SPECIFICATIONS FOR SANITARY SEWER SYSTEM CONSTRUCTION

FOR

PARADISE TOWNSHIP SEWER AUTHORITY

IN

LANCASTER COUNTY

PENNSYLVANIA

JUNE 2024

Prepared by:

RETTEW Associates, Inc.
3020 Columbia Ave
Lancaster, PA 17603
800-738-8395

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ADOPTED this 5th day of August, 2024 by the Paradise Township Sewer Authority, in lawful session only assembled.

PARADISE TOWNSHIP SEWER AUTHORITY

By:

SEAL

Paradise Township Corporate Seal 1987 Pennsylvania Sewer Authority

Chairman

Vice Chairman

Secretary

Treasurer

Assistant Secretary-Treasurer

Section 1
General

A. Definitions

Applicant: Developer and/or Owner requesting capacity allocation from PTSA.

Authority: Paradise Township Sewer Authority (PTSA) a Pennsylvania municipal authority, acting by and through its board or, in appropriate cases, acting by or through its authorized representative.

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

Condominium Unit: An individually-owned unit that is contained within a building of multiple units that is owned by a condominium association. The units are not on individual lots.

Connection: The joint, or the process of joining, the service line with the sewer lateral.

Contractor: Individual, partnership, company, or corporation that performs the installation of sewers and/or pumps and pumping stations.

Developer: Any individual, partnership, company or corporation which (a) promotes and effects the construction of sanitary sewers and/or pumping stations, the ownership of which is intended to be dedicated to the Authority, or (b) connects to the Authority's system.

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

Industrial Waste: Any solid, liquid or gaseous substance or water-borne wastes or form of energy ejected or escaping from any industrial, manufacturing, trade or business process or from the development, recovering or processing of natural resources, as distinct from sanitary sewage.

Inspector: Individual employed by the Engineer or appointed by the Authority to perform field inspection of work carried out under these regulations.

Owner: Any individual, partnership, company, association, society, corporation, or other group that is vested with ownership, legal or equitable, sole or partial, of any property situated in the service area of the Authority.

Professional Engineer: An individual licensed and registered under the laws of the Commonwealth of Pennsylvania to engage in the practice of engineering.

Professional Land Surveyor: An individual licensed and registered under the laws of the Commonwealth of Pennsylvania to engage in the practice of surveying.

Right-of-Way/Easement: The right of the Authority and its representatives to use real property for the purpose of installing, improving and maintaining sanitary sewer facilities.

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

Service Line: That part of the main house drain or sewer line extending from the outer building wall or foundation wall to its connection with the sewer lateral at the easement or right-of-way boundary.

Sewage Treatment Plant: The Paradise Township Waste Watter Treatment Plant

Sewer Lateral: That section of a sanitary sewer that extends from the sewer main to the property which it serves and connects to the service line at the easement or right-of-way boundary.

Sanitary Sewer System: System comprised of sewer mains, sewer laterals, sewage pumping stations, sewer force mains, and all appurtenant facilities owned and operated by the Authority for the purpose of collecting and conveying sanitary and/or Authority-approved industrial waste.

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

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

Townhouse Unit: A building that is owned by an individual property owner and is located on a lot that may or may not be owned by the property owner.

B. Conditions of Service and Standard of Quality

1. No connection, through which sanitary sewage or industrial waste does or may enter the sewer system, shall be constructed, altered, repaired, or allowed to exist, which does not comply with these Standard Specifications.

2. All construction, reconstruction, and alterations of sewer connections and appurtenances shall be performed in a competent, workmanlike manner in accordance with recognized standards of the plumbing trade and specifications currently on file with the Authority. The Authority in its sole discretion may stop, or require reconstruction of, any work not conforming to these standards or specifications at the developer's expense.

3. No connection to the sewer system shall be made except under the supervision of the Authority or its authorized representative. The application and its acceptance by the Authority shall constitute, from the date of acceptance by the Authority, a contract obligating the applicant to pay rates and charges and to comply with the Standard Specifications which shall be established by the Authority from time to time.

4. Sewer service shall be furnished only after:

    a. The Owner of the improved property to be served shall have installed, at his own cost and expense, the service line in accordance with the Standard Specifications; and

    b. The Authority has inspected and observed testing of said service line and approved such facilities as complying with the Standard Specifications.

5. Whenever improved property that is connected to the sewer system is vacated, the Owner shall give prompt notice to the Authority.

6. Whenever improved property that is connected to the sewer system is sold, or otherwise conveyed, the purchaser and/or the seller shall promptly notify the Authority of such sale or conveyance.

C. Extensions by Developers

1. Where an individual, builder, or developer desires to extend sewerage service to a house or to a group of houses within a development, he may do so after having made proper written application to the Authority and having met all of the conditions of these Standard Specifications. All extensions so constructed shall include, without limitation, all laterals, sewers and other necessary appurtenances and shall be constructed by and at the expense of the developer. All construction shall be done in accordance with plans and specifications approved by the Authority prior to the start of construction, and subject to inspection, testing, and approval by the Authority or its designated representative.

2. Plans and Specifications

    a. Approved Preliminary Development (Construction) Drawings

All construction drawings shall be submitted on 24" x 36" sheets. Complete sets of drawings must be prepared for all proposed facilities and shall include the following required information.

(1) A site plan showing all lots in the development. Also included shall be an overall plot plan of the proposed collection system showing the location of sewers, laterals and manholes as well as the point of connection to the existing sanitary sewer system.

(2) Manhole numbers and arrows depicting the direction of flow in sewers shall be included. Existing manholes shown on the plan shall be labeled with the proper PTSA manhole designation.

(3) The location of all existing and proposed wells in the development shall be shown.

(4) Plans of the sewer lines and force mains shall be at a scale that most clearly shows the proposed sewer system; however, the horizontal scale shall not exceed 1" = 50' (i.e., 1" shall not represent more than 50' on the drawings).

(5) Profiles of sewer lines and force mains shall have the same horizontal scale as the plans and a vertical scale that most clearly depicts the proposed vertical alignment. The profiles shall show existing and proposed grade, rim and invert elevations relative to the Authority's datum. The survey datum for all plans shall be based on the Lancaster County GIS datum. Plans prepared with elevation information extracted from existing PTSA plans shall be adjusted accordingly to conform to this datum.

(6) Plans and profiles of sewer lines shall be shown on the same sheet. Plans shall include all relevant rights-of-way, property lines and addresses (or lot numbers if addresses have not yet been established), existing buildings, utilities and any other pertinent details necessary for construction of the facilities. Profiles shall include slopes, line sizes, materials of construction and the stationing of all manholes, utility crossings and any other pertinent objects.

(7) Specifications, design calculations and complete design drawings including plans, sections and details shall be provided if a pumping station, grinder pump or related facilities are proposed. The drawings shall be provided at suitable scales large enough to show clearly what is intended.

(8) The location of sewer laterals and the stationing of the sewer laterals from the downstream manhole shall be provided at the discretion of the Authority's Engineer.

(9) Plans should indicate all easements as required for sanitary sewers or other utilities. In those cases where sanitary sewer lines which are to be dedicated to PTSA will be installed on private property, legal descriptions and plans for sanitary sewer easements shall be furnished. In addition, the name and address of all property owners who will be granting easements to PTSA and the name and address of any lien holders who hold mortgages or judgments against the property through which the easements will be granted shall be provided.

(10) All plans submitted for review shall be sealed and signed by a registered Pennsylvania professional engineer (required if plans include the design of a pumping station) or land surveyor.

(11) Approval of the preliminary drawings does not exonerate the Applicant from constructing facilities in accordance with these sanitary sewer specifications in the event of a reviewer oversight during the plan review process. The Authority's inspector will enforce the construction of all facilities in accordance with these sanitary sewer specifications.

b. Record Drawings

(1) Record drawings of sewers, sewer laterals, force mains, pumps, pumping stations, and other facilities which discharge sewage to the Authority's sewer system shall be prepared and submitted to the Authority when construction has been completed. In addition, the angle of a sewer lateral from perpendicular to the sanitary sewer main must be provided if the angle is greater than 5 degrees.

(2) The drawings shall be to scales as described in subparagraph 2.a above and shall be provided on the same base plans as the approved preliminary development plans. Sewer profile elevations shall be re-surveyed and construction plans updated accordingly. The record drawings shall bear the signature of a professional engineer or a professional surveyor (with the exception of plans including pumping station design, which must be sealed by a professional engineer).

(3) Upon review and approval of the record drawings, two sets of prints of all the newly constructed facilities shall be provided. An overall plan sheet showing the full extent of the project (extracted from the approved preliminary plans, with a key plan if applicable) shall be included in the sets submitted.

(4) For the purpose of developing the Authority's Geographical Information System (GIS) database, the developer shall provide, in digital format, a drawing file compatible with the version of AutoCAD software as specified by the Authority's Engineer. The drawing file

shall depict all physical entities associated with the newly installed sanitary sewerage facilities including, but not limited to, manholes, sanitary sewer mains, laterals, force mains, grinder pumps and pumping stations. Entity locations shall adhere to the spatial standards used by the Lancaster County GIS, the details of which are specified below:

(a) Projection: Lambert Conformal Conic

(b) Coordinate System: State Plane, Zone 3702 (Pennsylvania South)

(c) Horizontal Datum: North American Datum 1983

(d) Vertical Datum: NAVD 1988

(e) Units: Feet

c. Specifications

The materials to be used shall be specified on the construction drawings. The Authority reserves the right to require the submission of written specifications of any aspect of the construction that deviates from these Standard Specifications.

3. Shop Drawings

Shop drawings shall be submitted for all items to be used in the construction of the facilities. Approval of shop drawings must be obtained prior to installation of such items.

4. Inspection and Testing

a. Inspection of Work

All construction work performed under these regulations shall be subject to inspection and testing by the Authority Engineer. No sanitary sewers, pumps, pumping stations, force mains, lateral connections, service lines or other sewerage facilities shall be connected to the Authority's sewer system until such inspection has been carried out and approval given by the Authority's Engineer.

b. Required Notice for Inspection Services

It shall be incumbent upon the Contractor to notify the Authority a minimum of 48 hours in advance of when inspection is needed. All subsurface construction shall be inspected before any backfilling is done. Accommodation of a request for inspection services when less than 48 hours advance notice is provided shall be solely dependent on the

Authority's availability. Any work done by the Contractor that requires inspection services shall be done solely at the Contractor's risk when less than 48 hours advance notice is given to the Authority.

When inspection services have been scheduled with the Authority, it shall be incumbent upon the Contractor to notify the Authority of any changes to the inspection schedule. If changes in the Contractor's work activities result in the need to cancel scheduled inspection services, the Contractor shall notify the Authority a minimum of 48 hours prior to the time the inspection was originally scheduled for. In the event that the Contractor does not provide a minimum of 48 hours notice for cancellation of inspection services, the Authority reserves the right to bill the Developer for 4 hours of inspection time regardless of whether any inspection was performed. This shall only apply under conditions when the Contractor has properly scheduled inspection and would reasonably be expected to work, and shall not apply to cancellation of work resulting from circumstances beyond the control of the Contractor (i.e., weather).

Inspection costs will be borne by the Developer.

c. Testing

Testing of sewer lines, manholes and other facilities is described in detail in each section of these regulations.

d. Inspection of Other Utilities

The Authority reserves the right to visit the site for the purpose of inspection during construction of the water utilities (or other utilities, if deemed necessary). The purpose of such visits shall be to ensure adherence to the approved plans of all utilities relative to the sanitary sewerage system. The frequency of site visits for construction of utilities other than sanitary sewer, as well as the length of time on site during these visits, shall be as required to ensure the integrity of the sanitary sewerage facilities. All costs for such inspection by the Authority's Engineer shall be borne by the Developer.

e. Connection to Existing System

In an effort to avoid the introduction of sewer gases into a newly constructed sanitary sewer extension, it shall be incumbent on the Contractor to securely plug the new sanitary sewer line at the point of connection to the active line as soon as reasonably possible without interfering with the construction of the remainder of the line. The plug shall remain securely in place until such time that all newly constructed sewerage facilities have been successfully tested and inspected by the Authority. Alternatively, the Contractor may choose to withhold

connecting into the active sewer until such time that all newly constructed sewerage facilities have been successfully tested and inspected by the Engineer.

5. Private Sewer Extensions

   a. Construction of all sewerage facilities shall be in accordance with the Standard Specifications regardless of whether the facilities are intended to remain privately-owned or be dedicated to PTSA.

   b. All sanitary sewer extensions intended to be privately-owned shall require a metering manhole at a location approved by the Authority's engineer prior to the point of connection into the PTSA-owned system. The intent of the metering manhole is to provide the Authority with a location to install and maintain access to a permanent or temporary meter if, at some future date, there is a concern about possible excessive infiltration/inflow from the privately-owned development. Therefore, the location of the metering manhole shall be such that all sewage flow generated from the privately–owned development shall flow through the metering manhole. The metering manhole shall be provided with a sewer metering flume installed in the manhole. The flume shall be approved by the Authority's engineer prior to installation. All costs associated with construction of the metering manhole and the manufacturer- certified installation of the flume shall be borne by the developer. The metering manhole shall be dedicated to PTSA. A metering manhole detail is included with the Standard Details at the end of this document.

D. Permits

1. Connection to PTSA Sanitary Sewer System

   No person shall uncover, connect into, make any opening into, or use, alter or disturb in any manner any sewer without first making application for and obtaining a permit, in writing, from the Authority. Application to the Authority for a permit required hereunder shall be made by the Owner of the improved property to be served, in such form as may be prescribed by the Authority. The application shall be accompanied by such tapping and connection fees as may be required by the Authority.

2. Street and Highway Openings:

   a. Township Roads

      Whenever the surface of any public street, sidewalk, or cartway is disturbed by construction of the sewer lines, it will be the responsibility of the Developer to secure and maintain street opening permits from the municipality having jurisdiction.

b. State Roads

PennDOT Highway Occupancy Permits (HOP) for any work to be performed in state highways shall be obtained in the name of the Authority upon request by the Developer. The Developer shall be responsible for preparing the HOP application and upon completion shall present it to the Authority for signature.

3. Approval by the PTSA inspector of all or part of any work performed under permit issued by an independent agency shall not constitute acknowledgement that the work was performed in accordance with such permit; nor shall such approval by the inspector be construed as a release of the applicant from his obligations to meet the requirements of the permit, or a waiver of PTSA's right to seek enforcement from the permitting agency.

E. Special Requirements

1. All construction activities shall conform to the most current requirements of the Occupational Safety and Health Act (OSHA).

2. All equipment used on roadways shall be equipped with rubber tires or treads. If other than rubber tires or treads are used, the pavement shall be properly protected. If pavement, curb and/or sidewalk is damaged or marred by construction equipment, the areas shall be restored at no cost to the Authority.

3. A competent Contractor representative shall be identified and made available within two hours in case emergency situations arise during non-working hours.

4. The local police and fire departments shall be informed of the work schedule and of possible street obstructions.

5. Blasting for excavation shall be permitted only after securing approval(s) and establishing the hours of blasting. The blasting procedure, including protection of persons and property, shall be in strict accordance with federal, state and local regulations.

F. Detail Drawings

Relevant detail drawings are:

20 Metering Manhole

END OF SECTION

Section 2
Gravity Sewers

A. General

1. All designs shall conform to good engineering practice and shall meet the requirements of the Pennsylvania Department of Environmental Protection (PADEP), Occupational Health and Safety Administration (OSHA), Pennsylvania Department of Transportation (PennDOT) and the Pennsylvania Department of Labor and Industry, and shall conform to the requirements contained herein.

2. Permits

   The Applicant shall secure, in the name of the Authority, all permits that are required from PADEP, Conrail and PennDOT. The Applicant shall secure, in his own name, all required construction permits such as highway or local street opening permits. Any existing street, highway or other improvements disturbed during construction shall be restored to the satisfaction of the appropriate municipality or Owner before the facilities will be accepted for dedication by the Authority. All costs of such permits, including any and all bonds required, shall be the sole expense of the Applicant.

B. Design Criteria

1. Diameter and Slope

   The minimum sewer diameter shall be 8 inches and the minimum slope for all gravity sewer shall be as listed in the PADEP "Domestic Wastewater Facilities Manual". The minimum slope for all terminal sections of sewers shall be 1.0%. The maximum distance between manholes shall be 400 feet for mains 15" or less in size.

2. Depth of Sewers

   a. All sewers shall be designed to provide a minimum depth of cover of 3'-6" above the top of the pipe.

   b. Under normal conditions, sewer lines with depths greater than 15 feet will not be approved. If greater depths of sewers are deemed necessary, the design should be thoroughly evaluated and discussed with the Authority prior to formal submission of the plans for approval. In all cases where subsequent approval is given by the Authority, the pipe shall be SDR 21 PVC.

3. Separation of Utilities

   The Authority's interpretation of the PADEP requirements for 10-foot horizontal and 18-inch vertical separation distances between sewerage and water utilities is as follows:

   a. Parallel Installation

      A minimum 10-foot horizontal separation (measured from edge of pipe to edge of pipe) between sanitary sewer lines and water lines shall be required when the lines are constructed parallel (relatively) to one another. When this condition cannot be met, concrete encasement of the sanitary sewer line shall be required for the entire length of the line that fails to meet the 10-foot separation distance requirement, at the discretion of the Authority's Engineer. However, under no conditions shall the horizontal separation distance between sewer and water lines be less than 6 feet.

   b. Line Crossings

      A minimum 18-inch vertical separation between the top of the sanitary sewer line and the bottom of the water line shall be required when the lines cross one another. When this separation cannot be met, concrete encasement of the sanitary sewer line shall be required for a minimum distance of 10 feet on either side of the point of crossing, and/or until the minimum 10-foot separation distance requirement is met (depending on the angle of crossing).

      Where a water main crosses below a sewer main, structural support must be provided for the sewer main to prevent any damage to the water main.

   These requirements shall apply to laterals (both water and sewer) as well as main line construction.

4. Borings

   Bored crossings shall be done in accordance with PennDOT requirements.

C. Materials and Equipment

1. Ductile Iron Pipe and Fittings

   (References to ASTM, AWWA and ANSI Specifications imply latest edition.)

   a. Ductile Iron Pipe

      Ductile iron pipe shall conform to AWWA C151 and ASTM A746. Pipe shall be supplied in standard lengths as much as possible and shall be by

U.S. Pipe and Foundry Company, American Ductile Iron Pipe Company or Griffin Pipe Products Company.

b. Joints

Joints shall be rubber-gasket push-on type or rubber-gasket mechanical joint type conforming to AWWA C111. Gasket shall be of SBR.

c. Linings

Ductile iron pipe and fittings shall be lined with Protecto 401 ceramic-filled amine cured epoxy by Indurall, SewperCoat calcium aluminate mortar by Lafarge Calcium Aluminates or approved equal.

d. Minimum Thickness

Thickness design shall be per AWWA C150, except provide minimum Class 350.

2. Polyvinyl Chloride Sewer Pipe and Fittings

a. Materials

Polyvinyl chloride (PVC) sewer pipe and fittings shall be PVC SDR 35 with full diameter dimensions and shall conform to ASTM D3034 for sizes 6 (for sanitary sewer laterals) through 15 inches and shall conform to ASTM F679 for sizes 18 through 36 inches.

PVC Schedule 40 pipe shall be used for 4-inch pipe (for service lines). PVC Schedule 40 pipe shall conform to ASTM D1785.

b. Joints

PVC pipe and fittings shall have bell and spigot push-on joints. The bell shall consist of an integral wall section with a solid cross-section elastomeric gasket (as manufactured by J.M. Manufacturing Co. or approved equal) securely locked in place to prevent displacement during assembly. Installation of elastomeric gasketed joints and performance of the joint shall conform to ASTM F477, ASTM D3139 or ASTM D3212.

3. Steel Casing Pipe

a. The steel casing pipe shall have a minimum yield strength of 35,000 psi, have a thickness as required but not less than 0.375 inches, be equipped with grout holes and conform to AWWA C200 and ASTM A53.

b. Casing interior and exterior shall be painted with two coats bitumastic enamel coating in accordance with AWWA C203.

c. Pipe cradles or isolators shall be as shown on the detail drawing, APS casing spacers, Model SSI or approved equal.

d. Minimum casing diameter shall be in accordance with PennDOT or Amtrak requirements as applicable.

D. Installation

1. Excavation

   a. The trench shall be excavated to a depth of six inches below the outside diameter of the pipe barrel, or deeper if so specified. The width of the trench shall be as shown on the detail drawings. The resultant subgrade shall be undisturbed or compacted as approved by the Engineer if disturbed.

   b. When the pipe is to be laid in fill, bring the fill to two feet above the elevation of the top of pipe to be laid before excavation commences. Compact fill to 95% of the maximum density as determined by ASTM D1557-70 or AASHTO T-180, Method D (Modified Proctor). The bottom of the trench shall be compacted to 95% of maximum density prior to installation of the pipe bedding.

2. Bedding

   a. The pipe shall be bedded on 6" of AASHTO 8 (PennDOT 1B) stone, the full width of the trench (a minimum of 6" on either side of the pipe), and shall be covered with AASHTO 8 (1B) stone to a height of 12" over the top of the pipe. The bedding shall be thoroughly compacted. The bedding shall provide uniform and continuous bearing and support for the pipe at every point between the bells.

   b. Flowable fill shall also be an acceptable material for trench bedding and backfill and shall conform to PennDOT Form 408 Type B flowable backfill.

   c. If potentially corrosive materials are encountered, polyethylene encasement shall be installed to protect ductile iron pipe in accordance with ANSI/AWWA C105/A21.5.

   d. Unstable Subgrade

      Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the

opinion of the Authority, should be removed, the Applicant shall excavate and remove such unsuitable material to the width and depth recommended by the Authority. Before pipe is laid, the subgrade shall be formed by backfilling with AASHTO 57 stone in 3-inch (uncompacted thickness) layers thoroughly compacted to 95% of standard Proctor density and the bedding prepared as specified above in D.2.a.

e. Special Foundations

Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the Authority, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, the Applicant shall construct a foundation for the pipe consisting of piling, timbers or other materials, in accordance with plans approved by the Authority.

f. Concrete Encasement

Pipes to be encased in concrete shall have a minimum six inches of concrete above and below the pipe and the concrete shall be extended for the full width of the trench. No formwork to limit the concrete width shall be used. Flexible pipe joints shall be provided in the pipe at a distance of three times the pipe diameter from the ends of the concrete encasement, to provide pipe articulation. Pipes shall be protected against flotation during placement of concrete encasement. This may require two- stage concrete placement combined with anchor straps.

3. Laying Pipe

a. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA C600. PVC pipe and fittings shall be installed in accordance with the requirements of the manufacturer and ASTM D2321. All pipes shall be laid to a uniform line and grade, bell ends upgrade, with a firm and even bearing along the barrel of the pipe. The spigot end of the pipe is to be centered in, shoved tight and secured against the bell of the previously laid pipe. The interior of each pipe shall be cleaned of all foreign material before the next pipe is laid. Pipe laying shall commence at the lowest point and proceed upgrade. At the close of each day's work, and at such other times when pipe is not being laid, the open end of the pipe shall be closed by a watertight plug or other approved means.

b. Grade and Alignment Control

At the request of the Authority, a grade sheet for each manhole run shall be furnished . Grade and alignment control shall be established by laser (direct reading).

c. Pipe Clearance in Rocks

(1) Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and fittings for pipes 24 inches in diameter or less, and 9 inches for pipes larger than 24 inches in diameter.

(2) The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of such rock, boulder or stone.

d. Pipes at Manholes or Other Rigid Structures

Pipes directly connected to or supported by rigid structures shall not have a length beyond the rigid support in excess of that shown in the manhole detail drawings.

e. Water in Trenches

Trenches shall be dewatered prior to laying pipes. Ground and surface water in trenches shall not be permitted to enter the sewerage system.

4. Backfilling

a. The trench may be filled with excavated material above the AASHTO 8 stone as specified above except that stones larger than eight (8) inches may not go in the trench and the fill shall not contain more than 20% stone in total volume.

b. The trench shall be properly tamped in lifts not to exceed the maximum thickness for the type of tamping equipment used.

c. All bedding and backfilling shall be compacted to 95% of maximum density as determined by ASTM D1557-70 or AASHTO T-180, Method D (Modified Proctor).

d. Backfilling shall not be done with frozen material. No backfilling shall be done if the material already in the trench is frozen.

e. In state highways, all backfill shall be in accordance with the requirements of PennDOT Chapter 459. The requirement for backfilling in other streets shall be as required by the municipality in which the street is located.

5. Surface Restoration

a. In state highways surface restoration shall be in accordance with PennDOT requirements, or as specified in the PennDOT permit issued for the subject project.

b. In township roads, paved areas or other traffic areas, surface restoration shall be in accordance with the requirements of the local municipality in which the street is located.

c. All street, road or highway surfaces which are disturbed or damaged during installation of the sewers shall be properly repaired at the Owner's cost.

d. Subsequent settlement of the street, road or highway surface resulting from improper compaction of the sewer line trench or failure to protect the sewer line trench shall be promptly repaired at the Owner's cost.

e. The Authority may require televising and air testing of lines in settled areas to confirm the absence of sags or damage to the sewer pipe.

6. Bored Crossings

a. The carrier pipe shall be installed to the exact line and grade required within the casing pipe using a leveling grout course, adjustable pipe supports, or other methods as approved by the Authority.

b. The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing by the method of support shown on the detail drawings.

c. All work shall be performed in conformance with the requirements of PennDOT, Amtrak or other regulatory agencies involved.

7. Termination of Vacant Sanitary Sewer

a. All vacant or abandoned sewer mains shall be capped

b. Vacant/Abandoned lines may be required to be grouted with flowable-fill at the discretion of the Authority.

E. Testing and Inspection

1. Notification

It is incumbent upon the Applicant to notify the Authority a minimum of 48 hours in advance of when the work will be ready for inspection.

2. Mandrill Test

   After the mains have been laid and backfilled, the Contactor will perform a mandrill test to determine whether the alignment of the sewer is true and whether any pipe has been displaced, broken or otherwise damaged subsequent to laying. The Authority inspector shall be present for the test. The contractor shall notify the Authority a minimum of 48-hours in advance of inspection. This test will again be conducted before final acceptance of the sewer. Each section (manhole to manhole) of sewer shall be inspected. Any and all defects shall be corrected to the satisfaction of the Authority before acceptance.

3. Leakage Tests

   a. Sewers shall be tested for leakage only after all sewers and sewer laterals, including stoppers, are installed. Each sewer section between manholes including all laterals will be tested with low pressure air. Testing will be done only after all backfilling has been completed and trench settlement has been minimized. The Applicant shall furnish all labor, materials, tools, equipment and accessories necessary to perform the required tests. All tests shall be made in the presence of, and to the complete satisfaction of the Authority.

   b. The equipment shall be specifically designed and manufactured for testing pipelines with low-pressure air and shall be provided with an air regulator valve or air safety valve set to prevent the air pressure in the pipeline from exceeding 9 psig. All plugs shall be braced to prevent blowout. Care must be taken so that the pressures generated by the air testing equipment do not exceed the pipe manufacturer's recommendations.

   c. The above ground air control equipment shall include a shut-off valve, pressure regulating valve, pressure relief valve, input pressure gauge and a continuous monitoring pressure gauge having a range from 0 to 10 or 15 psi.

   d. Low pressure air shall be slowly introduced into the sealed line until the internal pressure reaches approximately 5 psig. The pipe shall remain under pressure for not less than 2 minutes before the test begins, to allow equilibrium of the air temperature with the pipe wall.

   e. When the pressure has stabilized at 5 psig, the air hose from the control panel to the air supply shall be disconnected.

   f. The pipe shall be considered acceptable if the pipe holds a pressure of 5 psig for a minimum of 5 minutes.

g. The Applicant shall repair or replace all defective material and/or workmanship and shall conduct such additional tests as required to demonstrate that the sewer meets the requirements, at no additional cost to the Authority. All materials and methods used to repair the sewer shall meet with the approval of the Authority's Engineer.

4. Cleaning

At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipe. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Engineer or the Authority will examine the pipes for leaks. If any defective pipes or joints are discovered, they shall be repaired or replaced as directed by the Engineer or the Authority.

F. Detail Drawings

Relevant detail drawings are:

1 Right-of-Way Restoration

2 Concrete Encasement

3 Pavement Restoration

21 Pipe Cradle in Casings

END OF SECTION

Section 3
TV INSPECTION OF SEWER PIPELINES

A. Summary

1. Section Includes:

    a. Assess the condition of the indicated sanitary gravity sewer pipes.

    b. Closed-circuit television (CCTV) of selected gravity sewer pipes using the National Association of Sewer Service Companies (NASSCO) industry standard Pipeline Assessment and Certification Program (PACP) forms and coding.

    c. Creation of a digital submission of sewer inspection data, videos, photos, and reports on portable external hard drives.

    d. Provide a visual and written record of internal pipeline features including, general information, overall condition, wastewater depth, structural integrity, and significant defects.

B. Products

1. External Hard Drives

    a. Description: A portable storage device that can be attached to a computer through a USB connection.

    b. Solid state data storage devices are preferred.

2. CCTV Software

    a. Capable of providing complete survey reports in compliance with the most recent version of NASSCO PACP.

    b. The PACP defect and construction codes shall be pre-programmed in the CCTV software and shall be grouped by PACP Groups.

    c. Software and Databases

        i. Fully compliant with PACP

        ii. Capable of customization with the ability to modify or add to the pipeline condition and group them for ease of use.

        iii. Assessment and reporting software program shall be menu-driven and shall have a complete on-screen help file.

iv. NASSCO PACP mandatory fields and any additional available field requested by the Authority shall be setup in the software prior to the assessment, and all these fields shall be populated with information collected during the assessment. Any general and pipe segment information that is already known prior to the assessment shall be entered into the appropriate fields in advance of performing the physical assessment.

v. Maintain a database of underground pipe and manhole assets. Structure the asset database similar to the one referencing pipe usage (i.e., sanitary, storm, drainage, etc.) sections (i.e., projects, areas, quadrants).

vi. Surveys include a method of pipe segment numbering and a chronological survey set- up numbering system.

vii. Capacity to import and export survey results in the most recent NASSCO PACP exchange format.

d. The footage reading from the camera equipment shall be automatically entered into the survey log and shall directly correspond to the noted observation location throughout the pipe graphical and tabular reports generated.

3. Sewer Assessment Reports

a. File Naming Conventions: Name all files in accordance with the requirements of the Authority to allow direct linking of files to pipe assets using a common unique identifier.

i. Each manhole has been given a unique manhole identification (Asset ID) the file name for each pipeline assessed shall be that unique upstream manhole Asset ID followed by an underscore followed by the unique downstream manhole such as 0123S0456_0123S0457.pdf.

ii. If an unnamed manhole is found, the letter "A" shall be added to the end of the upstream manhole's Asset ID to form a new Asset ID. The data/video files shall then be renamed to include the new Asset ID and a new CCTV assessment shall be started from the new Asset ID.

iii. If more than one unnamed manhole is found between two named manholes, subsequent new manhole Asset IDs shall be formed using the letters "B", "C", etc.

iv. If an unnamed manhole is found, provide documentation showing the location of the unnamed manhole to the Authority depicting the change in connectivity found in the field.

v. If the contractor performs a reverse setup and televises an individual pipe segment from more than one direction (i.e., the camera is only able to televise a portion of the entire segment heading downstream, and the remaining portion of the pipe segment was televised heading upstream) then two or more separate video files are allowable. The name of the additional database files etc. (i.e., unique manhole Asset ID followed by an underscore followed by the unique downstream Asset ID) followed by "_1", "_2" etc. at the end of the filename so that it is clear there are multiple files and videos for the same pipe segment. If unnamed manhole(s) is (are) found the procedure previously described shall also apply. Examples:

1. Initial filename: 0015S0001_0015S0002

2. Additional filenames: 0015S0001_0015S0002_1

3. Base the name of each digital still photo on the video/data filename of the specific sewer in which the photo was taken. Record the name as the video/data filename followed by the PACP code for the item pictured followed by the footage at which the observation was encountered. Examples:

4. (Filename)_(PACP Coded)@(footage).jpg

5. 0015S0001_0015S0002_HSV@37_2.jpg

6. 0015S0001_0015S0002_1_MCU@113_6.jpg

b. Format all data files to facilitate upload into a NASSCO PACP exchange database.

c. Digital Video: CCTV assessments shall be captured at a minimum video bit rate of 4,500 kbps.

d. Indicate individual survey results in tabular form and provide a sortable list of surveys based on a user-defined description field. Include the starting and ending manhole Asset IDs depths, pipe material, total survey length, and pipe diameter. All reports and and/or submittals shall comply with the most recent version of NASSCO PACP standards.

e. Submit assessment data to the Authority on a weekly basis, including digital videos, digital photos, and evaluation reports, all in electronic format on portable external hard drive. All hard drives and the information contained within them are the property of the Authority after submittal.

i. Fill data on each portable external hard drive to minimize the number of hard drives submitted. The hard drives shall contain separate digital files for each manhole-to- manhole section of pipe assessed.

ii. Sections of a single segment of sewer shall not be recorded to more than one hard drive.

iii. Video footage of recorded segments shall be grouped by area and shall be submitted in sequential order relating to the area mapping designation.

iv. The footage counter reading from the camera shall appear on all videos.

f. Create separate folders for each inspection. Within each inspection folder include the video file, digital photos, evaluation reports, supporting documentation etc.

i. Label each portable external hard drive clearly to indicate the date range of the assessments included on the hard drive, the name of the project, the Authority's project number, Contactor's name, and the index number of the hard drive. The index number for each hard drive shall be the sequential number followed by the area number.

ii. Each portable external hard drive submitted shall contain all sewer assessment data obtained to date. The database shall be comprehensive for the entire project and additional data shall be added to the database each week.

iii. On each hard drive, new data collected since the previous hard drive submittal shall be indicated as such to facilitate separation of the new data from the previously submitted data.

iv. A typewritten summary in pdf format shall be provided for each portable external hard drive that lists the files contained on that hard drive.

C. Execution

1. Preparation

a. Sewer Flow Control

i. Evaluate each segment of sewer to be assessed with respect to diameter, flowrate, velocity, upstream/downstream manhole diameter, debris levels, extent of pipe wall corrosion, and accessibility. Select and provide the most appropriate equipment and methods based on the condition of the specific sewer line segment and its access manhole(s) at the time the work commences.

ii. All assessment work shall be attempted during periods of low flow in the sewer segments being assessed.

iii. At all times during the assessment, the flow in the sewer line segment(s) being assessed shall be suitably controlled as needed to perform the assessment.

iv. If the depth of flow in the sewer segments to be assessed is above the maximum allowable for the use of floating inspection equipment, off peak hours should be pursued to perform the assessment. If flow levels are not sufficient during off peak hours, the flow level shall be lowered by either:

1. Using flow through plugs

2. Performing bypass pumping as approved by the Authority.

v. When flow in a sewer line is plugged, blocked, or bypassed, take precautions:

1. to protect the sewer lines from damage that might result from sewer surcharging.

2. to ensure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewer involved.

vi. The use of floating inspection equipment is subject to approval by the Authority only after all other methods included in this section have been ineffective or deemed not practical.

b. The equipment and methods used for each sewer pipe and the setup location shall conform to the submitted and reviewed plan.

i. Standard CCTV equipment is appropriate for sewer segments that:

1. Have a depth of flow less than 25 percent of the pipe diameter.

2. Do not have signs of corrosion.

3. Do not appear to have significant debris accumulation below the water surface.

ii. Floating HD Image equipment is appropriate for sewer segments that:

1. Do not meet the previously listed conditions for using standard and CCTV equipment.

2. Require longer continuous lengths of assessment due to the difficulty of the manhole access or connection to a buried manhole or manholes.

D. Application

1. CCTV Equipment

    a. Provide a mobile vehicle large enough to accommodate at least three people with video monitoring equipment specifically compatible with the camera equipment being used. Authority shall have unrestricted access to observe the television screen and all other operations.

    b. CCTV Camera:

        i. Designed and constructed for such assessment and shall be capable of producing digital still photos of all sewer observations and service connections.

        ii. Adjustable light source that generates an even distribution of lighting for the camera that results in a clear color picture of the entire periphery of the pipe.

        iii. Operable in 100 percent humidity conditions and in a hazardous and corrosive environment.

        iv. Provide a backup (spare) camera either on the project site or at a nearby location so performance of the Work is not delayed.

        v. When usage of standard CCTV equipment is not feasible due to access issues, pipe condition, and/or depth of water flow, floating camera equipment may be used.

        vi. Capable of panning 360 degrees and tilting 270 degrees and with minimum optical zoom ratio of 10:1 plus a minimum digital zoom ration of 4:1 to facilitate the assessment of all laterals and defects with optimum picture quality provided by focus and iris adjustment.

    c. Floating HD Camera: the camera shall be capable of recording 360-degree view using a fisheye lens without tilting or panning.

    d. CCTV Equipment

        i. Camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Authority. Picture resolution shall be a minimum of 460 television lines (TVL).

        ii. Provide a lighting system adequate for quality pictures. A reflector in front of the camera may be required to enhance the lighting in black pipe.

iii. Accurate footage counter to display on the monitor the exact distance of the camera from the centerline of the starting manhole.

iv. Compatible with the version of NASSCO PACP used by the CCTV software and the reports and submittals generated from the software.

E. FIELD QUALITY CONTROL

1. The following measurements shall be collected for each accessible manhole and included in the PACP exchange database:

    a. Utilize GPS equipment to obtain X and Y state plane coordinates with a submeter accuracy.

    b. Field-measure the vertical distance from the top of the manhole frame to the invert in accordance to NASSCO PACP standards.

2. Pipeline Assessment:

    a. Each sewer section shall be assessed from the upstream manhole to the downstream manhole if possible.

    b. For the upstream and downstream manholes on each segment of pipe that is assessed, pan and tilt from the invert and take digital still photos that clearly depict the entirety of the manhole interior, including cone section.

    c. Assess the full length of each sewer between access points. When the camera is unable to pass an obstruction even though flow is continuing, perform a reverse setup of the CCTV equipment from the opposite access point.

    d. Perform all CCTV assessments using personnel who are trained and certified (current standing) in the use of NASSCO's PACP.

    e. Multiple upstream and/or downstream sewer segments can be televised from a single manhole setup location as long as each manhole-to-manhole video section restarts its footage counter at zero and a separate video file for each assessment is submitted.

    f. The CCTV camera shall travel through the lines using its own power unless a tethered floating unit is used. The pictures taken of the entire inside periphery of the pipe shall be clear and visible. Picture quality and definition shall be to the satisfaction of the Authority.

    g. Stop the camera at all service laterals and pan at such an angle that an internal view of the service lateral is available to determine if the lateral is active, inactive, or plugged. Take photos:

i. include a brief description of the subject of the photo directly on the photo.

ii. catalogue and link in the CCTV database so the photos correspond with the length along the sewer line where the photo of the recorded observation was taken.

iii. JPEG format and at least 50 kilobytes in size.

h. Adjust the camera height such that the camera lens is always centered in the pipe being televised.

i. Retrieve camera equipment that becomes stuck within a sewer.

j. Submit CCTV inspection videos, where reversal setups are not required, in one continuous video section from manhole to the immediately adjacent manhole and not in multiple files. If a reverse setup is required, two complete inspections and video are acceptable.

3. Calibrate camera footage on a weekly basis in the presence of the Authority with a above ground tape measure and simultaneous CCTV footage counter.

4. Project Notifications: Notify the Authority immediately if:

a. A collapsed pipe or other significant pipe failure is discovered.

b. The conditions for CCTV assessment are found to be unsafe or impractical.

c. A manhole is buried, cannot be found, or cannot be accessed. Include a diagram in PDF file format that clearly indicates the location of the manhole, identifies its Asset ID, and lists the procedures that were used to attempt to locate the manhole.

d. Any defects that pose immediate danger to the public are observed (i.e., missing, or broken manhole covers, sinkholes, etc.).

e. Any major pipe blockages, manhole surcharging, or potential overflow conditions are observed.

f. The pipe configuration in the field is different than shown on the Drawings. Include a diagram in PDF file format that clearly indicates the location of structures in relation to immediately adjacent structures.

g. Any significant obstructions are found within permanent sewer easement, even if these obstructions do not impact the Work.

5. Public Notifications: Provide 48-hour notice prior to the assessment of any pip segment, distribute door-to-door a door hanger, approved by the Authority, describing the work

to be performed to notify the owner of every property, including residences and businesses, that may be affected. Door hangers shall be double-sided with the notification information in the English language on one side and in the Spanish language on the reverse side. Affected properties shall include, but not be limed to, properties on which:

a. A sewer to be accessed is located.

b. A manhole for accessing a sewer to assessed is located.

c. An existing sewer easement that could be used to access the sewer is located.

d. A temporary right-of-entry agreement with the property owner and the contractor for accessing a sewer or manhole on the property.

e. An existing sewer lateral serving the property directly connects to a sewer to be assessed or manhole to be accessed for the sewer assessment.

F. DATA QUALITY CONTROL

1. Review quality and accuracy of each submittal of CCTV assessment data and revise as needed to correct any inaccuracies prior to providing submittal to the Authority.
2. Quality Review:
    a. Authority requires a 30-day period to review sewer assessment data/videos after each submittal has been received.
    b. Payment applications will not be processed until the sewer assessment data/videos have successfully passed the quality review and have been accepted by the Authority.
    c. Additional 30-day review periods apply to each resubmittal of data/videos determined to be unacceptable by the Authority.
    d. Re-inspection is required when digital videos are inaccurate or of such poor quality that the Authority is unable to evaluate the condition of the sewer or locate sewer service connections.
    e. Provide CCTV assessment data contained on each portable external hard drive in the most recent version of PACP exchange format. Include video indexing for all observations. CCTV assessment data to be submitted:
        i. Database file
        ii. Still photos in JPEG file format for each observation
        iii. Video for each inspection in MPEG1 file format.
        iv. Summary report for each pipe segment in PDF format.

END OF SECTION

Section 4
CLEANING OF SEWERS

A. General

1. Section includes cleaning of sewer pipe and fittings installed and/or rehabilitated, complete as shown on the approved drawings and as specified herein.

2. Cleaning includes proper high-pressure water jetting, rodding, bucketing, brushing, and flushing of sewers and manholes prior to inspection by closed circuit television, pipeline rehabilitation or replacement, point repairs, manhole preparation, and testing operations.

3. Clean all sewers to remove debris, roots, intruding services, deposits, and other blockages to a minimum of 95 percent open. Perform sewer cleaning work to an acceptable level as necessary to perform a thorough television inspection of sewer. If pipe condition is such that cleaning may cause a potential collapse, then pipe shall be televised without attempting to clean it to 95 percent condition, pending approval by Authority.

4. Submit one complete set of documentation regarding inspections and work performed. Based on work scope, submit written reports, photographs and External Hard Drives that incorporate color video and data per SECTION 3 – TV INSPECTION OF SEWER PIPELINES.

5. Submit a safety plan prior to performing any on-site work that includes the following as a minimum:

    a. Confined Space Entry

    b. Personal Protective Equipment

B. Qualifications Statement

1. Contractor shall have a minimum of five years' experience in sewer line and underground structure cleaning. Submit a list of at least three customers who have had similar work complete. Furnish trained and qualified technicians with proper experience operating equipment that is being used on for the work.

C. Definitions

1. Light Cleaning: Small amounts of debris existing within sewer line and where sewer reaches do not require heavy cleaning, as defined below, and that produce little or no debris. Minimum of 2 jetting passes.

2. Heavy Cleaning: Large deposits of debris or heavy root growth existing within sewer line and where sewer reaches require debris removal of depths up to 25 percent of pipe height.

3. Excessive Heavy Cleaning: Large deposits of debris or heavy root growth existing within sewer line and where sewer reaches require debris removal exceeding the definition of Heavy Cleaning, and time required to clean and inspect the line must be at least twice the average time required to clean and inspect other sewers of comparable length and diameter.

D. Measurement

1. Light Cleaning: Clean sewer using standard industry procedures of high-pressure water jetting equipment or other approved equipment. Costs related to cleaning of such sewers shall be included in Contractor's unit prices for CCTV and Light Cleaning.

    a. Basis of Measurement: By linear foot, measured to the nearest 0.1-foot.

    b. Basis of Payment: TV inspection, data compiling according to NASSCO PACP standards, and audio-video recording of pipeline.

2. Heavy cleaning: Heavy cleaning must be designated as such by the Authority and approved by Authority prior to work taking place. Include costs related to cleaning of such sewers in Unit Prices for Heavy Cleaning. Costs related to televising of such sewers following heavy cleaning shall be included in Unit Prices for CCTV and Light Cleaning. Compensation for heavy cleaning of a particular line will only be paid if:

    a. Heavy cleaning was authorized by Authority prior to performance of the work.

    b. Contractor proves that both significant time and effort was necessary to clean the line, (i.e. time required to clean and inspect the line must be at least twice the average time required to clean and inspect other sewers of comparable length and diameter.

    c. Adequate video proof of 'before' blockage, debris, grit or grease build-up, or other condition is provided.

    d. A submerged camera does not justify a need for heavy cleaning; proof that submergence was due to a blockage or heavy debris and not a sag in the line will be required.

    e. Heavy Cleaning will be paid for on a lineal foot basis only for length required to be cleaned, i.e., from downstream manhole to approximate location of heavy cleaning. This may or may not include entire pipe section, unless otherwise approved by the Authority.

f. Basis of Measurement: By linear foot measured to the nearest 0.1-foot.

g. Basis of Payment: TV inspection, data compiling according to NASSCO PACP

h. standards, and audio-video recording of pipeline.

3. Excessive Heavy Cleaning: Pipes that contain excessive blockages will be paid on a time and material basis, upon approval by Authority. A full-time inspector is required to oversee time and material work. Provide direct water source as required. Authority may determine any individual pipe be cleaned on a time and material basis.

E. Execution

1. Remove debris, roots, intruding services, deposits, and other blockages to a minimum of 95 percent open as necessary to perform a thorough television inspection of sewer. If pipe condition is such that cleaning may cause a potential collapse, televise pipe without attempting to clean it to 95 percent condition, pending approval by the Authority.

2. Preparation

    a. Select, based on pre-construction CCTV inspection, cleaning equipment to address conditions of manhole and sewer lines at the time the work commences to adequately remove dirt, grease, rocks, sand, and other materials and obstructions from sewer lines and manholes to allow performance of other work.

    b. Take satisfactory precautions to protect sewer lines from damage that might be caused by improper use of cleaning equipment. Whenever using hydraulically propelled cleaning tools that depend upon water pressure to provide their cleaning force, or any tools that retard flow of water in sewer line, take precautions to ensure that water does not cause damage or flooding to public or private property.

    c. No fire hydrant shall be obstructed in case of a fire in area served by hydrant.

    d. Remove water meters, piping, and related equipment from fire hydrants at end of each workday.

3. Equipment

    a. Hydraulic Sewer Cleaning Equipment:

        i. Equipment: movable dam type constructed so that a portion of the dam may be collapsed at any time during cleaning operation to protect against flooding of sewer.

            1. Movable dam shall be same diameter as pipe being cleaned and shall provide flexible scraper around outer periphery to ensure total removal of grease. If sewer cleaning balls or other such

equipment which cannot be collapsed instantly are used, take special precautions against flooding of sewers and public or private property.

b. High Velocity Jet (Hydro cleaning) Equipment:

   i. Have a minimum of 500 feet of high-pressure hose.

   ii. Have a selection of two or more velocity nozzles that can produce a scouring action from 15 to 45 degrees in all size lines to be cleaned. Also include a high velocity gun for washing and scouring manhole walls and floor.

   iii. Be capable of producing a minimum of 80 gallons per minute flows from a fine spray to a long-distance solid stream and delivering up to 1000 psi. Be able to carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel. Locate controls so equipment can be operated above ground. Select flowrates and pressures as required for each size of sewer, type of debris, and amount of debris, and as recommended by nozzle manufacturers.

   iv. Have a water tank, auxiliary engines and pumps, and a hydraulically driven hose reel.

   v. Have root cutting blades that are hydraulically spun.

c. Mechanical Cleaning Equipment:

   i. Bucket machines shall be in pairs and with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe shall not be acceptable.

   ii. Power rodding machines shall be either sectional or continuous type capable of holding a minimum of 750 feet of rod. Rod shall be specifically treated steel. To ensure safe operation, machine shall have a fully enclosed body and an automatic safety release clutch or relief valve.

4. Application

   a. Provide appropriate screening to stop passing of materials into downstream sewers. Sludge, dirt, sand, rocks, grease, and other solid or semisolid residue, debris, and material resulting from cleaning operations shall be removed at downstream manhole of section of sewer being cleaned. Passing material from manhole section to manhole section which could cause line stoppages, accumulations of sand in wet wells, or damage to pumping equipment shall not be permitted.

b. Remove debris, residue, and other materials resulting from cleaning operations from site at end of each workday and shall be disposed of in an approved and lawful manner. Under no circumstances will accumulation of debris, residue, and other matter be permitted on site beyond stated time, unless prior written authorization is given for storage in totally enclosed containers. Contractor shall be fully responsible for the disposal of debris at the end of each working day.

c. Specifics regarding the scheduling, monitoring, disposal fees (if any) and approved methods and procedures for disposal must be arranged with the Authority.

d. Flushing of sanitary sewers to facilitate cleaning activities without the capture of solids and debris is expressly prohibited.

e. Retrieval of equipment lodged in pipes or a wet well is Contractor's responsibility and shall be performed at Contractor's expense.

f. Cleaning Precautions: During sewer cleaning operations, satisfactory precautions shall be taken in use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) or tools which retard flow in sewer line are used, precautions shall be taken to ensure that water pressure created does not damage or cause flooding of public or private property being served by sewer. When possible, flow of sewage in sewer shall be utilized to provide necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, water shall be conserved and not used unnecessarily.

g. No sewer cleaning shall take place in a particular sewer segment until upstream pipe segments have been cleaned. If cleaning is done in a downstream pipe segment to facilitate overall cleaning operations, segment shall be re-cleaned at no additional cost to the Authority, after pipes upstream of that segment have been cleaned.

h. Sewer line walls shall be cleaned adequately to provide for proper operation of joint testing and sealing equipment or internal inspection to discern structural defects, misalignment, and infiltration/inflow sources. Cleaning shall be performed immediately prior to joint testing and sealing and internal inspection to preclude build-up of debris from infiltration/inflow sources and discharges from upstream pipeline sections.

i. Designated sewer manhole sections shall be cleaned using hydraulically propelled, high velo jet, or mechanically powered equipment. If cleaning of an entire section cannot be successfully performed from one manhole, equipment shall be set up on other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or equipment fails to traverse entire manhole section, it will be assumed that a major blockage exists, and cleaning

effort shall be repeated with other types of equipment. Immediately report any blockages to the Authority.

j. Water for sewer cleaning shall be purchased and obtained at locations in accordance with utility owner. If water is obtained from a potable supply, provide appropriate backflow prevention devices as required by authority having jurisdiction to protect potable system from cross connections and contamination. Prevent cross contamination of any public or private water systems used for this purpose.

5. Field Quality Control

   a. Acceptance of sewer line cleaning is contingent on satisfactory completion of television inspection. If television inspection shows cleaning to be unsatisfactory, re-clean sewer line and re-inspect until cleaning is shown to be satisfactory.

   b. If internal joint testing and sealing is to follow cleaning, give particular attention to adequacy of cleaning to ensure that proper seating of sealing packer can be achieved.

   c. Inspection of cleaning operations will be made daily by the Authority.

6. Final Cleaning

   a. Upon cleaning of underground sewer lines or structures, removal debris from finish grade and clean work areas so conditions at conclusion of the work are equal to or better than areas prior to work of this Section.

END OF SECTION

Section 5
CURED-IN-PLACE PIPE LINING

A. General

1. Furnish all labor, materials, equipment, and incidentals required to install and test the cured-in- place pipe (CIPP) lining and appurtenances complete as shown on the approved drawings and as specified herein, including, but not limited to services necessary for traffic control, bypass pumping and/or diversion of sewage flows, cleaning and television inspection of sewers to be lined, liner installation, reinstatement of service connections, quality control, providing samples for performance of required material tests, final television inspection, testing of lined pipe system and warranty work, all as specified herein.

2. Sewer cleaning, pre-rehabilitation, and post-rehabilitation CCTV inspection of all pipes to be rehabilitated by CIPP lining methods are required per applicable Specifications.

3. Remove obstructions and protruding service connections as required to complete the CIPP rehabilitation. Removal of all pipeline obstructions and protruding service connections required for sewer rehabilitation using cured-in-place pipe lining shall be completed prior to the pre-rehabilitation CCTV inspection.

4. Neither the CIPP system, nor its installation, shall cause adverse effects to any of the Authority's processes or facilities. The use of the product shall not result in the formation or production of any detrimental compounds or by-products in the system or at the wastewater treatment plant. Notify the Authority and identify any by-products produced as a result of the installation operations, test and monitor the levels, and comply with any and all local waste discharge requirements. Cleanup and restore existing surface conditions and structures, and repair any of the CIPP system determined to be defective. Conduct installation operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians, businesses, and property Owners or tenants.

5. The installer performing the work shall not change any material, design values or procedural matters stated or approved herein, without informing the Authority and receiving written approval of the change. Such changes constitute a breach of contract and shall result in rejection and removal of work performed with the unapproved materials or processes at no expense to the Authority.

6. Maintenance and Protection of Traffic, confined space entry, and work site protection shall be the responsibility of the installer and costs of these items are included in the cost of the work. Notify Police, Fire, Ambulance agencies, and residents/businesses in advance of any and all road closures. Comply with applicable OSHA trench safety rules, confined space, and sewer system entry.

7. Submit to the Authority shop drawings, product data, materials of construction, design calculations, and details of installation including all information described in items 9 to 25 below. Provide this information without delay or claim to any confidentiality and shall include all information described in items 9 to 25 below.

8. Detailed information on the CIPP installation procedures (wet-out, heating, curing, and cool down, if applicable) and all tools and equipment required for a complete installation identifying which tools and equipment will be redundant on job site in the event of equipment breakdown. Equipment to be furnished for the work, including proposed back-up equipment, shall be clearly described. Outline the mitigation procedure to be implemented in the event of key equipment failure during the installation process.

9. CIPP lining schedules including field-verified lengths and diameters of all CIPP lining and appurtenances required shall be provided. Plans should include map(s) that show insertion point manholes for all CIPP installations. Insertion points that are not manholes shall be brought to the specific attention of the Authority for review prior to plan approval.

10. Shop drawings and product data to demonstrate compliance with these specifications and identify materials of construction (including resins, catalysts, felt, etc.), felt manufacturer, location of the felt manufacturing facility, location of the wet-out facility, etc., flexible membrane (coating) material (including recommended repair/patching procedure, if applicable) shall be provided.

11. Manufacturers' shipping, storage, and handling recommendations for all components of the CIPP System.

12. MSDS sheets for all proposed products and materials to be furnished for the work.

13. Detailed sample collection, laboratory testing and quality control procedures including schedule and shipping and storage requirements.

14. A written description and/or plan for odor control that will ensure that project specific odors such as styrene will be minimized at the work site and surrounding area.

15. Provide the end seal material(s) and description of their installation such that a hydraulic seal is present between the CIPP liner and host pipe at the manholes.

16. Detailed written plan of the method of flow maintenance (Bypass Pumping plan) and noise prevention measures shall be provided.

17. A detailed description of the installer's proposed procedures for removal of any existing blockages in the pipeline that may be encountered during the cleaning process.

18. A detailed written traffic-control plan that details every street that will be impacted and how impacts will be mitigated.

19. Data on the maximum allowable stresses and elongation of the tube during installation and the means in which monitoring stress and elongation shall be provided (i.e., ideal inversion head and maximum cold head, minimum inversion head, maximum hot head).

20. A detailed public notification plan shall be prepared and submitted including detailed staged notification to residences affected by the CIPP installation.

21. A complete description of the proposed wet-out procedure for the proposed technology.

22. A Safety Plan identifying all competent persons, a description of a daily safety program for the job site and all emergency procedures to be implemented in the event of a safety incident. All work shall be conducted in accordance with the submitted Safety Plan.

23. A detailed quality control plan (QCP) that fully represents and conforms to the requirements of these specifications. At a minimum the QCP shall include the following:

    a. A detailed discussion of the proposed quality controls to be performed by the installer.

    b. Defined responsibilities of the installer's personnel for assuring that all quality requirements for this work are met. These shall be assigned by the installer, to specific personnel.

    c. Proposed procedures for quality control including those pertaining to fit and finish, and product sampling and testing shall be defined and submitted as part of the plan.

    d. Proposed methods for product performance controls, including method of and frequency of product sampling and testing both in raw material form and cured product form.

    e. A schedule for performance and product test result reviews with the Authority at regularly scheduled job meetings.

    f. Inspection forms and guidelines for quality control inspections shall be prepared in accordance with the standards specified in these specifications and submitted with the QCP.

24. Design data and specification data sheets listing all parameters used in the CIPP liner design and thickness calculations based on ASTM F 1216 for fully deteriorated "deteriorated gravity pipe conditions." Thickness of liners for oval and egg-shaped pipe shall be calculated in accordance with the "Sewerage Rehabilitation Manual" published by the Water Research Center (WRC). All calculations shall be prepared under the supervision of and stamped by a professional engineer registered in the State of Maryland.

25. Before, during and after CIPP installation work shall include the following:

a. Prior to each shipment of CIPP lining, submit certified test reports that the CIPP lining was manufactured and tested in accordance with all ASTM Standards specified and referenced herein.

b. CIPP lining schedules including field-verified lengths and diameters of all CIPP lining and appurtenances required to show that every pipe to be rehabilitated has been physically measured. Plans should include map(s) that show insertion points for all CIPP installations.

c. Detailed installation procedures and manufacturer's recommended cure method for each diameter and thickness of CIPP liner to be installed, including CIPP lining production schedule, acceptable inversion heads and pressures, inversion or winching procedures, curing and cool-down procedures detailing the curing rate of temperature increases and cool down and the method of application, and times for each stage of the process.

d. Wet-out forms/reports for each CIPP segment with detailed information including but not limited to: date and time of wet-out, wet-out facility address, volumes and/or weights of resin, length and diameter of CIPP liner (both wet-tube and dry-tube), roller gap settings, start times, finish times, resin used (product name and batch/shipment number) and quantity, gel times, resin injection locations, thickness of CIPP liner (dry and wet), catalyst(s) name and quantity used, and any other pertinent data documenting the wet-out for each section of CIPP liner manufactured. The wet-out forms shall be submitted prior to CIPP liner installation and shall be provided without delay or claim to any confidentiality. Wet out forms shall be submitted to the Authority field representative on the day of delivery.

e. CIPP liner field curing reports documenting the liner installation for all sewer segments. The CIPP liner reports shall document all details of liner installation, including manhole numbers, street names/sewer location, project number, date, time, ambient temperature, heads used during the inversion process, pressures and/or heads (minimum inversion pressure, ideal head, maximum hot head, and maximum cold head) used during curing (including cool down if applicable), curing temperature, curing time, rate of cool down, CIPP liner thickness, etc. A sample report shall be submitted to the Authority for approval prior to the installation of any CIPP lining. The reports shall be submitted without delay or claim to any confidentiality.

f. For UV cured liners, record the curing and light train speed (feet per minute), light source (number of lamps, intensity, and wattage), inner air pressure (psi), exothermic (curing) temperatures per unit time over the length of the liner, and temperature of the internal liner surface. Include liner manufacturer recommended citations in the submittal.

g. Complete certified copies of the report(s) output(s) of the continuous temperature monitoring systems used in the control of the curing, printed and in

electronic format. The reports shall be submitted without delay or claim to any confidentiality. Also provide the Authority with access to the website where the secure reports can be obtained.

h. Pre-rehabilitation and post-rehabilitation closed-circuit television (CCTV) inspection data as further defined herein. Post-rehabilitation CCTV inspection data shall be submitted within one week after the CIPP segment is installed and conform to requirements set forth in SECTION 3 – TV INSPECTION OF SEWER PIPELINES.

i. Samples of installed liner(s) for testing to be performed by an ASTM-certified independent testing laboratory, as described further herein.

j. Information on any grouts, epoxy, or cements proposed for sealing annular space between CIPP liner and host pipe at manholes, or for other uses.

k. Submit daily production reports to the Authority's Superintendent and/or field representative at the end of each workday.

l. A list of all service laterals (with distances and clock position) that were abandoned or reconnected as part of the work as further defined herein.

m. Some installations may result in the need to repair or replace a defective CIPP. Submit in writing, for review by the Authority, specific repair or replacement procedures for potential defects that may occur in the installed CIPP. Repair/replacement procedures shall be as recommended by the CIPP system manufacturer and shall be submitted to also include the following:

    i. Defects in the installed CIPP that will not affect the operation and long-term life of the product shall be identified and defined.

    ii. Repairable defects that may occur in the installed CIPP shall be specifically defined by the installer based on manufacturer's recommendations, including a detailed step-by-step repair procedure, resulting in a finished product meeting the requirements of these specifications. Repairable defects may include but are not limited to blisters, wrinkles, fins, pinholes, over- or under-cut lateral connections, and any voids found between liner and the host pipe.

    iii. Un-repairable defects that may occur to the CIPP shall be clearly defined by the installer based on the manufacturer's recommendations, including a recommended procedure for the removal and replacement of the CIPP. Un- repairable defects may include but are not limited to thickness below required minimum thickness, structural strength below required limits, lifts, shrinkage, folds, bulges, and delamination.

n. A list of all repair or replacement of CIPP defects that were executed during the work including identification of segment, location of the repair, and type of repair.

B. Materials and Equipment

1. CIPP Liner

a. CIPP liner shall be Inliner by Layne Inliner, Inc., Insituform by Insituform Technologies, Inc., National Liner by National EnviroTech Group LLC, SAK Liner by SAK Construction LLC, CIPP Corp., Sancon CIPP by Sancon Engineering Inc., Improved Technologies Group, or Authority approved equal.

b. CIPP liner shall be composed of tubing material consisting of one or more layers of a flexible non-woven polyester felt with or without additives such as woven fiberglass or other fibers and meet the requirements of ASTM F 1216, ASTM F 1743 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP), and ASTM D 5813 "Standard Specification for Cured-in-Place Thermosetting Resin Sewer Piping Systems". Determine the felt content of CIPP liner; however, it shall not exceed 15 percent of the total impregnated liner volume. Fabric tube shall be capable of absorbing and carrying resins, constructed to withstand installation pressures, and curing temperatures and stretch to fit irregular pipe sections. Submit certified information from felt manufacturer on normal void volume in the felt fabric that will be filled with resin.

c. CIPP liner tube may be made of single or multiple layer construction, with any layer not less than 1.5 mm thick, unless the tube is made of fiberglass material. Wet-out fabric tube shall have a uniform thickness and void space for resin distribution that when compressed at installation pressures will produce a predictable finished thickness that meets or exceeds the design thickness after cure.

d. No material shall be included in fabric tube that may cause de-lamination in cured CIPP. No dry or unsaturated layers shall be acceptable upon visual inspection as evident by color contrast between felt fabric and activated resin containing a colorant.

e. Wall color of interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made. Hue of the color shall be dark enough to distinguish a contrast between fully resin saturated felt fabric and dry or resin lean areas.

f. Seams in the fabric tube, if applicable, shall meet the requirements of ASTM D5813.

g. The outside layer of the tube shall be coated with an impermeable material compatible with the resin and fabric.

h. Prior to inversion, if applicable, outside and/or inside layer of tube (before inversion/pull- in as applicable) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate, if applicable, vacuum impregnation and monitoring of resin saturation during the resin impregnation (wet out) procedure.

i. Exterior of manufactured tube shall have distance markings along its length at regular intervals not to exceed 5 feet. Use these marks as a gauge to measure elongation during insertion. Should overall elongation of a reach exceed 5 percent, liner tube shall be rejected and replaced.

j. Identify the wet-out facility where all CIPP liner under this specification will be manufactured. All CIPP liner shall be manufactured from this designated wet-out facility throughout the entire project unless specifically approved otherwise by the Authority in writing. Multiple wet-out facilities shall not be allowed.

k. Authority and/or an agent of Authority may inspect CIPP liner during manufacturing and wet-out. Authority shall be given an opportunity to witness manufacturing of all CIPP liner for this project. Authority is responsible for costs associated with witnessing the manufacturing of CIPP liner.

l. If Authority decides to inspect the manufacturing of CIPP liner, provide full access to witness wet-out process and shall provide any and all information related to the manufacturing as requested by Authority or Authority's agent without delay and without claims of confidentiality or product privacy.

m. Application of resin to felt tubing (wet-out) shall be conducted under factory conditions using vacuum impregnation and materials shall be fully protected against UV light, excessive heat, and contamination at all times. If on-site wet out is required, maintain ambient conditions similar to those encountered during factory wet outs.

n. Liners that are impregnated at the factory and transported to the project site in refrigerated trucks shall be installed as soon as possible and no more than two (2) weeks after the date of impregnation at the factory.

o. Shall form a continuous, tight-fitting, hard, impermeable liner that is chemically resistant to any chemicals normally found in domestic sewage per Table 2.1 in ASTM F 1216. CIPP liner shall be chemically resistant to trace amounts of gasoline and other oil products commonly found in municipal sewerage and soils adjacent to sewer pipe to be lined.

p. CIPP liner tube shall be manufactured or fabricated to a size that will tightly fit internal circumference of sewer being rehabilitated after being installed and

cured. CIPP liner shall be capable of fitting into irregularly shaped pipe sections and through bends and dips within the pipeline. Allowance for longitudinal and circumferential expansion shall be considered when sizing and installing CIPP liner. Tube shall be properly sized to diameter of existing pipe and length to be rehabilitated and be able to stretch to fit irregular pipe sections and negotiate bends. Determine minimum tube length necessary to effectively span designated run between manholes. Verify lengths in field prior to ordering and prior to impregnation of tube with resin, to ensure that tube will have sufficient length to extend entire length of the run, which is defined as the length of the existing host pipe measured from the interior walls of the manholes, and/or from the ends of the pipe when/if the pipe extends into the manholes. Measure inside diameter and circumference of existing pipelines at face of each manhole in field prior to ordering liner so that liner can be installed in a tight-fitted condition with little or no wrinkling.

q. Length of CIPP liner shall be as deemed necessary to effectively carry out insertion of CIPP liner and sealing of CIPP liner at outlet and inlet manholes. Required diameter and length of each pipe segment shall be measured in advance of wet-out and a list of these measurements shall be submitted to Authority at least one week prior to installation of each CIPP liner.

r. Installer shall be responsible for ensuring that correct liner is installed in each sewer reach being rehabilitated.

s. All pipes of diameter 8-in and greater shall have a minimum finished thickness of 6mm or as designed, whichever is greater.

t. Verify proposed CIPP liner thicknesses and submit associated calculations. Actual cured liner thickness shall be -5/+10 percent of approved design thickness and shall not include thickness of any non-structural membrane (inner/pre- liner). CIPP liner shall be designed in accordance with applicable provisions of ASTM F 1216 for "fully deteriorated gravity pipe conditions", unless Authority agrees in writing, prior to installation that "partially deteriorated gravity pipe conditions" shall apply based upon review of CCTV video. CIPP liner shall meet following design conditions, unless Authority agrees in writing of their change:

    i. AASHTO H 20 Live Load.

    ii. Constrained soil modulus of native soil in the pipe zone of 1,000 psi.

    iii. Soil weight of 120 pounds per cubic foot and a coefficient of friction of Ku'=0.130r shall be used for the installed depths.

    iv. Long-term flexural modulus used in design calculations shall be estimated by multiplying lowest short-term flexural modulus used in

design calculations by a retention factor of 0.50 (i.e., long-term retention of mechanical properties equal to 50 percent.)

v. Design safety factor of 2.0.

vi. Typical groundwater levels shall be estimated at one half (1/2) the distance between crown of pipe and ground surface. If actual groundwater depth information is available from USGS or other sources, it shall be utilized in calculations. Groundwater depth used in calculations shall be from estimated maximum groundwater level from surface to invert of interior pipe or at elevation specified for in these Standard Specifications.

vii. Service temperature range shall be 40 to 100 degrees F.

viii. Minimum ovality of host pipe of 2 percent.

ix. Long-term retention of mechanical properties equal to 50 percent.

x. Thickness to be used for CIPP liner shall be largest thickness as determined by calculations for deflection, bending, buckling and minimum stiffness.

xi. CIPP liner thickness for non-round pipes or circular pipes with greater than 10 percent ovality shall be designed on accordance with WRC Sewerage Rehabilitation Manual, Type II Design, Section 5.3.2.iii.

xii. Minimum liner thickness after installation and curing for all pipes 8 inches in diameter and larger shall be 6 mm or as designed, whichever is greater. Thicknesses following installation and curing shall be based on design calculations provided by the installer.

xiii. CIPP liner shall provide a minimum service life of 50 years and, fordesign purposes, shall have the following minimum initial and long-term properties:

Property	Test Method	Initial (psi)	Long Term (psi)
Flexural Strength	ASTM D 790	4,500	2,250
Flexural Modulus of ElastiAuthority	ASTM D 790	350,000	175,000

xiv. The CIPP shall be designed to withstand all imposed loads, including dead and live loads and, if applicable, hydrostatic pressure. The liner shall have sufficient wall thickness to withstand all anticipated external pressures and loads that may be imposed after installation.

2. Resin

    a. Resin shall be a corrosion resistant polyester or vinyl ester resin and catalyst system or epoxy and hardener system manufactured specifically for sewer rehabilitation, that, and when properly cured within the tube composite, meets the requirements of ASTM F 1216, ASTM F 1743 or ASTM F 2019 (Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)), the physical properties herein, and those, which are to be utilized in the design of CIPP for this project. Resin shall produce CIPP that will comply with or exceed structural and chemical resistance requirements of this specification. Liner material and resin shall be completely compatible. Generally, resin shall not contain fillers, except those required for viscosity control or fire retardance or increase strength, and with applications for which inert fillers would facilitate better heat transfer and retention during installation. Liner installer may add up to 5 percent by mass, a thixotropic agent for viscosity control, which will not interfere with visual inspection.

    b. Resins may contain pigments, dyes, or colorants, which shall not interfere with visual inspection of cured liner. Quantity of resin used for tube impregnation shall be sufficient to fill volume of air voids in tube with additional allowances for polymerization shrinkage and loss of resin through cracks and irregularities in original pipe wall. Use serial vacuum impregnation or pressure impregnation process (or approved equal) to provide maximum resin impregnation throughout the tube.

3. Styrene Reducing Agent

    a. The styrene reducing agent shall be a gelatin, water soluble, biodegradable, non-toxic, FDA approved powder and/or capsule. The styrene reducing agent shall be added in a calculated amount according to manufacturer's recommendations into the down-tube for water curing or directly into the water holding tank for steam curing.

    b. The styrene reducing agent shall be StyRedux by Integrated Chemical & Equipment Corporation or approved equal.

4. End Seals

    a. End seals shall be composed of hydrophilic rubber and molded as a one-piece, three-inch wide cylinder which when installed will form a 360-degree seal between the host pipe and the newly installed liner. Use of caulking, rope or band type of an end seal shall not be allowed. Acceptable end seals are Insignia™ End Seals by LMK Enterprises or approved equal.

    b. Where manhole rehabilitation is necessary and required, install epoxy at the end of each lined pipe to cover any piece of existing pipe that are exposed at the

manhole wall. Acceptable epoxy resins are Sikadur 31 or approved equal. Where rehabilitation of the manholes is not necessary or feasible, the hydrophilic seals shall provide adequate protection against infiltration.

5. Service Lateral Seals

    a. Service lateral connections shall be sealed. If the sewer is not under the phreatic surface, seal service lateral connection by injecting a chemical hydrophilic grout into the space between the connection and the main line using a remote packer system. If the sewer is under the phreatic surface, seal the service lateral connection by installing a hydrophilic rubber connection seal.

    b. Chemical hydrophilic grout shall be AV-202 Multigrout by Avanti International or approved equal.

    c. Rubber connection seals shall be composed of a hat made of hydrophilic polymeric neoprene rubber designed with a specified wall thickness to provide a compression seal at connection of a lateral and a mainline pipe. Use of caulking, rope or band type of an end seal shall not be allowed.

    d. Acceptable hydrophilic rubber seals are Insignia™ Hydrophilic Connection Hat by LMK Enterprises or approved equal.

6. CIPP Spot Repairs

    a. Install a sectional CIPP spot repair for areas where longitudinal shrinkage of the installed CIPP liner near the manholes is three (3) inches or more, at no cost to the Authority.

    b. For any other longitudinal shrinkage observed within a pipe segment, install a sectional CIPP spot repair.

    c. CIPP spot repair shall be accomplished using a liner tube of a particular length and a thermo-set resin with physical and chemical properties appropriate for the application. The tube positioned within a translucent inversion bladder is vacuum impregnated with the resin, then placed inside a protective launching device and winched through the sewer pipe. The tube shall consist of one or more layers of flexible non-woven needled felt or a reinforced non-woven felt. The tube shall be continuous in length exhibiting a uniform minimum wall thickness based upon design calculations found in ASTM F1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube, appendix XI. No overlapping sections shall be allowed in the circumference or the length of the liner. The tube shall include compressible material at each end forming a smooth transition to the host pipe. The liner shall be capable of conforming to offset joints, bells, and disfigured pipe sections. The resin shall be polyester, vinyl-ester or epoxy with proper catalysts as designed for the specific application. The cured-in-place pipe

shall provide a smooth bore interior. Each installation shall have a design report documenting the design criteria for a fully deteriorated pipe section, or a partially deteriorated pipe in cases where the pipe has previously been lined. The installation procedure shall conform to ASTM F2599-11 "Standard Practice for Sectional Repair of Damaged Pipe by Means of an Inverted Cured-In-Place Liner". The cured-in-place pipe shall meet or exceed the minimum test standards specified by the American Society for Testing Methods as described in the most current ASTM F1216 standard, most current edition. Acceptable CIPP spot repairs are LMK Performance Liner or approved equal.

d. CIPP spot repairs shall be ambient cure and shall have a fiberglass mat consisting of two or more layers of 0/90 degrees bias woven fiberglass with a Trevara felt coating on one side and capable of carrying a two component, 100 percent solid epoxy or silicate base resin. Acceptable fiberglass CIPP spot repairs are Prime Line sectional lining spot repair or approved equal.

C. Installation

1. Delivery, Storage, and Handling

    a. Care shall be taken in shipping, handling, and laying to avoid damaging the CIPP liner. CIPP liner damaged beyond repair in shipment shall be replaced as directed by the Authority.

    b. Any CIPP liner showing a visible split, tear, or defect, shall be repaired per manufacturer's recommendations and to the satisfaction of the Authority or, if not possible, shall be removed at once from the project site.

    c. While stored, CIPP shall be adequately supported and protected in a manner as recommended by manufacturer.

    d. CIPP liner shall be maintained at a proper temperature in refrigerated facilities to prevent premature curing at all times prior to installation. CIPP liner shall be protected from UV light. CIPP liner showing evidence of premature curing will be rejected for use and shall be immediately removed from the site.

2. If available, examine Authority's CCTV video of each pipe segment before starting work.

3. Notify all property owners or businesses that discharge sewage directly to sewer being lined and whose service lateral will be affected by lining work, that their service will be temporarily discontinued during installation of CIPP liner. Deliver written notification to each such resident or business at least 72 hours in advance, giving the date, start time. and estimated completion time for the work being conducted, and any restrictions on use of sewage system facilities including exact days and hours when sewer system cannot be used. Method of notification, and the text included in the notification, shall be approved by the Authority.

4. Clean each length of pipe to be lined and shall dispose of all resulting material offsite as specified in SECTION 4 – CLEANING OF SEWERS.

5. Conduct a pre-rehabilitation CCTV inspection of all sewers to be rehabilitated by CIPP lining methods. Inspection shall be for purpose of identifying defects in pipe, to document location of all service lateral connections, and to confirm point repair locations. The project manager and/or superintendent shall review the pre-rehabilitation inspection videos to confirm the quality of the videos, locations of lateral connections, and locations of point repairs to be performed; only after the video quality is adequate for a clear review of pipeline, shall they be submitted to the Authority. Authority will review pre- rehabilitation inspection videos to confirm locations of point repairs to be performed. If the Authority is on site or immediately available, allow the Authority to view the pre-installation video to verify the pipe is ready for CIPP installation which includes proper cleaning, trimming protruding taps and mitigating and significant infiltration.

6. If the data is available, Authority will provide information on location of known active laterals and cleanouts; however, this list may not be interpreted as all-inclusive. Installer shall be responsible for verifying active customer service connection prior to rehabilitation. Compare service connections from CCTV video with the above ground measurements at approximate location of center of each house or building. Any discrepancies between CCTV data and above ground measurements of laterals shall be brought to attention of the Authority for a determination of lateral reinstatements. If an error is discovered or an addition to the list provided, immediately notify Authority for additional investigation. Upon completion of rehabilitation work, a list of all service laterals abandoned or reconnected as part of the work shall be submitted to Authority. Compiled list can be in the form of post-inspection installation inspection logs and shall include the following information:

    a. Location of each service lateral based on CCTV inspection logs. Location shall include both accurate distance measured from centerline of starting manhole as well as a notation (by clock-reference) of where on circumference of pipe, the service lateral connects.

    b. Status (Active or Inactive).

    c. Address of each customer and associated active lateral location.

7. During pre-rehabilitation CCTV inspection and prior to installation of CIPP lining, all service lateral connections protruding into main line by 1/2-inch or more shall be internally cut or ground down flush with pipe wall with a robotic cutter specifically designed for this purpose. Internal cutter shall be capable of cutting unreinforced concrete pipe (CP), cast iron pipe, PVC, vitrified clay pipe (VCP), ductile iron pipe, and Orangeburg pipe. All materials / cuttings shall be removed from sewer and properly disposed of.

8. Infiltration runners or gushers as defined by NASSCO PACP that are observed during the pre- rehabilitation CCTV shall be stopped by injecting a chemical hydrophilic grout as required using a remote packer, unless otherwise approved by the Authority. If the pipe is larger than 36 inches, man-entry with hand-applied fast-setting epoxy can be performed to stop the infiltration.

9. Maximum amount of time any home or business shall be without sanitary sewer service is 10 hours and not between 6:00 PM and 8:00 AM. Any service out longer than 10 hours shall be bypassed to a sanitary sewer at no cost to Authority.

10. Provide bypass pumping of sewage flows to accommodate the work. Service connection effluent may be plugged only after proper notification to affected residence and may not remain plugged overnight. Installation of liner shall not begin until the required plugs or a sewage by-pass system have been installed and all pumping facilities have been tested under full operating conditions, including bypass of mainline and side sewer flows. Once lining process has begun, existing sewage flows shall be maintained, until resin/felt tube composite is fully cured, cooled down, fully televised and CIPP ends finished.

11. Wastewater flows from existing sewers shall not be allowed to enter the new or rehabilitated facilities until the new or rehabilitated facilities have been cleaned and tested as required in these Standard Specifications.

12. Provide CIPP liner in full length of sewer as shown on work orders. Installation of CIPP liner shall be in complete accordance with applicable provisions of ASTM F 1216 or ASTM F 1743 and manufacturer's recommendations.

13. Install a hydrophilic end seal at face of each manhole at all manhole penetrations prior to inverting or pulling in uncured CIPP liner.

14. If in the opinion of CIPP liner manufacturer and/or the Authority, rate of infiltration in sewer segment is high enough to risk washout of resin, perform measures, as required, to minimize infiltration prior to installation, including pre-liners, grouting, etc. If during pre- lining CCTV inspection, any infiltration runners, or gushers (per NASSCO PACP®) are observed, submit in writing for approval by Authority the methods and materials for mitigating any adverse impacts from the infiltration.

15. Pressure gauges for the ends shall be digital pressure/vacuum gauges with a pressure range of 0 to 50 psi and ±0.25% test gauge accuracy.

16. For pipes 18-in diameter and larger, install and use continuous temperature sensor strips. Provide the Owner's representative with access to the longitudinal temperature monitoring system data during the installation via digital data, web-based or other approved methodology and printed reports.

17. CIPP liner shall be installed via inversion using hydrostatic head or air pressure in accordance with ASTM F 1216 or ASTM F 1743 and manufacturer's recommendations or

inserted through a manhole by means and methods required by the manufacturer. Hydrostatic head and/or steam pressure used during installation process shall be sufficient to hold liner tight to pipe wall, producing dimples at all service connections, and flared ends at two access manholes. Closely follow the requirements in the submitted liner field curing reports, including the minimum inversion pressure, ideal head, maximum hot head, and maximum cold head for each installation.

18. If CIPP does not fit tightly against original pipe at its termination points, at no additional cost to the Authority, the full circumference of CIPP exiting host pipe shall be filled with a resin mixture compatible with CIPP, approved by CIPP manufacturer and Authority. There shall be no significant leakage of groundwater between existing pipe and CIPP at manhole connection or service lateral connections. Any leakage shall be removed and/or eliminated at no additional expense to Authority. Any infiltration found at manhole and/or service connections shall be eliminated by no additional expense to Authority. Any infiltration runners or gushers as defined by NASSCO PACP shall be stopped with chemical hydrophilic grouting.

19. Fit heat source with monitors to accurately gauge temperature of incoming and outgoing water or steam supply. Place another such gauge between CIPP liner and pipe invert at downstream end to determine temperature during curing process. Temperature in CIPP during curing process shall be as recommended by resin manufacturer. Length of time for allowing curing process to be completed shall be of duration recommended by manufacturer, during which time the installer shall maintain required temperature throughout CIPP. Provide a written temperature data chart/curing log to Authority's Representative for review to ensure that curing temperatures for resin meet manufacturer's recommendations.

20. The full length from manhole to manhole of the installed resin-impregnated flexible felt tube CIPP liner shall be cured using circulating heated water or steam in accordance with ASTM F 1216 and manufacturer's recommendations or with UV light sources to affect desired cure throughout length of the tube, extending full length from manhole to manhole(s). Resin shall be cured into a rigid, impermeable pipe with minimum specified thickness, providing a structurally sound, uniformly smooth interior and tight-fitting liner within existing pipe. Cool-down procedures shall be in accordance with ASTM F 1216 and manufacturer's recommendations. The cool-down shall follow manufacturer's guidelines, be measured digitally to allow inspector to inspect or record, be linear, and be gradual; no super cooled air shall be allowed to be injected. UV cured CIPP shall not be permitted without written approval from Authority and after documentation has been reviewed that liner is compatible with all specifications and other related work including any lateral lining systems.

21. For pull-in-place liners cured by UV light (ASTM F2019)

    a. Fiberglass liner shall be cured with UV light sources at a constant inner pressure sufficient to maintain the liner tight against the existing wall of the pipe.

b. The time, the rate of travel of the ultraviolet light assembly, light sources and the internal pressures shall all be recorded and as specified by the liner manufacturer. This segment curing data shall be submitted to the Authority, along with the manufacturer's curing standards.

22. CIPP lining may be installed in multiple sewer segments at one time where possible. When installing CIPP lining in multiple sewer segments at one time, the top one-half of CIPP liner in intermediate manhole shall be neatly removed, leaving the invert in place, and void between CIPP liner and existing channel shall be filled with non-shrink grout. Manhole bench shall be reconstructed as required to provide a smooth transition to new CIPP liner.

23. All cutting and sealing of CIPP liner at manhole connections shall provide watertight pipe and manhole seals. All cut edges of cured liner shall be thoroughly sealed with same resin as was used in liner. Catalyst or hardener used shall be compatible with resin/catalyst used in liner previously but shall not require an external heat source to begin exothermic reaction (curing). There shall be no leakage of groundwater into manhole between CIPP liner and existing sewer pipe and between existing sewer pipe and manhole wall.

24. Continuous temperature monitoring systems are required for all 18 inches or larger sewer or any sized sewer in locations with significant known groundwater infiltration or if pipe is within 50 feet of stream, river or lake for liners being cured by heated water or steam. This system shall be installed at the invert of pipe and be installed per manufacturers recommended procedures. Temperature sensors shall be placed at upstream and downstream ends of reach being lined to monitor pressurized fluid's (air or water) temperature during curing process. To monitor temperatures inside tube, wall and to verify proper curing, temperature sensors shall be placed between host pipe and liner in bottom of host pipe (invert) throughout the reach to record the heating and cooling that takes place on the outside of liner during processing. As a minimum, sensors shall be spaced apart at intervals no greater than 20 feet for pipe sizes up to 15 inches in diameter; and no greater than 10 feet for pipe sizes 18 inches and larger. Additionally, sensors shall be strategically placed at points where a significant heat sink is likely to be anticipated. Monitoring of these sensors shall be by a computer that can record temperatures at this interface throughout processing of CIPP utilizing a tamper-proof database. Temperature monitoring systems shall be Zia Systems or Vericure by Pipeline Renewal Technologies.

25. Pipes smaller than 18 inches may be monitored with thermocouples at the upstream and downstream manholes.

26. Prior to installing liner in host pipe, temperature monitoring system's proper functioning shall be confirmed by hooking it up to computer and seeing that sensors are reporting their ambient temperatures. No more than two sensors in sequence can be found faulty during this test. If three or more sensors in sequence are discovered faulty, a new sensor array shall be provided and installed at no extra cost to the Authority; and the new array shall be again tested for its proper functioning.

27. Curing of resin system shall be as per recommendations of CIPP system manufacturer of CIPP product. Temperatures achieved and duration of holding the liner at those temperatures shall be per System Manufacturer's established procedures. If any sensor or sensors along reach indicates that there is a localized issue with respect to achieving proper curing per written installation procedure, the installer shall address the issue prior to acceptance of the liner. Sensor array's database required in above paragraphs shall have an output report that identifies each sensor by its station in reach and shows maximum temperature achieved during processing of CIPP and time sustained at or above Manufacturer's required curing temperature at each sensor. The temperature of the liner shall be recorded until the liner has completed the cool-down process.

28. If cool-down is to be accomplished by introduction of cool water into an inversion standpipe to replace water being drained from a small hole made in downstream end, the hardened liner shall be cooled down to a temperature below 100 degrees F (38 degrees C), or ambient temperature, whichever is smaller, before relieving static head in inversion standpipe. Take measures to ensure that, in release of static head, a vacuum will not be produced that could damage the newly installed CIPP liner.

29. Incorporate mitigation measures to control styrene odors during installation and curing of the liner. If any styrene odor complaints occur on the jobsite, means and methods shall be provided to immediately mitigate the issue at no additional expense to the Authority.

30. Vent and/or exhaust noxious fumes or odors generated during and remaining after curing process is completed. This process shall remain in place at all manholes, laterals, etc., until noxious odors have dissipated to an acceptable level in accordance with OSHA requirements for materials used and there is no more air pollution or potential health hazard left to general public or construction workers.

31. Identify points to which curing water can be discharged. At no point shall curing water be discharged to a storm sewer system.

32. Provide piping, pumps, valves, and other equipment to discharge curing water.

33. After the installation of the first 1,000 linear feet of CIPP lining, no additional CIPP lining shall be installed until acceptance testing demonstrates that the product meets all thickness and strength properties specified herein. Once the Authority has reviewed and approved the test results, the remainder of the lining installation may resume.

D. Reinstatement of Service Lines

1. After new CIPP has been cured and completely cooled down, if applicable, reconnect existing service laterals as designated by pre-installation television inspection report. This shall be done without excavation but from interior of pipeline by means of a television camera and a remote cutting device that reestablishes service connection to not less than 95 percent or better of original diameter and to a maximum of 100 percent of original diameter; overcut connections are not acceptable. All openings shall be clean

and neatly cut and the cut shall be buffed with a wire brush to remove rough edges and provide a smooth finish. Bottom of openings shall be flush with bottom of lateral pipe and shall have smooth edges with no protruding material capable of hindering flow or catching debris. All service lateral connections shall be sealed per the requirements of this specification.

2. Coupons shall be removed from laterals by any means possible including flushing water into yard cleanouts and, with approval of the homeowner, entering homes to flush the material via access from cleanout or other sewer drainage points.

3. Excess resin that builds up and hardens in and around the lateral connections(s) must be removed and/or ground down prior to acceptance of the re-instatement. Supply an extended lateral cutter bit to reach resin buildup beyond standard length bits.

4. If necessary, because of uncertainty of matching each tap in the sewer with each property, perform a dye test to verify if a service connection is active at the direction of the Authority.

5. Service laterals that were determined to be inactive during CCTV inspection will be abandoned by not reopening service connection after installation of cured-in-place pipe liner. All lateral connections shall be identified as repaired or abandoned in post rehabilitation CCTV. Provide an image file for all lateral locations along a given pipe segment, even if lateral connection has been abandoned.

6. Do not open abandoned/capped service connections except at Authority's direction. If an abandoned service connection is opened without Authority's approval, an internal spot repair shall be performed to close connection, at no additional expense to the Authority.

7. Provide a fully operational backup device for reinstating service laterals. If for any reason remote cutting device fails during reinstatement of a service lateral, immediately deploy the standby device to complete reinstatement. Backup equipment shall be onsite throughout reinstatement process.

8. For service lateral reconnections and/or renewals to be made by excavation methods, InsertaTees may be used for solid wall pipes having a 0.36-inch or greater wall thickness. InsertaTees shall be "Fatboy" type with hub manufactured of SDR 26 PVC material incorporating a 360-degree integral stop on the hub surface and exceeding ASTM F1336 Section 10.3 Pipe Stop Load Support Test or approved equal. Romac type saddles shall be used for pipes having a wall thickness thinner than 0.36-inches. Saddle connections shall be seated and sealed to new CIPP using grout or resin compatible with the CIPP.

9. All existing break-in and/or hammer-tap (break-in) laterals shall be cut and sealed to provide a watertight connection between the lateral and the lined pipe. The method for cutting and sealing of each lateral shall be submitted to the Authority for approval.

E. Testing and Inspection

1. CIPP lining placed shall be guaranteed by the installer and manufacturer for a period of two years from Substantial Completion. During this period, serious defects discovered in CIPP lining, as determined by Authority and which may materially affect the integrity, strength, function and/or operation of pipe, shall be removed and replaced as recommended by the manufacturer in a satisfactory manner at no expense to Authority. Authority may conduct an independent CCTV inspection, at its own expense, of CIPP lining work prior to completion of warranty period. Defects replaced at that time shall be fully warranted by the installer and manufacturer for a period of two years from date the defect was repaired. Wrinkles in flow stream, blisters that may affect the longevity of CIPP liner, dry spots where liner tube has no resin saturation, or other defects that may affect the integrity or strength of the CIPP or the flow capaAuthority of the pipe, are unacceptable. Installer shall be responsible to remove and repair, at no expense to the Authority, all such defects in a manner that is satisfactory to Authority. Defects also include but not limited to the following:

    a. Leakage through the liner or between liner and host pipe.

    b. Reduction of liner thickness of more than 10 percent of the thickness designed and/or required. Final liner thickness shall be delivered based on installed product physical properties and as specified in these Standard Specifications.

    c. Separation of liner from host pipe where an annular space is clearly noticed, shrinkages (longitudinal and/or circumferential), dry spots, delamination of liner, cured lifts, dry spots, bulges due to external loading, reverse curvatures, splits, cracks, lifts, breaks, folds, major wrinkles (as defined further herein), flats, pinholes, crazing and any other defects that in the CIPP lining will compromise the longevity of the installed product.

    d. Circumferential defects (wrinkle, fin, bulge, etc.) in the invert of pipe between 4:00 and 8:00 o'clock shall not exceed three percent of the host pipe diameter or 1/2-inch by visual measurement, whichever is smaller, at the discretion of the Authority.

    e. Longitudinal wrinkles or fins shall not exceed maximum allowable height of five percent of equivalent host pipe diameter or 1-inch, whichever is smaller.

    f. Structural strength below the required limits

2. CIPP linings shall follow the quality control plan submitted to the Authority.

3. CIPP linings shall be from a single manufacturer. Suppliers shall be responsible for provisions of all test requirements specified herein as applicable. In addition, CIPP lining to be installed under this specification may be inspected at the plant for compliance with these specifications by an independent testing laboratory provided by Authority. The installer shall require manufacturer's cooperation with these inspections.

Cost of plant inspection of all CIPP lining approved will be the responsibility of Authority.

4. Inspections of CIPP lining may also be made by the Authority or other representatives after delivery. CIPP lining shall be subject to rejection at any time on account of failure to meet any of the requirements specified, even though sample CIPP lining may have been accepted as satisfactory at the place of manufacture. CIPP lining rejected after delivery shall be marked for identification and shall be removed from the job site.

5. Field acceptance of CIPP lining shall be based on Authority's evaluation of installation, including a review of the CIPP liner curing data, review of post-rehabilitation CCTV inspection data, and review of certified test data for installed CIPP liner, including air testing. All CIPP sample testing, and repairs to installed CIPP as applicable, shall be completed before final acceptance, meeting requirements of these specifications and documented in written form.

6. In the event that an installation is rejected based on review of the post-rehabilitation CCTV inspection, the sewer segment shall be repaired to the satisfaction of the Authority at no additional expense to the Authority.

7. For every 1,000 linear feet of CIPP liner installed for the first 5,000 linear feet, sampling and testing shall be performed to determine the installed CIPP liner flexural properties and CIPP liner thickness. After the first five test results have been collected and all have passed the minimum standards per the specification, the Authority may require collecting random samples up to one sample per 5,000 linear feet for testing. Frequency of testing may be reduced as approved by Authority after sufficient tests are performed to verify CIPP liner design, production, and installation procedures. Likewise, frequency of testing may be increased by Authority and performed at no additional expense to Authority when required tests show that installed CIPP liner does not meet specifications. If a test is not passed, the installer shall re- evaluate liner thickness design to determine if installed physical properties meet minimum design requirements; if it does not, liner shall be replaced or relined with approval from Authority at no additional expense to Authority.

8. Testing shall be performed by an independent testing laboratory certified by the American Association for Laboratory Accreditation (A2LA). Submit to the Authority the name and location of independent testing laboratory, a certified statement from laboratory indicating that they are independent from and not associated with the installer in any way, and A2lA certification for independent testing laboratory.

9. All expenses for sampling and testing of installed liner shall be paid for the installation contractor. Cost of all manufacturer's testing to qualify products furnished to project site shall also be the responsibility of the installer.

10. Sampling and testing of the installed CIPP liner shall conform to ASTM F 1216 and the following requirements:

a. Remove one restrained sample of installed CIPP liner at least 18-inches in length. Sample shall be captured by installing CIPP liner through a section of PVC pipe (same diameter as existing sewer diameter) within the most downstream manhole of installation and at all intermediate manholes if multiple sewer segments are lined at same time. The installer may elect to cut the sample longitudinally and provide 1/2 the sample to Authority's representative or inspector for direct shipping to laboratory and keep other half of sample for additional testing if necessary.

b. CIPP liner thickness shall be measured in accordance with ASTM D 5813. Flexural properties shall be determined in accordance with ASTM D 790. Label and date all samples and provide to inspector or Authority's representative same day of installation for shipping to independent testing laboratory. Authority shall be copied on all transmittals to independent testing laboratory. Testing results shall be submitted to the Authority within 30 days after installation of CIPP liner.

c. Any CIPP lining that does not meet new calculated thickness requirements shall be corrected in a manner approved by the Authority at no additional expense to Authority. Authority's decision on how to correct deficient CIPP liner installations shall be final. Options for correcting deficient CIPP liner installations that will be considered by Authority include the following: removal of existing CIPP liner and re-lining the sewer, open-cut replacement of sewer from manhole to manhole, re-lining sewer with existing CIPP liner in place, or accept a deduct from the total work value.

11. Along with the physical properties testing and post installation CCTV survey, deliver a certified copy of the curing report output from the temperature monitoring system used in the control of the curing process for pipes; or provide the Authority with access to the website where the secure report can be obtained.

12. Perform a post-rehabilitation CCTV inspection of all sewers rehabilitated using CIPP lining methods. Post-rehabilitation CCTV inspection shall be performed following installation of CIPP liner and reinstatement of all active service laterals. The installer's project manager and/or superintendent shall review the post-rehabilitation inspection videos to confirm the quality of the videos and of the installed CIPP; only after the video is confirmed to be of good quality, the videos shall be submitted to the Authority. If it is determined that any repairs are needed at any segment, a new CCTV inspection shall be performed of the entire segment(s) after the repairs have been completed.

13. Liner Installation Inspection - A visual inspection of the liner will be considered acceptable if liner shows no significant, wrinkles, lifts, ridges, splits, cracks, delamination, flats, dry spots, pinholes, shrinkage, foreign inclusions, crazing, reverse curvatures, or other type of defects in the CIPP lining. Significant defects as defined in this section; and/or any defect that may create a maintenance issue in future such as inhibiting CCTV cameras or allowing solids to get caught on defect, and/or any defect that appears to reduce long-term structural strength or stability of pipeline. Longitudinal

wrinkles/fins in height up to a maximum of five percent of inside diameter of host pipe or 1-inch, whichever is smaller, may be acceptable and shall be evaluated by the Authority for acceptance on a case-by-case basis. Defective lining shall be repaired or replaced at no additional expense to Authority. If during removal process, the pipe is damaged, perform a point repair at no additional expense to the Authority.

14. Post CCTV Video Inspection: Submit a digital CCTV of post-lined sewer within seven business days for each pipe segment. Authority shall review these post-lining videos and approve the installation based upon satisfactory completion of a liner that is free of significant defects.

    a. Removal of wrinkles or fins deemed significant at the discretion of the Authority, shall be removed using a milling head, relined, or replaced as directed by the Authority at no additional expense to the Authority. There shall be no evidence of other major defects in the CIPP lining.

    b. Longitudinal shrinkage of the CIPP liner's length, of more than three (3) inches from the face of the manhole shall be repaired with a fiberglass reinforced CIPP spot repair at no cost to the Authority.

    c. Circular shrinkage shall be measured via man entry to try to insert a 1/16" thick ruler or similar into any gap more than 8 inches past the MH wall. Document these measurements with digital photos that shall be submitted to the Authority for approval. Circular shrinkage shall be repaired per manufacturer recommendations at no expense to the Authority.

15. The CIPP liner shall be watertight. Groundwater infiltration through the wall of the liner shall be zero.

16. All service connections shall be opened to a minimum of 95 percent and a maximum of 100 percent of opening so that a new lateral or lateral lining can be installed properly. Any overcuts more than 105 percent shall be repaired with hydrophilic seal hat connection, CIPP liner or other approved method by the Authority.

17. All coupons and excess resin shall be removed from reinstated service laterals prior to acceptance of CIPP lining.

18. All pipe-to-manhole connections shall be watertight and free of infiltration.

19. When CIPP is installed using pressurized air, perform an air-test per SECTION 2 – GRAVITY SEWERS, in presence of Authority's representative immediately following cool down and prior to lateral reinstatement. Otherwise, hydrostatic testing (exfiltration test) of completed liner shall be performed after liner curing and cool down in accordance with ASTM F 1216. Hydrostatic testing shall be performed prior to reinstatement of active services.

20. CIPP liners installed with water inversion methods shall be tested for water tightness using an exfiltration test. Maximum allowable leakage shall be 50 gallons per day per diameter inch of pipe per mile in accordance with ASTM F 1216.

21. After all installations are complete, inspected, post-construction CCTV has been reviewed and approved by the Authority, and all work is satisfactory to Authority, cut and trim the new liner at each manhole wall with a minimum 4-inch reveal to maintain a mechanical lock of the liner to the manhole. Seal liner to manhole wall with a sealant material.

END OF SECTION

Section 6
Sanitary Sewer Laterals

A. General

1. A sanitary sewer lateral is that section of a sanitary sewer that extends from the main sewer to a point 12 inches beyond the right-of-way, curb or sidewalk (or termination point as approved by the Engineer) in front of the property which it serves (refer to Detail 5 – Lateral Connection).

2. Each improved property shall have its own sanitary sewer lateral. Each side of a duplex, or each townhouse unit shall have its own sewer lateral. Buildings incorporating multiple condominium units may be served by one sanitary sewer lateral, similar to an apartment building sewer service.

3. Permits

   The Applicant shall secure, in the name of the Authority, all permits that are required from the Pennsylvania Department of Environmental Protection (PADEP), Conrail and the Pennsylvania Department of Transportation (PennDOT). The Applicant shall secure, in his own name, all required construction permits such as highway or local street opening permits. Any existing street, highway or other improvements disturbed during construction shall be restored to the satisfaction of the appropriate municipality or Owner before the facilities will be accepted for final acceptance by the Authority. All costs of such permits, including any and all bonds required, shall be the sole expense of the Applicant.

4. Disconnection of Sewer Laterals

   Disconnection of a sewer lateral shall be done at the sewer main. The 45° bend and the lateral pipe shall be removed and a cap installed on the sanitary tee on the main line. After the cap has been installed, concrete shall be poured over the sanitary tee and cap to prevent future connections at that point. If it is not possible to remove the lateral pipe, and at the discretion of the Engineer, the pipe may be filled with AASHTO 8 (PennDOT 1B) stone, sand or flowable fill to prevent future use.

5. Prior to installing a new lateral on an existing sanitary sewer main, the Applicant shall request the Engineer to determine whether or not the existing sanitary sewer main has been lined (rehabilitated). The method of construction for the lateral connection shall be determined on the basis of whether or not the existing sanitary sewer main has been lined.

B. Design Criteria

Fittings (sanitary tees, risers and bends) and sewer lateral pipe shall be furnished and installed in strict accordance with these specifications and any and all practices and precautions required for the main gravity sewers are equally applicable to the sewer laterals.

1. Diameter and Slope

   Sewer laterals shall be designed so that all units shall be served by a minimum 6-inch sewer lateral. Laterals shall be installed with a minimum 1% slope and shall include a watertight cap or stopper. All sanitary tees shall be set in accordance with the detail drawings using 6-inch bends. The invert elevation of the 6-inch service lateral at the 45° bend shall be the same as the elevation of the crown of the main.

2. Depth and Alignment

   All laterals shall be provided with a minimum cover of 3'-6". Laterals shall be constructed, generally, perpendicular to the sanitary sewer main. Laterals shall only be constructed at an angle other than perpendicular to the main when no other reasonable alternative exists, and/or at the discretion and approval of the Authority's Engineer.

3. Separation of Utilities

   The Authority's interpretation of the PADEP requirements for 10-foot horizontal and 18-inch vertical separation distances between sewerage and water utilities is as follows:

   a. Parallel Installation

      A minimum 10-foot horizontal separation (measured from edge of pipe to edge of pipe) between sanitary sewer lines and water lines shall be required when the lines are constructed parallel (relatively) to one another. When this condition cannot be met, concrete encasement of the sanitary sewer line shall be required for the length of line that fails to meet the 10-foot separation distance requirement, at the discretion of the Authority's Engineer. However, under no conditions shall the horizontal separation distance between sewer and water lines be less than 6 feet.

   b. Line Crossings

      A minimum 18-inch vertical separation between the top of the sanitary sewer line and the bottom of the water line shall be required when the lines cross one another. When this separation cannot be met, concrete encasement of the sanitary sewer line shall be required for a minimum

distance of 10-feet on either side of the point of crossing, and/or until the minimum 10-foot separation distance requirement is met (depending on the angle of crossing).

Where a water main crosses below a sewer main, structural support must be provided for the sewer main to prevent any damage to the water main.

These requirements shall apply to laterals (both water and sewer) as well as main line construction.

5. Sewer laterals shall not be connected to manholes unless approved by Engineer.

C. Materials and Equipment

1. Gravity Sewer Laterals

   a. Ductile Iron Pipe and Fittings

      Refer to Section 2 – Gravity Sewers for these requirements.

   b. Polyvinyl Chloride Sewer Pipe and Fittings

      Refer to Section 2 – Gravity Sewers for these requirements.

   c. Alternative Gravity Sewer Pipe Materials

      Alternative gravity sewer pipe materials may be considered and will be subject to approval by the Authority on a case-by-case basis. Full details of alternatives must be submitted.

2. Low-Pressure Sewer Laterals

   Refer to Section 9 – Low-Pressure Sewers for these requirements.

3. Sanitary Tees for Connection to Main Line

   Sanitary tees shall conform to the pipe materials specifications above.

4. Lateral Connections to Existing Sanitary Sewer Lines

   a. Saddles used to connect laterals to existing PVC sanitary sewer lines shall be molded tees, gasket branch and gasket skirt and shall have two stainless steel straps. Saddle tees installed on PVC pipe shall be solvent-weld type saddles by GPK Products, Inc. or approved equal.

   b. Saddle tees installed on terra cotta or asbestos cement (transite) pipe shall be by Romac Industries, Inc. or equal.

D. Installation

1. General

   Where a sanitary wye/tee already exists in the sewer main, refer to Section 2 – Gravity Sewers for these requirements. Section 2 also applies after a new wye/tee has been installed. Where no sanitary wye/tee is present in an existing sewer line and a new wye/tee must be installed, lateral connections shall be made as follows:

   a. PVC Pipe

      Lateral connections shall be made with a saddle type connection. The hole for this saddle must be carefully cut into the existing line, making sure that the cut-out piece is not dropped into the pipe. All saddles shall be securely fastened to the existing line with two stainless steel straps, one on each side of the opening in the pipe. In addition, saddles installed on PVC pipe shall be glued per the manufacturer's recommendations. A bead of silicone caulk shall be used to seal the saddle at the interface with the existing sewer main. Under no circumstances should any inserted pipe protrude into the sewer main.

   b. Ductile Iron Gravity Sewer Main

      Lateral connections to existing ductile iron gravity sewer main shall be made by cutting out a small section of the main and installing a ductile iron tee. The tee shall be secured to the main by attaching the bell ends of the tee to the main line on one side and a short section of pipe on the other side. The short section of pipe shall be secured to the main using a Dresser style repair coupling or approved equal.

2. Excavation

   Trench excavation, in any material, shall extend four (4) feet beyond the end of the lateral for the full depth of the lateral. If the lateral is intended to be used at a later date, then prior to backfilling, a minimum 2-inch x 4-inch treated lumber locator marker shall be placed against the end of the lateral and shall extend a minimum of 12 inches above finished grade.

   Refer to Section 2 – Gravity Sewers for other requirements.

3. Bedding

   Refer to Section 2 – Gravity Sewers for these requirements.

4. Laying Pipe

Refer to Section 2 – Gravity Sewers for these requirements.

5. Backfilling

   Refer to Section 2 – Gravity Sewers for these requirements.

6. Surface Restoration

   Refer to Section 2 – Gravity Sewers for these requirements.

E. Testing and Inspection

1. Lateral connections which are constructed as part of new sanitary sewer installations shall be tested and inspected as described in Section 2 – Gravity Sewers.

2. Lateral connections to existing sanitary sewer lines shall be visually inspected prior to backfilling. Laterals shall be inspected for alignment, depth, slope, and for fittings and pipe material used.

F. Detail Drawings

Relevant detail drawings are:

1 Right-of-Way Restoration

2 Concrete Encasement

3 Pavement Restoration

4 Lateral Connection

4a Standard Lateral or Service Line Cleanout

5 Lateral Connection Riser

13 Typical Low-Pressure Lateral Connection to Low-Pressure Main or Force Main

END OF SECTION

Section 7
Service Lines

A. General

1. A service line is that portion of a sanitary sewer line that extends from the outer building wall or foundation wall to its connection with the sewer lateral at the easement or right-of-way boundary.

2. Each improved property shall have its own individual service line. Each side of a duplex and each townhouse unit shall be considered a separate property requiring individual sewer connections.

3. Where premises in single ownership consist of more than one building, the Authority reserves the right to determine, under the circumstances of each case, whether each separate building must have its own individual sewer connection or whether all buildings together may use a single connection.

4. For non-residential connections the Authority may require a wastewater flow meter and/or monitoring manhole to be installed for billing or water quality monitoring purposes.

5. Maintenance and Repair of Service Lines:

   All service lines shall be maintained and repaired by the Owner at the expense of the Owner of the improved property. Such repairs shall be subject to the approval and inspection of the Authority.

6. Inspection of Premises:

   The Authority, by its agents and employees, shall have the right at all reasonable times to enter any premises connected to or about to be connected to the sewer system in order to enforce compliance with these Rules and Regulations.

7. Existing Service Lines:

   Existing service lines may be used provided they have been inspected by the Authority and found to be reasonably true to grade and alignment, in good condition for the purpose of conveying sanitary sewage or industrial wastes and have tight joints of approved materials. The integrity of the existing line shall be determined by performing the air test described in paragraph E – Testing and Inspection of this section. If the existing line does not conform to these requirements, the problem shall be corrected, or a new line shall be laid at the expense of the property owner in accordance with the specifications contained herein. All testing required by the Authority shall be at the expense of the Owner.

8. Supervision and Inspection:

   The construction of service lines shall at all times be subject to the supervision and inspection of the Authority or its authorized representative and shall conform to the Authority's specifications. No service connections shall be covered or backfilled until authorized by the Authority to do so.

9. The Authority will not be responsible for any damage that may result from basements being flooded by a blockage in the service line. Basement floor drains and sump pumps that collect groundwater or surface water shall not be connected to the sewer system.

10. Special Conditions and Requirements

    a. Construction of a service line under a paved driveway is discouraged and should be avoided whenever possible. However, when this condition is unavoidable and the service line is to be placed under a drive or other roadway and the depth is less than four feet (4'), the line shall be constructed of ductile iron pipe or as the Authority may direct.

    b. Service lines for all service stations, garages or other establishments storing, using or dispensing gasoline, kerosene, benzene or similar solvents shall be constructed of ductile iron pipe with chemically resistant joints.

    c. Grease and Sediment Interceptors

       1. No hotel, restaurant, hospital, school, bed and breakfast or other public eating establishment shall connect to the sewer system without first installing a grease interceptor on the service line from the kitchen area. The location of the interceptor shall be approved by the Authority. Sanitary waste shall be kept separate from the kitchen waste and shall not enter the interceptor. The interceptor shall be of double compartment design and shall be sized in accordance with the guidelines of the USEPA "Design Manual – Onsite Wastewater Treatment and Disposal System" October 1980 Edition. The design shall be submitted to the Authority for review and approval.

       2. No service station, garage, factory building or commercial establishment which handles oils, petroleum or similar products, or which washes cars, trucks or other types of machinery, shall connect to the sewer system without first installing grease and grit traps, of a size and type approved by the Authority, on the service line at a location approved by the Authority.

B. Design Criteria

1. Diameter and Slope

   The internal diameter of the pipe shall be a minimum of 4 inches. All service lines shall be installed with a minimum grade of two percent. Pipes shall be laid in straight lines.

2. Depth of Sewers

   A minimum cover of three and a half feet shall be maintained to prevent crushing and freezing. Any exceptions to this requirement must be approved by the Authority on a case-by-case basis.

3. Placement of Sewers

   Sewer and water service lines shall be spaced 6 feet apart horizontally. If this separation cannot be met, the service lines may be spaced a minimum of 3 feet apart, provided that the lines are installed with the bottom of the water service line above the top of the sewer service line for the entire length of the lines.

4. Cleanouts

   Cleanouts shall be provided in each service line at intervals not greater than 75 feet and at all horizontal bends of 45° or greater in the line to permit complete rodding of the service line. If a cleanout has not been provided inside the house, then a cleanout will be required within 5 feet outside the foundation wall. Cleanouts shall be constructed using a wye fitting in the run of the pipe with a 45° bend and risers to the ground surface. The riser shall be provided with a standard four inch (4") screw type ferrule and shall be installed a minimum of 4 inches above grade.

5. Traps

   An intercepting trap shall be placed outside the right-of-way and driveway, between the curb line (or sidewalk) and the building. The trap shall be a cast iron or PVC single running trap with vent. The riser and vent shall be on the building side of the trap. Unless otherwise authorized by the Authority, the top of the vent shall be a minimum of 4-inches above the ground and shall have a cowl type vent to prevent surface water from entering the service line, and shall be located in an area not subject to flooding or ponding.

C. Materials and Equipment

1. Gravity Service Lines

   a. Ductile Iron Pipe and Fittings

Refer to Section 2 – Gravity Sewers for these requirements.

b. Polyvinyl Chloride Pipe and Fittings

Four-inch gravity service lines shall be Schedule 40 PVC conforming to ASTM D1785. Six-inch and larger gravity service lines shall be SDR 35 PVC as specified in Section 2 – Gravity Sewers.

2. Low-Pressure Service Lines

Refer to Section 9 – Low-Pressure Sewers for these requirements.

3. Jointing materials for the various types of pipe shall be as follows:

a. Cast Iron Pipe shall have approved pre-molded rubber joints made with bell and spigot ends. Portland cement joints will not be permitted.

b. SDR 35 PVC pipe (6 inches or larger) shall have joints of O-ring gaskets, or an O-ring adapter manufactured of rubber, and shall be installed in accordance with the manufacturer's recommendations.

c. Schedule 40 PVC pipe (4 inches or smaller) shall have either:

(1) joints of O-ring gaskets per ASTM D3212 installed in accordance with the manufacturer's recommendations; or

(2) glued joints per ASTM D2672. Pipe ends shall be cleaned, deburred, primed, glued and installed in accordance with the manufacturer's recommendations.

4. Flexible Coupling

Flexible couplings composed of elastomeric PVC shall conform to ASTM C443, C425, C564 and D1869 as manufactured by Fernco, Inc. Each coupling shall be supplied with two Type 305 stainless steel adjustable clamps.

D. Installation

1. General

a. The portion of the service line which runs through building or foundation walls shall pass through a 5' cast iron or steel wall sleeve. The sleeve shall be two pipe sizes larger than the service line.

b. A straight horizontal alignment shall be maintained where possible. When conditions exist that require the use of bends (ell fittings) in the line, the following shall apply:

(1) It shall be incumbent on the Contractor to contact the inspector prior to excavation to discuss the proposed route of the service line and the use of bends in the line.

(2) Measures shall be taken by the Contractor to minimize the number of bends and/or directional changes in the service line.

(3) The existence of rock is not an acceptable reason for using bends.

(4) Cleanouts shall be provided at all horizontal bends of 45° or greater. The use of a series of multiple lesser degree bends to achieve a horizontal directional change of 45° or greater shall be prohibited.

(5) A 45° or 90° bend installed horizontally but rotated in a downward orientation shall be considered a horizontal bend if the angle of rotation from horizontal is less than 45° and, thus, shall require a cleanout.

(6) Vertical bends of greater than 45° shall be prohibited.

c. The excavator shall supply sufficient 1B stone in the trench so that the service pipe may be laid on a firm continuous bed of stone. Pipe shall not be blocked up on rocks, bricks or wood in accordance with the International Plumbing Code.

d. Connections to Sewer Laterals

(1) Where the service line and the sewer lateral are of different pipe sizes and similar materials, the connection shall be made using a DWV (drain-waste-vent) hub.

(2) Where the service line and the sewer lateral are of the same size pipe and similar material, connections shall be made by properly joining the bell end of the service line with the lateral sewer.

(3) If the service line and sewer lateral are of unlike materials, the connection may be made with a Fernco flexible coupling with stainless steel bands suitable for the type and size of pipe to be connected.

(4) Projecting the smaller pipe into the larger and sealing with grout or mastic will under no circumstances be permitted.

(5) In the case of a low-pressure sewer, joining the service line to the sewer lateral of the same size shall be done using the proper fittings and an approved solvent cement.

(6) When connecting a low-pressure sewer to a gravity sewer lateral, connection shall be made using a PVC adapter and an approved solvent cement.

(7) All connections to sewers shall be made at the terminus of the sewer lateral unless the Authority specifically authorizes otherwise.

(8) Whenever a sewer lateral has not previously been constructed the construction of the sewer lateral and the connection of the sewer lateral to the sewer main shall be as described in Section 6 – Sanitary Sewer Laterals of these regulations.

e. Ground and surface water in trenches for service lines shall not be permitted to enter the sewerage system. Care shall be taken to prevent broken lateral caps and other debris from entering sewage system.

f. No trench shall be backfilled until the service line has been inspected and approved by the Authority or its representative.

g. The following requirements shall be applicable for that portion of the service line installed within the paved portion of the rights-of-way of township roads and state highways, and it shall be the responsibility of the Owner of the property served to require his plumber or contractor to adhere to these requirements.

(1) The trench shall be thoroughly compacted using mechanical tamping equipment.

(2) The trench area shall be graded to conform to existing grade.

(3) No surplus excavated materials or debris shall be piled or stored in this area.

(4) All street, road or highway surfaces which are disturbed or damaged by the Owner or Contractor shall be properly repaired at the Owner's expense.

(5) Subsequent settlement of the street, road or highway surface resulting from improper compaction of the service line trench or failure to protect the lateral line trench shall be promptly repaired at the Owner's expense.

(6) If the Owner or Contractor fails to comply with any of the requirements of subparagraphs (1) through (5) of this subsection h, then after reasonable notice to the Owner, the Authority may proceed on its own to make any necessary correction or repairs so that the

aforesaid requirements are fulfilled. If the Authority performs such work, then the Owner of the property shall be liable to the Authority for the entire costs of such repairs and said costs will be included in the Owner's next quarterly billing for sewer services.

2. Excavation

   Refer to Section 2 – Gravity Sewers for these requirements.

3. Bedding

   Refer to Section 2 – Gravity Sewers for these requirements.

4. Laying Pipe

   Refer to Section 2 – Gravity Sewers for these requirements.

5. Backfilling

   Refer to Section 2 – Gravity Sewers for these requirements.

6. Surface Restoration

   Refer to Section 2 – Gravity Sewers for these requirements.

E. Testing and Inspection

1. Notification

   It is incumbent upon the Applicant to arrange a pre-construction meeting or an inspection 48 hours in advance.

2. Inspection Procedure

   The inspection procedure for service line installations shall be as follows:

   a. Prior to excavation for the service line, the Applicant shall be responsible for arranging a meeting between the excavator, the plumber and the PTSA inspector. This meeting shall serve as a pre-construction meeting, where the inspector can review PTSA requirements with the excavator and plumber. During this meeting, the alignment for the service line shall be established and marked.

   b. Once the service line has been installed, the inspector shall be called out again to inspect the installation and witness the air test. This second inspection shall be conducted prior to backfill of the service line. The service line shall be clearly visible, with 6 inches of the specified stone bedding material beneath the line (the line shall not be supported by

blocks or large stones). At this time, there shall also be a stockpile of the proper stone backfill onsite to ensure that the trench will be backfilled with the proper material.

c. If the installation fails either because of a failed air test or an improper installation of the service line, subsequent visits to the site by the inspector shall be charged to the Applicant.

3. Air Test Procedure

a. Each service line shall be subjected to an air test prior to approval by the Authority. The test shall be witnessed by an agent of the Authority and the service line shall not be deemed acceptable until said service line has satisfactorily passed the test described below. All costs of testing and any subsequent test(s), including equipment, material or labor required shall be the responsibility of the Owner.

b. The service line shall be tested by plugging the line at the point of connection with the Authority's system by the use of a "test wye" and by plugging the line just before the point of connection with the building sewer. All risers, vents, plugs and cleanouts should be adequately blocked, plugged or supported to withstand the pressure associated with the test. The test shall be an air test and shall be designed to provide a residual pressure of 5 psi throughout the length of the service line.

c. The air test shall be made by attaching an air compressor testing apparatus to any suitable opening and after closing and supporting all other inlets and outlets to the service line, forcing air into the service line until there is a uniform gauge pressure of 5 psi. Wait for approximately 2 minutes to allow the air temperature in the pipe to stabilize. If necessary, add more air to attain a testing pressure of 5 psi. The service line shall be deemed acceptable if this pressure is maintained for 5 minutes without the introduction of additional air.

d. Care must be taken that the pressures generated by the air test do not exceed the pipe manufacturer's recommendations.

F. Detail Drawings

Relevant detail drawings are:

1 Right-of-Way Restoration

10 Typical Gravity Service Line – Profile

11 Typical Gravity Service line - Plan

12 Typical Low-Pressure Service Line to Gravity Sewer

13 Typical Low-Pressure Service Line to Low-Pressure Sewer Main or Force Main

END OF SECTION

Section 8
Precast Reinforced Concrete Manholes

A. Design Criteria

1. Manholes between gravity sewers shall be placed at all pipe intersections and at intervals not greater than 400 feet (for sewer main 15" and smaller). Manholes shall be placed at all changes in grade, pipe size and alignment. External drop manholes are required if the invert of the incoming pipe is greater than 2'-0" above the invert of the outgoing pipe. However, use of drop manholes shall be avoided wherever possible.

2. Unless otherwise noted, manholes shall be constructed of precast concrete with cast iron frames and covers, as shown on the detail drawings contained herein. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be with a smooth curve of as large a radius as the size of the manhole will permit.

3. New manholes to be constructed over existing sanitary sewers that have been rehabilitated with a cured-in-place pipe (CIPP) liner shall be constructed with a cast-in-place concrete base per Detail 16A. The pipe liner shall at all times remain, in effect, one contiguous pipe, and under no circumstances shall the pipe liner be cut completely through the entire circumference into two (or more) separate pieces unless otherwise approved by the engineer. If the existing sanitary sewer line that was CIPP-lined is asbestos-cement material, then all current regulations and protocol for working with that material shall be adhered to in the construction of the new manhole. Existing pipe material shall be confirmed with the Engineer prior to construction.

4. All manholes shall be adjusted to finished grade in paved areas and 12-inches to 18-inches above grade in rights-of-way or unpaved areas or as approved by the Engineer. If a manhole is to be at grade in unpaved areas on residential properties, or at the discretion of the Authority, a watertight manhole frame and cover shall be installed. If the proposed construction includes an existing street or right-of-way in which the existing grade will be changed, the Applicant shall be responsible for adjusting all existing manholes to finished grade. All adjustments required shall be in accordance with methods approved by the Authority. Such approval must be obtained in writing prior to construction.

5. Liftholes in manholes shall not extend through the entire width of the wall.

6. Exterior and interior surfaces of the manholes must be coated or lined, as described in Paragraph B – Materials and Equipment.

7. Manholes shall be constructed in accordance with the standard details noted on the detail drawings contained herein. Shop drawings shall be submitted for approval.

8. Manholes that are installed in field or wooded areas may, at the discretion of the Authority, be required to have a post installed adjacent to the manhole to serve as a marker.

B. Materials and Equipment

1. Precast Reinforced Concrete Manhole Riser and Tops

   a. Precast reinforced concrete manhole risers and tops shall conform to ASTM Specification C-478 Latest Edition and shall be of watertight construction. Joints between manhole sections shall be provided with preformed plastic joint sealing material conforming to ASTM C990 and shall be Ram-Nek as manufactured by K.T. Snyder Co., MAS-STIK as manufactured by Concrete Products Supply Co., or approved equal. The preformed joint sealer shall be protected by a removable two-piece wrapper and shall be applied in strict accordance with the manufacturer's recommendations. The chemical composition of the sealer shall meet the following requirements: the latest revision of: Bitumen-ASTM D-477, Inert Ash Mineral AASHTO T-11-42, Volatile Matter ASTM D-667. Shop drawings and specifications must be submitted for approval prior to installation.

   b. Manhole bases may be cast-in-place concrete, and shall have a compressive strength of not less than 4,000 psi after 28 days (tests to be in accordance with ASTM Specification C-39, Latest Revision).

   c. Precast manhole bases shall have flexible watertight joints at the point of entry of any sewer pipe into the manhole. The rubber materials shall conform to ASTM C443. The gaskets shall be cast into the manhole base to become an integral part of the concrete. The gaskets shall be Press Wedge II as manufactured by Press-Seal Gasket Corporation, Dura-Seal III, or Dura-Seal PSX as manufactured by Dura Tech Inc., and supplied by Monarch, Dallastown, PA, Dual Seal 11 as supplied by Terre Hill Concrete Products, or equivalent.

   d. Manhole bases with precast outside drop shall conform to ASTM C478, Latest Revision and shall provide a 90-degree elbow cast in monolithically with the base. The riser pipe shall be supported by concrete U-shaped collars. The collars shall be a minimum vertical height of 12 inches and shall be connected by tongue-and-groove joints.

e. Precast concrete grade rings with a minimum thickness of 2 inches used for leveling and adjusting to grade shall be of compressive strength as specified above. Precast rings shall be a single piece (no semi-circular pieces). Rubber grade rings are acceptable with a minimum thickness of 0.5 inches and for tapered arrangements, and shall be "Infra-Riser" as manufactured by GNR Technologies. The use of poured concrete grade rings shall be allowed only with prior approval from the Authority. Design of the grade rings must provide for full bearing of manhole frame. Joints between grade rings must be sealed using an approved preformed plastic joint sealing material specified in this section. Cement mortar will not be permitted in any joints.

2. Frame and Cover

Manhole frame and cover shall be of cast iron, 24-inch diameter and equal in design to Product 00112014, as manufactured by East Jordan Iron Works, East Jordan Michigan, or equal machined and having the letters "Sanitary Sewer" cast approximately in the center of the cover. All manhole cover frames shall be securely attached to the manhole by use of anchor bolts. The joint between the frame and the precast manhole section shall be provided with preformed plastic joint sealing material equal to Ram-Nek as manufactured by K.T. Snyder Company, Inc. of Houston, TX, and shall be of self-sealing design with a continuous rubber gasket supplied in a machined groove in the surface upon which the cover rests.

3. Watertight Manhole Frame and Cover

Manhole frame and cover shall be of cast iron, 24-inch diameter and equal in design to Product 00131051, as manufactured by East Jordan Iron Works, East Jordan Michigan, or equal machined and having the letters "Sanitary Sewer" cast approximately in the center of the cover. Watertight frames shall be securely attached to the manhole by use of anchor bolts. The joint between the frame and the precast manhole section shall be provided with preformed plastic joint sealing material equal to Ram-Nek as manufactured by K.T. Snyder Company, Inc. of Houston TX. All joints shall be watertight. Manhole covers shall be bolted to the frames using four 4 ½-inch stainless steel bolts. Watertight designs using bowl inserts or locking bars shall not be acceptable. Shop drawings for this type of cover must be submitted for approval before installation.

4. Manhole Steps

a. Manhole steps shall be composed of a ½-inch Grade 60, ASTM A615 steel reinforcing bar completely encapsulated in Grade 49108, ASTM D2146 polypropylene copolymer compound, as manufactured by M.A. Industries Inc., Peachtree City, GA or equal. The Authority reserves the right to have

steps tested according to the latest revision of ASTM Specification C-478 at the extender's cost.

b. Manhole steps shall be positioned to form a continuous ladder with 12-inch intermediate spacing in the manhole in such a manner to permit easy access to the manhole and not conflict with either influent or effluent lines. The first step shall be no further than 24-inches from the top of the manhole, and the bottom step shall be no higher than 16-inches from the bench.

5. Protective Coatings and Linings

a. Exterior Coating

All exterior surfaces shall be coated with dampproofing. Dampproofing shall be coal tar waterproofing pitch; Pro-Mastic 900 by Pro-Guard Coatings; Hydrocide 648 by Sonneborn Building Products; Dehydratine 4 by A.C. Horn Inc.; Meadows Trowel Mastic (Type 3) or approved equal.

b. Interior Coating (hydrogen sulfide corrosion protection)

(1) New manholes with an internal drop of less than 2 feet shall have a white epoxy coating (Amerlock ® 2/SIGMACOVER™) by PPG Protective and Marine Coatings or approved equal, applied to all interior surfaces at the manhole manufacturer's facility before delivery to the site. Surface preparation and application shall be as recommended by coating manufacturer.

(2) New manholes with a drop of 2 feet or greater or force main terminal manholes shall have one of the following liners:

(a) A High Density Polyethylene (HDPE) liner to provide an impermeable lining on the interior concrete surfaces shall be AGRU Sure Grip HDPE of polypropylene random copolymer as furnished and installed by Terre Hill Concrete Products, Terre Hill, PA. The Sure Grip liner shall have a minimum thickness of 2 mm. The minimum anchor stud density shall be 39 studs per square foot. The anchoring studs shall not be welded or mechanically attached to the liner. All joints shall be sealed by thermal welding performed by AGRU certified welders. The interior surfaces to be protected shall include the wall, ceiling, pipe entries and structure chimney.

(b) A Polyvinyl Chloride (PVC) resin liner to provide an impermeable lining on the interior concrete surfaces shall be Dura Plate 100 as manufactured by A-Lok Products, Inc. Tullytown, PA. The Dura

Plate liner shall have a minimum thickness of 1.65 mm. The PVC liner, channel joints, H-joints, and corner joints shall be manufactured from PVC and shall be white in color. A combination of standing ribs and dovetails shall be used to secure the liner panels to the wall of the structure and shall be spaced a maximum of 6 inches apart. Liner panels for 48" through 60" diameter manholes shall be a minimum of 0.50 inches high and shall be 0.75 inches high for 72" and larger diameter manholes. Liner panels shall be formed to the correct radius and have a PVC return into the joint of 0.50 inch. The fabricated liner panels shall be joined together by a slotted strip of EPDM rubber meeting the manufacturer's specifications. Sections of lined concrete structure shall be joined together by an approved butyl rubber strip as manufactured by A-Lok Products, Inc., designed to produce sufficient squeeze-out between PVC returns. Manhole steps, if required, shall be polypropylene drive-in step. Pipe penetrations through the wall shall be afforded protection by applying 0.125-inch cementitious corrosion resistant material, Forsroc Epoxy Liner, to the unlined exposed areas within the openings and shall overlap the liner wall a minimum of 1.50 inches. The manhole chimney shall be protected by installing a telescoping PVC connector, Water-Lok, as manufactured by A-Lok. The interior surfaces to be protected shall include the wall, ceiling, pipe entries and structure chimney.

(c) Manholes to receive a PVC or HDPE liner shall also have a fiberglass reinforced plastic (FRP)-lined base. The FRP base liner shall be by GU International. The liner shall be of one-piece construction of unlayered, homogenous composite. Minimum thickness shall be 0.12" – 0.20" (3 mm – 5 mm) and shall be in lengths and nominal inside diameters corresponding to the precast concrete base section. The prefabricated FRP base liner shall include full flow channels with side walls to the crown of the pipe; inner surface of the bench shall have an anti-skid pattern; watertight gasketed pipe bell connections of FRP/PVC boot hole sleeves to suit specific pipe types, grade and alignment, shall be monolithically attached to prefabricated FRP base liners to extend to the outside profile of the precast concrete structure. The outer surface of the liner shall be aggregate-coated and shall have steel spirals/lattice bonded to the FRP to ensure adequate anchoring to concrete base sections to pass vacuum test with 10" of negative pressure.

(3) Existing manholes receiving a new drop connection of 2 feet or greater or a new force main connection shall be lined with an epoxy or

urethane resin applied monolithic liner system that will provide corrosion protection from hydrogen sulfides and other corrosive materials typically found in sanitary sewer systems. Acceptable liner systems are: SprayWall by Sprayroq, Raven 405 by Raven Lining Systems, S-301/M-301 by Warren Environmental, NPR-5300 by NeoPoxy, Epoxytec Lining Systems by Epoxytec, or equal. The installation of the liner system shall be in accordance with the manufacturer's specifications, and the contractor installing the liner system shall be certified by the manufacturer as a trained applicator of the selected lining process. Prior to installing the liner system the manhole's walls and bench shall be thoroughly cleaned using a pressure water spray. The use of acid for cleaning purposes will not be allowed. All damaged concrete shall be patched and repaired as necessary. The contractor shall fill voids, rough surfaces, and other surface defects which may affect the performance or adhesion of the liner product using resurfacing products recommended by the liner system manufacturer. All liners shall be applied so that they result in a monolithic liner covering the invert, walls and corbelled top up to the cast iron manhole frame.

If the Authority determines that an existing manhole receiving a new drop connection of 2 feet or greater or a new force main connection is in poor condition and cannot be rehabilitated using an interior coating, a new manhole will be required and the interior shall be as described in paragraph B.5.b.(2) above.

C. Installation

1. General

   The relevant parts of Section 2 – Gravity Sewers shall apply regarding earthwork.

2. Precast Concrete Bases

   a. Bedding

      Install bases on a 6-inch deep compacted layer of aggregate meeting requirements of pipe bedding as specified previously in Section 2 – Gravity Sewers.

b. When using prefabricated pipe opening seals (i.e., Press Wedge II, Dura-Seal, etc.) for connecting pipes into manholes, and such seals create an annular space on interior and exterior of manhole wall pipe openings after pipe connection is made, fill such annular spaces with non-shrink grout. Following

sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.

3. Concrete Channel Fill

   a. The following criteria shall apply to both field and factory formed bases:

      (1) Form inverts directly in concrete channel fill. Concrete fill shall be a minimum depth of 3 inches.

      (2) Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.

      (3) Make changes in size and grade gradually.

      (4) Make changes in direction of entering sewer and branches to a true curve of as large a radius as manhole size will permit.

      (5) Make slopes gradual outside the invert channels. Provide a minimum slope of 1"/foot and a maximum slope of 2"/foot.

   b. Use 3000 psi concrete unless indicated otherwise on the detail drawings.

   c. Channels shall be full pipe height; PVC channels may be used for invert section.

4. Manhole Wall Erection

   a. Precast Components

      Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps.

   b. Install two rings of preformed plastic sealing compound between sections in accordance with manufacturer's recommendations and as shown on the detail drawings, and join sections in accordance with written instructions of manhole component manufacturer.

      (1) Prime joint surfaces if required by preformed sealing compound manufacturer.

      (2) If sealing compound is installed in advance of section joining, leave exposed half of two piece protective wrapper in place until just prior to section joining.

(3) Use preformed sealing compound as the sole element used in sealing section joints from internal and external hydrostatic pressure.

(4) Following manhole section installation, trim any excess sealing compound to provide a smooth surface that is flush with interior face of manhole.

(5) Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases.

5. Frame and Cover Installation

   a. Adjust frames using grade rings. Set grade rings in preformed plastic joint sealing material specified in this section.

   b. Bolt manhole frames in place on manhole top section, or on grade rings, if required, after installing ½-inch thick preformed plastic sealing compound on bearing surface of manhole frame and between grade rings. Remove excess sealing compound squeeze-out after manhole frame is bolted in place.

   c. Use bolts of sufficient length to properly pass through concrete grade rings, if any; engage full depth of manhole top section inserts and allowing enough threaded end to pass through manhole frame to properly tighten nut and washer.

6. Drop Manholes

   Construct as depicted on the detail drawings.

7. Cast-in-Place Concrete Base (New Manhole Over Existing CIPP-Lined Sewer)

   a. Proposed Pipe Elevation

      In an effort to maintain the integrity of the existing CIPP-lined pipe by minimizing the cutting of the liner, the proposed pipe shall be designed such that the invert of the proposed pipe shall match (or be higher than) the crown of the existing pipe.

      In the event that the above criteria cannot be met and approval is granted by the Authority to allow the invert of the proposed pipe to match the invert of the existing CIPP-lined pipe, removal of a section of the CIPP-lined pipe to achieve this shall only be done using a cut-off machine. Cutting of the CIPP-lined pipe with a reciprocating saw shall not be permitted.

b. Finish

Upon completion of manhole construction, the top of the existing CIPP-lined pipe shall be cut off at the spring line and removed. All cutting shall be done with a cut-off machine. A concrete bench shall be formed around the existing CIPP-lined pipe and a channel shall be formed to convey sewage flow from the new pipe into the main channel of the manhole.

D. Testing and Inspection

1. Notification

   It is incumbent upon the applicant to notify the Authority a minimum of 48 hours in advance of when the work will be ready for inspection.

2. All manholes shall be tested for water infiltration. The Extendor shall furnish all labor, materials, water, tools, equipment and accessories necessary to perform the required tests. All tests shall be made in the presence of and to the complete satisfaction of the Authority.

3. The manhole shall be thoroughly cleaned and all openings sealed to the satisfaction of the Authority. All pipe openings in the base and the walls shall be plugged with plugs properly designed to provide a watertight and airtight seal. All excess joint sealing material protruding into the manhole shall be removed.

4. There shall be no groundwater around the outside of the manhole during the vacuum test. If there is groundwater around the manhole during the vacuum test and any water is found in the manhole at the conclusion of the test, it shall be deemed to have failed the test.

5. The manhole shall be tested using the vacuum testing method (ASTM C1244)

   a. An inflatable circular rubberized seal shall be placed in the manhole cover frame, and a vacuum of 10-inches (mercury) shall be applied to the manhole. The time lapse shall be measured for the vacuum to drop from 10 inches to 9 inches. The vacuum drop shall be measured by a vacuum gauge graduated between 0 and 20 inches (mercury).

   b. If the time lapse is greater than 60 seconds, the manhole is considered to have passed the test.

   c. If any manhole fails to meet the testing requirements, the Extendor shall determine at his expense the source or sources of leakage. The Extendor shall repair or replace all defective material and/or workmanship and

shall conduct such additional tests as required to demonstrate that the manhole meets the requirements, at his expense. All materials and methods used to repair the manholes shall meet with the approval of the Authority.

E. Detail Drawings

Relevant detail drawings are:

6 Precast Concrete Manhole

6a Shallow Manhole

7 Drop Manhole

7a Precast Drop Manhole Base

7b Internal Drop Connection to Manhole

8 Cast-in-Place Base – New Manhole over Existing Sewer

9 New Sewer to Existing Manhole Connection

15 Force Main Connection to Manhole

END OF SECTION

Section 9
Low-Pressure Sewers

A. General

1. Intention

   The use of low-pressure sewers, which are located in public roads or rights-of-way, is intended to provide sewer service to existing properties which cannot be served by conventional gravity type sewers or common pumping stations and force mains.

2. Approvals

   The Authority will approve the use of low-pressure sewers only under special circumstances. Where it is possible to install gravity-type sewers, or where it is feasible to use sewage pumping stations and force mains, the use of low-pressure sewers will not be permitted.

3. Developers

   Developers who wish to provide sewer service by using low-pressure sewers within tracts to be developed, must familiarize themselves with the Authority's "Individual Grinder Pump Management Plan". Grinder pumps will be used in low-pressure sewer systems. The proposed use of grinder pumps and low-pressure sewers will be reviewed on a case-by-case basis.

B. Design Criteria

1. Design

   It is incumbent upon the Applicant to provide full details of the proposed design of low-pressure sewer systems for review by the Authority. Design shall be in accordance with PA DEP *Domestic Wastewater Facilities Manual*, latest edition.

2. Diameter and Slope

   The internal diameter of the pipe shall be a minimum of 1.5 inches. Pipes shall be laid at a constantly increasing grade to each air release manhole or point of discharge. The applicant shall provide sufficient construction control to assure that there are no sags or decrease in slope in the force main which could tend to accumulate and trap air.

3. Depth of Sewers

   A minimum cover of 3.5 feet over the top of the pipe shall be maintained.

4. Location of Sewers

   Refer to Sections 2, 6 and 7 as appropriate for these requirements.

5. Pumps

   Pumping units will be individual on-lot pumps as described and specified in Section 11 – Grinder Pumps.

6. Cleanout Manholes

   Provide cleanout manholes at all bends of 45 degrees or greater. The maximum distance between cleanout manholes shall be 600 feet.

7. Thrust Restraints and Blocking

   Thrust restraints shall be provided at all tees, crosses, bends, wyes, pipe ends or other locations that have unbalanced pressure forces.

8. Air Release Valves

   The use of air release valves will only be considered if it is demonstrated that they are absolutely necessary and that no alternatives are possible.

9. The pressure sewer shall be color coded using magnetic warning safety tape to distinguish between sanitary sewer (green) and water main (blue) in accordance with PA DEP requirements.

C. Materials and Equipment

1. Ductile Iron Pipe

   Refer to Section 10 – Force Mains for these requirements.

2. Polyvinyl Chloride Pipe

   a. Material

      (1) Main line and lateral applications: PVC pressure pipe sized 1.5 inch through 12 inch shall conform to the requirements of ASTM D2241. All pipe shall have a pressure rating of 200 psi with a dimension ratio of 21 (SDR 21). The pipe shall be PVC 1120 made from PVC compounds Class 12454-A or 12454-B as defined in ASTM D1784. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code and pressure rating.

      (2) Service line applications: PVC Schedule 40 pressure pipe sized 1.5 inch through 3 inch shall be manufactured from a Type I, Grade I polyvinyl

chloride (PVC) compound with a cell classification of 12454 per ASTM D1784. The pipe shall be manufactured in strict compliance with ASTM D1785 and ASTM D2665 (where applicable). All belled-end pipe shall have tapered sockets to create an interference type fit, which meet or exceed the dimensional requirements and the minimum socket length for pressure-type sockets as defined in ASTM D2672 for solvent cement joints on pressure pipe. All PVC Schedule 40 pipe must also meet the requirements of CSA Standard B137.3 rigid PVC pipe for pressure applications. All pipe shall have a minimum pressure rating of 260 psi. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code and pressure rating.

b. Fittings

(1) PVC fittings shall meet the requirements of ASTM D2241 for SDR 21 and ASTM D1785 for Schedule 40 and be of the same (or higher) pressure rating as the pipe line.

(2) The connection between the lateral and service line shall be made with an approved solvent cement (glue) or compression type fitting.

c. Joints

(1) In main line and lateral applications: Pipe joints shall be of the rubber gasket type with a grooved pre-molded coupling bell or sleeve.

(2) In service line applications: Pipe joints shall be solvent welded as recommended by pipe manufacturer and according to ASTM standards.

(3) Within valve and blow-off chambers: Pipe joints shall be solvent welded as recommended by pipe manufacturer and according to ASTM standards.

(4) Adequate pipe restraint shall be provided at all changes of direction along main lines and laterals and as needed for fittings and within valve and blow-off chambers. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restraining glands for PVC pipe shall conform to AWWA C111 and be (“Megalug”) as manufactured by EBAA Iron Inc. of Texas.

3. Polyethylene Pipe

   a. Material

      Polyethylene pipe shall conform to ASTM D-1248 and D-3350 for Type III Grade P34, Category 5, and Plastic Pipe Institute Material Designation PE-3408. Pipe shall be SDR-11 or approved equal.

   b. Joints

      Pipes shall be jointed by thermal butt-fusion in accordance with ASTM D-2657 and pipe manufacturer's recommendations. Termination to pump basins, valves and fittings shall be flange assemblies. The pipe adjacent to these joints must be rigidly supported for a distance of one foot beyond the flange assembly.

4. Air Release Valves

   Air release valves shall be located at all high points along a low-pressure sewer alignment. Air release valves shall be used as a last resort if high points in the line cannot be avoided. Air release valves and valve chamber shall be as specified in Section 10 – Force Mains.

5. Valve and Cleanout Manholes

   a. Cleanouts

      Cleanouts shall be constructed of PVC, Schedule 80 material and shall be provided with an isolation valve on either side of the cleanout on the low-pressure main. The outlet shall have a threaded end with screwed removable cap. The transition from iron fittings to PVC material, if required, shall be made by use of approved methods recommended by the manufacturers of the products.

   b. Valves

      Ball or plug valves shall be installed on services, low pressure and force main lines. Valves installed in valve/cleanout pits shall be actuated with a quarter turn type hand lever. Buried valves shall be actuated with an underground actuator through a valve box. Valves shall have the same or greater pressure rating as the attached pipe.

6. Valve Boxes

   Valve boxes shall be 6" PVC pipe installed over all buried valves and service line cleanouts in accordance with AWWA C500-80. Valve boxes shall not be located in roadways or driveways.

7. Detectable Warning Tape

   Detectable warning tape shall be polyethylene film encasing a metallic core, minimum 6 inches wide and 4 mils thick, color-coded green for sewer, bearing in black letters – CAUTION: SEWER LINE BELOW.

D. Installation

1. Excavation

   Refer to Section 2 – Gravity Sewers for these requirements.

2. Bedding

   Refer to Section 2 – Gravity Sewers for these requirements.

3. Laying Pipe

   During the installation of a low-pressure sewer, the pipe shall be laid at a constantly increasing grade to each high point, air release manhole or point of discharge. The Contractor shall provide sufficient construction control to assure that there are no sags or loss in grade in the force main which could tend to accumulate air.

   Refer to Section 2 – Gravity Sewers for other requirements.

4. Backfilling

   Refer to Section 2 – Gravity Sewers for these requirements.

5. Surface Restoration

   Refer to Section 2 – Gravity Sewers for these requirements.

E. Testing and Inspection

1. Notification

   It is incumbent upon the Applicant to notify the Authority a minimum of 48 hours in advance of when the work will be ready for inspection.

2. Inspection

   Pipelines shall be visually inspected, prior to commencement of backfilling, for alignment, depth, slope and for fittings and pipe material used.

3. Pressure Test

   After the pipe has been laid and backfilled as specified, all newly laid pipe shall be subjected to a hydrostatic pressure of 50 pounds per square inch (psi), or 150% of the normal working pressure, whichever is greater, for 30 minutes in accordance with AWWA C-600. If the pressure does not drop within the 30-minute test period, the test shall be deemed successful.

F. Detail Drawings

Relevant detail drawings are:

1 Right-of-Way Restoration

2 Concrete Encasement

3 Pavement Restoration

14 Air Release Valve and Chamber

15 Force Main Connection to Manhole

18 Thrust Blocks for Horizontal Bends and Lower Vertical Bends

19 Restrained DI Pipe Length

22 Low-Pressure Sewer Valve and Cleanout Manhole

23 Low-Pressure Sewer Terminal Cleanout Manhole

END OF SECTION

Section 10
Force Mains

A. General

1. Force mains described and specified in this section are sewers which convey sewage under high pressure from pumping stations to locations in the gravity sewer system. Low-pressure sewers used with grinder pumps are specified in Section 9 of these specifications.

2. Force mains shall be installed in strict accordance with these specifications, and any applicable practices and precautions required for gravity sewer are equally applicable to the installation of pressure sewers. These include, but are not limited to, excavation, pipe bedding, concrete encasement and backfilling.

3. The use of polyvinyl chloride pipe (PVC) and fittings will not be permitted.

B. Design Criteria

1. Diameter and Slope

   The diameter shall be determined by the flow required to be conveyed and shall not be less than 2.5-inches. All force mains above 4-inches shall be ductile iron. During the installation of a force main, the pipe shall be laid at a constantly increasing grade to each air release manhole or point of discharge. The Applicant shall provide sufficient construction control to assure that there are no sags or decrease in slope in the force main which could tend to accumulate and trap air.

2. Depth of Sewers

   A minimum cover of 3.5 feet over the top of the pipe shall be maintained.

3. Separation of Utilities

   Refer to Section 2 – Gravity Sewers for these requirements.

4. Thrust Restraint and Blocking

   Thrust restraints shall be provided at all tees, bends, wyes, pipe ends or other locations that could become disconnected in the event of a pressure surge.

5. Air Release Valves

   The use of air release valves will only be considered if it is demonstrated that they are absolutely necessary and that no alternatives are possible.

C. Materials and Equipment

1. Ductile Iron Pipe and Fittings.

   (References to ASTM, AWWA and ANSI Specifications imply latest edition.)

   a. Ductile Iron Pipe

      (1) Pipe shall conform to ANSI Specification A21.51, AWWA C151 and ASTM A746 for the material class or pressure designated and ANSI A21.50 and AWWA C150, for wall thickness. Pipe shall be supplied in standard lengths as much as possible.

      (2) Ductile iron pipe shall be by U.S. Pipe and Foundry Company, American Ductile Iron Pipe Company or Griffin Pipe Products Company.

   b. Joints

      (1) Joints shall be rubber-gasket push-on type or rubber-gasket mechanical joint type conforming to AWWA C111. Gasket shall be of SBR.

      (2) Restrained joints shall be push-on restrained joints (U.S. Pipe and Foundry Co.'s. Field Lok 350 Gaskets or equal) as manufactured by the pipe supplier or manufacturer subject to the Authority's approval. The restraint provided shall be standard restrained joint or bolt-less, integral restraining system. Restrained joints shall be suitable for the specified test pressure. Mechanical joint retainer glands ("Megalug") as manufactured by EBAA Iron Inc. of Texas can be selected for restraining the mechanical joint of ductile iron pipe for field closures as approved by the Authority. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil.

      (3) Sleeve type couplings shall be ductile iron mechanical joint solid sleeves.

   c. Minimum Thickness

      Thickness design shall be per AWWA C150, except provide minimum Class 52.

d. Ductile Iron Fittings

(1) Pipe fittings shall be ductile iron with pressure rating of 350 psi for 24-in and smaller piping and 250 psi for 30-in and larger piping. Fittings shall meet the requirements of AWWA C110 or AWWA C153 as applicable. Fittings shall have the same pressure rating, at a minimum, of the connecting pipe.

(2) Closures shall be made with mechanical joint ductile iron solid sleeves and shall be located in straight runs of pipe at minimum cover outside the limits of restrained joint sections. Location of closures shall be subject to approval of the Engineer.

e. Interior Lining

(1) Cement mortar lining shall only be used in pipe and fittings that are continuously filled or full flow not exposed to the atmosphere. The cement mortar lining with an asphalt seal coat shall conform to ANSI Specification A21.4 or AWWA C104, latest edition, except the thickness of linings should not be less than 1/8-inch.

(2) Hydrogen sulfide resistant linings shall be used in all pipe and fittings with partial flow depth or exposed to the atmosphere (in the vicinity of air release valves, terminal manholes, etc.). These linings shall be Protecto 401 ceramic-filled amine cured epoxy lining shall be as manufactured by Indurall. The lining thickness shall be 40 mils minimum. Application shall be performed by an applicator approved by the coating manufacturer, in accordance with manufacturer's instructions and under controlled conditions at the applicator's shop or the pipe manufacturer's plant. Applicator shall submit a certified affidavit of compliance with manufacturer's instructions and requirements specified herein.

f. Exterior Coating

(1) Buried pipe shall be installed with a bituminous coating in accordance with AWWA C151 and C110 respectively.

(2) Buried pipe in corrosive soils shall be installed with polyethylene encasement conforming to AWWA C105, where indicated on the drawings or as directed by the Authority. The polyethylene sheet shall be 8 mils thick minimum.

2. PVC Pipe and Fittings

(References to ASTM, AWWA and ANSI Specifications imply latest edition.)

a. PVC Pipe

(1) PVC SDR pressure pipe sized 2-in through 3-in shall conform to the requirements of ASTM D2241. All pipe shall have a pressure rating of 200 psi with a Dimension Ratio of 21 (SDR 21). The pipe shall be PVC 1120 made from PVC compounds Class 12454-A or 12454-B as defined in ASTM D1784. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code, and pressure rating.

(2) PVC Schedule 40 pressure pipe sized 2-in through 3-in shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM D1785 and ASTM D2665 (where applicable). All belled-end pipe shall have tapered sockets to create an interference type fit, which meet or exceed the dimensional requirements and the minimum socket length for pressure-type sockets as defined in ASTM D2672 for solvent cement joints on pressure pipe. All PVC Schedule 40 pipe must also meet the requirements of CSA Standard B137.3 rigid PVC pipe for pressure applications. All pipe shall have a minimum pressure rating of 260 psi. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code, and pressure rating.

b. Joints

(1) Pipe joints shall be solvent welded as recommended by pipe manufacturer and according to ASTM standards.

c. PVC Fittings

(1)) PVC fittings shall meet the requirements of ASTM D2241 for SDR 21 and ASTM D1785 for Schedule 40 and be of the same (or higher) pressure rating as the pipeline.

3. Plug Valves

a. Plug valves shall be of the offset disc type, 1/4 turn, non-lubricated, serviceable (able to be repacked) under full line pressure and capable of sealing in both directions at the rated pressure. The disc shall be completely out of the flow path when open. Plug valves specified herein shall be by DeZurik, Valmatic or Clow.

b. All buried valves shall open counter-clockwise and be especially constructed for buried service. Exterior ferrous metal surfaces of all buried

valves shall be blast cleaned in accordance with SSPC SP 6 and given two shop coats of an approved two-component coal tar epoxy paint.

c. All size plug valves shall have a minimum port area of 80 percent.

d. Valves shall be rated at minimum 175 psi WOG (water, oil and gas) working pressure for sizes 4 inch to 12 inch inclusive and at minimum 150 psi WOG working pressure for sizes 14 inch and larger.

e. All plug valves under this paragraph shall be performance, leakage and hydrostatically tested in accordance with AWWA C504, except as modified herein. At the above rated minimum working pressures, the valves shall be certified by the manufacturer as permitting zero leakage for a period of at least 30 minutes with pressure applied to the seating face.

f. Valve bodies shall be of cast iron, 30,000 psi tensile strength, ASTM A126, Grade B, or of ductile iron, ASTM A536 and of the top entry, bolted bonnet design, cast with integral flanges conforming to the connecting piping. All exposed bolts, nuts and washers shall have Type 316 stainless steel hardware.

g. The valve disc shall be cast iron ASTM A126, Grade B, or ductile iron, ASTM A536, Grade 65 45-12, be removable without removing the valve from the line and have an integral upper and lower shaft which shall have seals on the upper and lower journals to prevent entrance of solids into the journals.

h. Shaft bearings shall be permanently lubricated, rigidly backed TFE, stainless steel or bronze at both upper and lower stem journals. The operator shaft shall have easily replaceable seals, which shall be externally adjustable and repackable without removing the bonnet from the valve or shall have self adjusting packing.

i. The valve seating surface shall provide full 360 degree seating by contact of a resilient seating material on the disc mating with welded in high nickel content overlay seating surface in the body.

j. Discs shall have a full resilient facing of neoprene or Buna N.

3. Valve Boxes

All buried valves shall be provided with extension-type, roadway-type valve boxes. Valves boxes shall be cast iron and shall be two-piece telescoping screw-type construction. Valve boxes shall have 5 1/4-inch shafts, shall have covers marked “SEWER”, and shall be coated inside and out with a tar or

asphalt compound. Valve boxes shall be manufactured by Bingham & Taylor or Tyler Pipe.

4. Air Release Valves

   a. The valves shall be designed for sewage service and shall be non-clogging with cast iron or 316 stainless steel body, bronze or 316 stainless steel trim and 316 stainless steel floats. Valves shall be provided with shutoff valve, blow-off valve and quick disconnect hose connection and backflushing hose and valve.

   b. Valves shall have a venting capacity of 270 C.F.F.A.M. at 50 psig differential pressure and shall be similar to those manufactured by A.R.I., APCO, Golden-Anderson, Val-Matic or approved equivalent.

   c. Valve chamber shall be standard precast concrete manhole construction in accordance with ASTM C478, and shall be of adequate size to permit entry around valve for servicing and maintenance. Manhole base shall be provided with drain. Manhole cover shall be adequately vented to ensure discharge or intake of free air.

5. Detectable Warning Tape

   Detectable warning tape shall be polyethylene film encasing a metallic core, minimum 6" wide and 4 mils thick, color-coded green for sewer, bearing in black letter – CAUTION: SEWER LINE BELOW.

D. Installation

1. General

   Ductile iron pipe shall be installed in accordance with AWWA C600.

2. Excavation

   Refer to Section 2 – Gravity Sewers for these requirements.

3. Bedding

   Refer to Section 2 – Gravity Sewers for these requirements.

4. Laying Pipe

   a. Refer to Section 2 – Gravity Sewers for these requirements.

   b. Construction Control

During the installation of a force main, the pipe shall be laid at a constantly increasing grade to each high point, air release manhole, or point of discharge, as indicated on the Drawings. The Contractor shall provide sufficient construction control to assure that there are no sags or loss in grade in the force main which could tend to accumulate air.

c. Permissible Deflection of Joints

If deflection is required, the amount of deflection shall not exceed the maximum limits as specified in the AWWA Standard C600, or those specified by the pipe manufacturer.

d. Fittings and Valves

(1) General

Valves and fittings shall be set and jointed to pipe in the manner specified previously for cleaning, laying and jointing pipe.

(2) Valve Chamber

Provide a precast concrete manhole for every air release and vacuum valve as specified in Section 8 – Precast Reinforced Concrete Manholes. The manholes shall be constructed of sufficient size to permit entry for valve repairs and protect the valve and pipe from impact where they pass through the manhole walls. All valves and fittings shall be supported as indicated on the detail drawings.

5. Thrust Restraint and Blocking

Restraint of pipe and fittings shall be provided at all tees, crosses, bends, wyes, pipe ends, or at other locations that have unbalanced pressure forces. Restraint shall be provided by one of the following:

a. Pipe manufacturer's restrained joint system as approved by the Authority.

(1) Provide computations for the embedment lengths required for the following minimum conditions:

Design pressure	=	150 psi
Depth of cover	=	3.5 feet
Safety factor	=	1.5
Soil type	=	cohesive granular

Soil internal friction angle	=	20 degrees
Soil cohesion	=	200 psf
Soil density	=	90 pcf

Ref. - "Thrust Restraint for Ductile Iron Pipe", DIPRA

(2) Minimum restrained lengths required for pipe anchorage with restrained joints as shown on the detail drawings.

b. Metal harness or tie rods

(1) Metal harness or tie rods of adequate strength to prevent movement shall be used.

(2) Restrained pipe length shall be the same as those for restrained joints.

(3) Steel rods or clamps shall be suitable for bury. The minimum number shall be as follows:

(a) Use a minimum of two ¾-inch diameter rods for pipes 6 inches and smaller.

(b) Use a minimum of four 1-inch diameter rods for pipes 8 inches through 14 inches.

(c) Minimum restrained length required for pipe anchorage with metal harness and tie rods shall be the same as those indicated for restrained joint pipe.

c. Concrete anchor blocks

(1) Concrete anchor blocks shall be designed for the same parameters as those for restrained joints with the additional condition of a minimum allowable soil bearing pressure of 2000 psf.

(2) Minimum anchor blocks shall be as shown on the detail drawings.

6. Backfilling

Refer to Section 2 – Gravity Sewers for these requirements.

7. Surface Restoration

Refer to Section 2 – Gravity Sewers for these requirements.

E. Testing and Inspection

1. Notification

   It is incumbent upon the applicant to notify the Authority a minimum of 48 hours in advance of when the work will be ready for inspection.

2. Pressure Test

   a. After the pipe has been laid and backfilled as specified, all newly laid pipe shall be subjected to a hydrostatic pressure of 150 pounds per square inch or 150% of the normal working pressure, whichever is greater, for 2-hours, in accordance with AWWA C 600.

   b. Where any section of a force main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.

   c. Air release valves shall be installed but isolated during testing of the pipeline.

   d. Duration of Pressure Tests

      The duration of each pressure test shall be two hours.

   e. Procedure

      Each section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connections, and all necessary apparatus, including gauges, shall be furnished by the Contractor and are subject to approval by the Engineer. The Contractor will make all taps into the pipe, and furnish all necessary assistance for conducting the tests. The Contractor shall supply either a container calibrated in 0.1 gallon increments or a laboratory certified calibrated water meter calibrated to an accuracy of 0.1 gallons.

   f. Expelling Air Before Test

      Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air release valves are not located at all high points, the Contractor shall make the necessary taps at such points before the test

is made. After the test has been completed, the Contractor shall remove and plug the taps or leave them in place at the direction of the Engineer.

g. Examination Under Pressure

Any cracks or defective pipes, fittings or valves discovered in consequence of this pressure test, shall be removed and replaced by the Contractor, and the test shall be repeated.

h. If the pressure does not drop within the 2-hour test period, the test shall be deemed to be successful.

F. Detail Drawings

The relevant detail drawings are:

1 Right-of-Way Restoration

2 Concrete Encasement

3 Pavement Restoration

14 Air Release Valve and Chamber

15 Force Main Connection to Manhole

18 Thrust Blocks for Horizontal Bends and Lower Vertical Bends

19 Restrained DI Pipe Length

END OF SECTION

Section 11
Grinder Pumps

A. General

1. Grinder pumps are to be used if it is intended that low-pressure sewers, as described in Section 9, are to be installed. Developers and individuals who wish to install grinder pumps must familiarize themselves with the Authority's "Individual Grinder Pump Management Plan". The proposed use of grinder pumps will be reviewed on a case-by-case basis.

2. Simplex (single) grinder pump units shall be used at residential property locations, and simplex or duplex (double) grinder pump units shall be used at commercial or industrial properties. Additionally, provision of a spare pump and a standby power supply are recommended for non-residential uses. In certain cases, a simplex installation may be permitted for a non-residential use. Such exceptions will be reviewed on a case-by-case basis and must have the approval of the Authority.

3. Grinder pump units shall be installed in either concrete, high-density polyethylene or fiberglass-reinforced polyester basins for outdoor installations only. Indoor installations will not be permitted.

4. The grinder pump package shall consist of the basin, grinder pump(s) and motor(s), quick disconnect, pump removal system, junction box, start-stop level controls, motor high temperature shutoff, motor seal leak alarm, high water alarm, shutoff valve, pump check valve and redundant check valve, anti-siphon valve, discharge piping and fittings, and all internal wiring terminating in a junction box.

5. The location of the grinder pump package and control panel shall be determined by the property Owner or Developer.

6. The following NEMA ratings are required for the specified areas:

    a. Outdoors, within 10 feet of the pump basin – NEMA 4X

    b. Outdoors, at least 10 feet from the pump basin – NEMA-4 or NEMA 4X

7. Provision of bollards to protect the structure and/or control panel is recommended in areas where there is potential for traffic.

B. Materials and Equipment

1. Grinder Pump Unit

   a. The pump unit shall consist of a centrifugal or positive displacement grinder type pump with accessories as specified herein. The pumps shall comply with the following characteristics:

   b. Pumps shall be of sufficient horsepower to perform the intended work and shall be a minimum of 1 horsepower.

      (1) Residential

         (a) Maximum Flow = No greater than 50 gpm at 10 feet Total Head

         (b) Minimum Flow = 10 gpm at 90 feet Total Head

         (c) Minimum Shutoff Head = 105 feet

      (2) Non-Residential

         (a) Maximum Flow = to be determined based on application

         (b) Minimum Flow = 10 gpm at 90 feet Total Head

         (c) Minimum Shutoff Head = 105 feet

   c. Submersible Pump and Motor

      (1) The grinder pump and motor are to be specifically designed and manufactured so they can operate completely submerged in wastewater. Electrical power cord is to be sealed, with individual conductors additionally sealed, thus eliminating water entering the motor by following individual conductors inside the insulation. Wire sizing and voltage drop associated with run lengths over 100 feet shall comply with NEC rules.

      (2) The combination pumping elements and grinder unit shall be attached to a common motor and pump shaft made of stainless steel. The grinder unit shall be on the suction side of the pump impeller inlet leaving no exposed shaft to permit packing of ground solids. Both stationary and rotating cutters shall be made of hardened and ground stainless steel. The full diameter impeller shall be provided.

      (3) The pump-motor shaft shall be sealed by mechanical carbon and ceramic-faced seals or similar material. An electric sensing probe shall be mounted in the seal chamber to detect any water leakage past the

lower seal before damage is done to the motor. The seal probe circuit sensitivity shall not be affected by cable length between the motor and the seal probe circuitry in the control panel. This probe shall be connected to an indicator light in the control panel.

(4) The shaft shall be supported by two radial and thrust ball bearings and a lower bronze radial sleeve guide bushing for radial load from grinder impeller. Ball bearings shall be designed for 50,000 hours B-10 life.

(5) The rotor winding and rotor are to be mounted in a sealed, submersible type housing which is filled with clean high dielectric oil or air as pump design dictates. A heat sensor or thermostat shall be located in the motor winding and shall be provided to detect over temperature and stop the pump. When the temperature drops to a safe level, the pump will automatically reset.

(6) For residential applications, submersible motor shall be constant speed, suitable for operation on a 240 Volt, 60 HZ, single-phase service. Submersible motors for non-residential applications shall be constant speed, suitable for operation on a 240 Volt, single-phase service or a 120/208 or 480 Volt, three-phase service. The motors shall be of proper size to drive the pump at any point on the pump curve. Thrust bearings shall be of the ball type. The motor shall be a capacitor start-capacitor run type with high starting torque.

(7) Motor shall be amply rated for the head and capacity values specified, on continuous duty, without exceeding 1.0 service factor load at the minimum capacity design point, and without exceeding the motor full service factor load at any head between shutoff and 10 feet TDH, which is the minimum expected dynamic head to be found in this installation.

(8) For non-residential installations, the use of explosion-proof motors and the provision of a spare pump are recommended.

2. Level Controls

Sealed float-type mercury switches shall be supplied to control sump level and alarm signal. The mercury type switches shall be sealed in a solid polypropylene float for corrosion and shock resistance. The support wire shall have a heavy neoprene jacket. A weight shall be attached to the cord above the float to hold switch in the sump. The weight shall be above the float to effectively prevent sharp bends in the cord when the float operates. Two float switches shall be used to control level: one for pump turn-on and one for pump turn-off. A third switch shall be provided for high water alarm and redundant pump turn-on (in the case of a duplex installation). The float switch shall hang in the sump and be supported by a stainless-steel bracket

and cord snubber that will give positive support to the controls and allow flexibility in the setting of levels. All mounting structures and hardware shall be stainless steel.

3. Operation of System

   On sump level rise, lower mercury switch shall first be energized, then upper-level switch shall next energize and start pump. With pump operating, sump level shall lower to low switch turn-off setting and pump shall stop. If level continues to rise when pump is operating, alarm switch shall energize and activate the alarm. All level switches shall be adjustable for level setting from the surface. Duplex systems shall also have a lag pump on switch.

4. Corrosion Protection

   All materials exposed to wastewater shall have inherent corrosion protection, i.e., cast iron, fiberglass, stainless steel or PVC. Galvanized steel is not acceptable. Any interior steel surfaces are to be suitably protected against corrosion. All fasteners shall be stainless steel.

5. Junction Box

   a. The junction box shall be constructed of fiberglass for corrosion resistance at residential properties and NEMA 7 at commercial/industrial properties. The enclosure shall be of adequate thickness and properly reinforced to provide good mechanical strength. The junction box shall have a fully gasketed cover that is held in place by four stainless steel captive screws with slotted/flat sided heads total encapsulated in PVC so that no metal parts are exposed. The cover shall be connected to the body with stainless steel chain.

   b. An adequate number of sealing type cord grips shall be supplied for incoming pump and switch cords. The cord grips shall be made of non-corrosive material, such as PVC or nylon, and shall have rubber compression bushing that will make an effective seal around the wire jackets. The cord grip shall also seal to the junction box wall with an o-ring, gasket or other effective means.

   c. The hub shall be of a corrosion resistance material and shall be of adequate size to accommodate the number of wires required to operate the pump.

   d. A method for sealing the incoming wires in the junction box shall be supplied by the manufacturer so that condensation from the conduit or ground water will not enter the enclosure; or, an explosion-proof conduit seal shall be required. Duct seal shall not be used.

e. Wires shall be connected within junction box by means of wire nuts and the connections further protected by non-hardening sealant.

f. Electrical cable for power and control wiring between the junction box and each pumping unit shall be supplied. Wire size shall be selected in accordance with amp capacities required by the National Electric Code.

6. Valves

a. Check Valves

The pumps shall be equipped with a factory-installed integral ball check valve built into the discharge pipe. This valve shall provide a full-ported passageway when open, and shall introduce a friction loss of less than six inches of water at maximum rated flow. The valve body shall be made of cast iron. Ball check valves shall include a corrosion resistant non-metallic ball and rubber-sealed seat.

b. Ball Valve

The pump shall be equipped with an isolation ball valve which shall be of PVC (Schedule 80), bronze or stainless steel construction, three-piece design, full port, with TFE seals and seat valves shall have screwed end connections and shall be lever-operated with an extension handle extended vertically to a supporting bracket fixed not more than twelve (12) inches below finished grade. Valves shall be as manufactured by Jamesway Corporation, Worcester Controls or approved equal.

c. Redundant Check Valve

(1) All pumps shall include one additional separate check valve per unit for installation in the discharge line inside the pump basin to ensure maximum protection against backflow.

(2) The valve shall be gravity operated, ball type. The check valve shall provide a full-ported passageway when open and shall introduce a friction loss of less than six inches of water at maximum rated flow. Working and internal parts shall be at least equal to those specified above for the check valve.

(3) The valve body shall be a high gloss, injection molded part made of PVC Type I-II with hub and socket compatible with 1-1/2" PVC pressure pipe, SDR 21.

(4) Dimensions for hub and socket shall be in accordance with commercial standards C5-272-65.

d. Anti-Siphon Valve

The pump shall be constructed with a positively primed flooded suction configuration. As added assurance that the pump cannot lose prime even under negative pressure conditions in the discharge piping system, the pump shall be equipped with an integral anti-siphoning, air relief valve in the discharge piping. This valve shall be of PVC and shall be mounted horizontally in the discharge piping, between the redundant check valve and the shut off valve. The anti-siphon valve will automatically close when the pump is running and open to atmosphere when the pump is off.

7. Flexible Discharge Coupling

The pump discharge piping within the pump basin and the discharge force main shall be connected with a flexible discharge coupling to accommodate differential settling of the force main and the pump basin. Flexible discharge couplings shall be made of an inner corrugated hose sheathed in an outer braid. Flexible discharge couplings shall be constructed of stainless steel and shall be rated for 345 psi.

8. Basins

a. General

(1) Either concrete, high-density polyethylene or fiberglass basins may be provided. However, concrete basins shall be used in areas subject to traffic loadings. All basins shall register a minimum 4" above finished grade to prevent infiltration of surface water. The basin shall be located in an area not subject to ponding or flooding.

(2) For residential installations, PTSA recommends the basin have a minimum difference of 30-inches between the pump shut-off elevation and the invert of influent line from the connected structure.

(3) For non-residential installations, PTSA recommends a minimum operating tank volume of 140 gallons, or 24 hours of storage, whichever is greater, be provided. If anticipated daily sewage flow exceeds the available storage volume, the owner should perform backup calculations for the anticipated flow rate. Non-residential storage requirements may be reduced by provision of a back-up power source and a spare pump.

(4) The basin shall be provided with a concrete anti-flotation collar (minimum of 1 cubic yard (cy) of concrete) to prevent flotation of the basin at high groundwater elevation when the basin is empty.

(5) Watertight seals are required for all power and control connections within the basin as follows:

(a) between control panel motor feeders and junction box

(b) between junction box and motor leads

(c) between motor leads and pump housing

(d) for all control device conduits/leads and junction boxes inside basin

b. High-Density Polyethylene

(1) The basin shall be high density polyethylene, with a grade selected to provide the necessary environmental stress cracking resistance.

(2) Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. The corrugations of the outside wall are to be a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be 0.250″ thick (minimum).

(3) All seams created during tank construction are to be thermally welded and factory tested for leak tightness. The tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.

(4) One 4-inch diameter inlet hub shall be provided for each grinder pump unit. The inlet hub shall be suitable for use with 4-inch PVC or Schedule 40 pipe. Hubs shall be field installed to meet field conditions.

(5) One 1-1/2" NPT discharge coupling shall be provided for the grinder pump unit. Internal piping shall be provided to this discharge coupling. The depth of the discharge coupling (centerline of coupling to finished grade) shall be no less than 42".d. Fiberglass Basin

(6) The basin shall be custom molded of fiberglass reinforced polyester resin using a lay-up and spray technique that will assure that the interior surface is smooth and resin-rich. The basin shall have a nominal wall thickness of 1/4-inch.

(7) The fiberglass basins shall be built in accordance with:

(a) Plastics Laminate ASTM C581 and C582.

(b) Chemical-Resistance Test ASTM C581. Previous tests will be acceptable provided laminates are representative.

(8) The basins shall be free of imperfections, sound, watertight, and of high quality workmanship. Basins shall have lifting lugs or other devices for unloading and installation. All conduit and piping connections shall be plugged for shipment.

(9) One 4-inch diameter inlet hub shall be provided for each grinder pump unit. The inlet hub shall be suitable for use with 4-inch PVC or Schedule 40 pipe. Hubs shall be field installed to meet field conditions.

(10) One 1-1/2" NPT discharge coupling shall be provided for the grinder pump unit. Internal piping shall be provided to this discharge coupling. The depth of the discharge coupling (centerline of coupling to finished grade) shall be no less than 42".

(11) Fiberglass basins shall be equipped with an aluminum or fiberglass cover. The cover shall be bolted to the basin with stainless steel cap screws. Stainless steel nuts for the screws shall be bedded in the fiberglass to prevent turning and for corrosion resistance.

9. Electrical Control Panel

a. General

(1) A separate remote electrical control panel shall be installed as shown on the detail drawings. In addition, the panel shall contain a U.L. listed NEMA sized motor contactor having a guaranteed component life span, without maintenance or contact replacement, of one million operations (definite purpose contactors will not be allowed). The panel shall have an adjustable or non-adjustable 2 pole bi-metallic temperature compensated U.L. listed overload relay meeting NEMA Class 10 tripping characteristics, and the auxiliary contact of the overload relay must be connected in series with the motor contactor coil to switch off the contactor in event of overload. The panel shall also have lightning protection, elapsed time meter for each pump, and any other items required for proper control of the centrifugal type grinder pump unit. The incoming wires/conduit shall be provided with a watertight seal.

(2) The enclosure shall contain an inner back panel for mounting of the internal components. The enclosure shall be fully gasketed, hinged, and NEMA rated for the applicable location as specified in paragraph A.6 of this section. The enclosure shall be stainless steel or UV-stabilized fiberglass, with combination closing latch and locking hasp.

(3) The control panel shall be fitted with an integral red alarm light on the top.

(4) The light shall be provided with a lamp test switch mounted within the panel. The alarm light shall be flashing type activated by both moisture in the pump seal chamber and high water in the wet well and shall go out when the condition(s) cease.

(5) Inside the control enclosure shall be an LED-style, red 1-inch neon glow lamp high water indication and an amber 1-inch neon glow lamp for moisture leak detection. The flashing light on the enclosure top shall flash when either or both lights within enclosure are activated due to failure.

(6) A nameplate shall be provided above each component with the name of the component inscribed or failure inscribed when labelling the indicator lights.

(7) A "Hand-Off-Auto" selector switch shall be provided within a control panel for operating the pump manually when in "Hand", pump disable when in "Off", and normal operation when in the "Auto" position. The selector switch shall not disable the alarms under any condition.

(8) A main disconnect switch integral to the panel shall be provided with padlocking device to de-energize the panel. Toggle switch shall not be considered. From the load side of this switch shall be a two-pole circuit breaker for motor overload and short-circuit protection. Also, and in parallel with the above breaker shall be a circuit breaker for protection of the control circuit.

(9) An electrical wiring diagram shall be supplied and attached to the inside of the panel enclosure. This diagram shall identify wire color, external connections to a numbered terminal block and shall be arranged in a functional sequence ladder type diagram.

(10) The control panel enclosure shall be provided with padlock. This lock shall be of the solid corrosion proof case design, with a hardened steel shackle and zinc coating.

(11) Wiring shall meet the following requirements:

(a) Minimum size for power wiring shall be #12 AWG

(b) Minimum size for control wiring shall be #14 AWG

(c) Minimum size for signal wiring shall be #18 AWG

(d) Analog signal to be shielded twisted #18 AWG

(e) Insulation to be 600 V XHHW for wet locations and THWN for dry/damp locations

b. Control Panel Supports (for post-mounted installations)

The control panel support for property owner installations shall consist of 3" x 3" x 3/16" gauge structural steel tubing (minimum yield strength 46,000 psi) or 4" x 4" pressure treated wood post, all horizontal support channels and panel connection hardware, coated with baked-on epoxy ASA 61 paint. The length of pipe or post shall be embedded in a concrete foundation to the dimensions shown on the detail drawings.

C. Installation

1. The grinder pump unit shall be installed at a location to be determined by the property Owner or Developer. Generally, the unit will be located in close proximity to the sanitary sewer service line near the building.

2. The depth of the grinder pump unit will be dependent upon the location and depth of the house service line. The minimum total unit depth from the invert of sump pit to top of entry hatch shall be no less than eight feet and no greater than sixteen feet.

3. All grinder pumps shall be installed on a bed consisting of AASHTO No. 8 (PennDOT No. 1B) aggregate and shall have a concrete anti-flotation collar poured around the bottom. The remaining excavated area shall be backfilled with excavated material containing no soil lumps, stones, concrete or foreign objects greater than 3" in maximum dimension. Six inches of topsoil with seed and supplements shall be placed around the surrounding excavated area. The top of the pump basin shall be a minimum of 4 inches above grade and the surrounding area shall be graded in such a manner as to slope away from the basin to allow water to drain away from the basin. In paved areas, the top of the basin shall be at grade and equipped with a watertight lid. Basins located in traffic areas shall be traffic rated (H-20 or H-25 as appropriate).

4. All electrical installations shall be in accordance with NEC and local codes.

5. Conduits shall be supported/anchored every 3 feet. All conduit straps to be stainless steel.

D. Testing and Inspection

1. It is incumbent upon the Contractor to notify the Authority a minimum of 48 hours in advance to inspect the pump after installation is completed. The

Contractor shall provide all pressure gauges and other equipment necessary to perform the tests. The work will be tested and inspected for:

a. Tank cracks, loose fittings and general workmanship.

b. Minimum depth of force main and stone bedding.

c. All specified required fittings, valves and appurtenances.

d. Hydrostatic pressure test of 50 pounds per square inch for a grinder pump connection to a gravity service lateral, 75 pounds per square inch for a grinder pump connection to a low-pressure service lateral, or as determined by the Engineer, shall be applied to the low-pressure line in accordance with AWWA C-600. There shall be no drop in pressure for a period of 15 minutes.

2. The following electrical testing is required of the applicant before energizing:

   a. Equipment inspection and mechanical operation

   b. Megger all power circuits

   c. Ring all control circuits

   d. Check ground

3. The pipe trench will be backfilled only after the inspection and testing has been completed.

4. The pump shall be run through two normal pump cycle tests to confirm on/off operation as well as the proper sounding of all alarms. Applicant is responsible for providing water for the test. Use of clean water is acceptable.

E. Detail Drawings

Relevant detail drawings are:

12 Typical Low-Pressure Service Line to Gravity Sewer

13 Typical Low-Pressure Service Line to Low-Pressure Sewer Main or Force Main

16 Concrete Basin for Typical Individual Pump

17 Fiberglass or HDPE Basin for Typical Individual Pump

24 Wall-Mounted Control Panel (External Installation)

25 Post-Mounted Control Panel (External Installation)

END OF SECTION

Section 12
Pumping Stations

A. General

1. The information contained in this section is meant to serve as a general guide for pumping station design. All pumping station designs must be submitted to the Authority for review and approval prior to construction.

2. State Requirements

   Sanitary sewage pumping stations shall be properly designed to conform to all applicable regulations of the Pennsylvania Department of Environmental Protection (PADEP), Occupational Safety and Health Administration (OSHA) and the Pennsylvania Department of Labor and Industry.

3. Permits

   The Applicant shall secure, in the name of the Authority, all permits that are required in the name of the Authority such as those from PADEP, Conrail and the Pennsylvania Department of Transportation (PennDOT). The Applicant shall secure, in his own name, all required construction permits such as local street opening permits. Costs of all permits, including any and all bonds required, shall be the sole expense of the Applicant. Any existing street, highway or other improvements disturbed during construction shall be restored to the satisfaction of the appropriate municipality or Owner before the facilities will be accepted for final acceptance by the Authority.

4. Environmental Class

   Special consideration must be given to the fact that wet wells, other than those in residential properties, are considered a hazardous Class 1, Group D environment.

5. Safety Requirements

   All gears, chains, couplings, projecting set screws, keys and similar rotating or reciprocating parts shall be protected in accordance with the American National Standards Institute (ANSI).

6. Drawings and Details

   Prior to approval by the Authority, detailed construction drawings, specifications, design calculations and pump curves must be submitted for review by the Engineer. The drawings will be reviewed for general design, general dimensions and apparent suitability and will be approved or returned for revisions. Such approval will not relieve the Applicant of the

responsibility for furnishing equipment which will satisfactorily perform under the conditions specified.

B. Design Criteria

1. Municipal Requirements

   All aspects of the site design shall be in accordance with county and local municipal zoning and land development requirements.

2. Site

   a. The pumping station site shall be properly graded to eliminate any storm water problems and/or ponding conditions. After grading, the site shall be seeded and landscaped. Provisions shall be made to include shrubbery or trees in the landscaping to enhance the appearance of the station. The Applicant is responsible for obtaining a good stand of grass until the time of first cutting.

   b. The site shall be of sufficient size to accommodate the pumping facilities and to permit the turn-around of service vehicles.

3. Access Road and Turn-around

   a. The access road and turn-around at the pumping station shall have a paved surface. The minimum width of the paved surface of the access road shall be 12 feet and the access road and turn-around shall be constructed to the following minimum requirements:

      Formed, shaped and compacted subgrade

      Bituminous concrete base course - 6" thick

      Bituminous concrete binder course - 1-1/2" thick

      Bituminous concrete wearing course - 1" thick

   b. The paved area within the fenced area must be large enough and be designed so as to allow the turn-around of a single unit utility vehicle with a wheelbase of 20' and width of 8'-6".

4. Fencing and Lighting

   a. The site shall be fenced with vinyl-coated chain link fence 6'-0" high with sliding/rolling link fence gate and personnel gate. The personnel gate may be integral with the sliding/rolling gate or separate. Locking devices must be provided on both gates.

b. The site shall be provided with overhead exterior lighting.

5. Flow Metering

   a. A magnetic flow meter capable of continuously recording pumped flows shall be provided.

6. Power Supply

   The power supply for each new pump station shall be three-phase power, where applicable. Additionally, all new pump motors shall operate on three-phase power, where applicable. Phase converters shall not be allowed. Any exceptions to this requirement must be reviewed by the Engineer on a case-by-case basis. All pumping stations will be equipped with a diesel-powered emergency electrical generator with transfer switch.

C. Materials and Equipment

1. Description of Equipment

   The Applicant shall furnish a complete description of all equipment to be supplied including manufacturer's information and relevant pump characteristic curves based on laboratory tests of existing similar pumps. The curves shall show the capacity, head, efficiency and brake horsepower throughout the head and capacity range.

2. Spare Parts and Tools

   a. The Applicant shall furnish one complete set of all tools that are necessary for the maintenance and repair of the pumps. One pressure grease gun for each type of grease required for pumps and motors shall be furnished.

   b. Spare parts shall consist of one extra set of ball and/or roller bearings, two sets of mechanical seals for each pump, and one extra shaft sleeve for each pump size.

3. Pipes and Fittings

   Suction and discharge piping shall be Class 52 (min) ductile iron: ANSI A21.50 and ANSI A21.51. Fittings shall be gray iron or ductile iron: ANSI A21.10, up to 12" inclusive, 250 psi rated. Flanged joints shall be used inside structures. Mechanical joints shall be used for buried pipe.

4. Valves

   All valves of the same type shall be provided by the same manufacturer.

a. Gate Valves

(1) Valves shall open to the left (counter-clockwise). Operating nuts or wheels shall have an arrow and the word "open" indicating the direction of opening cast on the valve body.

(2) Acceptable manufacturers: (1) Clow Corporation; (2) American Cast Iron Pipe Co. (ACIPCO); (3) Kennedy Valve; (4) or equal.

b. Check Valves

(1) The valve shall be designed for a minimum working water pressure of 150 psi.

(2) The valve shall be iron body, bronze mounted, full opening swing check type with bolted cover, stainless steel hinge and malleable iron clapper arm. Disc shall be of cast iron with bronze seat ring.

(3) Valves 10" diameter and larger shall be furnished with outside lever and spring.

(4) Valves less than 10" diameter shall be furnished with outside lever and weight.

D. Station Construction

1. Submersible Type Pumping Stations

a. General

A minimum of two pumps (one duty, one standby) must be provided and installed. The station, including pump and valve chambers, manholes, meter pits, and other structures constructed below grade shall be watertight and must meet current ASTM Specifications. A separate valve chamber must be provided in accordance with PADEP requirements.

b. Wet Well and Cover

The wet well shall be of reinforced concrete and shall be provided with a hinged stainless-steel cover of non-skid pattern. The cover shall be large enough to comfortably accommodate the pumps. The cover shall have angle frame with rectangular opening of sufficient size to permit easy removal of the pumps. Cover shall have a hold-open bar that can be locked in open position and shall have a lock that uses a key or special insert to open. All hardware shall be 316 stainless steel. All interior concrete surfaces shall be lined with either a PVC or HDPE liner as specified in Section 8 – Precast Reinforced Concrete Manholes.

c. Valve Chamber

(1) A separate valve chamber shall be provided on the discharge side of the wet well. The valve chamber shall accommodate a check valve and a gate valve for each pump and shall be large enough to comfortably accommodate the valves and fittings. Above grade valve vaults will be considered on a case-by-case basis.

(2) A NEMA 4 light switch shall be provided on each check valve to signal open/close operation. The switches shall have N.O. (normally open)/N.C. (normally closed) contacts rated 120 volts, 10 amps. These switches shall be connected to the pump fail circuitry.

(3) The valve chamber shall be provided with a stainless-steel hatch cover with a non-skid pattern.

(4) Chamber shall be minimum 6'-6" deep with aluminum access ladder with rungs at 12" on center or steps of ½ " reinforcing bar encased with copolymer propylene. A 3" diameter drain shall be provided from the floor of the chamber to the wetwell. The floor shall be sloped towards the drain. The drain shall have a check valve to prevent backflow from the wetwell in case of high water level in the wetwell.

(5) A 120V single phase receptacle shall be provided in the valve chamber for operation of a dehumidifier.

d. Meter Chamber

(1) A separate meter chamber shall be provided on the discharge side of the valve chamber. The valve chamber shall accommodate a magnetic flow meter and restrained dismantling joint on the downstream side of the meter. A buried plug valve and box shall be installed on the downstream side of the meter chamber.

(2) The meter chamber shall be provided with an aluminum hatch as manufactured by Bilco, Halliday Products or approved equal. Chamber shall be a minimum 6'-6" deep precast or reinforced concrete structure with aluminum access ladder with rungs at 12" on center or steps of ½ " reinforcing bar encased with copolymer propylene. A 3" diameter drain shall be provided from the floor of the chamber to the wet well. The floor shall be sloped towards the drain. The drain shall have a trap and check valve to prevent backflow from the wet well in case of high water level in the wet well.

(3) A 120V single phase receptacle shall be provided in the valve chamber for operation of a dehumidifier.

e. Davit Crane

Station shall be provided with a manual davit crane to facilitate removal of the pumps. Davit crane shall be rated to remove two-times (2x) the weight of each pump.

f. Submersible Pumps

(1) Type: Pumps shall be Barnes ZSGV2072L Razor Grinder Pump 145349NC-MF,NC, moveable fitting, no cord.

(2) Casings: Pump casing and motor casing of ASTM-A48 cast iron. Pump casing of the single volute type, ribbed to prevent excessive deflection and hydrostatically tested to twice the design head, or 150% of the shutoff head, whichever is greater. Volute sized at all points to pass solids which can pass through the impeller and internally finished to provide smooth, unobstructed flow.

(3) Impeller: Non-clogging type of ASTM-A48 cast iron, statically, dynamically and hydraulically balanced, capable of passing 3" solids. Key seat the impeller and secure it to the shaft by a hex head impeller nut.

(4) Pump Shaft: Stainless steel of sufficient strength and size to safely transmit the maximum torque developed by the drive unit. Shaft sized to provide rigid support of the impeller and prevent excessive vibration.

(5) Pump Shaft Bearings: Ball or roller type, oil lubricated. Upper bearings to support full dead load and hydraulic thrust. Design bearings with a 20,000-hour B10 minimum bearing life per AFBMA test procedure.

(6) Shaft Seals: Provide each pumping unit with a double mechanical seal, running in an oil-filled reservoir, composed of two separate lapped faced seals, each consisting of one stationary and one rotating tungsten carbide ring each held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening.

(a) Protect the compression spring against exposure to the pumped liquid. Seal the pumped liquid from the oil reservoir by one face seal and the oil reservoir from the motor chamber by the other.

(b) Equip each pumping unit with a liquid sensing device to prevent damage to the motor in the event of a shaft seal failure.

(7) Pump Motor: Provide a motor having Class F insulated windings (which are moisture resistant) housed in watertight casing. The motor shall have cooling characteristics suitable to permit continuous operation in a totally, partially, or non-submerged condition. Motors shall be rated Class 1, Group D hazardous.

(8) Pump Accessories: Provide the following accessories with each pumping unit.

(a) Stainless steel chain of adequate strength and length to permit raising of the pump to the outside of the wetwell for inspection and removal. Chain must have large secondary links attached at minimum 10' intervals.

(b) Stainless steel guide rails.

(c) Stainless steel upper guide rail brackets.

(d) Pump mooring plate with discharge elbow and lower guide rail support brackets.

(e) Power cable of adequate length.

g. Controls

(1) Mercury Float Switch Controller: Provide a control system consisting of mercury float switch and other necessary appurtenances. Switches to be molded into an epoxy-filled polypropylene float. Provide two spare floats with cables to the Owner.

(2) Pump Controls: One circuit breaker disconnect unit per pump with magnetic trip sized for individual pump protection. This unit shall provide the maximum electrical motor protection available, serving as a circuit breaker and manual disconnect switch.

(a) One across-the-line starter per pump, sized in accordance with NEMA horsepower standards.

(b) One N.O. auxiliary contact for run status and one N.C. auxiliary contact for stop status, overload relay, and all other controls and accessories necessary for proper operation and protection.

(c) Low voltage (24 VAC) level sensing circuitry for intrinsically safe relaying.

(d) Solid state alternator for duplex controls.

(e) Individual toggle type selector switches to provide "Auto-Off-Hand" control of each pump.

(f) 24 Volt AC control transformer, protected by circuit breakers or fuses on both the primary and secondary.

(g) Terminals shall be provided for connection of the level sensors.

(h) A removable dead-front panel shall be provided to protect the operator.

(i) All operator controls, toggle switches, circuit breakers, etc. shall be accessible without removing the dead-front panel.

(j) NEMA 1 enclosure with latch mechanism Duplex 3-phase 240 or 480 volt power supply as dictated by the power company and motor requirements.

(k) A relay that automatically reconnects the control circuit to Pump No. 2 if the Pump No. 1 circuit breaker trips.

(l) High level and low-level alarm relays with unpowered contacts and terminals shall be included.

(m) Pump running transformer type pilot lights (red) mounted on operator's control panel. Pump stopped pilot lights (green) mounted on operator's control panel.

(n) Non-resettable running time meters mounted on operator's control panel.

(o) Seal leak detector for each pump with unpowered relay contacts for alarming.

(p) 3-phase power monitor with adjustable settings, stops pump for low voltage, single phasing and phase reversal.

(q) One pump to be locked off during generator operation with ability to switch to other pump should selected pump fail.

(r) A "Hand-Off-Auto" selector switch provided for each of the two pumps controlled with the following operation:

1. Hand Position: In this position, the pump controlled by the switch will run regardless of the wet well level. The pump will continue to run until the switch is turned to "Off" or "Auto".

2. Auto Position: In this position, the operation of the pumps is controlled automatically by the level sensors in the wet well as follows:

    a. The control circuit is placed in standby mode when the liquid level rises to tilt the lowest level sensor that is a redundant cutoff and low water alarm.

    b. As the level continues to rise, the control circuit is energized when the pump off level sensor rises.

    c. As the level continues to rise and the next level sensor is tilted, the first (lead) pump will start. In this step, the pumps will alternate on successive cycles. If Pump No. 1 starts first on one cycle, Pump No. 2 will start first on the next cycle. This insures equal operating time and wear on each pump.

    d. As the level in the well is pumped down, the pump(s) will continue to operate until the level drops just below the pumps' off level sensor.

    e. If the level in the well continues to rise with one pump in operation, the second pump will be turned on when the level reaches the lag pump on high water alarm level float.

    f. If the water continues to rise, the high water alarm level sensor will activate an alarm.

h. Flow Meter

(1) A flow metering device which is capable of continuously recording pumped flows and displaying instantaneous flow rate and totalized flow shall be provided. Meter shall be a COPA-X, Series 10D14654, magnetic flowmeter by ABB. It shall have a polyurethane liner; ANSI 150, 304 stainless steel flanges and metering tube; 316 SST bullet nose type electrodes; Division 2, Hazardous Location, safety rating; operating on 120 V ac, 60 Hz power; 120 V ac, 60 Hz remote mounted electronics; occasional submergence enclosure; process temperature to 190° F; 4-20 mA dc output signal. Meter shall be factory calibrated with a copy of the report in the O & M manual. Meter grounding shall be in accordance with the manufacturer's recommendations. Meter shall be capable of running empty indefinitely without damage to any component. Meter shall also have communication capabilities to allow for output of flow signal via future telemetry by others.

(2) A flow converter / transmitter shall be furnished with the meter. It shall operate on 120 V, 60 Hz power, have an isolated 4-20 mA output into a 0 to 1,000 ohms; with a NEMA 4X wall mount; connecting signal cable between flow meter and signal converter; and a seven digit, non-reset totalizer on the face of the enclosure and a scalable pulse output to drive the totalizer with a multiplier power of 10.

(3) A microprocessor based circular chart pen recorder and totalizer shall be provided to record the flow on a circular 10" or 12" diameter chart, 7-days/24 hour adjustable chart speed and a one year supply of pens and charts. Recorder shall be by ABB, Bristol or Honeywell. It shall operate on 120 V, 60 Hz power, and an input signal of 4 20 mA DC. Recorder shall integrate and display the totalized flow and be of the non-reset type and shall not reset on loss of power. Pens shall be of the disposable ink type. The mounting case shall be NEMA 3 or 4, as required, for wall or panel mounting.

E. Alarm System

1. An alarm system capable of monitoring the following functions and transmitting the relevant signal to the designated location shall be installed:

   a. Submersible Type Pumping Stations

      Power failure

      High wet well

      Low wet well

      Seal Leak

      Generator failure

      Pump failure

2. The dialer shall be a real voice type with 8-channel capacity. Acceptable dialer manufacturers: Verbatim by RACO or MCS 500 by Microtel.

3. Provide a wall-mounted pushbutton telephone and RJ-11 jack. Acceptable manufacturer: Bell, AT&T, G.E., or approved equal. Applicant shall make all arrangements with telephone company and pay all relevant installation charges and fees.

F. Tests

Field tests shall be carried out at the expense of the Applicant to insure that pumps and all equipment meet the design criteria. The Authority's personnel will witness the field tests.

G. Emergency Power

1. The Applicant shall install a diesel emergency generator set and automatic transfer switch required to run the pumps and all equipment within the station upon loss of normal power. Emergency generators will be considered on a case-by-case basis.

2. The system components shall be new equipment of current design, not one-of-a-kind, and consist of a state-approved engine-driven, electric generator with mounted start-stop controls, an automatic load transfer control, fuel, oil and anti-freeze, and necessary accessories. All components shall be completely built, tested and shipped by a manufacturer who has been regularly engaged in the production of such equipment for the past ten years and who has a local parts and service facility. The generator shall be as manufactured by Kohler, Caterpillar, Cummins Onan or approved equal.

3. The generator shall be mounted on a welded steel skid base, which in turn shall mount on 6" high I-beams securely mounted to the frame and a concrete pad. The pad shall be sloped to prevent standing water from accumulating under the generator set. The starting batteries shall be placed on a cast iron rack inside the housing. The muffler shall be a hospital-grade silencer attached to the exhaust line by 125-lb. standard pipe flanges. The exhaust line shall contain a condensate trap with drain cock at the first point of rise in the line from the engine. Only long radius elbows shall be used in the exhaust line.

4. All required anchor bolts shall be furnished and installed. A stainless-steel flexible pipe shall connect the engine to the exhaust system.

5. Exhaust air ductwork between radiator and exhaust louver shall be 20-gauge galvanized sheet steel. Engine radiator shall have a flexible duct adapter.

6. A thermostatically controlled jacket water heater shall be provided to maintain a jacket water temperature of 90° F. This unit shall be as manufactured by Chromalox or approved equal.

7. Provide a line circuit breaker with the generator. Breaker shall be rated to handle the generated fault currents and shall be one of those listed by the transfer switch manufacturer. Breaker shall have the required number of poles and current rating capable of handling required load.

8. Provide generator control panel with the following: voltmeter, ammeter, selector switch, start controls, voltage level adjustment rheostat, oil pressure gauge, fault indicators for safety shutdown, "Auto/Manual" switch, water temperature gauge, battery charge rate ammeter, field circuit breaker, running time meter, panel face illumination from the battery, generator failure output contacts.

9. Provide base-mounted diesel fuel tank of sufficient capacity to sustain a minimum of 24 hours running at full load, fuel gauge, fuel lines, threaded vent opening and a full tank of diesel fuel.

10. The use of propane gas as an alternative energy source will be considered by the Authority.

11. A current-limiting battery charger shall be furnished to automatically recharge the starting batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, and fused AC input. AC input voltages shall be 120 volts. Amperage output shall be no less than 5 amperes. Charger shall be LaMarche Manufacturing Company, Magnevolt or approved equal.

H. Transfer Switch

1. The automatic transfer switch shall be fully rated to protect all types of loads, inductive and resistive, from loss of continuity of power. The switch shall afford complete protection. The switch shall be rated as suitable for all classes of loads without de-rating, either open or enclosed.

2. The transfer switch shall automatically transfer its load circuit to an emergency or alternate power supply from failure of its normal or original supply. Upon restoration of the normal supply, the transfer switch shall automatically retransfer its load circuits to the normal supply.

3. All pilot devices/relays shall be of the industrial type rated 10 amperes with self-cleaning contacts.

4. Components of the operating mechanism shall be insulated or electrically dead.

5. All electrical equipment or apparatus of any one system must be the product of one manufacturer, or equivalent products of a number of manufacturers which are suitable for use in a unified system. No circuit breaker types are acceptable, nor parts thereof.

6. For complete protection, close differential voltage sensing relays shall be provided to monitor each phase of the normal supply. A drop in voltage in

any phase below the predetermined dropout value of the relay shall initiate load transfer. The relay shall initiate retransfer of the load to normal supply as soon as the voltage is restored in all phases beyond the predetermined pickup value of the relay.

7. The transfer switch shall obtain its operating current from the sources to which the load is being transferred.

8. The automatic transfer switch shall also be furnished with the following options: adjustable 2 to 120 second time delay on normal to emergency; adjustable 0 to 15 second time delay on engine starting; adjustable 12 second to 30 minute time delay on emergency to normal; adjustable 0 to 30 minutes, set at 5 minute time delay for engine cooloff; frequency/voltage relay for emergency source; test switch in cover of switch; normal supply pilot lights, emergency supply pilot light; engine start-stop contacts; relay auxiliary contacts on normal and emergency source, 1 N.O. and 1 N.C.; solid neutral bar assembly; plant exerciser for automatic test operation of plant with transfer of load for pre-selected intervals (adjustable 0-168 hours in multiples of 15 minutes) at least once a week.

9. All accessories and equipment shall be front accessible for ease of maintenance or removal.

10. Transfer switches and options shall be as manufactured by ASCO 940, Kohler, Cummins Onan or approved equal.

I. Lighting

1. The Applicant shall furnish all lighting equipment and components shown on the drawings, listed in the fixture schedule and specified herein.

2. The Applicant shall install lamps and accessories as required. Prior to acceptance of building by the Authority, all fixtures shall be cleaned, free of dust, insects and all foreign matter.

3. The light fixture schedule is as follows: industrial, ceiling mounted fluorescent, 2-lamp, 4 foot, 10-15 apertured up-light porcelain enamel reflectors, 120 volts.

4. Outdoor wall-mounted high pressure sodium, 120 volts, photo control.

J. Electrical Construction

1. The Applicant shall meet with the electric company and the local telephone company to determine all requirements at the site for service and metering. Any excess charges by the utilities for furnishing the required service shall be the responsibility of the Applicant.

2. The Applicant shall furnish and install a service pole at each pumping station if the service is overhead. Service conductors and raceways shall be installed from the generator building underground to the service pole and up the pole terminating in an approved entrance fitting. The power company will furnish and install an overhead service drop to the pole and connect to service conductors. Poles shall be guyed if required to offset pull of power company's service drop.

3. If the service is underground, the Applicant shall furnish and install underground conduit, current transformer cabinet, and meter base. Current transformer cabinet or self-contained meter base, as necessary, shall be mounted on the generator building. The utility companies will furnish and install the service lateral.

4. A grounding grid shall be provided at the service pole. Metal raceways, metal enclosures of electrical devices, transformer frames, neutral conductor and other equipment shall be completely grounded in accordance with the National Electrical Code. All necessary conduit, conductors, clamps, connectors, etc. for the grounding system shall be furnished and installed by the Applicant.

5. Provide a main service entrance approved disconnect switch with current limiting fuses as required. Heavy-duty type, NEMA 1 enclosure indoors, NEMA 3R enclosure outdoors with padlock attachment; Square D, Eaton Cutler-Hammer, G.E. or approved equal.

6. The panel board shall be rated for the voltage present, dead-front type, lockable with thermal-magnetic bolt-on circuit breakers, neutral and ground bus, typed circuit directory.

7. Lightning protection shall be provided on the feeders immediately on the load side of the main disconnect switch, grounding lead as short as possible to grounding system, Innovative Technology, Inc. "P-Plus" series, no equal. A plug-in protector shall be used which has receptacles and RJ-11 jack for the telephone/dialer connections, Innovative Technology, Inc. Model PIU, no equal.

8. Light switches to be 20 amp, 120/277 volt rated, P&S Series 20AC or approved equal; if weatherproof use P&S WP-1 lever handle weather sealing cover with FS box.

9. Receptacles shall be 20 amp rated, 120 volt, two-pole, grounding duplex, P&S 5362 or approved equal; ground fault type to be P&S 2091-F; if weatherproof use FS box with wet location cover; power outlet receptacle rated as required, heavy-duty, twist-lock, P&S Series or approved equal.

10. Underground conduit shall be PVC Schedule 40 as manufactured by Carlon, Sedco or approved equal. All bends in duct lines of 40° and greater shall be manufactured steel elbows of the same size as the PVC ducts. Ducts shall be encased in four inches of concrete. Where conduits pass under roadways, parking lots, or on filled ground, a mat shall be provided in concrete, consisting of two longitudinal #4 bars with #3 ties, 12" on center. Trenches shall be backfilled with clean dirt, thoroughly compacted.

11. All conduit shall be rigid galvanized steel or intermediate type, conforming to Federal Specifications WW-C-581E and be U.L. listed and manufactured by Triangle Conduit & Cable Company, National, Allied Tube & Conduit or approved equal.

12. Fittings for IMC conduit shall conform to Federal Specifications W-F-408 and shall be threaded type.

13. Install sealing fittings, Crouse-Hinds type EYS or EZS, Appleton type EYS or ESU, or approved equal, wherever a conduit passes into a hazardous area or extends between areas having widely different temperatures.

14. Wires and cables minimum size shall be #12, medium hard drawn copper. For 600 volt service and under, wire shall have Type THHN-THWN insulation. Wire size of #10 and larger shall be stranded. All wiring shall be color coded in accordance with current NEC requirements.

15. For wire size #10 and smaller, a solderless type press connector similar to "Buchanan" shall be used with snap-on type nylon insulator; splices of larger sizes of wire shall be made using an indentor type coupling applied with a hydraulic pressure tool.

16. All materials and workmanship shall meet the minimum requirements of the following standards where applicable:

    a. National Electrical Code (NEC) - National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts

    b. National Electrical Manufacturers Association (NEMA), 155 East 44th Street, New York, New York - Standards

    c. Institute of Electrical and Electronic Engineers (IEEE), 33 West 39th Street, New York, New York - Standards

    d. The U.S.A. Standards Institute, 29 West 39th Street, New York, New York - Standards & Definitions of Electrical Terms (U.S.A.S.)

e. National Bureau of Standards, Washington, D.C. - National Electrical Safety Code

f. Reflector and Lamp Manufacturers Institute, Inc. 307 North Michigan Avenue, Chicago, Illinois - Lamp Reflector

g. Underwriter's Laboratories Inc. - Standards

h. OSHA Standards, where applicable, shall also be met, including those for temporary wiring on construction sites.

17. All necessary permits and fees for this work shall be secured and paid for by the Applicant. Inspection shall be by an approved inspection agency licensed by the Commonwealth of Pennsylvania and final certificate of approval shall be delivered to the Authority prior to acceptance.

M. Start-Up

1. The Applicant shall provide the services of fully qualified manufacturer's representatives for services during installation, at start-up, and for instructing the Authority's personnel in the operation, routine maintenance, and troubleshooting for all equipment, mechanical and electrical, furnished with the pumping station. Applicant shall full load test the generator for four (4) continuous hours using Applicant-furnished load bank. Notify Engineer 48-hours prior to the test. If testing stops for any reason, correct the problem and start new four (4) hour test. Submit test results.

2. The Applicant shall provide five (5) bound copies of a manual fully explaining the operation, routine maintenance and troubleshooting for equipment. The manuals shall include copies of all shop drawings with all required revisions. These manuals must be submitted to the Authority for approval prior to acceptance.

3. The manuals must include information relative to suppliers of spare and replacement parts.

4. Trainings for the Authority shall be conducted on site.

5. A digital copy in .pdf and .dwg shall be provided to the Authority. One (1) hard copy of record drawings shall be provided to the Authority.

END OF SECTION

Section 13
Easements

A. General

1. Easements shall be required for all sanitary sewerage facilities intended for dedication to the Authority that are constructed outside the limits of a public street right-of-way. This would include sanitary sewerage facilities installed within a private street. In addition, easements may be required for sewerage facilities constructed within a public street right-of-way if the existing right-of-way does not provide sufficient room for access or maintenance of the sewer line.

2. Easements shall be a minimum of 20 feet wide and shall be, in general, centered over the sanitary sewerage facilities unless otherwise approved by the Authority. Additional easement width may be required by the Authority on a case-by-case basis.

3. The Authority shall only approve the use of a combined utility easement when it is proven that no other reasonable alternative to the proposed layout exists. A combined utility easement shall be a minimum of 30 feet wide, with the sanitary sewer being located a minimum distance of 10 feet from the edge of the easement and at least 10 feet from all other utilities located within the utility easement, thus adequately meeting the sewer/water separation distance requirement.

4. The Authority and its agents, contractors or employees shall have free ingress, egress and regress over and through the easement at all times and seasons in order to maintain, reconstruct, enlarge, repair, inspect, remove or relocate any sanitary sewer main or mains, manholes, connection fittings or other appurtenances.

5. No building, fence, lighting fixture, pond, swimming pool, driveway, parking lot or other permanent structure shall be erected or located within the sewer easement. No vehicles, campers, trailers, boats or other large equipment or facilities shall be stored within the easement on a long-term basis. No trees, shrubbery or bushes shall be planted within the boundaries of the easement.

6. Property owners shall not be due compensation from the Authority for damage to permanent structures or loss of trees, shrubbery or bushes resulting from work performed by the Authority and its agents, contractors or employees that occurs to such items that are placed within the easement following execution of an easement agreement.

7. Property owners shall not alter the grade or construct landscaping features within the easement that would impair access by the Authority.

B. Developer Project Requirements

1. Individual plot plans and legal descriptions shall be provided for all easements.

    a. When an easement crossing multiple parcels is proposed by a Developer, a single plot plan (at a legible scale) and legal description shall be acceptable only if the Developer owns all parcels impacted by the easement at the time when the easement is offered for dedication. Otherwise, individual plot plans and legal description shall be required for all parcels containing a portion of the easement.

    b. The Developer shall be responsible for securing all easements from private property owners when facilities are constructed across private property to serve the Developer's property. Those easements shall be assigned to the Authority following review and approval of as-built plans and prior to dedication of the newly constructed sanitary sewerage facilities.

    c. The Developer shall provide evidence that proposed sewer easements are incorporated into the deeds for individual properties within the development.

2. Dedication of easements shall occur following review and approval of as-built plans and prior to dedication of the newly constructed sanitary sewerage facilities.

END OF SECTION

PARADISE TOWNSHIP SEWER AUTHORITY
Lancaster County, Pennsylvania

REQUIREMENTS AND PROCEDURES
FOR ONE EDU CONNECTIONS TO THE SEWER SYSTEM

1. Upon verbal inquiry from Owner, obtain the following information:

   a. Name, street address and telephone number of Owner.

   b. Road on which connection is to be made.

   c. Verify that property is in PTSA service area.

   d. Is connection to an existing lateral?

   e. Is connection on a state road?

   f. Who is the contractor? Telephone number?

   g. What is the schedule for construction?

   If there is no sewer extension or PENNDOT permit involved, RETTEW will provide letter to the Owner stating that a Sewer Permit can be applied for and obtained at the Authority Office, located a 2 Township Drive, Paradise, PA 17562.

2. Lateral in State Road

   a. PENNDOT Permit will be required. Permit to be in PTSA's name. Inform Owner that RETTEW can prepare the PENNDOT Permit application if the Owner so wishes. The costs associated with preparation of the permit application will be billed to the Owner.

   b. Owner is to execute a Short Form Developer's Agreement with PTSA. The Agreement will be prepared by the PTSA solicitor and sent to the Owner for signature.

   c. When the Agreement has been signed and the PENNDOT Permit received, a copy of the permit will be sent to the Owner for his contractor's use.

   d. Upon completion of inspection, RETTEW will track scheduling of restoration work required by the PENNDOT Permit and will perform a follow-up inspection. Upon satisfactory completion of the follow-up inspection, the RETTEW inspector will send notification of completion to PENNDOT.

3. Sewer Main Extension

In the case where an extension of the sewer main is involved and the line will be dedicated to PTSA, the Owner is to execute a long form Developer's Agreement with PTSA. All other steps in the procedure will remain the same. After RETTEW has completed an inspection and the line is deemed acceptable, the solicitor will be so informed and will prepare necessary documents for dedication to PTSA.

PARADISE TOWNSHIP SEWER AUTHORITY
Lancaster County, Pennsylvania

DEVELOPER'S REQUIREMENTS AND PROCEDURES TO CONSTRUCT EXTENSIONS TO THE SANITARY SEWER SYSTEM OF THE PARADISE TOWNSHIP SEWER AUTHORITY

A. Pre-Submission Phase

1. The Authority's Administrator ("Administrator") shall be the initial point of contact for a developer seeking to obtain sanitary sewer service for a potential land development project. The Developer seeking to obtain sanitary sewer service shall attend the Authority meeting occurring on the first Monday of every month. The week prior to the meeting, the Authority shall be notified by the developer that they will be attending the meeting.

2. Developer must confirm the escrow has been established through the Township.

B. Capacity Reservation Phase

1. Applicants desiring capacity allocation from Paradise Township Sewer Authority (PTSA) must provide the following information:
    a. Date of formal written request.
    b. Name and location of the development or project.
    c. Name, address, and phone number to which communications should be directed.
    d. Date on which plans were, or will be, filed with the Township.
    e. Two (2) copies of the subdivision and/or land development plan.
    f. Number of equivalent dwelling units (EDU's) proposed.
    g. Total projected sewage flow (at 250 GPD per EDU).
    h. Anticipated timing, including:
        (1) Start of construction.
        (2) Rate of Sewer Permit acquisition.
        (3) Completion of construction.
    i. Statement as to whether the development or project is in conformance with the most recent Act 537 Plan for the Township. If not, please state the applicant's plans and schedule to achieve conformance.
2. The applicant requesting a capacity allocation from PTSA must represent and have responsibility for the entire property or development for which sewage capacity is being requested, i.e. a developer representing his proposed development or a Township (or developer) representing a particular area desiring to be sewered. PTSA will not accept requests from an individual or individuals representing property in which they do not have controlling equity interest.

3. In the case of a sewer capacity request for a non-residential waste discharge, the applicant is advised of the possible requirement, and associated expenses, for an executed Industrial Waste Discharge Agreement, dependent upon the characteristics of the proposed discharge.

4. Information submitted by the applicant in accordance with Item B.1 of these Requirements and Procedures will be reviewed by PTSA and, if acceptable, the project will be placed on the Capacity Request List. The date the project is placed on the Capacity Request List shall be defined as the Applicant's Commitment Date.

5. Placing a project on the Capacity Request List does not guarantee that capacity will be provided by PTSA. The ultimate capacity and service area of the PTSA system is also dependent on decisions by the County and the Pennsylvania Department of Environmental Protection.

6. PTSA has a limited reserve capacity for sewage conveyance and treatment. In order to assure that PTSA's reserve is not exceeded, the engineer's review will include the projected impact of the proposed project on both the reserve capacity at the treatment plant and PTSA's conveyance facilities.

7. Should the Authority determine that a feasibility study is necessary to assess the ability of the Authority's sewer system to accommodate the project, the applicant will be advised of the estimated cost for the feasibility study to be performed by the Authority's Engineer. The applicant shall deposit such estimated cost with the Authority prior to the initiation of the study. Should the scope of the feasibility study increase for any reason, the applicant shall deposit additional funds as requested. Payment of all actual costs associated with the preparation of feasibility studies must be made by the applicant prior to Authority acceptance of the preliminary plans.

8. Assuming capacity is available, the applicant will be able to reserve capacity with the Authority. While reservation of capacity prior to construction is not mandatory, it is recommended, in particular for projects located within drainage basins of limited available conveyance capacity.

9. To reserve capacity, the applicant shall be required to pay to PTSA a Capacity Reservation Fee of $120 per EDU per year for a maximum of three years. For commercial applicants, the volume of the proposed wastewater discharge will be converted to EDUs using the Authority's standing EDU value at the time of the reservation. The amount of the reservation fee is periodically updated and will be at the rate established by the Authority as of the day of payment. A full year's payment in advance will be required on the Applicant's Commitment Date and will cover reservation fee expenses through the same date of the following year. A full year's payment in advance of the Capacity Reservation Fee will be required on the anniversary of the Applicant's Commitment Date for each subsequent year, for as long as the project remains on the Capacity Request List, not to exceed three years (discussed in C.6 of these procedures). Alternatively, the applicant may choose to pay the Authority's established tapping fee per EDU. In this scenario, annual reservation fees would not be required. If the applicant does not pay the Capacity Reservation/Tapping Fee within 30 days of the due date, the project will be dropped from the Capacity Request List.

C. <u>Plan Review Phase</u>

1. If not provided in conjunction with the capacity review phase, the applicant shall submit two copies of preliminary development plans and/or sewage planning modules to PTSA and one copy of each to the Authority Engineer for review. Requirements for preliminary development plans are outlined in Exhibit A.

2. In the event planning modules are submitted to PTSA prior to preliminary development plans, the applicant shall submit with the planning modules: (a) a site plan showing all lots in the development, (b) the point(s) of connection to the existing system, and (c) the number of EDUs per point of connection. This information must be submitted prior to engineering review.

3. After preliminary development plans have been approved by PTSA, the applicant shall perform the following:

    a. Furnish PTSA with an estimate of the cost of completion of the proposed wastewater system improvements reflecting the full cost to install pumping stations, sewers, including all related manholes, accessories and appurtenances. The cost shall be established by submission to PTSA of a bona fide bid or bids from the contractor(s) chosen by the applicant.

    b. Furnish PTSA with an irrevocable letter of credit from a bank authorized to do business in Pennsylvania guaranteeing the installation of the sewer lines. The letter of credit must be in the form provided by PTSA and must be equal to 110% of the cost to install the sewer line extension.

    c. If required, obtain a Water Quality Management Permit from the Pennsylvania Department of Environmental Protection, if required. Although this permit will be issued in the name of PTSA, it is the responsibility of the applicant to apply for the Water Quality Management permit.

    d. Furnish PTSA with a proposed schedule by which the permits will be obtained for the development. The schedule is intended to serve as a planning tool for PTSA, and will not be binding on the applicant insofar as the number of permits per year which need to be obtained.

4. After all of the preceding activities have been completed, the applicant shall enter into a Developer's Agreement with PTSA for extension(s) of PTSA's sewer system, as well as any required improvements to existing PTSA facilities, in a form acceptable to the PTSA solicitor. Upon execution of the Developer's Agreement, the applicant's project shall be placed on the PTSA Management Plan that shall reserve the capacity granted by the Authority for a period of five years from the date of execution of the Developer's Agreement.

5. The Capacity Reservation Fee will remain in effect per EDU per year throughout the project's duration for those EDUs for which the applicant has not yet obtained permits in any given

year. Reservation Fees shall be pro-rated or credited to the applicant on a quarterly basis in any case where a partial year payment may apply.

D. Construction Phase

1. In the event wastewater upgrades are to be installed within any state highways, the applicant must obtain a highway occupancy permit from the Pennsylvania Department of Transportation and any required bonds.

2. Sanitary sewer construction and testing shall be performed in accordance with the provisions of PTSA's Specifications for Sanitary Sewer Construction. Prior to commencement of construction of the sewer line extension, the applicant shall provide the PTSA with a construction schedule. PTSA or its designated representative will perform inspection of the construction.

3. Upon the completion and satisfactory inspection of the wastewater upgrades, the applicant shall furnish the PTSA with record plans for the upgrades including all lateral depths, lengths, and locations.

4. Following review and acceptance of the record plans by PTSA's Engineer, the applicant shall be eligible to obtain Sewer Connection Permits for the development on an as-needed basis. In lieu of submitting complete record plans for an entire project or phase at one time, applicants shall have the option of submitting record plans for individual sewer lines or combination of lines. Upon review and acceptance of such lines, the applicant shall be eligible to obtain Sewer Connection permits for the lines in question. An exception to the record plan requirement prior to Sewer Connection Permit issuance will be made for up to 50 percent of the total number of EDUs in the completed portion of the project, or a maximum of 20 EDUs, whichever is less, provided construction and satisfactory inspection of the sewer lines has been completed.

5. Payment of connection and tapping fees shall be made at the time the Sewer Connection Permits are obtained, if not paid previously in conjunction with capacity reservation. Applicants are reminded that Sewer Connection Permits are only valid for a period of one year from the date on which they are obtained.

6. Capacity for Sewer Connection Permits not obtained within the three-year guaranteed capacity period may only be maintained by payment of the associated tapping fees prior to the expiration of the guaranteed capacity period, unless otherwise specifically approved by PTSA. All capacity not reserved by payment of the appropriate tapping fees will be forfeited by the applicant. The applicant shall also be responsible for the payment of PTSA user fees equivalent to the typical billing cycle for the service area in which the project is located, in lieu of reservation/commitment fees, for all EDU's secured by payment of tapping fees after the three-year period.

7. The guarantee of sewage capacity by the Authority shall apply only to the party executing the Developer's Agreement with the Authority. Should the applicant subsequently transfer any of the properties covered by the Developer's Agreement to another party, it shall be the applicant's responsibility to provide documentation of the transfer in a form acceptable to PTSA to maintain the continuity of the capacity reservation.

8. The construction of service connections to the sewer extension shall be in accordance with the PTSA's Specifications for Sanitary Sewer Construction. PTSA or its designated representative will perform inspection of the installation of service connections.

9. The applicant shall deliver executed sewer easement agreements for all cases where sanitary sewer lines to be dedicated to PTSA are located on private property. The applicant shall provide evidence that all easement agreements have been recorded on the respective deeds.

10. The applicant shall execute and deliver to PTSA a Bill of Sale transferring the sewer lines to Appel, Yost & Zee, LLP. The Bill of Sale shall include a legal description and plans of the sewer lines being conveyed to PTSA.

E. Warranty Phase

1. The applicant shall be responsible to correct any defects in workmanship or materials for a period of 18 months following the acceptance of the sewer line extension by PTSA. The applicant's letter of credit shall be maintained at 10 percent of the construction cost estimate for the 18-month period.

Note: The foregoing outline and explanation is not intended to be a complete statement of all of the requirements and procedures applicable to sewer extensions. Furthermore, in some instances, the applicant will have to determine, based upon his own circumstances, the sequence in which various approvals will be obtained. It is anticipated that the foregoing information will be a helpful guide to applicants, and PTSA encourages any applicant to attend the regular meetings of the Authority that are held at Two Township Drive, Paradise, Pennsylvania, on the First Monday of each month at 7:00 p.m. to obtain further information and guidance.

EXHIBIT A

Paradise Township Sewer Authority
Preliminary Development Plans

Yes	No	Development Information
____	____	1. Name and address of the developer and developer's engineer.
____	____	2. Name and location of project.
____	____	3. Date(s) the project plans were filed with PTSA.
____	____	4. Number of dwelling units proposed in the project.
____	____	5. Written request for sewage treatment capacity.
		Minimum Plan Requirements
____	____	1. Vicinity map showing which part of the Township the project will be located. Scale 1" = 2000'
____	____	2. Plans should indicate all easements as required for sanitary sewers or other utilities.
		In those cases where sanitary sewer lines which are to be dedicated to PTSA will be installed on private property, the applicant shall furnish PTSA with legal descriptions and plans for sanitary sewer easements. In addition, applicants must provide PTSA with the name and address of all property owners who will be granting easements to PTSA and the name and address of any lien holders who hold mortgages or judgments against the property through which the easements will be granted.
____	____	3. A site plan showing all lots and utilities (sewer, water and stormwater at a minimum) in the development. Plan and profile views showing sewers and water lines (if applicable). Isolation distances between sewer and water lines should be provided on the plans and profiles.
____	____	4. Plans should show locations of existing wells.
____	____	5. Plan views should be at a scale of 1" = 50'. Profile view should be at a scale of 1"=50' horizontally and 1" = 10' vertically. All sheets should be standard size of 22"x34" or 24"x36"
____	____	6. Material of construction of the sewer and water lines must be noted (e.g. 8" SDR 35, etc.)
____	____	7. Length and slope of each section of sewer line between manholes must be noted on the plan and profile sheets.
____	____	8. All manholes must be numbered in plan and profile.
____	____	9. Location of the existing manhole, sewer or pumping station, to which the proposed

project will connect must be clearly noted on the plans. The DEP permit number and PTSA - designated manhole number of where the connection will be made should be provided.

____ ____ 10. Rim and invert elevation must be indicated for each manhole.

____ ____ 11. If a pumping station or individual submersible pumps are required, detailed drawings and specifications should be provided.

____ ____ 12. The following details should be provided.

(1) Precast concrete manhole detail.
(2) Concrete encased outside drop, if used in plans.
(3) Service connection detail.
(4) Service pipe riser detail.
(5) Pipe trenching detail

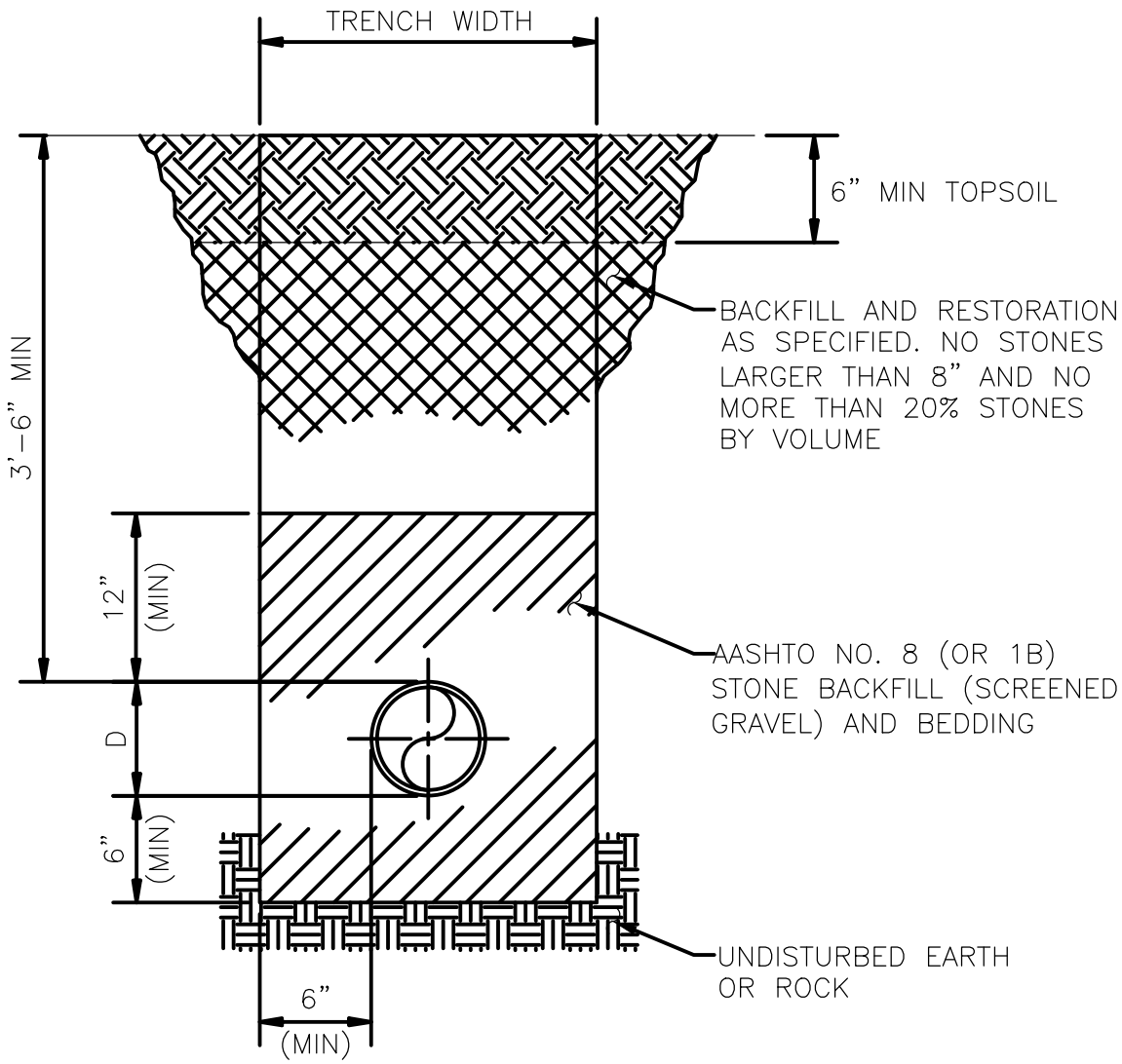
____ ____ 13. A Note stating: "All sanitary sewers and appurtenances shall be constructed in accordance with Paradise Township Sewer Authority Specifications."

____ ____ 14. All plans and specifications submitted for review should be sealed and signed by a Registered Professional Engineer or Land Surveyor.

APPENDIX C

DETAIL DRAWINGS INDEX

No.	Description
1.	Right-of-Way Restoration
2.	Concrete Encasement
3.	Pavement Restoration
4.	Lateral
4a.	Standard Lateral or Service Line Cleanout
5.	Lateral Riser
6.	Precast Concrete Manhole
6a.	Shallow Manhole
7.	Drop Manhole
7a.	Precast Drop Manhole Base
7b.	Internal Drop Connection to Manhole
8.	Cast-in-place Base - New Manhole over Existing Sewer
9.	New Sewer to Existing Manhole Connection
10.	Typical Service Line - Profile
11.	Typical Service Line – Plan
12.	Typical Pressure/Low-Pressure Service Line Schematic to Gravity Sewer
13.	Typical Low-Pressure Service Line Schematic to Low-Pressure Sewer Main or Force Main
14.	Air Release Valve and Chamber
15.	Force Main Connection to Manhole
16.	Concrete Basin for Typical Individual Pump
17.	Fiberglass Basin for Typical Individual Pump
18.	Thrust Blocks for Horizontal Bends and Lower Vertical Bends
19.	Restrained DI Pipe Length
20.	Precast Concrete Flow Monitoring Manhole
21.	Pipe Cradle in Casings
22.	Low-Pressure Sewer Valve and Cleanout Manhole
23.	Low-Pressure Sewer Terminal Cleanout Manhole
24.	Wall-Mounted Control Panel (External Installation)
25.	Post-Mounted Control Panel (External Installation)



NOTE:
TRENCH SIDE SLOPES SHALL BE IN ACCORDANCE WITH OSHA REQUIREMENTS. BEGIN SIDE SLOPES, IF USED, APPROXIMATELY 18" ABOVE TOP OF PIPE (TYPICAL ALL BEDDING TYPES).

RIGHT-OF-WAY RESTORATION

DETAIL

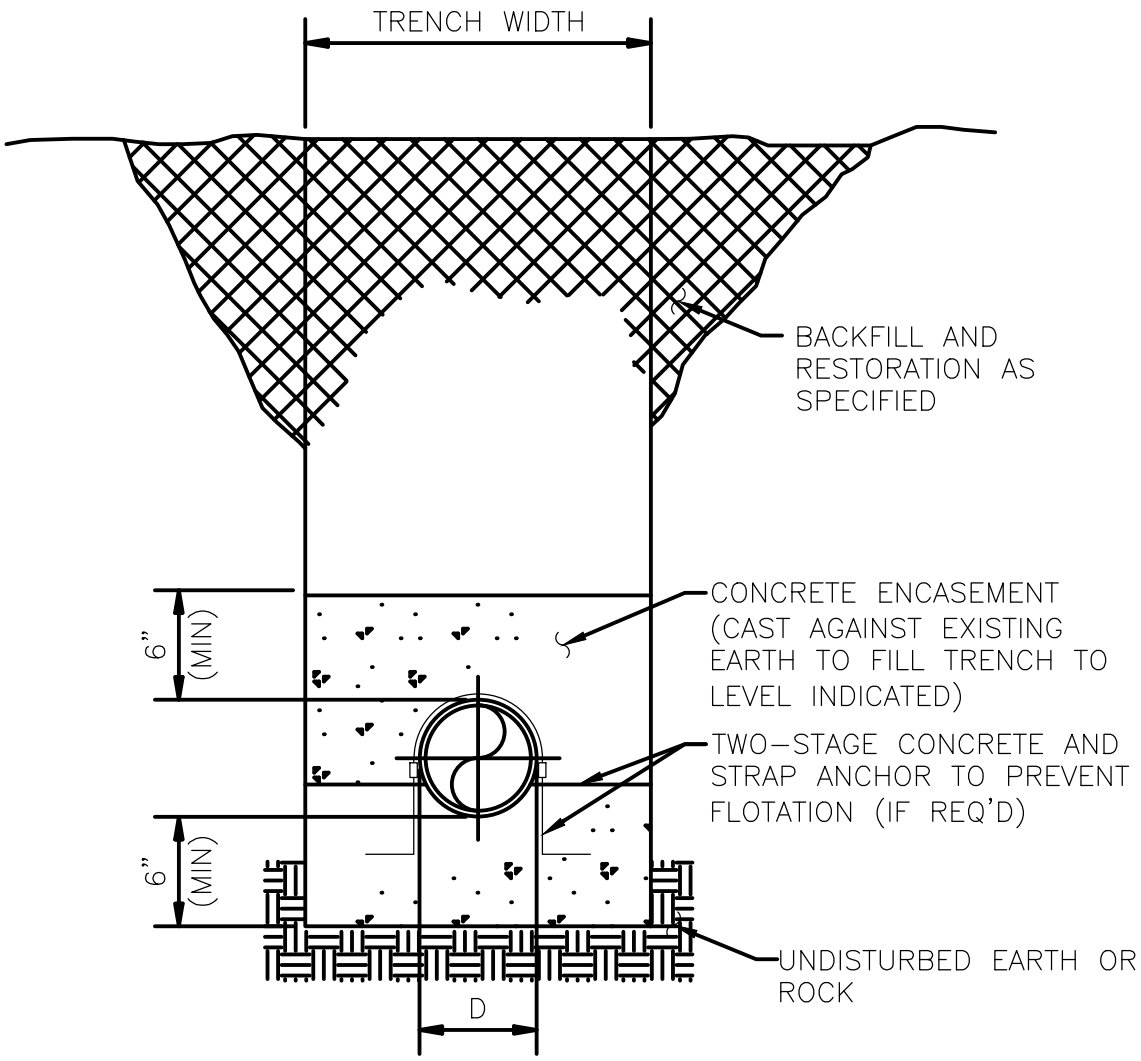
NO SCALE

1

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

DRAWN BY: JNW
DATE: MAY 2024
SCALE: NO SCALE
DWG. NO.



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CONCRETE ENCASEMENT DETAIL

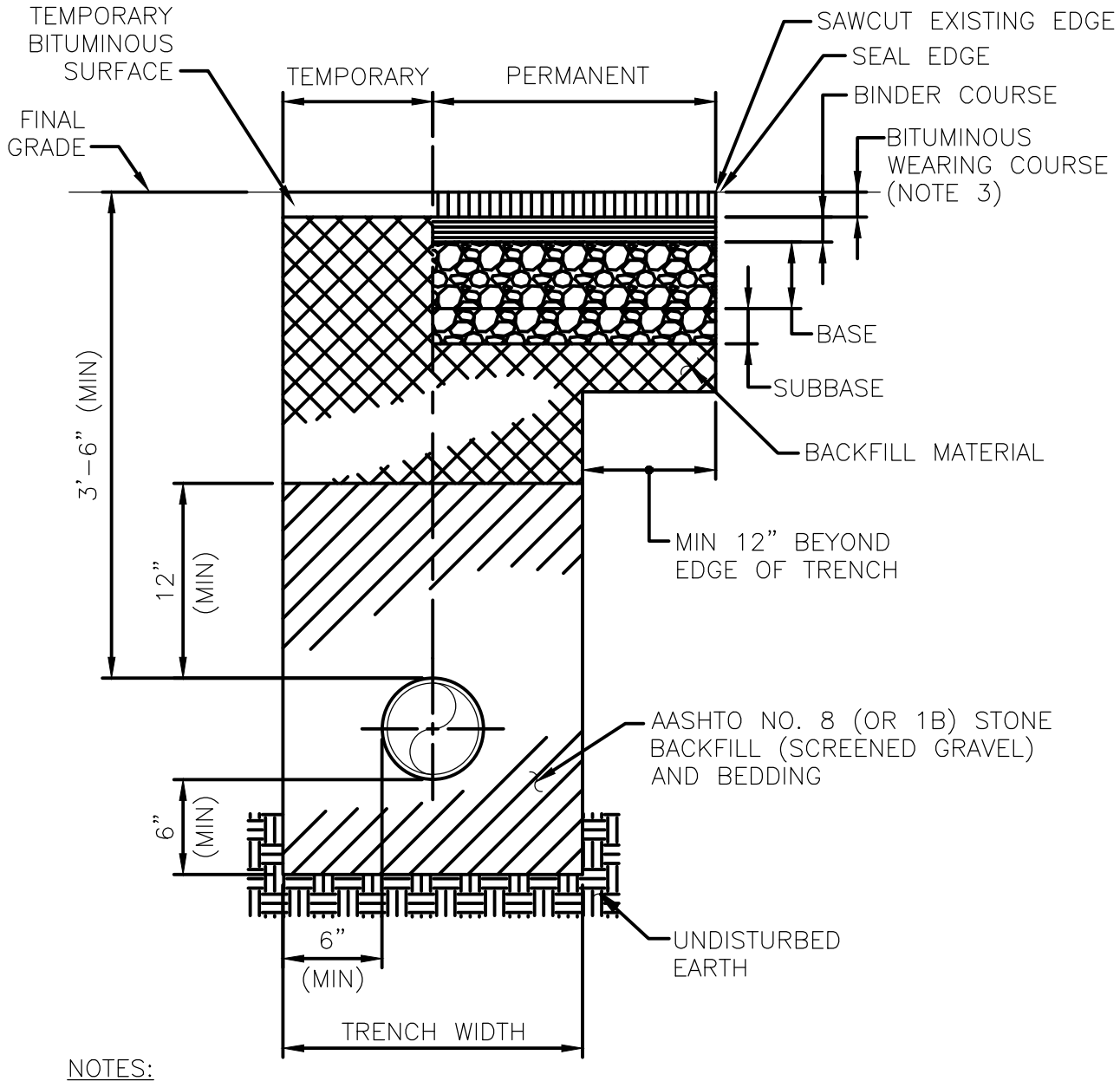
NO SCALE

2

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

DRAWN BY: JNW
DATE: MAY 2024
SCALE: NO SCALE
DWG. NO.



NOTES:

1. BACKFILL & PAVEMENT RESTORATION IN STATE ROADS SHALL BE AS SPECIFIED BY PADOT.

2. BACKFILL & PAVEMENT RESTORATION IN TOWNSHIP ROADS, ACCESS DRIVES, PARKING AREAS AND LOADING AREAS SHALL BE AS SPECIFIED IN THE WEST DONEGAL TOWNSHIP SUBDIVISION AND LAND DEVELOPMENT ORDINANCE.

3. REFER TO PARADISE TOWNHSIP SALDO ORDINANCE – SECTION 602.6 FOR PAVEMENT THICKNESS REQUIREMENTS.

PAVEMENT RESTORATION DETAIL

NO SCALE

3

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

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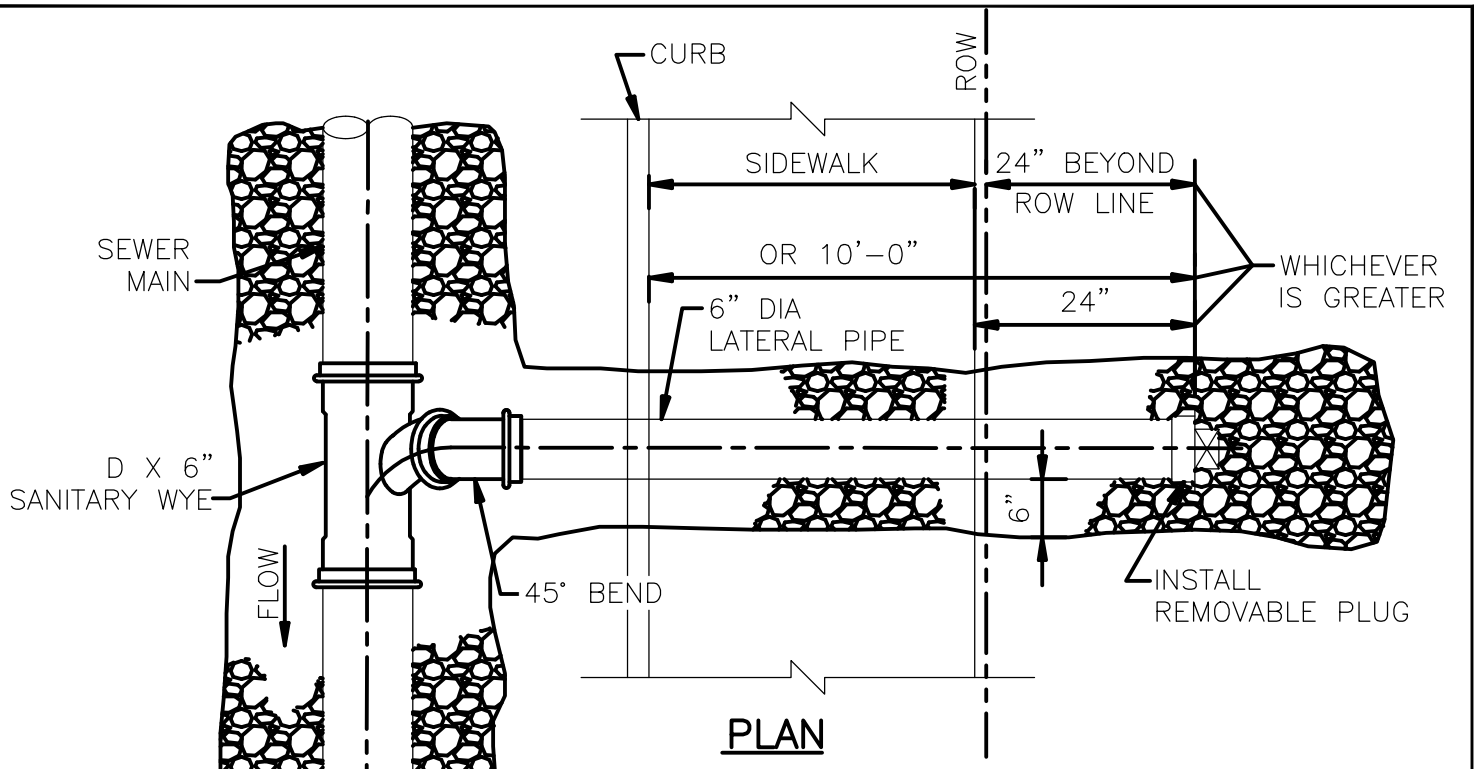
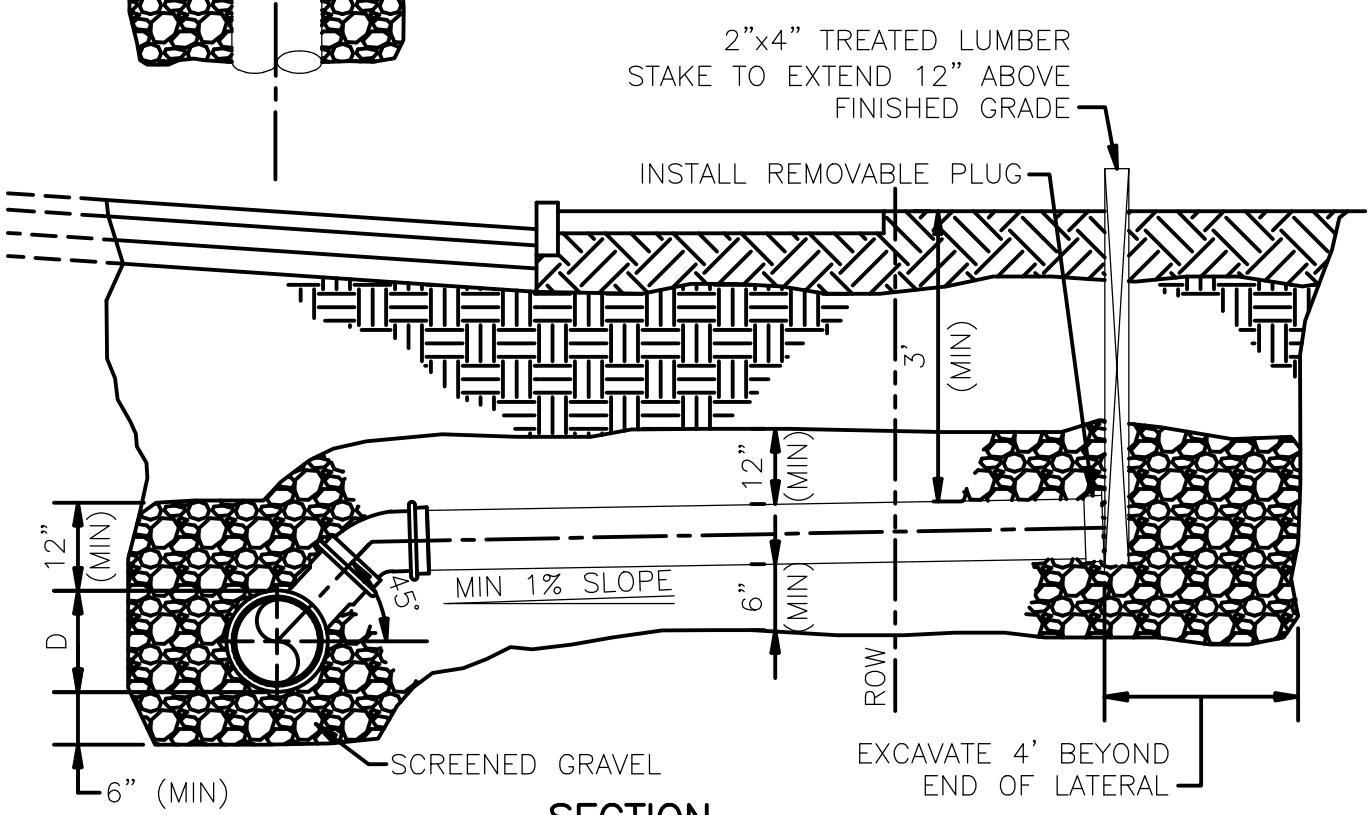


PLAN



SECTION

LATERAL

DETAIL

NO SCALE

4

DEVELOPER SPECIFICATIONS
FOR

PARADISE TOWNSHIP SEWER AUTHORITY

MONROE COUNTY, PA

RETTEW

RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

DRAWN BY: JNW
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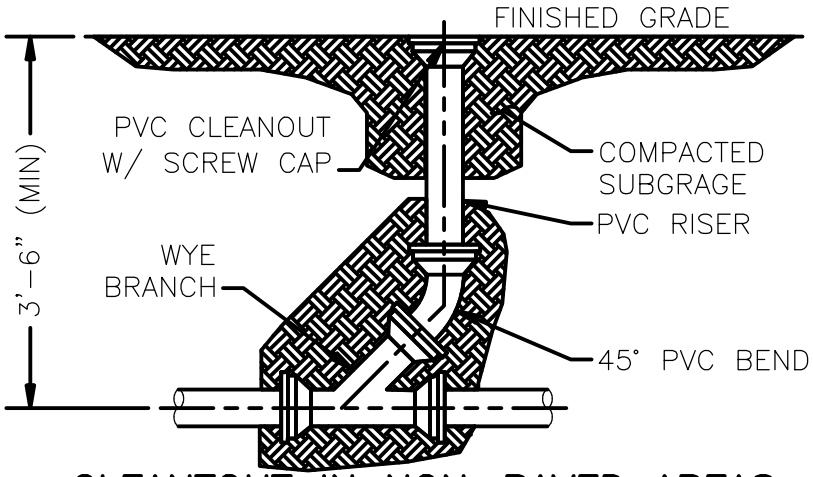
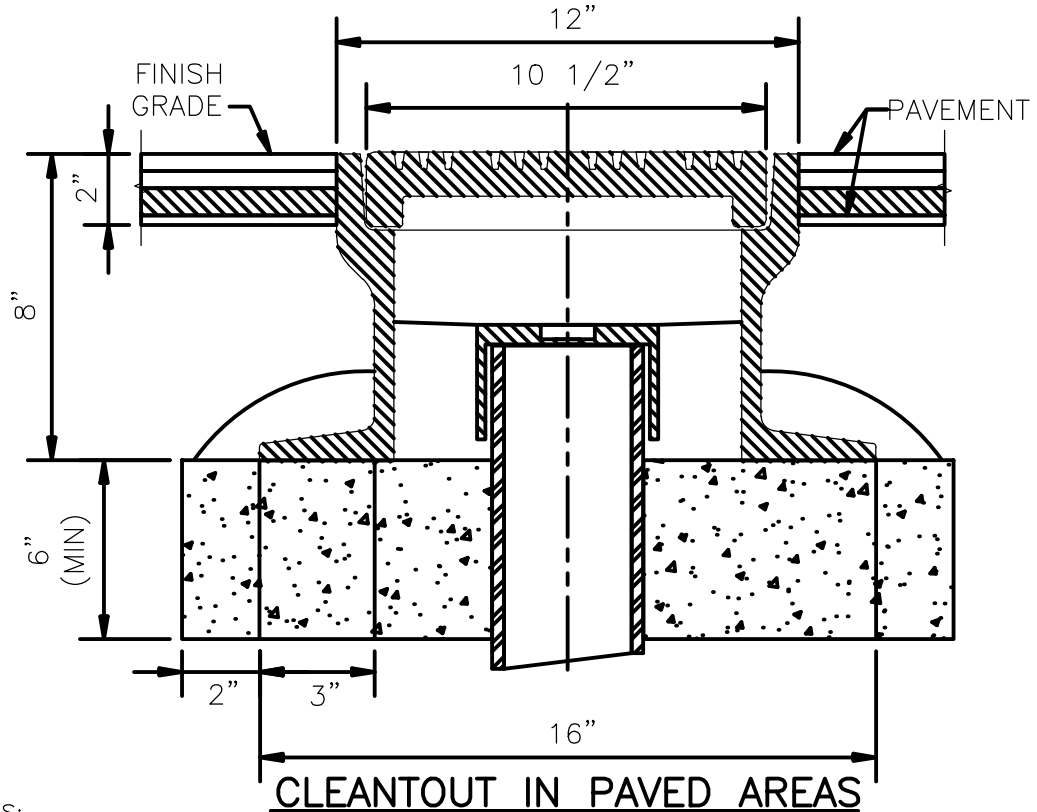


CLEANTOUT IN NON-PAVED AREAS



CLEANTOUT IN PAVED AREAS

NOTES:

1. THIS DETAIL APPLIES TO RESIDENTIAL APPLICATION ONLY; FOR NON-RESIDENTIAL APPLICATIONS, CLEANOUT CONSTRUCTION SHALL BE AS APPROVED BY ENGINEER.
2. SERVICE LINE SHALL BE CONNECT TO THE CLEANOUT AT THE WYE; CONNECTION FO A SERVICE LINE INTO THE RISER PORTION OF A CLEANOUT SHALL NOT BE PERMITTED.
3. IF LOCATED IN CONCRETE PAVING, THE CLEAN-OUT SHALL BE ENCASED IN A 24"X24" AREA BOXED OUT WITH EXPANSION JOINT MATERIAL.

STANDARD LATERAL ON SERVICE LIN CLEANOUT

DETAIL

NO SCALE

4a

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
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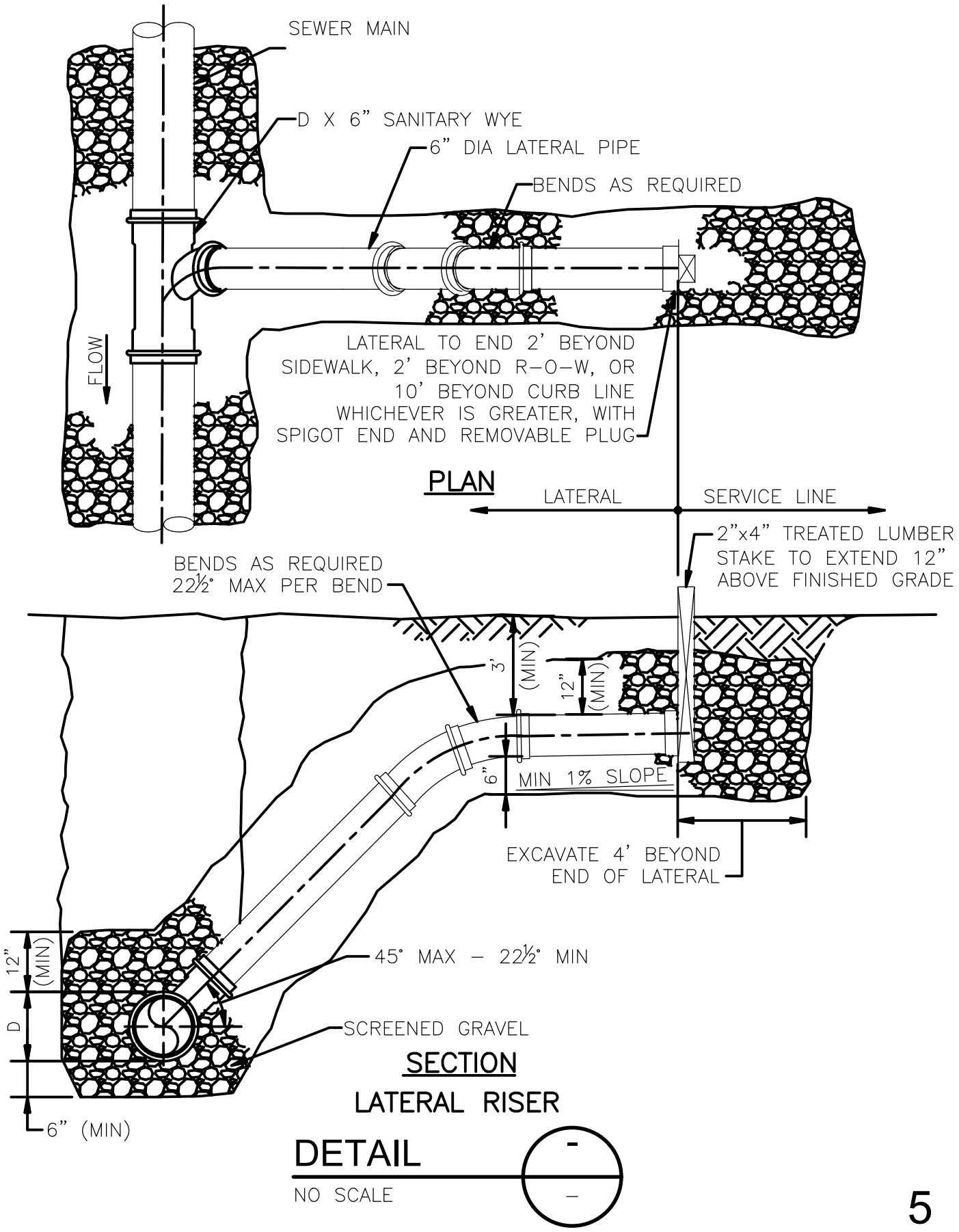

5

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

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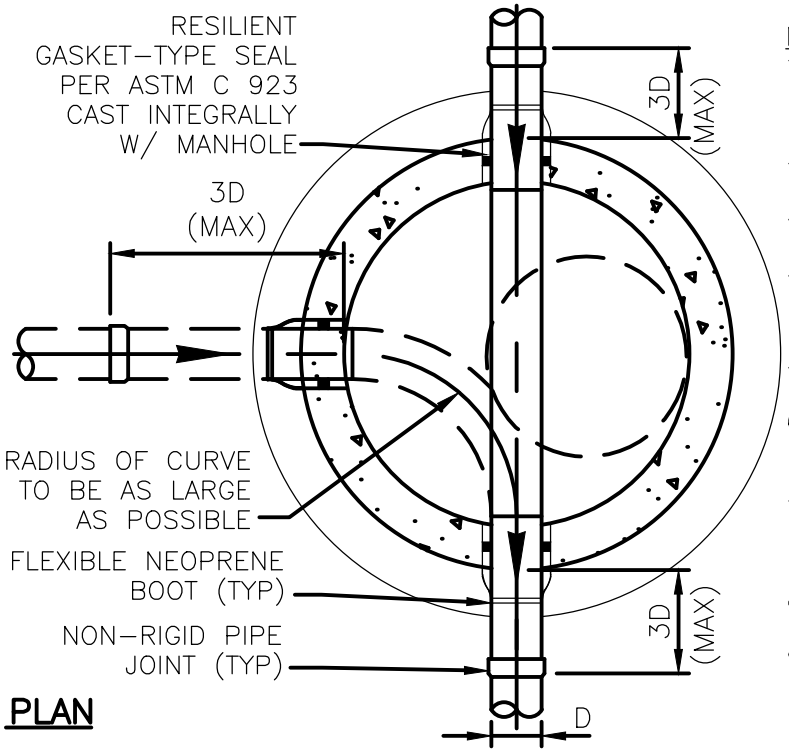
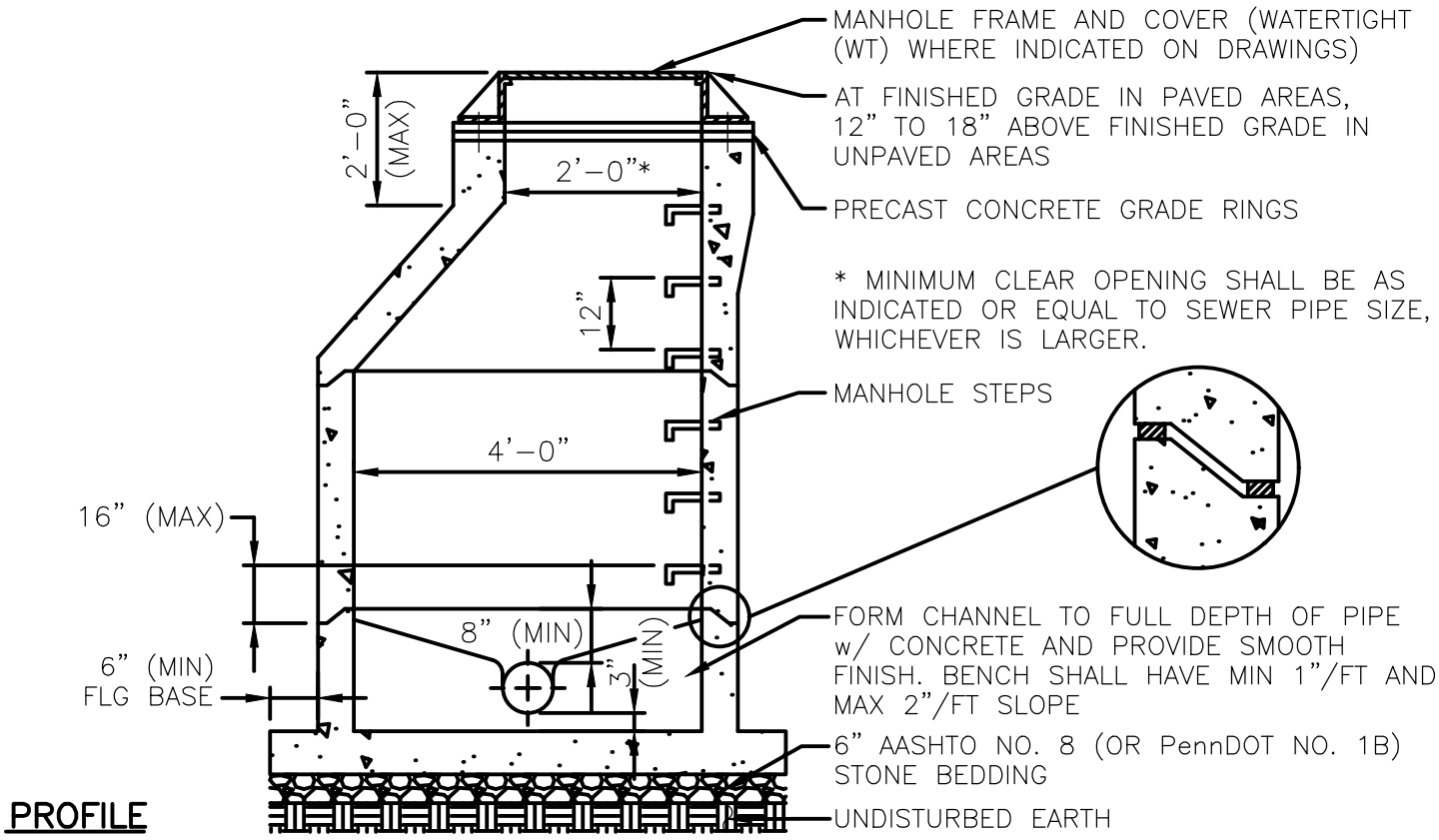
SCALE: NO SCALE
DWG. NO.



PLAN

NOTES:

1. ALL PRE CAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTM C–478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH 4,000 psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A–615.
4. 24" DIA. CAST IRON FRAME AND COVER PER ASTM A–48, CLASS 30, FOR H–20 LOADING.
5. CAST IRON FRAME TO BE BOLTED TO MANHOLE WITH 5/8" ANCHOR BOLTS.
6. CASTING AND GRADE RINGS TO BE SEALED TO MANHOLE WITH PREFORMED PLASTIC SEALING COMPOUND.
7. ALL JOINTS SHALL BE SEALED WITH TWO RINGS OF PREFORMED PLASTIC SEALING COMPOUND.
8. COAT MANHOLE EXTERIOR WITH DAMP PROOFING.
9. COAT MANHOLE INTERIOR WITH H2S CORROSION PROTECTION AS SPECIFIED.



PROFILE

PRECAST CONCRETE MANHOLE DETAIL

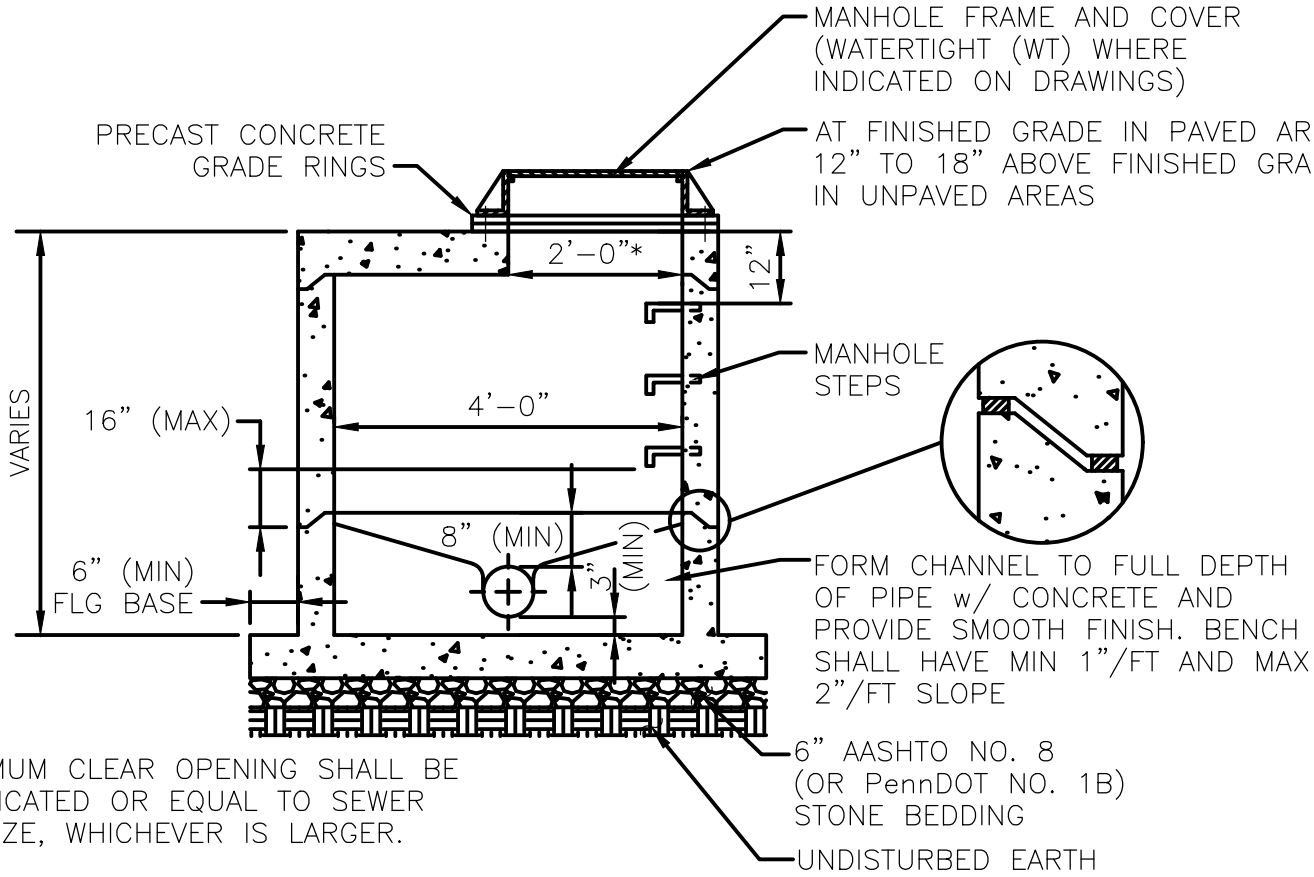
NO SCALE

6

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738–8395
Email: rettew@rettew.com
Website: www.rettew.com

DRAWN BY: JNW
DATE: MAY 2024
SCALE: NO SCALE
DWG. NO.



* MINIMUM CLEAR OPENING SHALL BE AS INDICATED OR EQUAL TO SEWER PIPE SIZE, WHICHEVER IS LARGER.

NOTES:

1. ALL PRE CAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTM C-478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH 4,000 psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A-615.
4. 24" DIA. CAST IRON FRAME AND COVER PER ASTM A-48, CLASS 30, FOR H-20 LOADING.
5. CAST IRON FRAME TO BE BOLTED TO MANHOLE WITH 5/8" ANCHOR BOLTS.
6. CASTING AND GRADE RINGS TO BE SEALED TO MANHOLE WITH PREFORMED PLASTIC SEALING COMPOUND.
7. ALL JOINTS SHALL BE SEALED WITH TWO RINGS OF PREFORMED PLASTIC SEALING COMPOUND.
8. COAT MANHOLE EXTERIOR WITH DAMP PROOFING.
9. COAT MANHOLE INTERIOR WITH H2S CORROSION PROTECTION AS SPECIFIED.

SHALLOW MANHOLE

DETAIL

NO SCALE

6a

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
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Website: www.rettew.com

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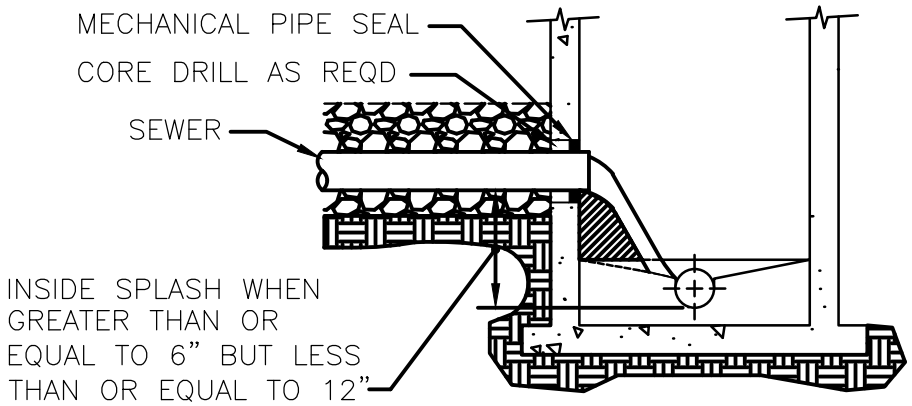
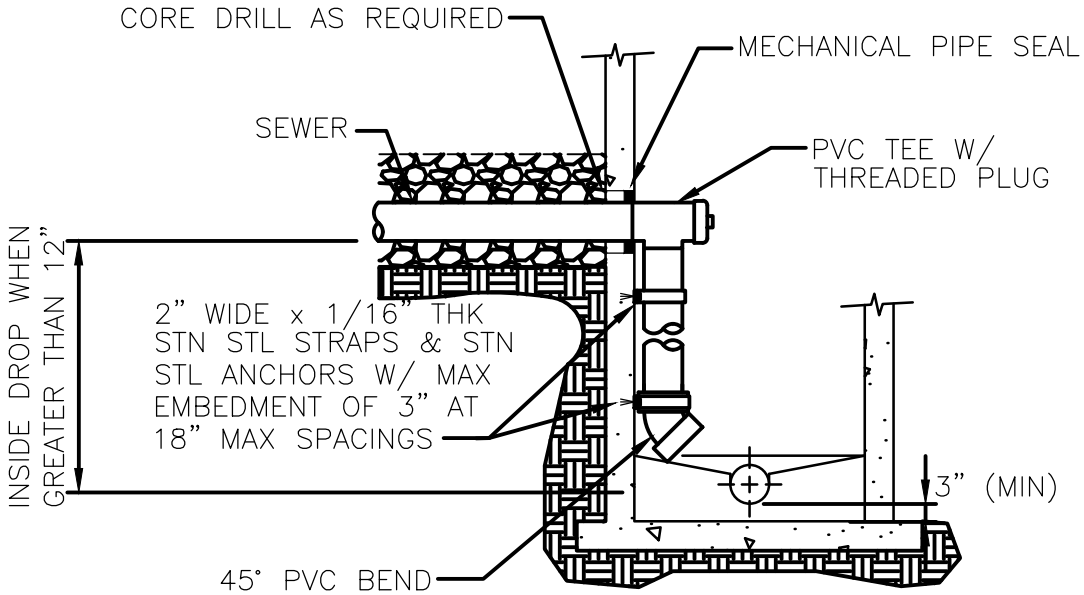
DATE: MAY 2024
SCALE: NO SCALE
DWG. NO.



SECTION – INSIDE SPLASH



SECTION – INSIDE DROP

NOTE:

FOR INSIDE SPLASH/DROP CONNECTIONS TO POLYMER CONCRETE MANHOLES, ALL MATERIALS OF CONSTRUCTION WITHIN THE MANHOLE SHALL BE HYDROGEN SULFIDE RESISTANT.

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

INSIDE SPLASH/DROP CONNECTION TO MANHOLE

DETAIL

NO SCALE

7

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
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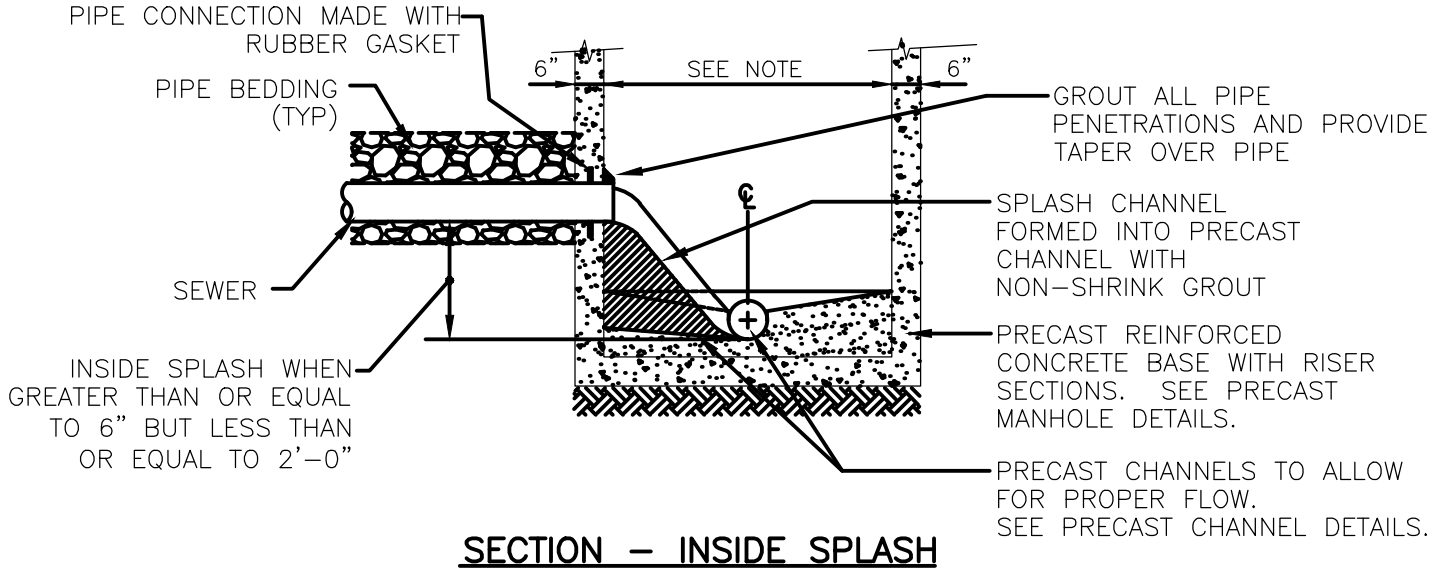
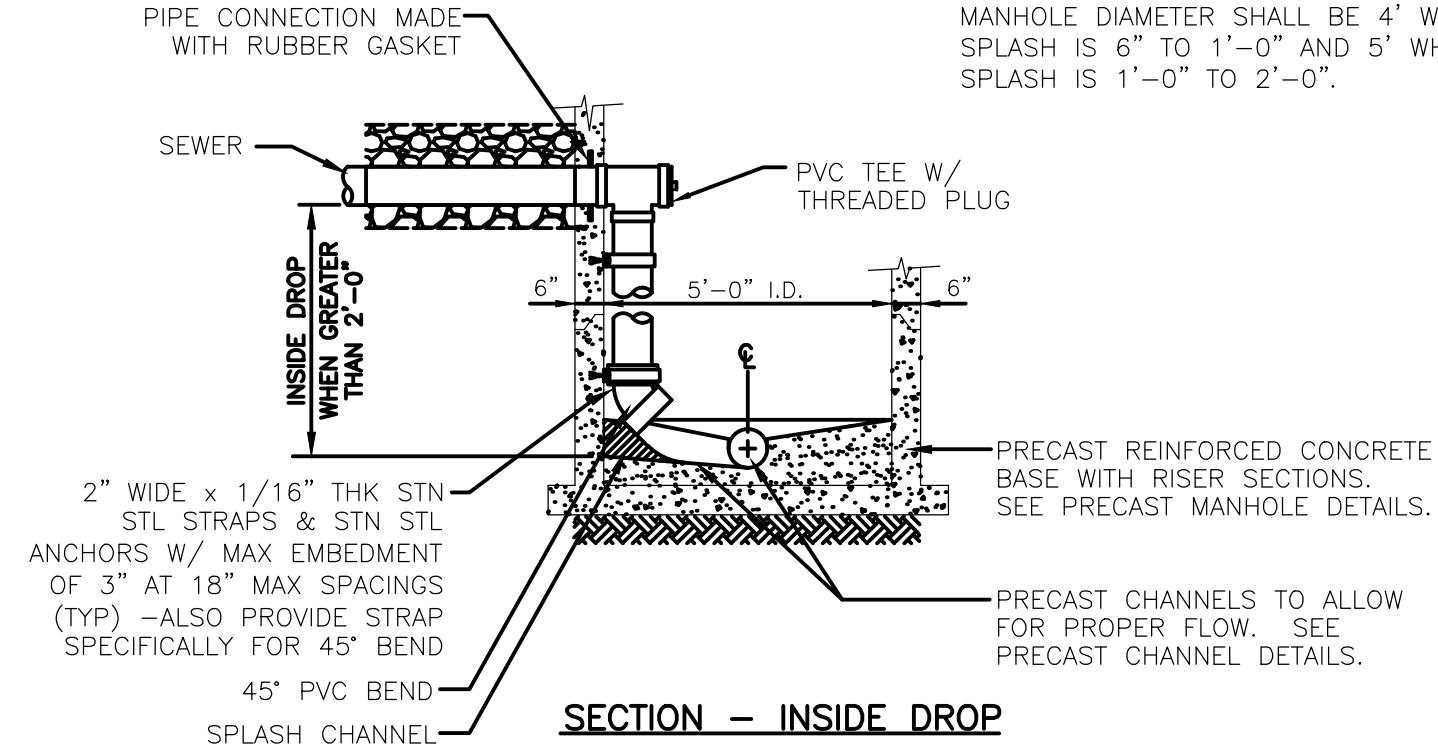
DWG. NO.



SECTION – INSIDE SPLASH

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



SECTION – INSIDE DROP

NOTE:
FOR INSIDE SPLASH/DROP CONNECTIONS TO POLYMER CONCRETE MANHOLES, ALL MATERIALS OF CONSTRUCTION WITHIN THE MANHOLE SHALL BE HYDROGEN SULFIDE RESISTANT.

INSIDE DROP PRECAST DROP MANHOLE BASE DETAIL

NO SCALE

7a

DEVELOPER SPECIFICATIONS FOR

PARADISE TOWNSHIP SEWER AUTHORITY

MONROE COUNTY, PA

RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

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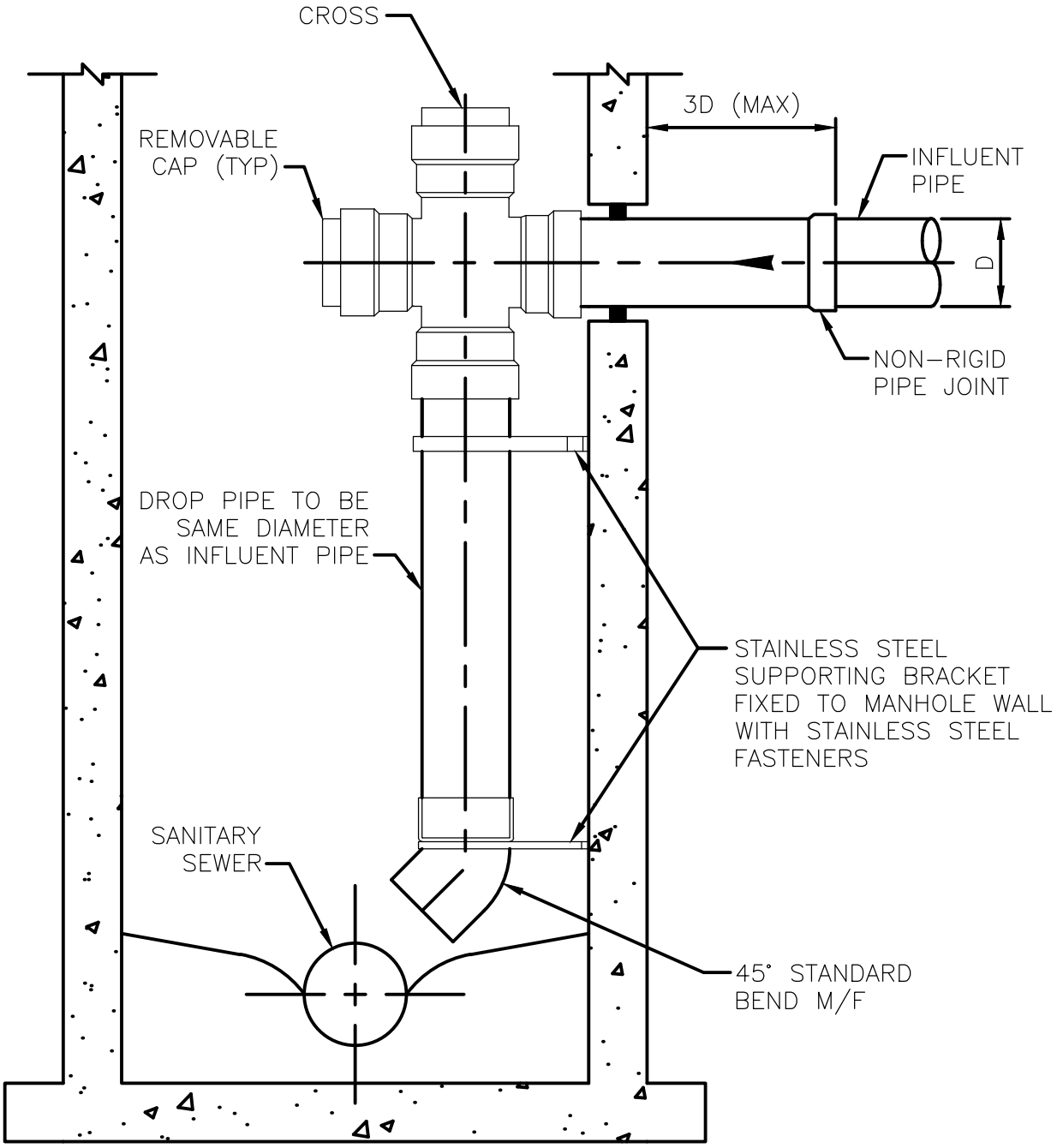
DATE: MAY 2024
SCALE: NO SCALE
DWG. NO.



NOTES:
1. MANHOLE INTERIOR WITH H2S CORROSION PROTECTION SHALL BE PROVIDED AS REQUIRED.
2. MINIMUM INTERNAL DIAMETER OF MANHOLE SHALL BE 5 FEET.

INTERNAL DROP CONNECTION TO MANHOLE

DETAIL

NO SCALE

7b

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

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3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
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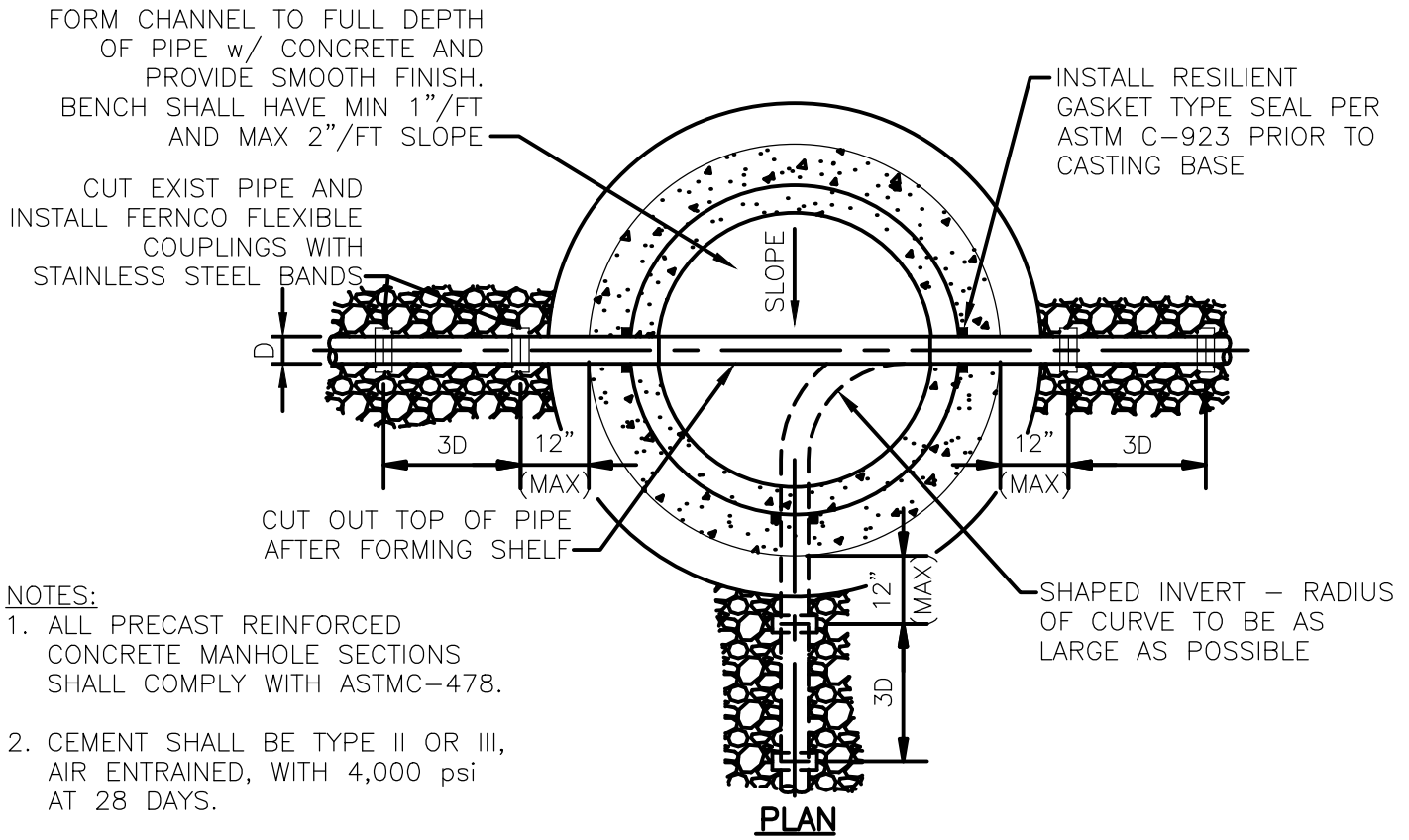
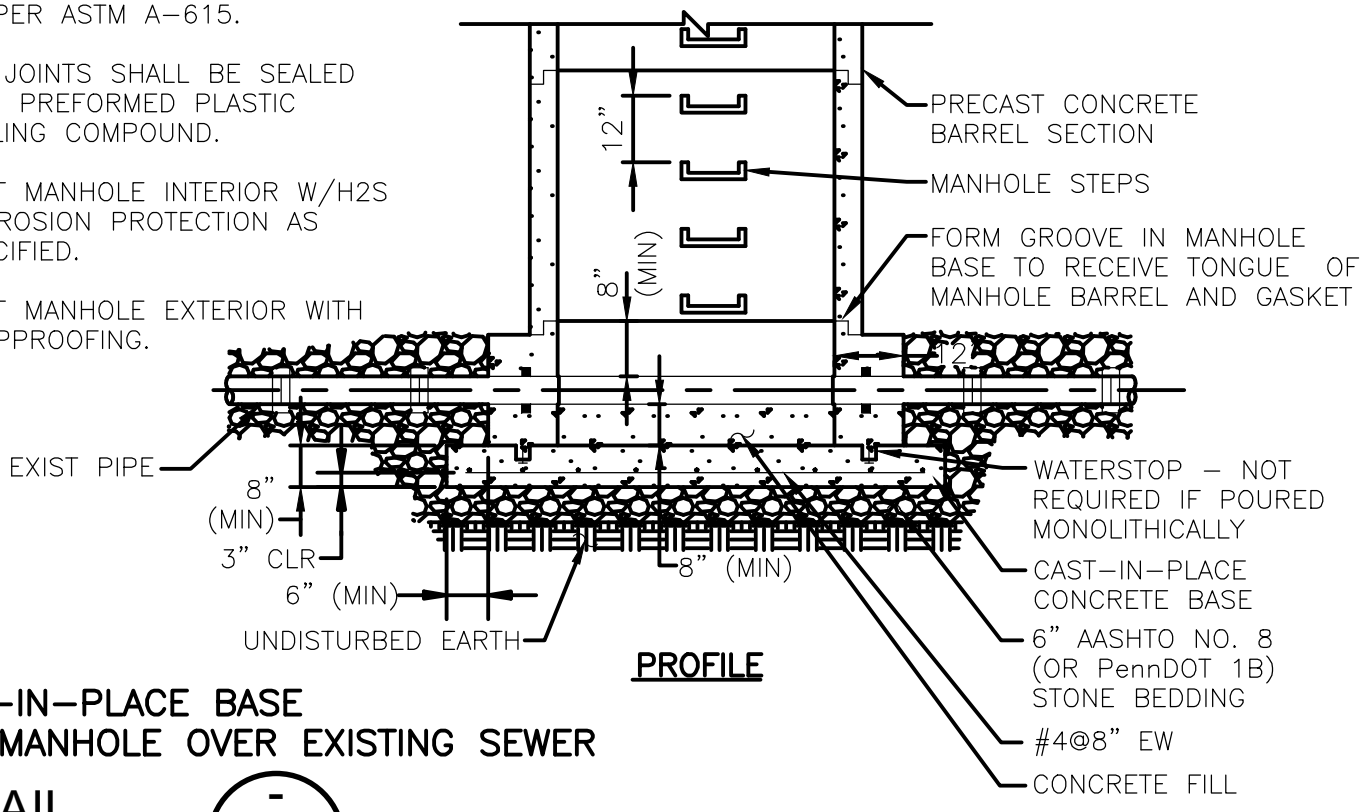


PLAN

NOTES:

1. ALL PRECAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTMC-478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH 4,000 psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A-615.
4. ALL JOINTS SHALL BE SEALED WITH PREFORMED PLASTIC SEALING COMPOUND.
5. COAT MANHOLE INTERIOR W/H2S CORROSION PROTECTION AS SPECIFIED.
6. COAT MANHOLE EXTERIOR WITH DAMPPROOFING.



PROFILE

CAST-IN-PLACE BASE
NEW MANHOLE OVER EXISTING SEWER

DETAIL - NO SCALE

8

DEVELOPER SPECIFICATIONS FOR

PARADISE TOWNSHIP SEWER AUTHORITY

MONROE COUNTY, PA

RETTEW

RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
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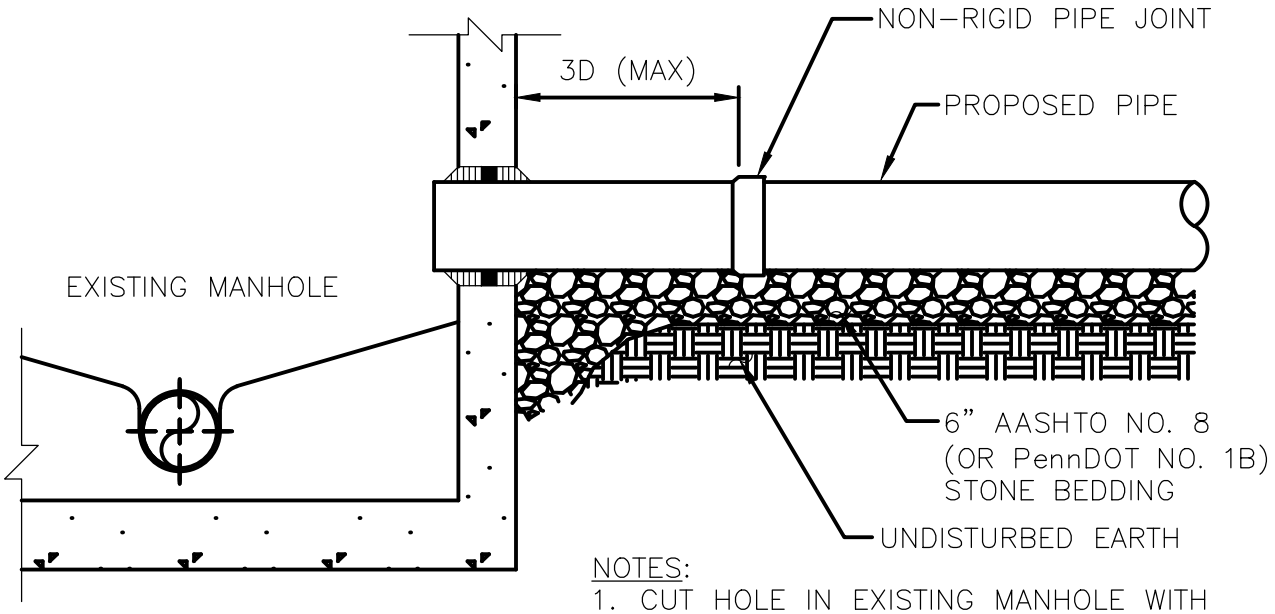
SCALE: NO SCALE
DWG. NO.



NOTES:
1. CUT HOLE IN EXISTING MANHOLE WITH CORING MACHINE.
2. INSTALL RESILIENT GASKET TYPE SEAL PER ASTM C–923.
3. CAULK ANNULAR SPACE WITH PREFORMED PLASTIC SEALING COMPOUND.

FLEXIBLE CONNECTION AT MANHOLE

NEW SEWER TO EXISTING MANHOLE CONNECTION DETAIL

NO SCALE

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

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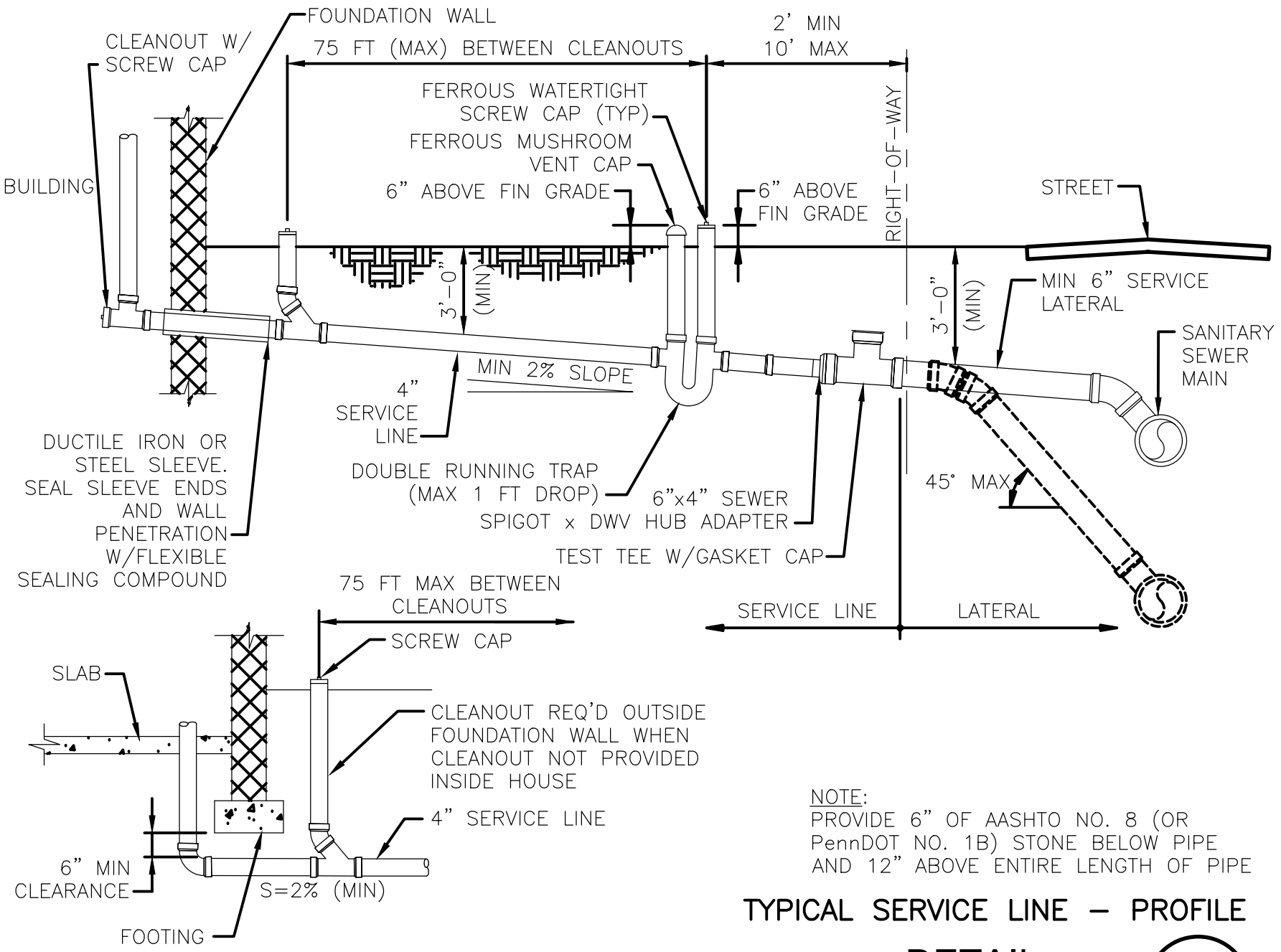

NOTE:
PROVIDE 6" OF AASHTO NO. 8 (OR PennDOT NO. 1B) STONE BELOW PIPE AND 12" ABOVE ENTIRE LENGTH OF PIPE

TYPICAL SERVICE LINE – PROFILE

DETAIL

NO SCALE

-
–

DRAWN BY: JNW
DATE: MAY 2024
SCALE: NO SCALE
DWG. NO.

10

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

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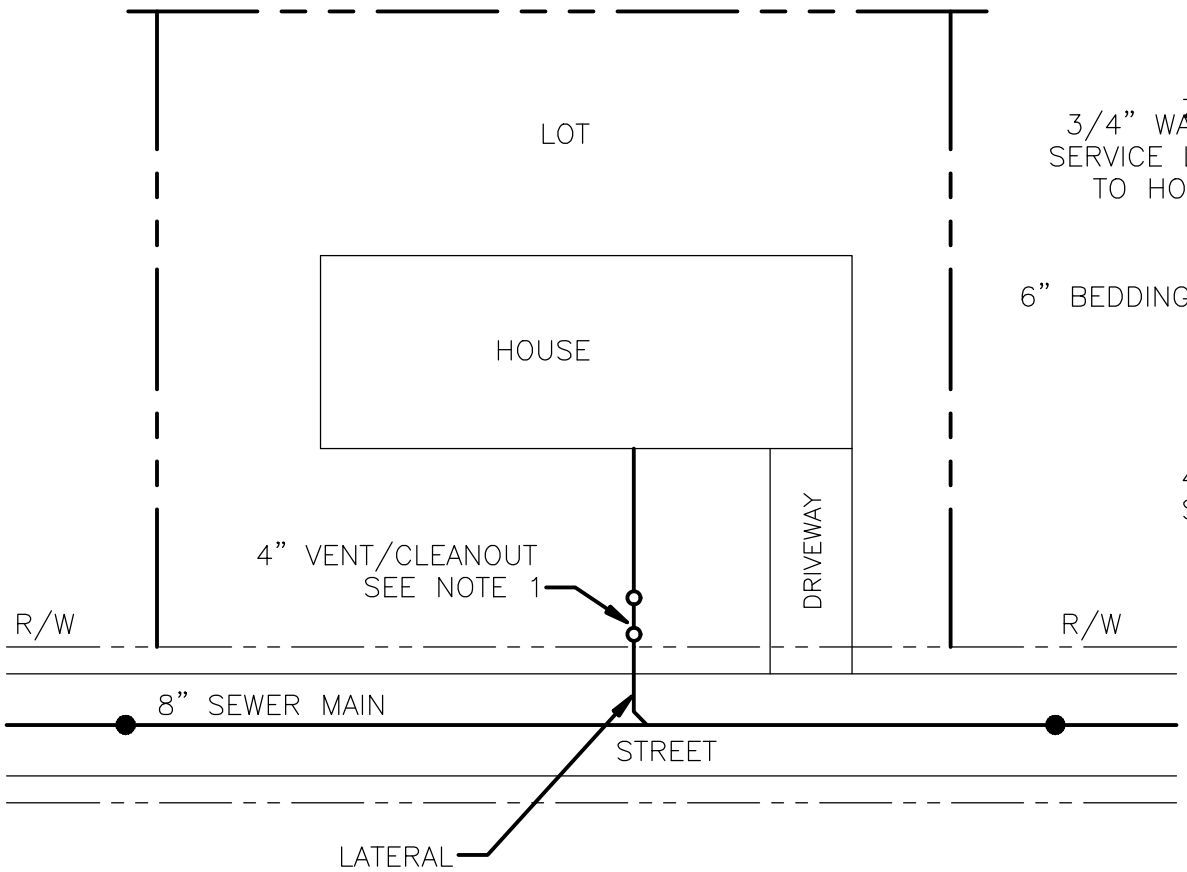

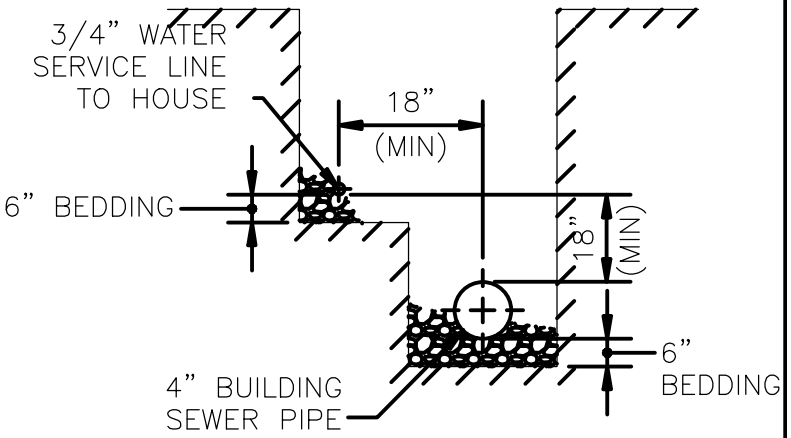

TYPICAL TRENCH FOR
SEWER PIPE

NOTES:

1. ALL VENTS AND CLEANOUTS SHALL BE LOCATED IN THE YARD AREA AND NOT IN DRIVEWAY.
2. IF SEWER LATERAL IS LOCATED UNDER DRIVEWAY, ADD FITTINGS AND PIPE AS REQUIRED TO LOCATE VENTS AND CLEANOUT IN YARD AREA.
3. VENTS AND CLEANOUTS SHALL BE A MINIMUM OF 6" ABOVE FINISHED GRADE.
4. IF 18" VERTICAL SEPARATION CANNOT BE MAINTAINED BETWEEN WATER AND SEWER SERVICES, PROVIDE 5' HORIZONTAL SEPARATION WITH WATER ABOVE SEWER.

TYPICAL SERVICE LINE – PLAN
DETAIL
NO SCALE

DRAWN BY: JNW
DATE: MAY 2024
SCALE: NO SCALE
DWG. NO.

DEVELOPER SPECIFICATIONS
FOR
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MONROE COUNTY, PA

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Phone (800) 738-8395
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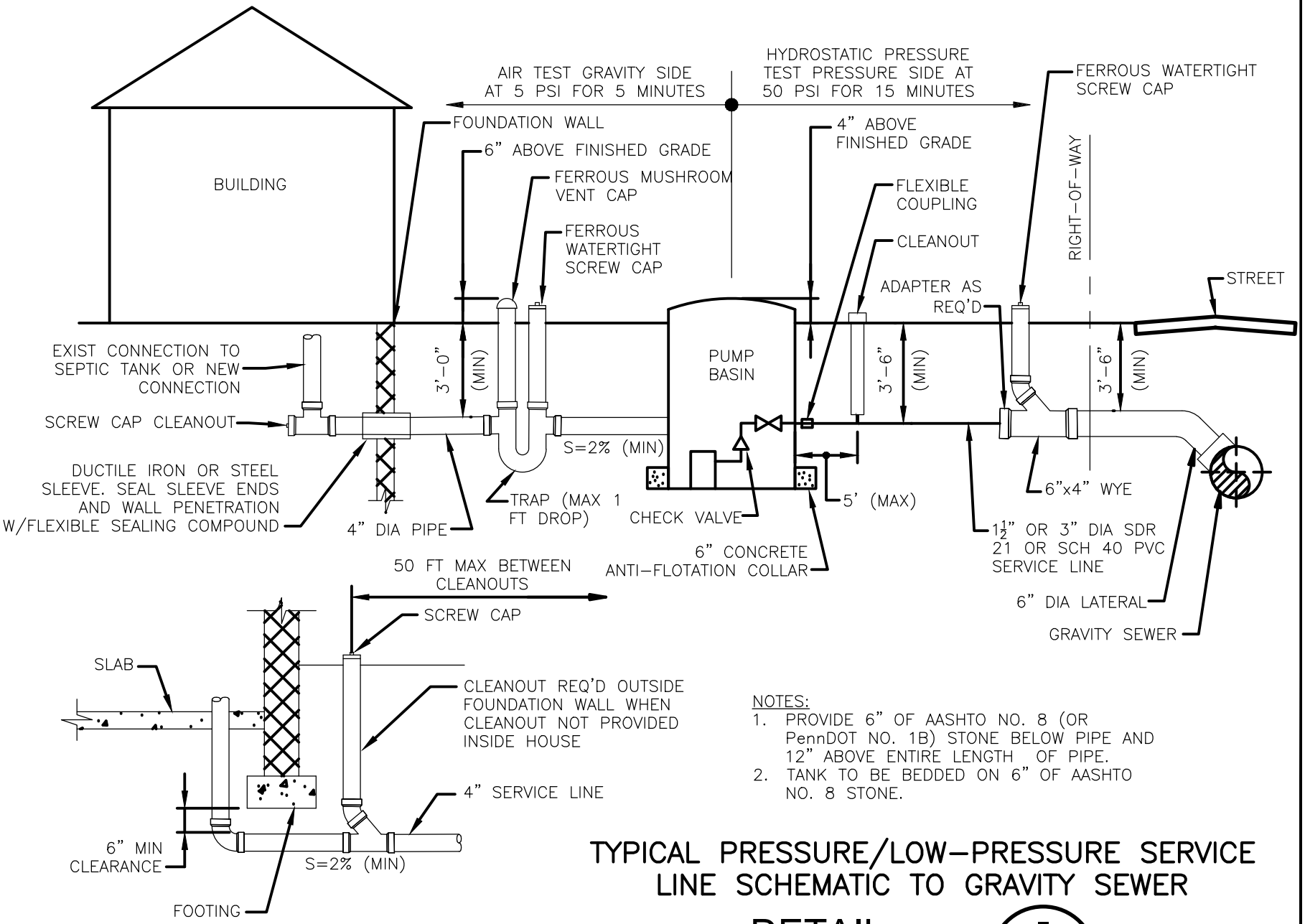

NOTES:
1. PROVIDE 6" OF AASHTO NO. 8 (OR PennDOT NO. 1B) STONE BELOW PIPE AND 12" ABOVE ENTIRE LENGTH OF PIPE.
2. TANK TO BE BEDDED ON 6" OF AASHTO NO. 8 STONE.

TYPICAL PRESSURE/LOW-PRESSURE SERVICE LINE SCHEMATIC TO GRAVITY SEWER

DETAIL

NO SCALE

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
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DATE: MAY 2024
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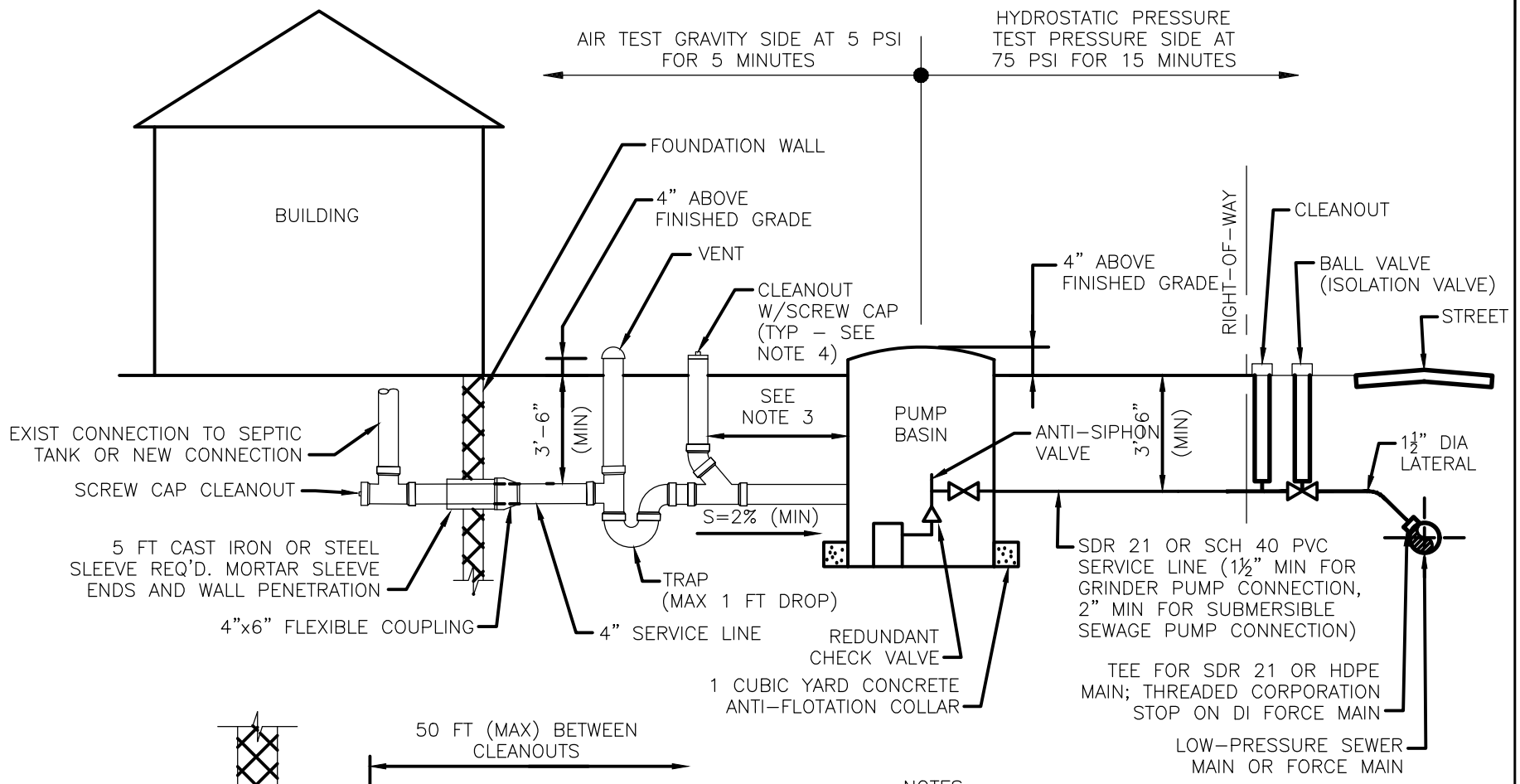
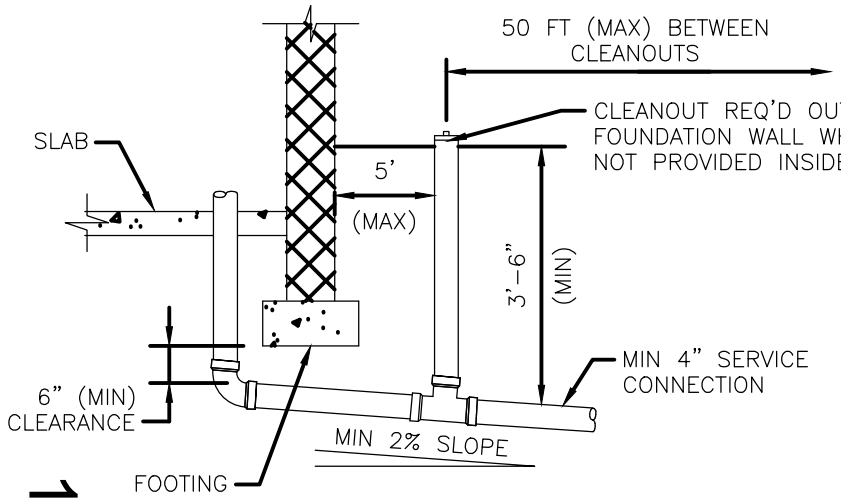




NOTES:
1. PROVIDE 6" OF AASHTO NO. 8 (OR PennDOT NO. 1B) STONE BELOW AND ON EITHER SIDE OF PIPE AND 12" ABOVE ENTIRE LENGTH OF PIPE.
2. TANK TO BE BEDDED ON 6" OF AASHTO NO. 8 (OR PennDOT NO. 1B) STONE.
3. 75 FT MAX BETWEEN CLEANOUTS.
4. VALVE BOX TOP SECTION IS REQUIRED IN PAVED AREAS.

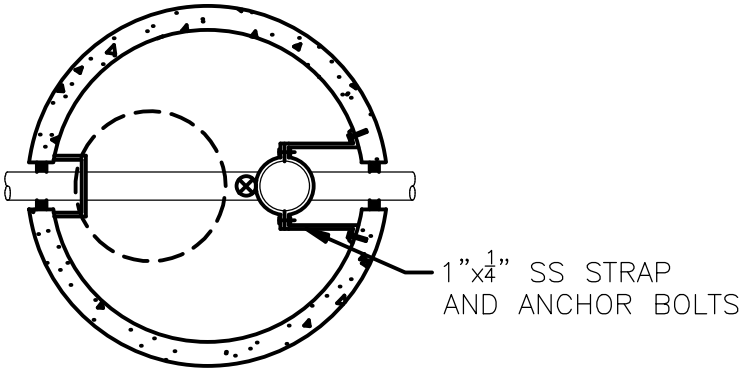
TYPICAL LOW–PRESSURE SERVICE LINE TO LOW–PRESSURE SEWER MAIN OR FORCE MAIN DETAIL

NO SCALE

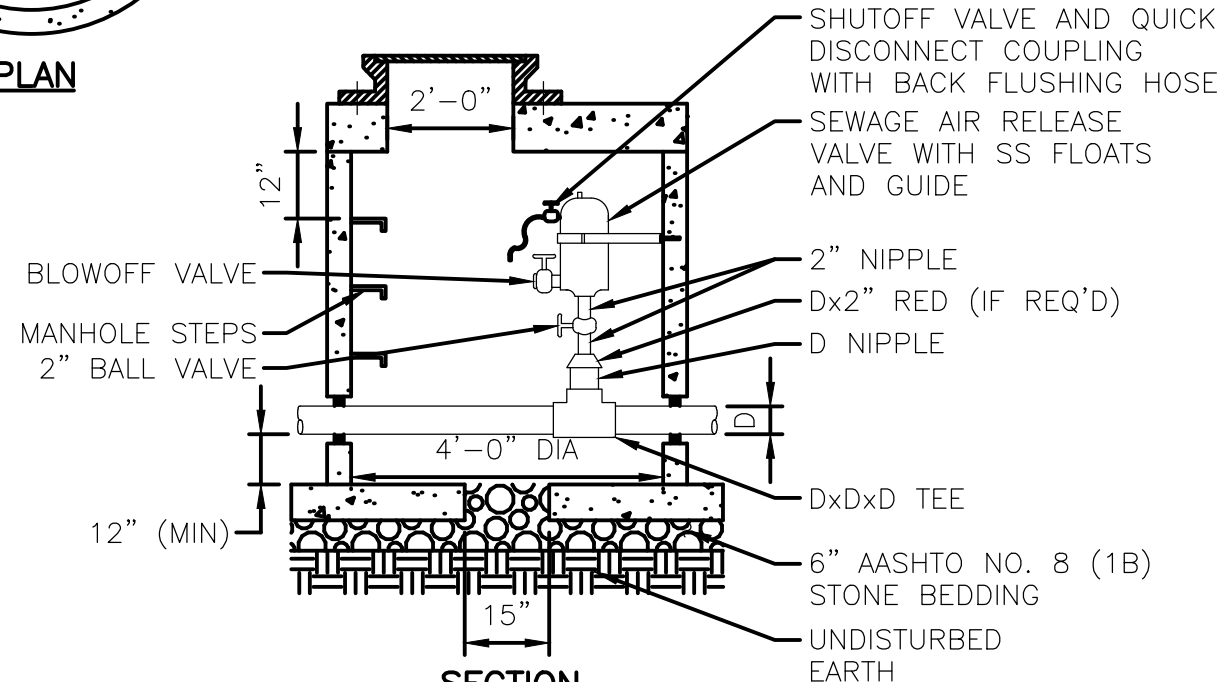
13

NOTES:

1. ALL PRECAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTM C-478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH f'c=4,000 psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A-615.
4. 24" DIA. CAST IRON FRAME AND COVER PER ASTM A-48, CLASS 30, FOR H-20 LOADING.
5. CAST IRON FRAME TO BE BOLTED TO MANHOLE WITH 5/8" ANCHOR BOLTS.
6. CASTING AND GRADE RINGS TO BE SEALED TO MANHOLE WITH PREFORMED PLASTIC SEALING COMPOUND.
7. ALL JOINTS SHALL BE SEALED WITH PREFORMED PLASTIC SEALING COMPOUND.
8. LINE MANHOLE INTERIOR W/T-LOCK PVC OR HDPE LINER SYSTEM.
9. ALL PIPING BETWEEN THE FORCE MAIN AND AIR RELEASE VALVE SHALL BE SCHEDULE 80 316 STAINLESS STEEL.



PLAN



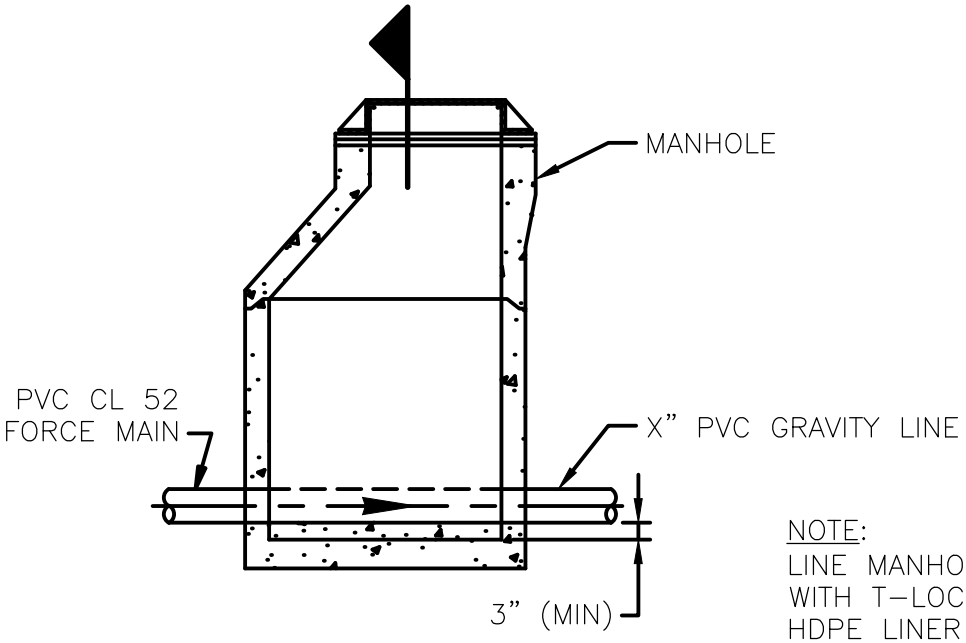
SECTION

AIR RELEASE VALVE AND CHAMBER DETAIL

NO SCALE

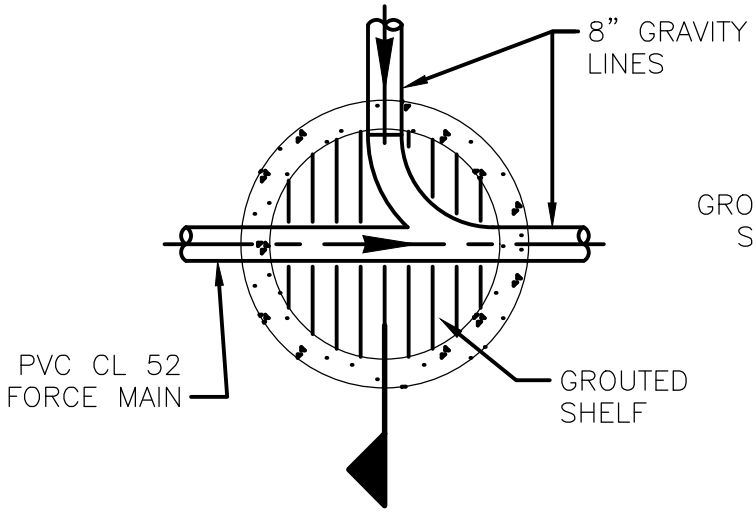
14

DEVELOPER SPECIFICATIONS FOR **PARADISE TOWNSHIP SEWER AUTHORITY** MONROE COUNTY, PA	RETTEW RETTEW Associates, Inc. 3020 Columbia Avenue, Lancaster, PA 17603 Phone (800) 738-8395 Email: rettew@rettew.com Website: www.rettew.com	DRAWN BY: JNW DATE: MAY 2024 SCALE: NO SCALE DWG. NO.

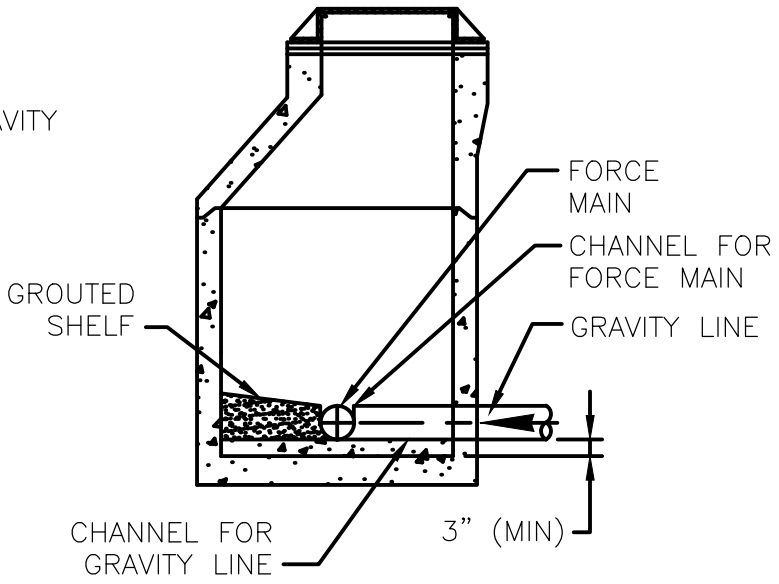


NOTE:
LINE MANHOLE INTERIOR WITH T-LOCK PVC OR HDPE LINER SYSTEM.

ELEVATION



PLAN



SECTION

FORCE MAIN CONNECTION TO MANHOLE

DETAIL -

NO SCALE

15

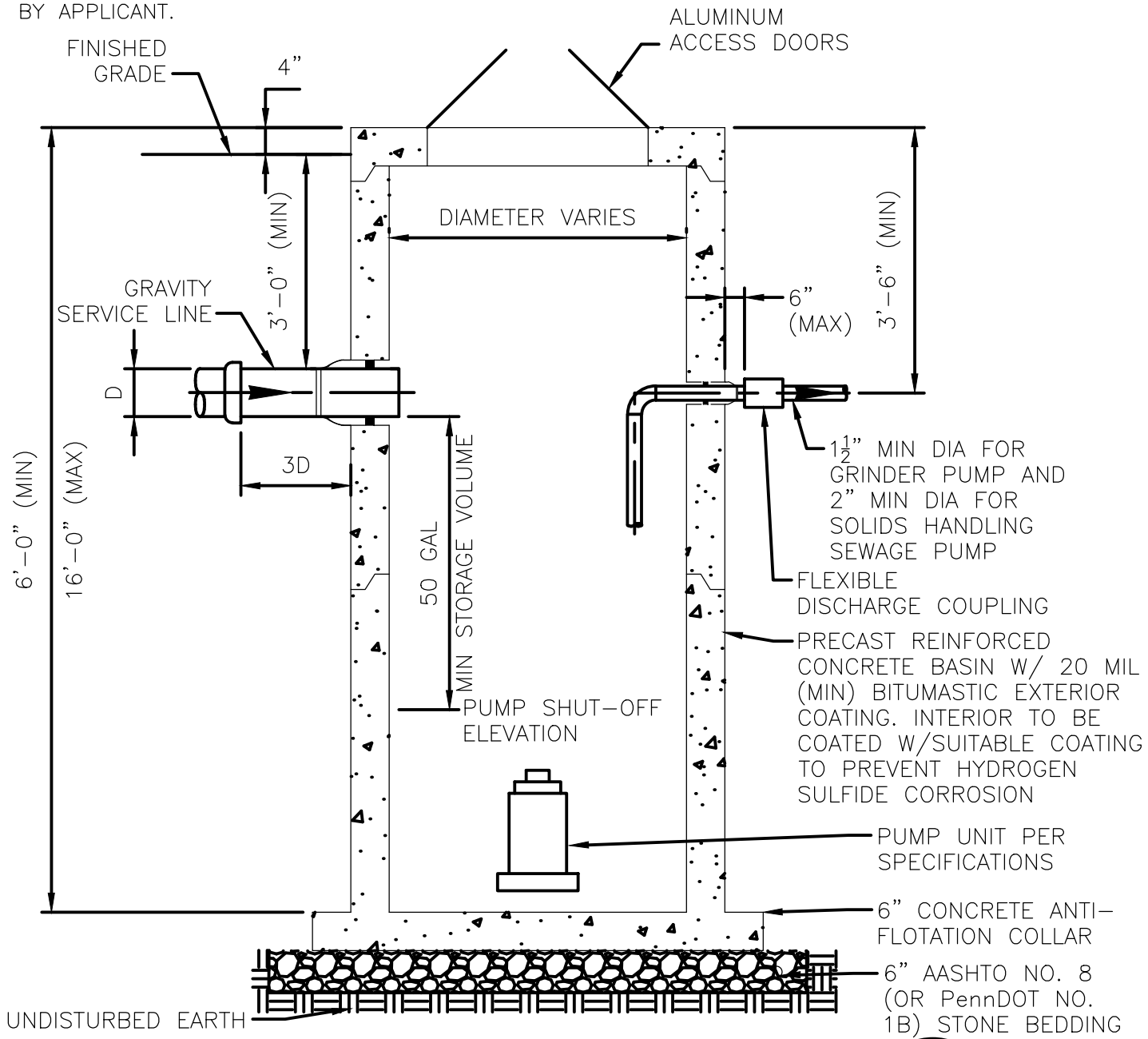
DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

DRAWN BY: JNW
DATE: MAY 2024
SCALE: NO SCALE
DWG. NO.

NOTES:

1. CONCRETE BASINS SHALL BE USED IN AREAS SUBJECT TO TRAFFIC LOADING.
2. CONCRETE BASINS SHALL COMPLY WITH ASTM C-478 AND SHALL BE WATERTIGHT.
3. JOINTS BETWEEN SECTIONS SHALL BE PROVIDED W/PREFORMED PLASTIC JOINT SEALING COMPOUND.
4. LOCATION OF BASIN TO BE DETERMINED BY APPLICANT.
5. EXCAVATED AREA SHALL BE BACKFILLED TO 6" BELOW GRADE. BACKFILL MATERIAL SHALL BE EXCAVATED MATERIAL CONTAINING NO SOIL LUMPS, STONES, CONCRETE, OR FOREIGN OBJECTS LARGER THAN 1" MAX DIMENSION, OR AASHTO NO. 8 STONE.
6. FINISHED GRADE SHALL BE SLOPED AWAY FROM THE BASIN TOP.



CONCRETE BASIN FOR TYPICAL INDIVIDUAL PUMP

DETAIL

NO SCALE

16

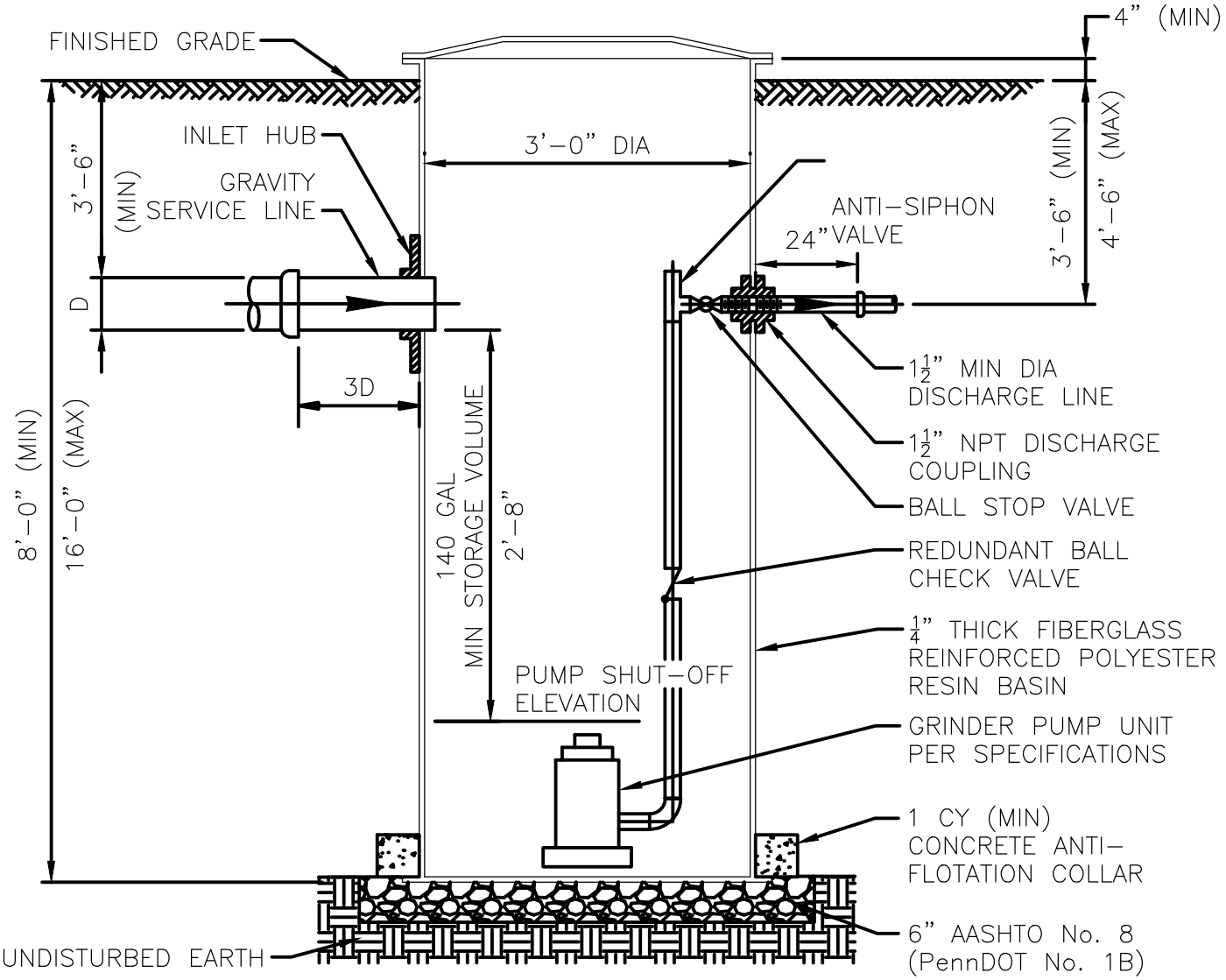
DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

DRAWN BY: JNW
DATE: MAY 2024
SCALE: NO SCALE
DWG. NO.

NOTES:

1. FIBERGLASS BASINS MAY NOT BE USED IN AREAS SUBJECT TO TRAFFIC LOADING.
2. LOCATION OF BASIN TO BE DETERMINED BY PROPERTY OWNER OR DEVELOPER.
3. EXCAVATED AREA SHALL BE BACKFILLED TO 6" BELOW GRADE. BACKFILL MATERIAL SHALL BE EXCAVATED MATERIAL CONTAINING NO SOIL LUMPS, STONES, CONCRETE, OR FOREIGN OBJECTS LARGER THAN 1" MAX DIMENSION, OR AASHTO No. 8 STONE.
4. 6" TOPSOIL AND SEED SHALL BE PLACED TO GRADE THE SURROUNDING EXCAVATED AREA.
5. STANDARD TANK SIZE FOR 1 EDU IS 36" DIA x 96".
6. PROVIDE A REDUNDANT CHECK VALVE ON PUMP DISCHARGE PIPING.



FIBERGLASS BASIN FOR TYPICAL INDIVIDUAL PUMP

DETAIL

NO SCALE

17

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
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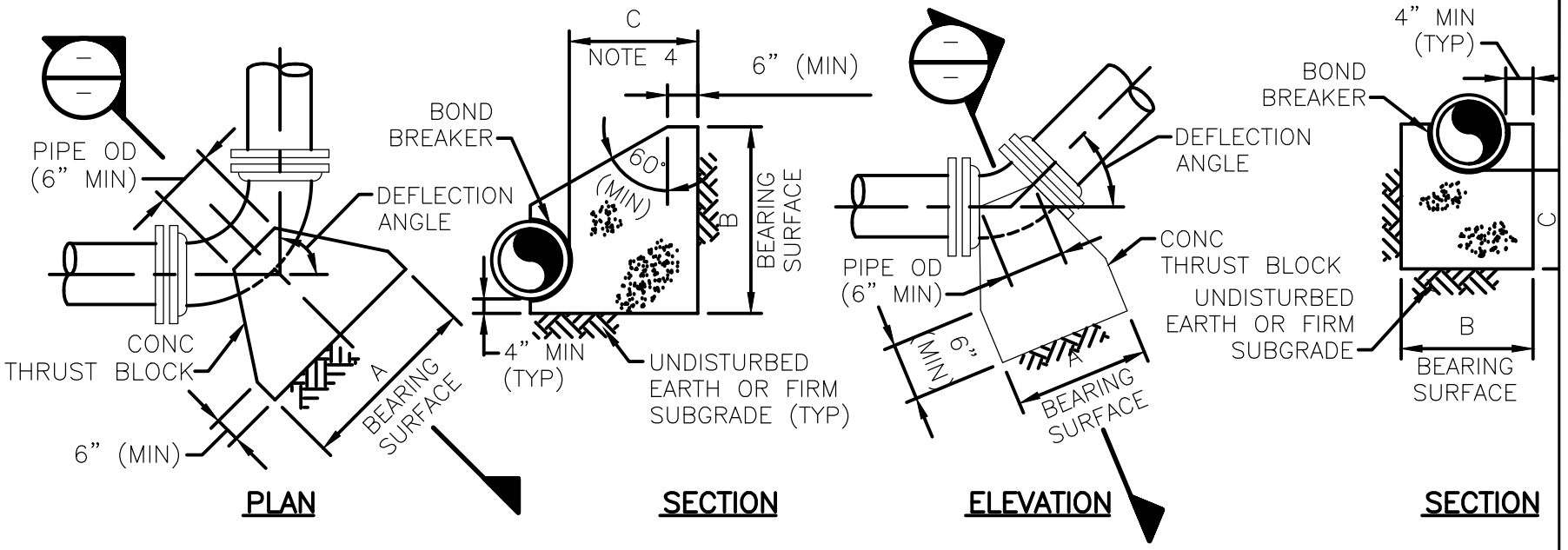


DETAIL FOR HORIZONTAL BENDS **DETAIL FOR LOWER VERTICAL BENDS**

NOMINAL PIPE SIZE (INCHES)	MAXIMUM PIPE OD (INCHES)	REQUIRED BEARING AREA (SQ FT)					
		90 DEG	60 DEG	45 DEG	30 DEG	22.50 DEG	11.25 DEG
4	4.80	2.9	2.0	1.6	1.1	0.8	0.4
8	9.05	10	7	6	4	3	1.4
12	13.20	22	15	12	8	6	3
18	19.50	48	34	26	17	13	7
20	21.60	58	41	32	21	16	8
24	25.80	83	59	45	30	23	12

THRUST BLOCKS FOR HORIZONTAL BENDS AND LOWER VERTICAL BENDS

NOTES:

1. MAXIMUM TEST PRESURE = 1.5 x 150 PSI
2. MINIMUM ALLOWABLE SOIL BEARING PRESSURE = 2000 PSF
3. BEARING AREA = A x B
4. C SHALL BE GREATER THAN A/2 AND B/2.

THRUST BLOCKS
FOR HORIZONTAL BENDS
AND LOWER VERTICAL BENDS

DETAIL -
NO SCALE

MINIMUM RESTRAINED PIPE LENGTH (FT) FOR VERTICAL BENDS (WITHOUT POLYETHLENE ENCASEMENT)			
DIAMETER (IN)	VERTICAL BEND ANGLE (DEGREES)		
	45	22½	11¼
6	20	10	5
8	26	12	6
10	32	15	8
12	37	18	9
14	43	21	10
16	48	23	12
18	54	26	13
20	59	28	14
24	70	34	17

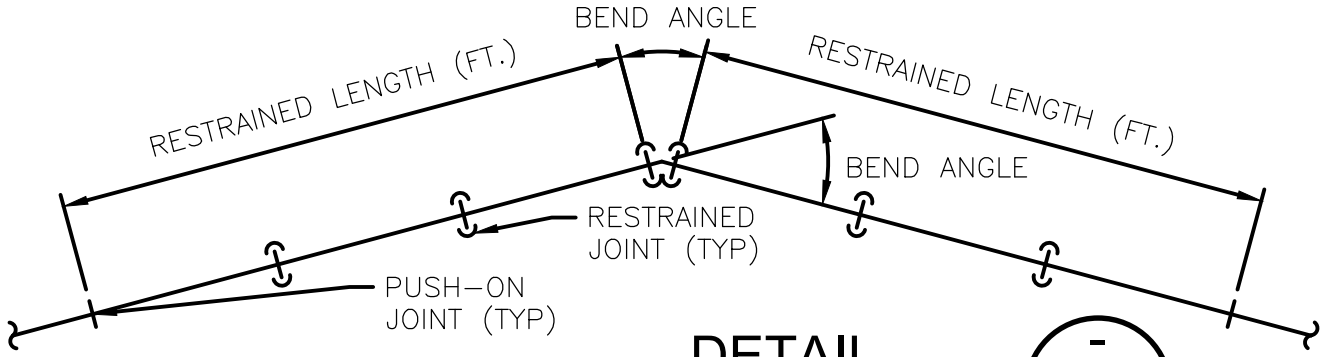
MINIMUM RESTRAINED PIPE LENGTH (FT) FOR HORIZONTAL BENDS (WITHOUT POLYETHLENE ENCASEMENT)				
DIAMETER (IN)	HORIZONTAL BEND ANGLE (DEGREES)			
	90	45	22½	11¼
6	15	6	3	1
8	19	8	4	2
10	23	10	5	2
12	28	11	5	3
14	32	13	6	3
16	36	15	7	4
18	40	16	8	4
20	43	18	9	4
24	51	21	10	5

MINIMUM RESTRAINED PIPE LENGTH (FT) FOR VERTICAL BENDS (WITH POLYETHLENE ENCASEMENT)			
DIAMETER (IN)	VERTICAL BEND ANGLE (DEGREES)		
	45	22½	11¼
6	29	14	7
8	37	18	9
10	45	22	11
12	53	26	13
14	61	29	15
16	69	33	16
18	77	37	18
20	85	41	20
24	100	48	24

MINIMUM RESTRAINED PIPE LENGTH (FT) FOR HORIZONTAL BENDS (WITH POLYETHLENE ENCASEMENT)				
DIAMETER (IN)	HORIZONTAL BEND ANGLE (DEGREES)			
	90	45	22½	11¼
6	16	7	3	2
8	21	9	4	2
10	26	11	5	3
12	30	13	6	3
14	35	14	7	3
16	39	16	8	4
18	44	18	9	4
20	48	20	9	5
24	56	23	11	6

NOTES:

1	DESIGN PRESSURE	= 150 PSI
2	DEPTH OF COVER	= 4 FEET
3	SAFETY FACTOR	= 1.5
4	SOIL TYPE	= COHESIVE GANGULAR
5	SOIL INTERNAL FRICTION ANGLE	= 20 DEGREES
6	SOIL COHESION	= 200 PSF
7	SOIL DENSITY	= 90 PCF



RESTRAINED DI PIPE LENGTH

DETAIL

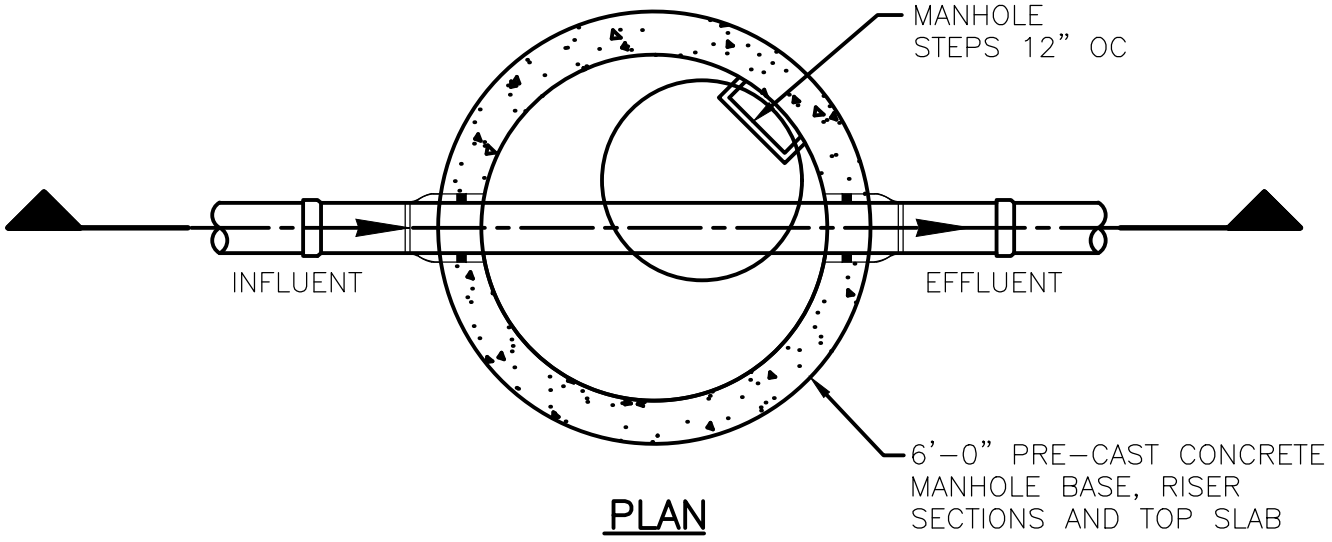
NO SCALE

19

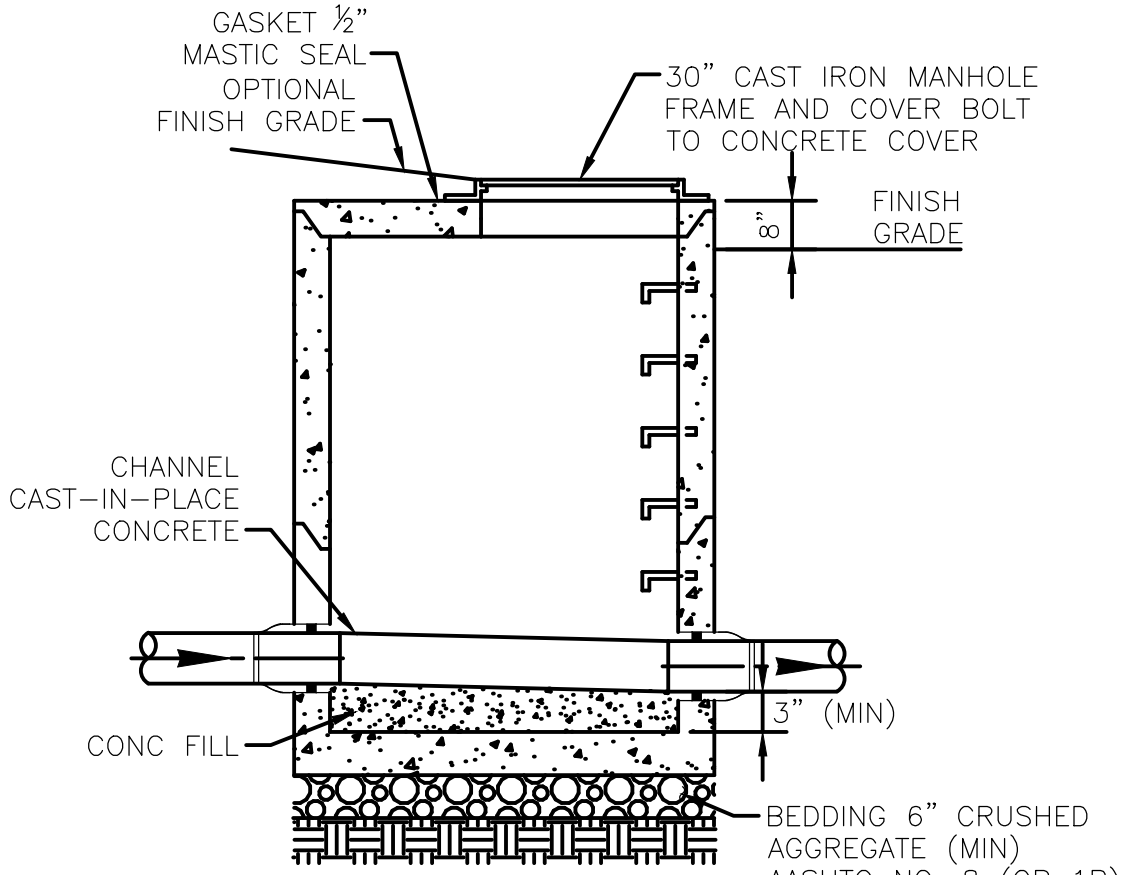
DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

DRAWN BY: JNW
DATE: MAY 2024
SCALE: NO SCALE
DWG. NO.



PLAN



SECTION

PRECAST CONCRETE FLOW MONITORING MANHOLE

DETAIL

NO SCALE

20

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

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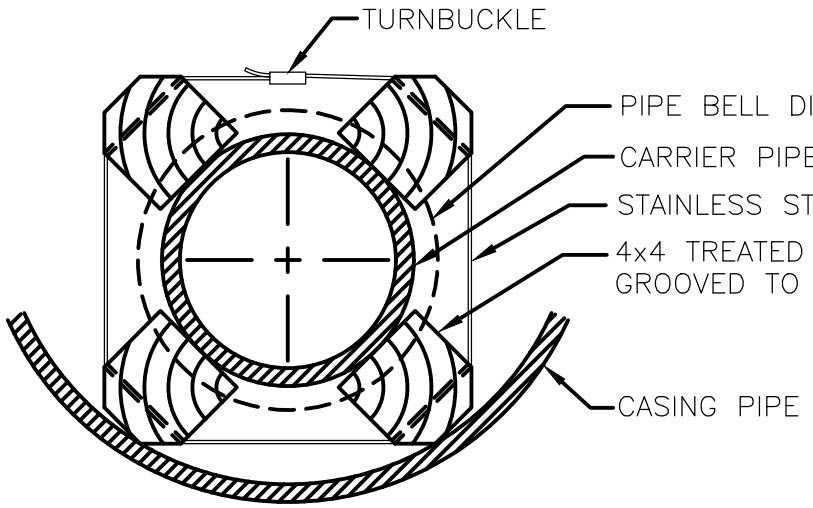
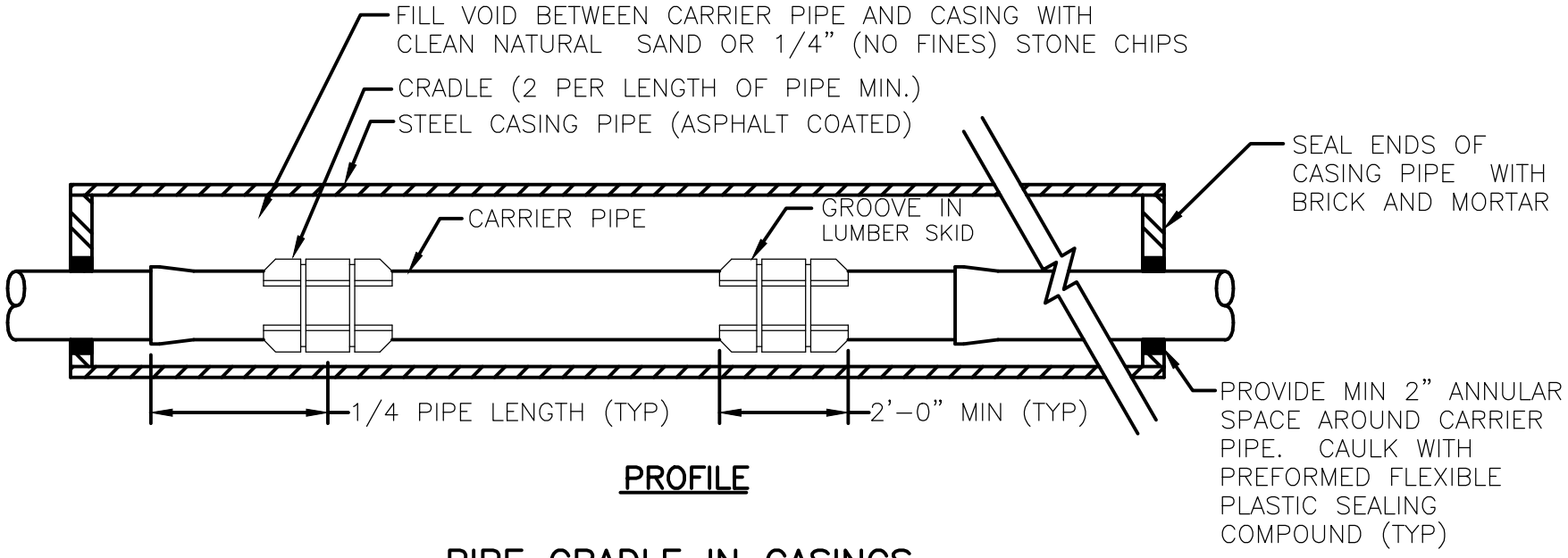


CROSS SECTION

NOTES:
1. FOR PIPES CROSSING STATE ROADS OR RAILROADS ADDITIONAL REQUIREMENTS (IF ANY) IMPOSED BY HIGHWAY OR RAILROAD OWNER MUST BE MET.
2. DIAMETER OF CASING SHALL BE IN ACCORDANCE WITH HIGHWAY OR RAILROAD OWNER'S STANDARDS.

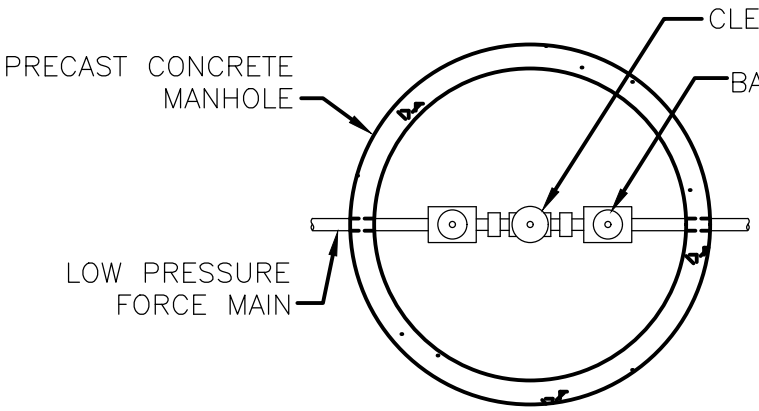


PROFILE

PIPE CRADLE IN CASINGS

DETAIL

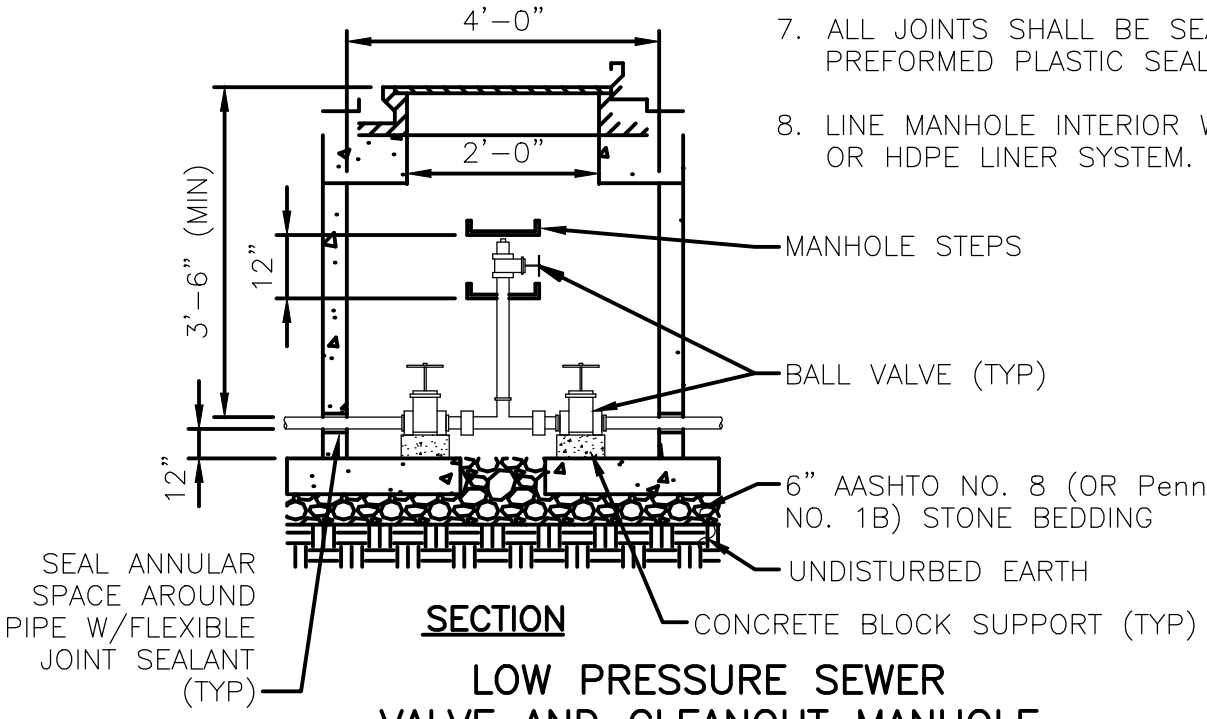
NO SCALE



PLAN

NOTES:

1. ALL PRECAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTM C-478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH f'c=4,000 psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A-615.
4. 24" DIA CAST IRON FRAME AND COVER PER ASTM A-48, CLASS 30, FOR H-20 LOADING.
5. CAST IRON FRAME TO BE BOLTED TO MANHOLE WITH $\frac{5}{8}$" ANCHOR BOLTS.
6. CASTING AND GRADE RINGS TO BE SEALED TO MANHOLE WITH WATERPROOF MORTAR OR PREFORMED PLASTIC SEALING COMPOUND.
7. ALL JOINTS SHALL BE SEALED WITH PREFORMED PLASTIC SEALING COMPOUND.
8. LINE MANHOLE INTERIOR W/T-LOCK PVC OR HDPE LINER SYSTEM.



SECTION

LOW PRESSURE SEWER VALVE AND CLEANOUT MANHOLE

DETAIL

NO SCALE

DEVELOPER SPECIFICATIONS
FOR
PARADISE TOWNSHIP SEWER AUTHORITY
MONROE COUNTY, PA

RETTEW
RETTEW Associates, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

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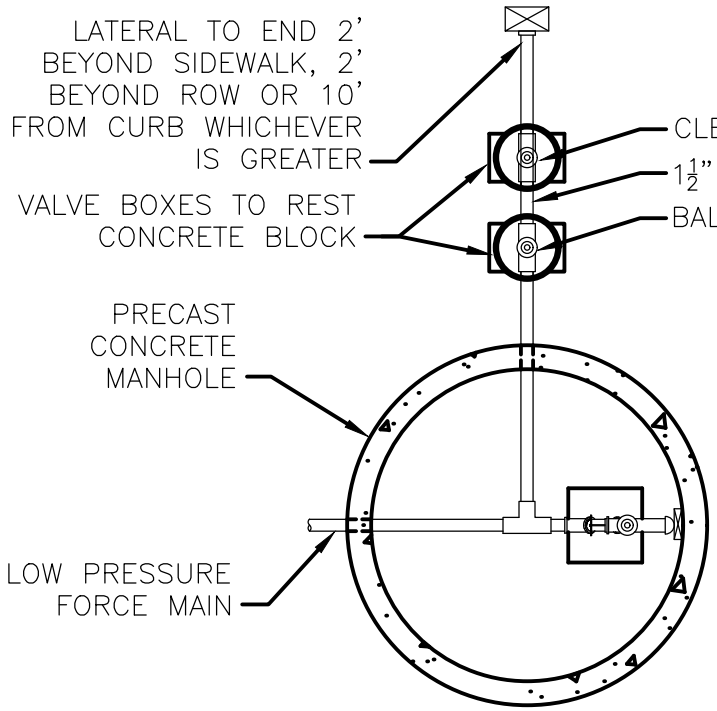
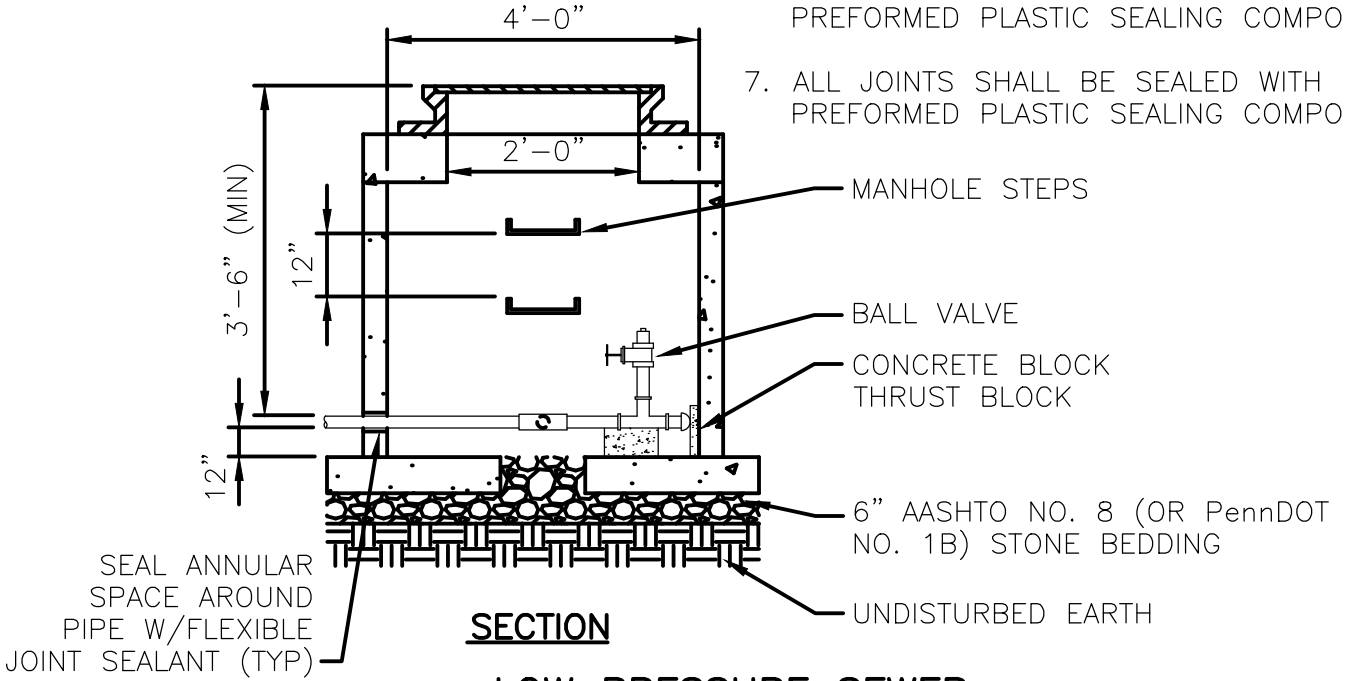


PLAN

NOTES:

1. ALL PRECAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTM C-478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH f'c=4,000 psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A-615.
4. 24" DIA CAST IRON FRAME AND COVER PER ASTM A-48, CLASS 30, FOR H-20 LOADING.
5. CAST IRON FRAME TO BE BOLTED TO MANHOLE WITH ⅝" ANCHOR BOLTS.
6. CASTING AND GRADE RINGS TO BE SEALED TO MANHOLE WITH WATERPROOF MORTAR OR PREFORMED PLASTIC SEALING COMPOUND.
7. ALL JOINTS SHALL BE SEALED WITH PREFORMED PLASTIC SEALING COMPOUND.



SECTION

LOW PRESSURE SEWER TERMINAL CLEANOUT MANHOLE

DETAIL

NO SCALE

23

DEVELOPER SPECIFICATIONS FOR

PARADISE TOWNSHIP SEWER AUTHORITY

MONROE COUNTY, PA

RETTEW

RETTEW Associates, Inc.
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Website: www.rettew.com

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Phone (800) 738-8395
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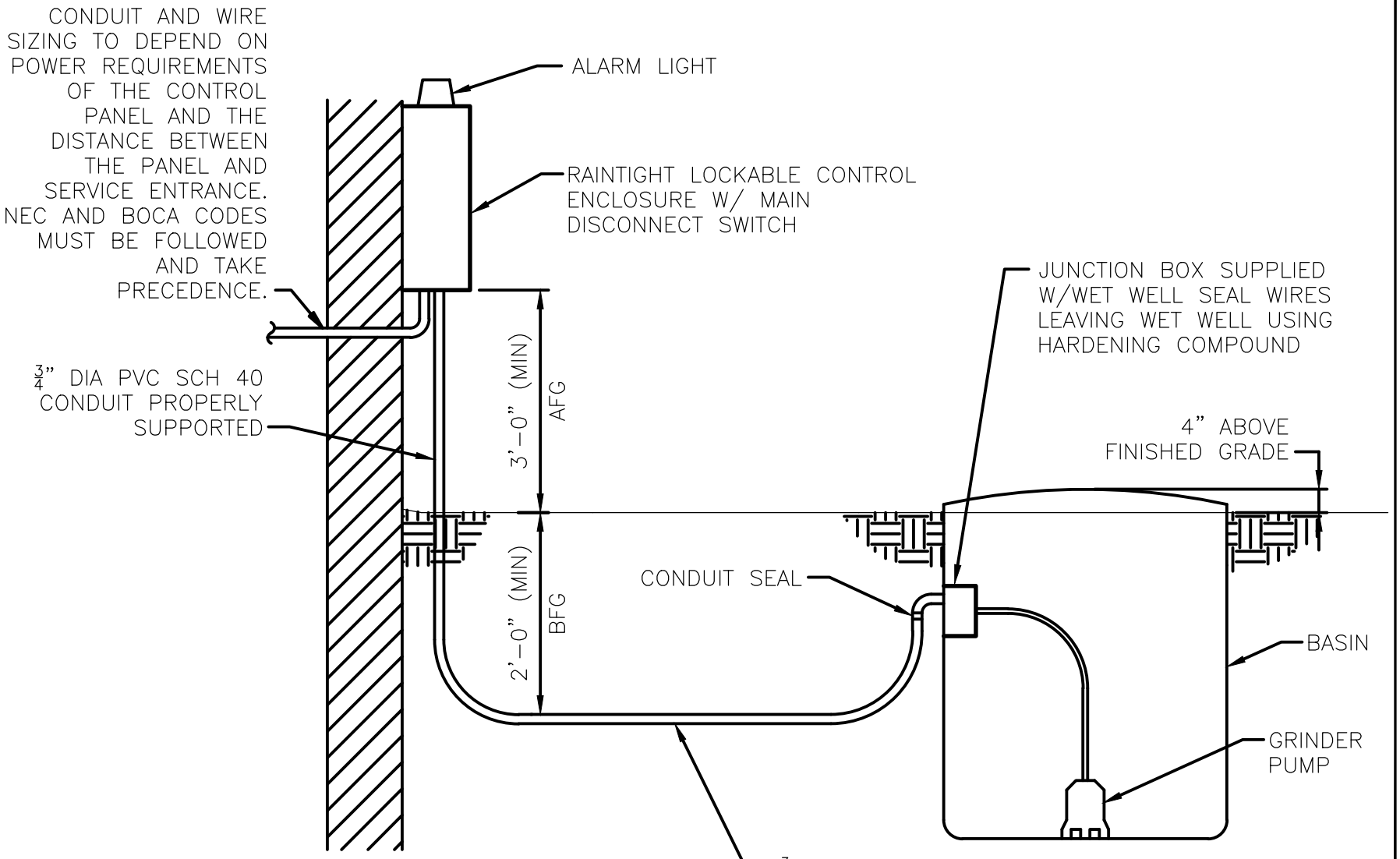
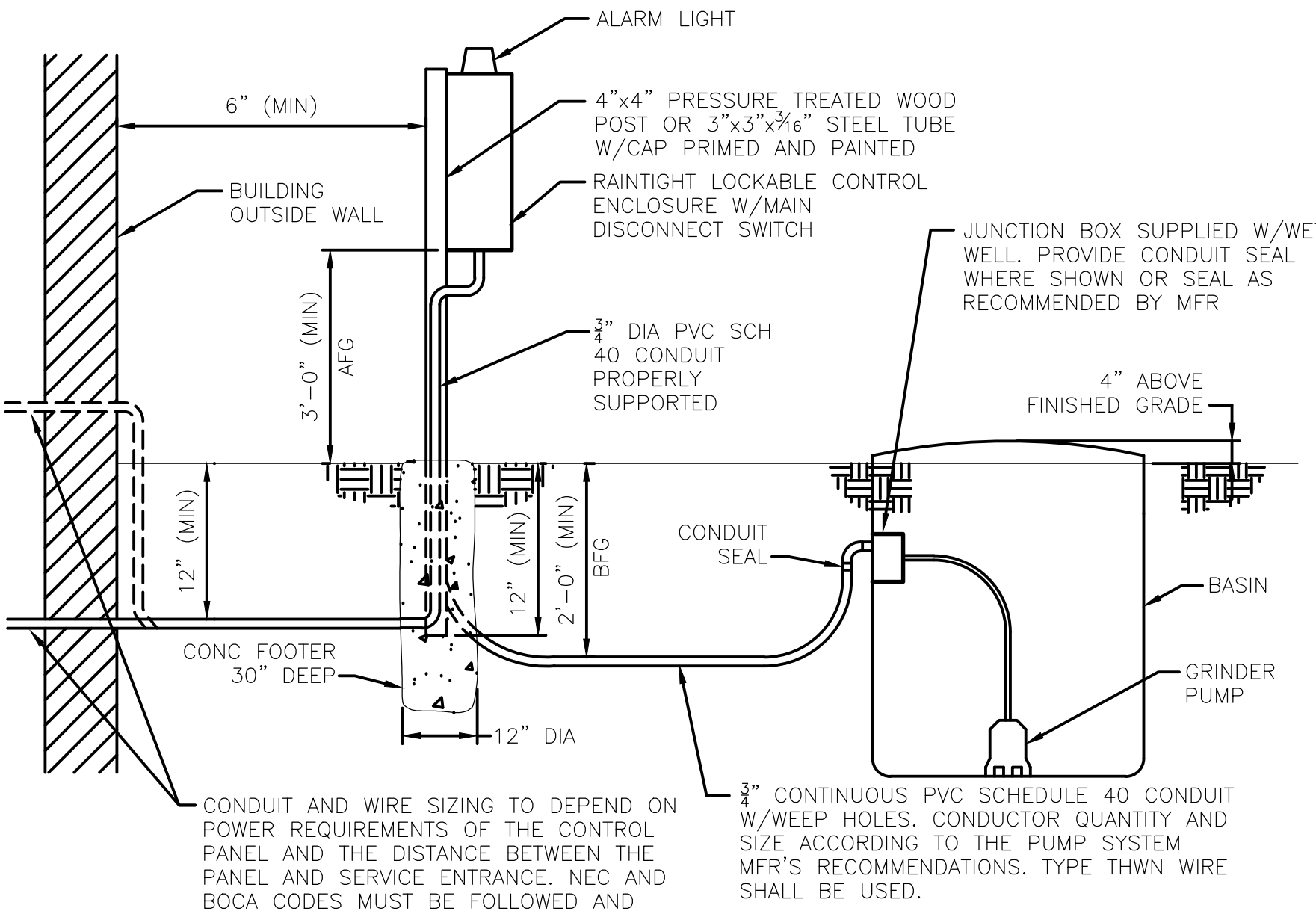


WALL-MOUNTED CONTROL PANEL (EXTERNAL INSTALLATION)

DETAIL

NO SCALE



POST-MOUNTED CONTROL PANEL (EXTERNAL INSTALLATION)

DETAIL

NO SCALE

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3020 Columbia Avenue, Lancaster, PA 17603
Phone (800) 738-8395
Email: rettew@rettew.com
Website: www.rettew.com

DRAWN BY: JNW

DATE: MAY 2024

SCALE: NO SCALE

DWG. NO.