EAST COCALICO TOWNSHIP AUTHORITY

Lancaster County, Pennsylvania

SPECIFICATIONS FOR SANITARY SEWER SYSTEM CONSTRUCTION

May 2026

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Recipients of this document must keep themselves informed of any revisions which may be made to the Specifications.

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SECTION 1 – GENERAL REQUIREMENTS

A. GENERAL

1. Applicant/Owner

    a. All references to the “Applicant or Owner” in these specifications pertain to the individual, organization, company, or developer who makes application to construct or install sewer lines, sewer systems and sewer services in the East Cocalico Township Authority’s Sanitary Sewer Service area.

2. Submittals

    a. The applicant shall provide shop drawings of all materials and equipment proposed for Authority approval prior to construction.

3. Authority’s Right of Inspection

    a. The Authority shall have the right to inspect any sewer system construction being carried out by the Applicant. Should the inspected work prove to be unsatisfactory, the cost of removing and replacing, renewing and making good the unsatisfactory work shall be borne by the Applicant. No sewer service facility shall be placed in service until it has been successfully tested in the presence of an authorized Authority representative.

4. Working Conditions

    a. Night, Saturday, Sunday, or National Holiday work subject to Authority inspection will be permitted only with written consent of the Authority. No work shall be done when, in the opinion of the Authority, the weather is unsuitable.

5. Standard Specifications

    a. Standard specifications of societies, associations, institutes, etc., referred to in these Specifications, shall be the latest edition of such Specifications unless otherwise noted.

6. Work Area Traffic Control and Maintenance

    a. Traffic in work areas shall be controlled to protect the public and workmen, while minimizing the inconvenience to the public. Traffic control devices shall conform to PennDOT Publication 213 and be consistent with the general provisions of *67 Pa. Code, Chapter 212, Official Traffic Control Devices* and the national *Manual on Uniform Traffic Control Devices* as issued by the Federal Highway Administration. Traffic control measures shall be coordinated with East Cocalico Township.

    b. When vehicles must be stopped for short periods, work shall be performed during other than peak traffic periods. Access to residential and business establishments

shall be maintained, except when work is actually being performed in the area. Trenches across driveways, side streets, alleys and entrances shall be maintained after backfilling.

7. Compliance with Provisions of Pennsylvania Act No. 287/187 of 1996

   a. Pennsylvania General Assembly Act No. 287/187 sets forth requirements designed to protect underground utility lines from damage during excavation. Generally, the Act requires that the location and type of utility lines at the work site be ascertained and detailed information from each user (utility owner or operator) not less than three working days before beginning work, be requested. In Pennsylvania, the organization to contact is Pennsylvania One-Call. The telephone number is 1-800-242-1776.

8. Permits

   a. The Applicant shall secure, in the name of the Authority, all permits and approvals that are required from the Department of Environmental Protection, Conrail, PennDOT, Turnpike Commission or any other applicable agency. The Applicant shall secure, in his own name, all required construction permits and approvals such as local street opening permits. Any existing street, highway or other improvements disturbed during construction shall be restored to the satisfaction of the Authority 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.

   b. Approval by the East Cocalico Township Authority 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 that such approval be a waiver of East Cocalico Township Authority’s right to seek enforcement from the permitting agency.

   c. Separate from the Authority, the applicant shall satisfy all requirements of East Cocalico Township.

9. Special Requirements

   a. All sewer lines shall be extended to the furthest property lines or corners of the development under consideration. The exception shall be where lines cannot be further extended at the sole discretion of the Authority. The size and location of the sewer mains, pumping stations, treatment facilities, valves and other appurtenances shall be determined or approved by the Authority’s Engineer so as to comply with the Authority’s long-range facilities planning.

   b. All sewer mains to be dedicated to the Authority shall have a minimum 30-foot right-of-way. The maximum slope of final grade for the full width of the right-of-way (new or existing) shall be 10:1 (horizontal:vertical), which includes all non-paved areas. All rights-of-way must be accessible for maintenance.

c. Gas utility mains shall be shown on water and sewer plan and profile sheets during the design phase of the project for Authority approval prior to construction.

d. Construction of sewers and appurtenances shall conform to the requirements of the Occupational Safety and Health Act (OSHA).

e. 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 protected by heavy rubber belting. If pavement, curb and/or sidewalk is damaged or marked by construction equipment, the areas shall be restored at no cost to the Authority.

f. The work shall be protected from damage during storms.

g. A competent person shall be identified and made available within 2 hours in case emergency situations arise during non-working hours.

h. The local Police and Fire Departments shall be informed of the work schedule and of possible street obstructions.

i. 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.

j. In an effort to avoid the introduction of sewer gases into a newly constructed sanitary sewer extension, it shall be incumbent on the Applicant 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 Applicant 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 Authority.

END OF SECTION

SECTION 2 – SERVICE LINES

A. GENERAL

1. Each Improved Property shall have a single, individual service line. A service line consists of all piping, pumps and other appurtenances between the house or building to the receiving end of the Authority's sewer lateral.

    a. Where premises in single ownership consist of more than one building, all buildings together must use a single lateral for connection to the sanitary sewer.

    b. For non-residential connections the Authority may require a wastewater flow meter and/or monitoring manhole to be installed for billing purposes. Prior to installation, flow meter information must be submitted to the Authority for review and approval. Flow meters shall be permanently wired and shall be accompanied with a means of transferring the flow data electronically to the Authority. Maintenance of the equipment shall be performed by a qualified provider. All costs associated with the installation, operation and maintenance, as approved by the Authority, shall be the responsibility of the Owner. The flow data and maintenance records shall be submitted to the Authority on a regular basis.

    c. Water meters that may be used for sewer billing purposes when approved by the Authority shall meet the requirements of the Authority's *Specifications for Water System Construction*.

2. Maintenance and Repair of Service Lines

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

3. Existing Service Lines

    a. Existing service lines may be utilized providing 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 (ductile iron, schedule 40 PVC, SDR 35 or cast iron). The integrity of the existing line shall be determined by performing the air test described herein. If the existing line does not conform to these requirements, the line shall be corrected or a new line shall be laid at the expense of the Owner in accordance with the specifications contained herein. All testing required by the Authority shall be at the expense of the Owner.

4. Supervision and Inspection

    a. The construction of service lines shall at all times be subject to the supervision and inspection by the Authority or its duly authorized representative and shall conform to

the Authority's specifications. No owner shall permit service connections to be covered or backfilled until authorized by the Authority to do so.

5. Basements

    a. 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.

6. Service Lines Under Buildings

    a. The length of service line that extends beneath a building foundation shall be kept to a minimum. In the case of multi-building developments, the service line for a building shall not be located beneath the foundation of another building.

7. Disconnection of Service Lines

    a. The disconnection of a service line shall be at the edge of the right-of-way and shall be capped or plugged with a lateral pipe type cap, plug or appropriate Fernco cap.

B. DESIGN CRITERIA

1. Diameter and Slope

    a. The internal diameter of the pipe shall be a minimum of 4 inches. All service lines shall be installed with a minimum grade of 2 percent. Pipes shall be laid in straight lines.

2. Depth of Sewers

    a. A minimum cover of three feet over the top of the pipe shall be maintained. Minimum cover in driveways, parking areas, and streets shall be four feet. Any exceptions to these requirements have to be approved by the Authority.

3. Location of Sewers

    a. Service lines shall be installed a minimum of 18 inches below, measured vertically, and a minimum of 18 inches away, measured horizontally from water utilities. If the vertical separation requirement cannot be met the service line shall be installed at least 5 feet away, measured horizontally, from water utilities.

    b. Service lines shall be installed at least 5 feet away, measured horizontally, from other utilities.

    c. Refer to Section 4 for additional requirements on utility separation.

    d. Locate service lines at least 10 feet away, measured horizontally, from trees.

4. Cleanouts

   a. Cleanouts shall be installed at maximum intervals of 100 feet in the service line and at changes in direction greater than 45 degrees.

   b. Cleanouts shall be provided either inside the building where the pipe enters the building or outside the building at the beginning of the service line.

   c. A 6-inch cleanout and test tee with riser shall be installed at the end of the lateral at the Right-of-Way. This cleanout at the end of the service line (beginning of ECTA owned lateral) shall have a ferrous metal cap.

   d. The top of the cleanout shall be 6 inches above finished surrounding grade. Alternatives to this requirement may only be considered by the Authority if adequate justification is provided by the Applicant that demonstrates that meeting this requirement is not feasible. Where it is not feasible to locate the cleanout above grade, the cleanout may be located below grade beneath a manhole frame and cover. The frame and cover shall be rated for traffic in driveway and parking areas. The frame and cover shall be East Jordan V5620 (frame) and East Jordan V6720 (cover). The frame shall be placed on six (6) 6-inch x 4-inch x 16-inch concrete block. The concrete blocks shall rest on a 6-inch bed of compacted 2A or 2B stone. If both a cleanout and vent are to be located together below grade, a heavy duty cast iron 24-inch manhole cover with frame shall be used, as specified in Section 6 - Manholes. If a cleanout only is to be located below grade, a 10-1/2-inch heavy duty cover with 12-inch frame shall be used. Alternatively, in non-traffic areas, the vent and cleanout may be installed in a 14-inch x 19-inch valve box as manufactured by NDS Inc. – Pro Series 213BC or approved equal, provided that ferrous metal is incorporated in the cover to permit future location detection.

C. MATERIALS AND EQUIPMENT

1. Pipes

   a. Ductile Iron Pipe and Fittings

      (1) Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

   b. Plastic Pipe and Fittings

      (1) Pipes for gravity service lines shall be Schedule 40 polyvinyl chloride (PVC) conforming to ASTM D1785. PVC SDR 35 as specified in Section 4 – GRAVITY SANITARY SEWERS is acceptable for 6-inch (minimum) diameter pipe.

      (2) Joints shall be:

         (a) O-ring gaskets per ASTM D3212 and shall be installed according to manufacturer’s recommendations.

         (b) Glued per ASTM D2672. Pipe ends shall be cleaned primed, glued and installed according to manufacturer’s recommendations.

(3) All fittings and accessories shall have bell and/or spigot configurations compatible with the pipe.

c. For low pressure sewer service lines refer to Section 5 – LOW PRESSURE SEWERS for these requirements.

2. Cleanouts

a. Cleanouts on service lines shall be of the same material as the service line pipe. Cleanout tops shall be a watertight screw type plug.

b. Cleanout set at the end of the service line (beginning of ECTA owned lateral) shall have a ferrous metal cap.

3. Extended Adapter Bushing

a. The extended adapter bushing shall be a 6-inch sewer spigot by 4-inch DWV hub tapered concentric reducer and shall be of the same material as the sanitary sewer lateral pipe.

4. Test Tee

a. The Test Tee shall have gasketed joints and be of the same material as the sanitary sewer lateral pipe.

5. Flexible Coupling

a. Flexible couplings composed of elastomeric PVC shall conform to ASTM C443, C425, C564 and D1869 as manufactured by Fernco, Inc. (Strongback 6000 RC) or MAXADAPTOR.

b. Each coupling shall be supplied with two Type 305 stainless steel adjustable clamps.

c. Flexible coupling shall consist of a flexible sealing sleeve, stainless steel clamps, and a stainless steel shield referred to as a shear ring.

(1) Couplings shall be of “Type B” complying with the standard specification ASTM C1173.

(2) Shear rings shall have a minimum thickness of 0.012 inches.

(3) Shear rings shall be equipped with a minimum of two 300 series stainless steel clamps.

(4) Clamps shall be permanently attached to shields by spot weld or rivet.

6. Expansion Joint

a. Expansion joints shall be Spears Elastomer Expansion Repair couplings.

D. INSTALLATION

1. Excavation

   a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

2. Bedding

   a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.
   b. Sand may be used as an alternate pipe bedding material.

3. Laying Pipe

   a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

   b. Connections to Sewer Laterals

      (1) The first fitting to be installed as part of the service line installation to connect to the sewer lateral shall be a test tee.

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

      (3) Where the service line and the sewer lateral are of different size pipes and similar material, connection of the service line with the lateral sewer shall be made by utilizing an extended adapter bushing with ends compatible with the lateral and service line piping.

      (4) If the service line and sewer lateral are of unlike materials, the connection may be made with a Fernco flexible coupling (gravity sewer connections only) with stainless steel clamps suitable for the type and size of pipe to be connected as approved by the Authority. Projecting the smaller pipe into the larger pipe and sealing with grout or mastic will not be permitted.

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

      (6) 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 3 of these specifications.

4. Backfilling

   a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

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

5. Surface Restoration

    a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

6. Special Conditions and Requirements

    a. Where the service line is to be placed under a drive or other roadway and the depth is less than 4 feet, the line shall be encased in flowable fill to 6 inches above the top of the pipe, or the line shall be ductile iron pipe meeting the requirements in Section 4.

    b. At the entry of the service line into the building a protective ductile iron or steel sleeve shall be provided through the wall of the building. The sleeve shall span across the excavated area outside the wall and at least two feet of the end of the sleeve shall rest on virgin soil. The sewer pipe shall be threaded through the sleeve and the annular space between the service line. Both ends of the sleeve shall then be sealed with non-corrosive silicon-based sealant or expandable foam. A flexible coupling pipe sleeve seal made of elastomeric PVC as manufacture by Fernco, Inc. may also be used to seal the sleeve and carrier pipe. The casing pipe shall be two pipe sizes larger than the service line.

    c. No hotel, restaurant, boarding house, or public eating place shall connect to the sewer system without first installing a grease interceptor, of a type and size approved by the Authority and a flow monitoring manhole in the service line at locations approved by the Authority.

    d. A grease interceptor shall consist of one of the following:

        (1) A three-stage grease interceptor consisting of three separate tanks or one or more tanks divided into three segments by grease trapping baffles.

        (2) A three-stage manufactured/engineered grease interceptor consisting of a double baffled three-compartment unit installed in containment vaults with flow valves and vent lines as recommended by the manufacturer.

        (3) A multi-stage grease interceptor of a configuration (baffles or piping) and orientation to comply with the requirements of this specification, sized to match the needs of the discharge being permitted.

    e. The size and capacity of three stage grease interceptors shall be in accordance with the following criteria and the formula requiring the largest size shall be used:

        (1) 6 gallons of capacity per stage, for every restaurant seat.

        (2) 3 gallons per food customer served per peak day of operation or anticipated peak day of operation in the case of a new business.

        (3) Such size as is sufficient to allow a minimum of 1 hour of detention of flow at the maximum flow rate generated at any time.

        (4) Minimum size will be 1,000 gallons.

f. 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 a grit-oil interceptor of a size and type approved by the Authority, and a flow monitoring manhole, in the service line or at a locations approved by the Authority.

(1) Grit-oil interceptor to be a dual compartment construction, and baffle wall to have 4-inch high and 24-inch wide opening 24 inches from interceptor invert.

(2) Minimum size will be 1,000 gallons.

E. TESTING AND INSPECTION

1. Notification

a. It is incumbent upon the Applicant to notify the Authority a minimum of 24 hours in advance of when the work will be ready for inspection.

2. Leakage Test

a. Each service line shall be subjected to a 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 hereinafter described. 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 the new connection with the Authority's system by the use of a "test tee" 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 exfiltration test with air as detailed in Section 4 – GRAVITY SANITARY SEWERS.

F. DETAIL DRAWINGS

Relevant detail drawings are:

11 Typical Service Line - Profile
12 Typical Service Line - Plan
27 Precast Concrete Flow Monitoring Manhole
30 Sanitary Sewer Vent/Cleanout in Driveway or Traffic Area
32 Grease Trap Detail

END OF SECTION

SECTION 3 – SANITARY SEWER LATERALS

A. GENERAL

1. A sanitary sewer lateral is that section of a sanitary sewer that extends from the main sewer to the property line, curb line or right-of-way line of the property which it serves.

2. All sanitary sewer laterals constructed within the service area of the East Cocalico Township Authority shall meet the requirements of this specification.

3. Sewer lateral pipe and fittings (wye branches, risers, and bends) shall be furnished and installed in strict accordance with these specifications, and any and all practices and precautions required for the main gravity sewers specified in Section 4 of these specifications are equally applicable to the sewer laterals.

4. Low pressure sewer laterals shall meet the requirements of Section 5.

B. DESIGN CRITERIA

1. Diameter and Slope

    a. The internal diameter of the pipe shall be a minimum of 6 inches. All laterals shall be installed with a minimum 1 percent slope to 2 feet beyond the edge of the right-of-way, a point two feet beyond the sidewalk or proposed sidewalk, or ten feet beyond the curb line or edge of street, whichever is greater, and shall include a removable watertight cap or stopper. All lateral wyes shall be set in accordance with the detail drawings contained herein using 6-inch bends. The invert elevation of the 6-inch service lateral at the 45-degree bend shall be the same as the elevation of the crown of the main for the typical lateral connection.

2. Depth of Sewers

    a. Sewer laterals shall be installed with a minimum cover of 3 feet at any point along its entire length. Minimum cover in driveways, parking areas, and streets shall be 4 feet. Any exceptions to these requirements have to be approved by the Authority.

3. Location of Sewers

    a. Laterals shall be installed at least 5 feet away, measured horizontally, from other utilities. Laterals shall also be installed below water utilities. If these minimum distances cannot be achieved, alternative methods for protecting the water utilities, as approved by the Authority, shall be used.

    b. Refer to Section 4 for additional requirements on utility separation.

    c. A lateral shall be provided for each lot.

    d. Sewer laterals shall not be connected to manholes unless approved by the Authority.

e. Locate laterals at least 10 feet away, measured horizontally, from trees.

f. Locate lateral wyes on main a minimum of 3 times the mainline pipe diameters from manholes, measured horizontally. For example, an 8-inch mainline would have minimum wye separation from manhole of 24 inches.

C. MATERIALS AND EQUIPMENT

1. Pipes

a. Ductile Iron Pipe and Fittings

(1) Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

b. Polyvinyl Chloride Sewer Pipe and Fittings

(1) Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

(2) Schedule 40 PVC pipe, conforming to ASTM D1785, shall be required for laterals installed via direct boring when that installation method is approved by the Authority.

2. Wyes for Connection to Main Line

a. Wyes shall conform to the pipe material specifications above.

3. Cleanouts

a. A 6-inch cleanout and test tee with riser shall be installed at the end of the lateral at the Right-of-Way. This cleanout at the end of the service line (beginning of ECTA owned lateral) shall have a ferrous metal cap.

D. INSTALLATION

1. Excavation

a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

2. Bedding

a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

3. Laying Pipe

a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

4. Backfilling

a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

5. Surface Restoration

    a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

6. Special Conditions and Requirements

    a. Trench excavation, in any material, shall extend for 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 each lateral and shall extend a minimum of 12 inches above the ground.

    b. Where no wye branch is present in an existing sewer line, lateral connections shall be made with either a saddle type connection or installation of a new tee or wye. For the saddle type connection, the hole for the saddle must be cut into the existing line with extreme care. The cut-out piece is not to be dropped into the pipe. It should be kept for inspection by the Authority. The saddle shall be a Style CB Sewer Saddle as supplied by Romac Industries, Inc. Installation of the saddle shall be in accordance with the manufacturer's instructions.

    c. Alternatively, a lateral connection may be made by removing a portion of the existing line and installing a new tee or wye with a restrained epoxy lined ductile iron mechanical joint sleeve.

    d. All connections to existing sewers must be witnessed and approved by an Authority representative.

E. TESTING AND INSPECTION

1. Notification

    a. It is incumbent upon the Applicant to notify the Authority a minimum of 24 hours in advance of when the work will be ready for inspection.

2. Lateral connections which are constructed as part of new sanitary sewer installations shall be tested and inspected as described in Section 4 – GRAVITY SANITARY SEWERS.

3. Lateral connections to existing sanitary sewer lines shall be visually inspected prior to commencement of 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
5 Lateral Riser

END OF SECTION

SECTION 4 – GRAVITY SANITARY SEWERS

A. GENERAL

1. Regulatory Agencies

a. All designs shall conform to good engineering practice and all proposed sewer construction projects shall meet the requirements of the Pennsylvania Department of Environmental Protection (DEP), OSHA, and the Pennsylvania Department of Labor and Industry, and shall conform to the requirements contained herein.

B. DESIGN CRITERIA

1. Diameter and Slope

a. The minimum sewer diameter shall be 8 inches. Minimum slopes shall be as those which appear in the DEP *Domestic Wastewater Facilities Manual* (Latest Edition). The minimum slope for all terminal sections of sewers shall be 1.0 percent. The maximum distance between manholes shall be 400 feet.

2. Depth of Sewers

a. All sewers shall be designed to provide a minimum depth of cover of 3 feet – 6 inches (42 inches) 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 to be necessary, the design should be 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 to be used shall be ductile iron.

3. Location of Sewers

a. General

(1) Sewer mains shall normally be located within the right-of-way lines of public streets. If it is necessary to locate a sewer main on private property, the Applicant shall provide a sewer easement in the name of the Authority. The easement shall consist of a minimum 30-foot wide permanent easement, normally centered on the pipeline, and an additional 20-foot wide temporary construction easement.

b. Utility crossings shall be minimized. Maximum horizontal separation of utilities shall be provided for ease of future maintenance and health and safety reasons.

c. Sewer mains shall have a minimum horizontal separation of 5 feet from curbs.

d. Sewers Near Water Mains

(1) Sewer installation near water mains shall conform to the Pennsylvania Department of Environmental Protection's *Domestic Wastewater Facilities Manual*.

(2) Parallel Installation: Sewers shall be laid at least 10 feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot separation, the Authority may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a water main, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

(3) Crossings: Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. This vertical separation shall be maintained for the portion of the sewer located within 10 feet horizontally of any water main it crosses. The 10 feet is to be measured as a perpendicular distance from the sewer line to the water line.

(4) Exception: When it is impossible to obtain the proper horizontal and vertical separation as stipulated in Items (2) and (3) above, both the water main and sewer line shall be constructed of ductile iron pipe having mechanical joints. Other types of joints of equal or greater integrity may be used at the discretion of the Authority. Where a sewer must cross over a water main, additional protection shall be provided by:

(a) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line;

(b) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line; and

(c) Centering the length of the water line at the point of the crossing so that the joints are equidistant and as far as possible from the sewer.

(5) The Authority shall be consulted when any of the above conditions cannot be met, to discuss the use of double casing or concrete encasement of sewer and/or water lines as possible alternatives.

(6) No water pipe shall pass through, or come into contact with, any part of a sewer manhole.

e. Sewer Mains Near Gas Mains and Other Utilities

(1) Parallel Installation: Sewer mains shall be laid at least 10 feet horizontally from any existing or proposed gas main or other utility. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot separation, the Authority may allow deviation on a case-by-case basis, if supported by data from the design engineer.

(2) Crossings: Whenever sewer mains must cross gas mains or other utilities, a minimum vertical separation of 18 inches shall be provided measured edge to edge. This vertical separation shall be maintained for the portion of the sewer main located within 10 feet horizontally of any gas main or other utility it crosses. The 10 feet is to be measured as a perpendicular distance from the gas main or other utility to the sewer main. Where the sewer main must cross under a gas main or other utility, adequate structural support for the gas main or other utility shall be provided to prevent excessive deflection of the joints and the settling on and breaking of the sewer line.

(3) The Authority shall be consulted when any of the above conditions cannot be met, to discuss possible alternatives.

4. Borings

a. 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

(1) Ductile iron pipe shall conform to AWWA C151 and ASTM A746. 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.

(3) 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.

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.

c. Minimum Thickness

(1) Thickness design shall be per AWWA C150, except provide minimum Class 50.

2. Polyvinyl Chloride Sewer Pipe and Fittings

a. Materials

(1) Polyvinyl chloride (PVC) sewer pipe and fittings shall be PVC SDR 35 with full diameter dimensions and shall conform to ASTM D3034 for sizes 8 inches

through 15 inches and shall conform to ASTM F679 for sizes 18 inches through 36 inches.

b. Joints

(1) 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.

c. All fittings and accessories for sewers shall have bell and/or spigot configurations compatible with the pipe.

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, and conform to AWWA C200 and ASTM A53.

b. Casing exterior shall be painted with bitumastic coating.

c. Pipe cradles or isolators shall be field assembled as shown on the detail drawings, APS casing spacers (Model SSI), CCI Piping Systems Casing Spacers, or approved equal. Manufactured spacers shall be made of stainless steel.

d. Casing end seals shall be APS brand (Model AC) or CCI Piping Systems rubber end seals or approved equal.

e. 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 6 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. All of this excavation may be done by machine. 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 inches of AASHTO No. 8 (PennDOT No. 1B) or AASHTO No. 57 (PennDOT No. 2B) stone, the full width of the trench, and shall be covered with AASHTO No. 8 (PennDOT No. 1B) or AASHTO No. 57 (PennDOT No. 2B) stone to a height of 12 inches over the top of the pipe.

   b. The bedding shall be thoroughly compacted to 90% Standard Proctor, AASHTO T-99. The bedding shall provide uniform and continuous bearing and support for the pipe at every point between the bells.

   c. Unstable Subgrade

      (1) 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 No. 8 (or PennDOT No. 1B) stone in 3-inch (uncompacted thickness) layers thoroughly compacted to 95% of maximum density and the bedding prepared as hereinbefore specified.

      (2) Flowable Backfill meeting the requirements of PennDOT Form 408 may be used as an alternative to backfilling with stone. Material consists of a mixture of cement and water which shall have a 28-day unconfined minimum compressive strength of 100 psi based on the manufacturer's certification, and shall be placed in accordance with the manufacturer's recommendations.

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

   e. Special Foundations

      (1) 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, a suitable foundation for the pipe shall be designed and submitted to the Authority for approval.

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.

(1) Grade and Alignment Control

(a) Prior to construction, three copies of a grade sheet for each manhole run shall be furnished to the Authority. Grade and alignment control shall be established by laser (direct reading).

b. 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 rock, boulder, or stone.

c. Pipes at Manholes or Other Rigid Structures

(1) Pipes directly connected to or supported by rigid structures (manholes, vaults, wall, etc.), shall not have a length beyond the rigid support in excess of that shown in the detail drawings. One flexible joint shall be required within three pipe diameters of a rigid structure.

(2) New sewer line connections to existing manholes shall be installed as follows:

(a) Cut hole in existing manhole with coring machine.

(b) Install resilient gasket type seal as specified in Section 6 per ASTM C-923.

(c) Caulk annular space with preformed plastic sealing compound as specified in Section 6.

d. Water in Trenches

(1) 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 No. 8 (or PennDOT No. 1B) stone as specified above except that stones larger than 8 inches may not be placed 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 being used. The first lift above the bedding material

shall be two feet with subsequent lifts not to exceed one foot. 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). Backfilling shall not be done with frozen material. No backfilling shall be done if the material already in the trench is frozen.

c. Utility excavations in areas of streets, access drives, parking areas and loading areas shall be backfilled and compacted in accordance with East Cocalico Township's Subdivision and Land Development Ordinance.

d. In State highways, all backfill and compaction shall be in accordance with the requirements of PennDOT Chapter 459.

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 East Cocalico Township's Subdivision and Land Development Ordinance.

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 utilizing a levelling 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.

E. TESTING AND INSPECTION

1. Notification

a. It is incumbent upon the Applicant to notify the Authority a minimum of 24 hours in advance of when the work will be ready for inspection.

2. Allowable Deflection Test

a. Deflection shall be measured with a rigid mandrel (Go/No Go) device cylindrical in shape and constructed with a minimum of nine evenly spaced arms or prongs, allowing a maximum of 5 percent pipe deflection. Drawings of the mandrel with complete dimensions shall be submitted to the Engineer for each diameter of pipe to be tested. The mandrel shall be hand pulled through all sewer lines. Provide certification that these tests have been conducted to the Authority. These tests must be witnessed and approved by the Engineer or the Authority.

b. Any section of sewer not passing the mandrel shall be uncovered and the bedding and backfill replaced to prevent excessive deflection. Repaired pipe shall be retested.

c. Contractor shall wait 30 days following backfill to perform deflection testing.

3. Leakage Test

a. General

(1) 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 or the Authority's inspector.

(2) Submit copies of test conditions and results to the Authority for each section tested.

(3) Test the first section of pipeline as soon as it is installed to demonstrate that the work conforms to this Section.

(4) Testing of pipe shall closely follow pipe laying. No more than 1,000 feet of pipe shall remain untested at any time.

(5) Contractor shall notify the customers when service will be interrupted for testing.

b. Exfiltration Test with Air

(1) Submit the proposed method of testing to the Engineer or the Authority for approval. Air testing shall be performed in accordance with the procedures described in UNI-B-6-98 (PVC or DI), ASTM C828 (Clay), or ASTM C924 (Concrete) for the appropriate pipe material.

(2) 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. It is extremely important that all plugs be installed and braced to prevent blowouts. Note that the force of 250 pounds is exerted on an 8-inch plug by an internal pressure of 5-psig, and a force of 5,090 pounds is exerted on a 36-inch plug by an internal pressure of 5 psig. No persons should be allowed in the alignment of the pipe during testing. Care must be taken that the pressures generated by the air testing equipment do not exceed the pipe manufacturer's recommendations.

(3) 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 psi to 10 psi or 15 psi. The continuous monitoring gauge shall be no less than 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of ±0.04 psi.

(4) 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.

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

(6) The pipe shall be considered acceptable if the pipe holds a pressure of 5 psig for a minimum of 15 minutes.

(7) If the results of the air test are unsatisfactory, the Owner shall, at his own expense, determine the source of the leakage and make all necessary corrections and retest. The extent and type of repair which may be allowed, as well as results, shall be subject to approval of the Engineer or the Authority.

4. Closed Circuit Television Inspection (CCTV)

   a. Pipe inspection by CCTV shall be executed in periods of low or no flow.

   b. All debris and small roots shall be removed from the sewer system before full inspection.

   c. Pipes shall be inspected according to the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) standards.

   d. Two copies of CCTV inspections to be provided to the Authority on two USB flash drives, or two external hard drives.

5. Cleaning

a. 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 pipeline. 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
9 New Sewer to Existing Manhole Connection
28 Sewer Main Pipe Casing

END OF SECTION

SECTION 5 – LOW PRESSURE SEWERS

A. GENERAL

1. Intention

a. 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 or as dictated by Authority programs, which delineate a special service area to be governed by an Authority generated management plan.

2. Approvals

a. 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 utilize sewage pumping stations and force mains, the use of low pressure sewers will not be permitted.

3. Developers

a. Developers, who wish to provide sewer service by using low pressure sewers within tracts to be developed, must familiarize themselves with all applicable management plans. Grinder pump systems 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

a. 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

a. The internal diameter of the pipe shall be a minimum of 1-1/2 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. A minimum cover of 3 feet – 6 inches (42 inches) feet over the top of the pipe shall be maintained.

4. Location of Sewers

    a. Refer to Sections 2, 3 and 4 as appropriate for these requirements.

5. Pumps

    a. Pumping units shall be as specified in Sections 8 and 10 as appropriate.

6. Cleanouts Manholes

    a. Provide cleanout manholes at all bends of 45 degrees or greater. The maximum distance between cleanout manholes shall be 500 feet.

7. Thrust Restraints and Blocking

    a. 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

    a. 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 to distinguish between sanitary sewer and water main in accordance with PA DEP requirements.

C. MATERIALS AND EQUIPMENT

1. Ductile Iron Pipe and Fittings

    a. Refer to Section 7 – FORCE MAINS for these requirements.

2. Polyvinyl Chloride Pipe

    a. Material

        (1) Main line and lateral applications: PVC pressure pipe sized 1-1/2 inches through 12 inches 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: SDR 21 or PVC Schedule 40. PVC Schedule 40 pressure pipe sized 1-1/2 inches through 3 inches 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. 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 premolded 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. High Density Polyethylene Pipe

a. HDPE pipe resins shall be high molecular weight, high density polyethylene with a cell classification number of 345464C (or E) or higher cell classification in accordance with ASTM D3350. Pipe shall conform to the dimension requirements of the IPS Sizing System (ANSI B36.10). Pipe shall meet the requirements of Dimension Ratio (DR) 11. The minimum pressure rating shall be 200 psi. All polyethylene pipes shall meet the requirements of ASTM F714.

b. The pipe shall be joined with butt, heat fusion joints. All joints shall be made in strict compliance with the manufacturer's recommendations and ASTM 2657. Where required, flange connections, mechanical joint connections and butt connections using bolted mechanical couplers shall be provided from a pipe stub with a polyethylene and steel stiffener. Flanged connections shall be provided from a pipe stub and a steel back-up flanged. Back-up flanges shall be primed and painted in a

corrosion protected paint recommended and supplied by the manufacturer. All bolts, nuts and hardware shall be Type 316 stainless steel.

c. HDPE fittings shall be fully pressure rated to match the pipe DR pressure rating. All fittings shall be molded or fabricated by the same manufacturer as the pipe. HDPE fittings shall be joined using butt, heat fusion and/or electrofusion. Adhesives and solvent cements shall not be permitted.

4. Air & Vacuum Valves

   a. Air & vacuum valves and valve chamber shall be as specified in Section 7 – FORCE MAINS.

5. Cleanouts

   a. Cleanouts shall be constructed of the same material as the pipe and shall be provided with shut-off valves on both sides of the tee and a valve on the discharge branch of the tee to permit blow off from either direction. 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.

6. Valves

   a. 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.

7. Valve Boxes

   a. Valve Boxes shall be screw-type of cast iron and shall be installed over all buried valves and service line cleanouts in accordance with AWWA C500-80. Valve boxes shall have 5-1/4-inch shafts and the word SEWER cast in the center of the cover. Valve boxes shall not be located in roadways, driveways or sidewalks.

   b. Valve Boxes within paved areas are to include a 1.5- inch steel riser ring manufactured by Bingham & Tylor or Tyler Union. New valve box designs are to incorporate a single 1.5 - inch steel riser installed such that finished height of valve boxes are 0.5 inches below finished grade.

8. Detectable Warning Tape/Wire

   a. Detectable warning tape, for open cut installations, 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, the continuous legend - CAUTION - PRESSURE MAIN BURIED BELOW.

   b. For trenchless installations tracer wire shall be #12 A WG high strength copper clad steel conductor (HS-CCS), insulated with a 30 mil, high density, high molecular

weight polyethylene (HDPE insulation, and rated for direct burial use at 30 volt. HS-CCS conductor must be a 21% conductivity for locating purposes, break load 380# minimum. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet APWA color code standards for identification of buried utilities. Tracer wire shall be Copperhead HS-CCS HDPE 30 mil insulation or approved equal. Direct bury corrosion proof wire connectors shall be installed as necessary during the installation and connection of the tracer wire. Copperhead Snakebite wire connectors shall be installed as necessary during the installation and connection of the tracer wire. Copperhead Snakebite wire connectors or approved equal shall be installed to terminate and connect all tracer wire.

D. INSTALLATION

1. Refer to Section 7 – FORCE MAINS for these requirements for PVC pipe.

2. Install detectable warning tape or tracer wire directly above pipeline, a minimum of 18 inches below finished grade but no less than 24 inches above the crown of the pipe.

3. Horizontal Directional Drilling for HDPE Pipe

   a. Perform all horizontal directional drilling in accordance with ASTM F1962-99.

   b. The drill rig and associated equipment shall be in good condition. The drill bit and reamers shall have a closed face and shall be capable of supporting the excavated area (face) during excavation and shutdown. The bit shall be full directional in both the horizontal and vertical directions from the drill rig so that the alignment can be maintained during the entire drilling operation. The drill bit shall be capable of drilling though all materials encountered including sand, gravel, and organics.

   c. Excavate slurry recovery sump pits as/where required for completion of work. Restore all area upon completion of drilling and product installation. Provide sump areas to contain drilling fluids. Minimize the number of access pits. Contain excess drilling fluid at entry and exit points until recycled or removed from the site. Provide spoils recovery system to remove the drilling spoils from the sump areas. Remove, transport, and properly dispose all spoils. Do not dispose of drilling spoils in sanitary sewers, storm sewers, or public/private drainage systems.

   d. Continuously monitor drilling fluid pumping rate, pressure and viscosity during the pilot bore, back reaming and product installation stages to ensure adequate removal of cuttings and stabilization of the bore hole.

   e. After the pilot bore and any initial back reams have been completed, attach the product line to the terminal end of the drill string and pull it back to the entry pit. Protect and support the product being pulled into the bore so that it moves freely and is not damaged in any way during installation. Do not exceed the manufacturer’s recommended pullback forces for the product.

   f. Establish surface settlement monitoring points along the centerline of the pipe. Record location of settlement monitoring points with respect to construction baselines and elevations.

E. TESTING AND INSPECTION

1. Notification

It is incumbent upon the Applicant to notify the Authority a minimum of 24 hours in advance of when the work will be ready for inspection. Pipelines shall be visually inspected, prior to commencement of backfilling, for alignment, depth, slope, and for fittings and pipe material used.

2. Pressure Test

a. Refer to Section 7 – FORCE MAINS for these requirements with the following exceptions:

(1) The hydrostatic pressure test shall be 50 psi, or 150% of the normal working pressure, whichever is greater, for 30 minutes.

(2) If the pressure does not drop within the 30-minute test period, the test shall be deemed to be successful.

F. DETAIL DRAWINGS

Relevant detail drawings are:

1 Right-of-Way Restoration
2 Concrete Encasement
3 Pavement Restoration (State and Township Roads)
13 Typical Individual Grinder Pump Service Line Schematic to Gravity Sewer
14 Typical Individual Grinder Pump Service Line Schematic to Low Pressure Sewer
15 Typical Lateral Connection to Low Pressure Force Main
18 Low Pressure Sewer Valve and Cleanout Manhole
19 Low Pressure Sewer Terminal Cleanout Manhole
25 Thrust Blocks for Horizontal Bends and Lower Vertical Bends
26 Restrained DI Pipe Length

END OF SECTION

SECTION 6 – MANHOLES

A. DESIGN CRITERIA

1. Manholes for gravity sanitary sewers shall be placed at all changes of direction, pipe intersections and at intervals not greater than 400 feet. Manholes shall be placed at all changes in grade, pipe size, and alignment. Drop manholes are required if the invert of the incoming pipe is greater than 2 feet above the invert of the outgoing pipe. Internal type drop manholes shall have an internal diameter of 5 feet. External type drop manholes shall have the outside drop cast integrally with the manhole base.

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. Channels for changes in direction of flow shall be as large a radius as the size of the manhole will permit.

3. Exterior and interior surfaces of the manholes must be coated or lined, as described in Section 6.B.6.

4. All manhole covers shall be set to finished grade in paved areas and 12 inches to 18 inches above grade in rights-of-way or unpaved areas, each of which will require a manhole insert. If a manhole is to be at grade in unpaved areas a watertight frame and cover shall be installed. In flood plains, or where deemed necessary by 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. Lift holes in manholes shall not extend through the entire width of the wall.

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 by K.T. Snyder Company, 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.

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). Manhole bases shall have a minimum 6-inch wide flanged lip around the edge of the base for anti-flotation purposes.

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 PSX as manufactured by Press-Seal Gasket Corporation and supplied by Monarch, Dallastown, PA, Dual Seal II as manufactured by Dual Seal Gaskets and supplied by Terre Hill Concrete Products, or approved equal.

d. Precast concrete grade rings with a minimum thickness of 2 inches used for levelling and adjusting to grade shall be of compressive strength as specified above. Rubber grade rings are acceptable with a minimum thickness of 1/2-inch and for tapered arrangements, and shall be “Infra-Riser” as manufactured by East Jordan Iron Works. Rubber risers shall be set on two beads of polyurethane sealant or as recommended by manufacturer. The use of field-poured concrete grade rings shall be allowed only with prior approval from the Authority. If used, field-poured concrete grade rings shall have a minimum thickness of 3 inches and shall be completely cured prior to setting on preformed plastic. Design of the grade rings must provide for full bearing of manhole frame. All joints must be sealed using an approved preformed plastic joint sealing material specified in this section. Cement mortar will not be permitted in any joints. Maximum distance between the top of the manhole frame and the first manhole step shall not exceed 24 inches.

e. All grade ring joints and manhole frame joint shall be sealed with the WrapidSeal (or approved equal) manhole encapsulation system as manufactured by CCI Pipeline Systems, which utilizes an irradiated and cross-linked polyethylene impermeable backing, coated with protective heat-activated adhesive. The sleeve shall extend a minimum of 6 inches below the joint at the top of the manhole.

   (1) Physical properties of the heat shrink sleeve shall be:

      (a) System Type: High Shrink
      (b) Nominal Thickness (as applied): 125 mils
      (c) Fully Recovered Thickness: 141 mils
      (d) Stretch Ratio: 70%

   (2) Sleeve backing tensile strength shall be 2,900 psi.

   (3) Primer shall be WrapidSeal primer or approved equal.

f. Steel Riser Rings

   (1) Steel riser rings shall be as manufactured by East Jordan Iron Works.

   (2) Riser heights greater or equal to 1.75 inches to be Type M1 Solid. Riser height less than 1.75 inches to be Type M7 Solid.

(3) New manhole designs are to incorporate a single 1.75-inch riser installed such that finished height of manholes are 0.5 inches below finished grade.

2. Frame and Cover

   a. Manhole frame and cover shall be heavy duty type with a 24-inch cover, of cast iron, equal in design to Number R-1726-A or R-1670-A manufactured by the Neenah Foundry Company, Neenah, Wisconsin, or1119Z (frame) and 1120A (cover) as manufactured by East Jordan Iron Works, machined and having the words "SANITARY SEWER" cast approximately in the center of the cover.

   b. In locations that require a shallow manhole frame, if approved by the Authority, it shall be heavy duty cast iron, equal in design to 1119Z as manufactured by East Jordan Iron Works.

   c. Frames shall be drilled or cast with holes for anchor bolts. All manhole cover frames shall be securely attached to the manhole by use of anchor bolts.

   d. All joints between the frame and the precast manhole section or concrete grade rings shall be provided with preformed plastic joint sealing material specified in this section and shall be watertight. All joints directly under rubber grade rings shall be sealed using two beads of polyurethane sealant or as recommended by manufacturer. No mortar joints will be permitted.

3. Watertight Manhole Frame and Cover

   a. Watertight manhole frames shall be heavy duty type with a 24-inch bolted, gasketed cover, equal in design to Number R-1916-D as manufactured by Neenah Foundry Co., Neenah, Wisconsin and having the words "SANITARY SEWER" cast approximately in the center of the cover.

   b. Watertight frames shall be securely attached to the manhole by use of anchor bolts.

   c. The joint between the frame and the precast manhole section shall be provided with preformed plastic joint sealing material specified in this section. All joints shall be watertight.

   d. Shop drawings for this type of cover must be submitted for approval before installation.

4. Manhole Inserts

   a. PVC inserts shall be deep bowl type with vent holes and strap. The bowl shall be 8 inches deep, with an inside diameter of 22 inches and an outside diameter of 24 inches. Inserts shall be Model PMI1 as manufactured by Parsons Environmental Products of Reading PA or approved equal.

5. Manhole Steps

    a. Manhole steps shall be composed of a 1/2-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., or approved equal.

    b. The Authority reserves the right to have steps tested according to the latest revision of ASTM Specification C-478 at the Applicant's cost.

    c. Manhole steps shall be positioned 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.

6. Protective Coatings and Linings

    a. Exterior Coating

        (1) All exterior surfaces shall be coated with dampproofing. Dampproofing shall be coal tar waterproofing pitch; Cooper Black No. 760 Heavy Duty Protective Coating or approved equal.

    b. Interior Coating (Hydrogen Sulfide Corrosion Protection)

        (1) New and existing manholes with internal drop of less than 2 feet or those having watertight lids shall have a spray-applied polyurethane or epoxy coating or a cured-in-place PVC composite liner; SprayWall by Sprayroq, Raven 405 by Raven Lining Systems (RLS); or approved equal. Interior Coating shall be installed by a Sprayroq certified technician or an RLS certified applicator, as appropriate, and be applied so that it results in a monolithic liner covering the invert, bench, walls and corbelled top up to the cast iron manhole frame. Coat thickness shall be 250 mils for new manholes and 300 to 350 mils for existing manholes.

        (2) New manholes with a drop of 2 feet or greater, force main terminal manholes, manholes downstream of steep slope (10 percent) lines and for the two (2) manholes located immediately downstream of a drop manhole or force main terminal manhole 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 175891, (717) 445-3100 or GSE StudLiner as manufactured by GSE Lining Technology, Inc. The liner shall have a minimum thickness of 2 mm (0.0787 inches). 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 19077, (215) 547-3366. The Dura Plate liner shall have a minimum thickness of 0.065 inches (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-inch through 60-inch diameter manholes shall be a minimum of 0.5 inches high and shall be 0.75 inches high for 72-inch 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., MT-329, designed to produce sufficient squeeze-out between PVC returns. Manhole steps, if required, shall be polypropylene drive-in step. Pipe penetrations though 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 Predl Systems. The liner shall be of one-piece construction of unlayered, homogenous composite. Minimum thickness shall be 0.12 inches – 0.20 inches (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 inches of Mercury of negative pressure.

(3) Existing manholes receiving a new drop connection of 2 feet or greater, a new force main connection and for the two (2) existing manholes located immediately downstream of a drop manhole or force main terminal manhole shall have either a spray-applied polyurethane coating or a cured-in-place PVC composite liner, as described in Section 6.B.6.b.(1), provided that the condition of the manhole is suitable.

If the Authority determines that an existing manhole requiring an interior coating is in poor condition, a new manhole will be required, and the interior coating shall be as described in Section 6.B.6.b.(2).

(4) All other new manholes not meeting conditions specified above shall have a white epoxy coating (AMERLOCK 2/SIGMACOVER 2, 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.

(5) Special Conditions

(a) Where the interior coating of manhole becomes delaminated and need rehabilitation, it shall be repaired with a 100% solids epoxy coating suitable for wastewater environments. The coating shall be Parsonpoxy FS1+ by Parson Environmental, Dura-Plate 5900 by Sherwin Williams, or approved equal.

(b) Grout repairs to damaged concrete portions, within wet wells, or drop manholes are to be completed using structural epoxy grout. The epoxy grout shall be SR-6100 by Sprayroq, Dura-Plate 100 by A-Lok Products, or approved equal.

C. INSTALLATION

1. General

a. The relevant parts of Section 4 – GRAVITY SANITARY SEWERS shall apply regarding earthwork.

2. Precast Concrete Bases

a. Bedding

(1) Install bases on a 6-inch deep compacted layer of aggregate meeting requirements of Pipe Bedding as specified previously in Section 4 – GRAVITY SANITARY SEWERS.

b. When using prefabricated pipe opening seals for connecting pipes into manholes, and such seals create an annular space on interior and exterior of manhole wall pipe openings after pipe connection is made, fill such annular spaces with non-shrink, corrosion-resistant cement grout.

(1) Tightly caulk sealing compound into annular spaces in a manner to completely fill the spaces and render the installation watertight.

(2) Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.

3. Concrete Channel Fill

a. Field pour concrete channel fill for each manhole base.

(1) Form inverts directly in concrete channel fill.

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

(3) Make changes in size and grade gradually.

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

(5) Make slopes gradual outside the invert channels.

b. Use 3,000-psi concrete unless indicated otherwise on Detail drawings.

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

4. Manhole Wall Erection

a. Precast Components

(1) 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 preformed plastic sealing compound between sections in accordance with manufacturer's recommendations, and join sections also 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 utilized in sealing section joints from internal and external hydrostatic pressure.

(4) Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.

(5) Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases. Caulk annular space with non-shrink, corrosion resistant grout; SC Multipurpose Grout by SpecChem LLC or approved equal.

(a) Manholes with corrosion resistant coatings per Paragraphs 2.4-B-1&2 shall receive non-shrink epoxy mortar; Duraplate Epoxy Mortar by A-Lok Products or approved equal.

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 1/2-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

a. Construct as depicted on the Detail Drawings.

7. Connection of New Sewer Line to Existing Manholes

a. Construct as depicted in the Detail Drawings.

D. TESTING AND INSPECTION

1. Notification

a. It is incumbent upon the Applicant to notify the Authority a minimum of 24 hours in advance of when the work will be ready for inspection.

2. All manholes shall be tested for water infiltration. The Applicant 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. If a manhole has an Interior Coating for corrosion protection, the vacuum test shall not be performed within 24 hours of the application of the coating.

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

a. Install an inflatable circular rubberized test head in the manhole cover frame. Evacuate the air until the internal air pressure of the manhole is lowered by 10 inches of Mercury. Close the valve on the vacuum line and shut off the vacuum pump.

b. The manhole shall pass the test if the time for the vacuum reading to drop from 10 inches of Mercury to 9 inches of Mercury is at least 60 seconds.

c. If the manhole fails the initial test, the Applicant shall determine at his own expense the source of the leakage. At no cost to the Authority, the Applicant shall repair or replace all defective material and/or workmanship and shall conduct such additional retesting as required to demonstrate that the manhole meets the requirements. All materials and methods used to repair the manholes shall meet with the approval of the Authority. Non specified repair materials shall not be used unless given prior written approval by the Authority.

E. DETAIL DRAWINGS

Relevant detail drawings are:

6 Precast Concrete Manhole
7 Precast Drop Connection to Manhole
8 Cast In Place Base New Manhole Over Existing Sewer
9 New Sewer to Existing Manhole Connection
10 Internal Drop Connection to Manhole

END OF SECTION

SECTION 7 – 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 utilized with grinder pumps are specified in Section 5 of these specifications.

2. Force mains shall be installed in strict accordance with these specifications, and any applicable practices and precautions required for gravity sewers (Section 4) are equally applicable to the installation of force mains. These include, but are not limited to, excavation, pipe bedding, concrete encasement, and backfilling.

B. DESIGN CRITERIA

1. Diameter and Slope

   a. The diameter shall be determined by the flow required to be conveyed and shall not be less than 4 inches. 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. A minimum cover of 3 feet – 6 inches (42 inches) over the top of the pipe shall be maintained.

3. Location of Sewers

   a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

4. Thrust Restraints and Blocking.

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

5. Air Release Valves

   a. 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 approved 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

(1) 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-inch and smaller piping and 250 psi for 30-inch and larger piping. Fittings shall meet the requirements of AWWA C110 or AWWA C153 as applicable. Fittings shall have the same pressure rating, as 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 utilized 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 utilized 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 one of the following:

(a) 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.

(b) Calcium aluminate mortar shall be made of fused calcium aluminate cement and fused calcium aluminate aggregates as manufactured by Lafarge Calcium Aluminates or approved equal. The minimum lining thickness shall be 0.125-inch for 6-inch through 12-inch pipe, 0.1875-inch for 14-inch through 24-inch pipe, and 0.250-inch for 30-inch through 54-inch pipe. The interior and exterior of the spigot end and the interior of the socket end, including a portion of the pipe barrel, shall be coated with a minimum of 8 mils of epoxy prior to lining.

(c) Polyethylene lining shall consist of a blend of polyethylene powders applied to the interior of a preheated pipe. The nominal lining film thickness shall be 40 mils minimum. Polyethylene lining of ductile iron pipe shall be done at pipe manufacturer's plant; fittings shall be done at pipe manufacturer's plant, or at experienced shop approved by the pipe manufacturer. 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. 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 or Valmatic.

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 1/2 hour (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

a. 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.

b. Valve Boxes within paved areas are to include a 1.5- inch steel riser ring manufactured by Bingham & Tylor or Tyler Union. New valve box designs are to incorporate a single 1.5 - inch steel riser installed such that finished height of valve boxes are 0.5 inches below finished grade.

4. Air & Vacuum 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. The valve shall function automatically to release into the atmosphere both large and small amounts of air that accumulate in the pipeline. The valve shall also function to admit air into the pipeline under emergency conditions or when it is being drained. Valves shall be provided with shutoff valve, blow-off valve, and quick disconnect hose connection and backflushing hose and valve.

b. Air & vacuum 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. Air & vacuum valves shall be installed on a full size (DxDxD) main line tee with a restrained flat top plug on the branch. The plug shall be threaded with a 2-inch NPT.

d. Air & vacuum valves shall be provided with a full ported stainless steel ball valve with a pressure rating equal to or greater than that of the force main.

e. All piping between the flat top plug and the air valve shall be Schedule 80 316 stainless steel.

f. Valve chamber shall be standard precast concrete manhole construction in accordance with ASTM C-478, lined with PVC or HDPE, 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. Refer to Section 6 – MANHOLES for additional requirements.

D. INSTALLATION

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

2. Excavation

   a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

3. Bedding

   a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

4. Laying Pipe

   a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

   b. Construction Control

      (1) During the installation of a force main, the pipe shall be laid at a horizontal or positive grade to each high point, air release manhole, or point of discharge, as indicated on the ECTA-approved plans. 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 at Joints

(1) 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

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

(2) Valve Chamber

(a) Provide a PVC or HDPE lined precast concrete manhole for every air release and vacuum valve meeting the requirements for manholes as specified in Section 6 - MANHOLES. The manholes shall be constructed of sufficient size to permit entry for valve repairs and afford protection to the valve and pipe from impact where they pass through the manhole walls. All valves and fittings shall be supported as indicated on the detail drawings.

5. Anchorage

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

(1) Pipe manufacturer’s restrained joint system as approved by the Authority.

(a) 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

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

(2) Metal harness or tie rods

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

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

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

i. Use a minimum of two 3/4-inch diameter rods for pipes 6 inches and smaller.

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

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

(3) Concrete anchor blocks

(a) Concrete anchor blocks shall be designed for the same parameters as those for restrained joints with the additional condition:

i. Minimum allowable soil bearing pressure = 2,000 psf.

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

6. Backfilling

a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

b. Install detectable warning tape directly above pipeline, a minimum of 18 inches below finished grade but no less than 24 inches above the crown of the pipe.

7. Surface Restoration

a. Refer to Section 4 – GRAVITY SANITARY SEWERS for these requirements.

E. TESTING AND INSPECTION

1. Notification

a. It is incumbent upon the Applicant to notify the Authority a minimum of 24 hours in advance of when the work will be ready for inspection.

2. Pressure Test

a. General

(1) After the pipe has been laid and backfilled as specified, all newly laid pipe shall be subjected to a hydrostatic pressure of 150 psi, or 150% of the normal working pressure, whichever is greater in accordance with AWWA C-600.

(2) Where any section of a force main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least 5 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 2 days have elapsed.

(3) Air release valves shall be installed but isolated during testing of the pipeline.

b. Duration of Pressure Tests

(1) The duration of each pressure test shall be 2 hours.

c. Procedure

(1) 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 Authority. The pump, pipe connections, and all necessary apparatus, including gauges, shall be furnished by the Applicant and are subject to approval by the Authority. The Applicant will make all taps into the pipe and furnish all necessary assistance for conducting the tests.

(2) Expelling Air Before Test

(a) Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Applicant shall make the necessary taps at such points before the test is made. After the test has been completed, the Applicant shall remove and plug the taps or leave them in place at the direction of the Authority.

(3) Examination Under Pressure

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

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

F. DETAIL DRAWINGS

Relevant Detail Drawings are:

1 Right-of-Way Restoration
16 Air Release Valve and Chamber
17 Force Main Connection to Manhole
25 Thrust Blocks for Horizontal Bends and Lower Vertical Bends
26 Restrained DI Pipe Length

END OF SECTION

SECTION 8 – GRINDER PUMPS

A. GENERAL

1. Grinder pumps are to be used if it is intended that low pressure sewers, as described in Section 5, are to be installed. Grinder pumps shall also be used if the property to be served cannot be served by a gravity type system and adequate total dynamic head conditions exist. 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 duplex (double) grinder pump systems shall be used at non-residential 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. In such cases, the pump used must be the residential pump model.

3. Grinder pump units shall be installed in either concrete 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 rail 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, 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 Applicant.

6. The following NEMA ratings for the control panel 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-3R/4 or NEMA-4X
    c. Indoors – NEMA-12, NEMA-3R/4 or NEMA-4X

B. MATERIALS AND EQUIPMENT

1. Grinder Pump Unit

    a. The pump unit shall consist of a centrifugal 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 2 horsepower.

(1) Residential

(a) Maximum Flow = No greater than 30 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. Acceptable Pump Types

(1) The manufacturers and models of acceptable grinder pumps are the following:

Manufacturer	Model
F.E. Myers Co.	*WG-20 (residential)*
Hydromatic	*HPG200 (residential)*
Barnes	*SGVH2022L HIGH HEAD (residential)*
F.E. Myers Co.	*WGX20, WGX30, WGX30H, WGX50H, WGX75H (non-residential)*
Hydromatic	*HPGX, HPGLX, HPGHX, HPGHHX, HPGFX, HPGFHX (non-residential)*
Barnes	Series X*SGV-L (non-residential)*
Liberty	Series LSG 202 M-C

d. 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 by use of a cord grip, with individual conductors additionally sealed into the cord cap assembly with epoxy sealing compound, thus eliminating water entering the motor by following individual conductors inside the insulation. The cord cap shall be sealed into the motor housing with a Buna-N o-ring, providing an electrical connection which is completely watertight, yet may be easily removed for service. Wire sizing and voltage drop associated with run lengths over 100 feet shall comply with NEC rules.

(2) The combination centrifugal pump impeller 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 two mechanical carbon and ceramic-faced seals or similar material within an oil-filled seal chamber. 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 located in the windings 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 to operate on a 240 Volt, 60 HZ, single-phase service. Submersible motors for non-residential applications shall be constant speed, suitable to operate 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. 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.

e. Rail Assembly

(1) A lift-out guide rail assembly shall be included as part of the grinder pump unit, which will permit easy removal and installation of the pump and lower check valve without the necessity of personnel entering the basin. Stainless steel or fiberglass guide rails with guide brackets and guide yokes of sufficient bearing strength to prevent binding shall bolt to the pump. The yokes shall mate over stainless steel guide rail support which shall be attached to and be supported by the basin sidewalls and the fixed attachment point on the floor of the basin. The guide rails may be supported by a fixed connection to the top of the basin provided that the connection is not part of the removable access cover and is

not affected by the removal of the access cover. All bolts, brackets and fittings used in the lift-out assembly shall be of stainless steel.

(2) A stainless steel lifting chain or stainless steel lifting cable shall be securely fastened to the top of the pump and to the top of the basin to facilitate removal of the pump. The chain shall be a minimum of 1/4-inch welded link type to support the weight while removing and installing the pump.

f. Level Controls

(1) 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 the switch in the sump. The weight shall be above the float to effectively prevent sharp bends in the cord when the float operates. The float switch shall hang in the sump and be supported by a stainless steel bracket and cord snubber which will give positive support to the controls and allow flexibility in the setting of levels. All mounting structures and hardware shall be stainless steel.

(2) 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 (for duplex installations). The lowest float (pump turn-off) shall be set no lower than the top of the pump motor to prevent overheating of the motor during operation. The second float (pump turn-on) shall be set to provide a minimum operating volume (defined as the area between the pump turn-on and pump turn-off levels) of 60 gallons for residential installations and 175 gallons for non-residential installations. The third float (high water alarm) shall be set between the pump turn-on float and the influent pipe invert for residential installations. In the case of non-residential installations, the redundant pump turn-on float shall be set between the lead pump turn-on float and the high water alarm float.

g. Operation of System

(1) 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.

h. Corrosion Protection

(1) 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.

i. Junction Box

(1) The junction box shall be constructed of fiberglass or PVC for corrosion resistance at residential properties and have a NEMA 7 rating 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 totally encapsulated in PVC so that no metal parts are exposed. The cover shall be connected to the body with stainless steel chain.

(2) 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.

(3) The hub shall be of a corrosion-resistant material and shall be of adequate size to accommodate the number of wires required to operate the pump.

(4) 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.

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

(6) 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.

2. Valves

a. Check Valves

(1) The pumps shall be equipped with factory-installed integral flapper-type check valve or 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 6 inches of water at maximum rated flow. The valve body shall be made of cast iron.

(2) Working parts of flapper-type check valves shall be made of 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom for assured seating even at very low pressures.

(3) Ball check valves shall include a corrosion resistant non-metallic ball and rubber-sealed seat.

b. Ball Valve

(1) The pump shall be equipped with an isolation ball valve which shall be PVC (Schedule 80), 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 12 inches below finish 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 compatible with 1-1/4-inch PVC pressure pipe, Schedule 80. Valves shall be manufactured by Flowmatic Corporation or approved equal.

d. Anti-Siphon Valve

(1) The basin assembly shall be arranged for quick and easy acceptance of an anti-siphon valve in the field when required. A riser pipe shall extend from a tee installed along the pump discharge pipe between the check valve and the shutoff valve to within two feet of the surface of the basin. If an anti-siphon valve is not needed, the riser shall be capped.

(2) When required, an anti-siphon valve shall be offered to assemble to the riser pipe. The valve assembly shall include all materials required to complete the assembly. The anti-siphon valve shall mount horizontally and shall not interfere with pump removal or installation. The anti-siphon valve shall be installed such that the direction of flow arrow points back towards the pump. In this way, flow will be prevented from cycling back into the basin during pump operation, but the valve will open to allow air into the discharge piping to disrupt siphoning when the pump is not in operation.

(3) Anti-siphon valves shall be swing type check valves constructed of PVC Type I, ASTM D 1784 material. Valves shall have maintenance free seal unit construction with EPDM seat and weighted disc. Valves shall have external flow arrow direction designation. Valves shall be pressure rated to 150 psi for water in full flow (open) position and to 75 psi in back pressure (closed) position. Valves shall be manufactured by Spears or approved equal.

e. Flexible Discharge Coupling

(1) 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.

3. Basins

a. General

(1) Either concrete 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 inches above finished grade to prevent infiltration of surface water. The basin shall be located in an area not subject to flooding or ponding.

(2) For residential installations, a minimum net effective total operating volume of 60 gallons between the pump shut-off elevation and the invert of influent line from the connected structure shall be provided for residential installations. For non-residential installation, a minimum total operating volume of 250 gallons, or 24 hours of storage, whichever is greater, shall be provided. If anticipated sewage flow exceeds 250 gallons per day, backup calculations for flow must be reviewed and approved by the Authority. Non-residential storage requirements may be reduced by provision of a back-up power source and a spare pump.

(3) A non-corrosive sign shall be attached to the basin cover indicating that the pump basin is a hazardous area where confined space entry procedures are required.

(4) The basin shall be provided with an anti-flotation collar to prevent flotation of the basin at high groundwater elevation when the basin is empty.

(5) The minimum acceptable basin diameters are as follows:

For pumps of 5 horsepower or less: 36-inch diameter (minimum)
For pumps greater than 5 horsepower: 60-inch diameter (minimum)

(6) In all cases, the Applicant shall confirm that a basin of sufficient volume and area is provided to allow for effective pumping system operation and maintenance.

(7) 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

(8) The basin shall be free of defects and shall provide watertight pipe and conduit penetrations.

b. Concrete Basin

(1) Precast reinforced concrete chambers shall conform to ASTM Specifications C-478 (Latest Revision) and shall be of watertight construction. Joints between sections shall be provided with preformed plastic joint sealing material such as Ram-Nek as manufactured by K.T. Snyder Co.

(2) 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: bitumen - ASTM D-4-52, Inert Ash Mineral AASHTO T-111-42, Volatile Matter ASTM D-6-39T.

(3) Mixing water for mortar and concrete shall be clean and free from oil, acid, alkali, sewage or other deleterious substances.

(4) Portland cement shall conform to ASTM Specification C-150, Type I. Where specifically authorized or required, high early strength (Type 3) shall be used.

(5) Concrete shall have a compressive strength of not less than 3,000 psi after 28 days (tests to be in accordance with ASTM Specification C-39, Latest Revision). Aggregate shall be of quality, gradation and proportions as approved by Engineer after submission of test results on the design mix. Each cubic yard of concrete shall contain no less than 6 bags of Portland cement. Slump of concrete shall not exceed 4 inches. Ready mixed concrete shall conform to ASTM Specification C-94 (Latest Revision).

(6) Reinforcing steel shall be clean and free from rust, scale or coatings that will reduce bond.

(7) The exterior of concrete basins shall be coated with bitumastic no less than twenty (20) mils in thickness. The coating shall be Bitumastic Super Service Black as manufactured by Koppers or approved equal.

(8) The interior of concrete basins shall be lined with PVC or HDPE to prevent hydrogen sulfide corrosion as specified in Section 6.

(9) Concrete basins shall be equipped with access cover and frame assembly of extruded aluminum with aluminum or stainless steel fittings. Each cover shall be provided with a lifting handle, safety catch to hold cover and locking hasps. The cover surface shall be of a non-skid checkered pattern and shall be provided with a keyed lock in traffic areas and a padlock in all other areas. The padlock shall be of the solid corrosion proof case design with hardened steel shackle and zinc coating. In paved/traffic areas, basins shall meet the loading requirements of H-20 or H-25 as appropriate.

c. Fiberglass Basin

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

(2) 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.

(3) 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.

(4) One minimum 4-inch diameter inlet hub (larger if necessary) shall be provided for each grinder pump unit. The inlet hub shall be suitable for use with 4-inch or 6-inch Schedule 40 PVC pipe or 6-inch or larger SDR 35 pipe. Hubs shall be field installed to meet field conditions.

(5) One discharge coupling, as specified under VALVES in this section, shall be provided for the grinder pump unit. Internal piping shall be provided to this discharge coupling. The depth of the discharge coupling (crown of coupling to finish grade) shall be no less than 42 inches.

(6) Fiberglass basins shall be equipped with an aluminum, stainless steel, 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.

(7) Provision of bollards to protect the structure is recommended in areas where there is potential for traffic.

4. 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 any other items required for proper control of the centrifugal type grinder pump unit. The incoming wires/conduit shall be provided with a water tight seal.

(2) The enclosure shall contain an inner back panel for mounting of the internal components and shall have a hinged door. The enclosure shall be NEMA rated for its applicable location as specified under Article A.6. of this section. The enclosure material shall be as follows:

Location	Material
Indoors	Painted steel or Thermoplastic
Outdoors	Stainless Steel, Thermoplastic or Ultraviolet Stabilized Fiberglass

Outdoor enclosures shall have combination closing latch and locking hasp.

(3) Pilots and indicators when exposed on control panel shall be NEMA-4X for outdoor applications and NEMA-1/12 for indoor applications. Indicators shall be LED style.

(4) The control panel shall either be fitted with an integral red tamperproof alarm light on the exterior of the panel or a separate alarm mounted inside the occupied portion of the building to be served. The internal alarm shall either be an audible alarm or a light type indicator.

(5) The lamp shall be of sufficient capacity to be readily noticed and be easily replaceable. The light shall be provided with a lamp test switch mounted within the panel. The alarm light shall be flashing type activated by high water in the wet well and/or moisture leak and shall go out when the condition ceases.

(6) The control panel shall have a high water indication lamp and a moisture leak detection lamp. The main alarm (light or audio) shall signal when either or both lights within the enclosure are activated due to failure.

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

(8) 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.

(9) The motor circuit shall have a two-pole circuit breaker for motor overload and short-circuit protection. Also, the control circuit shall be a separate circuit and shall include overload protection.

(10) 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.

(11) 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.

(12) 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 600V XHHW for wet locations and THWN for dry/damp locations

b. Control Panel Supports

The control panel support for Property Owner installations shall consist of 2-inch diameter stainless steel posts with cap or 3" x 3" x 3/16" gauge structural steel tubing (minimum yield strength 46,000 psi), all horizontal support channels and panel connection hardware, coated with baked-on epoxy ASA 61 paint or of galvanized steel. The length of pipe or post shall be embedded in a concrete foundation to the dimensions shown on the detail drawings. The top of the channel shall be permanently sealed from the elements. A double stand of 1-5/8-inch Unistrut metal framing may also be used to secure the control panel to a concrete surface. Channel frames, post bases and fittings shall be steel with a galvanized finish.

C. INSTALLATION

1. The grinder pump unit and control panel shall be installed at a location to be determined by the Property Owner or Applicant. Generally, the unit will be located in close proximity to the existing sewer service line near the building. The control panel may either be mounted to the wall of the building or mounted to a post.

2. The depth of the grinder pump unit will be dependent upon the location and depth of the existing house service. The minimum total unit depth from the invert of sump pit to top of entry hatch shall be no less than 6 feet and no greater than 16 feet.

3. All grinder pump basins shall be installed on a bed consisting of AASHTO No. 8 (or PennDOT No. 1B) coarse aggregate and shall have a concrete anti-flotation collar poured around the bottom that shall prevent flotation when there is high groundwater to top of basin and the basin is dewatered. The remaining excavated area shall be backfilled with excavated material containing no soil lumps, stones, concrete or foreign objects greater than one inch in maximum dimension. The top of the pump unit or basin shall project a minimum of 4 inches above grade and graded in a manner to slope away from the unit to prevent ingress of surface water. In driveway or sidewalk areas, top of 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 shall be stainless steel.

6. A minimum 18-inch vertical separation shall be maintained between all pump electrical supply and control wiring and the sanitary sewer service line. Magnetic warning tape shall be installed approximately one foot above the wiring.

D. TESTING AND INSPECTION

1. It is incumbent upon the Applicant to notify the Authority a minimum of 24 hours in advance to inspect the pump after installation is completed. The Applicant 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.

2. Hydrostatic test pressure of 50 psi, or 150% of the normal working pressure, whichever is greater, shall be applied to the force main in accordance with AWWA C-600. There shall be no drop in pressure for a period of 15 minutes. Refer to Sections 5 and 7 for additional requirements.

3. 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

4. The pipe trench will be backfilled only after the inspection and testing has been completed.

5. The pump shall be run through a normal pump cycle test 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:

13 Typical Individual Grinder Pump Service Line Schematic to Gravity Sewer
14 Typical Individual Grinder Pump Service Line Schematic to Low Pressure Sewer
20 Fiberglass Basin for Typical Individual Pump
21 Concrete Basin for Typical Individual Pump
22 Wall Mounted Control Panel (External Installation)
23 Post Mounted Control Panel (External Installation)
24 Metal Channel Framing for Control Panel Mounted on a Concrete Structure

END OF SECTION

SECTION 9 – PUMPING STATIONS

A. GENERAL

1. Pumping Station Types

a. The standard sewage pumping station shall be based on Gorman-Rupp self-priming suction lift pumps, taking flow from a concrete wet well, and a diesel-powered emergency electrical generator with transfer switch. All above ground facilities shall be enclosed in a permanent masonry building.

b. Both wet well/dry well and submersible type stations will be considered for unique conditions that cannot be adequately addressed by the standard suction lift pumping station. These requirements pertain to pumping stations that will serve multiple and/or industrial or other developments that discharge sewage by gravity to the pump station site. They do not apply to individual grinder pumps in low pressure systems.

c. Pumping stations using submersible pumps will be limited in size by flow and head conditions. As a guide for design purposes, if the total head in feet, multiplied by the flow in gallons per minute, is greater than 30,000 then a walk-down concrete wet well/dry well station may be required. Future flow conditions will be included when determining the type of pumping station required. The type of pumping station is subject to the approval of the Authority.

2. 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 DEP, PennDOT, East Cocalico Township, etc. The Applicant shall secure, in his own name, all required construction permits such as 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 and inspections, including any and all bonds required, shall be the sole expense of the Applicant.

3. Plans and Specifications

The Applicant shall furnish the Authority with detailed construction plans and specifications for the pumping station and related facilities including the hydraulic design calculations. The plans and specifications shall be sealed by a professional engineer registered in PA. The drawings will be examined only for general design, general dimensions and apparent suitability and will be approved or returned for the changes required. Such approval will not relieve the Applicant of the responsibility for furnishing equipment which will satisfactorily perform under the conditions specified.

4. Requirements for Keyed Door Locks

Pump station building doors shall be keyed to match ECTA keys as directed by the Authority.

B. DESIGN CRITERIA

1. Sewage pumping stations shall be properly designed and constructed to conform to all applicable regulations of the Pennsylvania Department of Environmental Protection (DEP), OSHA, the Pennsylvania Department of Labor and Industry and all other applicable codes.

2. Special consideration must be given to the fact that wet wells, other than those in residential properties, are considered hazardous Class 1, Group D environment.

3. The pumping station site shall be properly graded to eliminate any storm water problems and/or ponding conditions. Provisions shall be made to include shrubbery in the landscaping to enhance the appearance of the station.

4. The site shall be of sufficient size to accommodate the pumping facilities and to permit the turn-around of service vehicles. The minimum size shall be as determined by the Township Zoning and Sub-division Ordinance. Depending upon the locality, topography and pumping station type, a larger area, as determined by the Authority may be required.

5. The access road and turn-around at the pumping station shall have a paved surface designed to handle heavy maintenance equipment such as a sewer flushing truck. The minimum width of the paved surface of the access road shall be 12 feet.

6. The site shall be protected with a 6'-0" high, barbed wire topped, polyvinyl chloride (PVC) coated chain link fence with a sliding/rolling gate and man access gate.

7. The paved area within the fenced area must be large enough and be designed to allow the turn-around of an AASHTO standard single unit utility vehicle with a wheelbase of 20 feet and width of 8 feet 6 inches.

8. All stations shall be provided with a flow meter, overhead exterior lighting, and potable water supply.

9. All gears, chains, coupling, projecting set screws, keys and similar rotating or reciprocating parts shall be protected in accordance with American Standards Association Safety Code for Mechanical Power-Transmission Apparatus 815-1927.

C. MATERIALS AND EQUIPMENT

1. All Pumping Stations

a. 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.

b. Wet Wells

(1) Wet wells shall be designed in accordance with PA DEP Standards. It shall be sized to avoid heat buildup in the pump motor due to frequent starts and to avoid septic conditions due to excessive detention time. The effective capacity (e.g., capacity between working levels) of the wet well shall generally provide a holding period not to exceed 10-minutes for the maximum monthly average flow. Where tributary flow distance is short, a holding period, not to exceed 30-minutes for the maximum monthly average flow, should be considered.

(2) The wet well floor slope shall have a minimum slope of one horizontal to one vertical (1:1) to the hopper bottom. The horizontal area of the hopper bottom shall be not greater than necessary for proper installation and function of the inlet.

(3) The wet well shall be designed to minimize the turbulence from the incoming sewer, such as a cascade that might entrain air in the liquid. There must be sufficient submergence at the low water level to allow entrained air to escape, to prevent vortex formation, and provide adequate net positive suction head available (NPSHA) at the pump inlet.

(4) Wet wells shall be of reinforced concrete. All interior concrete surfaces (floor, walls, ceiling, pipe entries, and structure chimney) shall have an impermeable HDPE or PVC lining to protect against hydrogen sulfide corrosion. HDPE lining shall be AGRU Sure Grip HDPE or Polypropylene Random Copolymer as furnished and installed by Terre Hill Concrete Products, Terre Hill PA. 17581. The HDPE sure Grip liner shall have a minimum thickness of 2-mm (0.0787-inchers). There shall be a minimum of 39 anchor studs per square foot. Flat liner sheet used for overlapping joints shall have a minimum thickness of 3 mm. All joints shall be sealed by thermal welding by AGRU certified welders. PVC lining shall be Dura Plate 100 as manufactured by A-Lok Products, Inc., Tulleytown, PA 19077. The Dura Plate liner shall have a minimum thickness of 1.65-mm (0.065-inches). The PVC liner, channel joints, H-joints, and corner joints shall be manufactured from Polyvinyl Chloride resin (PVC) and shall be white in color. A combination of standing ribs and mechanical dovetails shall be used to secure the liner panels and shall be spaced a maximum of 6-inches apart. Liner panels shall be formed to the correct radius for circular surfaces. Liner panels with locking extensions shall be able to withstand a test pull of 100 pounds per linear inch applied perpendicular to the concrete surface for a period of 60-seconds with a temperature between 70° and 80° F. PVC liner panels shall have a continuous return into the joint for a minimum of 0.50-inches.

(5) The wet well access hatches shall be Type 316 stainless steel as manufactured by Bilco, Halliday Products or approved equal.

(6) The elevation of the top floor and/or access to the pumping station shall be minimum 2 feet above the 100 year flood elevation and 6-inches above surrounding grade.

c. Flow Meters

(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.

d. Fencing

(1) The site shall be fenced with a 6'-0" high, barbed wire topped, polyvinyl chloride (PVC) coated chain link fence with a sliding/rolling gate and man access gate. The man access gate may be integral with the sliding/rolling gate or may be a separate gate. A single or double swing gate for vehicular access will be considered if a sliding/rolling gate is not practical as determined by the Authority.

(2) The chain link fabric shall conform to Federal Specification RR-F-191/1D. The chain link fabric shall be Type 1. The fabric shall be 9 gauge core wire and galvanized all conforming to ASTM A641, woven after PVC coating in a 2-inch mesh. Top and bottom selvages shall have a twisted barbed finish, barbs to be formed by cutting wire on a bias. Fabric to be attached to intermediate posts with No. 6 aluminum fabric wire spaced approximately 15-inches apart and to the top

rail with 9 gauge wires spaced approximately 18-inches apart. The fabric shall be fastened to all terminal and gate posts with ¼-inch by ¾ inch stretcher bars with No. 11 gauge pressed steel bands spaced approximately 12-inches apart. All bands, wires and tension bars shall conform to Federal Specification RR-F-191/4D.

(3) Posts, rails, and braces shall conform to Federal Specification RR-F-191/3D and be fabricated of Class I (round steel sections), Grade A (hot dipped galvanized), seamless steel pipe, in accordance with ASTM A53 (Schedule 40), and be of the following sizes:

(a) Corner and terminal posts: SP3 (2.375-inch o.d.)
(b) Line posts: SP2 (1.900-inch o.d.)
(c) Gate posts: SP5 (4.000-inch o.d.)
(d) Rails and braces: SP1 (1.66-inch o.d.)
(e) Spacing of posts shall not exceed 10-feet.

(4) Gate and hardware shall conform to Federal Specification RR-F-191/2D. Gate shall be constructed of Class I, Grade A seamless steel pipe, size SP1, plus additional intermediate members when required and meeting the requirements of RR-F-191/3D. Gate frame shall be of welded construction or shall be assembled using fittings. When fittings are used, the frame shall be fitted with 3/8-inch minimum diameter adjustable length truss rods, meeting the requirements of Federal Specification RR-F-191/4D. When the frame is welded, all welding shall be done prior to galvanizing. Gate fabric shall be the same as for the fence. Install fabric with stretcher bars attached to gate frame at not more than 12-inches o.c. Extend end members 1-foot above the top horizontal member of the gate frame and attach three strands of barbed wire, uniformly spaced to end members with bands, clips or eyebolts.

(5) Both gates shall be provided with hot-dipped galvanized hinges, latches, stops and keepers in accordance with ASTM A153. Hinges shall be pressed steel or malleable iron, non-lift-off type, and offset to permit 180-degree gate opening. Latch shall be forked type to permit operation from either side of the gate. Provide padlock eye as integral part of latch.

(6) The PVC coating for the chain link fabric shall be Class 2a or 2b as defined by ASTM F668.

(7) Fence and gate(s) shall be topped with three strands of barbed wire consisting of two 12-1/2 gauge twisted line wires with 14 gauge round aluminum wire barbs having 4 points and spaced at 5-inches on center. Barbed wire support arms shall be single arm, for three strands of barbed wire and be at an angle of 45-degrees, with the top strand being 12-inches above and 12-inches out from the fence line.

(8) Set all posts to a depth of 3-feet unless otherwise shown. After setting and plumbing the posts fill the holes with 2,500 psi concrete. Crown top of concrete to shed water.

e. Water Supply

(1) Where public water supply is available, furnish and install a minimum 1" diameter metered water service with reduced pressure backflow preventer (RPBP). The RPBP shall be installed in a location above grade, where it will not be susceptible to flooding. The water supply shall terminate at a frost-proof yard hydrant. Hose bibs shall also be provided in the dry well in the case of wet well/dry well station.

(2) Where public water supply is not available, furnish and install a well and pump with all controls, power supply, bladder type hydro-pneumatic pressure tank, air line / gage well water level detection system, frost proof hydrant, and necessary appurtenances. The well and pump must be capable of producing a minimum of 5 gpm at 50 to 70 psi gage pressure at the hydro-pneumatic tank.

f. Pipes and Fittings

(1) Suction and discharge flanged piping shall be Class 53 (min), cement lined ductile iron in accordance with ANSI A21.50 and ANSI A21.51 or AWWA C115 and C150. Fittings shall be ductile iron in accordance with ANSI A21.10 or AWWA C110, up to 12" inclusive, 250 psi rated. Flanged joints shall be used inside structures or above grade.

(2) Cement mortar lining shall be twice the normal thickness and have an asphaltic seal coat. Unless otherwise specified, all coatings shall be shop applied with “hold-backs” provided as required at pipe and fitting ends for satisfactory installation for joint connections in the field. Provide all necessary coating materials to perform field coating applications at joints. Unless otherwise noted, field applied coating material shall be compatible with or equal to the shop applied material. Field repair of pipe with damaged coating shall receive prior approval of the Authority. If, in the opinion of the Authority, the coating damage is beyond repair, the pipe shall be replaced at the expense of the Applicant. All flange bearing surfaces shall be uncoated.

(3) Unless otherwise specified, all exposed exterior ferrous surfaces shall be painted with an applicable paint system.

(4) Pipe hangers and supports shall be provided at suitable distances along the pipeline. Pipe hangers and supports shall conform to MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture and MSS SP-69, Pipe Hangers and Supports - Selection and Application. All hangers and supports shall be of an approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for all supporting equipment, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10-feet of water filled pipe being supported. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment.

(5) All rods, clamps, hangers, inserts, anchor bolts, brackets and components for interior pipe supports shall be furnished with galvanized finish, hot dipped or

electro-galvanized coated, except where field welding is required, where cold-applied galvanizing may be used. Interior clamps on plastic pipe shall be plastic coated. Supports for copper pipe shall be copper plated or shall have a 1/16-inch plastic coating. All rods, clamps, hangers, inserts, anchor bolts, brackets and components for exterior pipe, submerged pipe, pipe within outdoor structures, and pipe in wet wells or other corrosive areas shall be of Type 316 stainless steel.

(6) Ductile iron, steel and stainless steel piping shall be supported at a maximum support spacing of 10-feet with a minimum of one pipe support per pipe section or joint. Floor supports shall be given preference. Support spacing for steel and stainless steel piping, 2-inch and smaller in diameter, and copper tubing shall not exceed 5-feet. For all stainless steel piping, provide neoprene isolators between the pipe and support components. Supports for individual PVC pipes shall be as recommended by the manufacturer except that the support spacing shall not exceed 3-feet. All vertical pipes shall be supported at each floor or at interval of not more than 12-feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to insure rigid construction. All vertical pipes passing through pipe sleeves shall be secure using a pipe collar. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically directed or authorized by the Authority.

g. Valves

(1) Gate Valves

(a) Gate valves 2-1/2 inches diameter and smaller shall have flanged or screwed ends as required and shall be brass, bronze, or Type 304 stainless steel, solid wedge, union bonnet, rising-stem, Fig. 47 or 48 as manufactured by Jenkins Brothers or similar products as manufactured by Crane, Fairbanks, or Lukenhiemer.

(b) All water valves 2-1/2 and 3-inches, unless otherwise noted, shall be brass body gates and shall be Jenkins No. 1240, or Hammond 1B-647.

(c) Valves shall open to the left (counter-clockwise). Operating nuts or wheels shall have cast thereon, an arrow and the word "open" indicating the direction of opening.

(2) 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 shall be as manufactured by DeZurik, or Valmatic.

(b) Plug valves shall have a minimum port area of 80-percent. Valves shall be rated for 175 psi WOG (Water, Oil and Gas) working pressure for sizes 4-in

to 12-in inclusive and conform to the requirements of AWWA C504. All exposed bolts, nuts, and hardware shall be Type 316 stainless steel.

(c) The valve disc shall be cast iron, ASTM A126, Grade B, or ductile iron, ASTM A536, Grade 65-45-12, and be of one piece. It shall be removable without removing the valve from the line.

(d) Valve seats shall be resilient and of the continuous interface type having consistent opening and closing torques and shall be no-jamming in the closed position. Screw-in seats are not acceptable.

(e) All valves shall be provided with a hand wheel actuator with valve position indicator.

(f) Plug valves shall be installed so that the direction of flow through the valve and the shaft orientation is in accordance with the manufacturer's recommendations. Unless otherwise noted, the shaft shall be horizontal with the plug opening up.

(3) Check Valves

(a) Check valves 2-inch diameter and larger shall be iron body, bronze mounted, single cast iron or cast steel disc with bronze seat ring, extended stainless steel hinge arm with outside lever(s) and weight(s), with oil damped controlled closing, full opening with bolted cover, and shall conform to AWWA C508. They shall be designed for a minimum working water pressure of 150 psi water working pressure non-shock and hydrostatically tested at 300 psi.

(b) Check valves shall be Golden-Anderson Model 25-DXH or APCO Model 6100.

(c) Check valves smaller than 2-inches for installation in copper and steel pipes shall be bronze, swing type, 125-lb with screwed ends and shall be Hammond 1B-940, or Jenkins 92A.

(4) Ball Valves

Ball valves shall be manual actuated, bronze, resilient seated, regular port, threaded two piece bolted body type valves. The body and cap shall be of brass, ASTM B30, the ball and stem of Type 316 stainless steel and the seats and seals of TFE. The valves shall have full floating ball and shall be non-lubricated. Valve seats shall be easily accessible and replaceable. Valves shall be rated to 250 psi and shall be as manufactured by Neles-Jamesbury, WKM or equal.

(5) Surge Relief Valves

(a) Sewage surge relief valves may be required in combination with the controlled closing swing check valves to limit water hammer associated with pump shut down and check valve closure on pumping stations with high total

dynamic head and/or long force mains. If required, they shall be Golden-Anderson, Models 624-D or 625-D, or APCO, Model 6300.

(b) If surge valves are utilized, they shall be manufactured by the same manufacturer as that of the controlled closing check valves. A manufacturer's representative shall be on-site to coordinate the operation of these valves during start-up.

h. Emergency Generator Building

(1) An emergency generator shall be mounted permanently in a building together with all appropriate electrical controls (including automatic transfer switch). The building shall also house the pump control panel specified elsewhere. The building shall be a masonry type building blending aesthetically with the surrounding environment. Construction details of the building shall be subject to approval by the Authority.

(2) The floor elevation of the generator building shall be a minimum 2 feet above the 100 year flood elevation and 6-inches above surrounding grade.

(3) For suction lift pumping stations, the generator building shall be designed with a separate room to house the suction lift pumps and related station piping including the flow meter and appurtenances.

(4) Alternatively, the generator may be installed in a permanent exterior enclosure, if approved by the Authority.

i. Controls

(1) Mercury Float Switch Controller

Provide a control system consisting of mercury float switch and other necessary appurtenances. Switches to be moulded into an epoxy filled polypropylene float. Provide two spare floats with cables.

(2) Pump Controls

(a) 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.

(b) One across-the-line starter per pump, sized in accordance with NEMA Horsepower standards.

(c) 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.

(d) Low voltage (24 VAC) level sensing circuitry for intrinsically safe relaying.

(e) Solid state alternator for duplex controls.

(f) Individual toggle type selector switches to provide "Auto-Off-Hand" control of each pump.

(g) 24 Volt AC control transformer, protected by circuit breakers or fuses on both the primary and secondary.

(h) Terminals shall be provided for connection of the level sensors.

(i) A removable dead-front panel shall be provided to protect the operator.

(j) All operator controls, toggle switched, circuit breakers, etc. shall be accessible without removing the dead-front panel.

(k) NEMA 1 enclosure with latch mechanism Duplex 3-phase 240 or 480 volt power supply as dictated by the power company and motor requirements. All controls, meter displays, and pilot devices mounted on the front of the enclosure shall be rated the same as the enclosure. The enclosure shall be installed in a NEMA 1 area or classified the same as the area where installed.

(l) A relay which automatically reconnects the control circuit to pump number 2 if pump number 1 circuit breaker trips.

(m) High level and low level alarm relays with dry contacts and terminals shall be included.

(n) Pump running transformer type pilot lights (red) mounted on operator's control panel. Pump stopped pilot lights (green) mounted on operator's control panel.

(o) Run time meters mounted on operator's control panel shall be continuous without a reset.

(p) Seal leak detector for each pump with dry relay contacts for alarming.

(q) 3-phase power monitor with adjustable settings, stops pump for low voltage, single phasing and phase reversal.

(r) Provide the ability to run both pumps during generator operation.

(s) A "Hand-Off-Auto" selector switch provided for each of the two pumps controlled with the following operation:

i. 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".

ii. Auto Position: In this position, the operation of the pumps is controlled automatically by the level sensors in the wet well as follows:

- The control circuit is placed in standby mode when the liquid level rises to tilt the lowest level sensor which is a redundant cut-off and low water alarm.

- As the level continues to rise, the control circuit is energized when the pump off level sensor rises.

- 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 number 1 starts first on one cycle, pump number 2 will start first on the next cycle. This insures equal operating time and wear on each pump.

- 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.

- 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 level float.

- If the water continues to rise, the high water alarm level sensor will activate an alarm.

j. Heater

An electrical heater shall be installed in the station and sized to maintain a minimum ambient temperature of 60^{o} F in the drywell. The heater shall be thermostatically controlled. The heater shall not be placed within two (2) feet of the control panel.

k. Landscaping

After final grading, the site shall be seeded and landscaped. The Applicant is responsible for obtaining a good stand of grass until the time of first cutting. Landscaping shall meet the requirements of the East Cocalico Township's Subdivision and Land Development Ordinance.

l. Access Road

(1) The access road and turn-around shall be constructed to the following minimum requirements:

(a) Formed, shaped and compacted subgrade
(b) Compacted stone base 6" thick
(c) Bituminous concrete binder 1-1/2" thick
(d) Bituminous concrete wearing course 1" thick
(e) Toe drains and stormwater culverts as dictated by topography

m. Station Painting

(1) Metal Surfaces

All motors, pumps, bases, brackets, ladders, piping and steel supports shall be properly primed and painted with two coats of rust inhibitor paint in strict accordance with the manufacturer's recommendations.

(2) Plastic Surfaces

Apply one coat of epoxy primer followed by one coat of acrylic urethane.

(3) Concrete and Masonry Walls and Ceilings

Apply one coat of epoxy primer followed by one coat of washable enamel paint.

n. Spare Tools

(1) The Applicant shall furnish one complete set of all the 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.

2. Suction Lift Pumping Stations

a. Pumps

(1) A minimum of 2 pumps shall be provided and installed. Pumps shall be Gorman-Rupp T-Series, self priming, horizontal, centrifugal, V-belt driven sewage pumps, sized to meet the design flow.

(2) The pumps shall be equipped with tungsten titanium carbide mechanical shaft seals and removable cover plate for complete access to pump interior.

(3) Pumps shall be furnished with internal piping and valves consisting of discharge check valves, automatic air release valve for each pump and a three-way discharge plug valve.

(4) Provide spare parts consisting of one extra set of ball and/or roller bearings, two sets packing, or mechanical seals for each pump, and one extra shaft sleeve for each pump size.

b. Motors

(1) The pump motors shall be horizontal, open drip-proof, induction type, suitable for 3-phase, 60 Hz, 120/208 or 480 Volt electrical service. The motors shall be severe duty with a minimum service factor of 1.15 (not to be utilized under normal operating conditions). They shall have normal starting torque and low starting current, as specified for NEMA Design B characteristics. The motors shall not be overloaded at the design condition, or at any head in the specified operating range. Each motor shall be in current NEMA design cast iron frame with copper windings.

(2) Power shall be transmitted from motors to pumps by means of V-belt drive assemblies. The drive assemblies must be selected to establish proper pump

speed to meet the specified operating conditions. Each drive assembly shall have a minimum of two V-belts. Drive systems with a factor of safety of less than 1.5 to 1.0 shall not be considered sufficient. Computations of the factor of safety shall be based on performance data provided by the drive manufacturer.

(3) Pump drive transmission belts shall be enclosed on all sides with safety guards having no opening larger than ½-inch. They shall be capable of being removed from the pump unit without interference with any unit component. The safety guards shall have belt inspection sight capability.

(4) Motors shall have Class F insulation, Class B temperature rise, 40° ambient. Insulation shall be of non-hygroscopic materials which resist moisture and are fungus resistant.

(5) Each motor shall have oversized, grease-lubricated ball bearings with the thrust bearing at the bottom locked in position to eliminate shaft end-play. The motor shaft shall be solid stainless steel.

(6) The motor-pump shaft shall be centered, in relation to the motor base, within .005". The shaft run-out shall be limited to .003".

(7) A special varnish treatment shall be applied to the stator windings and rust preventative compounds shall be used to coat the rotor and stator air gap surfaces and protect the motor against corrosion.

c. Automatic Air Release Valves

Automatic air release valves shall be as manufactured by Gorman-Rupp. Type shall be as recommended by the pump manufacturer. Each air release valve shall be furnished with an independent bleeder line directed back to the wet well.

d. Dehumidifier

If required, the Applicant shall install an automatic refrigeration type dehumidifier to maintain the relative humidity of the air in the pump chamber as low as possible. The dehumidifier shall be capable of removing three gallons of moisture per twenty-four hours and shall be automatically controlled by an adjustable thermostat and a panel-mounted humidistat. The condensation shall drain to the sump.

e. Sump Pump

If required, the Applicant shall install in each pump station a submersible sewage or grinder sump pump with motor mounted directly above the impeller. The volute casting shall have feet to support the impeller entrance the proper distance above the bottom of the sump. The pump shall have a minimum capacity of 100 gpm. The pump shall be controlled by a level control switch, capable of operation on a 2" differential water level. It shall discharge to the wet well through a 1-1/4" - 2" pipe with two check valves and a gate valve within the pump chamber.

3. Submersible Type Stations

   a. General

      A minimum of two pumps must be provided and installed. The station, including wet well and valve chamber, 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 DEP requirements. The elevation of the top of the wet well shall be minimum 2 feet above the 100 year flood elevation.

   b. Submersible Pumps

      (1) Casings

         Pump casing and motor casing shall be ASTM-A48 cast iron. Pump casing shall be of the single volute type, ribbed to prevent excessive deflection and hydrostatically tested to twice the design head, or one and one half times the shutoff head, whichever is greater. Volute shall be sized at all points to pass solids which can pass through the impeller and internally finished to provide smooth, unobstructed flow.

      (2) Impeller

         Impeller shall be 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.

      (3) Pump Shaft

         Pump shaft shall be stainless steel of sufficient strength and size to safely transmit the maximum torque developed by the drive unit. Shaft shall be sized to provide rigid support of the impeller and prevent excessive vibration.

      (4) Pump Shaft Bearings

         Bearings shall be ball or roller type, oil lubricated. Upper bearings shall support full dead load and hydraulic thrust. Bearings shall be designed with a 20,000 hour B10 minimum bearing life per AFBMA test procedure.

      (5) Shaft Seals

         (a) 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.

(b) 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.

(c) Equip each pumping unit with a liquid sensing device to prevent damage to the motor in the event of a shaft seal failure.

(6) 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 A, Group D hazardous. Motors shall be severe duty with a minimum service factor of 1.15 (not utilized during normal operation).

(7) Pump Accessories

(a) Provide the following accessories with each pumping unit.

i. Stainless steel chain of adequate strength and length to permit raising of the pumping unit for inspection and removal. Chain must have large secondary links attached at minimum 10' intervals.

ii. Guide rails

iii. Upper guide rail brackets

iv. Pump mooring plate with discharge elbow and lower guide rail support brackets

v. Power cable of adequate length

(8) Spare Parts

(a) Provide one additional set of radial and combination radial and thrust bearings and one additional set of seals.

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, an isolation plug valve and a surge relief valve, if required, for each pump, and shall be large enough to comfortably accommodate the valves and fittings.

(2) A NEMA 4 light switch shall be provided on each check valve to signal open/close operation. The switches shall have N.O./N.C. contacts rated 120 Volts, 10 amps. These switches shall be connected to the pump fail circuitry.

(3) The valve chamber shall be provided with an aluminum hatch as manufactured by Bilco, Halliday Products or approved equal. Chamber shall be minimum 6'-6" deep precast or reinforced concrete structure with aluminum access ladder with rungs at 12" oc. 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.

(4) Precast manholes utilized for valve chambers shall meet the requirements in Section 6.

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 minimum 6'-6" deep precast or reinforced concrete structure with aluminum access ladder with rungs at 12" oc. 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) Precast manholes utilized for meter chambers shall meet the requirements in Section 6.

e. Lift-out Rail System

(1) Station shall be provided with a rail system to facilitate easy removal of the pumps. Rails shall be made of 316 stainless steel and are to be firmly fixed with rail supports to the wall of the wet well. All hardware shall be stainless steel.

(2) Furnish and install a lifting mechanism to be able to remove the pumps from the wet well to a hauling truck. The type of lifting mechanism will be dictated by the specific application and shall be approved by the Authority.

D. ELECTRICAL REQUIREMENTS

1. Furnish all labor, materials and equipment required to install complete and make operational, the electrical distribution and process instrumentation systems.

2. The work shall include furnishing and installing the following:

a. Electrical service from the power company.

b. Telephone service from the telephone company.

c. Underground and exposed conduit, wire, cabling, and terminations for all motors, motor controllers, control devices, control panels, electrical equipment, HVAC equipment and controls, lighting, primary elements, transmitters, and local indicators.

d. Lightning and surge protection equipment and wiring at the electrical and telephone service entrances, and instrumentation transmitters.

e. Alarm System

f. Grounding System

3. Electric equipment, materials and installation shall comply with the latest edition of the National Electrical Code (NEC) and with the latest edition of the following codes and standards:

a. National Electrical Code (NEC)
b. National Electrical Safety Code (NESC)
c. Occupational Safety and Health Administration (OSHA)
d. National Fire Protection Association (NFPA)
e. National Electrical Manufacturers Association (NEMA)
f. American National Standards Institute (ANSI)
g. Insulated Cable Engineers Association (ICEA)
h. Instrument Society of America (ISA)
i. Underwriters Laboratories (UL)
j. Factory Mutual (FM)
k. National Electrical Testing Association (NETA)

4. Area Classifications and Enclosure Types

a. NEMA 12 for dry, indoor above grade locations including generator or pump station building interiors.

b. NEMA 3R for outdoor non-corrosive and non-hazardous areas at least 10’ away from open wet well or basin.

c. NEMA 4 for outdoor locations, rooms below grade, including basements and buried vaults at least 10’ away from open wet well or basin.

d. NEMA 4X, 316 Stainless Steel for corrosive areas or within 10’ from open wet well or basin.

e. NEMA 7 areas shall be rated "Class I Div. 1 Group D", including open wet wells and basins.

f. All electrical equipment shall be rated for the location of installation.

5. Service and Metering

a. Service will be obtained at 120/208 or 277/480 Volts, 3 Phase, 4 Wire, 60 Hz.

b. Coordinate with the power company to obtain electrical service, pay all power company charges and furnish all labor and material required to install all electrical equipment required by the power company, including all service entrance conduits and cabling, a power company approved metering current transformer enclosure and a pedestal or meter base. The power company shall approve conduit size and type.

c. Provide a main service entrance approved disconnect switch with current limiting fuses as required.

6. Hazardous Areas

a. Equipment, materials and installation in areas designated as hazardous shall comply with National Electrical Code Articles 500, 501, 502 and 503.

b. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

7. Materials and Equipment

a. Materials and equipment shall be new.

b. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.

8. Equipment Identification

a. Identify all electrical equipment including disconnect switches, separately mounted motor starters, control stations, motor control centers, control panels, panelboards, switchboards, switchgear, junction or terminal boxes, transfer switches.

b. Nameplates shall be engraved, laminated plastic, not less than 1/16 in thick by 3/4 in by 2 1/2 in with 3/16 in high white letters on a black background.

c. Nameplates shall be screw mounted to NEMA 12 enclosures and bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two-sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate the nameplate shall be permanently fastened to the adjacent mounting surface.

9. Emergency Power

a. 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.

b. The system components shall be new equipment of current design, not one-of-a-kind, and consist of a Pennsylvania approved engine-driven, electric plant 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, so there is one responsibility for the proper functioning of the entire system. The plant shall be as manufactured by Cummins.

c. The plant 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 to accumulate 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.

d. All required anchor bolts shall be furnished and installed. A stainless steel flexible pipe shall connect engine to the exhaust system.

e. Exhaust air ductwork between radiator and exhaust louver shall be 20-gauge galvanized sheet steel. Engine radiator shall have a flexible duct adapter.

f. 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, Singer, or approved equal.

g. 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.

h. 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.

i. 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.

j. The use of propane gas as an alternative energy source will be considered by the Authority.

k. 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, Model A-5, ESB Inc., or approved equal.

10. Automatic Transfer Switch

The Automatic Transfer Switch shall be designed for an emergency and normal source of 120/208, 277/480 Volt, 3 Phase, 3 Wire, 60 Hz. Current ratings shall be as required. Switches shall be listed under UL 1008. The switches shall initiate transfer of the load to the emergency source when any phase of the normal source drops below 90 percent of normal voltage. The transfer switches shall be adequately constructed to carry full rated current on a continuous 24 hour basis in all approved enclosures and shall not show excessive heating or be subject to de rating. The transfer switches shall be capable of withstanding all available system fault currents without parting of or damage to contacts during the fault clearing time of the system over current device. The transfer switches shall be of inherently 3 Pole double throw construction and shall have three position operations: closed to normal source, open, closed to emergency source. Time delay between opening of the closed contacts and closing of the open contacts shall be a minimum of 400 milliseconds to allow for voltage decay before transfer is complete. The transfer switch shall be furnished with a close differential adjustable phase sensing relay set to drop out at 80 percent of rated voltage and pick up at 90 percent of rated voltage. The relay shall be adjustable 0.5 to 6.0 second tune delay to override normal source power outages (set at 2 seconds) with two auxiliary contacts to open on normal source failure (for combustion air damper control) and two auxiliary contacts to close on normal source failure (for remote alarm and engine start). The transfer switch shall be furnished with a neutral (off) position relay with adjustable time delay 0.1 to 10 seconds, auxiliary contacts to open 0 to 30 seconds (adjustable) before transfer to either normal or emergency source and to close after transfer has occurred. These contacts are to cause variable frequency drive controllers to come to a controlled stop before transfer to either source and allow re start after transfer has occurred. Each transfer switch shall have one set of these contacts for each current source variable frequency drive controller connected downstream. Adjustable time delay on retransfer to normal (1 to 300 seconds) with a 0 to 25 minute adjustable unloaded engine running time after retransfer. A maintained contact test auto switch and normal/emergency pilot lights shall be mounted on the door. Enclosure paint color shall be ANSI Z55.1, No. 61, light gray. Automatic transfer switch shall have the following withstand ratings (10 cycle):

Switch Rating	Withstand Rating
100 to 200 Amps	22,000 Amps at 480 Volts RMS SYM
225 to 800 Amps	40,000 Amps at 480 Volts RMS SYM
1000 to 1600 Amps	50,000 Amps at 480 Volts RMS SYM

The automatic transfer switch shall also be furnished with a 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. All accessories and equipment shall be front accessible for ease of maintenance or removal. Automatic transfer switches shall be ASCO.

11. Main Circuit Breaker shall be a thermal magnetic molded case circuit breaker 480 Volt, 3 Pole, 22K AIC. Main circuit breaker type shall be coordinated with the automatic transfer switch to obtain 22 KA withstand/closing.

12. Panelboards

a. Distribution panelboards shall be of size, voltage, and number of phases as required, 120/208 or 277/480 Volt, 3 Phase, 4 Wire. Panelboards shall be fully rated for the specified circuit breaker fault current interrupting capacity. Series connected short circuit ratings will not be acceptable. Panelboards shall be equipped with circuit breakers. Circuit breakers shall be molded case, bolt in type. Each circuit breaker used in 120/208 or 277/480 Volt panelboards shall have an interrupting capacity of not less than 22 K AIC. GFCI (ground fault circuit interrupter) shall be provided for circuits where required. GFCI units shall be 1 Pole, 120 Volt molded case, bolt on breakers, incorporating a solid-state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be UL listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time) and an interrupting capacity of 22 K AIC. Circuit breakers shall be as manufactured by the panelboard manufacturer. Bus bars for the mains shall be of copper. Full size neutral bars shall be included. Phase bussing shall be full height without reduction. Cross connectors shall be copper. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

b. Mount boxes for surface mounted panelboards so there is at least 1/2 in air space between the box and the wall.

c. Connect panelboard branch circuit loads so that the load is distributed as equally as possible between the phase busses.

d. Type circuit directories giving location and nature of load served. Install circuit directories in each panelboard.

e. Install markers on the front cover of all panelboards which identify the voltage rating. Markers shall be made of self sticking B 500 vinyl cloth printed with black characters on an Alert Orange background, 2 1/4 in high by 9 in wide, Style A as manufactured by W.H. Brady Co. or equal.

f. Install a 1 in by 3 in laminated plastic nameplate with 1/4 in white letters on a black background on each panelboard. Nameplates shall be stainless steel screw mounted.

13. Disconnect Switches shall be heavy duty, quick make, quick break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle, as manufactured by the Square D Co.; Cutler Hammer Co.; General Electric Company; Siemens Company or equal.

14. Fused Disconnect Switches shall be heavy duty, quick make, quick break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle. Fuses shall be rejection type, 600 Volt, 200K A.I.C., dual element, time delay, as manufactured by Bussman, Gould Shawmut, Littelfuse Power Fuse Division or equal. Switches shall be as manufactured by the Square D Co.; Cutler Hammer Co.; General Electric Company; Siemens Company or equal.

15. General Purpose Dry Type Transformers shall be dry type, two winding with kVA and voltage ratings as required, four full capacity taps shall be furnished, two 2 1/2 percent

above and two 2 1/2 percent below rated primary voltage. Maximum temperature rise shall be 115 degrees C. Windings shall be copper. Transformers shall be built in accordance with ANSI C89.2 and NEMA ST 20. Transformers shall be furnished with mounting hardware. Transformers shall be manufactured by the Square D Co.; Cutler Hammer Co.; General Electric Company or equal.

16. Transient Voltage Surge Suppressors (TVSS) shall be a hybrid device utilizing SAD (Silicon Avalanche Diodes), MOV (Metal Oxide Varistors) and CAP (Capacitors) technology. The TVSS unit shall be listed under UL 1449 Second Edition and UL 1283 for noise attenuation devices. Units shall have parallel line-neutral, line-ground and neutral ground connection configuration, one Nanosecond or less response time, extend noise filtration with a 10 kHZ to 100 MHZ range, fused internal disconnect switch with 60 Amps, 300,000 AIC rating, LED indications, six digit surge counter, form C output contacts, 208/120 or 480/277 Volt, 3-phase, 4 wire, grounded voltage configuration. TVSS shall be as manufactured by United Power Corporation; Transtector Systems; Current Technology or equal.

17. Alarm System

    a. An alarm system capable of monitoring the following functions and transmitting the relevant signal to the designated location shall be installed:

        (1) Suction Lift Stations

            (a) Power failure
            (b) High wet well
            (c) Low wet well
            (d) Generator failure
            (e) Louver failure
            (f) Pump failure
            (g) To be determined by Authority

        (2) Submersible Type Stations

            (a) Power failure
            (b) High wet well
            (c) Low wet well
            (d) Seal leak
            (e) Generator failure
            (f) Louver failure
            (g) Pump failure

    b. An automatic phone dialer shall be installed. The dialer shall be a real voice type with 8-channel capacity. Acceptable dialer manufacturers: Verbatim by RACO or equal.

    c. Provide a wall-mounted push-button 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.

18. Lighting

    a. The Applicant shall furnish and install lamps and accessories as required. Overhead exterior lighting shall provide adequate lighting in wet well area and shall be in compliance with East Cocalico Township's Subdivision and Land Development Ordinance. Prior to acceptance of building by the Authority, all fixtures shall be cleaned, free of dust, insects and all foreign matter. The light fixture schedule is listed below:

        (1) Industrial, ceiling mounted fluorescent, 2-lamp, 4 foot, 10-15 aperture up-light porcelain enamel reflectors, 120 Volts.

        (2) Outdoor wall-mounted high pressure sodium, 120 Volts with integral photo cell control.

19. Electrical Unit Heaters

    a. Horizontal forced air unit heaters shall be rated for the building size. Mounting brackets designed for either ceiling or wall swivel mounting shall be furnished for each heater. The cabinet shall be of 18 gauge die-formed furniture grade steel. Individual adjustable louvers shall be furnished to provide desired control of discharge air. All metal surfaces of the casing shall be phosphate coated to resist corrosion, with a baked enamel finish.

    b. Automatic reset thermal over-heat protection shall be provided.

    c. Motors shall be of the totally enclosed fan-cooled continuous duty (TEFC), sleeve bearing type, equipped with built-in thermal overload protection.

    d. Fans shall be aluminum, directly connected to fan motor, dynamically balanced and designed specifically for unit heater application.

    e. Heaters shall be equipped with remote comfort control thermostats and necessary control transformers and contactors. Heaters shall be equipped with cord and twist lock plug for connection to receptacle and shall be Chromalox Type MUH, Singer, Berko, or approved equal.

20. Metal Louvers

    a. The Applicant shall furnish and install all metal louvers (both the gravity and motor operated type) required for installation in the Generator Building. The metal louvers shall be complete with all motors, controls, screens, trim and closure pieces for a complete installation. It shall be the responsibility of the Applicant to check all opening sizes and completely coordinate the installation to insure a neat workmanlike job.

    b. A gravity louver shall be furnished for installation on the generator discharge. This shall be a fully automatic louver with the exhaust blades normally in a closed position and set to open when air pressure is applied. The blades shall move independently of each other, smoothly and without flutter.

c. The head, sill, jambs and blades shall be extruded aluminum section, 6063-T52 alloy with reinforced bosses. The exhaust blades shall be cushioned the full length by vinyl gaskets. The heads, sills and jambs shall be one piece structural members with integral caulking strips and retaining beads. All fasteners to be stainless steel or aluminum. All louvers shall be provided with #2 mesh .063 inch diameter wire bird screen secured by an extruded aluminum frame on the louver exterior which can be easily removed for cleaning.

d. The louvers shall be free of scratches and blemishes and provided in a fluorocarbon polymer finish in a color to be selected by the Authority.

e. The gravity louver shall be Model SA/FBE as manufactured by Penn Ventilator Airstream, Airolite Co., or approved equal.

f. A motor operated louver shall be furnished for use as the generator air intake. This shall be a fully automatic louver with the operating blades normally in a spring closed position and opened by a motorized operator. The blades shall operate in a smooth continuous motion.

g. The head, sill, jambs, and blades shall be extruded aluminum sections, 6063-T52 alloy with reinforced bosses. The operating blades shall be double gasketed with a vinyl material. The heads, sills, and jambs shall be one piece structural members with integral caulking slot and retaining beads. All fasteners shall be stainless steel or aluminum.

h. The operating blades shall be operated by an electrically controlled motor operator. The motor shall be totally enclosed and suitable for operation on 120 Volt, 60 Hz, single-phase service. The unit shall be furnished with all controls and miscellaneous accessories for a complete working installation.

i. The motor operated louver shall be Model ASA/FBI manufactured by Penn Ventilator AirStream, Airolite, or approved equal.

j. The louvers are to be sized to suit the generator air requirements. The exhaust louver shall be sized so that the maximum pressure drop shall not exceed 1/2" of water when the generator is operating at full speed. The intake louver shall be sized 25% larger than the exhaust louver.

k. The motor operated intake louver shall be wired for both manual and automatic operation. A selector switch shall be provided for manual open-close operation.

l. The intake louver shall automatically open when the emergency generator starts and shall remain open until the generator shuts down. All necessary controls, relays, and wiring necessary for complete working installation shall be furnished and installed.

m. A thermostat shall also be provided to automatically open the intake louver on excessive heat build-up within the generator building. Thermostat shall have control range of 70^{o} to 140^{o} F, with a 2^{o} F differential, and shall be Model T631C, as manufactured by Honeywell, Chromalox or approved equal.

n. A limit switch shall be installed at the intake louver location and shall be positioned so that the switch is operated by the opening of the louver blades. If the louver and switch do not open after a preset time, a relay shall signal a "louver failure" condition to the telemetering alarm system. Limit switch shall be as manufactured by Westinghouse Type RR, Square D, or approved equal.

21. Conduits, Boxes and Fittings

a. Materials

(1) Rigid Steel Conduit (interior and exterior) shall be hot dipped galvanized and be as manufactured by the Allied Tube and Conduit Corp.; Wheatland Tube Co.; Triangle PWC Inc. or equal.

(2) PVC Coated Rigid Steel Conduit shall have a minimum 0.040 in thick, polyvinyl chloride coating permanently bonded to hot dipped galvanized steel conduit and an internal chemically cured urethane or enamel coating. The ends of all couplings, fittings, etc., shall have a minimum of one pipe diameter in length of PVC overlap. PVC conduit and fittings shall be manufactured by Occidental Coating Company; "Plasti Bond Red" as manufactured by Robroy Industries; Triangle PWC Inc. or equal.

(3) Rigid Aluminum Conduit shall be 6063 alloy and shall be as manufactured by New Jersey Aluminum Corp.; AFC Co.; VAW of America, Inc. or equal.

(4) Intermediate Metal Conduit shall be hot dipped or electro galvanized steel as manufactured by Allied Tube and Conduit Corp.; Triangle PWC Inc.; Wheatland Tube Co. or equal.

(5) Rigid Non-metallic Conduit shall be rigid polyvinyl chloride (PVC) schedule 40 and 80 as manufactured by Carlon; An Indian Head Co.; Kraloy Products Co., Inc.; Highland Plastics Inc. or equal.

(6) Liquid-tight flexible metal conduit, couplings and fittings shall be Sealtite, Type UA, manufactured by the Anaconda Metal Hose Div.; Anaconda American Brass Co.; American Flexible Conduit Co., Inc.; Universal Metal Hose Co. or equal. Fittings used with liquid-tight flexible metal conduit shall be of the screw in type as manufactured by the Thomas & Betts Co.; Crouse Hinds Co. or equal.

(7) Flexible couplings shall be type ECGJH as manufactured by the Crouse Hinds Co.; Appleton Electric Co.; Killark Electric Manufacturing Co. or equal.

(8) Pressed steel switch and outlet boxes shall be hot dipped galvanized as manufactured by the Raco Manufacturing Co.; Adalet Co.; O.Z. Manufacturing Co. or equal.

(9) Terminal boxes, junction boxes, and pull boxes for NEMA-4 and 12 areas, shall be galvanized sheet steel with continuously welded seams. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers

shall be gasketed and fastened with stainless steel screws. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps, 600 Volt. Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; Keystone/Rees, Inc. or equal.

(10) Terminal boxes, junction boxes, and pull boxes for NEMA-4X areas, shall be Type 316 stainless steel with stainless steel hardware and covers having a continuous gasket on all four sides. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps, 600 Volt. Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; Keystone/Rees, Inc. or equal.

(11) Explosion proof boxes shall be designed for Class 1, Group D, Division 1 hazardous locations. They shall be cast iron with cadmium zinc or hot dipped galvanized finish, stainless steel or hot dipped galvanized bolts; Type EJB as manufactured by the Crouse Hinds Company; Appleton Electric Co.; The Pyle National Co. or equal.

(12) All boxes and fittings used with PVC coated conduit shall be furnished with a PVC coating bonded to the metal, the same thickness as used on the coated steel conduit. The ends of couplings and fittings shall have a minimum of one pipe diameter PVC overlap to cover threads and provide a seal.

(13) Cast or malleable iron device boxes shall be Type FD. All cast or malleable iron boxes and fittings shall have cadmium zinc finish with cast covers and stainless steel screws as manufactured by the Crouse Hinds Co. or equal.

(14) Cast aluminum device boxes shall be Type FD. All cast aluminum boxes and fittings shall be copper free aluminum with cast aluminum covers and stainless steel screws as manufactured by the Killark Electric Co.; Crouse Hinds Co.; L. E. Mason Co. or equal.

(15) Steel elbows and couplings shall be hot dipped galvanized. Elbows and couplings used with PVC coated conduit shall be furnished with a PVC coating bonded to the steel, the same thickness as used on the coated steel conduit.

(16) Conduit hubs shall be as manufactured by Myers Electric Products, Inc. or equal.

(17) Conduit wall and floor seals for sleeved openings shall be type CSMI as manufactured by the O.Z./Gedney Co. or equal.

(18) Explosion proof fittings shall be as manufactured by the Crouse Hinds Co.; Appleton Electric Co.; O.Z./Gedney Co. or equal.

(19) Conduit sealing bushings shall be O.Z./Gedney Type CSB or equal.

(20) Combination expansion-deflection fittings embedded in concrete shall be Type XD as manufactured by Crouse-Hinds Co.; Type AXDX as manufactured by O.Z./Gedney Co.; Type DF as manufactured by Appleton Electric Co. or equal.

(21) Combination expansion-deflection fittings installed exposed shall be Type XD as manufactured by Crouse-Hinds Co.; Type AXDX as manufactured by O.Z./Gedney Co.; Type DF as manufactured by Appleton Electric Co. or equal.

b. Installation

(1) Except where otherwise specified, all wiring shall be in rigid steel conduit.

(2) Rigid steel conduit shall be used at all locations (underground and within structures) as raceways for shielded process instrumentation wiring, shielded control wiring, and I/O wiring.

(3) PVC coated rigid steel conduit shall be used in areas designated "CORROSIVE."

(4) PVC conduit shall be used for concrete encased underground duct banks except as specified in Item (2) above.

(5) Aluminum conduit shall be used for exposed conduit runs outdoors, in areas designated as "WET" or "Class 1, Div. 1."

(6) All boxes shall be metal.

(7) Exposed switch, receptacle and lighting outlet boxes and conduit fittings shall be cast or malleable iron, except that cast aluminum shall be used with aluminum conduit.

(8) Concealed switch, receptacle and lighting outlet boxes shall be pressed steel.

(9) Terminal boxes, junction boxes and pull boxes shall have NEMA ratings suitable for the location in which they are installed.

(10) Conduit wall seals shall be used where underground conduits penetrate walls.

(11) Conduit sealing bushings shall be used to seal conduit ends exposed to the weather.

(12) No conduit smaller than 3/4 in electrical trade size shall be used, nor shall any have more than the equivalent of three 90-degree bends in any one run. Pull boxes shall be provided as required or directed.

(13) No wire shall be pulled until the conduit system is complete in all details.

(14) The ends of all conduits shall be tightly plugged to exclude dust and moisture during construction.

(15) Conduit supports, other than for underground raceways, shall be spaced at intervals of 8 ft or less.

(16) Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

(17) All conduits shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduits shall be run perfectly straight and true.

(18) Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

(19) Conduit terminating in NEMA 3R, 4, 4X and 12 enclosures shall be terminated with Myers type conduit hubs.

(20) Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat grounding bushings.

(21) Conduits shall be installed using threaded fittings.

(22) Liquid-tight flexible metal conduit shall be used for all motor terminations, the primary and secondary of transformers, generator terminations and other equipment where vibration is present.

(23) Flexible couplings shall be used in hazardous locations for all motor terminations and other equipment where vibration is present.

(24) Aluminum fittings and boxes shall be used with aluminum conduit. Aluminum conduit shall not be imbedded in concrete. Aluminum conduit shall be isolated from other metals with plastic sleeves or plastic coated hangers. Strap wrenches shall be used for tightening aluminum conduit.

(25) Where conduits pass through openings in walls or floor slabs, the remaining openings shall be sealed against the passage of flame and smoke.

(26) PVC conduit to non metallic box connections shall be made with PVC socket to male thread terminal adapters with neoprene O ring and PVC round edge bushings.

(27) Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.

(28) PVC conduit shall be supported with non metallic clamps, PVC coated steel or non metallic racks and stainless steel hardware.

(29) PVC boxes, conduit fittings, etc. with integral hubs shall be solvent welded directly to the PVC conduit system.

(30) Non-metallic boxes with field drilled or punched holes shall be connected to the PVC conduit system with threaded and gasketed PVC Terminal Adapters.

(31) All conduit entering or leaving a motor control center, switchboard or other multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other manufacturer designated area, directly below the vertical section in which the conductors are to be terminated.

(32) Conduit sealing and drain fittings shall be installed in areas designated as NEMA 7.

(33) All conduit which may under any circumstance contain liquids such as water, condensation, liquid chemicals, etc., shall be arranged to drain away from the equipment served. If conduit drainage is not possible, conduit seals shall be used to plug the conduits.

(34) Where no type or size is indicated for junction boxes, pull boxes or terminal cabinets, they shall be sized in accordance with the requirements of N.E.C. Article 370.

(35) Miscellaneous steel for the support of fixtures, boxes, transformers, starters, contactors, panels and conduit shall be furnished and installed.

(36) Steel channels, flat iron and channel iron shall be furnished and installed for the support of all electrical equipment and devices, where required, including all anchors, inserts, bolts, nuts, washers, etc. for a rigid installation.

(37) Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc., shall be sealed with "Duxseal" as manufactured by Manville or seal fitting to prevent the accumulation of condensation.

(38) Rigid galvanized steel conduits which have been field cut and threaded shall be painted with cold galvanizing compounds.

(39) Conduit expansion and deflection fittings shall be installed on all conduits crossing building expansion joint. Where conduits are installed outdoors provide expansion and deflection fittings on all conduits crossing expansion joints or at 200 foot intervals whichever is the least dimension.

22. Conduit Mounting Equipment

a. In dry indoor areas hangers, rods, back plates, beam clamps, channel, etc. shall be galvanized iron or steel.

b. PVC coated steel channel or fiberglass channel with stainless steel hardware shall be used in areas designated "WET" and "CORROSIVE" and in outdoor locations. Fiberglass channel shall be resistant to the chemicals present in the area in which it is used.

23. Wall and Floor Slab Opening Seals shall be sealed with "FLAME SAFE" as manufactured by the Thomas & Betts Corp.; Pro Set Systems; Neer Mfg. Co.; Specified Technologies, Inc. or equal.

24. Cold Galvanizing Compound shall be as manufactured by ZRC Products Company, a division of Norfolk Corp. or equal.

25. Wire, Cable, and Accessories

    a. Materials

        (1) Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.

        (2) All conductors shall be stranded, except that lighting and receptacle wiring may be solid.

        (3) Except for control, signal and instrumentation circuits, wire smaller than No. 12 AWG shall not be used.

        (4) Wire for lighting, receptacles and other circuits not exceeding 150 Volts to ground shall be NEC Type THHN/THWN as manufactured by Okonite Co.; Southwire Co.; Pirelli Corp., or equal.

        (5) Wire for circuits over 150 Volts to ground shall be NEC type THHN/THWN for dry locations and XHHW for wet locations as manufactured by Okonite Co.; Southwire Co., or equal.

        (6) Wire for control, status and alarm circuits shall be No.14 AWG NEC type THHN/THWN for dry locations and XHHW for wet locations as manufactured by the Okonite Co.; Carol Cable Co. Inc. West; Pirelli Cable Corp. or equal.

        (7) Wire for process instrumentation signals (i.e. 1-5 VDC, 4-20 mA), R.T.D., potentiometer and similar signals shall be single pair cable, 2 or 3 wire or multiple pair, No.16 AWG stranded and twisted on 2 in lay, PVC with 300 Volt, 105 degrees C rated insulation, 100% mylar tape with drain wire, PVC jacket with UL Subject 13, UL 1581, and manufacturer’s identification, and UL listed for underground wet locations as manufactured by Belden (No. 1030) or equal.

        (8) Splices for power wiring shall be compression type connectors insulated with a heat shrink boot or outer covering and epoxy filling. Splice kits shall be as manufactured by Raychem; Ideal Industries; 3M Co. or equal.

        (9) Motor connections shall be ring type mechanical compression terminations installed on the branch circuit wires and the motor leads and secured with bolt, nut and spring washer. Connections shall be insulated with a Raychem Type RVC, roll on stub insulator or equal.

(10) Termination connectors for control wiring shall be of the locking fork end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

(11) Splices for control wiring shall be insulated compression type connectors of the expanded vinyl insulated parallel or pigtail type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

(12) Termination connectors for shielded instrumentation wiring shall be of the locking fork end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

(13) Wire markers shall be "Omni Grip" as manufactured by the W.H. Brady Co.; Thomas & Betts Co.; 3M Co. or equal.

(14) Wire and cables with diameters exceeding the capacity of the "Omni Grip" shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by the W.H. Brady Co.; Panduit Corp. or equal.

(15) Direct buried cable warning tape shall be 6 in wide, red polyethylene not less than 0.0035 in thick. Tape shall be W.H. Brady Co., Catalog No. 91296 or equal.

b. Installation

(1) Uniquely identify all wires, cables and each conductor of multi conductor cables (except lighting and receptacle wiring) at each end with wire and cable markers.

(2) Use lubrications to facilitate wire pulling. Lubricants shall be UL approved for use with the insulation specified.

(3) All wire shall be color coded or coded using electrical tape in sizes where colored insulation is not available. Where tape is used as the identification system, it shall be applied in all junction boxes, and other accessible intermediate locations as well as at each termination.

(4) The following coding shall be used:

System	Wire	Color
240/120 Volts	Neutral	White
1 Phase, 3 Wire	Line 1	Black
	Line 2	Red
208Y/120, Volts	Neutral	White
3 Phase, 4 Wire	Phase A	Black
	Phase B	Red
	Phase C	Blue

System	Wire	Color
240/120 Volts	Neutral	White
3 Phase, 4 Wire	Phase A	Black
delta, center tap	Phase B (High)	Orange
ground on phase	Phase C	Blue
coil A C		
480Y/277 Volts	Neutral	White
3 Phase, 4 Wire	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow

(5) Power conductors: Terminations shall be die type or set screw type pressure connectors as specified. Splices (where allowed) shall be die type compression connector and waterproof with heat shrink boot or epoxy filling. Aluminum conductors (where specified) shall employ terminations and splices specifically designed for aluminum conductors.

(6) Control Conductors: Termination on saddle type terminals shall be wired directly with a maximum of two conductors. Termination on screw type terminals shall be made with a maximum of two spade connectors. Splices (where allowed) shall be made with insulated compression type connectors.

(7) Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): terminations same as for control conductors. Splices allowed at instrumentation terminal boxes only.

(8) Except where permitted by the Authority no splices will be allowed in manholes, handholes or other below grade located boxes.

(9) Splices shall not be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc), conduit bodies, etc.

(10) Instrumentation cables shall be installed in rigid steel raceways as specified. All circuits shall be installed as twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever three wire circuits are required.

(11) Terminal blocks shall be provided at all instrument cable junction and all circuits shall be identified at such junctions.

(12) Shielded instrumentation wire shall be run without splices between instruments, terminal boxes, or panels.

(13) Shields shall be grounded as recommended by the instrument manufacturer and isolated at all other locations. Terminal blocks shall be provided for inter connecting shield drain wires at all junction boxes. Where individual circuit shielding is required, each shield circuit shall be provided with its own block.

26. Wiring Devices

    a. Materials

        (1) Wall switches shall be heavy duty, specification grade, toggle action, flush mounting quiet type. All switches shall conform to the latest revision of Federal Specification WS 896, Single pole, double pole, three way, or four way, 20 Amp, 120/277 Volt as manufactured by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

        (2) Explosion proof single pole factory sealed switches shall be for 20 Amps, 120/277 Volts, mounted in copper free aluminum or malleable iron cast boxes and be similar and equal to Crouse Hinds EDS Series, or equal by Appleton Electric Co. or Killark.

        (3) Receptacles for NEMA-12 areas shall be heavy duty, specification grade, conforming to Federal Specification WC596 F, Duplex, 20 Amp, 125 Volt, 2P, 3W; Arrow Hart, Catalog No. 5362, or equal by Harvey Hubbell, Inc.; Pass & Seymour, Inc.

        (4) Weatherproof/corrosion resistant single or duplex, 20 Amp, 125 Volt, 2P, 3W, with cover; Crouse Hinds Co., Catalog No. WLRS 5 20, or equal by Appleton Electric.

        (5) Ground fault interrupter, duplex, 20 Amp, 125 Volt, 2P, 3W, GFCI feed thru type with "test" and "reset" buttons. Arrow Hart, Catalog No. GF5342 or equal by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

        (6) Explosion proof single or duplex, 20 Amp, 125 Amp, 2P, 3W; Appleton Electric, Catalog No. CPCI 2350 and plug, Appleton Electric, Catalog No. CPP 2033 or equal by Crouse Hinds; Harvey Hubbell Inc.

    b. Installation

        (1) Switch and receptacles outlets shall be installed flush with the finished wall surfaces in areas with stud frame and gypboard construction, or when raceways are concealed. In dry areas with cement block construction surface mounted devices may be installed.

        (2) Do not install flush mounted devices in areas designated DAMP, WET or WET/CORROSIVE. Provide surface mounted devices in these areas.

        (3) Provide weatherproof devices covers in areas designated WET or WET/CORROSIVE.

27. Combination Magnetic Motor Starters shall be a combination motor circuit protector and contactor, 2 or 3 Pole, single or 3 phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non reversing unless otherwise shown on the Drawings. NEMA sizes shall be as required for the process horsepower. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for

use with magnetic motor starters. Motor circuit protectors shall be current limiting type, with additional current limiters if required. Combination motor starters shall be fully rated for a minimum of 22K AIC. Each motor starter shall have a 120 Volt operating coil and control power transformer. Three phase starters shall have three overload relays. One normally open and one normally closed auxiliary contact shall be provided as spares in addition to contacts shown on the Drawings. Combination magnetic motor starters shall be as manufactured by the Square D Co.; Cutler Hammer Co.; General Electric Company; Siemens Company or equal.

28. Control Stations shall be heavy duty type, with full size operators. Momentary contact stop buttons shall have a lockout latch that can be padlocked in the open position. Control stations shall be Square D Class 9001; Cutler Hammer Co.; General Electric Company; Allen Bradley Company or equal.

29. Control Relays shall be heavy-duty machine tool type, with 10 Amps, 300 Volt convertible contacts. Number of contacts and coil voltage shall be as shown on the Drawings. General use and latching relays shall be General Electric Co., Square D Co., Allen Bradley Co. or equal.

30. Time delay relays shall be pneumatic, 600 Volt, 20 Amp contacts, with calibrated knob operated adjustment. On delay and off delay types and timing ranges shall be as required. Relays shall be Agastat, or equal.

31. Polyethylene Warning Tape shall be red polyethylene film, 6 in minimum width. Warning tape shall be W.H. Brady Co., or equal.

32. Heat Tracing shall be temperature self limiting type rated 5 watts per foot at 50 degrees F, 120 Volt, 60 Hz and shall be Chemelex, Catalog No. 5BTV1 with stainless steel overbraid and fluoropolymer outer jacket or equal. Ambient air temperature sensing thermostat shall be adjustable from 15 to 150 degrees F, mounted in an enclosure, and shall be as manufactured by Chemelex, or equal. Aluminum heat transfer tape shall be 2 mil thickness, 2 1/2 in wide and shall be Chemelex, or equal.

33. Photocells shall be suitable for power duty with individual fixtures or for pilot duty with contactors. Enclosure shall be NEMA 3R or 4. Contacts shall be rated for 2,000 Watts continuous at 120 Volts. The unit shall turn on at 1.5 foot-candles and off at 5.5 foot-candles. Photocells shall be TORK, Model 2101 or equal.

34. Underground System

    a. Raceways shall be polyvinyl chloride conduit encased in concrete except that rigid steel conduit shall be used for 600 Volt shielded wire and data highway wiring.

    b. Handholes shall be precast concrete, heavy duty type, designed for a Class H 20 wheel load and conform to ASTM C478. Precast units shall be as manufactured by Chase Precast Corp.; American Precast Co. or equal and constructed to dimensions as shown on the Drawings. Handhole frames and covers shall be cast iron, heavy duty type for Class H 20 wheel loading.

35. Grounding

a. Ground rods shall be 3/4 in by 10 ft copper clad steel and constructed in accordance with UL 467. The minimum copper thickness shall be 0.25 mm. Ground rods shall be Copperweld or equal.

b. Grounding conduit hubs shall be malleable iron type similar to Thomas & Betts Co.; Cat No. 3940 (3/4 in conduit size) by Burndy; O.Z./Gedney Co. or equal, and of the correct size for the conduit.

c. Waterpipe ground clamps shall be cast bronze saddle type, similar to Thomas & Betts Co. Cat. No. 2 (1/2 in, 3/4 in, or 1 in size) or equal by Burndy; O.Z./Gedney Co. or equal, and of the correct size for the pipe.

d. Buried grounding connections shall be by Cadweld process, or equal exothermic welding system.

e. 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.

f. Run grounding electrode conductors in rigid steel conduits. Bond the protecting conduits to the grounding electrode conductors at both ends. Do not allow water pipe connections to be painted. If the connections are painted, disassemble them and re-make them with new fittings.

g. Install equipment grounding conductors with all feeders and branch circuits.

h. Bond all steel building columns in new structures together with ground wire in rigid conduit and connect to the distribution equipment ground bus.

i. Ground wire connections to structural steel columns shall be made with long barrel type one hole heavy duty copper compression lugs, bolted through 1/2 in maximum diameter holes drilled in the column web, with stainless steel hex head cap screws and nuts.

j. Metal conduits stubbed into a motor control center shall be terminated with insulated grounding bushings and connect to the motor control center ground bus. Bond boxes mounted below motor control centers to the motor control center ground bus. Size the grounding wire in accordance with NEC Table 250 95, except that a minimum No. 12 AWG shall be used.

k. Liquid tight flexible metal conduit in sizes 1 1/2 in and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps.

l. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with NEC Article 250 94.

m. Seal exposed connections between different metals with No Oxide Paint Grade A or equal.

n. Lay all underground grounding conductors slack and, where exposed to mechanical injury, protect by pipes or other substantial guards. If guards are iron pipe, or other magnetic material, electrically connect conductors to both ends of the guard. Make connections as specified herein.

o. Care shall be taken to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

p. All grounding type receptacles shall be grounded to the outlet boxes with a No. 12 THW green conductor connected to the ground terminal of the receptacle and fastened to the outlet box by means of a grounding screw.

q. Test the grounding system. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.

r. Testing shall be performed before energizing the distribution system.

s. Notify the Authority immediately if the resistance to ground for any building or system is greater than five ohms.

36. Sleeves and Forms for Openings

a. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.

b. Exact locations are required for stubbing up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.

c. Seal all openings, sleeves, penetration and slots.

37. Cutting and Patching

a. Cutting and patching shall be done in a thoroughly workmanlike manner. Saw cut concrete and masonry prior to breaking out sections.

b. Core drill holes in concrete floors and walls as required.

c. Install work at such time as to require the minimum amount of cutting and patching.

d. Do not cut joists, beams, girders, columns or any other structural members.

e. Cut opening only large enough to allow easy installation of the conduit.

f. Patching to be of the same kind and quality of material as was removed.

g. The completed patching work shall restore the surface to its original appearance or better.

h. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.

i. Remove rubble and excess patching materials from the premises.

j. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

38. Installation

a. Any work not installed according to the Specifications shall be subject to change as directed by the Authority.

b. Electrical equipment shall be protected at all times against mechanical injury or damage by water. Electrical equipment shall not be stored outdoors. Electrical equipment shall be stored in dry permanent shelters. Do not install electrical equipment in its permanent location until structures are weather tight. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and tested as directed by the Authority or shall be replaced at no additional cost at the Authority's discretion.

c. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Authority's discretion.

d. Repaint any damage to factory applied paint finish using touch up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted per the manufacturer’s recommendations.

e. Coordinate the conduit installation with other trades and the actual supplied equipment.

f. Install each 3 phase circuit in separate conduit.

g. Unless otherwise approved by the Authority, conduit installed interior to the building shall be installed exposed; conduit installed exterior to the building shall be concealed.

h. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

i. Exact locations of electrical equipment shall be determined by the Contractor and approved by the Authority during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Authority and furnish all labor and materials necessary to complete the work in an approved manner.

39. Underground System

    a. Install raceways to drain away from buildings.

    b. Reinforce raceway banks when conduits pass over newly excavated pipes.

    c. The minimum cover for raceway banks shall be 24 in unless otherwise permitted by the Authority.

    d. Swab all raceways clean before installing cable.

    e. Plug spare raceways and seal them watertight at all manholes, buildings and structures.

    f. Seal the ends of raceways and make watertight at all handholes, buildings and structures.

40. 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.

41. Phase Converters

    a. Three phase power must be provided. No phase converters will be permitted.

E. TESTING AND INSPECTION

1. It is incumbent upon the Applicant to notify the Authority a minimum of 2 weeks in advance to perform a final inspection after the installation is completed.

2. 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 "trouble-shooting" for all equipment, mechanical and electrical, furnished with the pumping station.

3. An arc flash study shall be performed and the results shall be posted in the facility on the respective equipment.

4. The Applicant shall provide five (5) bound copies of a manual fully explaining the operation, routine maintenance and "trouble-shooting" for equipment. The manuals shall include copies of all approved shop drawings and pump curves with all required revisions. These manuals must be submitted to the Authority for approval prior to acceptance. The manuals must include information relative to suppliers of spare and replacement parts.

5. Field tests shall be carried out and all testing equipment and labor required shall be provided to ensure that pumps and all equipment meet the design criteria. The Authority will witness the field tests.

6. 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.

7. Electrical Testing

   a. Conduct a mechanical inspection of circuit breakers, disconnect switches, motor starters, overload relays, control circuits and equipment for proper operation.

   b. Check rotation of motors prior to testing the driven load. Disconnect the driven equipment if damage could occur due to wrong rotation. If the rotation for the driven equipment is not correct, disconnect the motor lead connections at the motor terminal box and reconnect for proper rotation.

   c. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by control schematic and wiring diagrams.

   d. Check the full load current draw of each motor and ratings of all thermal overloads. If incorrect thermal overloads are installed replace with the correct size.

   e. Check power and control power fuse ratings. Replace fuses if they are found to be of the incorrect size.

   f. Check settings of the motor circuit protectors. Adjust settings to lowest setting that will allow the motor to be started when under load conditions.

   g. Check motor nameplates for correct phase and voltage.

   h. Check motor bearings for proper lubrication.

   i. Inspect each piece of equipment in areas designated as HAZARDOUS to ensure that equipment of proper rating is installed.

   j. Repair or replace all defective work and equipment.

   k. Make adjustments to the systems and instruct the Authority's personnel in the proper operation of the systems.

   l. Verify all terminations at transformers, equipment, control panels and enclosures.

   m. Test the grounding system using the three point fall in potential method.

   n. Test all 600 Volt wire insulation with a meg-ohm meter after installation. Make tests at not less than 500 Volts. Submit a written test report of the results to the Authority.

   o. Assist in the testing of the standby generator and automatic transfer switch. A licensed electrician shall be standing throughout the test to make adjustments to or test the equipment furnished under this section of the specifications and to open electrical enclosures. Applicant shall full load test the generator for four (4)

continuous hours using Applicant furnished load bank. Notify Authority 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.

END OF SECTION

SECTION 10 – SOLIDS HANDLING SUBMERSIBLE SEWAGE PUMPS

A. GENERAL

1. Individual solids handling submersible sewage pumps may only be used if the property or a portion of the property cannot be served by a gravity type system or a grinder pump system as specified in Section 8 due to low total dynamic head conditions. The proposed use of individual solids handling submersible sewage pumps will be reviewed on a case-by-case basis only after all other options are exhausted. These sewage pump systems must discharge to a gravity type sewer lateral.

2. Simplex (single) sewage pump units shall be used at residential property locations, and duplex (double) sewage pump systems shall be used at non-residential 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. Pump units shall be installed in either concrete or fiberglass-reinforced polyester basins for outdoor installations only. Indoor installations will not be permitted.

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

5. The location of the sewage pump package and control panel shall be determined by the Applicant.

6. The following NEMA ratings for the control panel 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-3R/4 or NEMA-4X
    c. Indoors – NEMA-12, NEMA-3R/4 or NEMA-4X

7. Sewage pump units shall be connected to a minimum 2-inch diameter force main meeting the requirements of Sections 5 and 7 as applicable.

B. MATERIALS AND EQUIPMENT

1. Sewage Pump Unit

    a. The pump unit shall consist of a centrifugal sewage type pump capable of a minimum flow of 10 gpm at a Total Dynamic Head (TDH) as determined by site conditions.

    b. Pumps shall be of sufficient horsepower to perform the intended work and shall be capable of handling 2-inch spherical solids.

c. Acceptable Pump Type

Manufacturer	Model
F.E. Myers Co.	WHR

d. Submersible Pump and Motor

(1) The sewage pump and direct-coupled motor are to be specifically designed and manufactured so they can operate completely submerged in wastewater. Electrical power cord is to be sealed by use of a cord grip, with individual conductors additionally sealed into the cord cap assembly with epoxy sealing compound, thus eliminating water entering the motor by following individual conductors inside the insulation. The cord cap shall be sealed into the motor housing with a Buna-N o-ring, providing an electrical connection which is completely watertight, yet may be easily removed for service. Wire sizing and voltage drop associated with run lengths over 100 feet shall comply with NEC rules.

(2) The common motor pump shaft shall be made of stainless steel and shall be heat shrunk into the die cast motor rotor.

(3) The pump-motor shaft shall be sealed by a single mechanical carbon and ceramic-faced seal.

(4) The shaft shall be supported by a lower ball bearing to take thrust and radial loads and by an upper bronze sleeve bearing to take radial load. 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 located in the windings 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) Submersible motor shall be constant speed (1,750 rpm), rated 1/2, 3/4 or 1 horsepower as required, suitable to operate on a 240 Volt, 60 HZ, single-phase service. The motors shall be of proper size to drive the pump at any point on the pump curve. 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 4 feet TDH, which is the minimum expected dynamic head to be found in this installation.

e. Rail Assembly

(1) A lift-out guide rail assembly provided by the pump manufacturer shall be included as part of the pump unit, which will permit easy removal and installation of the pump and lower check valve without the necessity of personnel entering the basin. Stainless steel or fiberglass guide rails with guide brackets and guide yokes of sufficient bearing strength to prevent binding shall bolt to the pump. The yokes shall mate over stainless steel guide rail support which shall be attached to and be supported by the basin sidewalls and the fixed attachment point on the floor of the basin. The guide rails may be supported by a fixed connection to the top of the basin provided that the connection is not part of the removable access cover and is not affected by the removal of the access cover. All bolts, brackets and fittings used in the lift-out assembly shall be of stainless steel.

(2) A stainless steel lifting chain or stainless steel lifting cable shall be securely fastened to the top of the pump and to the top of the basin to facilitate removal of the pump. The chain shall be a minimum of 1/4-inch welded link type to support the weight while removing and installing the pump.

f. Level Controls

(1) 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 the switch in the sump. The weight shall be above the float to effectively prevent sharp bends in the cord when the float operates. The float switch shall hang in the sump and be supported by a stainless steel bracket and cord snubber which will give positive support to the controls and allow flexibility in the setting of levels. All mounting structures and hardware shall be stainless steel.

(2) 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 (for duplex installations). The lowest float (pump turn-off) shall be set no lower than the top of the pump motor to prevent overheating of the motor during operation. The second float (pump turn-on) shall be set to provide a minimum operating volume (defined as the area between the pump turn-on and pump turn-off levels) of 60 gallons for residential installations and 175 gallons for non-residential installations. The third float (high water alarm) shall be set between the pump turn-on float and the influent pipe invert for residential installations. In the case of non-residential installations, the redundant pump turn-on float shall be set between the lead pump turn-on float and the high water alarm float.

g. Operation of System

(1) 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.

h. Corrosion Protection

(1) 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.

i. Junction Box

(1) 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 totally encapsulated in PVC so that no metal parts are exposed. The cover shall be connected to the body with stainless steel chain.

(2) 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.

(3) The hub shall be of a corrosion-resistant material and shall be of adequate size to accommodate the number of wires required to operate the pump.

(4) 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.

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

(6) 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.

2. Valves

a. Check Valves

(1) The pumps shall be equipped with factory-installed integral flapper-type check valve or 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.

(2) Working parts of flapper-type check valves shall be made of 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom for assured seating even at very low pressures.

(3) Ball check valves shall include a corrosion resistant non-metallic ball and rubber-sealed seat.

b. Ball Valve

(1) The pump shall be equipped with an isolation ball valve which shall be PVC (Schedule 80), 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 finish 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 compatible with 1-1/4-inch PVC pressure pipe, Schedule 80. Valves shall be manufactured by Flowmatic Corporation or approved equal.

d. Anti-Siphon Valve

(1) The basin assembly shall be arranged for quick and easy acceptance of an anti-siphon valve in the field when required. A riser pipe shall extend from a tee installed along the pump discharge pipe between the check valve and the shutoff valve to within two feet of the surface of the basin. If an anti-siphon valve is not needed, the riser shall be capped.

(2) When required, an anti-siphon valve shall be offered to assemble to the riser pipe. The valve assembly shall include all materials required to complete the assembly. The anti-siphon valve shall mount horizontally and shall not interfere with pump removal or installation. The anti-siphon valve shall be installed such that the direction of flow arrow points back towards the pump. In this way, flow will be prevented from cycling back into the basin during pump operation, but the valve will open to allow air into the discharge piping to disrupt siphoning when the pump is not in operation.

(3) Anti-siphon valves shall be swing type check valves constructed of PVC Type I, ASTM D 1784 material. Valves shall have maintenance free seal unit construction with EPDM seat and weighted disc. Valves shall have external flow arrow direction designation. Valves shall be pressure rated to 150 psi for water in full flow (open) position and to 75 psi in back pressure (closed) position. Valves shall be manufactured by Spears or approved equal.

e. Flexible Discharge Coupling

(1) 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.

3. Basins

a. General

(1) Either concrete 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 inches above finished grade to prevent infiltration of surface water. The basin shall be located in an area not subject to flooding or ponding.

(2) For residential installations, a minimum net effective total operating volume of 60 gallons between the pump shut-off elevation and the invert of influent line from the connected structure shall be provided for residential installations. For non-residential installation, a minimum total operating volume of 250 gallons, or 24 hours of storage, whichever is greater, shall be provided. If anticipated sewage flow exceeds 250 gallons per day, backup calculations for flow must be reviewed and approved by the Authority. Non-residential storage requirements may be reduced by provision of a back-up power source and a spare pump.

(3) A non-corrosive sign shall be attached to the basin cover indicating that the pump basin is a hazardous area where confined space entry procedures are required.

(4) The basin shall be provided with an anti-flotation collar to prevent flotation of the basin at high groundwater elevation when the basin is empty.

(5) The minimum acceptable basin diameter is 36 inches.

(6) In all cases, the Applicant shall confirm that a basin of sufficient volume and area is provided to allow for effective pumping system operation and maintenance.

(7) 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

(8) The basin shall be free of defects and shall provide watertight pipe and conduit penetrations.

b. Concrete Basin

(1) Precast reinforced concrete chambers shall conform to ASTM Specifications C-478 (Latest Revision) and shall be of watertight construction. Joints between sections shall be provided with preformed plastic joint sealing material such as Ram-Nek as manufactured by K.T. Snyder Co.

(2) 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: bitumen - ASTM D-4-52, Inert Ash Mineral AASHTO T-111-42, Volatile Matter ASTM D-6-39T.

(3) Mixing water for mortar and concrete shall be clean and free from oil, acid, alkali, sewage or other deleterious substances.

(4) Portland cement shall conform to ASTM Specification C-150, Type I. Where specifically authorized or required, high early strength (Type 3) shall be used.

(5) Concrete shall have a compressive strength of not less than 3,000 psi after 28 days (tests to be in accordance with ASTM Specification C-39, Latest Revision). Aggregate shall be of quality, gradation and proportions as approved by Engineer after submission of test results on the design mix. Each cubic yard of concrete shall contain no less than 6 bags of Portland cement. Slump of concrete shall not exceed 4 inches. Ready mixed concrete shall conform to ASTM Specification C-94 (Latest Revision).

(6) Reinforcing steel shall be clean and free from rust, scale or coatings that will reduce bond.

(7) The exterior of concrete basins shall be coated with bitumastic no less than 20 mils in thickness. The coating shall be Bitumastic Super Service Black as manufactured by Koppers or approved equal.

(8) The interior of concrete basins shall be lined with PVC or HDPE to prevent hydrogen sulfide corrosion as specified in Section 6.

(9) Concrete basins shall be equipped with access cover and frame assembly of extruded aluminum with aluminum or stainless steel fittings. Each cover shall be provided with a lifting handle, safety catch to hold cover and locking hasps. The cover surface shall be of a non-skid checkered pattern and shall be provided with a keyed lock in traffic areas and a padlock in all other areas. The

padlock shall be of the solid corrosion proof case design with hardened steel shackle and zinc coating. In paved/traffic areas, basins shall meet the loading requirements of H-20 or H-25 as appropriate.

c. Fiberglass Basin

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

(2) 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.

(3) 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.

(4) One minimum 4-inch diameter inlet hub (larger if necessary) shall be provided for each grinder pump unit. The inlet hub shall be suitable for use with 4-inch or 6-inch Schedule 40 PVC pipe or 6-inch or larger SDR 35 pipe. Hubs shall be field installed to meet field conditions.

(5) One discharge coupling, as specified under VALVES in this section, shall be provided for the sewage pump unit. Internal piping shall be provided to this discharge coupling. The depth of the discharge coupling (crown of coupling to finish grade) shall be no less than 42 inches.

(6) 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.

(7) Provision of bollards to protect the structure is recommended in areas where there is potential for traffic.

4. 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 any other items required for proper control of the centrifugal type pump unit. The incoming wires/conduit shall be provided with a water tight seal.

(2) The enclosure shall contain an inner back panel for mounting of the internal components and shall have a hinged door. The enclosure shall be NEMA rated for its applicable location as specified under Article A.6. of this section. The enclosure material shall be as follows:

Location	Material
Indoors	Painted steel or Thermoplastic
Outdoors	Stainless Steel, Thermoplastic or Ultraviolet Stabilized Fiberglass

Outdoor enclosures shall have combination closing latch and locking hasp.

(3) Pilots and indicators when exposed on control panel shall be NEMA-4X for outdoor applications and NEMA-1/12 for indoor applications. Indicators shall be LED style.

(4) The control panel shall either be fitted with an integral red tamperproof alarm light on the exterior of the panel or a separate alarm mounted inside the occupied portion of the building to be served. The internal alarm shall either be an audible alarm or a light type indicator.

(5) The lamp shall be 40 watt medium base type and be easily replaceable from within the enclosure. The light shall be provided with a lamp test switch mounted within the panel. The alarm light shall be flashing type activated by high water in the wet well and shall go out when the condition ceases.

(6) A silkscreen or phenolic 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) The circuit shall have a two-pole circuit breaker for motor overload and short-circuit protection. Also, there 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 600V XHHW for wet locations and THWN for dry/damp locations

b. Control Panel Supports

(1) The control panel support for Property Owner installations shall consist of 2-inch diameter stainless steel posts with cap or 3-inch x 3-inch x 3/16-inch gauge structural steel tubing (minimum yield strength 46,000 psi), all horizontal support channels and panel connection hardware, coated with baked-on epoxy ASA 61 paint or of galvanized steel. The length of pipe or post shall be embedded in a concrete foundation to the dimensions shown on the detail drawings. The top of the channel shall be permanently sealed from the elements. A double stand of 1-5/8-inch Unistrut metal framing may also be used to secure the control panel to a concrete surface. Channel frames, post bases and fittings shall be steel with a galvanized finish.

C. INSTALLATION

1. The sewage pump unit and control panel shall be installed at a location to be determined by the Property Owner or Applicant. Generally, the unit will be located in close proximity to the existing sewer service line near the building. The control panel may either be mounted to the wall of the building or mounted to a post.

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

3. All pump basins shall be installed on a bed consisting of AASHTO No. 8 (or PennDOT No. 1B) coarse aggregate and shall have a concrete anti-flotation collar poured around the bottom that shall prevent flotation when there is high groundwater to top of basin and the basin is dewatered. The remaining excavated area shall be backfilled with excavated material containing no soil lumps, stones, concrete or foreign objects greater than one inch in maximum dimension. The top of the pump unit or basin shall project a minimum of 4 inches above grade and graded in a manner to slope away from the unit to prevent ingress of surface water. In driveway or sidewalk areas, top of 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.

6. A minimum 18-inch vertical separation shall be maintained between all pump electrical supply and control wiring and the sanitary sewer service line. Magnetic warning tape shall be installed approximately one foot above the wiring.

D. TESTING AND INSPECTION

1. It is incumbent upon the Applicant to notify the Authority a minimum of 24 hours in advance to inspect the pump after installation is completed. The Applicant 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.

2. Hydrostatic test pressure of 50 psi, or 150 percent of the normal working pressure, whichever is greater, shall be applied to the force main in accordance with AWWA C-600. There shall be no drop in pressure for a period of 15 minutes. Refer to Sections 5 and 7 for additional requirements.

3. 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

4. The pipe trench will be backfilled only after the inspection and testing has been completed.

5. The pump shall be run through a normal pump cycle test 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:

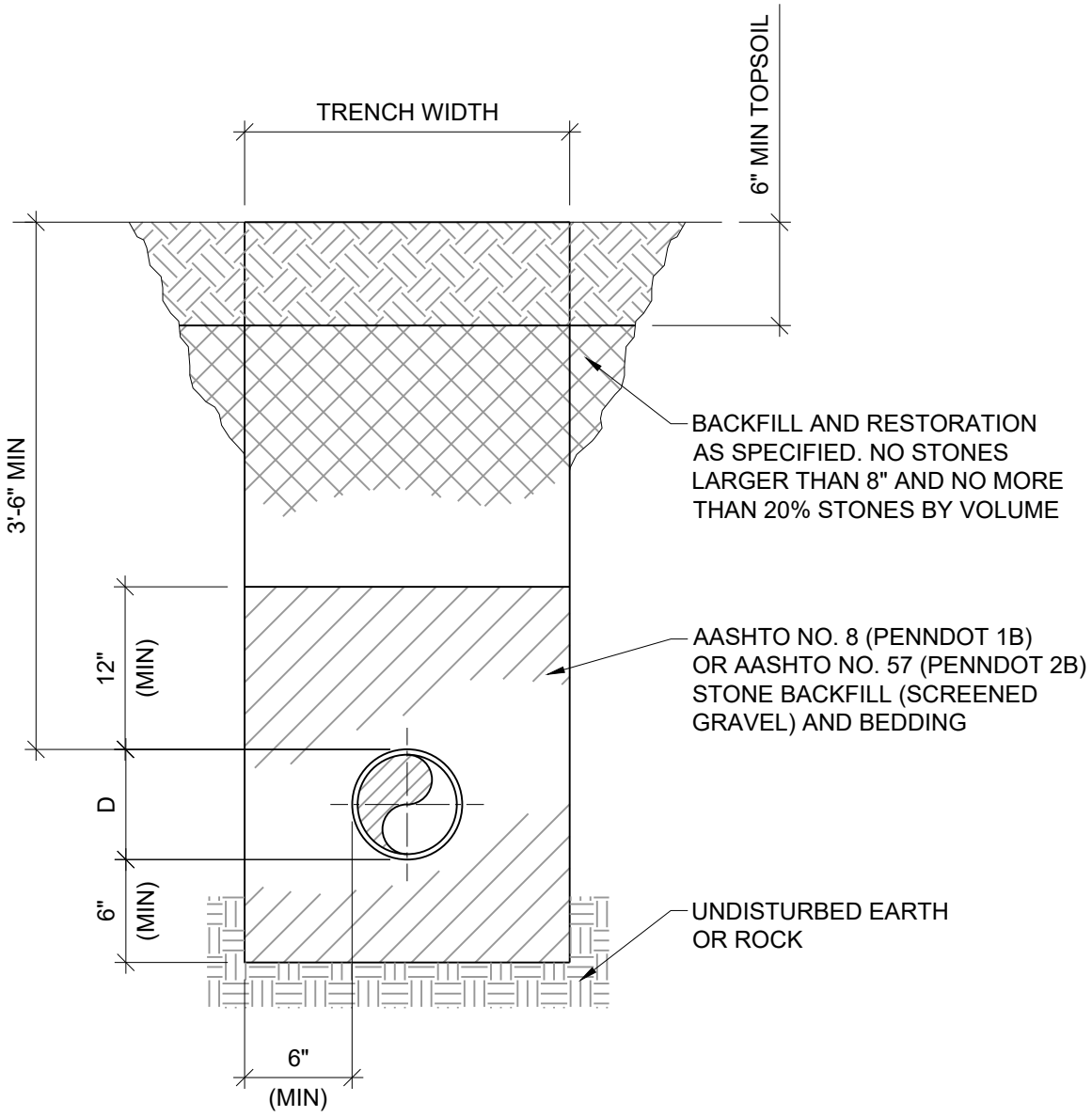
20 Fiberglass Basin for Typical Individual Pump
21 Concrete Basin for Typical Individual Pump
22 Wall Mounted Control Panel (External Installation)
23 Post Mounted Control Panel (External Installation)
24 Metal Channel Framing for Control Panel Mounted on a Concrete Structure
29 Typical Individual Solids Handling Sewage Pump Service Line Schematic to Gravity Sewer

END OF SECTION

APPENDIX A
DETAIL DRAWINGS INDEX

No. Description

1 ..... Right-of-Way Restoration
2 ..... Concrete Encasement
3 ..... Pavement Restoration
4 ..... Lateral
5 ..... Lateral Riser
6 ..... Precast Concrete Manhole
7 ..... Precast Drop Connection to Manhole
8 ..... Cast In Place Base New Manhole Over Existing Sewer
9 ..... New Sewer to Existing Manhole Connection
10..... Internal Drop Connection to Manhole
11..... Typical Service Line - Profile
12..... Typical Service Line - Plan
13..... Typical Individual Grinder Pump Service Line Schematic to Gravity Sewer
14..... Typical Individual Grinder Pump Service Line Schematic to Low Pressure Sewer
15..... Typical Lateral Connection to Low Pressure Force Main
16..... Air Release Valve and Chamber
17..... Force Main Connection to Manhole
18..... Low Pressure Sewer Valve and Cleanout Manhole
19..... Low Pressure Sewer Terminal Cleanout Manhole
20..... Fiberglass Basin for Typical Individual Pump
21..... Concrete Basin for Typical Individual Pump
22..... Wall Mounted Control Panel (External Installation)
23..... Post Mounted Control Panel (External Installation)
24..... Metal Channel Framing for Control Panel Mounted on a Concrete Structure
25..... Thrust Blocks for Horizontal Bends and Lower Vertical Bends
26..... Restrained DI Pipe Length
27..... Precast Concrete Flow Monitoring Manhole
28..... Sewer Main Pipe Casing
29..... Typical Individual Solids Handling Sewage Pump Service Line Schematic to Gravity Sewer
30..... Sanitary Sewer Vent/Cleanout in Driveway or Traffic Area
31a..... Typical Cast Iron Standard Manhole Frame & Cover Detail
31b..... Typical Cast Iron Standard Manhole Frame & Cover Detail
32..... Grease Trap Detail

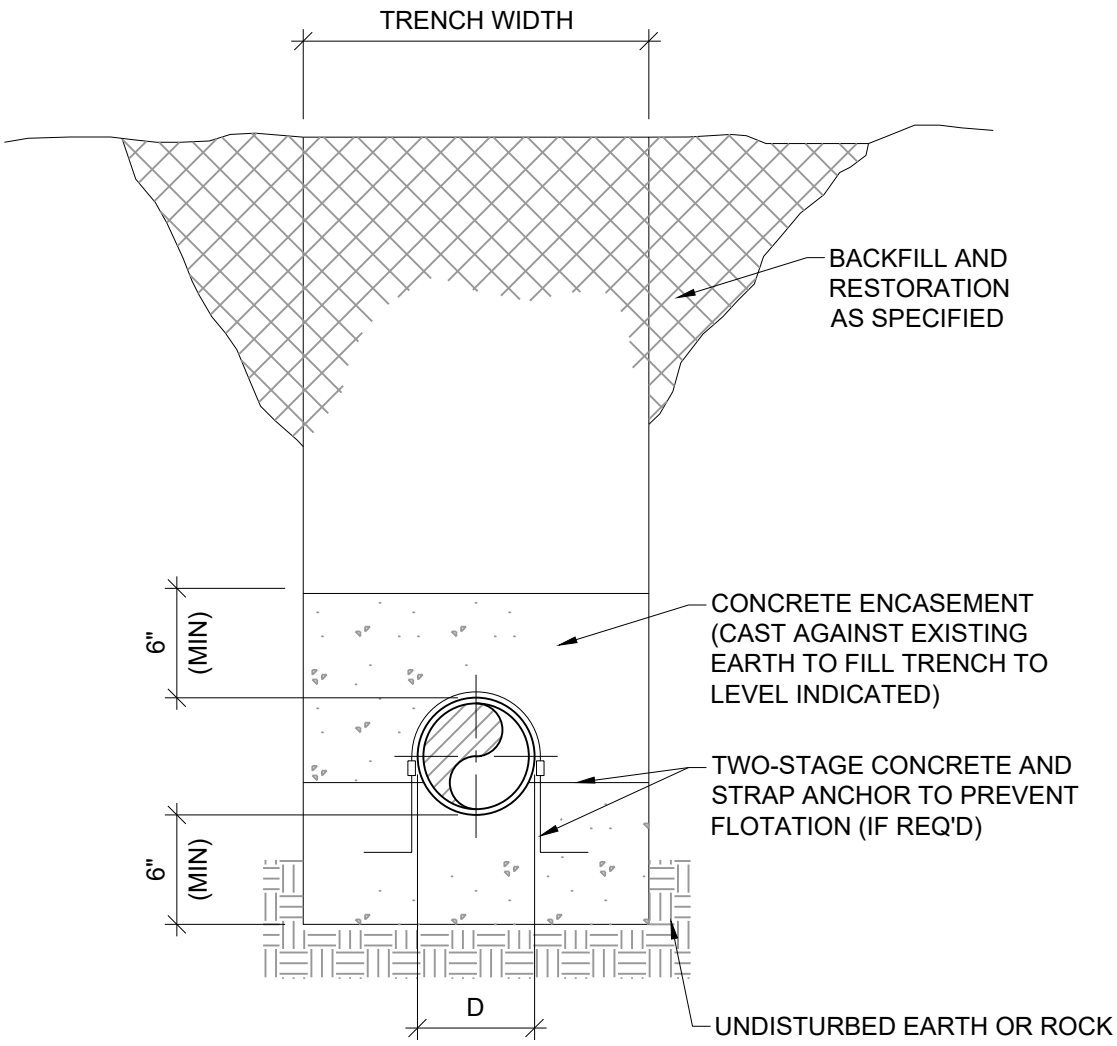


NOTES:

1. 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).

1 RIGHT-OF-WAY RESTORATION

Scale: NONE



NOTES:

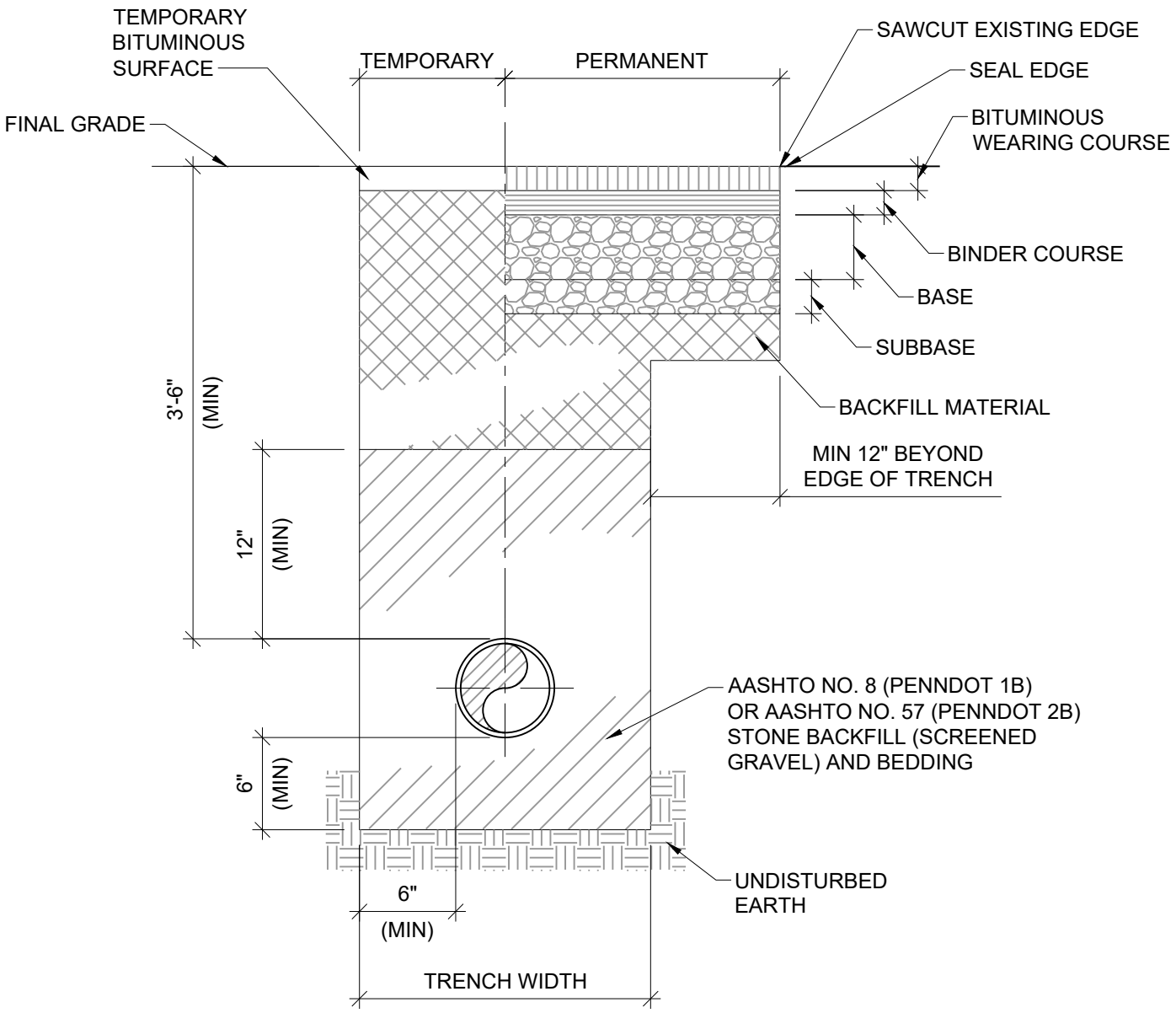
1. **TRENCH SIDE SLOPES SHALL BE IN ACCORDANCE WITH OSHA REQUIREMENTS. BEGIN SIDE SLOPES. IF USED, APPROXIMATELY 18" ABOVE TOP OF PIPE (TYPICAL ALL BEDDING TYPES).**

1

CONCRETE ENCASEMENT

Scale: NONE

ENTECH ENGINEERING 1.800.825.1372 www.entecheng.com	EAST COCALICO TOWNSHIP AUTHORITY CONRETE ENCASEMENT	DATE: 09/19/25	SCALE: AS NOTED
		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT002
		APPROVED BY: AGS	



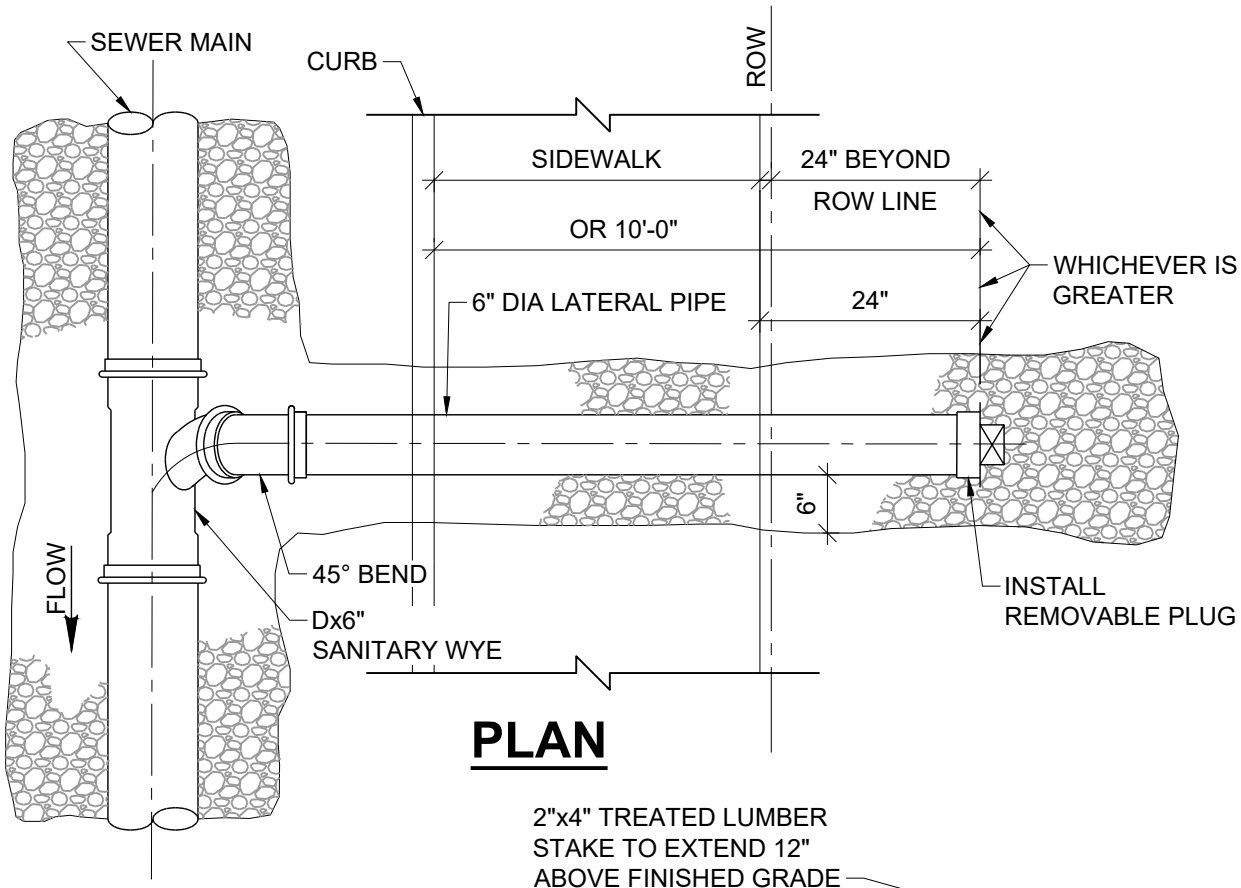
NOTES:

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 EAST COCALICO TOWNSHIP SUBDIVISION AND LAND DEVELOPMENT ORDINANCE.

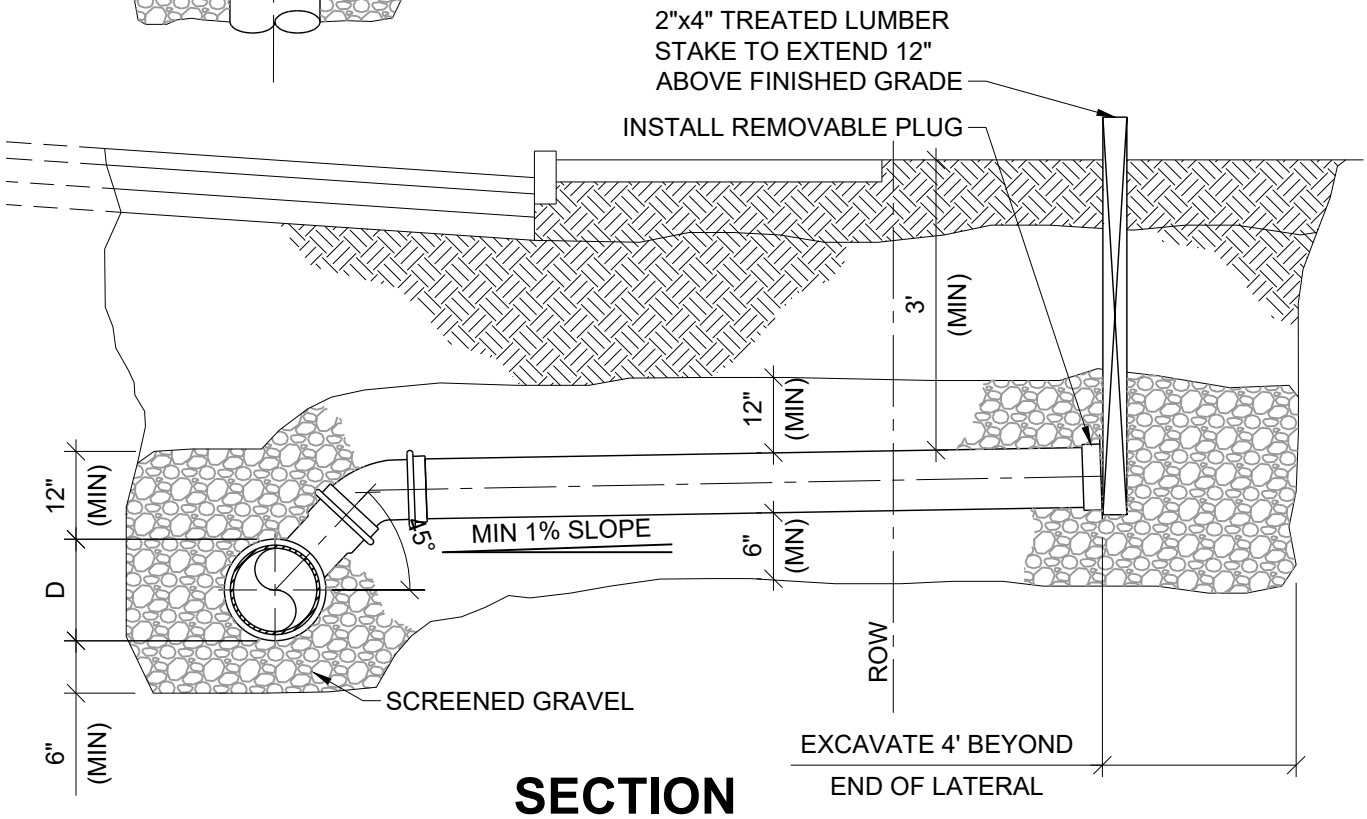
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PAVEMENT RESTORATION

Scale: NONE



PLAN



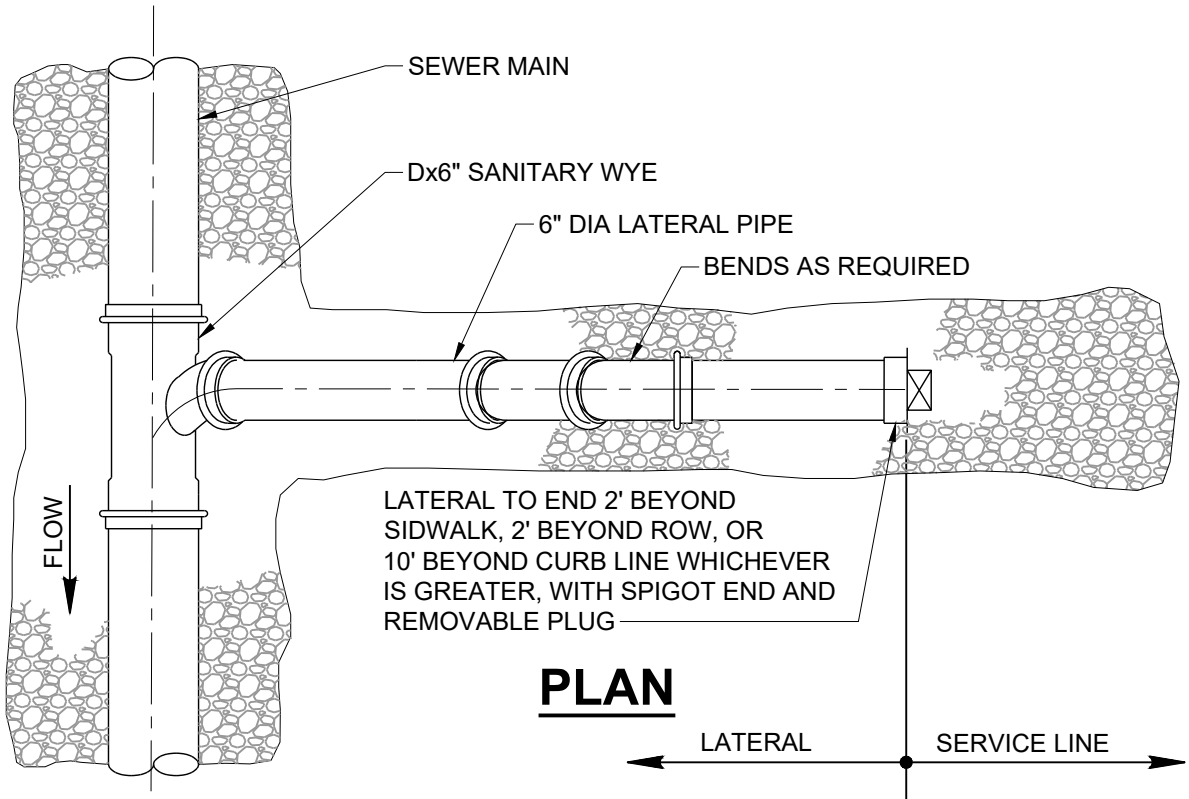
SECTION

1

LATERAL

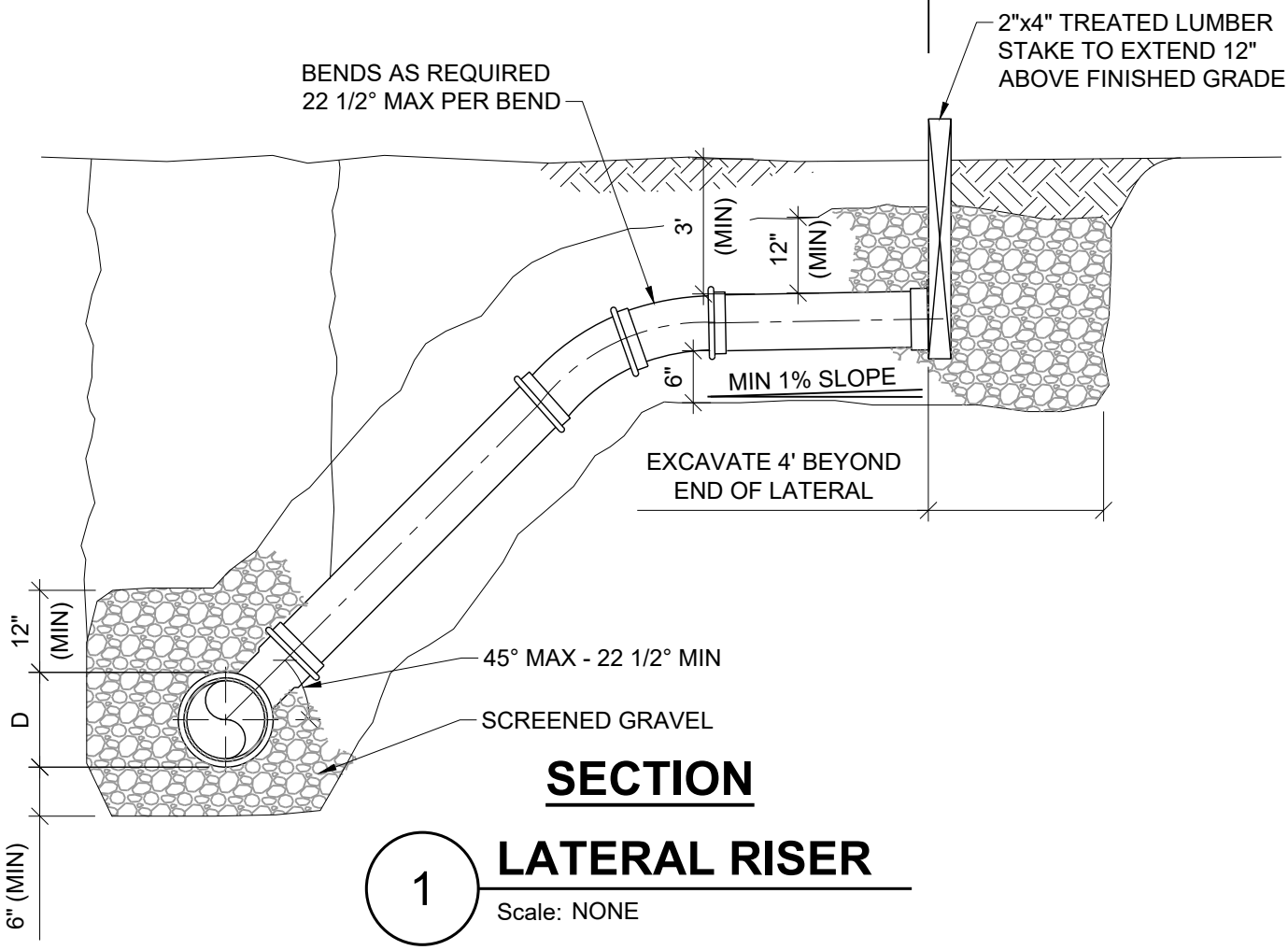
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		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT004
		APPROVED BY: AGS	



PLAN

LATERAL — SERVICE LINE

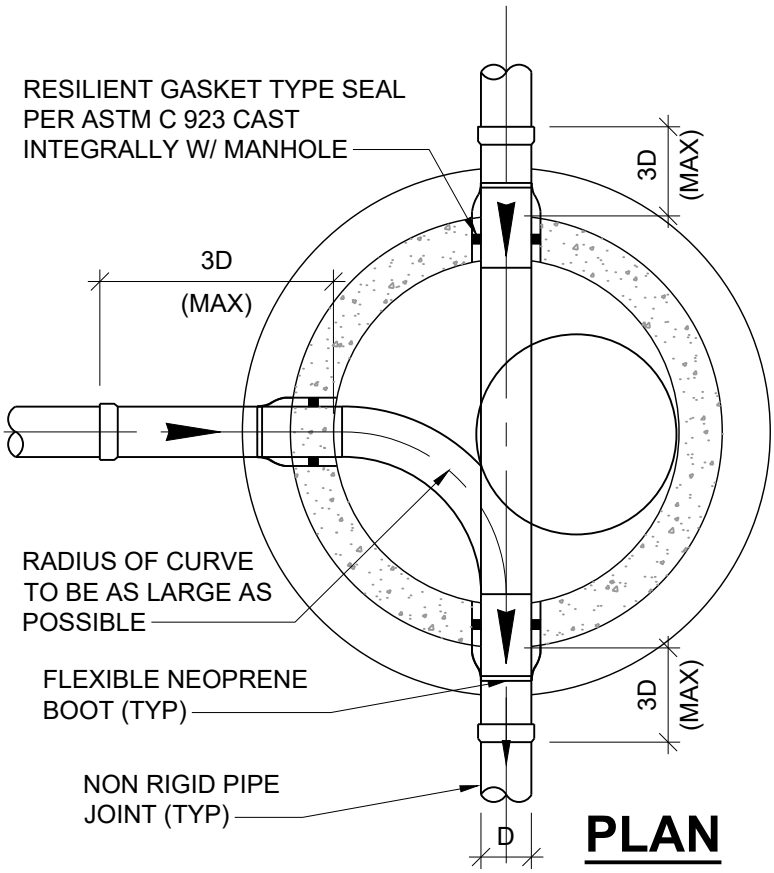


SECTION

1 **LATERAL RISER**

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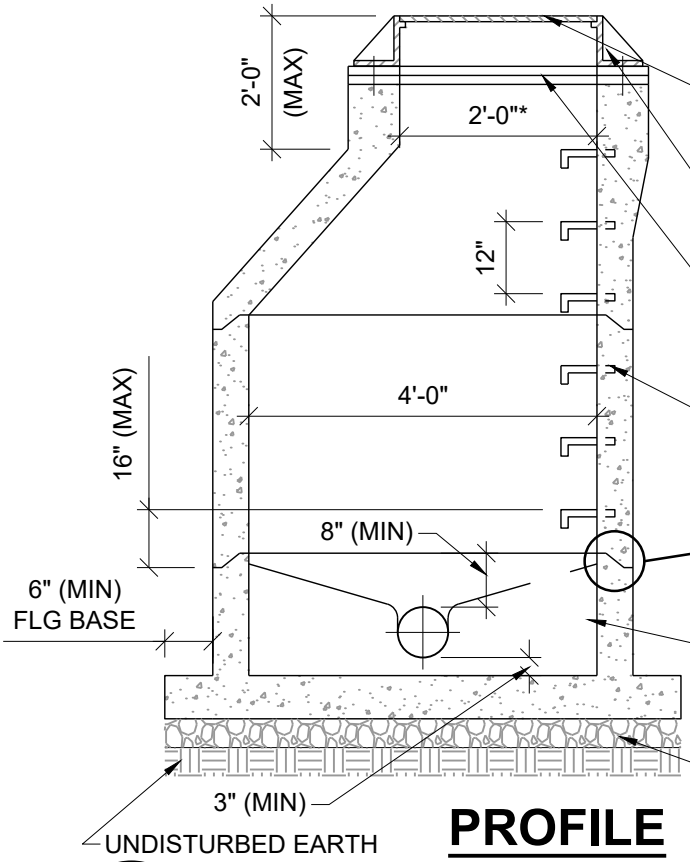
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		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT005
		APPROVED BY: AGS	



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 REQUIRED.**
10. **CAULK ANNULAR SPACE WITH NON-SHRINK, CORROSION RESISTANT CEMENT GROUT.**



PROFILE

1 PRECAST CONCRETE MANHOLE

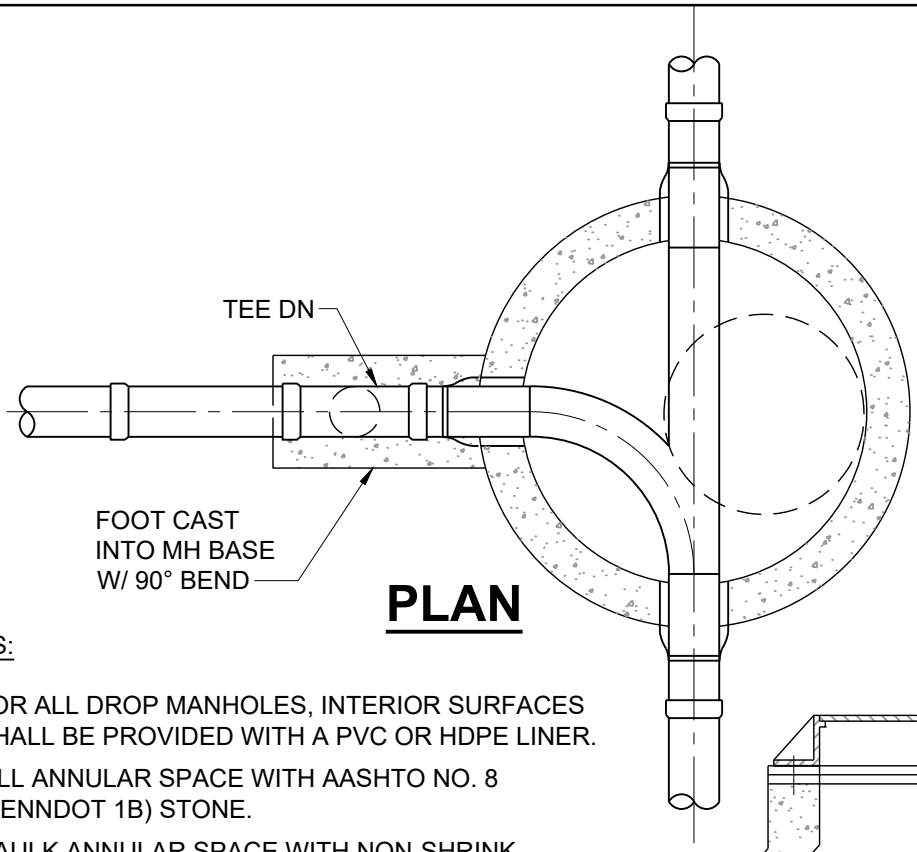
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EAST COCALICO TOWNSHIP AUTHORITY

PRECAST CONCRETE MANHOLE

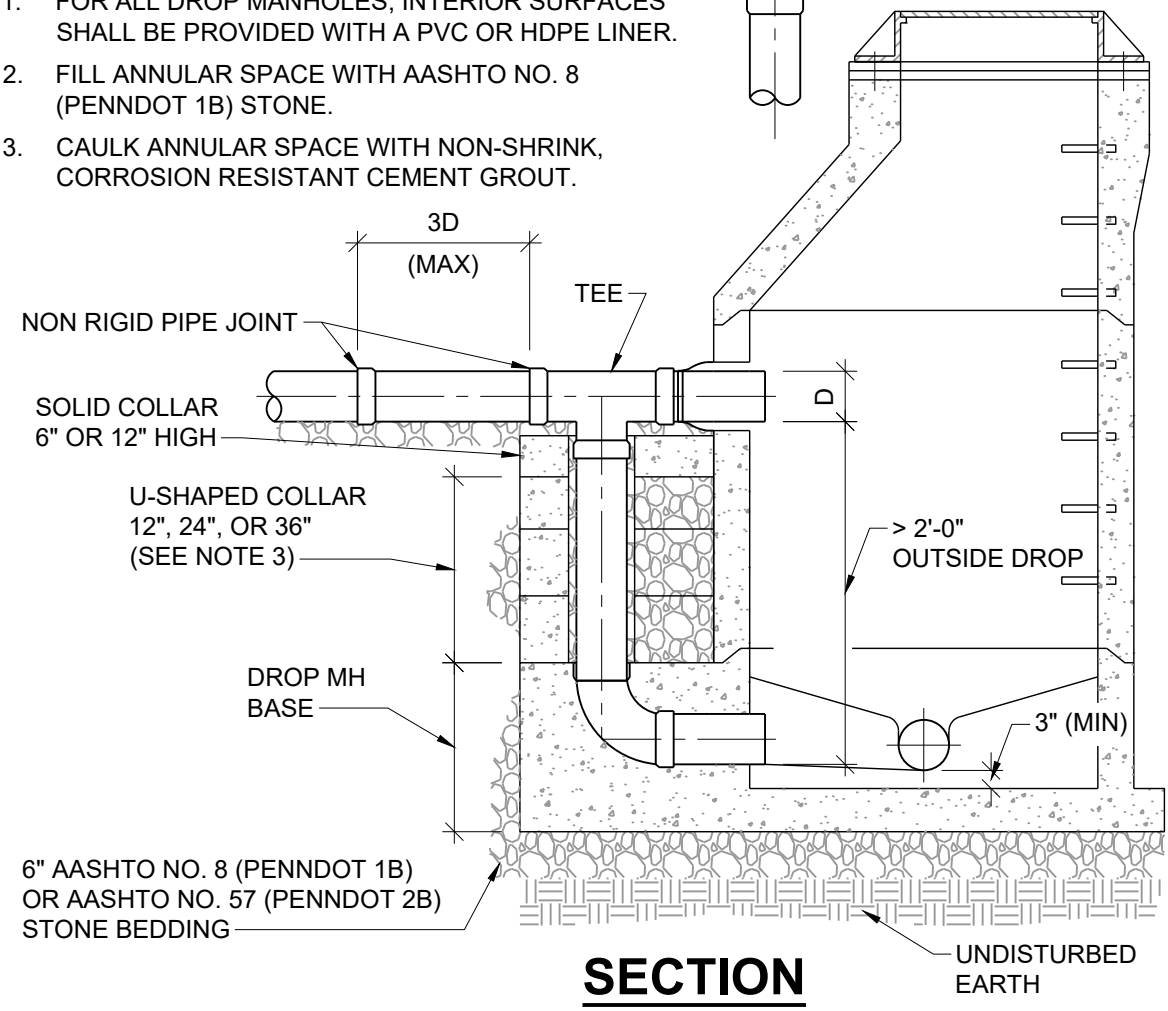
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PREPARED BY: ARA	PROJECT NO. 4673.030
CHECKED BY: AGS	DRAWING NO. ESWDT006
APPROVED BY: AGS	



PLAN

NOTES:

1. FOR ALL DROP MANHOLES, INTERIOR SURFACES SHALL BE PROVIDED WITH A PVC OR HDPE LINER.
2. FILL ANNULAR SPACE WITH AASHTO NO. 8 (PENNDOT 1B) STONE.
3. CAULK ANNULAR SPACE WITH NON-SHRINK, CORROSION RESISTANT CEMENT GROUT.

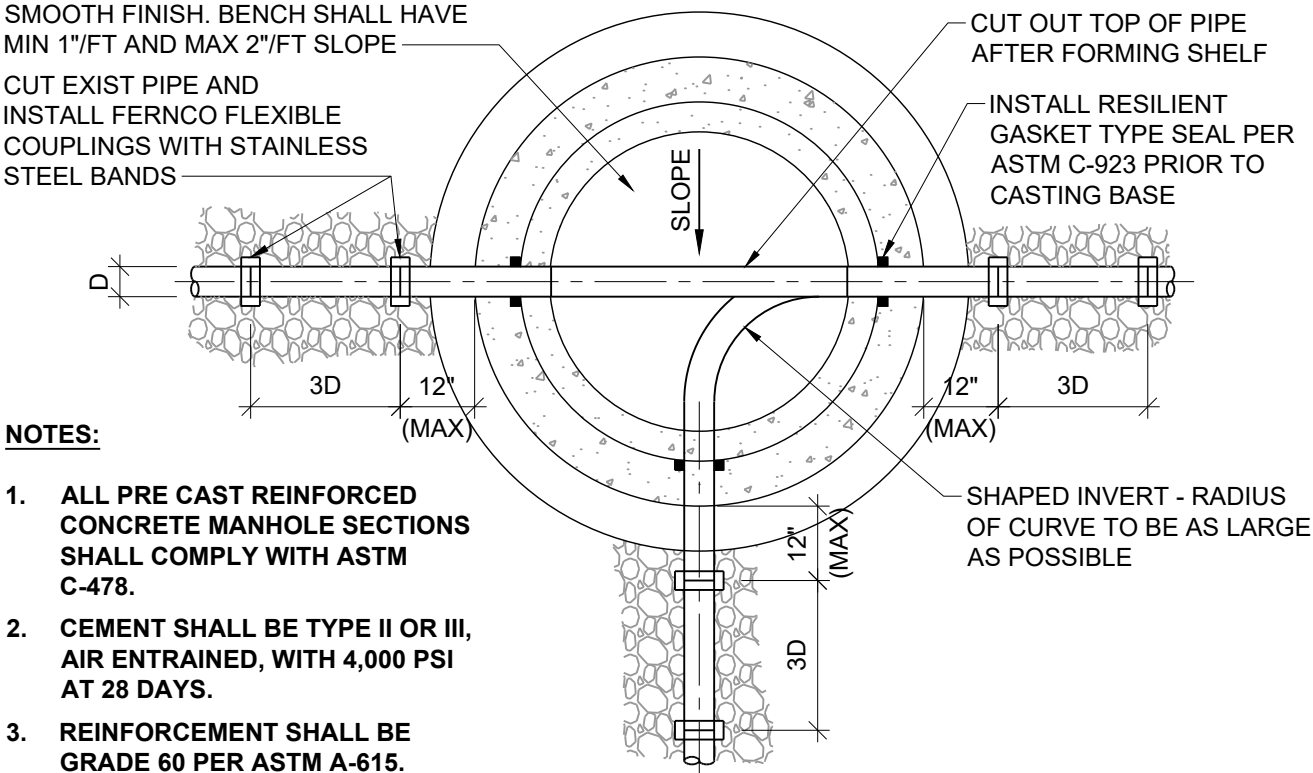


SECTION

1 PRECAST DROP CONNECTION TO MANHOLE

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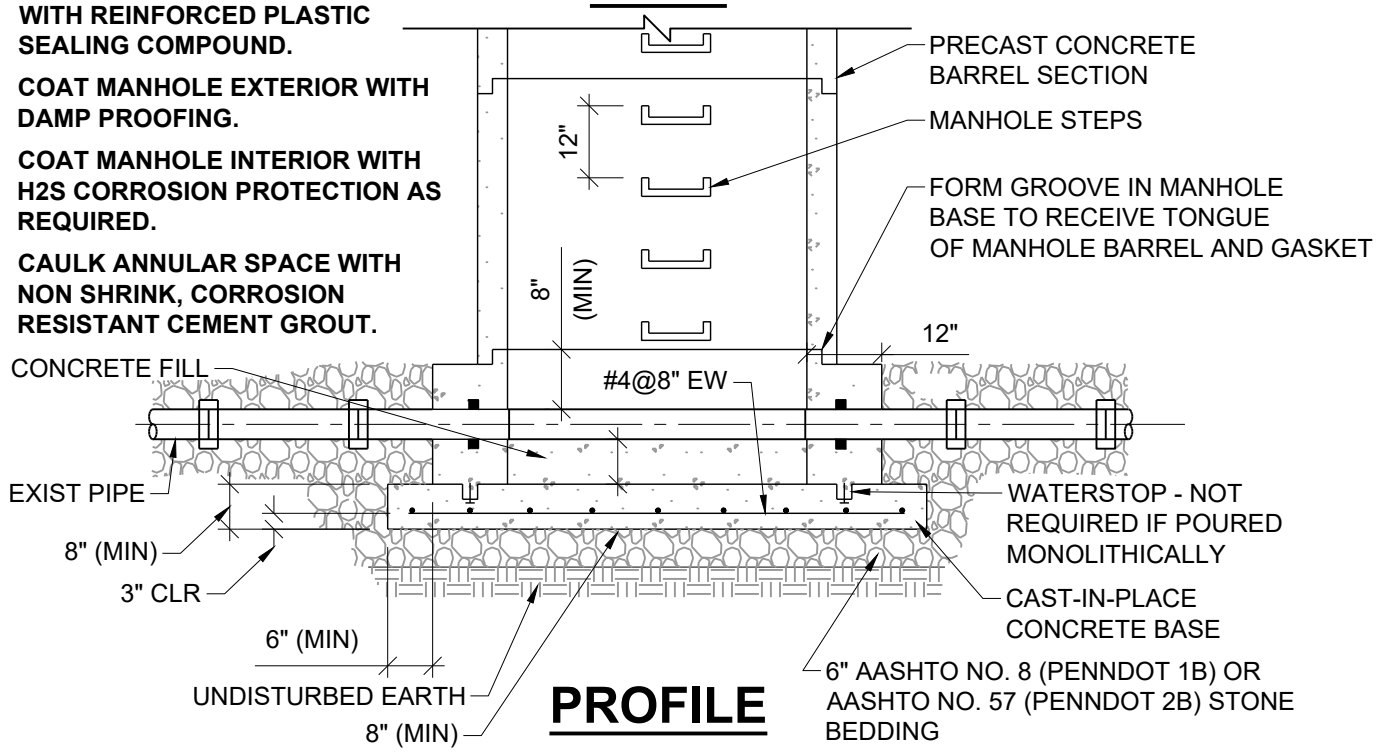
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		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT007
		APPROVED BY: AGS	



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. **ALL JOINTS SHALL BE SEALED WITH REINFORCED PLASTIC SEALING COMPOUND.**
5. **COAT MANHOLE EXTERIOR WITH DAMP PROOFING.**
6. **COAT MANHOLE INTERIOR WITH H2S CORROSION PROTECTION AS REQUIRED.**
7. **CAULK ANNULAR SPACE WITH NON SHRINK, CORROSION RESISTANT CEMENT GROUT.**

PLAN



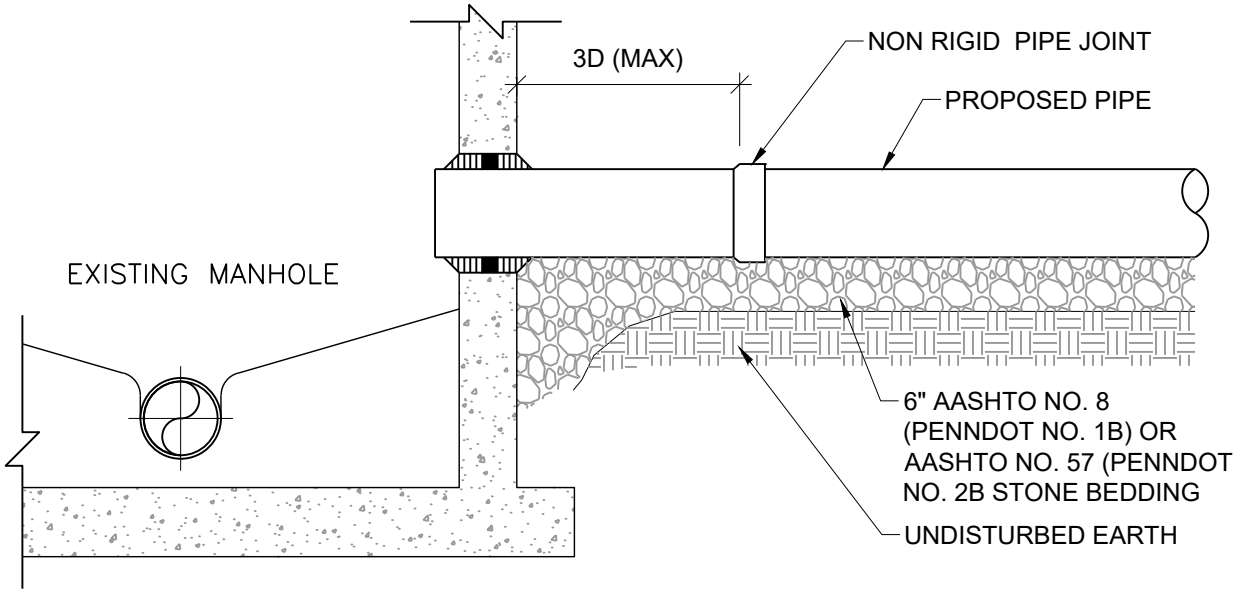
PROFILE

CAST IN PLACE BASE NEW MANHOLE OVER EXISTING SEWER

1

Scale: NONE

ENTECH ENGINEERING 1.800.825.1372 www.entecheng.com	EAST COCALICO TOWNSHIP AUTHORITY CAST IN PLACE BASE NEW MANHOLE OVER EXISTING SEWER	DATE: 09/19/25	SCALE: AS NOTED
		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT008
		APPROVED BY: AGS	



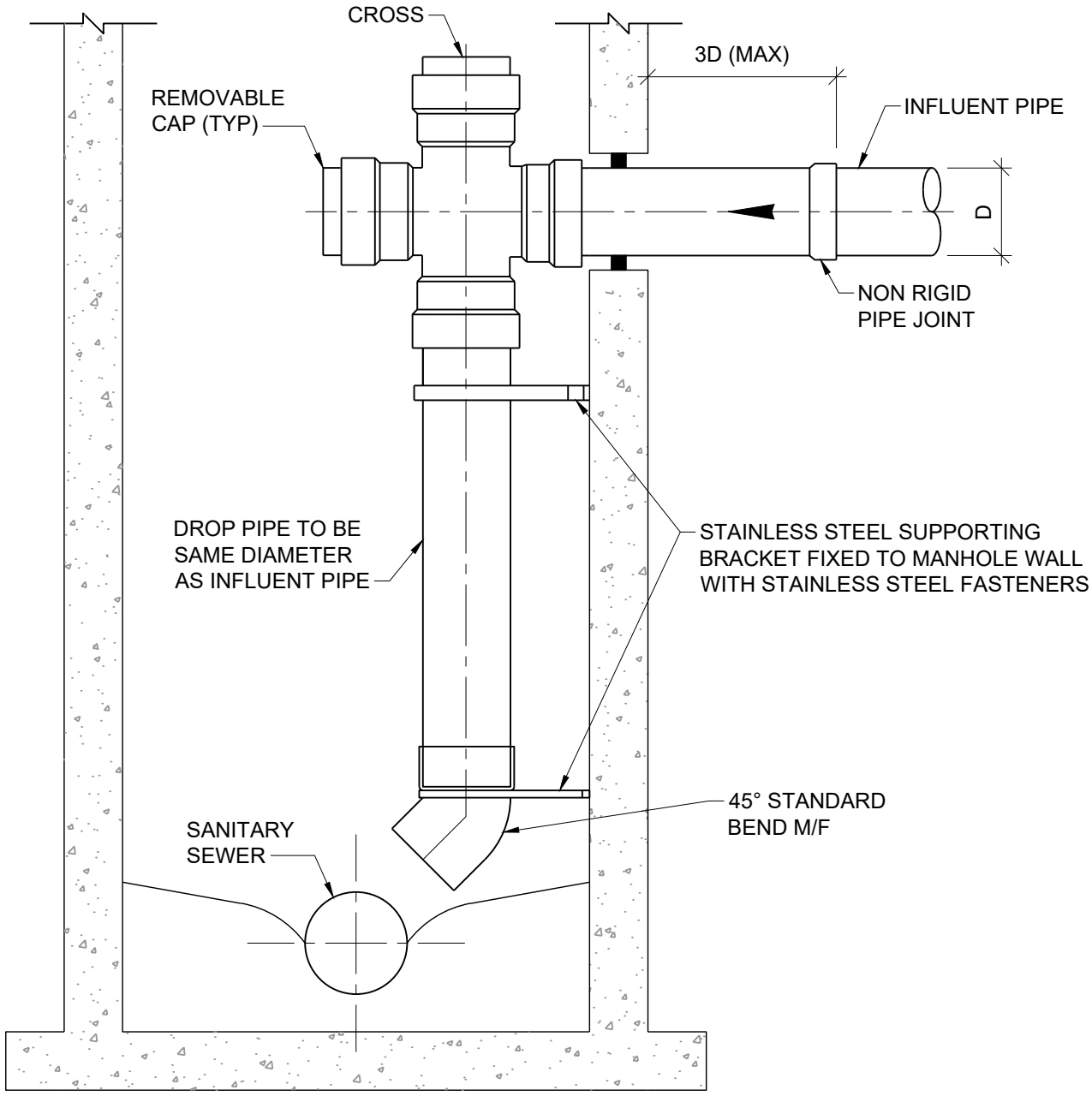
NOTES:

1. CUT HOLE IN EXISTING MANHOLE WITH CORING MACHINE.
2. INSTALL RESILIENT GASKET TYPE SEAL PER ASTM C-923
3. CAULK ANNULAR SPACE WITH NON-SHRINK CORROSION RESISTANT CEMENT GROUT.

FLEXIBLE CONNECTION AT MANHOLE

1 NEW SEWER TO EXISTING MANHOLE CONNECTION

Scale: NONE



NOTES:

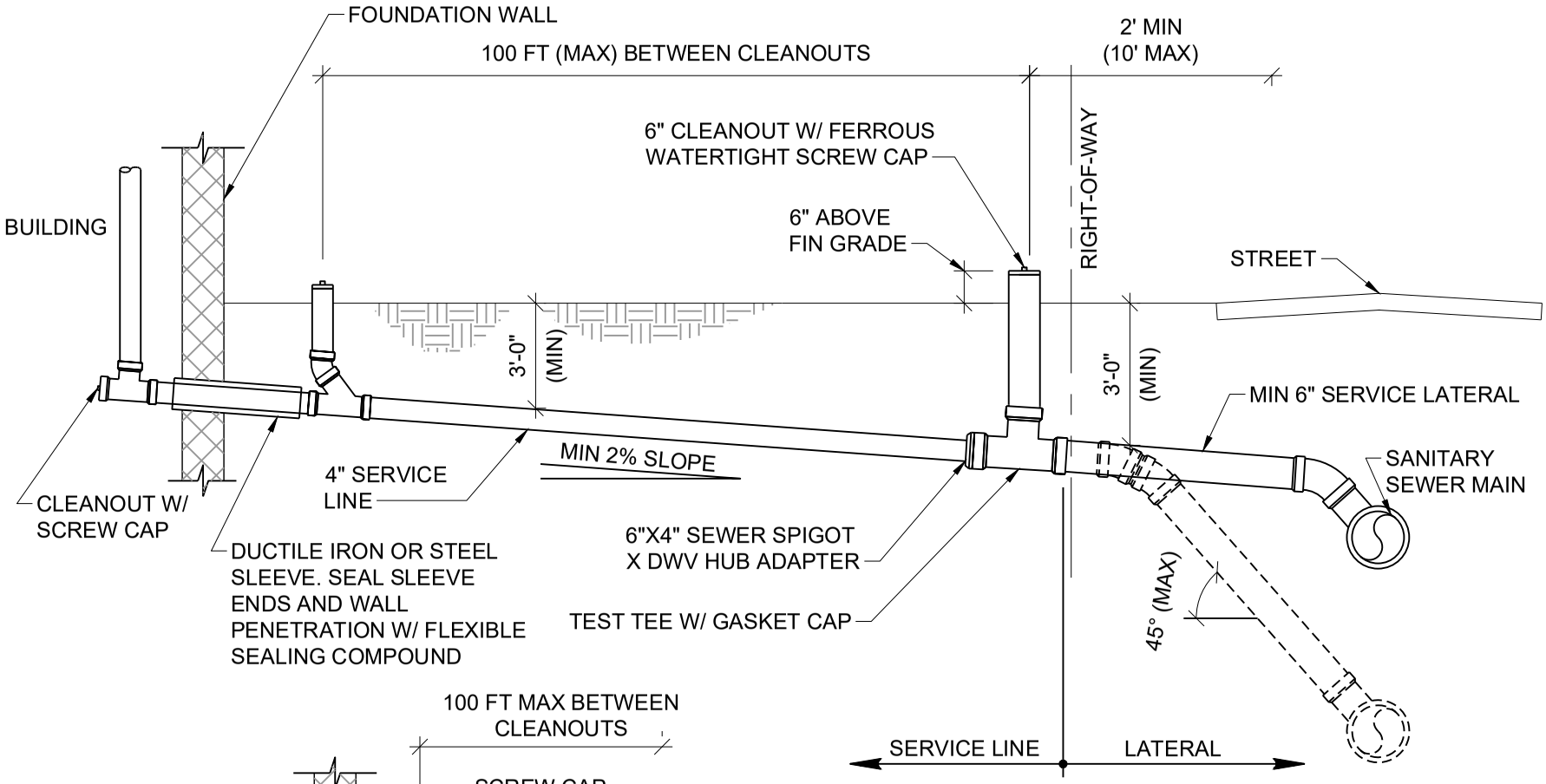
1. MANHOLE INTERIOR WITH H2S CORROSION PROTECTION SHALL BE PROVIDED AS REQUIRED.
2. MINIMUM INTERNAL DIAMETER OF MANHOLE SHALL BE 5 FEET.

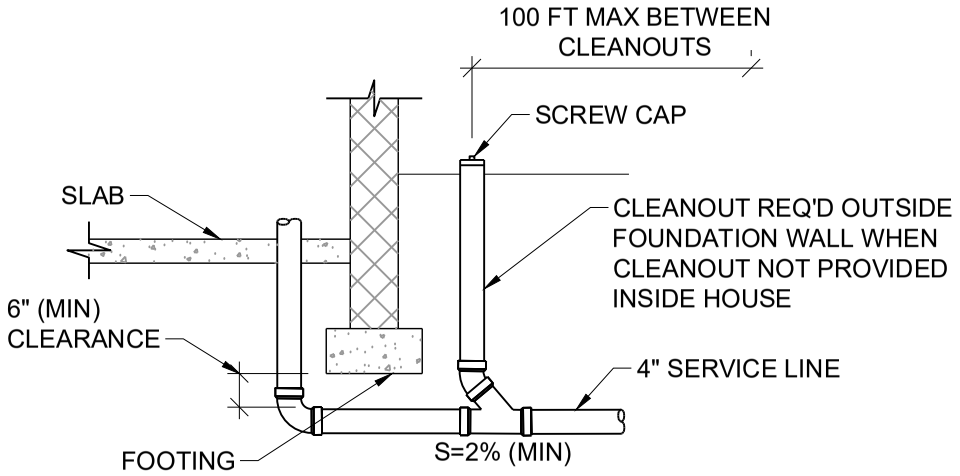
1

INTERNAL DROP CONNECTION TO MANHOLE

Scale: NONE

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		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT010
		APPROVED BY: AGS	





NOTES:

1. **PROVIDE 6" OF AASHTO NO. 8 (PENNDOT NO. 1B) OR AASHTO NO. 57 (PENNDOT NO. 2B) STONE BELOW PIPE AND 12" ABOVE ENTIRE LENGTH OF PIPE**

1

TYPICAL SERVICE LINE - PROFILE

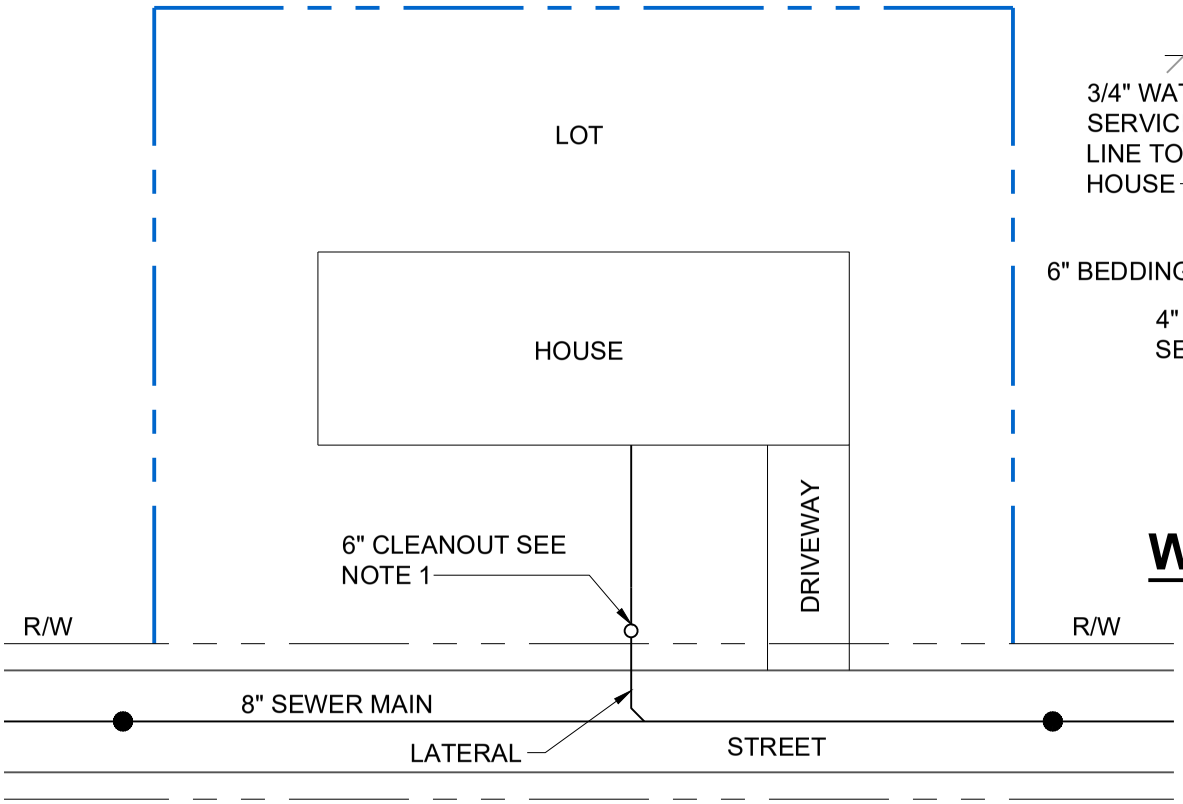
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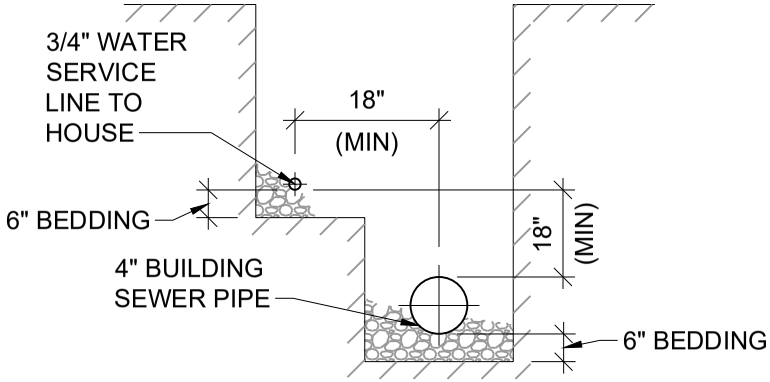
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PROJECT NO. 4673.030
DRAWING NO. ESWDT011
DATE: 09/19/25
PREPARED BY: ARA
CHECKED BY: AGS
APPROVED BY: AGS

EAST COCALICO TOWNSHIP AUTHORITY

TYPICAL SERVICE LINE - PROFILE

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TYPICAL TRENCH FOR WATER AND SEWER PIPE

NOTES:

1. **ALL 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 CLEANOUT IN YARD AREA.**
3. **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.**

1

TYPICAL SERVICE LINE - PLAN

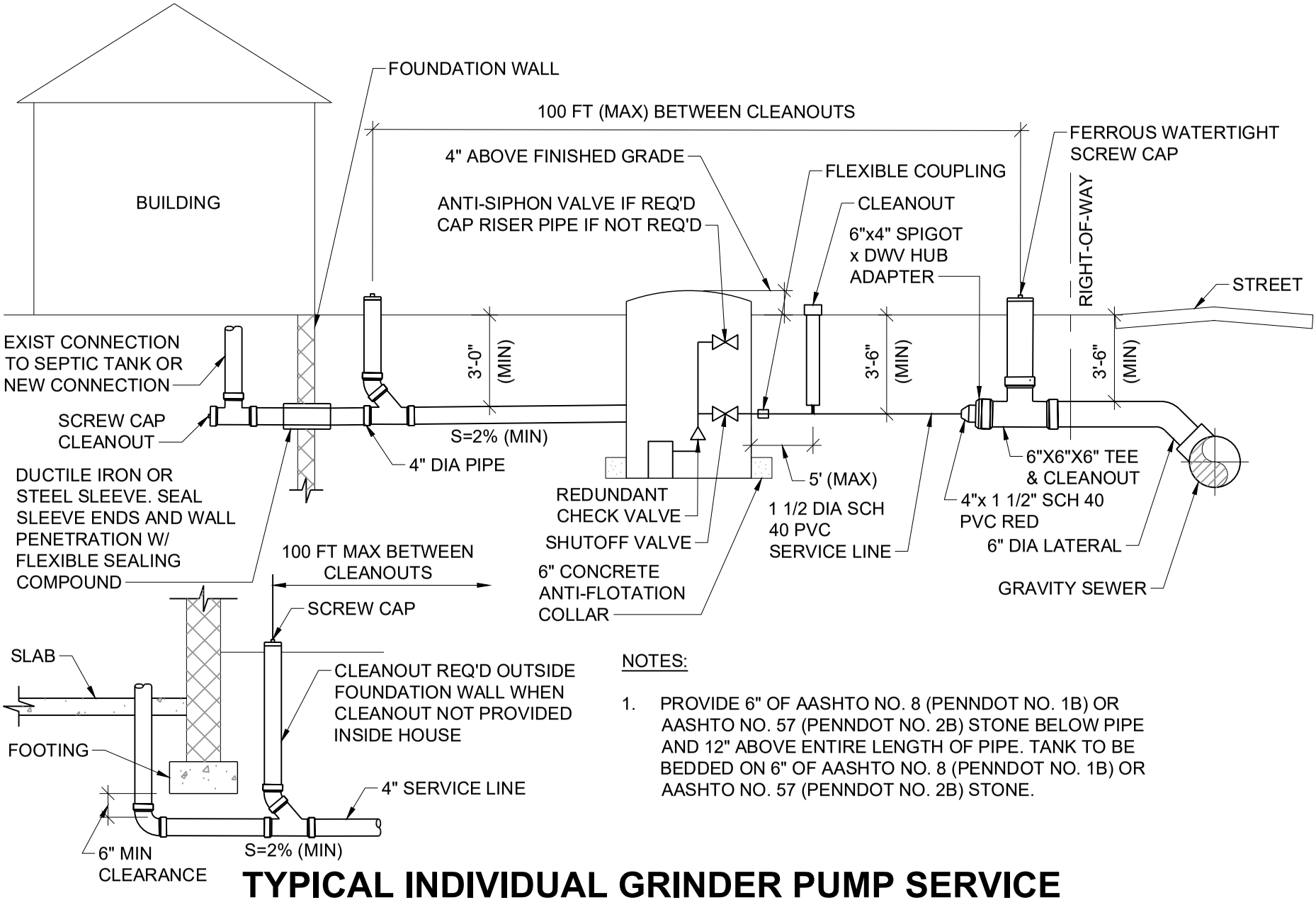
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PROJECT NO. 4673.030
DRAWING NO. ESWDT012
DATE: 09/19/25
PREPARED BY: ARA
CHECKED BY: AGS
APPROVED BY: AGS

EAST COCALICO TOWNSHIP AUTHORITY

TYPICAL SERVICE LINE - PLAN

ENTECH ENGINEERING
1.800.825.1372
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NOTES:

1. PROVIDE 6" OF AASHTO NO. 8 (PENNDOT NO. 1B) OR AASHTO NO. 57 (PENNDOT NO. 2B) STONE BELOW PIPE AND 12" ABOVE ENTIRE LENGTH OF PIPE. TANK TO BE BEDDED ON 6" OF AASHTO NO. 8 (PENNDOT NO. 1B) OR AASHTO NO. 57 (PENNDOT NO. 2B) STONE.

TYPICAL INDIVIDUAL GRINDER PUMP SERVICE LINE SCHEMATIC TO GRAVITY SEWER

1

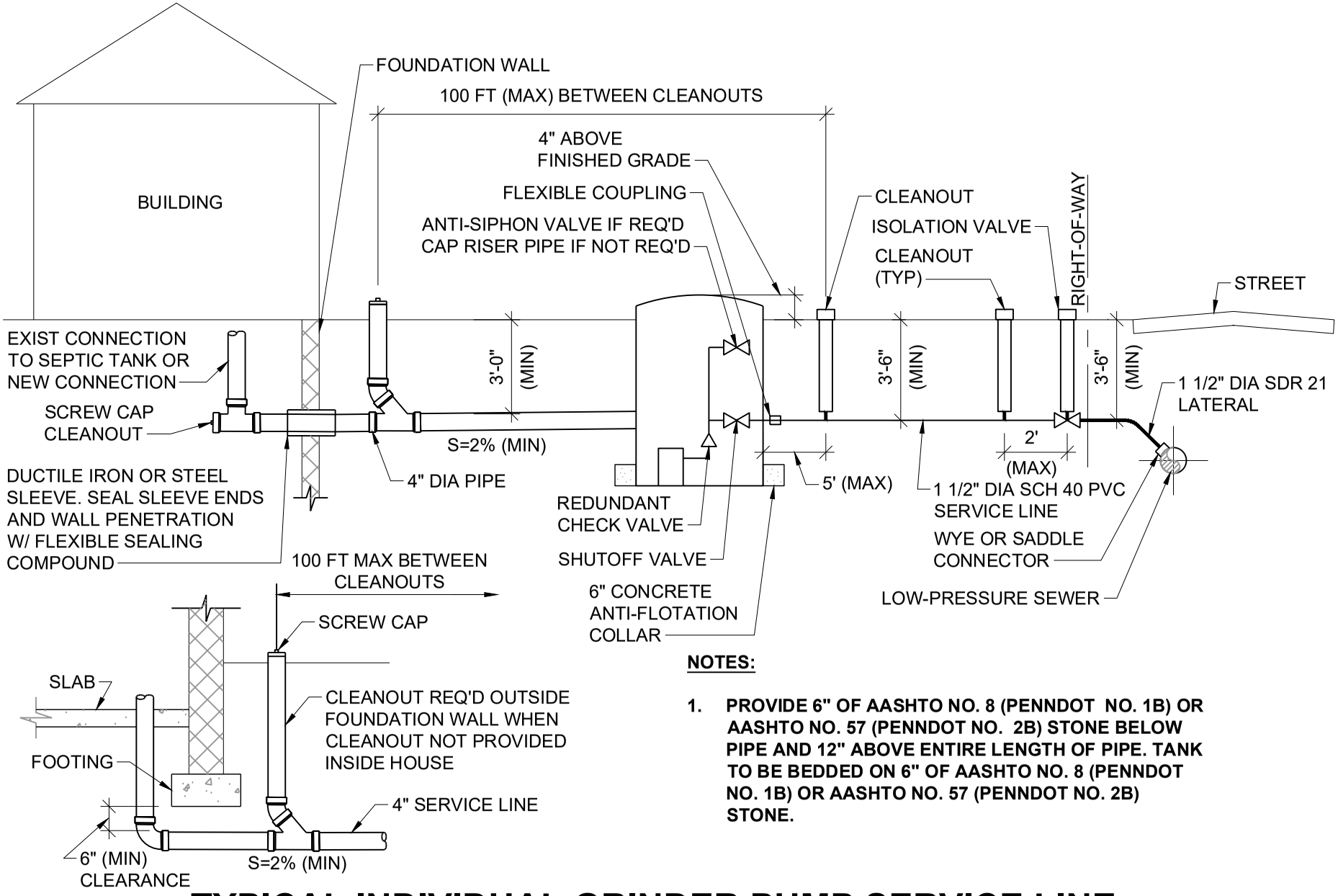
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PROJECT NO. 4673.030
DRAWING NO. ESWDT013
DATE: 09/19/25
PREPARED BY: ARA
CHECKED BY: AGS
APPROVED BY: AGS

EAST COCALICO TOWNSHIP AUTHORITY

TYPICAL INDIVIDUAL GRINDER PUMP SERVICE LINE SCHEMATIC TO GRAVITY SEWER

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NOTES:

1. **PROVIDE 6" OF AASHTO NO. 8 (PENNDOT NO. 1B) OR AASHTO NO. 57 (PENNDOT NO. 2B) STONE BELOW PIPE AND 12" ABOVE ENTIRE LENGTH OF PIPE. TANK TO BE BEDDED ON 6" OF AASHTO NO. 8 (PENNDOT NO. 1B) OR AASHTO NO. 57 (PENNDOT NO. 2B) STONE.**

TYPICAL INDIVIDUAL GRINDER PUMP SERVICE LINE SCHEMATIC TO LOW PRESSURE SEWER

1

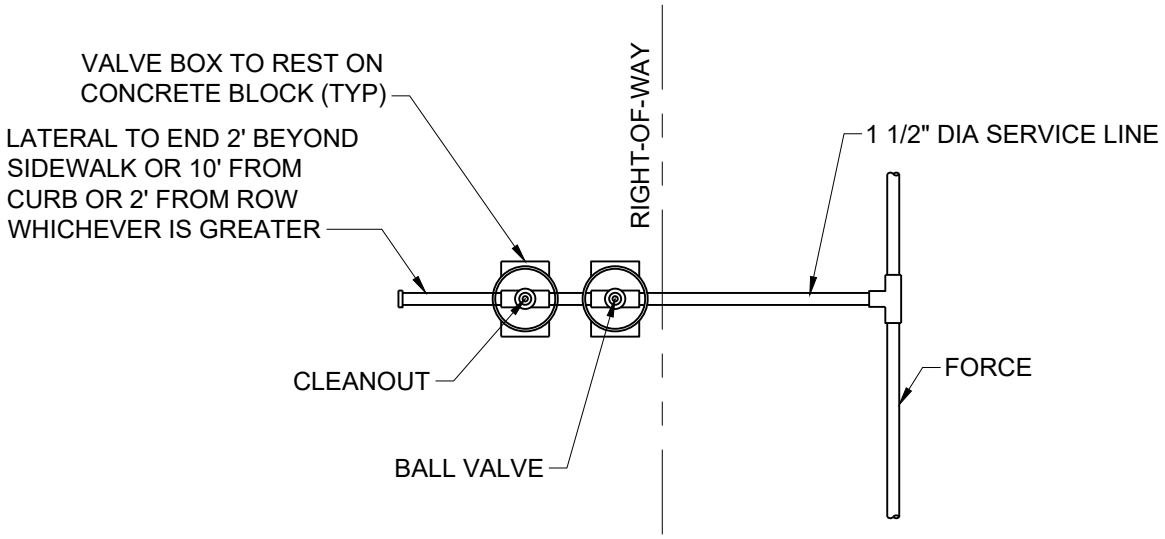
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DRAWING NO. ESWDT014
DATE: 09/19/25
PREPARED BY: ARA
CHECKED BY: AGS
APPROVED BY: AGS

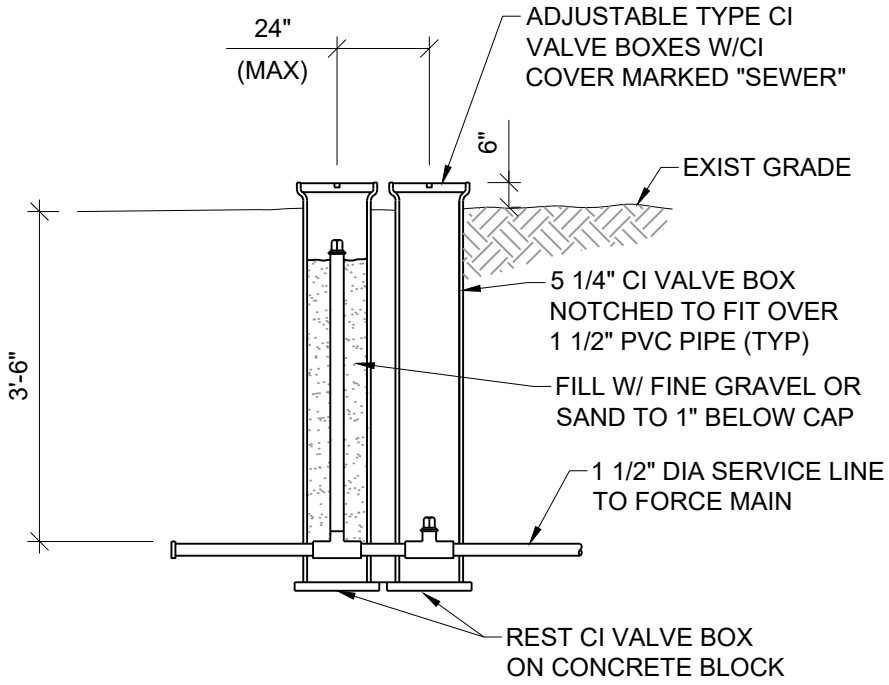
EAST COCALICO TOWNSHIP AUTHORITY

TYPICAL INDIVIDUAL GRINDER PUMP SERVICE LINE SCHEMATIC TO LOW PRESSURE SEWER

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PLAN



SECTION

NOTES:

1. ALL PVC CONNECTIONS SHALL BE SOLVENT WELDED UNLESS NOTED OTHERWISE.
2. PROVIDE 6" OF AASHTO NO. 8 (PENNDOT NO. 1B) OR AASHTO NO. 57 (PENNDOT NO. 2B) STONE BELOW PIPE AND 12" ABOVE ENTIRE LENGTH OF PIPE.

TYPICAL LATERAL CONNECTION TO LOW PRESSURE FORCE MAIN

1

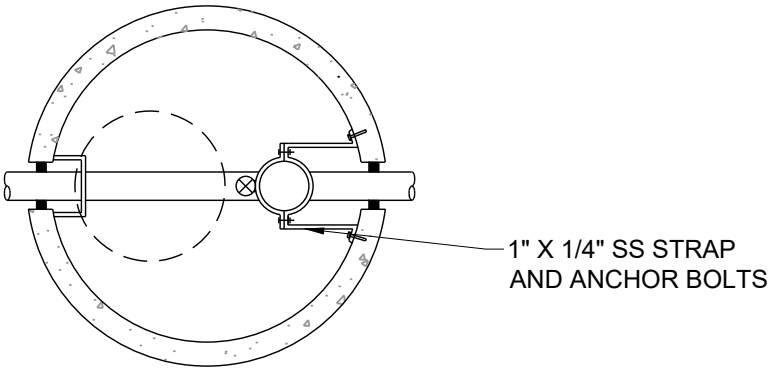
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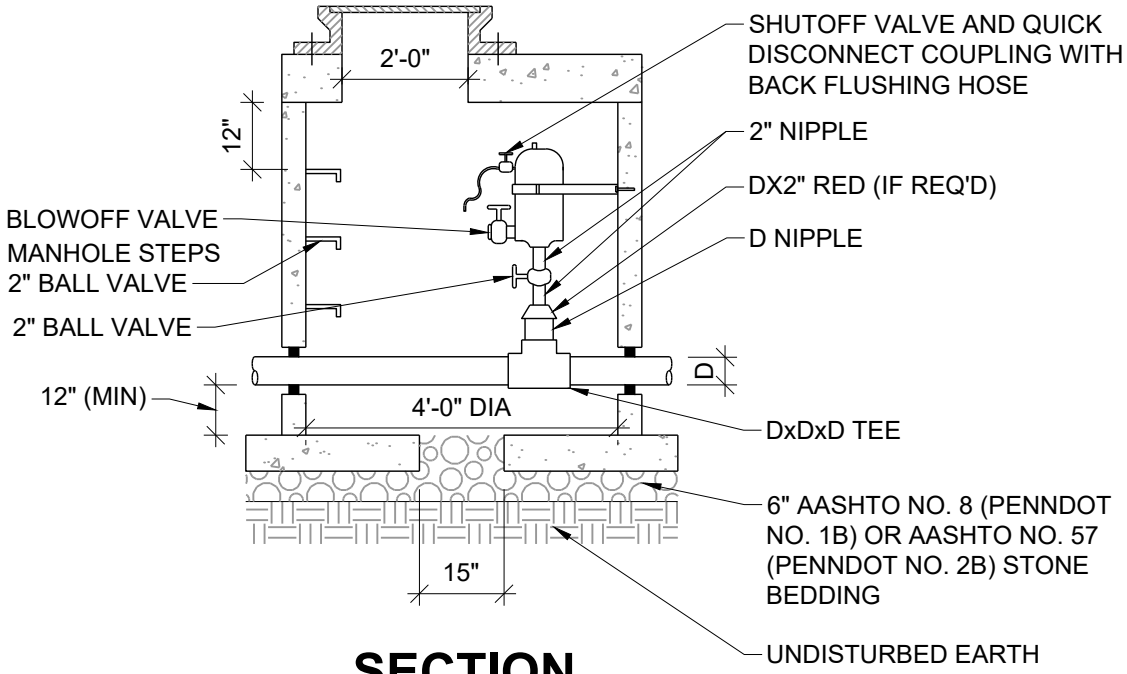
EAST COCALICO TOWNSHIP AUTHORITY

TYPICAL LATERAL CONNECTION TO LOW PRESSURE FORCE MAIN

DATE: 09/19/25	SCALE: AS NOTED
PREPARED BY: ARA	PROJECT NO. 4673.030
CHECKED BY: AGS	DRAWING NO. ESWDT015
APPROVED BY: AGS	



PLAN



SECTION

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.**

1

AIR RELEASE VALVE AND CHAMBER

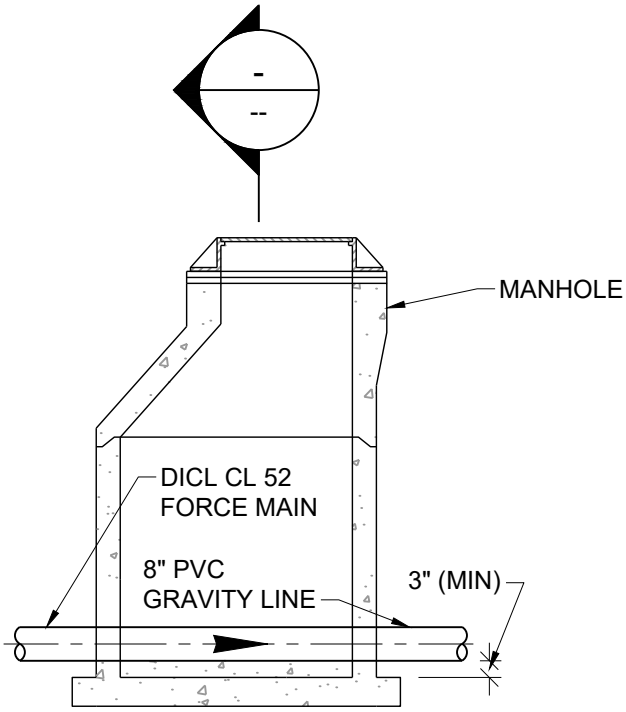
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EAST COCALICO TOWNSHIP AUTHORITY

AIR RELEASE VALVE AND CHAMBER

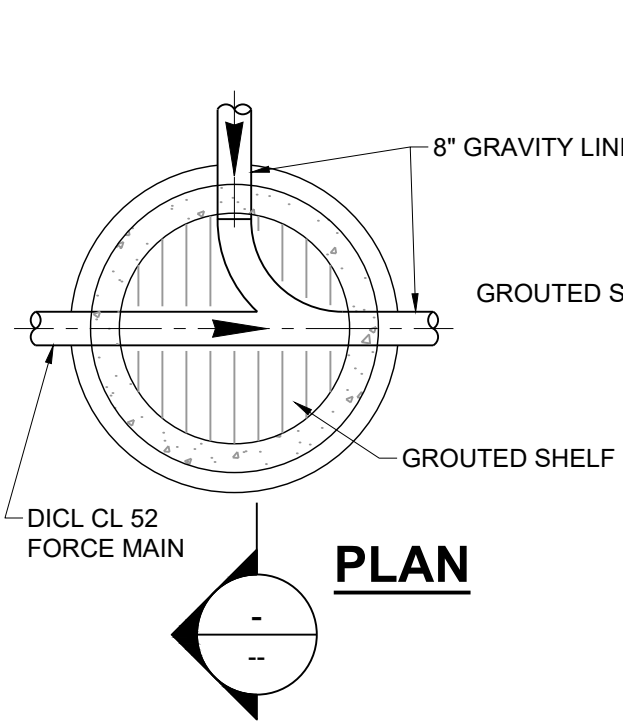
DATE: 09/19/25	SCALE: AS NOTED
PREPARED BY: ARA	PROJECT NO. 4673.030
CHECKED BY: AGS	DRAWING NO. ESWDT016
APPROVED BY: AGS	



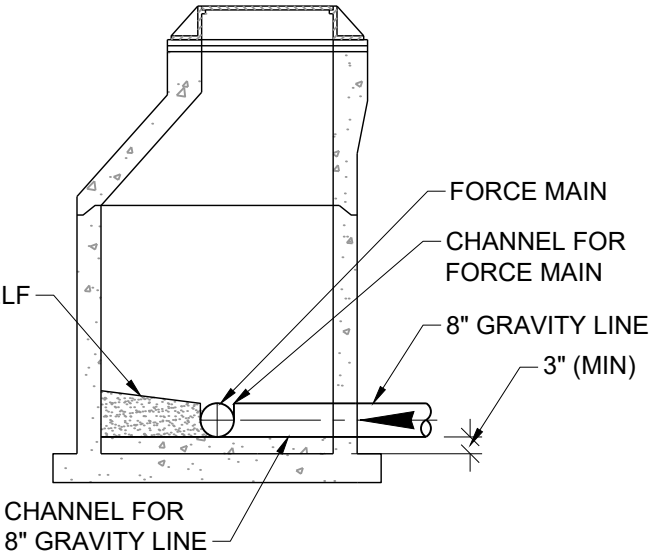
NOTES:

1. LINE MANHOLE INTERIOR WITH T-LOCK PVC OR HDPE LINER SYSTEM.

ELEVATION



PLAN

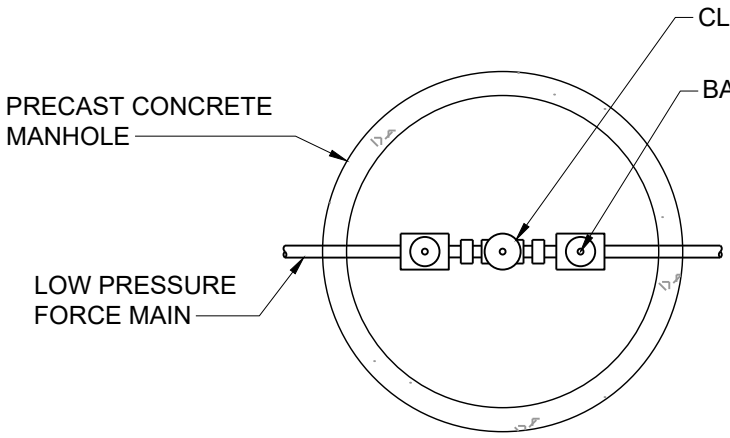


SECTION

1 FORCE MAIN CONNECTION TO MANHOLE

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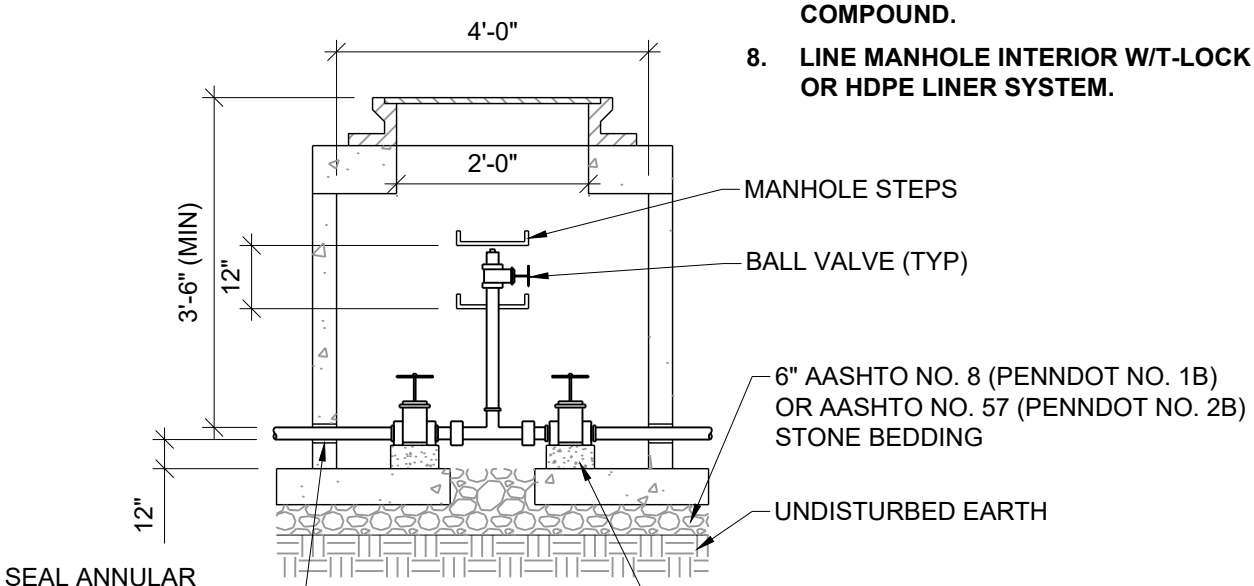
ENTECH ENGINEERING 1.800.825.1372 www.entecheng.com	EAST COCALICO TOWNSHIP AUTHORITY FORCE MAIN CONNECTION TO MANHOLE	DATE: 09/19/25	SCALE: AS NOTED
		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT017
		APPROVED BY: AGS	



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 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.**



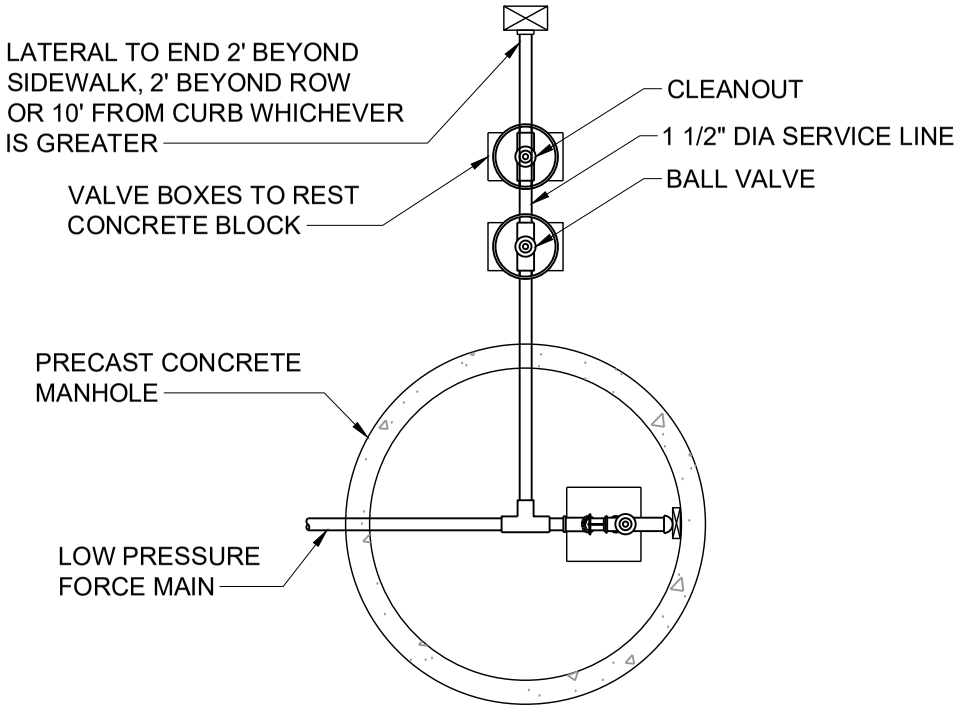
SECTION

LOW PRESSURE SEWER VALVE AND CLEANOUT MANHOLE

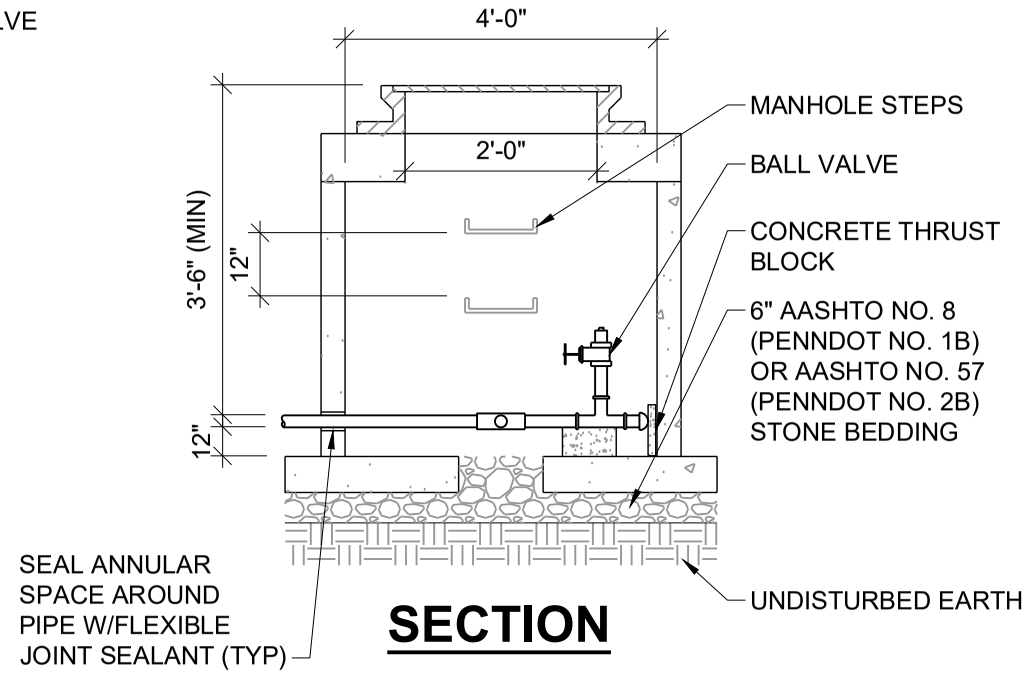
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		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT018
		APPROVED BY: AGS	



PLAN



SECTION

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 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 WATERPROOF MORTAR PREFORMED PLASTIC SEALING COMPOUND.**
7. **ALL JOINTS SHALL BE SEALED WITH PREFORMED PLASTIC SEALING COMPOUND.**

LOW PRESSURE SEWER TERMINAL CLEANOUT MANHOLE

1

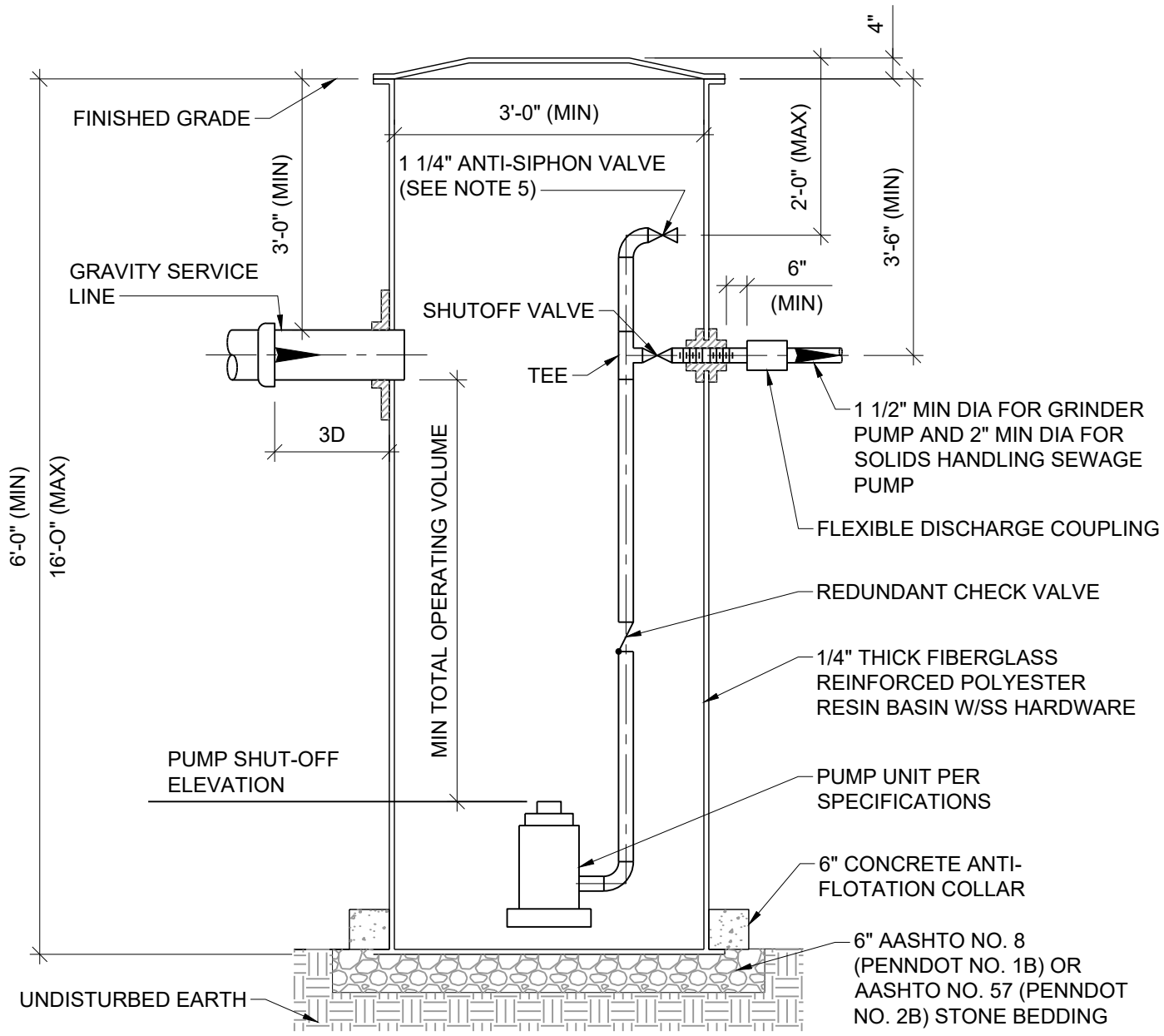
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SCALE:	AS NOTED
PROJECT NO.	4673.030
DRAWING NO.	ESWDT019
DATE:	09/19/25
PREPARED BY:	ARA
CHECKED BY:	AGS
APPROVED BY:	AGS

EAST COCALICO TOWNSHIP AUTHORITY

LOW PRESSURE SEWER
TERMINAL CLEANOUT MANHOLE

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NOTES:

1. FIBERGLASS BASINS MAY NOT BE USED IN AREAS SUBJECT TO TRAFFIC LOADING.
2. LOCATION OF BASIN TO BE DETERMINED BY APPLICANT.
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. FINISHED GRADE SHALL BE SLOPED AWAY FROM THE BASIN TOP.
5. HORIZONTAL ANTI-SIPHON VALVE SHALL BE INSTALLED IF NECESSARY. IF ANTI-SIPHON VALVE IS NOT NEEDED, CAP THE RISER PIPE.

FIBERGLASS BASIN FOR TYPICAL INDIVIDUAL PUMP

1

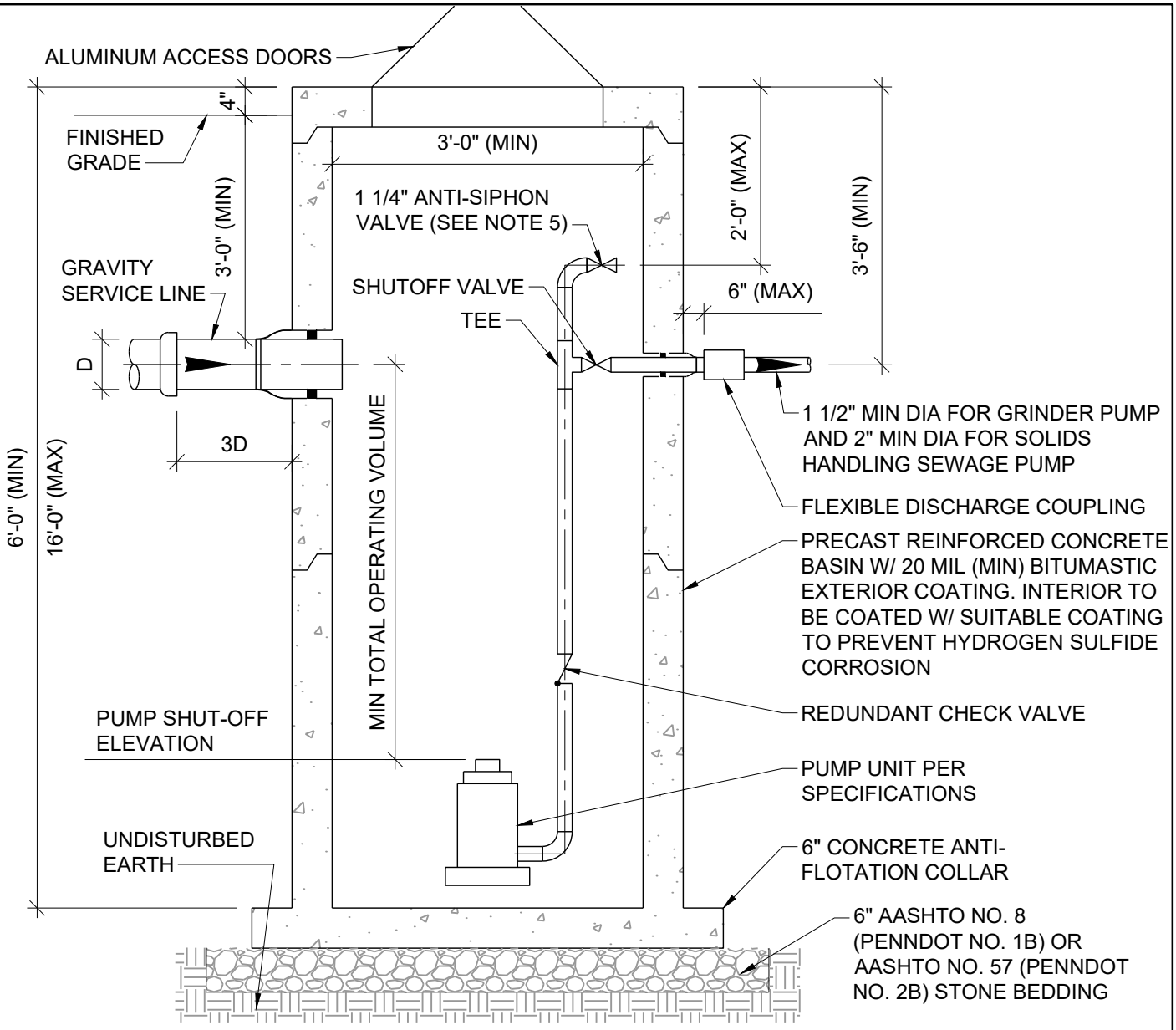
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EAST COCALICO TOWNSHIP AUTHORITY

FIBERGLASS BASIN FOR TYPICAL INDIVIDUAL PUMP

DATE: 09/19/25	SCALE: AS NOTED
PREPARED BY: ARA	PROJECT NO. 4673.030
CHECKED BY: AGS	DRAWING NO. ESWDT020
APPROVED BY: AGS	



NOTES:

1. CONCRETE BASINS SHALL BE USED IN AREAS SUBJECT TO TRAFFIC LOADING.
2. CONCRETE BASINS HALL 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 AASHTO NO. 8 STONE.
6. FINISHED GRADE SHALL BE SLOPED AWAY FROM THE BASIN TOP.
7. HORIZONTAL ANTI-SIPHON VALVE SHALL BE INSTALLED IF NECESSARY. IF ANTI-SIPHON VALVE IS NOT NEEDED, CAP THE RISER.

CONCRETE BASIN FOR TYPICAL INDIVIDUAL PUMP

1

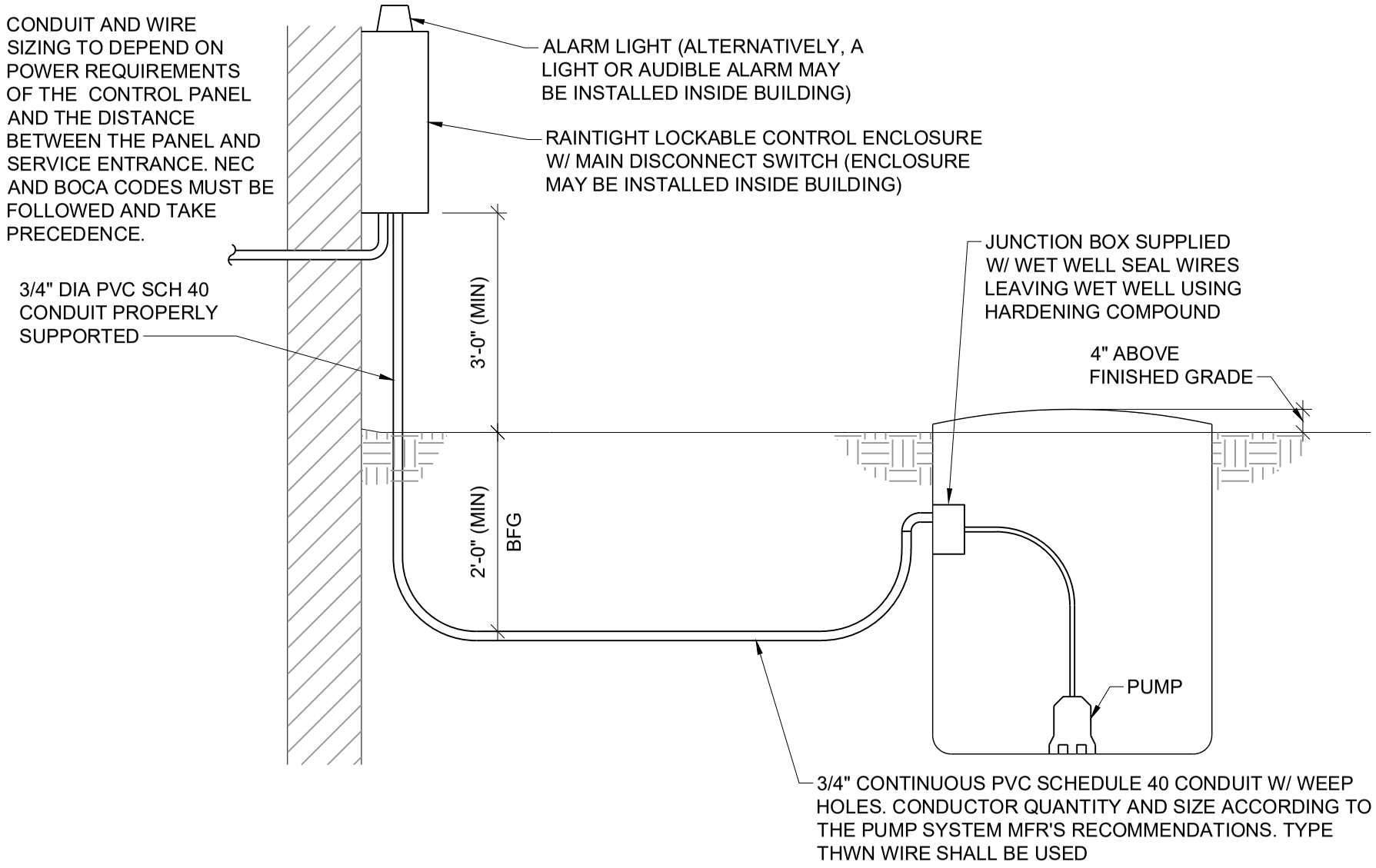
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EAST COCALICO TOWNSHIP AUTHORITY

CONCRETE BASIN FOR TYPICAL INDIVIDUAL PUMP

DATE: 09/19/25	SCALE: AS NOTED
PREPARED BY: ARA	PROJECT NO. 4673.030
CHECKED BY: AGS	DRAWING NO. ESWDT021
APPROVED BY: AGS	



WALL MOUNTED CONTROL PANEL (EXTERNAL INSTALLATION)

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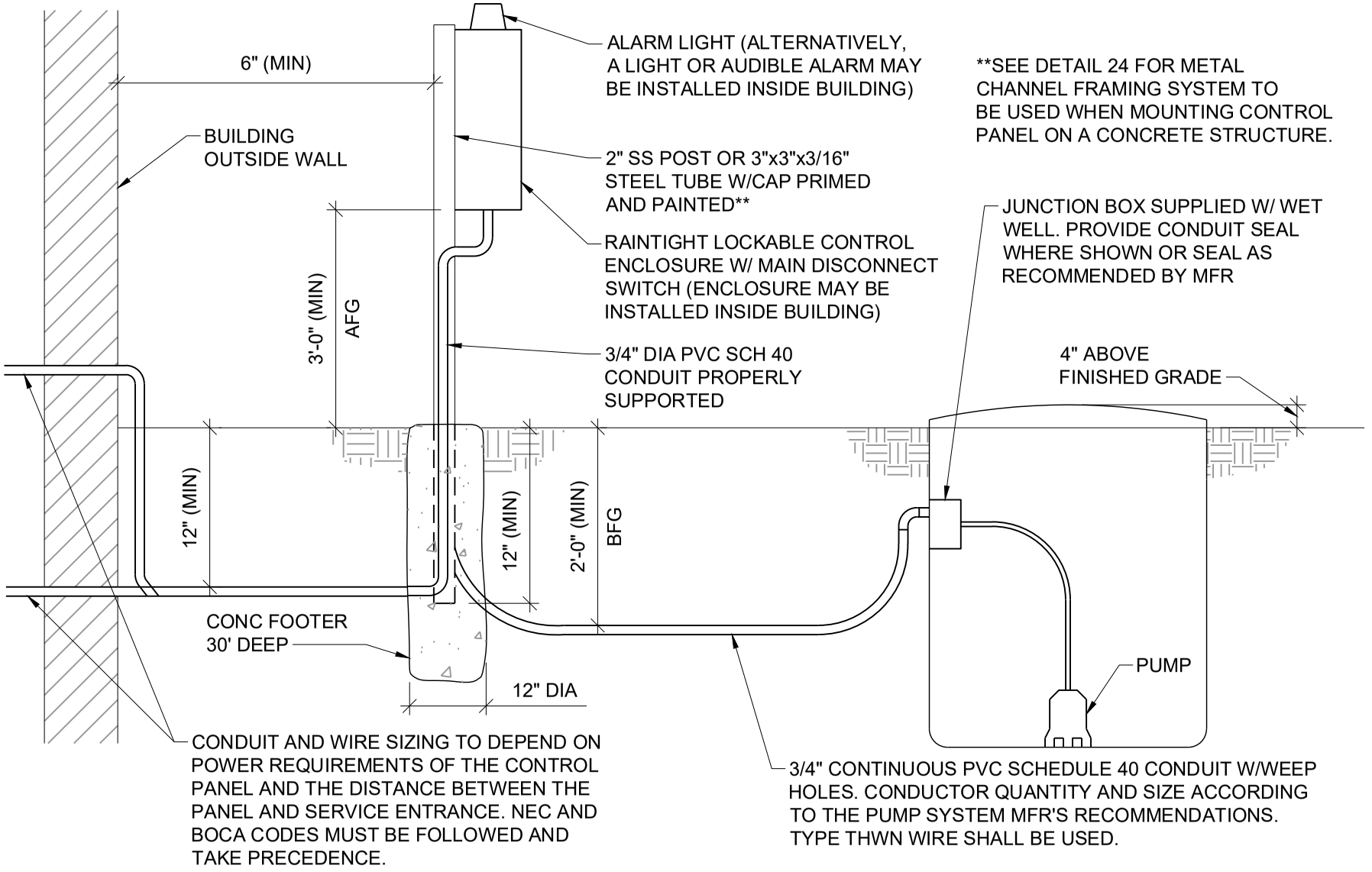
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PROJECT NO. 4673.030
DRAWING NO. ESWDT022
DATE: 09/19/25
PREPARED BY: ARA
CHECKED BY: AGS
APPROVED BY: AGS

EAST COCALICO TOWNSHIP AUTHORITY

WALL MOUNTED CONTROL PANEL (EXTERNAL INSTALLATION)

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**SEE DETAIL 24 FOR METAL CHANNEL FRAMING SYSTEM TO BE USED WHEN MOUNTING CONTROL PANEL ON A CONCRETE STRUCTURE.

POST MOUNTED CONTROL PANEL (EXTERNAL INSTALLATION)

1

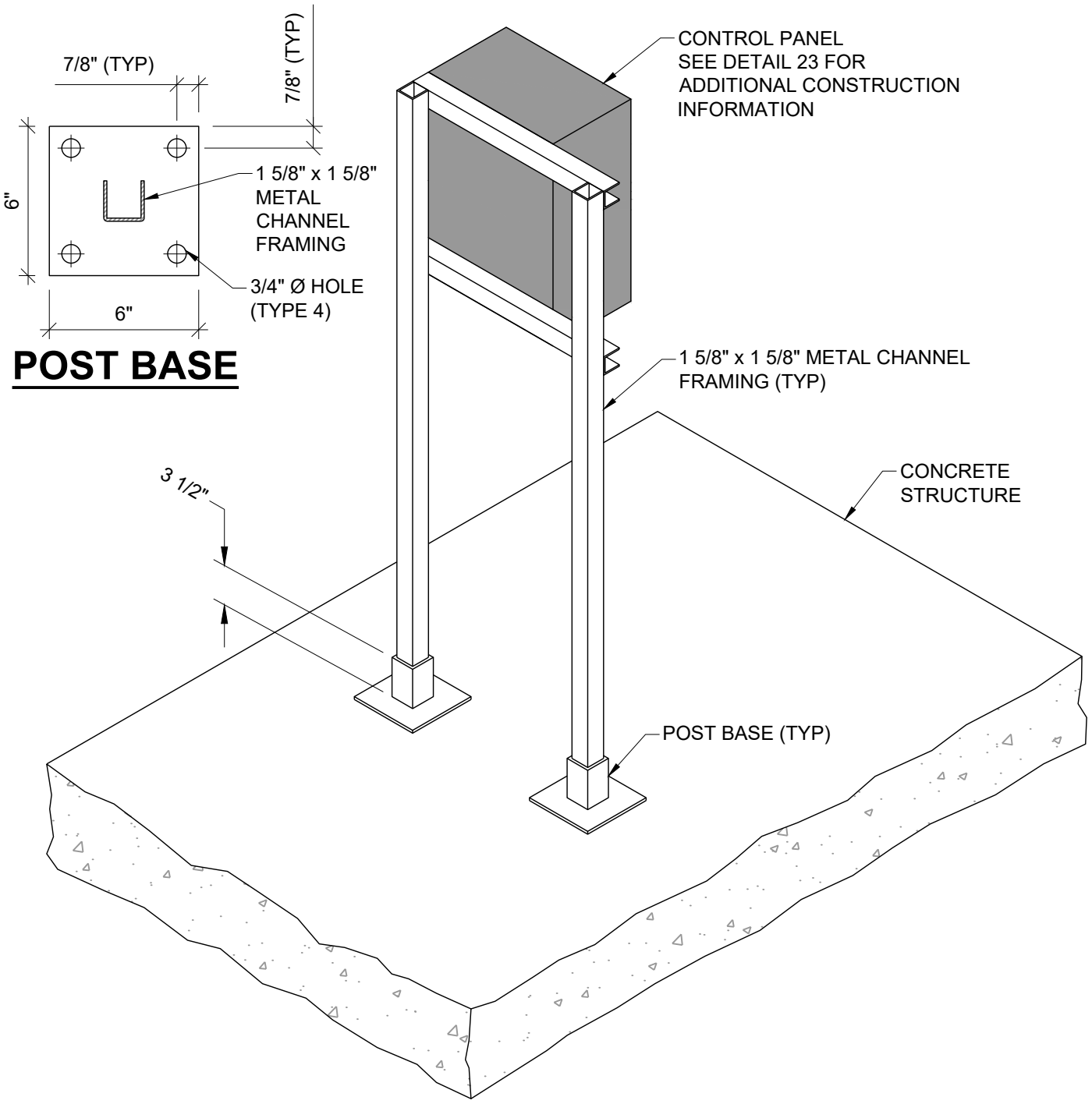
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PROJECT NO. 4673.030
DRAWING NO. ESWDT023
DATE: 09/19/25
PREPARED BY: ARA
CHECKED BY: AGS
APPROVED BY: AGS

EAST COCALICO TOWNSHIP AUTHORITY

POST MOUNTED CONTROL PANEL (EXTERNAL INSTALLATION)

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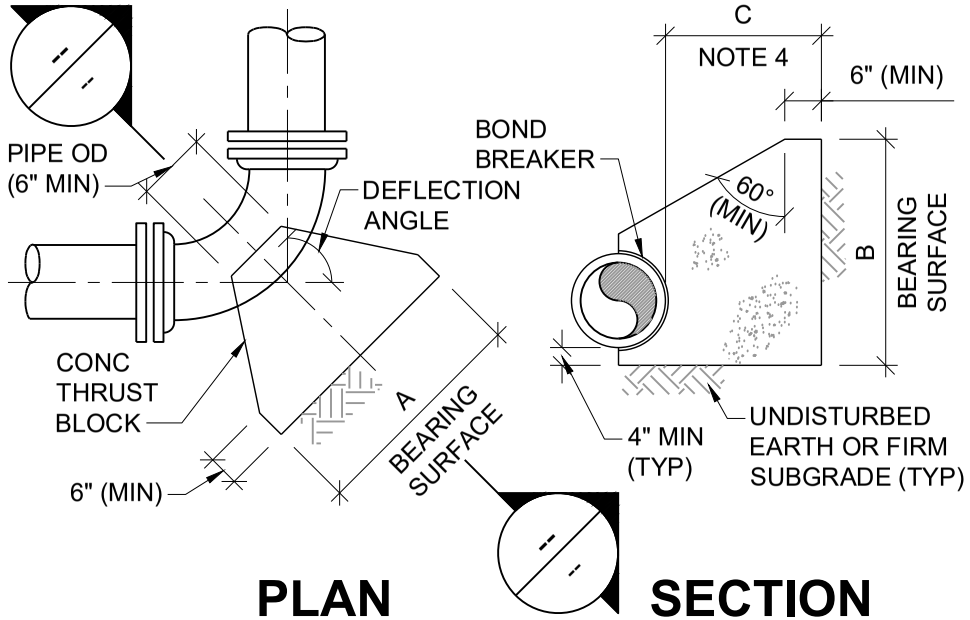


METAL CHANNEL FRAMING FOR CONTROL PANEL MOUNTED ON A CONCRETE STRUCTURE

1

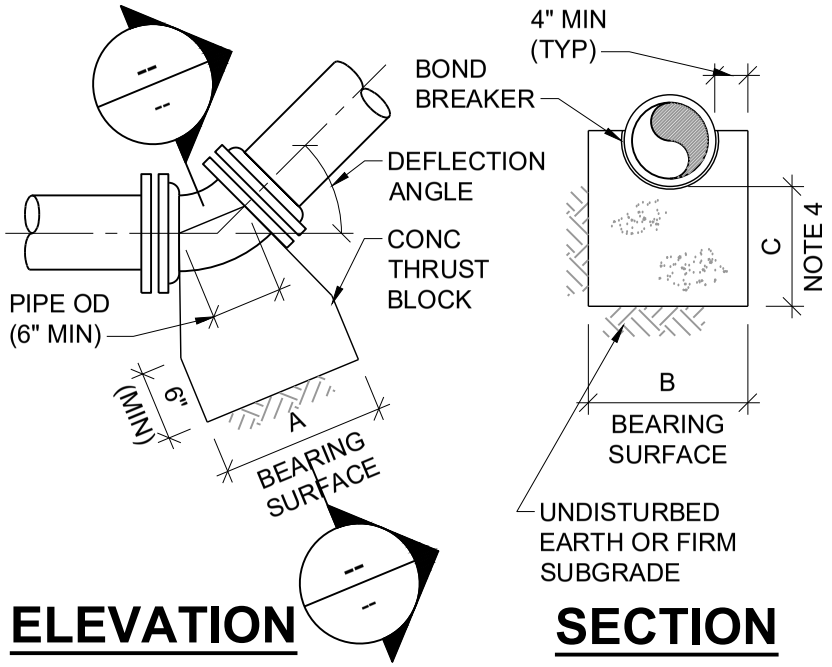
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ENTECH ENGINEERING 1.800.825.1372 www.entecheng.com	EAST COCALICO TOWNSHIP AUTHORITY METAL CHANNEL FRAMING FOR CONTROL PANAL MOUNTED ON A CONCRETE STRUCTURE	DATE: 09/19/25	SCALE: AS NOTED
		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT024
		APPROVED BY: AGS	



PLAN **SECTION**

DETAIL FOR HORIZONTAL BENDS



ELEVATION **SECTION**

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

NOTES:

1. **MAXIMUM TEST PRESSURE = 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

1

Scale: NONE

SCALE: AS NOTED
PROJECT NO. 4673.030
DRAWING NO. ESWDT025
DATE: 09/19/25
PREPARED BY: ARA
CHECKED BY: AGS
APPROVED BY: AGS

EAST COCALICO TOWNSHIP AUTHORITY

THRUST BLOCKS FOR HORIZONTAL BENDS AND LOWER VERTICAL BENDS

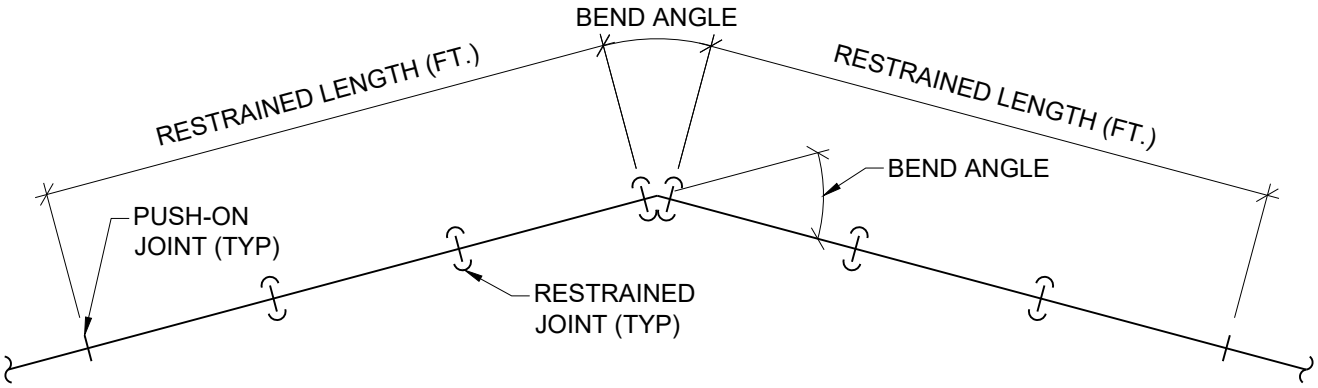
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MINIMUM RESTRAINED PIPE LENGTH (FT) FOR VERTICAL BENDS (WITHOUT POLYETHLENE ENCASEMENT)			
DIAMETER (IN)	VERTICAL BEND ANGLE (DEGREES)		
	45	22½	11¼
6	20	10	5
8	26	12	6
10	32	15	8
12	37	18	9
14	43	21	10
16	48	23	12
18	54	26	13
20	59	28	14
24	70	34	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

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**



* PROVIDE 3/4" THREADED RODS (2 PER ASSEMBLY) AT LEAST 3 PIPE LENGTHS UPSTREAM AND DOWNSTREAM OF BEND.

X

RESTRAINED DI PIPE LENGTH

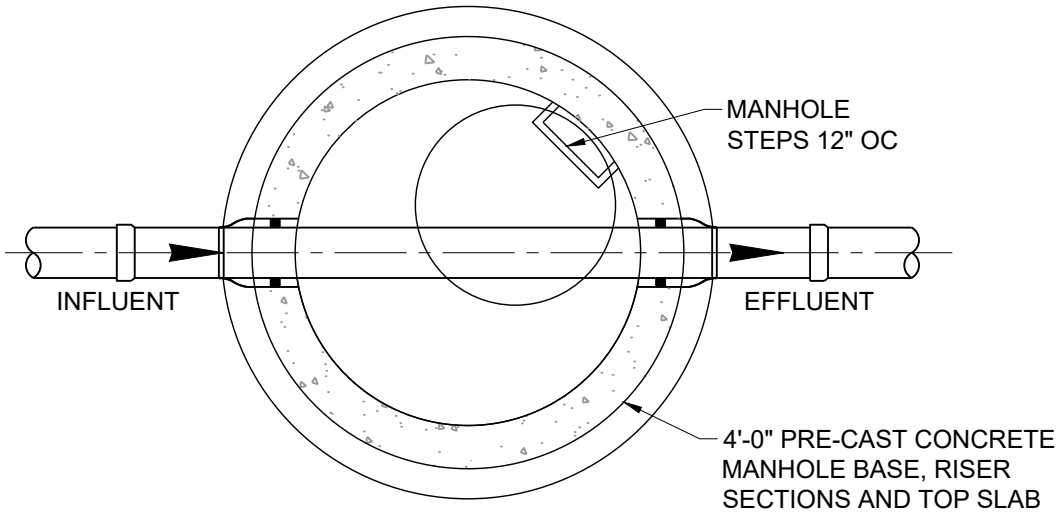
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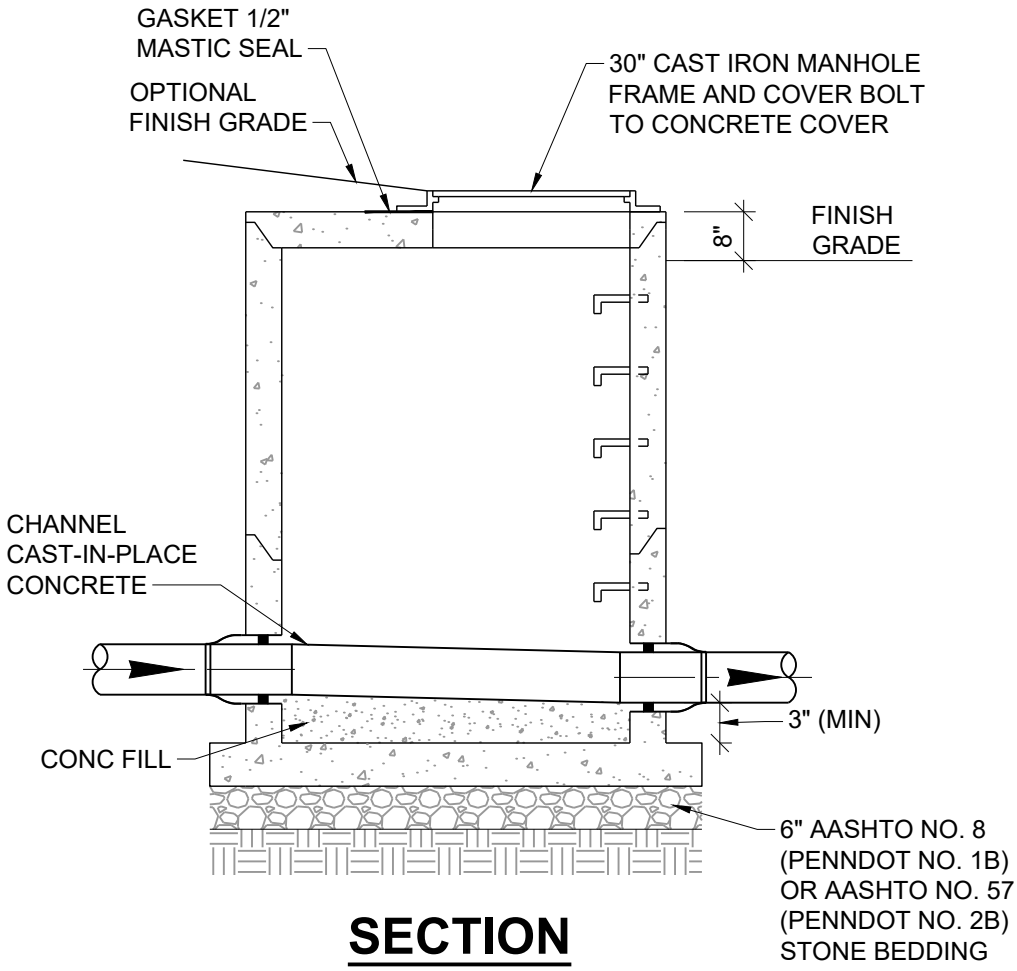
EAST COCALICO TOWNSHIP AUTHORITY

RESTRAINED DI PIPE LENGTH

DATE: 09/19/25	SCALE: AS NOTED
PREPARED BY: ARA	PROJECT NO. 4673.030
CHECKED BY: AGS	DRAWING NO. ESWDT026
APPROVED BY: AGS	



PLAN



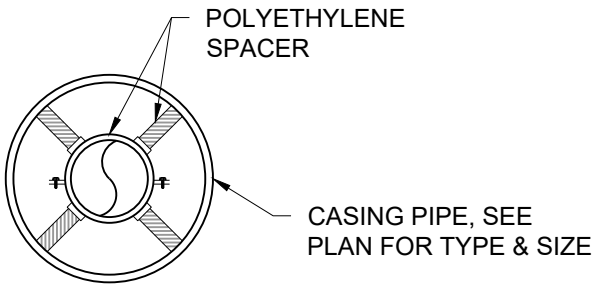
SECTION

PRECAST CONCRETE FLOW MONITORING MANHOLE

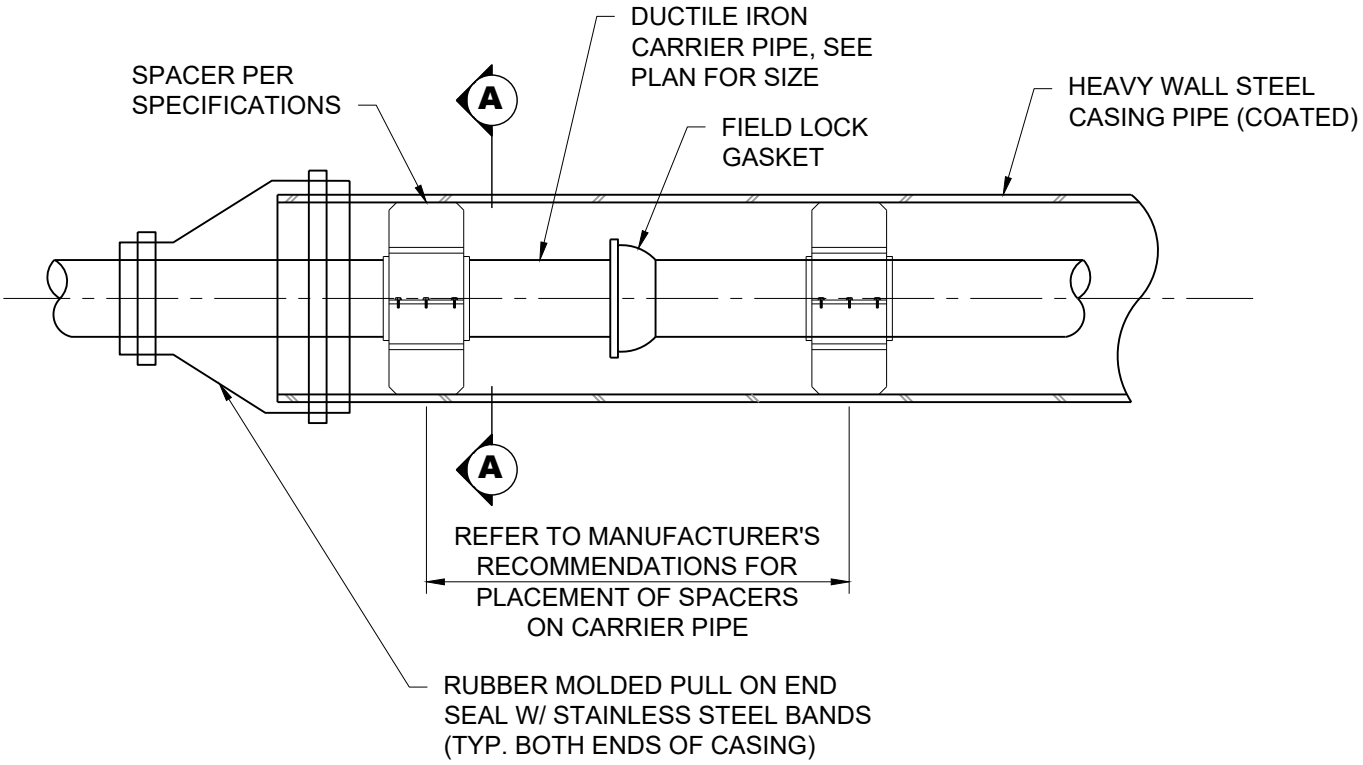
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Scale: NONE

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		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT027
		APPROVED BY: AGS	



SECTION A-A



NOTES:

1. **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, AND CONFIRM TO AWWA C200 AND ASTM A53.**
2. **CASING EXTERIOR SHALL BE PAINTED WITH BITUMASTIC COATING.**
3. **PIPE CRADLES OR ISOLATORS SHALL BE FIELD ASSEMBLED AS SHOWN ON THE DETAIL DRAWINGS, APS CASING SPACERS (MODEL SSI), CCI PIPING SYSTEMS CASING SPACERS, OR APPROVED EQUAL. MANUFACTURED SPACERS SHALL BE MADE OF STAINLESS STEEL.**
4. **CASING END SEALS SHALL BE APS BRAND (MODEL AC) OR CCI PIPING SYSTEMS RUBBER END SEALS, OR APPROVED EQUAL.**
5. **MINIMUM CASING DIAMETER SHALL BE IN ACCORDANCE WITH PENNDOT OR AMTRAK REQUIREMENTS AS APPLICABLE.**

1

SEWER MAIN PIPE CASING

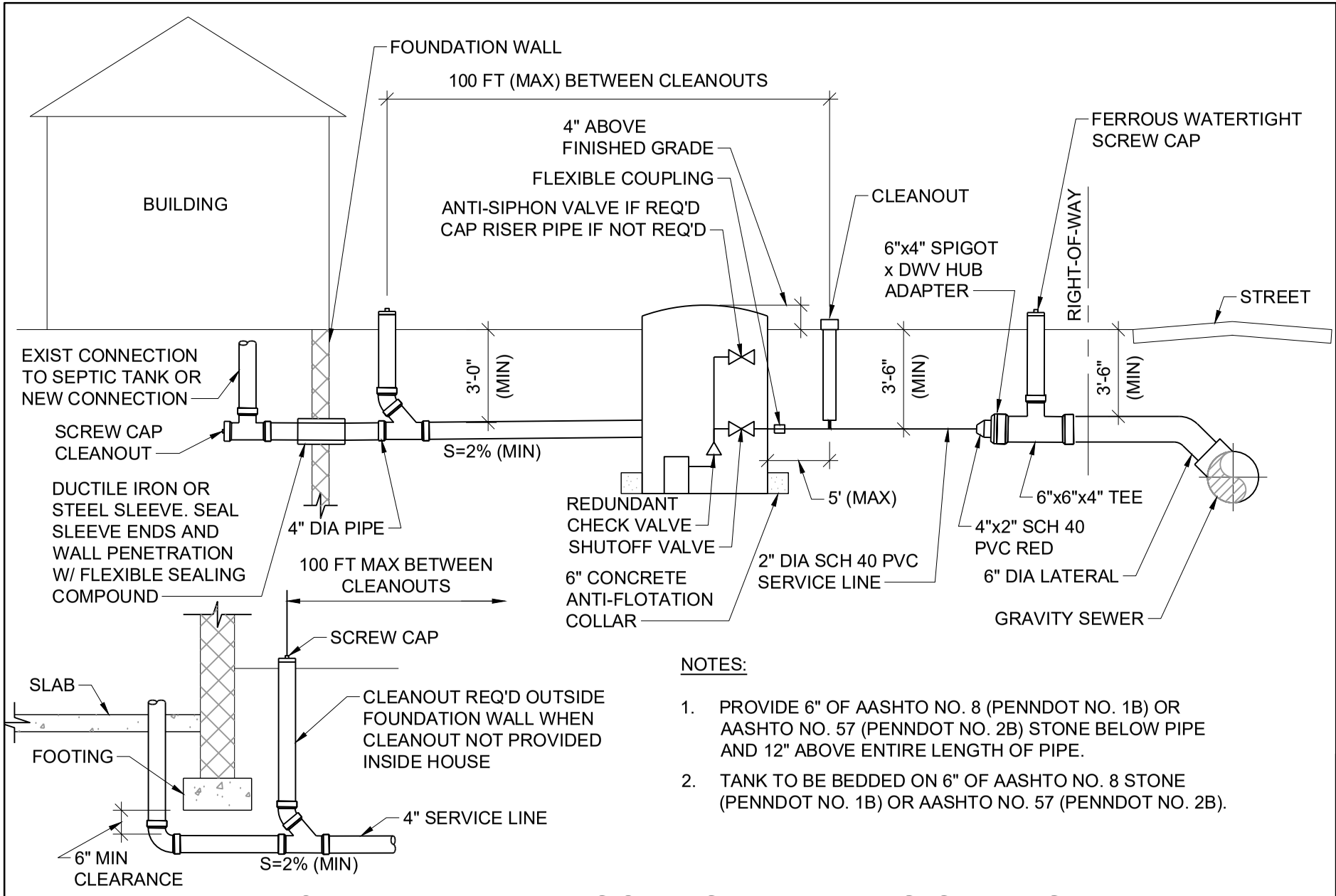
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EAST COCALICO TOWNSHIP AUTHORITY

SEWER MAIN PIPE CASING

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APPROVED BY: AGS	



NOTES:

1. PROVIDE 6" OF AASHTO NO. 8 (PENNDOT NO. 1B) OR AASHTO NO. 57 (PENNDOT NO. 2B) STONE BELOW PIPE AND 12" ABOVE ENTIRE LENGTH OF PIPE.
2. TANK TO BE BEDDED ON 6" OF AASHTO NO. 8 STONE (PENNDOT NO. 1B) OR AASHTO NO. 57 (PENNDOT NO. 2B).

TYPICAL INDIVIDUAL SOLIDS HANDLING SEWAGE PUMP SERVICE LINE SCHEMATIC TO GRAVITY SEWER

1

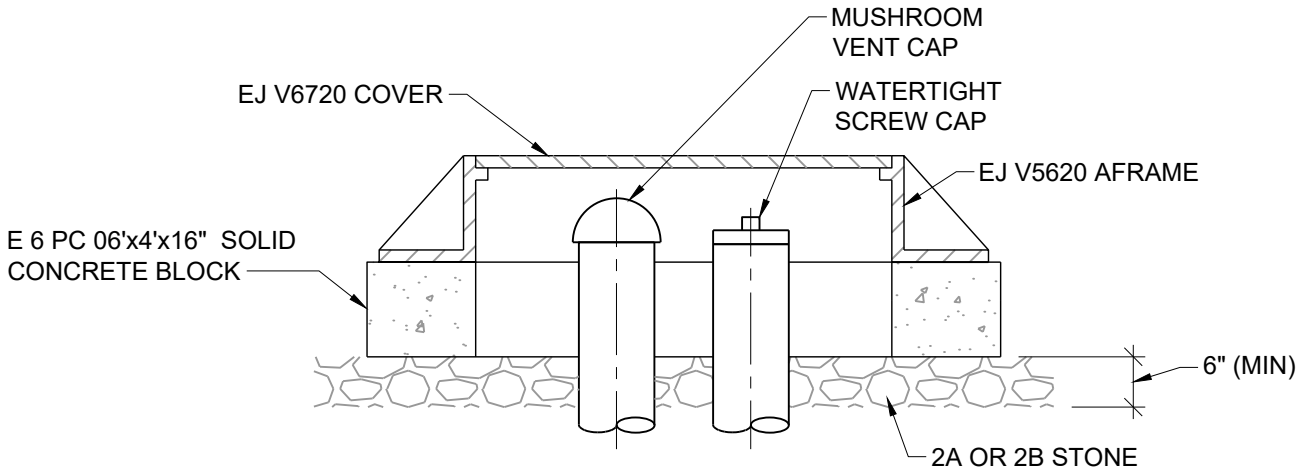
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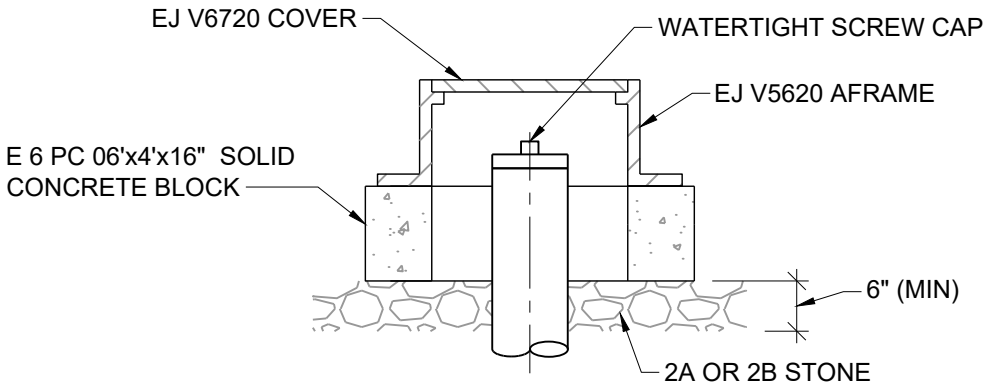
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PROJECT NO. 4673.030
DRAWING NO. ESWDT029
DATE: 09/19/25
PREPARED BY: ARA
CHECKED BY: AGS
APPROVED BY: AGS

EAST COCALICO TOWNSHIP AUTHORITY

TYPICAL INDIVIDUAL SOLIDS HANDLING SEWAGE PUMP SERVICE LINE SCHEMATIC TO GRAVITY SEWER

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SANITARY SEWER VENT/CLEANOUT IN DRIVEWAY OR TRAFFIC AREA

1

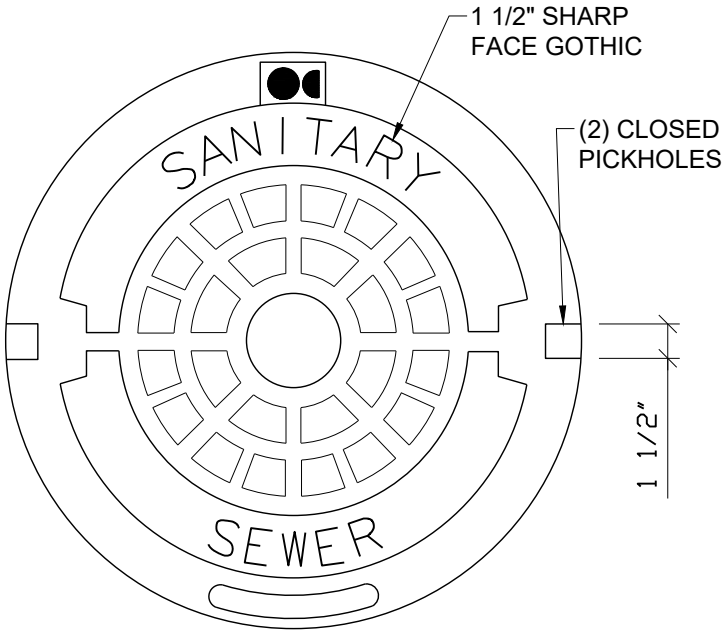
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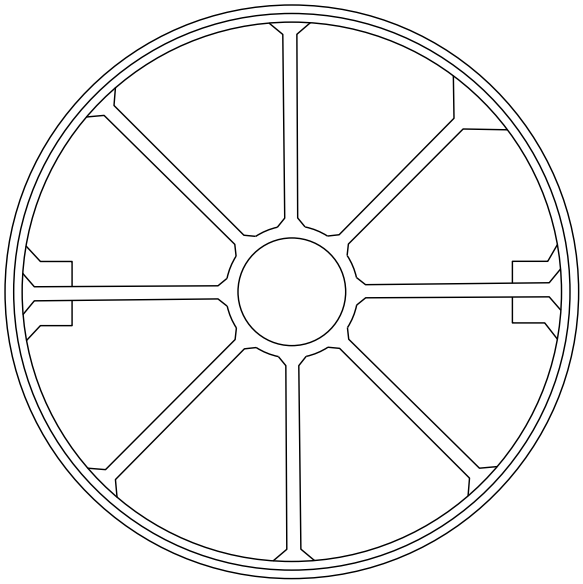
EAST COCALICO TOWNSHIP AUTHORITY

SANITARY SEWER VENT/CLEANOUT IN DRIVEWAY OR TRAFFIC AREA

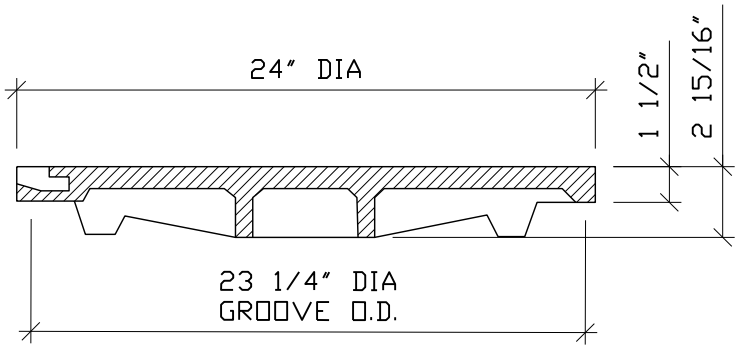
DATE: 09/19/25	SCALE: AS NOTED
PREPARED BY: ARA	PROJECT NO. 4673.030
CHECKED BY: AGS	DRAWING NO. ESWDT030
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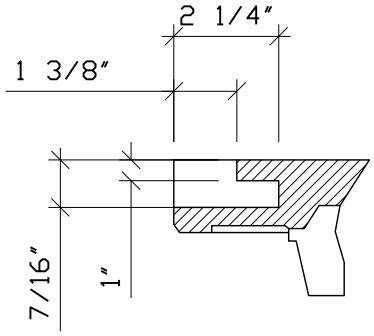
PLAN VIEW



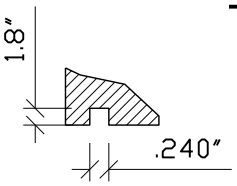
BOTTOM VIEW



COVER SECTION



PICKHOLE DETAIL



GROOVE SECTION

TYPICAL CAST IRON STANDARD MANHOLE FRAME & COVER DETAIL

1a

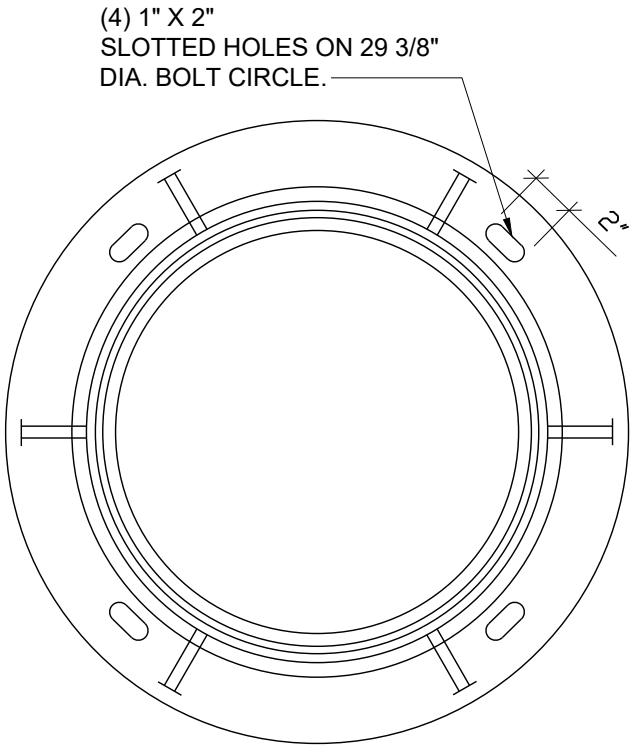
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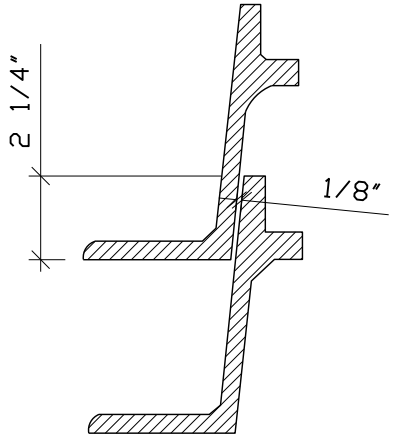
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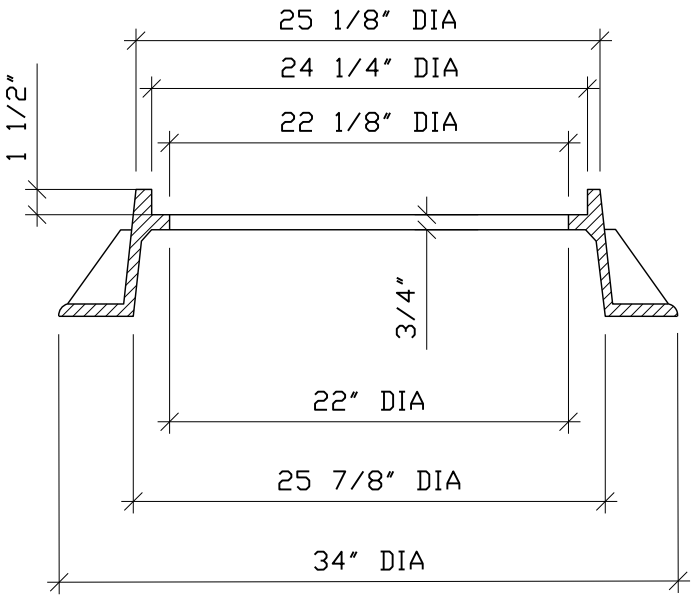
TYPICAL CAST IRON STANDARD
MANHOLE FRAME & COVER DETAIL

DATE: 09/19/25	SCALE: AS NOTED
PREPARED BY: ARA	PROJECT NO. 4673.030
CHECKED BY: AGS	DRAWING NO. ESWDT031a
APPROVED BY: AGS	





STACK DETAIL



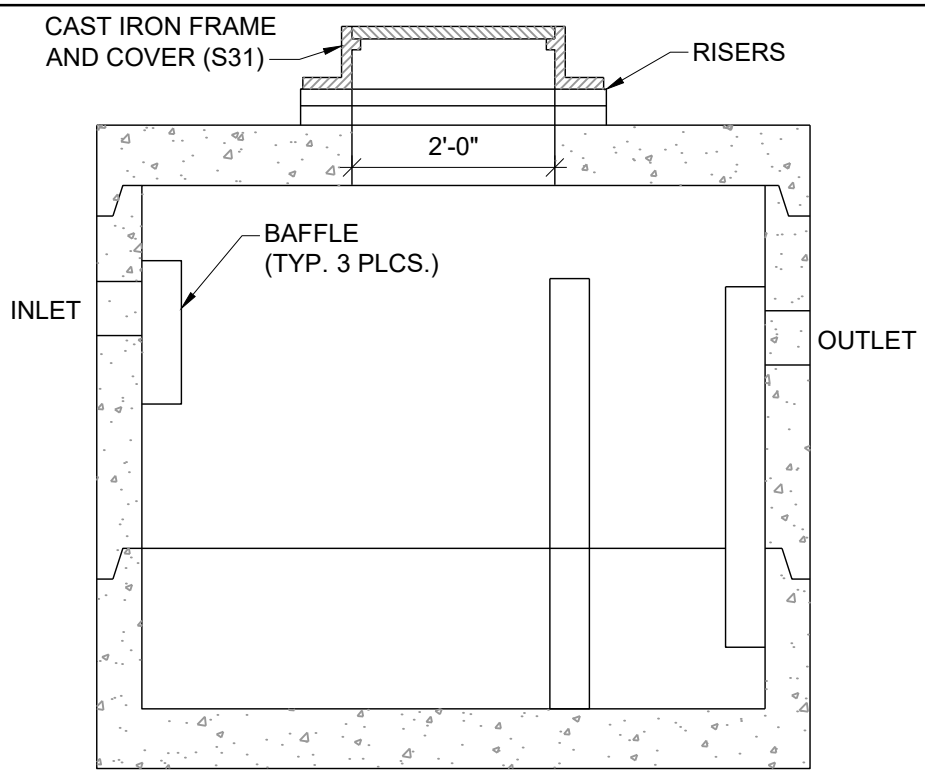
FRAME SECTION

TYPICAL CAST IRON STANDARD MANHOLE FRAME & COVER DETAIL

1b

Scale: NONE

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		PREPARED BY: ARA	PROJECT NO. 4673.030
		CHECKED BY: AGS	DRAWING NO. ESWDT031b
		APPROVED BY: AGS	



NOTES:

1. A GREASE TRAP SHALL CONSIST OF ONE OF THE FOLLOWING:
   - A THREE-STAGE GREASE INTERCEPTOR CONSISTING OF THREE SEPARATE TANKS OR ONE OR MORE TANKS DIVIDED INTO THREE SEGMENTS BY GREASE TRAPPING BAFFLES.
   - A THREE-STAGE MANUFACTURED/ENGINEERED GREASE INTERCEPTOR CONSISTING OF A DOUBLE BAFFLED THREE-COMPARTMENT UNIT INSTALLED IN CONTAINMENT VAULTS WITH FLOW VALVES AND VENT LINES AS RECOMMENDED BY THE MANUFACTURER.
   - A MULTI-STAGE GREASE INTERCEPTOR OF A CONFIGURATION (BAFFLES OR PIPING) AND ORIENTATION TO COMPLY WITH THE REQUIREMENTS OF THIS SPECIFICATION, SIZED TO MATCH THE NEEDS OF THE DISCHARGE BEING PERMITTED.
2. THE SIZE AND CAPACITY OF THREE STAGE GREASE INTERCEPTORS SHALL BE IN ACCORDANCE WITH THE FOLLOWING CRITERIA AND THE FORMULA REQUIRING THE LARGEST SIZE SHALL BE USED.
   - 6 GALLONS OF CAPACITY PER STAGE, FOR EVERY RESTAURANT SEAT.
   - 3 GALLONS PER FOOD CUSTOMER SERVED PER PEAK DAY OF OPERATION OR ANTICIPATED PEAK DAY OF OPERATION IN CASE OF A NEW BUSINESS.
   - SUCH SIZE AS IS SUFFICIENT TO ALLOW A MINIMUM OF 1 HOUR OF DETENTION OF FLOW AT THE MAXIMUM FLOW RATE GENERATED AT ANY TIME.
   - MINIMUM SIZE WILL BE 1,000 GALLONS
   - 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 A GRIT-OIL INTERCEPTOR OF A SIZE AND TYPE APPROVED BY THE AUTHORITY, AND A FLOW MONITORING MANHOLE, IN THE SERVICE LINE OR AT A LOCATIONS APPROVED BY THE AUTHORITY.
   - GRIT-OIL INTERCEPTOR TO BE A DUAL COMPARTMENT CONSTRUCTION, AND BAFFLE WALL TO HAVE 4-INCH HIGH AND 24-INCH WIDE OPENING 24 INCHES FROM INTERCEPTOR INVERT.
   - MINIMUM SIZE WILL BE 1,000 GALLONS.

1

GREASE TRAP DETAIL

Scale: NONE

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EAST COCALICO TOWNSHIP AUTHORITY

GREASE TRAP DETAIL

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