Restoration, Section 02575

B. CONTRACTOR shall stage site restoration work for a large project in accordance with the construction schedule approved by ENGINEER.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Sanitary Pump Station Force Main

1.02 RELATED INFORMATION

- A. Related Sections:
 - 1. Section 01560 Erosion and Sedimentation Control
 - 2. Section 02170 Stream Crossing
 - 3. Section 02220 Excavation, Backfill and Compaction
 - 4. Section 02229 Rock Removal
 - 5. Section 02300 Boring or Jacking Operations
 - 6. Section 02575 Restoration of Paved Surfaces
 - 7. Section 02733 Force Main Cleanout Chamber
 - 8. Section 02734 Sanitary Sewer System Testing
 - 9. Section 02905 Landscaping
 - 10. Section 03302 Concrete Work for Utilities
 - 11. Section 11306 Sewage Pumping Station
- B. Associated Construction Details:
 - 1. G-1 Pipe Embedment
 - 2. G- 2 Concrete Encasement
 - 3. G-12 Horizontal Thrust Block Arrangement

1.03 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American National Standards Institute (ANSI):

A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

A21.5 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids

A21.10 Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids

A21.11 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

A21 .15 Flanged Ductile - Iron Pipe with Threaded Flanges

A21.50 Thickness Design of Ductile-Iron Pipe

A21.5 1 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

A21.53 Ductile-Iron Compact Fittings, 3-inch through 16-inch, for Water and Other Liquids

2. American Society for Testing and Materials (ASTM):

D2241 Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

D3139 Specification for Joints far Plastic Pressure Pipes using Flexible Elastomeric Seals

F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

- B. Acceptable Manufacturer:
 - 1. The pipe, fittings and associated items shall be provided by a firm regularly engaged in the manufacture of such products of the types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
 - 2. Ductile iron pipe shall be provided by one of the following manufacturers, or approved equal.
 - a. U.S. Pipe and Foundry Company
 - b. Griffin Pipe Products Company
 - c. Atlantic States Cast Iron Pipe Company
 - 3. Polyvinylchloride (PVC) pipe shall be provided by one of the following manufacturers, or approved equal.
 - a. J-M Manufacturing Company, Inc.
 - b. ETI Pipe
 - c. CertainTeed Corporation

C. Reject materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner, or acid solder.

1.04 SUBMITTALS

- A. Submit manufacturer's descriptive literature for the following items:
 - 1. Pipe, pipe fittings, joints, joint gaskets and lubricants.
 - 2. Submit manufacturer's certificate certifying that the following items were manufactured and tested in accordance with the applicable standards:
 - a. Pipe and pipe fittings

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling:
 - 1. Do not place materials on private property without written permission of the property owner.
 - 2. During loading, transporting and unloading, exercise care to prevent damage to materials.
 - 3. Do not drop pipe or fittings. Avoid shock or damage at all times.
 - 4. Take measures to prevent damage to the exterior surface or internal lining of the pipe.
- B. Storage:
 - 1. Pipe may be strung along alignment where approved by the ENGINEER.
 - 2. Do not stack pipe higher than recommended by the pipe manufacturer.
 - 3. Store gaskets for mechanical and push-on joints in a cool, dry location out of direct sunlight and not in contact with petroleum products.

PART 2 – PRODUCTS

- 2.01 DUCTILE IRON PIPE
 - A. Pipe:

- 1. ANSI A21.51, Thickness Class 52 for buried service (mechanical or pushon joint) and Thickness Class 53 for non-buried service (flanged joint).
- 2. Double cement-mortar lining with seal coat, ANSI A21.4
- B. Fittings:
 - 1. Ductile-iron mechanical joint (below grade) or gray-iron flanged joint (above grade), ANSI A21.10 or ANSI A21.53.
 - 2. Provide double cement-mortar lining with seal coat as for ductile iron pipe, ANSI 21.4. Provide asphalt coating on the pipe exterior for below grade applications.
 - 3. Pressure rating shall be 350 psi for below grade applications and 250 psi for above grade flanged piping.
 - 4. Provide "Megalug® " restraint glands at all fittings.
- C. Joints:
 - 1. Where not specifically shown on the design plans, pipe joints in buried service may be either mechanical joint or push-on joint conforming with ANSI 21.11. Fittings in buried service shall have mechanical joints only, conforming to ANSI 21.11.
 - a. Rubber gaskets, lubricants, glands, bolts and nuts: ANSI A21.11.
 - 2. Flanged joints for pipe within chambers/structures shall conform with ANSI 21.10 and 21.15.

2.02 VINYLCHLORIDE (PVC) PIPE

- A. Pipe:
 - 1. Pressure-Rated:
 - a. ASTM D-1784, C-900 DR-14 (4"-12") and C-905 (12"-24") with a minimum pressure rating of 200 psi.
 - 2. Flexible Elastomeric Seals: ASTM D3139 Seal Material: ASTM F477.
- B. Fittings: Mechanical joint 350 psi ductile iron fittings cement lined and asphalt coated inside and out.

C. Provide Megalug® restraint glands at each fitting, suitable for use with the specified PVC pipe.

2.03 OTHER ITEMS

- A. Detection Tape:
 - 1. Six (6) inches wide, metallic, colored with wording of "CAUTION-SEWER LINE BURIED BELOW".
 - 2. Manufactured by Seton Name Plate Company (Style 6 SEW-G), or approved equal.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Perform trench excavation to the alignment indicated on the design plans and as specified in Section 02220.
- B. Unless otherwise indicated on the design plans, provide for a minimum cover of four (4) feet above the top of piping laid in the trench based on the finished grade elevation.
- C. Provide pipe bedding as specified in Section 02220 and as shown on Construction Detail G-l for each type of pipe used. Place aggregate in a manner to avoid segregation, and compact to the maximum practical density so that the pipe can be adequately supported.

3.02 LAYING PIPE IN TRENCHES

- A. Give ample notice to the Resident Project Representative in advance of pipe laying operations.
- B. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.
- C. Lay pipe proceeding from the terminal end to the sewage pumping station with the bell pointing toward the sewage pumping station.
- D. Lay pipe to a uniform line with the barrel of the pipe resting solidly in bedding material throughout its length. Excavate recesses in bedding material to accommodate joints, fittings and appurtenances. Do not subject pipe to a blow or shock to achieve solid bearing or grade.

- E. Lay ash section of pipe in such a manner as to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.
- F. Clean and inspect each section of pipe before joining. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement. Use lubricant recommended by the pipe or fitting manufacturer for making joints. If unusual joining resistance is encountered or if the pipe cannot be fully inserted into the bell, disassemble joint, inspect for damage, reclean joint components, and reassemble joint.
- G. Assemble joints in accordance with recommendations of the manufacturer.
 - 1. Push-on Joints:
 - a. Clean the inside of the bell and the outside of the spigot. Insert rubber gasket into the bell recess.
 - b. Apply a thin film of gasket lubricant to either the inside of the gasket or the spigot end of the pipe, or both.
 - c. Insert the spigot end of the pipe into the socket using care to keep the joint from contacting the ground. Complete the joint by forcing the plain end to the bottom of the socket. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot is fully inserted.
 - 2. Mechanical Joints:
 - a. Wash the socket and plain end. Apply a thin film of soapy water. Slip the gland and gasket over the plain end of the pipe. Apply soapy water to gasket.
 - b. Insert the plain end of the pipe into the socket and seat the gasket evenly in the socket.
 - c. Slide the gland into position, insert bolts, and finger-tighten nuts.
 - d. Bring bolts to uniform tightness. Tighten bolts 180-degrees apart, alternately.
 - e. Coat all bolts and nuts with bitumastic paint after installation.
 - 3. Coupled Joints: In accordance with manufacturer's recommendations.
- H. Disassemble and remake improperly assembled joints using a new gasket.

- I. Check each pipe installed as to alignment in place. Correct deviations immediately. A deviation from the alignment as shown on the design plans, or unnecessary deflection of pipe joints, will be cause for rejection.
- J. Place sufficient compacted embedment material on each section of pipe, as it is laid, to hold firmly in place.
- K. Install fittings as pipe laying progresses. Do not support weight of fittings from pipe.
- L. Clean interior of the pipe as work progresses. Where cleaning after laying is difficult because of small pipe size, use a suitable swab or drag in the pipe and pull forward past each joint immediately after the jointing has been completed.
- M. Keep trenches and excavations free of water during construction.
- N. When the work is not in progress, and at the end of each work day, securely plug open ends of pipe and fittings to prevent trench water, earth, or other substances from entering the pipes or fittings.

3.03 CUTTING PIPE

- A. Cut pipe without damaging pipe or lining.
- B. Grind cut ends and rough edges smooth. Bevel ends for push-on joints.

3.04 DEFLECTION

- A. When it is necessary to deflect a sanitary force main from a straight alignment horizontally or vertically, the sewage force main shall be laid in a smooth arc and the deflection of joints shall not exceed the following limits:
 - 1. Ductile Iron Pipe:
 - 2. PVC Pipe: Per manufacturer's recommendations
- B. Where required, fittings will be used to obtain deflections greater than noted above.

3.05 CAST-IN-PLACE CONCRETE CONSTRUCTION

A. Conform to the applicable requirements of Section 03302

3.06 CONCRETE ENCASEMENT

A. Provide concrete encasement for pipeline where indicated on the design plans, or as directed by the Resident Project Representative, and in accordance with Construction Detail G-2.

3.07 THRUST RESTRAINT

A. Provide thrust blocking in accordance with Construction Detail S-14 at all fittings associated with the sewage force main. The required bearing area is to be determined based on case specific calculations.

3.08 STREAM CROSSINGS

A. Construct sewage force main stream crossings in accordance with Section 02170.

3.09 FORCEMAIN CLEANOUT CHAMBER

A. Construct force main clean-out chamber(s) where shown on the design plans in accordance with Section 02733.

3.10 HIGHWAY AND RAILROAD CROSSINGS

- A. Install sewage force main crossings of highways and railroads as shown on design plans. Comply with Railroad Company, Pennsylvania Department of Transportation, and Warwick Township permits.
- B. When casing pipe is required, comply with requirements of Section 02300.

3.11 BRIDGE OR AERIAL CROSSINGS

A. For an above-the-ground sewage force main attached to a bridge or other structure, furnish and install and install all supports, hangers and fastenings, insulation, and protection jacket as shown on the design plans.

3.12 FORCE MAIN AIR RELEASE VALVE

A. See Section 11306 relative to specifications for an air release valve within the pump station valve chamber. If a separate air release valve chamber is needed on the force main, ENGINEER shall be contacted prior to design.

3. 13 BACKFILLING TRENCHES

A. Backfill pipeline trenches only after examination of pipe laying by the ENGINEER.

- B. Backfill trenches as specified in Section 02220.
- C. Provide a metallic detection tape over PVC force main.

3.14 TESTING

A. Force main shall be tested for leakage in accordance with Section 02734.

END OF SECTION

PART 1 GENERAL

1.01 SECTION DESCRIPTION

- A. This Section Includes:
 - 1. CONTRACTOR shall furnish all materials, labor and equipment necessary to install force main cleanout chamber(s) as and where shown on the Drawings and as hereinafter specified.
 - 2. The force main cleanout chamber shall consist of a precast reinforced concrete structure with manhole frame and cover and manhole steps. The equipment contained within the force main cleanout chamber shall contain piping, fitting with cleanout provision and hose end gate valve.

1.02 RELATED INFORMATION

- A. Related Work Specified Elsewhere:
 - 1. Section 01560 Soil Erosion and Sedimentation Control
 - 2. Section 02110 Clearing and Grubbing
 - 3. Section 02220 Excavation, Backfill and Compaction
 - 4. Section 02229 Rock Removal
 - 5. Section 02575 Restoration of Paved Surfaces
 - 6. Section 02732 Sanitary Force Main and Appurtenances
 - 7. Section 02934 Sanitary Sewer System Testing
 - 8. Section 02905 Landscaping
 - 9. Section 11306 Sewage Pumping Station
- B. Associated Construction Details
 - 1. S-17 Force Main Cleanout Chamber
 - 2. S-6 Manhole Frame and Cover-Watertight
 - 3. S-7 Manhole Step

1.03 QUALITY ASSURANCE

- A. Reference Standards
 - 1. American Society for Testing and Materials (ASTM):

A48 Specification for Gray Iron Castings

C270 Specification for Mortar for Unit Masonry

C478 Specification for Precast Reinforced Concrete Manhole Sections C923 Specification for Resilient Connections between Reinforced Concrete Manhole Structures and Pipes

2. Federal Specification:

SS-S-00210 Joint Sealant Compound

3. PA Department of Transportation:

Publication 408 Specifications

4. American National Standards Institute (ANSI)

A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

A21.10 Ductile-Iron .and Gray-Iron Fittings, 3-inch through 48-inches, for Water and Other Liquids

A21.11 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

A21.15 Flanged Ductile-Iron Pipe with Threaded Flanges

A21.50 Thickness Design of Ductile-Iron Pipe

A21.51 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

B 16.21 Non-metallic Flat Gaskets for Pipe Flanges

B 18.2.1 Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws

B 18.2.2 Square and Hex Nuts (Inch Series)

5. American Association of State Highway and Transportation Officials (AASTHO):

Standard Specifications for Highway Bridges

B. Acceptable Manufacturer:

- 1. The force main cleanout chamber structure, and frame and cover shall be provided by a firm regularly engaged in the manufacture of such projects of the types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- 2. The force main cleanout chamber structure(s) shall be provided by one of the following manufacturers or approved equal.
 - a. Atlantic Concrete Products, Inc.
 - b. Monarch Precast Concrete Corporation
 - c. Terre Hill Precast Concrete
 - d. Modem Concrete Septic Tank Company
- 3. Frame(s) and cover(s) shall be provided by one of the following manufacturers, or approved equal.
 - a. Neenah Foundry Company
 - b. E.A. Quirin Machine Shop, Inc.
 - c. East Jordan Iron Works, Inc.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit detail shop drawings of the precast reinforced concrete chamber.
- B. Manufacturer's Literature:
 - 1. Submit manufacturer's descriptive literature for the following items:
 - Manhole frame and cover Manhole steps Pipe to manhole flexible connections Gate valve with hose end Sump frame and grate Joint sealant compound

PART 2 – PRODUCTS

2.01 PRECAST CONCRETE CHAMBER

A. Structure: See Section 03411 - Precast Concrete

- 1. The chamber shall have an inside diameter of five (5) feet and an overall height as shown on the Drawings. The vertical walls shall be 6 inches thick while the top and bottom slabs shall be 8 inches thick.
- 2. The chamber shall be constructed of precast reinforced concrete sections which shall conform to ASTM C-478.
- 3. Openings for the force main shall be provided with integral flexible resilient connections which shall conform to ASTM C-923.
- B. Joint Sealing Compound:
 - 1. A preformed sealing compound, conforming with Federal Specification SS-S-00210 shall be provided to seal the joints of the precast sections.
 - 2. The preformed sealing compound shall be as manufactured by A-Lok Products Inc. ("Butyl-Lok"), K.T. Snyder Company, Inc. ("Ram-Nek"), or approved equal.
- C. Exterior Protective Coating:
 - 1. See Section 09900 Painting.
- D. Steps (See Construction Detail S-7):
 - 1. Steel reinforced polypropylene with serrated tread and end lugs as manufactured by M.A. Industries, Inc., or approved equal.
- E. Frame and Cover (See Construction Detail S-6):
 - 1. Domestic cast iron castings: ASTM A48, Class 30 or better; free of bubbles, sand and air holes, and other imperfections.
 - 2. Heavy duty traffic, AASHTO Loading Class HS-20.
 - 3. Contact surfaces machined and matched.
 - 4. All covers shall be in scripted 'WTWSA-SEWER' with raised letters. Letters shall have a height and width of not less than two (2) inches.
 - 5. Watertight cover to be provided which includes an O-ring gasket, four (4) bolt holes in frame and cover, ¹/₂ inch diameter bronze or stainless steel hex head bolts and two (2) concealed pick holes.

- 6. Manufactured by Neenah Foundry Company (Model R-1916-F), or approved equal.
- F. Sump Frame and Grating:
 - 1. Domestic cast iron castings: ASTM A48, Class 30 or better, free of bubbles, sand and air holes and other imperfections.
 - 2. Provide type and design in accordance with Construction Detail S-13.

2.02 PIPING AND VALVES

- A. Interior Piping:
 - 1. Flanged joint ductile iron pipe: ANSI A21.15.
 - 2. ANSI A21.51, Thickness Class 53.
 - 3. Double cement-mortar lining: ANSI A21.4.
 - 4. Fittings shall be ductile iron or grey-iron flat faced with pressure rating of 250 psi: ANSI A21.10.
 - 5. Gaskets shall be full-faced, rubber and 1/8" thick: ANSI B16.21.
 - 6. Bolts and nuts shall be low alloy steel: ANSI B 18.2.1 & B 18.2.2
- B. Exterior Piping:
 - 1. See Section 02732 Sanitary Force Main and Appurtenances
- C. Gate Valve
 - 1. Gate valve 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 and provided with bronze cap and chain.
 - 2. Gate valve shall be designed for a minimum water working pressure of 150 psi and shall be factory tested at a pressure of 300 psi. Gate valve shall have a clear waterway opening of the full nominal diameter of the valve.

- 3. Gate valve shall be hand-wheel operated and opened by turning in a counterclockwise direction. The operating wheel shall have cast thereon an arrow indicating the direction of opening.
- 4. Hose end gate valve shall be as manufactured by The Lunkenheimer Company (Figs. 366 61 1309), Walworth, Crane Company or approved equal.

2.03 OTHER MATERIALS

- A. Coarse Aggregate:
 - 1. PennDOT No. 2A or AASHTO No.8 in accordance with Table C, Section703.2, Publication 408 Specifications.
- B. Concrete:
 - 1. PennDOT Class A, Section 03302

PART 3 – EXECUTION

- 3.01 GENERAL
 - A. Refer to the Drawings for location and pertinent elevations of force main cleanout chamber.

3.02 CLEARING AND GRUBBING

- A. Clear and grub each force main cleanout chamber site as required for construction in accordance with the Drawings and as specified in Section 02110.
- B. A site inspection will be made with the Engineer to determine which of the existing trees are to remain which shall be suitably protected.

3.03 EXCAVATION

A. Excavate at the location of each force main cleanout chamber to the depth and area required as shown on the Drawings and as specified in Section 02220.

3.04 FOUNDATION

A. Provide a minimum 6" compacted coarse aggregate subbase for each precast farce main cleanout chamber.

3.05 CONSTRUCTION

- A. Force Main Cleanout Chamber:
 - 1. Construct the chamber of precast sections as shown on Construction Detail S-13 with steps in proper orientation and vertical alignment.
 - 2. Seal joints between precast concrete sections with two (2) rings of a preformed joint sealant compound.
 - a. Place joint sealant compound on lower section to be squeezed by the weight of the upper section.
- B. Piping and Miscellaneous Structural Work:
 - 1. Install frame and cover to the elevation shown on the Drawings by anchoring to the top slab at four (4) locations. Use precast grade rings to achieve elevation shown for frame and cover. Do not adjust elevation more than one (1) foot with precast grade rings. Seal joint between frame and top slab or grade ring with joint sealant compound.
 - 2. Provide a concrete floor in the chamber sloped to a sump pit with a frame and grate.
 - 3. Install the force main as specified in Section 02732 through the integral resilient connections within the precast base section of the chamber.
 - 4. Install fitting, gate valve with hose end and coupling as shown on Construction Detail S-13. Provide piping support as required.
- C. Leakage Test:
 - 1. An exfiltration or vacuum test shall be performed on each force main cleanout chamber once the piping connections have been completed.
 - 2. The exfiltration or vacuum test shall be performed as specified in Section 02734.

3.06 BACKFILLING AND COMPACTING

- A. Backfill around each force main cleanout chamber only after approval is received from the Resident Project Representative.
- B. Backfill and compact in accordance with the Drawings and as specified in Section 02220.

3.07 SITE RESTORATION WORK

- A. Once the Force Main Cleanout Chamber and related force main work have been the following site restoration work shall be completed in accordance with the Drawings and as specified in the noted Section(s).
 - 1. Finish Grading Section 02905
 - 2. Replace Topsoil and Seed Section 02905

3.08 STARTUP

A. After the force main cleanout chamber is completed and the force main is pressurized, CONTRACTOR shall conduct an inspection for leakage, perform a complete functional check of the valve and make all necessary adjustments for regular service.

END OF SECTION

PART I-GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Testing Gravity Sanitary Sewer Pipelines:
 - a. Low-pressure air test
 - 2. Testing Sanitary Force Main:
 - a. Hydrostatic leakage test
 - 3. Testing of Manholes and Circular Concrete Chambers:
 - a. Vacuum Test
 - 4. Deflection Testing of Plastic Sewer Pipe
 - 5. Television Inspection of Gravity Sewers

1.02 RELATED SECTIONS

- A Related Work Specified Elsewhere:
 - 1. Section 02664 Water Main Air Release Chamber
 - 2. Section 02730 Gravity Sanitary Sewer Pipe
 - 3. Section 02731 Sanitary Manholes
 - 4. Section 02732 Sanitary Force Main and Appurtenances
 - 5. Section 02733 Force Main Cleanout Chamber

1.03 QUALITY ASSURANCE

- A. Test Acceptance:
 - 1. No test will be accepted until the results are below the specified maximum limits.
 - 2. CONTRACTOR shall, at his own expense determine and collect the causes offset failure and retest until successful test results are achieved.

1.04 SUBMITTALS

- A. Testing procedures
- B. List of test equipment
- C. Testing sequence schedule
- D. Provisions for disposal of flushing and test water
- E. Certificate of test gauge calibration
- F. Deflection mandrel drawings and calculations

1.05 JOB CONDITIONS

- A. Do not allow personnel in manholes during low-pressure air testing.
- B. Provide relief valves set at 10 psig to avoid accidentally over pressurizing gravity sanitary sewer line during low pressure air testing.

PART 2 – PRODUCTS

2.01 AIR TEST EQUIPMENT

- 1. Air compressor
- 2. Air supply line
- 3. Shut-off valve
- 4. Pressure regulator
- 5. Pressure relief valve
- 6. Stop watch
- 7. Plugs
- 8. Pressure Gauge with minimum divisions of 0.1 lbs./sq. in., calibrated to 0.04 lbs./sq. in.
- 9. All other equipment and accessories as required

2.02 HYDROSTATIC TEST EQUIPMENT

- 1. Water pump
- 2. Pressure hose
- 3. Water meter
- 4. Test connections
- 5. Pressure gauge, calibrated to 0.1 lbs/sq. in.
- 6. Pressure relief valve

7. All other equipment and accessories as required

2.03 EXFILTRATION TEST EQUIPMENT

- 1. Means of water volume measurement
- 2. All other equipment and accessories as required

2.04 VACUUM TEST EQUIPMENT

- 1. Test head with pressure and vacuum gauges and vacuum pump
- 2. Source of compressed air
- 3. Vacuum line
- 4. Stop watch
- 5. Plugs
- 6. All other equipment and accessories as required

2.05 DEFLECTION TEST EQUIPMENT

- 1. Go, No-Go mandrels
- 2. Pull/retrieval rope
- 3. All other equipment and accessories as required

PART 3 – EXECUTION

3.01 PREPARATION

- A. Plug outlets, wye-branches and laterals. Brace plugs to offset thrust.
- B. Provide pressure pipeline with concrete reaction support blocking.
- C. Backfill trenches in accordance with Section 02220.
- D. Flush pipeline to remove debris. Collect and dispose of flushing water and debris but do not discharge directly to a stream or water course.
- E. Clean pipelines by "jetting" or propelling a "pig" through the pipeline with water from the upstream manhole to the downstream manhole. Investigate and correct any, stoppage of the cleaning ball. Collect and dispose of cleaning water and debris but do not discharge directly to a stream or water course.

3.02 TESTING GRAVITY SANITARY SEWER PIPELINES

A. Test each newly installed section of gravity sewer line between manholes for leakage, including laterals, by using the Low Pressure Air Test: Time - Pressure

Drop Method. All openings shall be carefully plugged and braced before start of the test. The testing procedure shall be in accordance with ASTM F 1417. Although the following summarizes the required procedure, the contractor shall be responsible for following the exact procedure as more fully described in ASTM F 1417, including implementation of all safety precautions.

- 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 the specified pressure. The test shall be performed on pipe with a wet inside condition. All outlets in the section to be tested shall be fitted with air-tight 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 groundwater is present, determine its elevation above the spring line of the pipe by means of a piezometric tube. For every foot of groundwater above the springline of the pipe, increase the starting test pressure reading by 0.43 psig. Do not increase pressure above 9 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 greater than average groundwater back pressure and start test.
- 3. Determine the test duration for a sewer section with a single pipe size from the following formula:

T= 0.085 DK/Q

Where:

T = shortest time allowed for the air pressure to drop 1.0 psig), sec K = 0.000419 DL but not less than 1.0

Q = leak rate in cubic feet/minute/square feet of internal surface

= 0.0015 CFM/SF

- D = measured average inside diameter of sewer pipe, in.
- L = length of test section, ft

For 8" PVC:

T=1.520~L

Where L = Length of pipe tested or 298 feet (length for minimum time) whichever is greater

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For 10" PVC

T = 2.374 L

Where L = Length of pipe tested or 239 feet (length for minimum time), whichever is greater

For 12" PVC

T = 3.418 L

- Where L = Length of pipe tested or 199 feet (length for minimum time), whichever is greater
- 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.
- 5. 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.

3.03 TESTING SANITARY FORCE MAIN

- A. Hydrostatic Leakage Test:
 - 1. Test each newly installed sanitary force main hydrostatically for a period of not less than 60 minutes at a 'pressure of not less than 1.5 times the working pressure of the pipeline or 100 psi whichever is greater based upon the elevation of the lowest point in the pipeline corrected to the elevation of the test gauge. Obtain working pressure from ENGINEER.
 - 2. Slowly fill the section (1,000 feet maximum) to be tested with water, expelling air from the pipeline at the high points. Install corporation stops at high points if necessary. After all air is expelled, close air vents and corporation stops and raise the pressure to the specified test pressure.
 - 3. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest as required.

- 4. After visible deficiencies are corrected, continue testing at the same test pressure for an additional two (2) hours to determine the leakage rate. Maintain pressure within plus or minus 5.0 psi 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.
- 5. Compute the maximum allowable leakage by the following formula:

$$L = \frac{ND\sqrt{P}}{7400}$$

Where L is the allowable leakage in gallons/hour. N is the number of joints in the section tested. D is the nominal diameter of the pipe in inches. P is the average test pressure in psig.

6. If the test of the pipe indicates leakage greater than that allowed, locate the source of the leakage, make corrections and retest until leakage is within allowable limits. Repair visible leaks regardless of the amount of leakage.

3.04 TESTING OF MANHOLES AND CIRCULAR CONCRETE CHAMBERS

- A. Vacuum Test
 - 1. Before the test is performed, the manhole shall be fully completed including installation of grade rings and frame set to final grade. All pipe openings shall be sealed with plugs designed to provide a water tight seal and securely braced to prevent the plug from being drawn into the manhole.
 - 2. The test shall be performed as per the manufacturer's recommendations along with the following requirements:
 - a. The test head shall be placed in the manhole frame in order to test the entire manhole structure including the grade adjustment ring joints.
 - b. The test head seal shall be inflated.
 - c. A vacuum of 10 inches of mercury shall be drawn after which the vacuum pump shall be shut off.
 - d. The time shall be measured for the vacuum to drop I inch of mercury.
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3. A successful test consists of an observed time period of at least the following duration:

Manhole Diameter	Time
(inches)	(seconds)
48	60
60	75
72	90

ENGINEER shall be consulted with regard to an appropriate time for manholes exceeding a diameter of 72 inches.

- 4. If the manhole fails the test, necessary repairs shall be made to the satisfaction of the ENGINEER. Retesting shall be performed until the successful test is obtained.
- 5. Testing may be performed at the CONTRACTOR's option prior to backfilling; however, a successful test must be performed on the fully completed manhole after back-filling is completed.

3.05 DEFLECTION TESTING OF PLASTIC SEWER PIPE

- A. Vertical Ring Deflection Test.
 - 1. Perform vertical ring defection testing on all portions of PVC sewer piping, in the presence of the ENGINEER after backfilling has been in place for at least 30 days but not longer than 12 months.
 - 2. The maximum allowable deflection for installed plastic sewer pipe shall be limited to 5% of the original vertical internal diameter.
 - 3. Perform deflection testing with a deflectometer, calibrated television, or a properly sized "Go, No-Go" mandrel. The mandrel(s) shall be constructed at CONTRACTOR's expense and subject to the approval of the ENGINEER.
 - 4. Pipe exceeding the allowable deflection shall be located, excavated, replaced, and retested at the sole expense of CONTRACTOR.

3.06 TELEVISION INSPECTION OF GRAVITY SEWERS

A. Final acceptance of the sewer system will be contingent upon television inspection of all sewer mains, submission of documentation in the form of two

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(2) professionally prepared audio-videotapes to ENGINEER, with subsequent review and approval of tapes by ENGINEER and AUTHORITY.

- B. Any repairs which must ' be made as a result of this inspection shall be the DEVELOPER's responsibility and must be made prior to acceptance of dedication. The repaired section of pipe must be re-televised and work completed to the satisfaction of the ENGINEER.
- C. Prior to televising, CONTRACTOR shall clean the sewer line 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. Water from the AUTHORITY water distribution system shall not be used for this purpose without prior authorization.
- D. 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 work associated with televising of the sewer mains shall be conducted in the presence of the ENGINEER, including cleaning of the lines prior to televising.
- E. CONTRACTOR shall employ only competent personnel skilled in this type of work. CONTRACTOR shall have not less than two years experience with closed circuit television inspection and videotaping of sewer lines. 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.
- F. Any taped coverage not acceptable to the ENGINEER shall be refilmed.
- G. Two complete sets of project tapes and reports shall be submitted to the ENGINEER for approval.
- H. Each tape 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-videotape shall in no way relieve the CONTRACTOR from preparing and submitting the written report.
- I. 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:

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- 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.
- J. The television camera used shall be one specifically designed and constructed for pipeline inspection. 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.
- K. 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.
- L. 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.
- M. 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.
- N. The locations of each manhole, identification of street in which each sewer is located and direction which televising is being done shall be provided.
- O. Tapes shall be 1/2" VHS format made in Standard Play (SP) mode, and shall not have less than 180 lines of resolution. The audio-video recorder shall have sound dubbing facilities that will permit an audio track to be added to the recordings.
- P. 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 retelevised after any repairs.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. Fence framework, fabric, and accessories.
 - 2. Excavation for post bases.
 - 3. Concrete anchorage for posts and center drop for gates.
 - 4. Manual gates and related hardware.

1.02 RELATED WORK

A. Section 03302 - Concrete Work for Utilities.

1.03 REFERENCES

- A. ASTM A120 Pipe, Steel, Black and Hot-dipped Zinc-coated (Galvanized) Welded and Seamless, for Ordinary Uses.
- B. ASTM Al23 Zinc (Hot Galvanized) Coatings on Products, Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
- C. ASTM A446 Steel Sheet, Zinc Coated by Hot Dipped Process.
- D. ASTM A569 Steel, Carbon Hot Rolled Sheet and Strip, Commercial Quality.
- E. ASTM A824 Metallic-Coating Steel Marcelled Tension Wire for Use with Chain Link Fence.
- F. ASTM F567 -Installation of Chain-Link Fence. ASTM F626 Fence Fittings.
- G. ASTM F626 Fence Fittings.
- H. ASTM F900 Industrial and Commercial Swing Gates.
- I. FS RR-F-191 Fencing, Wire and Post, Metal

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in commercial quality chain link fencing with at least two years experience.
- B. Installation: ASTM F567

1.05 SUBMITTALS

A. Submit shop drawing and product data.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Fence shall; be six (6) feet nominal height.
- B. Gates shall be double section with a width two (2) feet wider than the paving width (minimum width of 12 feet).

NOTE: Sliding gates on rollers for extra wide openings may be considered and evaluated on an individual site conditions basis.

2.02 ACCEPTABLE MANUFACTURERS

- A. Robertson Fence Company
- B. Semmerling Fence, and Supply, Inc. OR any manufacturer which is an active member of the Chain Link Fence Manufacturers, Institute.

2.03 MATERIALS

A. Framework:

Type I: ASTM Al 20; Schedule 40 steel pipe, standard weight, one piece without joints.

OR

Type II: Manufactured from steel conforming to ASTM A569 or ASTM A446 cold rolled, welded and having a minimum yield strength of 50,000 psi, nominal weight per foot shall be as follows.

Outside Diameter (inches)	Weight per Foot			
(Inches)	(lbs/ft)			
1.66	1.43			
1.92	2.81			
2.38	3.12			
2.88	4.64			

- B. Fabric: FS RR-F-191 Type IV vinyl coated steel.
- C. Gates: ASTM F900.
- D. Tension Wire: ASTM A824

2.04 CONCRETE MIX

A. Concrete: Class A as specified in Section 03302.

2.05 COMPONENTS

- A. Line Posts: 1.90 inch diameter steel pipe.
- B. Corner and Terminal Posts: 2.38 inch diameter steel pipe.
- C. Gate Posts: 2.88 inch diameter steel pipe.
- D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled steel pipe.
- E. Gate Frame: 1.66 inch diameter steel pipe for welded fabrication.
- F. Fabric: 2 inch diamond mesh steel wire, interwoven, 9 gage thick, top selvage twisted tight, bottom selvage knuckle end closed.
- G. Caps: Cast steel or malleable iron, galvanized; sized to post dimension, set screw retained.
- H. Steel Fittings: Sleeves, bands, clips, rail ends; tension bars, fasteners and fittings.
- I. Tension Wire: 7 gage thick steel, single strand.
- J. Gate Hardware: Fork type latch with cavity drop, center gate stop and drop rod; Mechanical keepers; two 180 degree gate hinges per leaf and hardware for padlock.
- 2.06 FINISHES: The choice of finish shall be made on an individual project basis.
 - A. Framework
 - 1. Type I: Galvanized (1.8 oz/sq. ft. coating); ASTM A123.
 - 2. Type II: Exterior triple coating consisting of zinc applied before or after welding (1.0 oz. /sq. ft. coating), chromate conversion (30 micrograms/sq. in. coating) and a clear polymer overcoat (0.5 mils).

- 3. Interior corrosion protection applied before or after welding.
- B. Fabric Vinyl Coating: Dark green color; coating shall be boarded on a galvanized core wire (0.30 oz./sq. ft.) with a thickness as follows:

Min. Thickness Max. Thickness Extrusion Coated 0.015 in.0.025 in. Thermally Fused 0.006 in- 0.0 10 in.

- C. Tension Wire: Galvanized (2.0 oz/sq.ft.); ASTM A824.
- D. Accessories: ASTM F626

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Space line posts at intervals not exceeding 10 feet.
- C. Set gate and comer posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff. Footing depth below finish grade: 36 inches.
- D. Provide top rail through line post tops and splice with 7 inch long rail sleeves.
- E. Brace each gate and comer post hack to adjacent line post with horizontal center brace rail and diagonal truss rods.
- F. Install center and bottom brace rail on gate leaves
- G. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
- H. Position bottom of fabric 2 inches above finished grade.
- I. Fasten fabric to top rail, line posts, braces, and bottom tension wire with wire ties maximum 15 inches on, centers.
- J. Attach fabric to end, comer, and gate posts with tension bars and tension bar clips.
- K. Install bottom tension wire stretched taut between terminal posts.

- L. Install gates with fabric to match fence. Install two hinges per leaf, latch, catches, drop bolt.
- M. Provide concrete center drop to foundation depth and drop rod retainers at center of double gate openings.

END OF SECTION

PART I – GENERAL

1.01 SECTION INCLUDES

A. Preparation of soil, placement of plants, ground cover, seed, sod, and fertilizer.

1.02 RELATED WORK

- A. Section 01560 Soil Erosion and Sedimentation Control
- B. Section 02110 Clearing and Grubbing
- C. Section 02220 Excavation, Backfill, and Compaction

1.03 QUALITY CONTROL

- A. Nursery: Company specializing in growing and cultivating the plant material specified in this Section.
- B. Sod Producer: Company specializing in sod production and certified by the State of Pennsylvania.
- C. Maintenance Services: Performed by CONTRACTOR or his agent (i.e., landscape subcontractor) unless otherwise specified.
- D. Reference Standards:
 - 1. Pennsylvania Department of Transportation, Publication 408 Specifications
 - 2. Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86 (3P.S.68.2), as amended.

1.04 WARRANTY

- A. Plant Material: Provide one year guarantee for plant life which includes one continuous growing season.
- B. Plants replaced under the terms of the guarantee shall be of same size and species as originally specified, planted in the next growing season, with a new warranty commencing on date of replacement.
- C. Seeded or Sodded Areas: Reseed and/or replace sod as required until grass is well established and exhibits a vigorous growing condition provided AUTHORITY

provides reasonable maintenance following completion and acceptance of the Work.

1.05 MAINTENANCE SERVICE

A. CONTRACTOR shall be responsible for the maintenance of seeded are-as, sodded areas, and plant material until completion and acceptance of the Work by AUTHORITY.

PART 2 – PRODUCTS

2.01 GRASS

- A. Seed Mixture:
 - 1. Permanent: The "Seeding Restoration Table" at the end of this Section lists specific seeding restoration requirements.
 - 2. Temporary Stabilization: Utilize Formula E as set forth in the "Seeding Restoration Table" at the end of this Section.
- B. Sod: ASPA/Pennsylvania certified, nursery grown cultivated grass sod; with strong fibrous root system. Sod mixture shall be specified as being hardy for the region of installation.

2.02 TREES, PLANTS, AND GROUND COVER

A. Landscape Plant Material and Ground Cover: Plant material specified on plant list indicated on Drawings shall be symmetrical in growth, true to species, variety and sire, nursery grown in climatic conditions similar to region of installation and be free of any pests or disease.

2.03 SOIL AND SOIL ENHANCEMENT MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, free of subsoil, clay or impurities, plants, weeds and roots or other foreign materials.
- B. Fertilizer:
 - 1. Basic Fertilizer: Analysis 0-20-200 and as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Act.

- 2. Starter Fertilizer: Analysis 10-5-5 or 12-6-6 and as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Act.
- C. Lime: Raw ground limestone conforming to Section 804.2(a), Publication 408 Specifications.

2.04 ACCESSORIES

- A. Wood Pegs: Softwood, sufficient size and length to ensure anchorage of sod on slope.
- B. Mesh: inter oven plastic.

PART 3 – EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Scarify subsoil to a depth o. F3 inches.

3.02 PLACING TOPSOIL AND TILLAGE

- A. Spread topsoil to a minimum depth of 4 inches to obtain the required grade elevation.
- B. Apply lime at a rate of 90 pound=, per 1,000 square feet.
- C. Apply basic fertilizer in according; with manufacturer's instructions at an application rate of 25 pounds per 1,000 square feet.
- D. Thoroughly loosen soil and incorporate lime and basic fertilizer to a minimum depth of 4 inches by discing, harrowing or other approved method.

3.03 FINISH GRADING

- A. Hand rake topsoil and remove all unsuitable materials.
- B. Uniformly grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.
- C. Apply starter fertilizer at an application rate of 10 pounds per 1,000 square feet and incorporate into soil.

3.04 SEEDING

- A. Apply seed within the following time periods unless otherwise directed by ENGINEER.
 - * Formula B, D, and L March 15 to June 1 August 1 to October 15
 - * Formula C Ryegrass Portion: March 1 to October 15
 - Crownvetch Portion: Anytime except September and October
 - * Formula E March 15 to October 15
 - * Formula W April 1 to June 15 August 16 to September 15

Formula E (Annual ryegrass) to be utilized for temporary stabilization of areas disturbed by construction may be applied anytime.

- B. Seeding Rates:
 - 1. Permanent- Apply seed or hydroseed with a seed slurry evenly in two intersecting directions at the rate noted in the Seeding Restoration Table unless an alternate seeding rate appropriate for site conditions is approved by ENGINEER.
 - 2. Temporary Stabilization: Apply seed or hydroseed with a seed slurry at the rate noted in the Seeding Restoration Table.
- C. Immediately following permanent or temporary seeding, apply agricultural mulch at a minimum rate of 135 lbs. per 1001: sq. ft.
 - 1. Apply water with a fine spray immediately after each area has been mulched.

3.05 LAYING SOD

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod within. 24 hours after harvesting; with tight staggered joints

- C. On slopes 1:2 and steeper, place mesh over top soil, lay sod perpendicular to slope and secure every row with wooden pegs.
- D. Water sodded areas immediately after placement.

3.06 PLANTING

- A. Set plants in pits or beds, partly filled with prepared backfill soil mixture.
- B. Saturate soil with water when the pit or bed is half full of backfill soil mixture, mid again when ball.

3.07 MAINTENANCE

- A. Mow grass at regular intervals to maintain at a maximum height of 2-1 /2 inches. Do not cut snore than 1.13 of grass blade at anyone mowing.
- B. Water to prevent grass and soil from drying out.
- C. Control growth of weeds. Apply herbicides and pesticides in accordance with manufacturer's instructions.

3.08 SCHEDULE - SEED FORMULA

- A. See Drawings for seeding restoration requirements at each specific location of Work; otherwise, use Formula D for shady areas and Formula B for sunny areas.
- 3.09 SCHEDULE SOD
 - A. See Drawings for areas where sod is to be utilized.

3.10 SCHEDULE - PLANT LIST

A. See Schedule on. Drawings listing type and locations of various planet life.

NOTE: SEEDING RESTORATION TABLE IS ATTACHED AT END OF THIS SECTION.

SEEDING RESTORATION TABLE **							
FORMULA AND SPECIES	% BY WEIGHT	MINIMUM %		MAX % WEED SEED	SEEDING RATE LBS. PER 1,000 SY		
		PURITY	GERMINATION		,		
Formula R *Perennial Ryegrass Mixture (Lolium perenne) A combination of improved certified varieties with no one variety exceeding 50% of the total ryegrass component	20	98	90	0.15	4.0		
*Creeping Red Fescue or Chewings Fescue	30	98	85	0.15	6.0		
*Kentucky Bluegrass Mixture (poa pratensis) A combination of improved certified varieties with no one variety exceeding 25% of the total bluegrass component.	50	98	80	0.20	TOTAL 21.0		
<u>Formula C</u> *Crownvetch (Coronilla varia)	45	99	70	0.10	4.0		
*Annual Ryegrass (Lolium multiflorum)	55	98	90	0.15	<u>5.0</u> TOTAL 9.0		
Formula D *Tall Fescue (Festuca arundinacea var. Kentucky 31)	70	98	85	0.15	15.0		
*Creeping Fed Fescue or Chewings Fescue	30	98	85	0.15	<u>6.0</u> TOTAL 21.0		
<u>Formula E</u> *Annual Ryegrass (Lolium moltiflorum)	100	98	85	0.15	TOTAL 10.0		
<u>Formula L</u> *Hard Fescue Mixture (Festuca longifolia) A combination of improved certified varieties with no one variety exceeding 50% of the totalhard fescue component.	60	98	85	0.15	12.5		
*Creeping Red Fescue	40	98	85	0.15	<u>8.5</u> TOTAL 21.0		
<u>Formula W</u> *Tall Fescue (Festuca arundinacea var. Kentucky 31)	70	98	85	0.15	7.5		
Birdsfoot Trefoil Mixture (Lotus corniculatus) A mixture of ½ Viking and ½ of either Empire, Norcen, or Leo	20	98	80	0.10	2.0		
*Redtop (Agrostis alba)	10	92	80	0.15	<u>1.0</u> TOTAL 10.5		

*Minimum 20% hardseed and 60% normal sprouts. **This table has been extracted from PennDOT Publication 408 (see Section 804 as supplemented April 26, 1993)

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of this section involves cast-in-place concrete construction associated with utilities which includes, but is not limited to:
 - 1. Base slabs
 - 2. Cradles and encasements
 - 3. Reaction and support blocking
 - 4. Fillets, benches, and miscellaneous
 - 5. Pavement restoration

1.02 RELATED INFORMATION

- A. Related Work Specified Elsewhere:
 - 1. Section 02170 Stream Crossing
 - 2. Section 02220 Excavation, Backfill & Compaction
 - 3. Section 02300 Boring or Jacking Operations
 - 4. Section 02575 Restoration of Paved Surfaces
 - 5. Section 02832 Chain Link Fence & Gate
 - 6. Section 02660 Water Mains
 - 7. Section 02662 Fire Hydrants
 - 8. Section 02664 Water Main Air Valve Chamber
 - 9. Section 02730 Gravity Sanitary Sewer Pipe
 - 10. Section 02731 Sanitary Manholes
 - 11. Section 02732 Sanitary Force Main and Appurtenances
 - 12. Section 02733 Force Main Cleanout Chamber
 - 13. Section 11306 Sewage Pumping Station
 - 14. Section 16620 Engine-Generator and Transfer Switch

1.03 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. Pennsylvania Department of Transportation Publication 409 Specifications
 - 2. American Society for Testing and Materials (ASTM):

A615 - Specification for Deformed and Plain Billet - Steel Bars for
Concrete Reinforcement
C31 - Making and Curing Concrete Test Specimens in the Field
C39 - Test for Compressive Strength of Cylindrical Concrete Specimens

C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete C 172 - Sampling Fresh Concrete

1.04 SUBMITTALS

- A. Certificates
 - 1. Submit certification from the concrete producer attesting that the cement concrete conforms to Section 704, Publication 409 Specifications for the class of concrete being used.
 - 2. Submit certified results of compressive strength tests performed by an independent testing laboratory.

PART 2 – PRODUCTS

2.01 CEMENT CONCRETE

- A. Ready-mixed, conforming to Section 104, Publication 408 Specifications.
 - 1. Requirements for State approved batch plants, design computations and plant 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:
 - 1. Class A
 - a. 28-day compressive strength: 3300 psi
 - b. Slump: 1 to 3 inches
 - 2. Class C
 - a. 28-day compressive strength: 2000psi
 - b. Slump: 2 to 6 inches
 - 3. High Early Strength
 - a. 28-day compressive strength: 3000 psi
 - b. Slump: 1 to 3 inches
 - 4. Cement Factor and Maximum Water-Cement Ratio conforming to Table A, Section 704.1 (b), Publication 408 Specifications.

2.02 REINFORCEMENT STEEL

- A. Reinforcement Bars:
 - 1. ASTM A615, Grade 60, deformed billet steel bars, finish conforming to Section 709.1, Publication 406 Specifications.
- B. Welded Steel Wire Fabric
 - 1. Plain type; unfinished conforming to gage and mesh size as noted on the Drawings and Sections 709.3 and 790.4, Publication 408 Specifications

PART 3 - EXECUTION

3.01 CONSTRUCTION

- A. Comply with Section 1001, Publication 408 Specifications for construction requirements including form work, curing, protection and finishing of cement concrete.
- B. Excavate and shape bottoms and sides of excavation to accommodate thrust block forms, cradles and encasements, manhole bases, and base slabs.
- C. Support pipe, valves and fittings where installed at the required elevation with brick or concrete block. Do not use earth, rock, wood, or organic material as supports.
- D. Construct reaction and support blocking, cradles, encasements, and miscellaneous buried mass concrete of Class C concrete.
- E. Construct base slabs, manhole bases, end walls, curbs, sidewalks, miscellaneous reinforced structures, and miscellaneous exposed mass concrete of Class A concrete.
- F. Construct reinforced and plain cement, concrete pavements and base courses of High Early Strength concrete as specified in Section 02575, Restoration of Paved Surfaces.
- G. Provide spaces, chairs, bolsters, ties and other devices for properly placing, spacing, supporting and fastening reinforcement in place.
- H. Place concrete utilizing all possible care to prevent displacement of ally pipe or fittings-Return displaced pipe or fittings to line and grade immediately.

- I. Insure tie rods, nuts, bolts and flanges are free and clear of concrete.
- J. Do not backfill structures until concrete has achieved its initial set, forms are removed, and concrete work is inspected by the Resident Project Representative.
- K. Perform back-filling and compaction as specified in Section 02220.

3.02 FIELD TESTS OF CONCRETE DURING CONSTRUCTION

- A. Test each 50 cubic yards or fraction thereof or as directed by the Engineer for each class of concrete for compressive strength. Retain an independent testing laboratory to test cylinders at the expense of CONTRACTOR.
 - 1. Sample concrete in accordance with ASTM 0172.
 - 2. Prepare and cure two test cylinders in accordance with ASTM C31.
 - 3. Test cylinders in accordance with ASTM C39
- B. If test cylinders fail to meet strength requirements, the Engineer nay require additional core tests in accordance with ASTM C-122 at the expense of CONTRACTOR.

END OF SECTION

PART 1- GENERAL

1.01 SECTION INCLUDES

A. Requirements for precast concrete structures, including, but not limited to pump station wetwells, valve chambers, manholes, meter pits, and any other sewer or water related precast concrete structures.

1.02 RELATED SECTIONS

- A. Section '- Submittals.
- B. Section Quality Control.
- C. Section 09900 Painting.
- D. Section 11306 Sewage Pumping Stations.

1.03 MATERIALS REQUIREMENTS FOR:

- A. Water
- B. Aggregates
- C. Reinforcing
- D. Welded Wire Fabric
- E. Gaskets/Sealants
- F. Precast Manhole Steps
- G. Seals

1.04 DEFINITIONS:

- A. ASTM American Society for Testing Materials.
- B. AASHO American Association of State Highway Officials.

1.05 SUBMITTALS

A. General: Make submittals including design data and engineering calculations, in accordance with the Submittals section, including, but not limited to, the

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following; gaskets, seals, manhole steps, pump station wetwells, valve chambers, manholes, and meter pits.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Water: clean and free of organic materials, strong acids, alkalis, oils, and salt.
- B. Portland Cement ASTM-C150, Type I. American Manufacture. One (1) brand used throughout project.
- C. Sand: (Fine Aggregate) shall be clean, sharp, coarse, (minimum fines) hard, natural sand free from salt, loam, clay, and other deleterious materials and shall conform to ASTM Specifications C33 or C330.
- D. Coarse Aggregate: Shall be well graded, washed, gravel or crushed stone and shall conform to ASTM Specification C33 for normal weight aggregate.
- E. Reinforcing Steel: Reinforcing bars shall be deformed high strength bars conforming to ASTM A615, Grade 40 and Grade 60.
- F. Welded Wire Fabric: Shall conform to ASTM A-18S-73 Standard Specifications for Welded Steel Wire Fabric for Concrete Reinforcement.
- G. Ad fixtures: No admixture shall be used without written approval of the Engineer.
- H. Forms: Wood, metal, or fiber type.
- I. Curing Materials: Waterproof paper, mats, burlap or polyethylene film.
- J. Gaskets/Seal any Rubber or neoprene and caulk or grout.
- K. Manhole Steps: Grade 60 #3 deformed steel bar coated-polypropylene plastic as manufactured by M.A. Industries, Inc of East Point, Georgia, or approval equal.
- L. Seals: Rubber or neoprene.

2.02 CONCRETE STRENGTH

A. Minimum ultimate compressive strength of the concrete at age 28 days shall be 4000 pounds per square inch. Slump shall not exceed 4 inches.

PART 3 – EXECUTION

3.01 STRUCTURAL DESIGN REQUIREMENTS

- A. The Contractor shall address all anticipated loading conditions as indicated on the drawings, as specified herein, and as required by local and state building codes. All load cases shall be considered and the design shall be based on the governing cases which produce the greatest stresses on the structure. Load cases to be addressed include: tanks empty with saturated soil outside, tanks full with saturated soil outside, tanks full with dry soil outside, and tanks full with no soil pressure outside.
- B. Maximum groundwater elevation shall be assumed to be at groundwater elevation shall be assumed to be at finish grade level. Saturated soil shall be assumed to exert a minimum equivalent fluid pressure of 90 p.c.f. onto the structure.
- C. All structures shall be designed to resist buoyancy when empty.
- D. Effects of all vertical, horizontal, and lifting loads anticipated on the finished structure shall be included in the analysis and design. Loading from piping and equipment, snow H-20 live load shall be included.
- E. All structures shall be watertight.
- F. Where conditions arise which are not specifically covered by these notes and specifications, the current standards of ACI 301, 304, 305, 306, 311, 315, 318, 350, and ASTM C-94 shall govern.
- G. Design calculations for the above conditions shall be prepared, signed, and sealed by a Registered Professional Engineer, registered in the State of Pennsylvania and submitted to the Engineer for review.

3.02 REINFORCEMENT

- A. Before placing, clean rust mill scale or coating, including ice, that would destroy or reduce bond from surface.
- B. Reinforcement shall not be bent or straightened in a manner injurious to the material.
- C. Splices at maximum stress not permitted. Laps and splices shall be of adequate length to transmit stresses. Splices in adjacent bars shall be staggered.

D. Wire reinforcement shall be cut and supported at proper elevations by standard accessories.

3.03 CONCRETE

- A. If requested by the Engineer, certificates shall be furnished to the Engineer showing that the concrete and reinforcement complies with tests and samples of applicable specifications.
- B. Forms used shall be clean and free from shavings, debris and frost, and thoroughly wetted except in freezing weather, or oiled before placing concrete.
- C. Care shall be exercised to prevent honey-combing or segregation of the ingredients of the concrete.
- D. All surface defects including tie holes shall be repaired immediately after form removal as per ACI 301-72 Chapter 9.

3.04 CURING

- A. For purposes of early re-use 'of forms, the concrete may be steam cured after an initial set has taken place. The steam temperature shall not exceed 160 degrees and the temperature shall be raised from normal ambient temperature at a rate that does not exceed 40 degrees per hour.
- B. The steam cured units shall not be removed from the forms until the units area able to withstand sufficient strength and any structural strain that might be applied during the form stripping process.
- C. After the stripping for forms, further curing by means of water spraying or membrane curing compound may be used. The compound shall conform to ASTM C309.

3.05 GASKETS/SEALANTS

A. All precast concrete structures are to be constructed so as to be totally watertight through the use of rubber of neoprene gaskets and approved caulking or non-shrink grout.

3.06 MANUFACTURERS

A. The precast concrete products shall be as manufactured by Atlantic Precast Corp. Monarch Precast Concrete Corp., Terre Hill Concrete Products, Rotondo Penn cast, Modem Precast, or approval equal.

3.07 SEALS

A. Precast manholes or meter pits shall have integrally cast rubber or neoprene seals at the points where pipe enters and/or exits the precast structure. These gaskets shall meet ASM C-443.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, and other coatings.

1.02 REFERENCES

- A. ASTM D 16 Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D4442 Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
- C. NACE (National Association of Corrosion Engineers) Industrial Maintenance Painting.
- D. NPCA Guide to U.S. Government Paint Specifications; National Paint and Coatings Association.
- E. PDCA Architectural Specifications Manual; Painting and Decorating Contractors of America.
- F. SSPC Steel Structures Painting Manual; Steel Structures Painting Council.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years experience.

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers Paint:
 - 1. Sherwin-Williams
 - 2. MAB-Pennsbury Coatings.
 - 3. Or approved equal.

Note: All trade names listed in the schedule (sections 3.8 & 3.9) below, are Sherwin-Williams products unless otherwise indicated. Equivalent MAB-Pennsbury products, are also acceptable.

2.02 MATERIALS

- A. Coatings: Ready mixed, except field catalyzed coatings. Prepare pigments:
 - 1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
 - 2. For good flow and brushing properties.
 - 3. Capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
- C. Patching Materials: Latex filler.
- D. Fastener Head Cover Materials: Latex filler.

2.03 FINISHES

A. Refer to schedule at end of this section for surface finish. Colors will be determined during shop drawing approvals.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and/or substrate conditions are ready to receive Work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. 00 not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM 04442.
 - 5. Concrete Floors: 8 percent.

3.02 PREPARATION

- A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.
- C. Marks: Seal with shellac wood surfaces, which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- F. Asphalt, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials.
- G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

- H. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- I. Copper Surfaces Scheduled for Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.
- J. Copper Surfaces Scheduled for a Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.
- K. Gypsum Board Surfaces: Fill minor defects with fitter compound. Spot prime defects after repair.
- L. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- M. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- N. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- O. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- P. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- Q. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- R. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

- S. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- T. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- D. Sand wood and metal surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Prime concealed surfaces of interior and exterior woodwork with primer paint.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint shop primed equipment.
- B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- C. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, and except where items are shop finished.
- D. Paint exposed conduit and electrical equipment occurring in finished areas.
- E. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- F. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated and color schedule. Provide flow arrows, and substance names.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 SCHEDULE - EXTERIOR SURFACES

- A. Wood Primed Only: Application: for wood fascias, and other wood surfaces to be capped or otherwise protected.
 - 1. One (1) coat A-1000 Alkyd Wood Primer Y24, WK
- B. Wood Painted; Application: wood surfaces to be primed and top coated.
 - 1. One (1) coat A-100 Alkyd Wood Primer.
 - 2. Two (2) coats A-100 Latex Satin House & Trim A-82.
- C. Concrete Block; Application; concrete block located above grade.
 - 1. One (1) coat Heavy duty filler, B42 W46, 10 mils DFT/coat. Color: white.
 - 2. Two (2) coats Metalatex Semi-Gloss Acrylic B42 series, 1.5 DFT/coat.
- D. Precast Concrete Structures Exteriors, Non-exposed Aluminum and Pump and Lift Station Wetwell Piping; Application; precast concrete installed below grade and nonexposed aluminum placed against concrete surfaces and pump and lift station wetwell piping (except for flange bolts and stainless steel pump "sliderail" system).
 - 1. One (1) coat of "Hi-Mil SHER-TAR" B69 B40/B60 V40, coal tar epoxy, 16-24 mils DFT/coat.
 - 2. Color: Black.
- E. Bare Steel; Application; unprimed bare steel.
 - 1. One (1) coat Kern Kromik Universal Metal Primer B50 Z Series, 3.0 mils DFT/coat.
 - 2. Two (2) coats of Industrial Enamel B54 Z Series, 2.0 mils DFT/coat.
- F. Steel Shop Primed: Application; factory primed, site finished exterior metals.
 - 1. Primer touch-up: One (1) coat Kern Kromik Metal Primer, 3.0 mils DFT/coat.
 - 2. Top Coat: Two (2) coats of Industrial Enamel B54 Series, 2.0 mils DFT/coat.
- G. Steel Galvanized: Application; Exterior galvanized metals (Except for chain link fence).

- 1. One (1) coat "Galvite" B50 WZ30 paint, 2.0 mils DFT/coat.
- 2. Two (2) coats of Industrial Enamel, B54 Series, 2.0 mils DFT/coat.
- H. Precast Concrete Pump Station! Lift Station Wetwell Interior Epoxy Coating:
 - 1. Two (2) coats Epoxide 33 Ceramic 8uff or 34 Ceramic White, 6.0 mils DFT/coat.
- I. Aluminum fabrications, angles "I" beams etc., to be in contact with concrete surfaces:
 - 1. One (1) coat of "Hi-Mil SHER-TAR" B69 B40/B60 V40, coal tar epoxy, 16-24 mils DFT/coat.
 - 2. Color: Black

3.06 SCHEDULE - INTERIOR SURFACES

- A. Wood Painted; Application: wood surfaces to be primed and top coated.
 - 1. One (1) coat Wall & Wood Primer B49 WZI.
 - 2. Two (2) coats ProMar 200 Alkyd Semi-Gloss Enamel B34 WZ 1101.
- B. Drywall Painted; Application: Interior room drywall surfaces.
 - 1. One (1) coat ProMar 200 Latex Wall Primer B28 W200.
 - 2. Two (2) coats ProMar 200 Alkyd Semi-Gloss Enamel B34 WZ 1101.
- C. Concrete Block; Application; interior concrete block wall surfaces located above grade.
 - 1. One (1) coat Heavy Duty Filler B42 W46, 10 mils DFT/coat. Color: white.
 - 2. Two (2) coats Metalatex Semi-Gloss Acrylic B42 series, 1.5 DFT/coat.
- D. Bare Steel; Application; interior unprimed bare steel.
 - 1. One (1) coat Kern Kromik Universal Metal Primer B50 Z Series, 3.0 mils Off/coat.
 - 2. Two (2) coats of Industrial Enamel B54 Z Series, 2.0 mils DFT/coat.
- E. Steel Shop Primed: Application; interior factory primed, site finished exterior metals.
 - 1. Primer touch-up: One (1) coat Kern Kromik Universal Metal Primer B50 Z Series, 3.0 mils DFT/coat.
 - 2. Top Coat: Two (2) coats of Industrial Enamel B54 Z Series, 2.0 mils DFT/coat.

- F. Concrete Floors: Application: Interior floors of buildings.
 - 1. One (1) coat of Concrete and Terrazzo Sealer.
 - 2. Two (2) coats of Industrial Enamel B54 Z Series, 2.0 rails, DFT/coat.
- G. Aluminum fabrications, angles "I" beams etc., to be in contact with concrete surfaces:
 - 1. One (1) coat of "Hi-Mil SHER-TAR" B69 B40/B60 V40, coal tar epoxy, 16-24 mils DFT/coat.
 - 2. Color: Black.

3.07 SCHEDULE-COLORS

- A. The Contractor shall paint all applicable existing (which will be used in the new plant) and proposed process piping in accordance with PAOEP'S requirements for sewage treatment works piping color coding, as follows:
 - 1. **Raw sludge line:** brown with black bands.
 - 2. **Sludge recirculation suction line:** brown with yellow bands.
 - 3. **Sludge draw-off line:** brown with orange bands.
 - 4. **Sludge gas line:** orange or red.
 - 5. **Natural gas line:** orange or red with black bands.
 - 6. **Nonpotable water line:** blue with black bands.
 - 7. **Potable water line:** blue
 - 8. **Chlorine water line:** yellow.
 - 9. **Wastewater line:** gray.
 - 10. **Compressed or blower air:** green.
 - 11. **Water lines for heating digesters or buildings:** blue with a six inch red band spaced 30 inches apart.

The contents and direction of flow shall be stenciled on the piping in a contrasting color, in a lettering size visible at least ten feet away.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
 - 1. CONTRACTOR shall furnish all materials, labor and equipment necessary to install a wet well-valve chamber style sewage pumping station with submersible pumps as shown on the Drawings and as hereinafter specified. Refer to Construction Details S-11 and S-12 relative to a typical Site Plan and Plan & Profile Views.
 - 2. The sewage pumping station structure shall consist of a precast reinforced concrete wet well and a precast reinforced concrete valve chamber. The principal items of equipment 'in the wet well shall include two (2) submersible non-clog sewage pumps with stainless steel guide rails, guide rail anchor brackets and lifting chains, stainless steel trash basket with stainless steel slide rails, submersible level sensing transducer with backup float system and operating controls. The principal items of equipment in the valve chamber shall include explosion proof lights, valves, check valves, air release (if necessary), backflush system with motor operated plug valve (tied to Pump Control Panel), and piping. Other related principal items at the pump station site shall include pump controls in a pad mounted stainless steel NEMA 4X enclosure, an emergency generator with skid mounted double wall diesel fuel storage tank and permanent load bank.
 - 3. This Specification Section covers a wet well-valve chamber style pumping station using submersible pumps. There may be circumstances where a wet well-dry well style pumping station is more appropriate in which case Authority should be consulted prior to design.
 - 4. The pumping station shall also include a pump station generator building, potable water supply, outside lighting, fencing, and all associated utilities as specified in this and related sections, and/or as shown on the Standard Details.

1.02 RELATED INFORMATION

A. Requirements for an emergency generator pumping station building which will house the emergency generator as well as the pumping station controls, water appurtenances, service sink, generator and load bank controls, is provided in Standard Detail S-13.

- B. Related Work Specified Elsewhere:
 - 1. Section 01560 Soil Erosion and Sedimentation Control
 - 2. Section 02110 Clearing and Grubbing
 - 3. Section 02220 Excavation, Backfill and Compaction
 - 4. Section 02229 Rock Removal
 - 5. Section 02510 Asphaltic Concrete Paving
 - 6. Section 02730 Gravity Sanitary Sewer Pipe
 - 7. Section 02732 Sanitary Force Main and Appurtences
 - 8. Section 02734 Sanitary Sewer System Testing
 - 9. Section 02832 Chain Link Fence and Gates
 - 10. Section 02905 Landscaping
 - 11. Section 03302 Concrete Work for Utilities
- C. Associated Construction Details:
 - 1. S-11 Typical Pump Station Site Plan
 - 2. S-12 Typical Pump Station Plan & Profile Views
 - 3. S-13 Pump Station Generator Building

1.03 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American National Standards Institute (ANSI) A21.4 Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings

A21.10 Gray-Iron and Ductile-Iron Fittings 3-inch through 48-inches

A21.15 Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges

A21.51 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

B 16.21 Non-metallic Flat Gaskets for Pipe Flanges

B 18.2.1 Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws

B 18.2.2 Square and Hex Nuts (Inch Series)

2. American Society for Testing and Materials (ASTM): C478 Specification for Precast Reinforced Concrete Manhole Sections

C923 Specification for Resilient Connections between Reinforced Concrete Manhole Structures and Pipes

Federal Specification: SS-S-00210 Joint Sealant Compound

National Fire Protection Association: National Electric Code

PA Department of Transportation: Publication 408 Specifications

- B. Experience:
 - 1. The manufacturer of the sewage pumping station specified herein shall have had equipment of this type in actual service for a period of not less than ten (10) years.
 - 2. The manufacturer shall upon request include, with the required submittal, a list of similar installations including the date placed in operation, unit description and name and phone number of a contact person.
- C. Factory Inspection and Testing:
 - 1. Prior to assembly, all station components shall be inspected for quality and tested for proper function and freedom from defects.
 - 2. The pump manufacturer shall perform the following factory inspections and tests on each pump.
 - a. A check of the voltage and frequency shall be made as shown on the name plate.
 - b. A motor and cable insulation test for moisture content or insulation defects shall be made.
 - c. The pump shall be completely submerged and run to determine that the unit meets three predetermined performance points.
 - d. A vibration test shall be run on each unit at maximum RPM with maximum velocity values not to exceed 1.0 Mils peak-to-peak.
 - e. A written report shall be provided showing the aforementioned tests have been performed.
- D. Acceptable Manufacturer of Pumps and Controls:

1. The pumps, pump controls and associated equipment shall be provided through and assembled by one (1) pumping station supplier who shall ensure appropriate coordination relative to the selection, fabrication, and installation of the various equipment components.

1.04 SUBMITTALS

A. Three sets of complete construction drawings, structural calculations, specifications, and hydraulic computations for the pumping station, pump station building and electrical generator shall be submitted to the Authority for approval. All drawings, specifications, and hydraulic computations shall be prepared, signed, and sealed by a Professional Engineer registered in the Commonwealth of Pennsylvania. Drawings shall incorporate structural, mechanical, civil and electrical details for all associated structures engine generator system site construction and landscaping as specified in other sections. Electrical drawings and specifications shall be prepared, signed, and sealed by a Professional Electrical Engineer registered in the Commonwealth of Pennsylvania.

No construction work shall commence until all plans have been reviewed and all items addressed in the review have been resolved.

- B. Shop Drawings:
 - 1. Submit detailed shop drawings, for the following items: precast reinforced concrete wet well; precast reinforced concrete valve chamber; Access covers for wet well and valve chamber; resilient connection seal(s); joint sealant compound; guide rails; trash basket and slide rail system, aluminum hatches, check valves; gate valves; plug valves and actuator; winch assembly and sockets; ductile iron pipe; automatic telephone dialer; pump and controls system as further described below.
 - 2. Pump Characteristic Curves. Six (6) copies of shop drawings including pump performance curves shall be submitted. Curves shall show head, horsepower 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. Standard submittals shall be complete and shall show all information needed to demonstrate that the pumps to be furnished are in accordance with the conditions specified. Standard submittals shall consist of, but not be limited to, Pump Outline Drawing, Control Data and Schematic, Access Door, Installation Guides, Technical Manuals and Parts lists.
 - 3. Certified Pump Test Curves. CONTRACTOR shall submit for approval by
ENGINEER, prior to shipment, certified pump test curves for each pump to be furnished. The pump test curves shall be certified by a registered Professional Engineer. The test curves shall show head versus capacity, horsepower versus capacity and pump efficiency as recorded at the manufacturer's test facility.

- 4. Operation and Maintenance Instructions. CONTRACTOR shall furnish AUTHORITY with four copies of complete operation and maintenance instructions in accordance with Section 010 I O.
- 5. For YFDs and motors, submit outline drawings, including top, side and front views, catalog cuts, wiring and interconnection diagrams, system operation descriptions, certification of compatibility, and operation and maintenance manuals. Include manufacturer's recommended instructions and field testing procedures.
- 6. Submissions shall include size and weight of equipment and location of all connections. It shall also indicate the system power factor at full speed, low speed, and three intermediate speeds. Calculations shall be provided as part of the submission.
- 7. The Vendor shall submit shop drawings of the control system. Submission shall include, but not be limited to, elementary diagrams, wiring diagrams, flow diagrams, nameplate listing, cuts of components including remote sensor and interface equipment, layout of enclosure and control panel, description of operation, block diagram indicating field wiring and installation instructions.
- 8. Submit Manufacturer's Installation Certificate in accordance with Section E.

1.05 MAINTENANCE MATERIALS

- A. Provided one (1) complete set of the manufacturers' recommended spare parts to include a minimum of the following:
 - 1. One (1) complete set of gaskets.
 - 2. One (1) set of pump and motor bearings.
 - 3. One (1) spare impeller.
 - 4. One (1) spare double mechanical seal for pump.
 - 5. One (1) set of pump control panel insulator lamps.
 - 6. Two (2) general purpose relays for control panel.
 - 7. One (1) spare transducer.

B. Package each part individually or in sets inside moisture-proof containers or wrappings, clearly labeled with part name and manufacturer's part/stock number. Provide any special tools required for equipment maintenance.

1.06 WARRANTY

A. For a period of 24 months from the date of shipment or 18 months from start-up, whichever occurs first, the equipment manufacturer shall warrant that the equipment and controls covered by these Specifications, other than the mechanical seal, shall be free from defects in material and workmanship under normal use and service. The manufacturer shall agree to repair or replace F.O.B. point of shipment such equipment or controls, or any part thereof, previously furnished by them which is found to be defective during the warranty period.

PART 2 – PRODUCTS

- 2.01 WET WELL
 - A. Structure:
 - 1. The wet well shall be a circular precast concrete structure with a monolithically poured base and riser section. The unit shall have a minimum 16" monolithic bottom with antiflotation collar, be 4,000 PSI reinforced concrete, and shall conform in all other aspects to ASTM specific C-478. Minimum inside diameter shall be 8'-0".
 - 2. All joints shall be sealed with Ram-Nec sealant.
 - 3. The top cover slab shall be concrete with:
 - a. Integral cast aluminum pump access hatch with safety platform.
 - b. Integral cast aluminum trash basket hatch.
 - c. A 4" stainless steel vent with bird screen. The vent shall have a confined space warning sign attached with stainless steel U-bolts.
 - d. A precast opening to accommodate a 6'; PVC (Sch 80) pressure transducer stilling well.
 - e. A precast opening to accommodate an 8" PVC (Sch 80) ventilation pipe.

- 4. The station shall also be equipped with an inlet gasket, 1.5" stainless steel guide rails (or larger as required by pump manufacturer), and a stainless steel level control switch-mounting bracket with a compression grommet that allows for level setting adjustment.
- B. Coatings:
 - 1. Interior: A white epoxy coating shall be applied to the entire interior concrete surface of the wet well. The coating shall consist of two (2) coats, each six (6) mils thick, of Penn-Chem Coating #54-W-23, by MAB Coatings; Epoxide 34, ceramic white, by Sherwin Williams; or approved equal, applied as recommended by the manufacturer under controlled conditions at concrete manufacturer's plant.
 - 2. Precast concrete installed below grade and nonexposed aluminum placed against concrete surfaces.
 - a. Two (2) coats of coal tar epoxy: Ply-Tile Epoxy Tar, by MAB Coatings; "HiMil SHER-TAR", by Sherwin Williams; or approved equal. Apply 8-10 mils DFT/coat. Color: Black.
 - b. If exterior coating is to be factory applied, it shall be done only after concrete is fully cured. Otherwise field apply exterior coating not earlier than 30 days after date of manufacture.
 - 3. Coatings for all internal piping and valves within wet well shall be as follows:
 - a. SP-10 near white blast with shop primer coat of 650 Ply-Mastic (polyamide polyamine epoxy) 3-5 mils DFT (MAB).
 - b. Field touch up with 650 Ply-Mastic (MAB) 3-5 mils DFT, followed by two coats of 650 Ply-Mastic at 4-6 mils DFT per coat. Provide color break between coats.
 - c. Final color to be Philly Gray 7116 (MAB).
 - 4. Paint exposed portion of PVC pipes with MAB Rust-O-Lastic Hydro-Prime II primer, followed by two coats of Hydro Shield acrylic latex at 2-3 mils DFT per coat.
- C. Aluminum Access Hatches:
 - 1. 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 trash basket removal. Pump station access hatch shall open

so as not to interfere with the operation of the portable hoist assembly during pump or trash basket lift-out. Provide a protective grating panel. Grating shall be hinged, sized to match each hatch leaf size, and shall be supplied with a positive latch to maintain unit in an upright position. Grating support ledges on 300 lbs. psf loaded access covers only shall incorporate nut rail with a minimum of four (4) stainless steel spring nuts. A padlock hasp for owner-supplied padlock shall be provided

- 2. 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. Mill finish with bituminous coating applied to exterior of this frame.
- 3. Pump Access Hatches shall be Halliday W2C Series, or other approved equal. Trash Basket Hatch shall be Halliday W1C3030 or approved equal. Protective grating panel shall be as manufactured by Halliday or approved equal.
- D. Bar Screen:
 - A stainless steel bar screen system shall be provided to remove potentially damaging debris from the pump station. It shall be of the bar screen style basket, having 2" clear opening between 114" thick bars and solid sides. The heavy duty guide rail system shall be constructed of structural stainless steel channel. For ease of operation, the basket will have (4) 2 112" solid aluminum wheels with 112" stainless steel axles. A stainless steel basket stop shall be supplied loose for field mounting to insure proper basket position. Bar Screen to be Halliday Model B4B Stainless Steel Trash Basket with stainless steel guiderails (do not furnish with ladder rungs).
- E. Pipe Penetration Seal:
 - 1. The annular opening between each pump discharge line and the wall sleeve shall be sealed with a sealing device specifically manufactured for wall pipe penetrations and rated to withstand the maximum external hydrostatic pressure which could occur.
 - 2. The sealing device shall be a Link-Seal as manufactured by Thunderline Corporation or approved equal.
- F. Coarse Aggregate:

- 1. PennDOT No. 2A or AASHTO No. 8 in accordance with Table C, Section 703.2, Publication 408 Specifications.
- H. Concrete:
 - 1. See Section 03411.

2.02 VALVE CHAMBER

- A. Structure: Rectangular Precast Concrete. Minimum inside dimensions shall be 8' 0" by 7' -0" Inside headroom clearance shall be 7'-6" minimum and 8'-0" maximum, unless otherwise approved by the ENGINEER.
- B. Coatings:
 - 1. Precast concrete installed below grade and nonexposed aluminum placed against concrete surfaces.
 - a. Two (2) coats of coal tar epoxy: Ply-Tile Epoxy Tar, by MAB Coatings; "HiMil SHER-TAR", by Sherwin Williams; or approved equal. Apply 8-10 mils DFT/coat. Color: Black.
 - b. If exterior coating is to be factory applied, it shall be done only after concrete is fully cured. Otherwise field apply exterior coating not earlier than 30 days after date of manufacture.
 - 2. Coatings for all internal piping and valves within the valve chamber shall be as follows:
 - a. SP-10 near white blast with shop primer coat of 650 Ply-Mastic (polyamide polyamine epoxy) 3-5 mils DFT (MAB).
 - Field touch up with 650 Ply-Mastic (MAB) 3-5 mils DFT,
 followed by two coats of 650 Ply-Mastic at 4-6 mils DFT per coat.
 Provide color break between coats.
 - c. Final color to be Philly Gray 7116 (MAB).
- C. Aluminum Access Hatches:
 - Provide a double leaf hatch for the valve pit sized to give clearance above the discharge valves and bypass line (minimum opening to be 48"x 48").
 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 $\frac{1}{4}$ " extruded aluminum frame.

- Provide each hatch with minimum ¼ " thick diamond checkered aluminum plate cover designed for minimum 300 lbs./sq. ft. loading. Furnish hatch with heavy bronze hinges, stainless steel hinge pins, springoperated lifting mechanism, automatic hold-open arm with release handle, stainless steel inside snap lock, and removable key-wrench lifting handle. Mill finish with bituminous coating applied to exterior of the frame.
- 3. Hatches shall be Halliday W2C Series or approved equal.
- D. Pipe Penetration Seal:
 - 1. The annular opening between each pump discharge line and the wall sleeve shall be sealed with a sealing device specifically manufactured for wall pipe penetrations and rated to withstand the maximum external hydrostatic pressure which could occur.
 - 2. The sealing device shall be a Link-Seal as manufactured by Thunderline Corporation, or approved equal.
- E. Ladder:
 - 1. A vertical aluminum ladder with a minimum width of 18 inches shall be provided. The ladder shall be capable of being fastened to the concrete valve chamber using stainless steel anchor bolts, and shall be as manufactured by Halliday or approved equal.
 - 2. The aluminum ladder shall conform to the requirements of the Occupational Safety and Health Standards, U.S. Department of Labor (29 CFR 1910.27).
- F. Coarse Aggregate:
 - 1. PennDOT No. 2A or AASHTO No. 8 in accordance with Table C, Section 703.2, Publication 408 Specifications.
- G. Concrete:
 - 1. See Section 03411.

2.03 RAW SEWAGE PUMPS AND APPURTENANCES

A. General Scope:

1. Two (2) submersible, non-clog "explosion-proof' sewage pumps, shall be provided each rated for the capacity (GPM) and total dynamic head (feet) associated with the project based on case specific calculations. Grinder pumps, shall only be used with specific approval of the Authority. The operating point of the pump shall be adequate to provide the required design flow with minor total dynamic head changes. Pump efficiency shall be a major consideration in pump selection.

The pump motor shall be 1750 RPM, when possible or 3500 rpm maximum. In all cases the motor shall operate on three phase, 60 Hertz, 240 or 480 volt power. Motor horsepower shall be selected based on case specific design.

- 2. The pumps shall be manufactured by a company regularly engaged in the manufacturing and assembly of similar units for a minimum of ten (10) years. The pumps shall be as manufactured by Barnes Pumps Inc. of Piqua, Ohio, or approved equal.
- B. Pump Design:
 - 1. Each pump shall be capable of handling raw, unscreened domestic sewage consisting of water, fibrous materials and spherical solids up to three (3) inches diameter.
 - 2. Each pump shall be capable of running dry for extended periods of time without damage to the motor and/or seals.
 - 3. Each pump shall contain no points of critical clearance nor require periodic adjustment or replacement to maintain reasonably operating efficiency.
 - 4. The pump motor shall be designed to be non-overloading under all anticipated operating conditions.
 - 5. The pump(s) shall be capable of handling liquids with temperatures to 104 degrees F continuous, 160 degrees F intermittent, and shall be capable of running dry for extended periods.
- C. Pump Construction:
 - Pump(s) shall be manufactured in the United States utilizing domestic parts and components in its construction. The pumps shall carry a UL Listing for operation in Class I, Division I, Groups C & D hazardous environments. The volute, seal plates, impeller and motor housing shall be constructed of high quality ASTM A-48 class 30 cast iron. Pump(s) shall

be painted with water based air dry enamel of 2.0 mil minimum thickness. All exposed hardware shall be 300 series stainless steel. The pump construction shall contain no points of critical clearance nor require periodic adjustment or replacement to maintain operating efficiency. Discharge connection shall be a standard 125 pound, 4 inch flange. All gaskets shall be of the O-ring type. The impeller shall be of the non-clog design with pump out vanes on the backside. The impeller shall be dynamically balanced to ISO G6.3 specifications.

- 2. The motor shall be designed to be non-overloading throughout the entire intended hydraulic operating range from shut off to static head. The pump and motor shall be UL Listed with Underwriters Laboratories as Class I, Groups C & D, Division I, explosion proof, for installation in water and sewage. All electrical parts shall be housed in an air filled, cast iron, watertight enclosure. The enclosure shall be sealed by the use of O-rings and shall include rabbit joints with a large overlap. The motor shaft extension and all external hardware shall be stainless steel. The motor windings shall have class F insulation system minimum and a 1.15 service factor. The shaft seals shall be a tandem design and operate in an oil filled enclosure. The shaft sealing system shall run in an oil bath. The lower, primary seal shall consist of one stationary silicone carbide ring and one positively driven (rotating) silicon carbide ring; while the upper seal between the motor and the oil housing shall consist of one stationary stainless steel ring and one positively driven rotating carbon ring. Each interface shall be held in place by its own independent spring system. The seal shall be commercially available and not a manufacturer's proprietary design.
- 3. Two moisture sensor probes shall be used to detect any influx of liquid past the other seal and provide ample warning to the first seal failure. Units utilizing one probe and grounding through the pump case or float devices are not acceptable. Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with a thermal switch embedded in the end coil of the stator winding. This shall be used in conjunction with and supplemental to external motor overload protection and wired into the pump control panel.
- 4. The pump shall be equipped with 25 ft. of type 8/4 SOW-A power cable and 25 ft. of sensor cable type 18/5 SOW. The cable entry design shall be such that it precludes specific torque requirements to insure a watertight and submersible seal. All incoming lead wires shall be spliced in the motor terminal housing. After splicing, the terminal housing shall be filled with epoxy to seal the outer cable jacket and the individual strands to prevent water from entering the motor housing. A secondary rubber pressure grommet shall be provided as an additional sealing point and strain relief at the point of cable entry. Cable entry designs utilizing

terminal boards to connect power cord leads with motor leads shall not be acceptable.

- D. Break Away Fittings:
 - 1. The break-away fitting shall be designed to allow the submersible pump to be installed or removed without requiring personnel to enter the wet well. The stationary portion of the BAF consists of a specially designed cast iron base elbow which is bolted to the floor of the wet well. The pump bolts to the cast iron moveable portion which is free to ride up and down the guide rails. An O-ring is pressed into a dove-tailed groove on the tapered face of the moveable fitting. The tapered faces of the moveable and base elbow allow for a positive mating of the O-ring to base. This elastomer to cast iron contact assures a complete and positive seal which allows pumps to operate without hydraulic leakage, over wide range of discharge pressures up to 150 PSI.
 - 2. The guiderails shall be attached to the base elbow at one end and to a stainless steel guide cap which is attached to the underside of the wet well cover at the other end. Both the guide cap assembly and the base elbow shall have cast iron plugs with O-rings mounted in them which aid in locating the guiderails and in reducing noise and vibration of the guide rails. The guiderails serve only to guide. They carry none of the pump weight. Stainless steel Schedule 40 pipe should be used for guiderails (min. diameter shall be 1.5"). A stainless steel intermediate guide pipe bracket should be used for depths of 13 feet or more.
- E. Pump Accessories:
 - 1. Each pump shall be furnished with a discharge elbow of the appropriate size, stainless steel upper guide bar bracket, stainless steel intermediate guide bar bracket(s), stainless steel safety hook and discharge connection accessories.
- F. Testing:

Testing performed upon each pump shall include the following inspections:

Impeller, motor rating and electrical connections shall be checked for:

- 1. Compliance with this specification.
- 2. Prior to submergence, each pump shall be run dry to establish correct rotation.
- 3. Each pump shall be run submerged in water.

Motor and cable insulation shall be tested for moisture content or insulation defects. Upon request, a written quality assurance record confirming the above testing/inspections shall be supplied with each pump at the time of shipment. Capacity and kilowatt draw required. Witness tests shall be available at the factory upon request.

G. Start-up Service:

The equipment manufacturer shall furnish the services of a qualified factory trained field service engineer at the site to inspect the installation and instruct the owner's personnel on the operation and maintenance of the pumping units. After the pumps have been completely installed and wired, the contractor shall have the manufacturer do the following:

- 1. Check Power cables
- 2. Check seal lubrication
- 3. Check for proper rotation
- 4. Check power supply voltage
- 5. Measure motor operating load and no load current
- 6. Check level control operation and sequence

During this initial inspection, the manufacturer's service representative shall review recommended operation and maintenance procedures with the owner's personnel.

H. Factory Service:

Factory-approved service facilities with qualified factory-trained mechanics shall be available for prompt emergency and routine service and shall be located within 100 miles of the site.

- I. Guarantee:
 - 1. Non-clog Pumps:

In addition to the general guarantee required elsewhere in these specifications, the pump manufacturer shall furnish the Owner with a written warranty to cover the pump(s) and motor(s) against defects in workmanship and material for a period of five (5) years or 10,000 hours of operation under normal use and service. The pump manufacturer will pay the following portion of the cost of all replacement parts and repair labor from the date of shipment of the pump unit. Pumps repaired under warranty will be returned to the owner freight prepaid.

Months	0-18	19-39	40-60
Hours	1-3,000	3,000-6,000	6,500-10,000
Warranty	100%	50%	25%

The warranty shall be in printed form and previously published as the manufacturer's standard warranty for all similar units manufactured.

2. Grinder Pumps:

A minimum 12 month warranty shall be provided in cases where grinder pumps have been specifically approved for use on a project. The pump manufacturer will pay the following portion of the cost of all replacement parts and repair labor from the date of shipment of the pump unit. Pumps repaired under warranty will be returned to the owner freight prepaid.

2.04 PUMP CONTROL PANEL

- A. Pump Control Panel: NEMA 4x stainless steel panel, furnished by pump supplier. A heavy-duty, three-position, hand-off-automatic selector switch shall be flushmounted on the inner door of the control center for the operation of each motor magnetic starter. This selector switch shall operate the starter when it is in either the "hand" position or the "automatic" position and the automatic control system is calling for the operation of the equipment in the manner as herein described.
- B. The panel shall be wall mounted and shall contain the following features:
 - 1. Level control system.
 - 2. Pump run lights.
 - 3. Pump failure lights (for high temp. cutout).
 - 4. Elapsed time run meters (one for each pump and one for simultaneous pump operation).
 - 5. High temperature resets.
 - 6. High level alarm with auxiliary contacts for telemetry.
 - 7. Pump seal failure contacts for indicator lights and telemetry, including manual reset capability.
 - 8. Contacts for an exterior mounted alarm light.
 - 9. Circuit breakers for each motor, and control circuit.
 - 10. Phase loss protection with automatic reset (for all motors) with contact for telemetry.
 - 11. Panel heater.
 - 12. Lightning and surge protection.

C. An inner door mounted ground fault interrupter (GFI) type convenience receptacle rated at 15 amperes shall be supplied for the operating of trouble lights, drill, etc. It shall be protected by a separate 15 ampere trip rated circuit breaker.

2.05 LEVEL CONTROL SYSTEM

A. Control System Manufacturer:

Pump Control System shall be a Touchtrol CS control system as described hereafter.

The naming of a manufacturer of equipment in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment, but is to establish a minimum standard for the material used, and to indicate a principle of operation desired.

All panel mounted equipment is to be identified on this panel sketch so that their existence can be checked and functional relationships determined.

B. System Coordination and Single Source Responsibility:

The equipment provided shall be a completely integrated microprocessor based automatic control and monitoring system consisting of the required controller, power equipment; motor starters, level/flow and alarm monitoring equipment in a factory wired and tested assembly. The automatic control and alarm/monitoring system components shall be standard, catalogued, stocked products of the system supplier to assure one source responsibility, immediately available spare/replacement parts, proper system interconnections and reliable long term operation.

C. Field Supervision:

The services of a factory trained, qualified representative shall be provided to inspect the completed installation, make all adjustments necessary to place the system in trouble free operation and instruct the operating personnel in the proper care and operation of the equipment.

- 1. This document provides specification requirements for a Quadraplex Constant Speed level control system package (Touchtrol CSTM pump controller package).
- 2. The level controller package manufacturer shall factory assemble, test and field adjust all installed packages for satisfactory operation. An authorized factory representative may place system into operation with prior approval from manufacturer.

- 3. The level controller package and its components, including the programmable logic controller (PLC), the operator interface terminal (OIT) and communication modules (if provided) and associated electrical control components must be from the same manufacturer and must be of current model in production. Prototypes, special configurations, discontinued models or proprietary configurations will not be allowed.
- D. Quality Assurance:
 - 1. The manufacturer of the level control system shall be a UL 508A and UL 913 certified facility.
 - 2. The level controller package shall be designed, constructed and tested in accordance with NEMA, IEC, UL 508A and UL 913 (if applicable) standards.
 - 3. Prior to shipment, the level controller hardware and software shall be fully tested at the factory as an assembled unit. Any ancillary components supplied with the system shall also be tested prior to shipment. Documentation shall be furnished at the engineer's request.
- E. Manufacturers:
 - 1. The level controller shall be the Siemens S7-226 Series PLC and TPI70A operator interface. Other associated electrical controls shall be of a high quality and bear Underwriters Laboratories labels. Shall be a standard product for the application specified. Custom designed packages are not acceptable.
- F. General Description:
 - 1. The level controller system shall provide pumping process control for water/wastewater applications, industrial process treatment and other constant speed pump applications as appropriate.
 - 2. The level controller system shall provide visual indication of incoming level and flow signals in bargraph form.
 - 3. The pumping configuration shall be configurable as a Simplex, Duplex, Triplex or Quadraplex system from the Touchscreen. This level controller shall be utilized throughout this Warwick Township collection system for operator familiarity purposes in Duplex, Triplex and Quadraplex modes. Upon selection of pumping configuration, all references to pumps shall be immediately updated by adding or deleting text from the screens.

- 4. The level controller shall be capable of controlling motor starters for each pump.
- 5. The level controller package shall typically include the following components:
 - a. A Programmable Logic Controller (PLC).
 - b. An Operator Interface Terminal (OIT).
 - c. NEMA rated enclosure.
 - d. NEMA electrical power components including contactors, starters and motor starter protectors.
 - e. UL listed or recognized electrical control components including relays, fuses, circuit breakers, pilot devices and terminal blocks.
- 6. System hardware and software shall be fully tested and ready for field installation. Final configuration to be performed by an authorized factory representative.
- 7. Level control system functionality shall include the following capabilities:
 - a. Automatic pump alternation sequencing on time or level.
 - b. Pump/Motor status monitoring.
 - c. Fault monitoring and logging.
 - d. Automatic internal Float backup control.
 - e. Pump failure replacement sequencing.
- 8. The following options are to be included for Warwick Township Water & Sewer Authority with the standard level control package:
 - a. Submersible transducer system package.
 - b. Password protection.
 - c. UL 508A and UL 913 certification.
 - d. Service entrance label.
 - e. Electrical surge protection.
 - f. Phase loss protection.
 - g. Thermostatically controlled heating.
 - h. Float backup mode. (Built into PLC)
 - i. Emergency power mode.
 - j. Duplex GFI convenience outlet.
 - k. Elapsed time meters with simultaneous operation (built into PLC).
 - 1. Programmable "flush" cycle feature.
- G. Controller (PLC) Data:
 - 1. The controller shall be a standard Siemens S7-226 Series platform.

- 2. All expansion digital and analog (I/O) modules required to properly operate the pumps shall be prewired and replacements shall be locally stocked.
- 3. The PLC shall be programmed in ladder logic or other graphical language.
- 4. The PLC shall be programmed using Siemens Step-7 MicroWin 32, or latest version.
- 5. The PLC shall have two RS-485 on-board serial ports.
- 6. The PLC shall accept an optional plug-in serial EEPROM or battery cartridge for program storage and data retention.
- 7. The PLC shall accept up to 7 expansion modules for a total of 256 digital and 32 analog I/O.
- 8. The PLC shall be capable of password protection.
- 9. PLC input voltage shall be 20.4-28.8VDC or 85-264VAC.
- 10. PLC shall be designed to operate under the following conditions:

Temperature	0°, C to 55° C Horizontal Mounting	
	0° C to 45° C Vertical Mounting	
Humidity	95% non-condensing	
Mech Shock	15G, 11 ms pulse, 6 shocks in each of 3 axis	
Electrostatic	8kV air discharge to all surfaces and	
	communication port	

- H. Operator Interface Terminal (OIT) Data:
 - 1. The Siemens TP170A Operator Interface Terminal shall be door-mounted on the PLC enclosure to facilitate operator access.
 - 2. OIT screen shall be CCFL back-lit (Cold Cathode Fluorescence Lamps) at 320 x 240 pixels and 4 Blue modes. Backlighting shall be capable of 50,000 hours or 6 years of continuous operation.
 - 3. Access to any OIT function shall be restricted by password protection.
 - 4. Configuration software shall be Windows® CE based.
 - 5. Unit shall have an RS-232/ RS-485 communication port.

- 6. OIT shall be of the touch (resistive/analog) type.
- 7. Memory shall be 256 Kbyte onboard.
- 8. Unit shall operate from 18-30VDC.
- 9. OIT shall be capable of 100 event messages.
- 10. Unit shall display a minimum of 20 screens.
- 11. OIT shall be designed to operate under the following conditions:

Temperature	0° C to 50°
Humidity	85% RH (no condensation)
NEMA rating	N 12/ IP65 (front)
	N1/IP20 (rear)

- I. Process Inputs:
 - 1. The PLC shall receive process input data for level from a submersible pressure, ultrasonic or bubbler differential pressure transmitter.
 - 2. The PLC shall receive process input data for flow from an ultrasonic, magnetic or doppler type flowmeter.
 - 3. Process input data shall be in the form of a 4-20mA 12 bit analog signal. Signal conditioners and amplifiers shall be included as required.
- J. Screen Descriptions:
 - 1. Main Screen
 - a. Bar-graph and digital displays of station level. Simulation buttons to test system operation with a watchdog timer feature.
 - b. Bar-graph and digital displays of station flow.
 - c. Run, stop and in automatic status of pumps.
 - d. Lead pump order indication.
 - e. Buttons for access to setup and alarm screens.
 - 2. System Setup Screen (1 of 3)

- a. Set well depth in feet (tenth of foot increments).
- b. Set high alarm setpoint in feet (tenth of foot increments).
- c. Set low alarm setpoint in feet (tenth of foot increments).
- d. Set flowmeter range in GPM.
- e. Set flowmeter low flow setpoint in GPM.
- f. Configure system alternation mode for time (1-24hr.) or pump stop.
- g. Buttons for access to other screens.
- 3. Pump/ Level Setup Screen (2 of 3)
 - a. Configure number of pumps on system.
 - b. Set number of pumps to run on generator power.
 - c. Configure pump start/stop setpoints.
 - d. Buttons for access to other screens.
 - e. Set pressure control set points (Utility Water Pumps Only)
- 4. Clock Setup Screen (3 of 3)
 - a. Set date/time (if different than internal clock)
 - b. Buttons for access to other screens.
- 5. Alarm Screen
 - a. Monitor the following individual alarms:
 - i. High Level Alarm
 - ii. Low Level Alarm
 - iii. Low Flow Alarm
 - iv. Level Signal Failure
 - v. Power Failure
 - vi. Phase Failure
 - vii. Pump 1-4 Thermal and Seal Failure
 - viii. Flush Valve Non-closure

- 6. Buttons for access to other screens.
- K. Communications:
 - 1. The CPU shall include two onboard RS-485 communications ports supporting the following protocols:
 - a. PPI (Peer-Peer Interface) master/slave protocol with communication speeds up to 187.5 Kbaud. Primarily used for programming, S7-200 CPU networking, and connection to operator interface terminals.
 - b. MPI (Master-Peer Interface) master/slave protocol with communication speeds up to 187.5 Kbaud. Primarily used for communication to larger S7-300/400 platform CPUs and other devices.
 - c. Freeport mode of operation through which the CPU can define the protocol of the communications port.
 - 2. The CPU shall support the following external communications modules and communication protocols:
 - a. **PROFIBUS**:
 - i. Module shall be capable of connecting CPU as a slave to a Profibus-DP network and other peripherals capable of being an MPI master.
 - ii. Module shall be capable of moving data to and from a block of variable memory defined in the S7-200 CPU.
 - Module shall be capable of operation as a communication interface to other MPI masters whether or not it is being used as a PROFIBUS-DP slave. A maximum connection to six devices shall be allowed.
 - iv. Communication port shall be RS-485.
 - v. Shall support a cable length of 1200m up to 93.75 Kbaud.
 - vi. Maximum of 126 stations or 99 PROFIBUS-DP slaves.
 - b. AS-INTERFACE:

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- i. Module shall be capable of supporting bi-directional slaves up to a maximum of 248 binary elements via 31 AS-Interface slaves.
- ii. Module shall include onboard terminal blocks for direct connection to an AS-Interface network.
- iii. Module shall include front panel mounted LEOs for displaying the operating state as well as the connected and activated slaves and their availability.
- iv. Module shall have a push-button for changing the operating states and the status/slave display as well as accepting the existing configuration.
- v. Module shall have an update cycle rate of 5ms for 31 slaves.

c. MODEM:

- i. Module shall have an RJ- 11 communication port.
- ii. Module shall support Bell 103, Bell 212, V.21, V.22, V.22 bis, V.23c, V.32, V.32 bis and V.34 standards.
- iii. Module shall be capable of baud rates between 300 and 33.6K.
- iv. Module shall include password protection and callback features.
- v. Module shall support pulse and tone dialing.
- vi. Module shall support Modbus and PPI industrial protocols.
- vii. Module shall support Plug and Play capability with the CPU.
- viii. Module shall be capable of alarm/event driven sending of SMS or pager messages.
- L. Panel Construction:

- 1. The CPU and Operator Interface terminal shall be housed in a standard industrial style NEMA 3 R stainless steel rated enclosure, unless otherwise specified herein.
- 2. The enclosure shall be either a stand-alone (floor mounted), interconnected MCC style (floor mounted) or wall mounted unit.
- 3. Enclosure shall bear a serialized UL label.
- 4. Local wiring codes and standards shall apply.
- 5. All pilot devices shall be 2 mm devices (unless otherwise specified) and include laminated lexan/Mylar nametags. The following minimum devices shall be supplied:
 - a. Control Power Light (white
 - b. PLC Failure Light (red)
 - c. Level Transmitter Fail Light (red)
 - d. Master Alarm Reset Pushbutton
 - e. Common Alarm or External Beacon (red)
 - f. Low Flow Alarm (red)
 - g. Pump Thermal Overload
 - h. Pump Moisture Sensor
- M. Redundant Backup Float Controller:
 - 1. A redundant backup float controller will be installed to operate the pumps and alarm on up to five back up floats (Low Alarm, Pumps Off, Lead Start, Lag Start, High Alarm) in the unlikely situation that the primary controller or transducer would fail. The backup controller is configured via the primary controller keypad and receives its data through the RS422 serial port using Modbus protocol. The controller will be configured as to the number of floats connected and float backup time delays settings. This information is stored in the backup controller and will operate as configured if the primary controller is failed or out of service. A dry telemetry contact is provided to indicate the backup controller is on. The controller shall be capable of being configured to operate the pumps and alarm on the backup floats as follows:
 - 2. When the high float is activated, the controller will call the lead pump and signal the alarm. If the float does not deactivate in a predetermined adjustable time the lag pump will also start. When the low float is deactivated, the pump(s) will be turned off. Each subsequent activation of the lead on float will turn the lead pump on and subsequent activation of

the high float will turn the lag pump on. The alarm will remain on until manually reset.

- N. Alarm Messages:
 - 1. In the event of an alarm condition the operator interface will display an alarm message. Press the "Alarm Ack" button to acknowledge the alarm and "Alarm Reset" button to clear the alarm. The following list of alarms shall be provided:
 - Low Level
 - High Level
 - Pump 1 Fail
 - Pump 2 Fail
 - Transducer Fail
 - Seal 1 Fail
 - Seal 2 Fail
 - Motor 1 Overtemp
 - Motor 2 Overtemp
 - Pump 1 Fail (Configurable from external device)
 - Pump 2 Fail (Configurable from external device)
 - Backup Float Test Fail
 - Generator Fail
 - Flush Valve Non-closure
- O. Pump Seal Fail:

A seal failure relay specifically designed to interface with a contact closure from each of the specified pumps will be included. A Seal Fail alarm message will be displayed on the controller. In addition the controller will be configured to designate it to the lag position until the condition is corrected.

P. Overtemperature Pump Protection:

Overtemperature protection relays shall be provided in the control panels to operate in conjunction with the overtemperature switch in each pump motor. The controller shall provide an Overtemp Fail alarm message and pump lockout of operation upon occurrence of high temperature. The circuitry shall also include a reset push button on the controller for manual reset capability.

Q. Selector Switches:

A heavy-duty, three-position, hand-off-automatic selector switch shall be flushmounted on the inner door of the control center for the operation of each motor magnetic starter. This selector switch shall operate the starter when it is in either

the "hand" position or the "automatic" position and the automatic control system is calling for the operation of the equipment in the manner as herein described. In addition an inner door heavy-duty green pilot light operated from a respective starter auxiliary contact, shall be provided to indicate a "pump running" condition. The pilot light shall have a replaceable bulb.

R. Weatherproof Alarm Light:

A weatherproof, high water alarm light assembly including a high impact resistant lexan red lens shall be included. The alarm light bulb shall be replaceable from inside the control panel without having to remove the weatherproof red lens from the panel. A solid state flasher shall be included to strobe the alarm light for any of the specified alarm conditions.

S. Telemetry:

Provide the following contacts for telemetry:

- Low Level Alarm
- Pump 1 Failure
- Pump 2 Failure
- High Level Alarm
- Transducer Fail
- Generator Fail
- Phase Loss
- Flush Valve Non-closure
- T. Submersible Wetwell Level Sensing Transducer:
 - 1. The Birdcage Water Level Controller for controlling the sewage level in wet wells shall consist of a submersible piezoelectric pressure sensing element, encased in a watertight case with 40 feet of vented cable, able to withstand 220 pounds of tensile strength, allowing the transducer to be suspended directly by the cable. The device shall require a 10-30 VDC low voltage power supply. The output shall be a standard 4-20 MADC control signal proportional to the range of the transducer and shall have an accuracy of +/- 0.25% B.F.S.L. with repeatability of +/-0.05% The transducer shall be provided with a container of desiccant to be attached to the vent cable to insure that no condensed moisture reaches the internal electronics. The nose of the transducer shall be threaded onto a protective device consisting of the top half of a 316 stainless steel chemical seal with a welded 316 s/s diaphragm. The fill fluid shall be glycerine or silicone depending on the extremes of temperatures expected to be encountered. Eight 304 stainless steel spacers and bolts and nuts hold a stand-off ring in position so as to fully protect the diaphragm from the debris frequently

encountered in lift stations. This device shall be the Birdcage Water Level Controller as assembled and fabricated by Blue Ribbon Industrial Components Corp.

2. The pump controller shall connect to the submersible transducer through an intrinsically safe module. The module shall provide an intrinsically safe interface for the sensor located in a hazardous area rated Class 1 Group A, B, C and D and Class 2 Group E, F and G. The intrinsic safety barrier shall be UL listed.

2.06 WETWELL LEVEL SENSING FLOAT SWITCHES

- A. Provide 3 back up float(s) for redundant control and alarm. The float(s) shall have a molded polyethylene body, internal redundant polyurethane foam floatation, potted switch/cable connections and fine stranded AWG #18 cable with heavyduty synthetic rubber jacket in lengths as required to run unspliced to the control panel.
- B. The Contractor shall furnish, install and wire the float switches as shown on the Drawings. The float switches shall be individually suspended in the wetwell with weight kits. The float switch cables shall be suspended from a cable rack mounted to the top of the wetwell.
- C. The pump level controller shall connect to the float switch level sensors through an intrinsically safe module. The module shall provide an intrinsically safe interface for the sensors located in a hazardous area rated Class 1 Group A, B, C and D and Class 2 Group E, F and G. The module shall contain an LED indicator providing visible indication of sensor actuation. The intrinsic safety barrier shall be UL listed.

2.07 SOLID STATE, REDUCED VOLTAGE MOTOR STARTERS (FULL RATED BYPASS) FOR APPLICATIONS FOR 20 HP MOTORS AND LARGER

A. The pump control system shall be provided with on Benshaw RediStart Digital motor starter with full rated bypass contactor. The Benshaw RediStart Digital motor starter is a microprocessor-controlled starter for single or three-phase induction motors. The starter can be custom designed for specific applications.

The starter offers:

- Solid state design
- Current limited reduced voltage starting
- Closed-loop motor current control
- Programmable motor protection
- Programmable operating parameters

- Programmable metering options
- Variable voltage control
- B. Available in NEMA (National Electrical Manufacturers Association) specified frame sizes, the starter may be used in numerous industrial applications. Each starter can operate within applied voltage and frequency values of 100VAC to 600VAC (optional 1000VAC) and 23 to 75Hz. This feature enables it to be installed in a wide range of sites and countries.
- C. The starter can be programmed for any motor FLA and all of the common motor service factors. It enables operators to control both motor acceleration and deceleration. It also protects the motor and its load from damage that could be caused by incorrect phase order wiring.
- D. The starter continually monitors the amount of current being delivered to the motor. This protects the motor from overheating or drawing excess current. The starter will automatically stop the motor if the line-to-line current is not within acceptable ranges or if the current is lost in a line.
- E. The RSD shall have these standard features:
 - Single, split or three-phase operation.
 - Adjustable ramp time (0 120s).
 - Adjustable initial current (50 400%).
 - Adjustable maximum current (200 600%).
 - Adjustable full-voltage kick start (0.1 to 5 seconds or Off).
 - Selectable motor deceleration Control for Pumps (0 60s).
 - Variable voltage control input (0 to 5 volts, 0 to 10 volts, 4 to 20rnA).
 - Variable current control input (4-20mA).
 - Extreme current imbalance/line phase loss detection.
 - Adjustable line current imbalance protection (5 40%).
 - General fault, motor power and up to speed form "C" contacts.
 - Line phase sequence sensitivity or insensitivity.
 - Phase loss and phase reversal protection.
 - Selectable solid state overload class 10, 20, 30, or None.
 - Negative sequence overload biasing.
 - Adjustable motor full load amps (1 1200A).
 - Adjustable motor service factor (1.00 1.40).
 - Adjustable current transformer ratio (72, 96, 144, 288, 864, 2640, 2880 and 5760:1).
 - Adjustable stalled motor detection (0 240s).
 - Operation at universal line voltage (100 through 600VAC, optional to 1000VAC).
 - Line frequency tracking (23Hz through 75Hz).
 - 120VAC external trip input (fault detection active on start or UTS).

- 800% FLA instantaneous overcurrent detection.
- Overcurrent (jam) protection (50 400%, 1 to 15 seconds or disabled).
- Undercurrent protection (25 100%, 1 to 15 seconds or disabled).
- Automatic or manual overcurrent and undercurrent trip reset.
- Shorted SCR detection and SCR condition indication.
- 3-digit 7 -segment LED Display.
- Programmable metering.
- F. LED display a three character, alphanumeric LED display located on the control card displays:
 - Starter status information.
 - Operating parameters.
 - Condition codes.
 - Fault codes.
 - Thermal Overload Content.
 - Metering.
 - Remote display active.
- G. LED indicators each starter will have indicating LEDs for:
 - Power On.
 - SCR Condition.
- H. Control Relays: The starter has four control relays:
 - Start/Stop input relay.
 - Fault output relay.
 - UTS (up to speed) output relay.
 - Motor power output relay.
- I. General: The RSD provides three Form "C" relay contacts. The contacts are capable of 250V AC, 16A Resistive, 8A Inductive, with exception of the fault contact, which is only capable of 125V AC 2A Resistive, 1A Inductive.
- J. Motor Power: This contact is energized whenever the SCRs are conducting as a direct command from the RSD. There is a 300ms delay from the time this contact engages to the time that the RSD starts firing SCRs, so this contact may be used to safely control an in-line or output isolation contactor.
- K. Up To Speed: When a true motor Up To Speed condition is achieved (SCRs fully phased on and motor current is under 150% FLA), the UTS contact will engage. Once engaged, the only time this contact will disengage is on a fault or stop command. There is a 300ms delay from the time a stop command is given to the time that the RSD actually starts a decel profile, so this contact may be used to safely control a bypass contactor or power factor capacitor bank. THIS

CONTACTOR SHALL BE RATED TO START THE PUMP IN A ACROSS THE LINE DUTY TO ACT AS 100% BACK UP TO THE SOFT STARTER.

- L. General Fault: The General Fault contact energizes when any motor or starter fault is detected. These faults include the following:
 - Line Phase Loss
 - Current Imbalance
 - Over/Undercurrent
 - Line Phase Sequence Change
 - Motor Thermal Overload Trip
 - Heatsink Thermal Switch Trip (120V AC trip input is de-energized)
 - Instantaneous Overcurrent
 - Shorted SCR
 - Control Power Failure
 - Computer Failure
 - Up To Speed Fault
- M. General: The starter has the capability to display a number of different line current combinations as well as the motor current imbalance percentage.
- N. Meter Options: The meter can display:
 - Phase 1 current.
 - Phase 2 current.
 - Phase 3 current.
 - Average current.
 - Maximum phase current.
 - Current imbalance level.
- O. Meter Dwell Time: The meter option also has a dwell time adjustment. This dwell time can be set to Off or from 2 to 30 seconds. When the meter dwell time is set to a value, the RSD will display the peak value reached during each time interval.
- P. Operating Requirements: The RSD is designed to operate in the following conditions:
 - Ambient Temperature: $0 40^{\circ}C$ ($32^{\circ}F$ to $104^{\circ}F$).
 - Humidity (non-condensing): 20 to 95%.
- Q. Storage Requirements: The RSD starter may be stored for up to two years before being installed. However, starter power terminations should be connected to full line voltage for one hour per year to maintain the voltage rating on the electrolytic

capacitors. This will prevent short circuits when the system is powered up. If the starter is to be stored, the following recommendations apply:

- Ambient Temperature: -40° C (-40° F) to 70° C (158° F).
- Temperature Rate of Change: 6 _ C in 30 minutes
- Humidity (non-condensing): 20% to 95%.
- Humidity Rate of Change: 10% in 30 minutes
- R. Power Requirements:
 - 1. General: The RSD starters are designed to operate with single or threephase AC power at the following nominal voltages:
 - Line Voltage: 100 to 600V AC (optional 1000VAC) single or 3 phase
 - Control Voltage: 120VAC single phase.

All starters are designed for universal operation at 23Hz through 75Hz at ambient temperatures of up to 40°C. Control voltage is specified by the customer at time of order and may not be modified by the customer. If a control transformer is supplied with the RSD, the operating voltage will be specified on the unit rating label.

2.08 EXTERNAL ALARM LIGHT

A. General:

- 1. An external alarm light shall be mounted on top of the exterior electrical enclosure. The light will be a 100 watt light, enclosed in a vapor proof fixture with metal guard and be provided with a solid state flasher and a push test button.
- 2. The alarm light will normally be off, but will flash at a rapid frequency during all alarm conditions as follows:
 - a. high liquid level in wet well.
 - b. lag pump in operation.
 - c. redundant off level in wet well.
 - d. sensing of moisture within a pump seal cavity (each pump).
 - e. sensing of excessive temperature within pump motor (each pump).

2.09 AUTOMATIC TELEPHONE DIALER

A. General Requirements:

- 1. A separate protected circuit shall be provided for the dialer.
- 2. The dialer shall be located within the exterior electrical enclosure.
- 3. The dialer shall be an Antx Elite 8 channel dialer.

B. Description:

- 1. The automatic dialing alarm system shall be microprocessor based and have the capability to monitor from 4-48 dry contact or digital inputs, 8 to 48 analog inputs or energize from 4 to 24 relays in any combination. Each of these inputs shall monitor a set of dry contacts (normally-closed or normally-open). In addition, the dialer shall monitor the AC power and battery voltage continuously. Upon detecting an alarm on any of its inputs, a low battery condition or detecting loss of its AC power, the dialer shall begin dialing the first of up to 16 user-programmed telephone numbers.
- 2. The dialer shall speak user-recorded messages to the called party describing its location and the alarm conditions that are present. The dialer shall then verbally request that an acknowledgment be given. The called party shall acknowledge the call by momentarily depressing the '8', '9' or ,*, key on their telephone keypad. If the dialer is not acknowledged during the call, it shall hang up, wait from 1 to 3600 seconds and then dial the next number in its phone list. If a successful acknowledgment occurs, the dialer shall give a sign-off message, hang up and then wait a user-programmed period of time for the alarm conditions to be corrected. If this period of time elapses and the alarm condition(s) still exist, the dialer shall begin the alarm notification cycle again.
- 3. The dialer shall have relay outputs that shall remain energized as long as the dialer has any unacknowledged alarms. This output shall be available to allow for wiring to an external horn, buzzer, light or other local alarm device. Alternatively, the user shall be able to program the dialer to allow remote activation of this relay from a telephone keypad.
- C. Construction:
 - 1. Environmental Limits:

Temperature: Electronics:	-40 to 185°F (-40 to 8S°C)
Humidity:	0-80% non-condensing @ 140°F
	0-90% non-condensing @ 104°F
Battery:	-4 to 176°F (-20 to 80°C)
VFD:	-4 to I58°F (-20 to 70°C)

- Power Requirements: 115 VAC 10% or 230 VAC 10%; 50 to 60 Hz; 25 watts
 Maximum current draw on DC power: 850 rnA at 15 VDC
- 3. Electrical Protection: Transient voltage/surge protection shall be provided on power line, telephone and all input channels. Solid state surge protection provided on digital input, analog input, serial port, parallel port, telephone and AC power circuitry.
- 4. Upgrades: The automatic dialer shall be field upgradeable (without returning unit to the manufacturer) for the following:
 - Dry Contacts or Digital Inputs from 0 to 48 input channels
 - Analog Inputs from 0 to 48 input channels
 - Relay Outputs from 0 to 24 outputs
 - 33.6Kbaud modem
 - 4 line x 20 character high visibility Vacuum Fluorescent Display (VFD)
- 5. Wiring Protection: All input channels shall be completely isolated from each other and from ground. Analog and Digital Input channels shall be capable of withstanding continuous 120VAC without damage.
- 6. Field Wiring: All I/O wiring shall use quick-disconnect pluggable connectors.
- 7. Digital Inputs: Dry Contact/Digital Input cards shall be capable of interfacing directly to dry contacts or digital input signals with voltages up to 24VDC.
- 8. Analog Inputs: Analog Input cards shall be capable of interfacing directly to 4-20ma, 0- 20ma, 0-IV, 1-5V, 0-10V, +/- IV, +/- 5V and +/- 10V signals. Each channel shall be programmable for range independently from any other channel on the same board. All channel range programming shall be via the keypad, phone or PC with no switches or resistors required. All channels shall be internally converted and presented to the user in engineering units.
- D. Performance Specifications:
 - 1. Telephone Number Capacity: Up to 512 available numbers up to 50 digits each. Numbers can include '*', '#', delays, and detection of dial tone.
 - 2. Recorded Speech Capacity: 16 seconds per input channel message and 8 seconds for System Identification message

All with dynamic silence reduction to optimize storage space

- 3. Monitoring Capacity: Up to 48 inputs in any combination of digital (4 or 8 per board) or analog (8 per board)
- 4. Message Requirements: Messages for:

Power loss Low battery power System identification Channel in alarm (for each channel) Channel is normal (for each channel)

5. Types of Alarms: The alarm dialer shall have the following alarm types:

System - loss of primary power, low battery, phone fault, Digital - on or off, number of times in a condition; accumulated time in a condition, Analog - a user-specified high or low limit for a specified period of time, a user-specified positive or negative rate of change.

All alarms will be recorded in the event log with the date/time of the alarm. The loss of power monitor shall be programmed for a time delay to allow the generator to activate and take over.

- 6. Speech Technology: Digitally recorded user messages plus permanent voice library.
- 7. Alarm Prioritization: The automatic dialer shall have the capability to prioritize alarms by the telephone list designated to each alarm channel. Additionally, alarms shall be prioritized by time of day to different phone lists.
- 8. Alarm Acknowledgment: The automatic dialer shall provide acknowledgement of all alarms from: the front panel, a phone that is called with an alarm condition, and a call-in from a remote location.

Alarm acknowledgement options via call-in shall be: none

- automatically acknowledge all alarms
- acknowledge all alarms upon user request
- acknowledge specific alarms

All acknowledgements will be recorded in the event log with the date/time of the acknowledgement, the method of acknowledgement and the Caller ID if from a remote location

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9. Status Reporting: The automatic dialer shall have the capability of documenting all alarms, dial-out, dial-in, and alarm acknowledgement, activities with time and date to a standard parallel printer or over a modem connection to a PC.

The status report shall contain the last 1000 events. Each event shall have the date/time of the event and the action performed.

- 10. Line Seizure: The alarm dialer shall have 2 phone jacks and automatically disconnect an in-progress call in order to make alarm calls.
- 11. Caller ID: The automatic dialer shall record the Caller ill in the event log of anyone calling into the dialer to acknowledge alarms or perform any programming functions.
- 12. Channel Status: Each alarm channel shall be individually programmed to be either enabled for alarms, disabled or status only.
- 13. Alarm Notification: The automatic dialer shall be capable of notifying alarm conditions by the following methods:
 - telephone and cell phone
 - digital and alphanumeric pager
 - modem call-out
 - modem call-in
 - LEDs
 - parallel printer
 - local display and
 - relay activation

Each alarm channel shall be programmable to continue alarm notification if condition returns to normal.

- 14. Battery Backup: The automatic dialer shall have internal battery back-up capacity sufficient to allow the dialer to perform its alarm call-out function for a minimum of 20 consecutive hours upon loss of primary AC power.
- 15. Arming and Disarming: The automatic dialer shall be capable of being armed or disarmed automatically based on time-of-day and day-of-week. Arming and disarming shall be a single key function via the keypad. Arming or disarming shall be recorded to the event log.

2.10 STAINLESS STEEL PORTABLE HOIST ASSEMBLY

A. Portable Hoist:

- 1. A portable hoist which can be seated in recessed sockets cast into the top slab shall be provided. The hoist shall be constructed of stainless steel, with stainless steel cable.
- 2. The hoist shall have a capacity substantially in excess of the weight of a pump and shall be capable of lifting the pumps without entering the wet well.
- 3. The portable hoist shall be manufactured by Them Inc. (1-800-843-7648), Halliday Products or approved equal.

Mounting Sockets: Recessed stainless steel sockets with covers suitable for the portable hoist shall be provided where necessary in order to properly lift the pumps as well as the trash basket. A drain hole shall be provided in the bottom of each socket and underlying concrete slab, to prevent damage from freezing.

2.11 PIPING AND VALVES

- A. Interior Piping:
 - 1. Flanged joint ductile iron pipe: ANSI A21.15
 - 2. Thickness Class 53: ANSI A21.51
 - 3. Double cement-mortar lining: ANSI A21.4
 - 4. Fittings shall be ductile iron or grey-iron flat faced with pressure rating of 250 psi: ANSI A21.10
 - 5. Gaskets shall be full-faced, rubber and 1/8" thick: ANSI B1621
 - 6. Bolts and nuts used in the wetwell and valve chamber, shall be 304 stainless steel.
- B. Exterior Discharge Piping:
 - 1. See Section 02732 Sanitary Force Main & Appurtenances.
- C. Check Valves:
 - 1. Horizontal swing check type designed for use with raw sanitary sewage, with an external lever with an adjustable counter weight. An air cushioned control feature may be necessary in certain cases of high static head.

- 2. The valve shall be of iron body construction with a stainless steel shaft incorporating bronze bushings, resilient seated, and renewable bronze disk seat rings.
- 3. The check valve shall have a minimum working pressure of 175 psi and shall conform to the AWWA C508 Standard.
- 4. Valves shall be manufactured by US. Pipe, Golden-Anderson (G-A), or approved equal.
- D. Gate Valves:
 - 1. Gate Valves shall conform to the AWWA C509 Standard and shall be of the resilient-seated type with a 200 psi working pressure rating.
 - 2. The gate valve shall be of iron body and cover construction with an elastomeric bonded cast iron disc and a non-rising bronze stem and bronze stem nut. The valve stem shall be sealed with a double "0" ring assembly. All valves shall be equipped with handwheel which shall cause the valve to be opened by turning in a counterclockwise direction in a horizontal flow alignment.
 - 3. All valves shall be mounted vertically in a horizontal flow alignment except for the valve on the emergency bypass connection.
 - 4. Valves shall be manufactured by ITT Kennedy Valve, Mueller Company or approved equal.
- E. Flap Valve:
 - 1. Iron Body, bronze mounted with flanged end.
 - 2. Valve shall be manufactured by Clow Valve Co. (Fig. F-3012) or approved equal.
- F. Flush Cycle Plug Valves:
 - Provide a motor operated plug valve and return line to wet well for automatic flushing of the wet well. Also provide a redundant isolation plug valve adjacent to the motor operated plug valve. The valves shall be eccentric plug valves unless otherwise specified. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. Standard. Bodies in 4" (100mm) and larger valves shall be furnished with a 1/8" welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised

surface completely covered with weld to insure that the plug face contacts only nickel: Screwed-in seats shall not be acceptable. Plugs shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be Chloroprene (CR) or resilient facing suitable for application. Bearings shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF8M in 1/2"-36" sizes. Shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the actuator or bonnet from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

- 2. Pressure ratings shall be 175 psi on sizes 1/2"-12" (15-300mm) and 150 psi for 14"-72" (350-1800mm). Every valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.
- 3. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, etc. as indicated on the plans.
- 4. All valves 6" and larger shall be equipped with gear actuators. All gearing shall be enclosed in a cast iron housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed 'and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.
- 5. All valves shall be as manufactured by DeZurik or approved equal.
- 6. Electric actuators shall be Rotork Model 2501 QT or approved equivalent, which will include the following features:
 - a. NEMA 6 Enclosure
 - b. Visual display (% open, status, torque)
 - c. Declutchable hand wheel

- d. Four configurable outputs
- e. Adjustable speed control
- f. Infra red setting without requiring removal of actuator cover
- g. Adjustable speed control
- G. Emergency Bypass Line:
 - 1. 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, swing check valve with outside lever and weight and threaded stainless steel cap.

2.12 SITE LIGHTING

- A. Description:
 - 1. Aluminum pole suitable for mounting on concrete base.
 - 2. Height 12 feet
 - 3. Floodlight shall be a heavy duty aluminum fixture with photo-cell and manual override activation switches, impact resistant glass and a 500 watt quartz lamp.

PART 3 – EXECUTION

3.01 GENERAL

- A. Refer to the Drawings for location and pertinent elevations of the wet well, valve chamber and related equipment associated with the proposed sewage pumping station.
- B. All electrical work shall conform with the National Electrical Code, latest edition, along with the requirements and conditions of PECO Energy.

3.02 CLEARING AND GRUBBING

- A. Clear and grub the pump station as required to construct facilities in accordance with Drawings and as specified in Section 02110.
- B. A site inspection will be made with the Engineer to determine which of the existing trees are to remain which shall be suitably protected.
- 3.03 EXCAVATION

A. Excavate at the location of the wet well and valve chamber the depth and area required as shown on the Drawings and as specified in Section 02220.

3.04 FOUNDATION

A. Provide an 8" compacted PADOT 2A modified aggregate for the precast wet well base and the precast valve chamber base.

3.05 CONSTRUCTION

- A. Wet Well:
 - 1. Construct wet well of precast sections, as shown on the Drawings.
 - 2. Seal joints between precast concrete sections with two (2) rings of preformed joint sealant compound.
 - a. Place joint sealant compound on lower section to be squeezed by the weight of the upper section.
- B. Valve Chamber:
 - 1. Construct valve chamber of precast sections, as shown on the Drawings.
 - 2. Seal joints between precast concrete sections with two (2) rings of preformed joint sealant compound.
 - a. Place joint sealant compound on lower section to be squeezed by the weight of the upper section.
- C. Piping and Miscellaneous Structural Work:
 - 1. Connect the incoming sewer line to the wet well by means of the integrally cast resilient connection in accordance with the Drawings.
 - 2. Install the ductile iron pump discharge and return lines between the wet well and valve chamber in accordance with the Drawings. All buried pipe connections shall be mechanical joint. Piping within wet well and valve chamber shall be provided with a restraint system to prevent movement caused by normal working pressure and surge pressure at pump start/stop. Each pipe line leaving the wet well and valve chamber shall be provided with a sealing device in order to provide a watertight condition.
 - 3. Install the force main leaving the valve chamber in accordance with Section 02732 and the Drawings.
SECTION 11306 SEWAGE PUMPING STATION

- 4. Connect the drain line between the valve chamber and wet well by means of an integrally cast resilient connection -in accordance with the Drawings.
- 5. Create the bottom of the wet well in accordance with the Drawings using mass concrete.
- 6. Complete vent pipe assembly on top slab of wet well and valve chamber as required in accordance with the Drawings.
- 7. Securely fasten the ladder in the valve chamber at the location shown on the Drawings.
- D. Leakage Test:
 - 1. An exfiltration test shall be performed on the wet well and valve chamber once the piping connections have been completed. The test shall be performed as follows:
 - a. All pipe openings shall be plugged with water tight plugs.
 - b. The structure shall be completely filled with water one hour prior to the start of the test to saturate the concrete.
 - c. The structure shall be refilled to the top, and in the presence of the Engineer the test started. The water level shall be maintained at the top, for a period of four (4) hours, with an accurate record kept of the quantity of water added during the period.
 - d. The structure shall be acceptable if the rate of exfiltration does not exceed 0.1 gallons per foot of diameter per vertical foot per hour.
 - e. If the structure fails the test, repairs shall be, and structure retested until satisfactory results are obtained.
- E. Equipment:
 - 1. Install pumps, VFDs, motors, controls and other accessory equipment in strict accordance with the manufacturer's written instructions.
 - 2. The installation of each equipment item shall be inspected, adjusted approved and certified satisfactory by the manufacturer. Obtain and submit an installation certificate signed by the equipment manufacturer's representative attesting that the equipment has been properly installed and is ready for start-up and performance testing.

SECTION 11306 SEWAGE PUMPING STATION

- F. The pump discharge base plate and piping between the wet well and valve chamber shall not be set in the final position until the top slab with access hatches is set. The pump base and piping shall be adjusted to obtain the maximum clearance between the hatches and pumps.
- G. A stainless steel bracket shall be mounted inside the wet well, adjacent to the hatch opening and accessible from the top by the Contractor to hold and position the level transducer, in conjunction with backup floats and electrical cables.
- H. Performance Testing:
 - 1. Upon completion of all work including adjustment of the equipment in a manner satisfactory to ENGINEER, the equipment shall be tested by placing it in full operation for a period of at least seven (7) days. Prior to putting the equipment in operation CONTRACTOR shall give ENGINEER at least seven (7) days written notice. On the day designated by CONTRACTOR for test start and approved by ENGINEER, CONTRACTOR's personnel with AUTHORITY's personnel observing, shall demonstrate to ENGINEER the mechanical performance of the equipment covered by these Specifications. If the demonstrations are satisfactory to ENGINEER, the test will be considered concluded after continuous service without any mechanical or electrical failures. If deficiencies are found, they shall be corrected by CONTRACTOR and the test repeated until the ENGINEER determines that the equipment has performed satisfactorily.
 - 2. During tests, all normal operation costs shall be paid for by CONTRACTOR. Operating costs shall be understood to include only the cost of grease, lubricating oils, and the wages of CONTRACTOR's personnel. Electric power cost will be paid by AUTHORITY.
 - 3. During the test, CONTRACTOR shall be responsible for demonstrating that each piece of equipment including controls can operate as specified and to the satisfaction of AUTHORITY.
 - 4. At any time within a twenty four (24) month period, subsequent to completion of herein before specified tests, CONTRACTOR at the request of the Authority or ENGINEER, shall furnish AUTHORITY with services of Pumping Station equipment manufacturer's representatives for a period of two (2) man-days, at no cost to AUTHORITY. Furthermore, said services shall be additional to those furnished in connection with equipment erection, installation, testing and the correction of deficiencies.
 - 5. Services provided shall consist of furnishing detailed instructions to personnel of AUTHORITY regarding equipment and maintenance after

SECTION 11306 SEWAGE PUMPING STATION

personnel of AUTHORITY have had an opportunity to become familiar with Pumping Station equipment.

- I. Water Supply System:
 - 1. Construct water service to pump station site in accordance with Section 02663.

3.06 BACKFILLING AND COMPACTING

- A. Backfill around structures with PADOT 2A modified, only after approval received from the Engineer.
- B. Backfill and compact in accordance with the Drawings and as specified in Section 02220.

3.07 SITE WORK

- A. Once the pump station structures have been completed, the following site work shall be completed in accordance with the Drawings and as specified in the noted Sections.
 - 1. Finish Grading Section 02905
 - 2. Access Road Section 02510
 - 3. Replace topsoil and seed Section 02905
 - 4. Construct chain link fence Section 02832
 - 5. Plant vegetation screening Section 02905

END OF SECTION

SECTION 12000 WASTEWATER TREATMENT PLANT DESIGN

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

- A. A predesign conference is mandatory, if a wastewater treatment plant is to be designed, built and offered for dedication to the Authority. It is the Authority's intent to model any future wastewater treatment plants after their Fish Creek Wastewater Treatment Plant. The general unit process requirements for any future wastewater treatment facilities are as follows:
 - 1. Influent flow metering.
 - 2. Complete Headworks including screen and grit removal.
 - 3. Concrete tanks for all unit processes.
 - 4. Submersible pump lift station with separate valve chamber.
 - 5. Sequencing Batch Reactor tertiary treatment units, utilizing programmable logic computer controllers.
 - 6. Positive displacement aeration blowers.
 - 7. Ultra-violet disinfection system.
 - 8. Aerobic sludge digestion, for sludge stabilization.
 - 9. Post aeration for plant effluent.
 - 10. Operations building to house critical plant components.
- B. Other specific requirements not mentioned above will be discussed at the predesign meeting. It is recommended that the applicant's design engineer prepare a sketch plan indicating a general layout of the treatment facility, for purposes of discussion at the predesign meeting.

END OF SECTION

SECT10N 12050 WATER TREATMENT PLANT DESIGN

PART 1 – GENERAL

1.01 SECTION DESCRIPTION

A. A predesign conference is mandatory, if a water treatment plant is to be designed built and offered for dedication to the AUTHORITY. The type of system and appurtences will be reviewed on a case by case basis.

END OF SECTION

STANDARD DETAILS

GENERAL CONSTRUCTION DETAILS

GENERAL CONSTRUCTION DETAILS



Ebert Engineering, Inc.

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			PERMANENT PA	VEMENT AND	TRENCH RE	STORATION F	OR STATE HIGHWAY
Ebert Engineerii	ng,	Inc.					
Water and Wastewater Engineering	1		WARWICK			A & SEVVE	<u>R AUTHURITY</u>
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Skippack, PA 19474 E-mail febert@ebertengineering.com		(610) 564 6704	FEE	NOT TO SCALE	050-003	02/10/14	G-8









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

PIPE SIZE	UP TO 8"			10" AND 12"			16" 18" 20"				24"					
TYPE OF BEARING MATERIAL					DEGREE OF BEND				OR DEFLECTION							
AND ALLOWABLE LOADS	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	26.1	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	36.3	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	16.8	12.0
SOFT ROCK 5 TON/SQ.FT.	1.0	1.0	1.6	1.0	1.0	1.9	3.5	2.2	1.6	4.4	8.0	5.7	3.9	7.3	13.5	9.6
ROCK 15 TON/SQ.FT.	1.0	1.0	1.0	0.4	1.0	1.0	1.2	0.8	1.0	1.4	2.6	1.9	1.3	2.4	4.5	3.2
PIPE SIZE		31	0"		36"				42"				48"			
TYPE OF BEARING MATERIAL									0.0		OTION					
					-	DEGRE	E OF	BEND) OK	DFFFF	CHON					
AND ALLOWABLE LOADS	22.5 *	45°	90°	D.E.	22.5°	45°	E OF 90°	BEND D.E.	0 OR 22.5°	45°	.C 110N 90°	D.E.	22.5 °	45 '	90°	D.E.
AND ALLOWABLE LOADS SAND 0.75 TON/SQ.FT.	22.5 [•] 40.3	45° 76.5	90° 139	D.E. 99.1	22.5° 55.5	45° 107.5	E OF 90° 197.5	BEND D.E. 140.0	0 OR 22.5° 74.3	45° 144.7	90° 266.5	D.E. 188.7	22.5° 83.2	45 ° 182.3	90° 336.2	D.E. 238.0
AND ALLOWABLE LOADS SAND 0.75 TON/SQ.FT. SOFT CLAY 1 TON/SQ.FT.	22.5* 40.3 30.2	45° 76.5 57.4	90° 139 104.3	D.E. 99.1 74.3	22.5° 55.5 41.6	45° 107.5 80.6	90° 90° 197.5 148.0	BEND D.E. 140.0 105.0	22.5° 74.3 55.7	45° 144.7 108.5	90° 266.5 200.0	D.E. 188.7 141.6	22.5 [•] 83.2 70.0	45 ° 182.3 136.7	90° 336.2 252.2	D.E. 238.0 178.0
AND ALLOWABLE LOADS SAND 0.75 TON/SQ.FT. SOFT CLAY 1 TON/SQ.FT. SAND AND GRAVEL 2 TON/SQ.FT.	22.5 [•] 40.3 30.2 15.1	45° 76.5 57.4 28.7	90° 139 104.3 52.1	D.E. 99.1 74.3 37.2	22.5° 55.5 41.6 20.8	45° 107.5 80.6 40.3	E OF 90° 197.5 148.0 74.0	BENC D.E. 140.0 105.0 52.5	22.5° 74.3 55.7 27.9	45° 144.7 108.5 54.3	266.5 200.0	D.E. 188.7 141.6 70.8	22.5 [•] 83.2 70.0 35.0	45 [•] 182.3 136.7 68.3	90° 336.2 252.2 126.1	D.E. 238.0 178.0 89.2
AND ALLOWABLE LOADS SAND 0.75 TON/SQ.FT. SOFT CLAY 1 TON/SQ.FT. SAND AND GRAVEL 2 TON/SQ.FT. CLAY 4 TON/SQ.FT.	22.5 [•] 40.3 30.2 15.1 7.6	45° 76.5 57.4 28.7 14.6	90° 139 104.3 52.1 26.0	D.E. 99.1 74.3 37.2 18.6	22.5 [•] 55.5 41.6 20.8 10.4	45° 107.5 80.6 40.3 20.2	E OF 90° 197.5 148.0 74.0 37.0	BEND D.E. 140.0 105.0 52.5 26.3	22.5° 74.3 55.7 27.9 14.0	DEFLE 45° 144.7 108.5 54.3 27.0	266.5 200.0 100.0	D.E. 188.7 141.6 70.8 35.3	22.5 [•] 83.2 70.0 35.0 17.5	45 [•] 182.3 136.7 68.3 34.2	90* 336.2 252.2 126.1 63.0	D.E. 238.0 178.0 89.2 44.6
AND ALLOWABLE LOADS SAND 0.75 TON/SQ.FT. SOFT CLAY 1 TON/SQ.FT. SAND AND GRAVEL 2 TON/SQ.FT. CLAY 4 TON/SQ.FT. SOFT ROCK 5 TON/SQ.FT.	22.5 [•] 40.3 30.2 15.1 7.6 6.0	45° 76.5 57.4 28.7 14.6 11.5	90° 139 104.3 52.1 26.0 20.9	D.E. 99.1 74.3 37.2 18.6 14.9	22.5° 55.5 41.6 20.8 10.4 8.3	45° 107.5 80.6 40.3 20.2 16.1	E OF 90° 197.5 148.0 74.0 37.0 29.6	BEND D.E. 140.0 105.0 52.5 26.3 21.0	22.5° 74.3 55.7 27.9 14.0 11.2	21.7	90° 266.5 200.0 100.0 50.0 40.0	D.E. 188.7 141.6 70.8 35.3 28.3	22.5 [•] 83.2 70.0 35.0 17.5 14.0	45 [•] 182.3 136.7 68.3 34.2 27.3	90° 336.2 252.2 126.1 63.0 50.4	D.E. 238.0 178.0 89.2 44.6 35.7

MIN. SQUARE FEET OF BEARING SURFACE REQUIRED FOR HORIZONTAL THRUST BLOCKING AND VERTICAL THRUST DOWNWARD

NOTES:

1. THIS CHART HAS BEEN DEVELOPED FOR D.I.P. WITH 100 P.S.I. WORKING PRESSURE, A 50% SURGE PRESSURE INCREASE, AND A 1.5. SAFETY FACTOR. CASE SPECIFIC CALCULATIONS ARE REQUIRED WHERE WORKING PRESSURE EXCEEDS 100 P.S.I AND/OR SURGE PRESSURE EXCEEDS 50% WORKING PRESSURE.

- 3. MINIMUM THRUST BLOCK AREA IS 1.0 SQ. FEET.
- 4. MEGALUG RESTRAINT SHALL BE INSTALLED AT ALL FITTINGS.

HORIZONTAL AND VERTICAL DOWNWARD THRUST BLOCK BEARING SURFACE AREA SCHEDULE

CONSTRUCTION DETAIL G-13

			HORIZONT	AL AND V	ERTICAL DOWNW	ARD THRUST BL	OCK BEARING S	URFACE AREA SCHEDULE
Ebert Engineering, Inc.			WARV	VICK	TOWNSH	FOR	R & SFWF	R AUTHORITY
PO Box 540 4397 Skippack Pike	Phone	(610) 584 6701	Project	Engr.	Scale	Job No.	Date	Drawing No.
Skippack, PA 19474 E-mail febert@ebertengineering.co		(610) 584 6704	FE	E	NOT TO SCALE	050-003	02/10/14	G-13

^{2.} D.E. = DEAD END



TYPICAL SECTION VERTICAL THRUST UPWARD

NOTES:

- 1. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3300 P.S.I. AT THE END OF 28 DAYS. (PENNDOT CLASS A)
- 2. ALL REINFORCING STEEL SHALL BE DEFORMED BARS. (ASTM GRADE 60) AND SHALL BE U-SHAPED AROUND WATER MAIN.
- 3. ALL FITTINGS AND JOINTS SHALL BE COVERED WITH POLYETHYLENE FILM BEFORE PLACING CONCRETE.
- 4. ALL EXPOSED STEEL SHALL BE COVERED WITH 2 COATS OF BITUMASTIC, KOPPER 300M OR
- APPROVED EQUAL.

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

PIPE SIZES		LENGTH			WIDTH		DEPTH			
	11.25°	22.5°	45°	11.25°	22.5°	45°	11.25°	22.5 °	45°	
4", 6" AND 8"	3.5'	4.5'	6'	3'	3'	3'	2'	3'	4'	
10" AND 12"	4.5'	7'	8'	3'	3'	4'	3'	4'	5'	
14" AND 16"	4.5'	7'	9'	4.5'	4.5'	4.5'	3.5'	4'	5'	
18" AND 20"	5'	7'	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'	

NOTES:

 THIS CHART HAS BEEN DEVELOPED FOR D.I.P. WITH A 100 PSI WORKING PRESSURE. A 50% SURGE PRESSURE INCREASE AND 1.5 SAFETY FACTOR. CASE SPECIFIC CALCULATIONS ARE REQUIRED WHERE THE WORKING PRESSURE EXCEEDS 100PSI AND/OR SURGE PRESSURE EXCEEDS 50% OF WORKING PRESSURE.
FOR VERTICAL THRUST DOWNWARD, SEE DETAIL G-12 AND G-13.

3. INSTALL MEGALUGS ON ALL FITTINGS

D. INSTALL MEGALUGS ON ALL FITTINGS

VERTICAL THRUST BLOCK ARRANGEMENT AND DIMENSIONS SCHEDULE

CONSTRUCTION DETAIL G-14

			VERTICAL THRU	JST BLOCK A	RRANGEMEN	T AND DIME	NSIONS SCHEDULE	
Ebert Engineering, Inc. Water and Wastewater Engineering		FOR WARWICK TOWNSHIP WATER & SEWER AUTHORIT						
PO Box 540 4397 Skippack Pike	Phone	(610) 584 6701 (610) 584 6704	Project Engr.	Scale	Job No.	Date	Drawing No.	
Skippack, PA 19474 E-mail febert@ebertengineering.com		(610) 564 6704	FEE	NOT TO SCALE	050-003	02/10/14	G-14	

SANITARY SEWER CONSTRUCTION DETAILS



FEE

NOT TO SCALE

050-003

02/10/14

Skippack, PA 19474 E-mail febert@ebertengineering.com Fax S-1



NOTE: TYPE "B" MANHOLE TO BE THE SAME AS TYPE "A" EXCEPT AS OTHERWISE NOTED

NOTES:

- 1. THE DEPTH OF THE INVERT CHANNEL SHALL BE EQUAL TO 1/2 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' DIAMETER BASE, REDUCTION IN DIAMETER TO 4' SHALL START AT THE FIRST JOINT ABOVE THE UPPERMOST PIPE CONNECTION TO WALL WHERE DEPTH IS SUFFICIENT.
- ALL MANHOLE FRAMES SHALL BE BOLTED TO THE CONE SECTION OR CONCRETE SLAB WITH 4 3/4" DIAMETER BOLTS WITH WASHERS AND NUTS. BOLTS TO BE AT 90" ON A 36" DIA. BOLT CIRCLE.
- 6. ALL CONCRETE SHALL BE 4000 P.S.I. MINIMUM.
- 7. A WHITE EPOXY COATING SHALL BE APPLIED TO THE ENTIRE INTERIOR CONCRETE SURFACE OF THE MANHOLE. THE COATING SHALL CONSIST OF TWO (2) COATS, EACH EIGHT (8) MILS THICK, OF HIPPO-POXY COATING 52 SERIES, #52-W-23 BY M.A.B. PAINTS OR APPROVED EQUAL. ENTIRE OUTSIDE SURFACE OF MANHOLE SHALL RECEIVE TWO COATS OF BITUMINOUS COATING. KOPPERS 300M OR APPROVED EQUAL.
- 8. INSTALL DOUBLE RING OF PLASTIC PREFORMED JOINT SEALANT BETWEEN ALL SECTIONS AND UNDER FRAME.
- 9. MANHOLE CONSTRUCTION SHALL BE IN ACCORDANCE WITH ASTM C-478.
- 10. STEPS TO BE STEEL REINFORCED POLYPROPYLENE. (SEE DETAIL S-7)
- 11. 4' DIAMETER MANHOLE FOR 8" TO 15" PIPES, 5' DIAMETER MANHOLE FOR 18" TO 27" PIPES

STANDARD MANHOLE TYPE B

CONSTRUCTION DETAIL S-2

			STA		DARD	MAN	HOLE	TYPE B
Ebert Engineering	ineering, Inc.			CK -	TOWNSH	FOR	R & SEWE	R AUTHORITY
PO Box 540 4397 Skippack Pike	Phone	(610) 584 6701	Project En	ngr.	Scale	Job No.	Date	Drawing No.
Skippack, PA 19474 E-mail febert@ebertengineering.cc		(010) 584 6704	FEE		NOT TO SCALE	050-003	02/10/14	S-2










































S-25























WATER CONSTRUCTION DETAILS

















METER BOX COVER





STANDARD SETTING



1-1/2" DIA. STYLE "K" PITSETTER

TANDEM SETTING

SPECIFICATIONS:

M3A CAST IRON METER BOX COVER AND FRAME, WITH 11 $1/2^{\prime\prime}$ COVER OPENING. AS MANUFACTURED BY METER BOX COVERS INC.

SOURCE REFERENCES:

METER PRO SERVICES- 302-475-2937 INSTA PIT INC.- 610-869-0470 US FILTER/WATER PRO- 215-822-3301

NOTES:

IF A METER PIT IS USED, THE PLACEMENT SHALL BE ON THE PROPERTY LINE OR R-O-W.

1-1/2" PRE-FABRICATED METER PIT

CONSTRUCTION DETAIL W-13

			1-1/2" PRE-FABRICATED METER PIT					
Ebert Engineeri	ng,	Inc.						
Water and Wastewater Engineering			WARWICK TOWNSHIP WATER & SEWER AUTHORITY					
PO Box 540 4397 Skippack Pike	Phone	(610) 584 6701 (610) 584 6704	Project	Engr.	Scale	Job No.	Date	Drawing No.
Skippack, PA 19474 E-mail febert@ebertengineering.com		(010) 564 6704	FEE		NOT TO SCALE	050-003	02/10/14	W-13




