FRANCONIA SEWER AUTHORITY
MONTGOMERY COUNTY, PENNSYLVANIA

Franconia Township

STANDARD TECHNICAL SPECIFICATIONS
AND
REQUIREMENTS
FOR THE
CONSTRUCTION
OF
SANITARY SEWERS AND APPURTENANCES

ISSUED
January 2005

PREPARED BY

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PART 1 - GENERAL

1.1 SCOPE

A. These specifications have been adopted by the Franconia Sewer Authority to specify the manner in which sanitary sewers and force mains shall be installed by Developers/Builders in Franconia Authority.

B. The Developer/Builder prior to construction shall comply with all regulations and requirements of Franconia Sewer Authority, Pennsylvania Department of Environmental Protection and where applicable, all Federal regulatory agencies.

C. Before any work is started at the construction site, the Developer/Builder shall notify the Franconia Sewer Authority, Franconia Authority, the Franconia Police Department, the Souderton Area School District and the various utility companies serving the Authority and shall schedule a preconstruction meeting with the Authority and their Engineer.

D. It shall be understood that the Authority at their discretion reserves the right to visit the construction site(s) and inspect the installation of the sanitary sewers and force mains and require corrective actions to assure compliance with these standards.

E. All work is subject to the inspection and final acceptance by the Authority's Engineer.

1.2 DEFINITIONS

Wherever the following terms are used, hereinafter they shall have the following meanings:

A. *Authority* shall mean the Franconia Sewer Authority, which is responsible for the public sanitary sewer system in Franconia Authority.

B. *Engineer* shall mean the Authority's Engineer: SC Engineers Inc., Fort Washington, PA, Telephone (215) 836-9912. or their representative in the field during construction.

C. *Contractor* shall mean the company performing the sanitary sewer construction for the "Developer/Builder."

D. *Developer/Builder* shall mean the party responsible for the sanitary sewer system installation pursuant to an agreement with the Authority.

E. *Drawings* shall mean the construction plans prepared for the Developer/Builder, and approved by the Authority.

E. *Authority* refers to Franconia Authority and its Public Works Department.

1.3 AUTHORITY POLICIES REGARDING SANITARY SEWERS

A. The Developer/Builder is responsible for the following:
   1. Construction of the on-site sewer system.
   2. Extension of the sewers across the property to facilitate future extension.
   3. Extension of an off-site sewer to connect to an existing sewer, as directed by the Authority.
   4. Reimbursement, as provided under the provisions in PA Act 57, for connection to an existing sanitary sewer installed at the expense of another developer.
   5. Payment of the then-current tapping fee to Authority.
   6. Reservation and purchase (through Authority) of treatment capacity, in terms of EDU, from the appropriate treatment agency.
   7. Application, payment and receipt of all required permits and approvals.

B. Sanitary sewers should be constructed in accordance with the current Authority standard specifications and details.

C. Sanitary sewers are based on providing service to the first floor of houses.

D. Sewers located outside of the public right-of-way require a 30-foot wide easement. The metes and bounds of these easements should be shown on the Record Plan. Copies of the recorded sanitary sewer easements, including legal descriptions and plans and executed agreements, should be provided by the developer prior to the initiation of construction.

E. To the extent possible, manholes should be installed at the centerline of the roads or, alternatively, in the center of a traffic lane in the road.

F. Watertight manhole covers should be used in the flood plain vicinity, as directed by the Authority.

G. Manholes installed outside of paved areas shall have a rim elevation 12 inches above the final grade, as directed by the Authority.

H. The proposed sewer system shall be dedicated to the Authority and so noted on the Record Plan.

I. Private sewer laterals are subject to review and approval by the Authority Code Enforcement Officer (CEO). Subject to the review by the CEO, lateral requirements include the following:
   a. The lateral should have a minimum slope of ¼" per foot (2%).
   b. A horizontal separation of 5 feet of undisturbed earth (measured between the outer walls) should be provided between the sanitary lateral and the water service line and so dimensioned on the plans. Alternatively, the required distance shall not apply where there is (1) a minimum 12" vertical clearance between the bottom of the water service and the top of the sewer lateral and (2) a minimum 12" horizontal separation.
   c. Clean-outs should be installed in the lateral every 50 feet and/or at bends that exceed 45°.

J. The property owner is responsible for the maintenance of the sewer lateral: (a) to the curb line where the sewer main is located in a road way or (b) to the sewer main where the sewer main is located in a non-traffic area.

K. Facilities providing food preparation/service require (a) an appropriately sized and designed oil and grease separator and (b) a sampling manhole in the sewer lateral.

PART 2 - REQUIREMENTS

2.1 DOCUMENTS TO BE SUBMITTED TO OBTAIN PLAN APPROVAL

A. The Developer/Builder shall, in order to obtain approval of plans, submit his proposed plans and data to the Authority with sufficient information to enable the Authority's Engineer and Attorney to review same for compliance with sound engineering practices and legal requirements and all Authority rules and regulations. The Drawings shall be clear and legible. The plan view shall be drawn at a minimum scale of one (1) inch equals fourty (40) feet. The profiles shall be drawn at a minimum scale of one (1) inch equals four (4) feet vertical and one (1) inch equals fourty (40) feet horizontal with an accompanying plan view. Each drawing shall contain a North arrow. Each Drawing shall name the legal owner of the land on which the construction is to occur and the legal name of the Developer/Builder.

B. The Authority's review of the Developer/Builder's plans is for the purpose of determining general conformance with the Authority's Standard Specifications and requirements and details of the Authority. The Developer/Builder remains responsible for implementation of the Authority's Specifications, requirements and details. The Developer/Builder is also responsible for the accuracy of the Approved Drawings and for the designed facility to function as intended. The Developer/Builder is also responsible for determining the size and location of all existing utilities. The Developer/Builder is hereby notified that any purchase of material and/or equipment etc., prior to the Authority's approval thereof is at the Developer/Builder's risk.

C. When the Authority through its Engineer indicates its general acceptances of the proposed plans, the Developer/Builder shall provide an estimate of the construction of the proposed facilities in sufficient detail for the Engineer to establish an escrow amount for the proposed work. Standard estimating procedure shall be used. In general, sewer installation shall be classified by depth and size for estimating. An estimate for rock excavation shall also be included. It is preferred that the estimate be done by a contractor competent in the work to be performed. The Engineer will have the right to adjust the estimate to reflect his understanding of the cost to perform this work.

2.2 SUBMITTALS

A. The Developer/Builder shall submit copies of all required permits and other various requirements as itemized herein.

B. All submittals shall be made in accordance with Section 01300 SUBMITTALS of these specifications.

C. The Developer/Builder shall, in accordance with the following schedule, transmit to the Authority two (2) copies or sets of the following data, unless otherwise noted.

1. Two (2) weeks prior to construction.

   a. Four (4) sets of the approved Drawings signed and sealed by a Professional Engineer licensed to practice in the Commonwealth of Pennsylvania.
   b. Pennsylvania Department of Environmental Protection permits (when required).
   c. PennDOT, County and/or Authority Highway Occupancy Permit (when required)
   d. Montgomery County Conservation District erosion and sediment control plan approval
   e. Any other permits or approvals, as required
   f. Easement documents (executed), as required for construction
   g. Shop Drawings (see Section 01300, SUBMITTALS for further information)
   h. Blasting Report, if required

2. During Construction

   a. Letters of Certification as to compliance with the Specifications for:
      (1) Paving material
      (2) Select backfill - Type No. 2A (PennDOT)
      (3) Crushed stone for pipe bedding
      (4) Concrete
      (5) Pipe
      (6) Manholes

3. After Construction (see Part 3 of this section for further information)

   a. Certificates of system testing results
   b. Blasting records
   c. Paving core tests
   d. Record Drawings
   e. Warranties and Guarantees
   f. Maintenance Bond
   g. Easement documents, including recorded legal descriptions and plans
   h. Dedication documents.
   i. Contractor's waiver of lien rights.

2.3 COORDINATION WITH UTILITIES

A. All work done by the Developer/Builder shall comply of all requirements of PA Act 187 requiring the location of existing utility lines.

2.4 ROCK EXCAVATION

A. All blasting shall be performed under the supervision of a professional engineer licensed to practice in the State of Pennsylvania as described in Section 02230, ROCK EXCAVATION.

2.5 SOILS TESTING

A. All soils testing as described in Section 02220, EARTHWORK FOR UTILITIES of these Specifications shall be performed by a reputable testing and control firm when required by the Authority.

2.6 BUILDING LATERALS

A. Building laterals are to be installed from the sewer to a point 10 feet past the Street Right-of-Way Line, in accordance with the Construction Details. Laterals installed from the Street Right-of-Way Line to the building shall be installed in accordance with local plumbing code.

B. Where sewer's are to be capped, the, Developer/Builder shall install Building Laterals from the sewer to the Street Right of Way Line, for each property.

2.7 SPECIAL PRECAUTIONS

A. Relation of New Sewers to Existing or Proposed Water Mains

1. Horizontal Separation
   a. Whenever possible, sewers should be laid at least 10 feet, horizontally, from water mains. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:
      1) It is laid in a separate trench; or if
      2) It is laid in the same trench, with the water main located at one side on a bench of undisturbed earth; and if
      3) In either case the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.

2. Vertical Separation

   a. 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. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation, for a distance of 10 feet extending on each side of the sewer. If possible, one full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible. Where less than an 18 inch vertical separation exists between the water and sewer line, the sewer line shall be concrete encased 10 feet on each side of the water main.

b. No water main shall cross under a sewer line unless absolutely required, in which case, the water main shall be encased in concrete for a distance of 10 feet either side of the intersection or until the horizontal separation is equal to or greater than 10 feet from the intersection.

3. If possible, sewers crossing water mains shall be constructed so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main and both the sewer and the water main shall be encased in concrete for a distance of 10 feet on each side of the intersection.

B. Relation of New Sewers to existing Public Water Supplies and Private Wells

1. In general, sanitary sewers should be located at least 100 feet from public water supply sources and 50 feet from private water supply sources unless the sanitary lines are encased in concrete or constructed of ductile iron pipe with mechanical joints or equivalent.

C. Wells

1. Prior to construction of the sewers the Developer/Builder shall locate all domestic wells within the construction area. If a new sewer falls within a 50-foot radius of an existing well, that segment of the sewer within the 50-foot radius shall be encased in concrete.

2. The Developer/Builder shall report to the Authority any possibility of damage, caused by blasting to existing underground water supply wells. In the event that the Developer/Builder's activities affect the groundwater supply to wells, such that the wells do not yield their normal amount of water, the Developer/Builder shall provide temporary water service until the original groundwater level has been reestablished.

D. Septic Systems

1. Any septic systems which are disturbed by the Developer/Builder during construction shall be returned to operational status as quickly as possible, at no cost to the owner.

E. Safety and Protection

1. The Developer/Builder will be solely responsible for initiating, formulating, supervising, reviewing and overseeing any and all safety precautions, practices, procedures, and programs which are or should be provided in connection with the Work. Developer/Builder will take all necessary or proper precautions for safety of and will provide the necessary protection to prevent damage, injury or loss to:

a. All employees on the Work and any other person who may be affected thereby whether or not such person is involved with the Work.

b. All the Work and all materials or equipment to be incorporated therein whether in storage on or off the site.

c. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

F. Gabions for Protection of Creek Banks

1. Gabions shall be installed along all creek banks disturbed by sewer construction.

2.8 ACCESS TO WORK

A. Representatives of the Authority shall have access to the work. The Developer/Builder shall provide proper and safe facilities for such access and observation of the work and also for any inspection or testing thereof by others.

2.9 AUTHORITY MAY STOP THE WORK

A. If the work is defective, or the Developer/Builder fails to supply suitable materials, the Authority may order the Developer/Builder to stop the work, or any portion thereof, until the cause for such order has been eliminated.

2.10 TESTS AND INSPECTIONS

A. Where so indicated in these specifications, or if the laws, ordinances, rules, regulations or orders of any public agency having jurisdiction require any work to specifically be inspected, tested, or approved by some public body, the Developer/Builder shall assume full responsibility thereof, pay all cost in connection therewith and furnish the Authority the required certificates of inspection, testing or approval.

B. The Developer/Builder shall give timely notice of readiness of work for all inspections or approvals.

C. The Contractor shall be responsible for obtaining and disposal of all liquids used for testing. Water based liquids used for testing shall be potable water, creek or stream water or other Authority approved sources.

2.11 FINAL INSPECTION

A. Upon written notice from the Developer/Builder that the project is complete, the Authority will make a final inspection with the Developer/Builder and will notify the Developer/Builder in writing of all particulars in which this inspection reveals that the work is incomplete or defective. The Developer/Builder shall immediately take such measures as are necessary to remedy such deficiencies.

2.12 FINAL APPLICATION FOR ACCEPTANCE

A. After the Developer/Builder has completed all such corrections to the satisfaction of the Authority and delivered all schedules, guarantees, bonds, certificates of inspection and other documents, the Authority shall issue a letter of final acceptance.

PART 3 – SYSTEM DEDICATION

3.1 GENERAL

A. After the Contractor has completed all corrections to the installed sewer system and the Authority issued final acceptance, the Developer/Builder shall offer the sytem to the Authority for dedication. The Developer/Builder shall deliver deliver the following documentation as part of dedication:

1. Warranties and Guarantees.
2. Easement documents, including legal descriptions and plans suitable for recording.
3. As-built drawings.
4. Dedication documents.
5. Contractor's waiver of lien rights.
6. Maintenance Bond

3.2 WARRANTY AND GUARANTEE

A. Warranties and guarantees shall be turned over to the Authority. The Developer/Builder warrants and guarantees to the Authority that all work will be of good quality and free from faults or defects. All unsatisfactory work, all faulty or defective work, and all work not conforming to the Approved Drawings and these Specifications shall be considered defective. The Authority will give timely notice of all defects to Developer/Builder. At the option of the Authority, all defective work, whether or not in place, may be rejected, or accepted with or without requiring corrections from Developer/Builder.

3.3 RECORD PLANS

A. At completion of work, the Developer/Builder shall provide the Authority with Record Plans, in a neat and clean condition, showing the "As-Built Conditions".

B. Plans shall be marked "Record Plans" and maintained at the Project site during construction by the Contractor. The Contractor shall record on the prints all vertical and horizontal deviations from his approved Drawings and these specifications, at the time that such deviations are made. Drawings shall also indicate a profile showing the depths where rock was encountered and all other changes made to his approved Drawings and these specifications.

1. The Record Plans should be prepared, signed and sealed by a professional engineer registered in Pennsylvania. The following statement is required on all record drawings.

These record plans have been completed and certified by _____ *as reflecting as-built conditions. Responsibility for accuracy of the record plans rests with the above engineer.*

_____

Engineer's Signature and Seal

The as-built certification should be sealed on each plan.

2. An overall sewer system plan for the entire development should be provided. In addition to the reproducible mylar set and four (4) sets of blueprint drawings, an AutoCAD file of the approved as-built plans shall be submitted at time of plan acceptance.

3. Internal TV inspection reports and videotapes should be provided to the Authority.

4. The benchmark for the as-built elevations should be noted on the plans and should be based on USGS or NAVD datum and established by control monumentation.

5. Sewer mains should be shown in profile drawings, showing (a) pipe diameter, material, length, and slope, (b) manhole rim and invert elevations, and (c) other pipelines crossing or within 10 feet of the sanitary sewer.

6. A note should be added to the plans to clarify whether the sewer lengths are measured between manhole exterior walls, manhole cover center points, or some other points.

7. The installation and lengths of concrete encasements should be shown.

8. As-built road stations and offsets (from centerline) should be provided for the manholes.

9. Manholes and other fittings in the rear and sides of the properties should be referenced to some permanent features, such as by triangulation to building corners.

10. The size, material and depth of the lateral services should be noted shown on the plan.

11. Laterals and clean-outs should be located on the Utility Plans and respective plan/profile drawings by station, depth and distance behind the face of curb. Stations for the wye connections should also be provided and can be taken from the internal TV inspection reports. A tabulation of lateral data should be provided on each plan.

12. The basis for locating the lateral wyes and clean-outs should be specified in a note on the plans:
    - ☑ Baseline. The sewer appurtenances should be referenced to some baseline, typically the centerline of the sewer.
    - ☑ Station. Manholes (which are more readily located) should serve as the basis of the as-built stationing. Each manhole should serve as a 0+00 station so that appurtenances are never more than about 400 feet from a reference point and can be readily located. Manholes should include "back" and "ahead" (0+00) stations for easy reference.
    - ☑ Offset or Distance behind face of curb. The lateral clean-outs should be located by station and offset distance measured to the curb closest to the specific house. The

note should specify whether the distance is measured perpendicularly to the sewer main or the curb line. If necessary (a) along curves in the road or (b) near the end of cul-de-sacs, an additional note should clarify how to measure the offset distance.

In any case, the location data should allow Authority personnel to quickly locate sewer appurtenances in the field with simple measurements, without the use of survey equipment.

13. Laterals and clean-outs located in the rear and side yards can be referenced to the sewer main using the manholes 0+00 stations and the sewer as the baseline.

C. A complete file of accepted field sketches, diagrams, and other changes as may become necessary during the progress of the work shall also be maintained and attached to the set of marked-up prints.

D. At completion of the work, the Developer/Builder shall provide, for the information of the Authority, each sheet of marked prints and all accepted field sketches and diagrams.

E. When this data has been checked and returned by the Authority, the Developer/Builder shall record all field changes and conditions on the reproducible mylar "Record Drawings." Each sheet of these "Record Drawings" shall be signed by an Officer of the Company certifying that each sheet reflects the as-built conditions.

F Before final acceptance of the Work, deliver "Record Drawings" in a clean and neat condition to the Authority.

3.4 MAINTENANCE BOND

A. The Developer/Builder shall be required to provide a Maintenance Bond equal to fifteen percent (15%) of the construction cost of the completed work, or ten thousand dollars ($10,000.00) whichever is greater. The Maintenance Bond shall be held for a period of 18 months from the date of acceptance. The Developer/Builder shall also purchase and maintain such insurance as will protect the Authority from any claims. The said insurance shall be as required under the laws of Pennsylvania.

3.5 CORRECTION PERIOD

A. If after final inspection and prior to the expiration of the 18-month maintenance bond or such longer period of time as may be prescribed by law or, by the terms of any applicable special guarantee required by the Authority any work installed by the Developer/Builder is found to be defective, Developer/Builder shall promptly, in accordance with Authority's written instructions, either correct such defective work, or, if it has been rejected by Authority, remove it from the site and replace it with non-defective work. if Developer/Builder does not promptly comply with the terms of such instructions, the Authority may have the defective work corrected or the rejected work removed and replaced, and all direct and indirect costs of such removal and replacement, including compensation for additional professional services shall be paid by Developer/Builder.

**** END OF SECTION ****

SECTION 01020: EROSION AND SEDIMENT CONTROL PLAN

PART 1 - GENERAL

1.1 INTENT

A. The Department of Environmental Protection of the Commonwealth of Pennsylvania (PADEP) requires the preparation and implementation of a plan for the prevention of accelerated soil erosion and sedimentation of the streams of the Commonwealth under Title 25, Chapter 102 of their regulations. Such plans are required for all earthmoving activities and it is intended that this plan will fulfill this PADEP requirement and prevent sedimentation.

B. It shall be the responsibility of the Contractor to implement this plan in the field and meet all state and local regulations pertaining to it. A copy of this plan shall be kept at the project site. The Contractor shall assign this responsibility to a person experienced in erosion and sediment control procedures. Modifications or deviations from this plan will be allowed only if the Contractor first obtains written permission from PADEP and/or other agencies having jurisdiction.

1.2 APPLICABLE STANDARDS

A. All soil erosion and sediment control practices on the drawings shall be constructed in accordance with the "*Erosion and Sediment Pollution Control Program Manual*" of the Commonwealth of Pennsylvania, Department of Environmental Protection, as printed in April 1990 with all current revisions and amendments.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A.	Clearing and grubbing:	Section 02110, CLEARING AND GRUBBING
B.	Excavation and backfilling:	Section 02220, EARTHWORK FOR UTILITIES
C.	Paving:	Section 02602, REPAVING
D.	Seeding and Sodding:	Section 02810, RESTORATION OF DISTURBED AREAS
E.	Details of Controls	Control measures shall be installed per the details in the Drawings and/or in accordance with the PADEP Manual.

1.4 STANDARD CONDITIONS RELATING TO PADEP WATER QUALITY MANAGEMENT PERMITS

A. The Contractor shall familiarize himself and shall be responsible for carrying out all requirements stated in the Standard Conditions Relating to Erosion Control which are attached to the PADEP Water Quality Management Permit issued for the construction of this project.

1.6 MEASUREMENT AND PAYMENT

A. The cost for erosion and sedimentation controls must be included in the unit prices for the items to which the erosion controls pertain or be included in the lump sum price of the Contract wherever applicable.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products and materials shall meet the requirements of the local soil conservation service or as specified elsewhere in these Specifications.

PART 3 - EXECUTION

3.1 PLANNING AND DESIGN FOR CONSTRUCTION

A. Construction projects that involve major land disturbance such as municipal plants, roadways and pipelines shall be planned and designed with soil erosion and sediment control in mind. While erosion and sedimentation controls are important on all sites, particular attention should be given to areas of steep topography and highly erodable soils. Cleared areas shall be kept to a minimum and the shortest practical distance ahead of construction.

B. Where practical, a construction sequence and schedule of earth moving activities shall be included in the submittals for the project.

C. Restoration work shall be done as the project progresses and not be left until the end of the project. No areas shall be left unprotected for more than twenty (20) days without some form of temporary seeding or if in a non-growing season, some other form of stabilization such as mulch.

3.2 SEDIMENT CONTROL MEASURES

A. Some of the sediment control measures or devices which can be used to control sedimentation of streams, water courses or pipelines are:

1. Stabilized Construction Entrance
   a. Where construction traffic will enter paved roads, a stabilized construction entrance shall be provided to prevent tracking or flow of sediment onto public rights-of-way.

2. Earth Berms and/or Diversion Ditches
   a. These structures shall be constructed at locations shown on the drawings. The primary purpose of these structures is to divert stormwater runoff to sediment traps or basins, thus preventing sediment from reaching streams, etc. The berm/ditch is usually constructed simultaneously by compacting the material just excavated from the ditch to form the berm.
   b. Earth berm/diversion ditches are normally 12 inches to 18 inches in width and have an average depth of 12 inches to 18 inches
   c. Side slopes should not exceed 2 horizontal to 1 vertical. If ditch slopes exceed 4 percent, they shall be stabilized with crushed stone.
   d. Whether the berms are temporary or permanent, they shall be stabilized immediately with seed or other acceptable stabilizers.

3. Sediment Basins
   a. These structures shall be constructed at locations shown on the drawings. Sediment basins may be temporary or permanent, formed by excavation and/or embankment to intercept sediment-laden runoff and to trap and retain sediment.
   b. Embankments shall not exceed 4 feet in height as measured at the low point of the original ground along the centerline of the embankment. Embankments shall have a minimum 4-foot top width at stone filter outlets and 2-foot minimum width for earth berms connecting the trap. Side slopes shall be 2:1 or flatter. The embankment shall be compacted while being constructed.
   c. All excavation operations shall be carried out in such a manner that erosion and water pollution shall be minimal. Any excavated portion of sediment traps shall have 2:1 or flatter slopes.
   d. There are two types of outlets generally used for basins.
      (1) Stone filter outlet. This outlet consists of a basin formed by embankment or a combination of embankment and excavation. The outlet is a built-up stone embankment with a core of straw bales and covered by a minimum of 6 inches of crushed stone. Crushed stone shall be similar to AASHTO PennDOT No. 57 stone. A stone emergency overflow weir shall be constructed 1 foot below the top of embankment.
      (2) Pipe outlet. The outlet is a combination of a corrugated metal perforated riser pipe connected to a horizontally sloped pipe going through the embankment. Trash rack, anti-vortex device and anti-seep collars, if required, shall be as specified in PennDOT Standards for Roadway Construction.

   e. Embankments and other areas disturbed by construction of basins shall be temporarily stabilized by seeding with temporary approved mixture at the rate of 1 pound per 1,000 square feet. After contributing areas have established permanent vegetation, the temporary sediment traps shall be removed, the areas regraded and reseeded permanently.

4. Sediment Traps
   a. Sediment traps are the same as the sediment basins described above but are normally existing low spots where stormwater runoff drains to naturally. The construction is mostly excavating to form a more shallow type earth containment system. Generally, a crushed stone filter berm outlet is sufficient for these traps similar to Paragraph 3.2, A, 3, d, (1) above. If earth berms are constructed, they shall be stabilized immediately.

5. Filter Berms
   a. When construction operations take place within existing curbed roadways and backfilling will not immediately take place, crushed stone filter berms may be required by the Engineer. The filter shall be 6 inches high placed perpendicular to the curb, and be shaped with side slopes which will facilitate vehicular traffic.

6. Filter Inlets
   a. Temporary filter inlets shall be used at existing stormwater inlets where required by the Engineer and are built by first setting concrete blocks in circle around the inlet and then piling crushed stone against the blocks. The stone filters sediment from the runoff and the blocks prevent the stone from being washed into the storm sewer system. After all disturbed areas draining to the inlet have been stabilized the filtering materials can be removed.

7. Silt Fence
   a. Materials
      (1) Synthetic filter fabric shall be a pervious sheet of propylene, nylon, polyester or ethylene yarn and shall be certified by the manufacturer or supplier as conforming to the following requirements:

Physical Property	Test	Requirements
Filtering Efficiency	VTM-51	75% (minimum)
Tensile Strength at	VTM-52	Extra Strength: 20% (max.) Elongation* 50 lbs./linear inch (min.) Standard Strength: 30 lbs./linear inch (min.)
Flow Rate	VTM-51	0.3 gal./sq.ft./min. (minimum)

* Requirements reduced by 50 percent after 6 months of installation.

Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0°F to 120°F.

(2) Posts for Silt Fences shall be either 4-inch diameter wood or 1.33 pounds per linear foot steel with a minimum length of 5 feet. Steel posts shall have projections for fastening wire to them.

(3) Wire fence reinforcement for silt fences using standard strength filter cloth shall be a minimum of 42 inches in height, a minimum of 14 gauge and shall have a maximum mesh spacing of 6 inches.

b. This sediment barrier utilizes standard strength or extra strength synthetic filter fabrics. It is designed for situations in which only sheet or overland flows are expected.

(1) The height of a silt fence shall not exceed 36 inches (higher fences may impound volumes of water sufficient to cause failure of the structure).

(2) The filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, filter cloth shall be spliced together only at a support post, with a minimum 6-inch overlap, and securely sealed.

(3) Posts shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground (minimum of 12 inches). When extra strength fabric is used without the wire support fence, post spacing shall not exceed 6 feet.

(4) A trench shall be excavated approximately 4 inches wide and 4 inches deep along the line of posts and upslope from the barrier.

(5) When standard strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least 1 inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of 2 inches and shall not extend more than 36 inches above the original ground surface.

(6) The standard strength filter fabric shall be stapled or wired to the fence, and 8 inches of the fabric shall be extended into the trench. The fabric shall not extend more than 36 inches above the original ground surface. Filter fabric shall not be stapled to existing trees.

(7) When extra strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric shall be stapled or wired directly to the posts with all other provisions of Subparagraph (6) applying.

(8) The trench shall be backfilled and the soil compacted over the filter fabric.

c. Maintenance

(1) Silt fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

(2) Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, the fabric shall be replaced promptly.

(3) Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier. At no time shall they be permitted to reach one-half the height of the barrier.

(4) Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

(5) Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, prepared and seeded.

8. Straw Bales
   a. Staked straw bales shall be installed where indicated on the drawings or required.

9. Other Filter Devices
   a. Other devices which can be used to trap sediment are straw bales, rock and stone dams, planting of grass or other vegetative cover on bare areas.

3.3 EROSION CONTROL MEASURES

A. Steep slopes, potential landslide areas, stream crossings, stream encroachments, cut and fill sections and trenching operations are the potential sources of soil erosion and the resulting sedimentation. Some soil erosion control measures which are available are:

1. Earth Slope Protection
   a. Earth slopes shall be protected from accelerated erosion as soon as possible after the cut or fill operation. This can be done by quick establishment of vegetative cover (temporary and/or permanent), benching or terracing or making flatter slopes where possible; mulches, providing jute matting or synthetic netting on steeper slopes or a combination of the above.
   b. On stream crossings, special planning and design consideration shall be done and complete details included in the Drawings and/or in these specifications.

2. Pipeline Trenches
   a. When trenches are backfilled, they shall be filled above the original ground to allow for settling and to allow water to run off instead of following the trench line when backfill settles.
   b. Where the grade along the top of the backfilled trench is over 5 percent, water breaks shall be installed diagonally across the trench to divert water onto grassy areas at about a 30-degree angle from a line perpendicular to the trench line and spaced at proper intervals. Intervals shall not exceed one hundred (100) feet.
   c. A water break may be an earth berm 6 inches to 8 inches high, a crushed stone berm or a straw bale barrier constructed diagonally across the trench to divert runoff to one side of the trench at intervals, thus preventing a constant flow of stormwater along the side of the backfilled trench.

3. Large Diversion Channels
   a. Where large stormwater diversion channels are to be constructed as a permanent facility, crushed stone, rip-rap or gabions shall be required as indicated on the drawings for bottom and/or slope protection.
   b. Every effort should be made to preserve and upgrade existing natural channels.
   c. Where space limitations are not a factor, wide channels with flat slopes lined with grass are normally sufficient to control erosion.
   d. Depending on the diversion channel gradient, grade control shall be required:

Slope	Requirement
1% to 2%	a drought resistant seed mixture shall be seeded to the channel bottom, and mulch material applied
2% to 4%	the channel bottom shall be seeded with a drought resistant seed mixture, the area mulched and the mulch stabilized with either jute matting or some commercial mulch and netting
>4%	channel shall be protected with erosion resistant materials according to the surface water velocities expected during a design storm

4. Preservation of Existing Vegetation
   a. Good stands of existing vegetation adequate to control erosion should be preserved wherever possible. Regeneration of wood plants should be encouraged where acceptable.
   b. New vegetation, soil treatments, etc. shall be done as specified on the Drawings and in the applicable sections of these specifications.

5. Storm Inlets and Endwalls
   a. Storm inlets and endwalls in grassy areas are usually permanent but are still devices that will slow erosion and sedimentation by directing surface waters safely underground. They may require special treatments at entrances or outlets to control erosion.
   b. All storm drainage inlets collecting sediment laden water from the project area shall be provided with inlet protection or shall be temporarily capped until permanent stabilization has been provided within the area tributary to the effected inlets.

3.4 STREAM PROTECTION

A. Where construction is close to existing streams and other waterways, construction shall be performed in a manner which will not contribute to stream pollution. Construction practices shall include the following:

1. Construction debris, excavated materials, brush, rocks, refuse and topsoil shall be kept as distant from the stream as is possible.

2. Stream crossings and machinery operation in streams is prohibited. Under no circumstances will a stream bed be permitted to become a highway for machinery traffic.

3. There shall be no change in preconstruction contours (excess material must be removed to an upland disposal area).

4. The discharge of dredged or fill material shall not destroy a threatened or endangered species as identified under the Endangered Species Act, or endanger the critical habitat of such species.

5. The discharge of dredged or fill material shall consist of suitable material free from toxic pollutants in other than trace quantities.

6. The fill created by the discharge of dredged or fill material shall be properly maintained to prevent erosion and other non-point sources of pollution.

7. The discharge of dredged or fill material shall not occur in a component of the National Wild and Scenic Rivers System or in a component of a State Wild and Scenic River System.

8. The discharge of dredged or fill material shall not be located in the proximity of a public water supply intake.

9. The discharge of dredged or fill material shall not occur in areas of concentrated shellfish production.

10. Discharges of dredged or fill material into waters of the United States shall be avoided or minimized through the use of other practical alternatives.

11. Discharges in spawning areas during spawning season shall be avoided.

12. The discharge shall not restrict or impede the movement of aquatic species indigenous to the waters or the passage of normal or expected high flows or cause the relocation of the waters (unless the primary purpose of the fill is to impound waters).

13. If the discharge creates an impoundment water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow, shall be minimized.

14. Discharges in wetland areas shall be avoided.

15. Heavy equipment working in wetlands shall be placed on matting. Matting shall be wood or other suitable protective material having a minimum thickness of 4 inches. The length and width, as determined by the contractor, shall be sized to protect the wetlands.

16. Discharges into breeding and nesting areas for migratory waterfowl shall be avoided.

17. All temporary fills shall be removed in their entirety.

18. Pollutants such as chemicals, fuels, lubricants, bituminous, raw sewage and other harmful waste shall not be discharged into or alongside of water sources or into natural or man-made channels leading thereto.

3.5 TRAFFIC CONTROL

A. Minimization of the area of disturbance also involves traffic control. Corridors for equipment travel shall be established to protect those areas that will not be denuded. Instructions shall be issued that routes for convenience shall not be allowed and that the established equipment travel corridors must be used. These instructions must be enforced. Traffic shall be kept to an absolute minimum. Delivery of material will be required and this traffic shall enter and leave on a designated access route. Passenger vehicle traffic shall be discouraged. Workmen shall walk from the street rather than drive and they shall park on stabilized areas whenever possible. The filtering of sediment-laden runoff by the vegetation is an important measure in the reduction of sediment delivered to down-stream areas and it must be preserved. Indiscriminate and convenience travel shall not be allowed to destroy these natural filter areas.

3.6 STOCKPILES

A. All stripped topsoil and excavated earthen material to be used within the project site shall be properly stockpiled. Material found to be unsuitable for subsequent use or in excess of the quantity required shall be disposed of. The location and method of disposal, and means of transport shall be in accordance with state and local laws.

B. Stockpile areas shall be selected and maintained by on-site personnel. Site selections and stockpile design shall incorporate sediment and erosion control facilities to prevent the potential direct

production and delivery of sediment to waterways, damage to vegetation that is part of the total sediment and erosion control plan, and the unnecessary destruction of trees that are selected for preservation. Temporary or interim stabilization of soil stockpiles shall be promptly instituted. The existence of critical slopes on stockpiles shall be avoided. Stockpiling in or immediately adjacent to diversion channels will not be allowed because the stockpiled material may provide a direct and high volume source of sediment due to storm runoff. Containment structure shall be installed on large stockpiles. Their design and implementation shall be accomplished by competent on-site personnel.

C. All soil that is to be stockpiled for a period of greater than 20 calendar days shall be temporarily stabilized as described in the "Temporary Stabilization" section of these specifications.

D. Temporary vegetative measures planned for implementation on stockpile areas shall be established immediately after the stockpile operation is completed or within twenty (20) days. Proper mulching and soil stabilization in conjunction with seeding operations shall also be carried out.

E. A staked straw bale berm shall be provided at the base of all the stockpiles for additional protection.

3.7 PUMPED WATER

A. Pumped water management shall be practiced by the Contractor to reduce the production of sediment. Pumped water shall be discharged onto stabilized surfaces and then allowed to be filtered by existing vegetation. If ditches are required to remove pumped water from construction excavations they shall be given the same consideration as any other man-made waterway and they shall be stabilized so they do not degrade and produce sediment.

3.8 EXCAVATION AND BACKFILL

A. Excavation shall be closely controlled. The material removed from the excavation shall be selectively stockpiled in areas where a minimum of sediment will be generated and where other damage will not result from the piled earth. Drainageways shall be protected at all times and the piling of soil in drainageways will not be allowed. Backfilling operations shall be performed in such a manner that remaining trees are not damaged. Temporary repaving shall be placed promptly after backfill operations are completed in improved areas.

3.9 TEMPORARY STABILIZATION

A. All areas disturbed by on-site grading that will not be constructed upon within the next 20 calendar days shall be temporarily stabilized:

1. Vegetative cover

Temporary vegetative cover shall be provided in areas requiring temporary stabilization during construction, and as specified by the owner as follows:

a. Fertilizer: apply 10-20-10 fertilizer or equivalent at the rate of 500 lbs per acre.
b. Limestone: shall be equivalent to 50% calcium plus magnesium oxides, and applied at the rate of 2 tons per acre.

c. Seed type shall be as indicated below:

(1) Optimum seeding dates are February 15 thru May 1 or August 15 thru October 15 for the following species:

Species	Pounds per Acre	Optimum Seed Depth (Double for Sandy Soil)
Annual Ryegrass	40	0.5 inch
Perennial Ryegrass	40	0.5 inch
Oats	86	1 inch
Barley	96	1 inch

(2) Optimum seeding dates of May 1 thru August 1 for the following species which may be planted throughout summer if the soil moisture is adequate or can be irrigated.

Species	Pounds per Acre	Optimum Seed Depth (Double for Sandy Soil)
Pearl Millet	20	1 inch
Sudangrass	30	1 inch
Millet (German or Hungarian)	30	1 inch
Weeping Lovegrass	5	1 inch

2. Mulching

Mulching shall be provided as required in areas difficult to vegetate, and during off-season operations. Mulching methods and materials shall conform to the following:

(1) Mulch materials shall be unrotted salt hay, hay or small grain straw applied at the rate of 70 to 90 pounds per 1000 square feet. Mulch blowers shall not grind or chop the material.

(2) Mulch shall be spread uniformly by hand or mechanically so that approximately 75 percent to 95 percent of the soil surface will be covered.

(3) Mulch anchoring shall be accomplished immediately after placement to minimize loss by wind or water. This may be done by one of the following methods, depending upon the size of slopes and costs.

(a) Peg and Twine - Drive 8 to 10 inch pegs to within 2 to 3 inches of the soil surface every 4 feet in all directions. Stakes may be driven before or after applying mulch. Secure mulch to soil surface by stretching twine between pegs in a criss-cross and a square pattern, secure twine around each peg with two or more round turns.

(b) Mulch Nettings - Staple paper, jute, cotton or plastic nettings to the soil surface. Use a degradable netting in areas to be mowed.

(c) Liquid Mulch Binders - may be used to anchor salt hay, hay or straw mulches.

(d) Applications should be heavier at edges were wind catches the mulch, in valleys and at crests of banks. Remainder of area should be uniform in appearance.

(e) Wood-fiber or paper-fiber mulch at the rate of 1,500 pounds per acre may be applied by a hydroseeder. Use is limited to flatter slopes and during optimum seeding periods in spring and fall.

3. Other

a. Where excessive soil erosion, tracking, or flowing of sediment is evident or anticipated, a minimum of 4 inches of crushed stone shall be placed within the affected area and maintained until permanent stabilization is provided. Additional stone shall be placed as required until stabilization is achieved. Crushed stone shall conform to AASHTO designation M43, size no. 2 (2½" to 1½").

3.10 FINAL GRADING AND SEEDING

A. The establishment of permanent vegetative cover such as seeding or sodding on all areas shall be accomplished within 10 days after final grading operations have been completed. Time extensions beyond the 10 day requirement must be requested in writing and are subject to written approval.

B. After the construction phase is complete permanent vegetation on the areas that have been disturbed shall be reestablished as rapidly as possible. If the completion of the construction activities does not coincide with a season in which permanent vegetation can be started an interim or temporary program is required. This shall include soil stabilization, mulching, or the establishment of filter strips. In any case erosion and sediment controls shall be installed promptly and their maintenance assured.

C. Finish grading, topsoiling, seeding and/or sodding shall be performed as specified on the Drawings and in Section 02810, RESTORATION OF DISTURBED AREAS, of these Specifications. Types and quantities of soil conditioners, fertilizers, and seed mixtures shall be as specified above or in accordance with the recommendations of the local state agricultural agent.

D. Sod shall be installed on all slopes steeper than 2 to 1 or where indicated on the Drawings. Under no circumstances shall slopes exceed 1½ to 1 after final grading is completed.

E. Two (2) one-pint samples from each source of topsoil proposed for use shall be forwarded to the local state agricultural agent for his recommendations as to types and quantities of soil conditioners, fertilizers and seed mixtures. As a minimum, permanent vegetative cover shall be established by providing the following:

1. Fertilizer: 500 lbs per acre of 10-20-10 or equivalent, in addition, 300 lbs per acre of 38-0-0 of slow release nitrogen or equivalent may be used in lieu of topdressing.

2. Limestone: shall be equivalent to 50% calcium plus magnesium oxides, and applied at the rate of 3 tons per acre.

3. Permanent seeding (minimum requirements) shall be as follows:

a. Sandy, Dry Soils
   (1) Optimum seeding dates: February 15 - May 1
   (2) Seed mixtures:

Type "B"	Pounds per acre
Redtop	10
Red fescue (creeping's or chewings's)	40
Blackwell switchgrass	10
Reed canarygrass	10
Weeping lovegrass	10
Perennial ryegrass	5
Kentucky-31 tall fescue	15

b. All except Sandy, dry soils
   (1) Optimum seeding dates: February 15 - May 1 or August 15 - October 15
   (2) Seed mixtures:

Type "A"	Pounds per acre
Kentucky bluegrass	20
Red fescue (creeping's or chewings's)	35
Kentucky-31 tall rescue	20
Redtop	10
Perennial ryegrass	10
White clover	5

4. Mulching, if required, shall be provided as described herein.

3.11 MAINTENANCE

A. Sediment and erosion control practices will not function properly throughout their designed life span if they are not maintained. Periodic inspection shall be made at frequent intervals and after each storm event to detect any impairment in the ability of the erosion control facilities installed as part of this plan to continue to function effectively. Responsibility for maintenance shall be assigned to an individual who has access to equipment, material and funds required to sustain the maintenance schedule.

B. Most control structures require work to restore them after each storm. This maintenance shall be performed to allow the structure to continue to perform the function for which it was designed.

C. Vegetative practices require maintenance. Frequently, a stand of vegetative cover established in the sediment and erosion control program is allowed to deteriorate and become ineffective. A fertilization and reseeding program shall be established and carried out as the construction proceeds. Areas where failures have been experienced in the establishment of vegetative protection shall be promptly treated. The reestablishment of permanent vegetative cover shall be initiated as soon as possible in an effort to keep the area requiring maintenance work to a minimum.

D. Information shall be distributed to all persons on the construction site describing and stressing the importance of the proper installation and maintenance of the erosion and sediment control procedures included in this plan. The actions and language of supervisors on the project shall continually emphasize the seriousness and importance of sound erosion and sediment control procedures.

E. The approved erosion and sediment control plan and any standard conditions relating to Soil Erosion and Sediment Control issued as part of any permits shall be available at the immediate site of construction activity at all times.

F. Maintenance of soil and erosion control facilities shall continue throughout the life of the project.

3.12 SUGGESTED SEQUENCE OF EARTHMOVING RELATED ACTIVITY

A. The following is a suggested sequence of earthmoving related activity that may be implemented in sections within the project site.

1. Construct silt fence in accordance with the grading, soil erosion control plan and site details.
2. Stabilize potential heavily traveled entrance/exit ways to active work areas in accordance with these specifications.
3. Construct inlet protection in accordance with these specifications, and as indicated on the drawings.
4. Strip topsoil within the proposed construction and regrading areas and stockpile. Provide a staked straw bale berm around stockpile.
5. Clear and grub site as required.
6. Conduct excavation operations in accordance with the drawings. Excavated material suitable for backfill shall be utilized within the site.
7. Rough grade the site as per the grading drawings.
8. Stabilize potential soil erosion areas per these specifications, and as indicated on the drawings.
9. Stabilize proposed pavement areas by constructing subbase as soon as practical. Temporarily stabilize problem areas in accordance with these specifications prior to subbase installation if required.
10. Construct all footings, subbases, underground utilities, and complete all other subsurface work.
11. Complete as much final grading as practical.
12. Construct all structures, pavements, and complete all other above grade work.
13. Complete all final grading.
14. Fertilize, seed, lime, and mulch areas designated to receive a grass cover within 10 days after final grading.
15. Remove all staked straw bales, silt fence, and other temporary soil erosion and sediment control materials after all areas have been permanently stabilized.

**** END OF SECTION ****

PART 1 - GENERAL

1.1 SCOPE

A. Description of Work

1. The Contractor shall comply with PA Act 287 of 1974 as amended by Act 172 (enacted June 10, 1987), by Act 38 (enacted December 12, 1991) and by Act 187 (effective December 19, 1996) and any subsequent amendments or revisions enacted by the Commonwealth of Pennsylvania. Accordingly, the Contractor, prior to performing excavation or demolition work on the job site shall obtain all recorded locations of existing lines as outlined herein.

2. Contact the Utility companies to provide exact locations of utilities before excavation or demolition work is started.

3. Attention is directed to the fact that there may be other lines in certain locations in addition to the recorded locations.

B. Related Work Specified Elsewhere

1. Act No. 187, Commonwealth of Pennsylvania
2. Excavation, Section 02220, EARTHWORK FOR UTILITIES.
3. Rock excavation, Section 02230, ROCK EXCAVATION.

1.2 SUBMITTALS

A. The Contractor shall furnish the Engineer a certification listing the names of the users whom he has contacted during course of construction.

1.3 DEFINITIONS

A. The "Definitions" defined below are intended to be the definitions used in PA Act No. 187.

1. "*Communications expenses*" means the direct telecommunications costs incurred by a one-call system in notifying a user of a potential excavation, including any costs billed directly to a user by a telecommunications company other than a one-call system.

2. "*Contractor*" means any person who or which performs excavation or demolition work for himself or for another person.

3. "*Demolition work*" means the use of powered equipment or explosives to destroy or raze any structure.

4. "*Designer*" means any architect, engineer or other person who or which prepares a drawing for a construction or other project which requires excavation or demolition work as defined by Act 187.

5. "*Emergency*" means any condition constituting a clear and present danger to life or property by reason of escaping gas, exposed wires, or other breaks or defects in a user's lines.

6. "*Excavation work*" means the use of powered equipment or explosives in the movement of earth, rock or other material, and includes but is not limited to anchoring, augering, backfilling, blasting, digging, ditching, driving-in, grading, plowing-in, pulling-in, ripping, scraping, trenching and tunneling; but shall not include such use in agricultural operations nor operations necessary or incidental to the purposes of finding or extracting natural resources including all well site operations and shall not include work within a State highway right-of-way, performed by employees of the Commonwealth acting within the scope of their employment, which does not extend more than twenty-four inches beneath the existing surface or political subdivisions performing minor routine maintenance within the right-of-way of roads within their jurisdiction.

7. "*Line*" means an underground conductor or underground facility used in carrying or providing electric or communication service, or an underground pipe used in carrying or providing gas, oil or oil product delivery, sewage, water or other service to one or more consumers or customers of such service and the appurtenances thereto. The term does not include storm drainage facilities which are located within a public highway right-of-way. The term shall not include oil and gas production and gathering pipeline systems designed principally to collect oil or gas production from wells located in this Commonwealth provided such systems are marked or staked where they cross a public highway right-of-way.

8. "*Minor routine maintenance*" means shaping of or adding dust palliative to unpaved roads, patching of the surface or base of flexible base, rigid base or rigid surface roads by either manual or mechanized method to the extent of the existing exposed base material, crack and joint sealing, adding dust palliative to road shoulders, patching of shoulders and shoulder bases by either manual or mechanized methods to the extent of the existing exposed base, and cleaning of inlets and drainage pipes and ditches.

9. "*One-call system*" means a communication system established within the Commonwealth of Pennsylvania to provide a single telephone number for contractors or designers or any other person covered by this act to call to notify users of underground lines and pipe of the caller's intent to use powered equipment for excavating, tunneling, demolition or similar work. A one-call system shall be incorporated and operated as a nonprofit corporation pursuant to 15 Pa C.S. Part III (relating to corporations not- for-profit).

10. "*Operator*" means any individual in physical control of powered equipment or explosives when being used to perform excavation or demolition work.

11. "*Owner*" means any person who or which engages a contractor for a construction or other project which requires excavation or demolition work as herein defined.

12. "*Person*" means an individual, partnership, corporation, political subdivision, a municipal authority, the Commonwealth and its agencies and instrumentalities, or any other entity.

13. "*Powered equipment*" means any equipment energized by an engine or motor and used in excavation or demolition work.

14. "*Site*" means the specific place or places where excavation or demolition work is being or is to be performed.

15. "*User*" means the public utility, political subdivision, municipality, authority, rural electric cooperative or its named representative trade association, or other person or entity who or which owns or operates a line. The term does not include the Commonwealth or its agencies.

16. "*Working day*" means any day except a Saturday, Sunday or legal holiday prescribed by act of the General Assembly.

PART 2 - PRODUCTS

2.1 NONE

PART 3 - EXECUTION

3.1 GENERAL

A. It shall be the duty of each Contractor who intends to perform excavation or demolition work within the Commonwealth to ascertain the exact location and type of users' lines which are located within the limits of work of this Contract.

3.2 OBTAINING LOCATION OF EXISTING USERS' LINES

A. The Contractor shall obtain the list of users from any of the following sources:

1. By inspection of the Drawings which show the approximate location of the users' facilities, and/or the "List of User's" shown thereon. The Contractor is responsible to verify and/or update this "List" prior to starting construction.

2. By requesting a list of users from the Montgomery County Recorder of Deeds.

B. The Contractor shall secure all necessary municipal permits relating to road occupancy prior to commencing excavation.

C. Not less than three nor more than ten working days prior to the day of beginning such work, to notify each user of the Contractor's intent to perform such work at its site or sites, and to request the information prescribed herein, from each such user's office designated on the Drawings or on the list of users obtained. The Contractor shall be deemed to have given the notice described in this clause if he calls a one-call system serving the location where the excavation is to be performed.

D. The following are the minimum cooperative steps which the Contractor shall take, either at or off the excavation or demolition site:

1. Before the Contractor starts any demolition work in the area of a particular user's line, the Contractor shall ascertain from the User if the user wants to have a representative present

during the excavation within this area. Additionally, the Contractor will comply with all standard regulations and necessary precautions as may be required by the User.

2. Inform each operator, employed by him at the site of such work, of the information obtained by him as noted above.

3. Report immediately to the User any break or leak on its lines, or dent, gouge, groove or other damage to such lines or to their coating or cathodic protection, made or discovered in the course of the excavation or demolition work.

4. Alert immediately the occupants of premises as to any emergency that he may create or discover at or near such premises.

E. The User may require additional cooperative steps be taken beyond those noted above depending on the circumstances of the time and/or location of this work.

F. The Contractor shall exercise due care; and take all reasonable steps necessary to avoid injury to or otherwise interfere with all lines where positions have been provided to the Contractor by the Users. If insufficient information is available the Contractor shall employ prudent techniques, which may include hand-dug test holes, to ascertain the precise position of such facilities.

3.3 LOCATING LINES

A. All recorded or unrecorded lines shall be located on the ground with pipe locating equipment well ahead of the work at all times. All such locations shall be plainly marked by coded paint symbols on pavement or by marked stakes in the ground. Such locations shall be established at least 50 feet in advance of all trench excavation. All such location work shall be provided by the Contractor to the satisfaction of the Engineer at no extra cost.

** **END OF SECTION** **

PART 1 - GENERAL

1.1 SCHEDULES

A. The Contractor shall be responsible for preparing a Progress or Work Schedule for the project.

1.2 SHOP DRAWINGS, SAMPLES AND MANUALS

A. The Contractor shall process the Shop Drawings required by his Work to the Engineer and he shall be responsible for their timely submission in accordance with the Shop Drawing schedule which is included in the overall progress or work schedule as described in Part 2 of this Section.

B. Any proposed deviations/substitutions from that specified shall be clearly noted on the cover letter transmitting the shop drawing. Failure to so note will be cause for rejection of equipment, materials, etc. after installation.

C. All submissions shall be marked with the Specification Section Number containing the item submitted for review, or Drawing number for items specified on Drawings only.

D. Revised shop drawings submitted for review shall be marked "RESUBMISSION."

1.3 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall be responsible for all construction progress photographs.

1.4 SUBMITTAL PROCEDURES

A. All submittals shall be delivered to the Engineer.

B. The Engineer will screen the submittals to ensure that they have been properly certified and identified by the Contractor. If they are submitted properly, the items will be processed for review.

C. The processed submittals will be returned to the Contractor.

PART 2 - SCHEDULE

2.1 PREPARATION

A. The Contractor shall prepare a Progress or Work Schedule for the Project, using CPM, showing the order in which the Contractor proposes to carry on his work and salient features, including submissions of shop drawings and samples and procurement of materials, to meet date of completion.

B. Each activity in the Progress or Work Schedule shall be identified and a time for the performance of such activity indicated. Each activity shall be preceded by all work that must be accomplished prior to that activity. All abbreviations, codes and/or symbols used shall be described on the Schedule.

C. In addition to the schedule described above, the Contractor shall submit a list of shop drawings he proposes to submit for review which shall include the following:

1. Specification Section Number (description of all items within section)
2. Drawing Number (description of all items on each Drawing, if not previously covered by the Specifications)
3. Approximate Date of Submittal

2.2 SUBMISSION

A. The Contractor shall submit six (6) copies of Schedule to the Engineer for review fourteen (14) days prior to starting construction. Update and resubmit Schedule monthly thereafter until completion of the work. Updated Schedule shall have completed activities removed or indicated as such. Whenever modifications are made to the Contract which add or delete activities and/or revise time of completion, Schedule shall be revised and resubmitted to the Engineer within ten (10) days after such modification is authorized.

B. In the event that the work is behind schedule, the Schedule shall be revised, through the use of overtime work or by other means, to ensure that the work is completed within the scheduled time.

PART 3 - SHOP DRAWINGS AND MANUALS

3.1 GENERAL

A. Shop drawings are defined as drawings, diagrams, illustrations, schedules, performance charts, brochures and other data prepared by the Contractor which illustrate how specific portions of the work shall be fabricated and/or installed.

B. Shop drawings are a supplementary means of communications to assist in the understanding of what the Contractor proposes to provide and to establish that whatever he intends to install either does or does not conform to the Drawings and/or Specifications.

C. In the instance of a request for a substituted item, the Contractor shall verify that it will fit into the space allocated to the originally required item giving due regard to all other trades' requirements. Where modifications to the Contract Documents are proposed, the Contractor must clearly indicate such deviation in writing in his transmittal letter.

3.2 CATALOG SHEETS

A. For standard manufactured items considered by the Engineer as not requiring special Shop Drawings, the Contractor shall submit three (3) copies of manufacturer's catalog sheets showing model numbers and illustrated cuts of the items to be furnished, scale details, sizes, dimensions, performance characteristics, capacities, wiring and control diagrams and all other pertinent information. This information shall be highlighted on all three (3) copies when appropriate.

B. The Engineer will retain two (2) copies and return the third to the Contractor submitting the catalog sheets.

3.3 SHOP DRAWINGS

A. The Contractor shall submit for review six (6) white prints of shop and working drawings of materials fabricated especially for his Contract, and of equipment and materials for which such drawings are specifically requested.

B. Shop drawings are to be submitted all at one time and in one package.

C. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter conforms to the Drawings and Specifications in all respects. Drawings which are correct shall be marked with the date, checker's name and certification of the Contractor's approval, and then shall be submitted to the Engineer. Any Shop Drawings submitted without the Contractor's certification will be returned without review.

D. The Engineer will retain two (2) copies, return two to the Contractor and transmit two to the Township.

E. Shop Drawings shall show the principal dimensions, weight, structural and operating features, performance characteristics and wiring diagrams, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawing. The shop drawing shall identify where the material is to be used, where appropriate. When it is customary to do so, when the dimensions are of particular importance or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for this application.

F. When so specified or if considered by the Engineer to be acceptable, manufacturer's specifications, catalog data, descriptive matter, illustrations, etc., may be submitted for review in place of shop and working drawings. In such case the requirements shall be as specified for shop and working drawings, insofar as applicable.

G. The Contractor shall be responsible for the prompt submission of all shop and working drawings in accordance with the shop drawing schedule so that there shall be no delay to the work due to the absence of such drawings.

H. No material shall be purchased or fabricated especially until the required shop and working drawings have been submitted and reviewed as conforming to the Authority Standard Specifications. All materials and work involved in the construction shall then be as represented by said drawings.

I. The Engineer's review of shop and working drawings will follow a general check made to ascertain conformance with the design concept and functional result of the project and compliance with the information given in the Standard Specifications. Each Contractor is responsible for details and accuracy, for conforming and correlating all quantities and dimensions at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades. Markings or comments placed on a submittal by the Engineer shall not be construed as relieving the Contractor from compliance with the Drawings and Standard Specifications nor departures therefrom.

J. Shop drawing approval shall be obtained prior to the initiation of any construction. The Developer/Contractor should anticipate a shop drawing review period of up to four (4) weeks.

3.4 MANUALS

A. The Contractor shall submit for review four (4) copies of all requested operating and maintenance manuals with the shop drawing submittals.

B. The Operating and Maintenance manuals shall provide, as a minimum, the following information for any major component of the equipment and the total assembly:

1. Installation Instructions.
2. Startup and operating procedures.
3. Maintenance and lubrication procedures.
4. Equipment drawings with parts list.
5. Electrical drawings
6. Troubleshooting guide.
7. Recommended spare parts.

C. The Engineer will retain three (3) copies and return the fourth to the Contractor.

D. Prior to project close-out, Contractor shall provide six (6) updated operating, maintenance manuals and parts lists for the Authority's use.

PART 4 - SAMPLES

4.1 SUBMISSION OF SAMPLES

A. Unless otherwise specified, each Contractor shall provide samples in duplicate and identify each sample by an appropriate tag or label listing the name of the Project, the Owner, the Engineer and the Contractor as well as the exact identification of the sample. Tag or label shall be large enough to provide a blank space for review stamps.

B. Samples of items submitted for destruction tests or for use in testing mixture with other materials will not be returned. Review of these items will be given by letter.

C. When reviewed, one sample of each item, not submitted for destruction, will be returned to the Contractor and shall be kept and maintained in good condition in the Contractor's office at the project site for later use in comparison with material actually delivered for the work. When samples of large fabricated items or of costly items are required, reviewed samples may be installed in the work if the exact location of such samples is recorded on the Record Drawings.

PART 5 - CERTIFICATIONS AND TESTS

5.1 GENERAL

A. Two (2) copies of certifications and reports of tests when required under the various sections of the Specifications shall be submitted.

PART 6 - CONSTRUCTION PHOTOGRAPHS

6.1 GENERAL

A. The Contractor shall provide pre-construction views, submitted in duplicate of the entire construction area before any work begins. Views shall be in the form of video tapes and/or 8-inch by 10-inch photographs at the discretion of the Engineer.

B. The Contractor shall provide, from commencement of Project through completion of all Work, clear, sharp, color, 8-inch by 10-inch photographs, in duplicate. These progress photographs shall be submitted to the Engineer each month.

C. Each photograph shall have the following information clearly noted on the picture. The information shall be typed or neatly printed on a label and placed on the face of the picture, and not obliterate important construction features.

1. Date Photo was taken and photo number
2. Client/Owner
3. Project Title
4. Contractor
5. Description of what is shown on the photo including direction

6.2 NUMBER OF VIEWS

A. For sewer lines and force mains, the Contractor shall provide from three to six views for each working crew every month depending on the progress of the Work.

**** END OF SECTION ****

Section 01500: TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor is referred to conditions and requirements given in various Divisions of the Specifications

1.2 OCCUPYING PRIVATE LAND

A. Written consent from the proper parties shall be obtained by the Contractor prior to entering or occupying with men, tools, materials or equipment any land other than his property or that of the Owner for any purpose related to his performance of the Work on this Contract.

1.3 PROTECTION OF EXISTING UTILITIES

A. The Contractor shall conduct his operations and take all special precautions necessary to protect equipment, utility lines, roadways and subsurface, submerged and overhead facilities which are to remain in place and undisturbed by his operations. The offending Contractor shall immediately notify the owner of the facilities or areas which are disturbed, damaged or injured as a result of the Contractor's operations, and determine the proper method of replacing or repairing the affected facilities at least to the conditions which existed prior to the Contractor's operations. The offending Contractor shall, at his own expense, replace, repair or restore the affected facilities or areas to their original condition or shall reimburse the owner of said facilities or areas for such expenses as the said owner may accrue in performing the work.

1.4 INTERFERENCE WITH/AND PROTECTION OF STREETS

A. The Contractor shall not close or obstruct any portion of a street, road or private way without obtaining permits therefore from the proper authorities. If any street or private way shall be rendered unsafe by the Contractor's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the appropriate authority.

B. The Contractor shall assume full responsibility for the maintenance and restoration of those roadways within the construction area and also those roadways on which equipment must operate to reach the construction area.

C. Streets, roads, private ways and walks not closed shall be maintained passable by the Contractor at his expense, and the Contractor shall assume full responsibility for the adequacy and safety of provisions made.

D. The Contractor shall, 72 hours in advance of closing any street, notify the police and fire departments and school district in writing, with a copy to the Engineer. He shall cooperate with the police department in the establishment of alternate routes and, at his own expense, shall provide adequate, plainly marked detour signs. The signs shall be as required by the agency that has jurisdiction over the roadway.

E. For the proper control of traffic, the Contractor shall provide an adequate number of persons employed at his own expense.

F. The Contractor shall immediately report in writing, giving full details, to the Engineer all accidents that arise out of or in connection with the performance of the Work, whether on or adjacent to the site, which cause death, personal injury or property damage. In addition, the accident shall be reported immediately by telephone or messenger to the municipality in which it occurred. If a claim is made or suit is filed by anyone against the Contractor on account of any accident, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

1.5 PROTECTION OF FACILITIES AND EQUIPMENT

A. Until final acceptance of the Work, the Contractor shall continuously maintain adequate protection of his work and work in progress from damage, and shall protect from loss or damage Contractor furnished and Township furnished machinery, equipment, materials and supplies being handled, including property considered for progress payments wherever located as well as other property of the Township from loss or damage arising out of or in connection with the prosecution of his work. He shall make good any such loss or damage. He shall adequately protect adjacent private and public property as provided by law and these Specifications.

B. The Contractor shall not load or permit any part of any structure to be loaded with a weight that would endanger its safety. It shall be the Contractor's responsibility to verify the acceptable load carrying capacity of any structure his equipment or work will affect, unless the load carrying capacity is so stated by the Engineer.

C. The Contractor shall immediately report in writing, giving full details, to the Owner all accidents which arise out of or in connection with the performance of the Work, whether on or adjacent to the site, which cause death, serious personal injury or substantial property damage. In addition, the accident shall be reported immediately by telephone or messenger to the Engineer. If a claim is made or suit is filed by anyone against the Contractor on account of any accident, the Contractor shall promptly report the facts in writing to the Engineer, with a copy to the Owner, giving full details of the claim.

D. The Contractor shall assume all risks of loss or damage of any kind to any vehicles, machinery, equipment, materials or supplies which he shall provide in doing the Work.

E. The Contractor shall conduct his work in such a manner as to adequately protect property owned by others on or about the Owner's premises from damage by the construction operations.

1.6 DUST CONTROL

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities so as to minimize the creation and dispersion of dust.

1.7 SANITARY

A. The Contractor shall provide, maintain and remove when no longer required, an adequate number of temporary, prefabricated, chemical-type toilets with proper enclosures for the use of workmen and women of all trades during construction. Toilets shall be located where directed. When connected to water and sewer, meet all code requirements and take precautions to prevent freezing.

B. The Contractor shall keep toilets clean and supplied with toilet paper at all times. The Contractor shall comply with all local and state health requirements and sanitary regulations.

1.8 BYPASSING FLOWS

A. The Contractor is responsible that the flow is maintained when making new connections to existing sewer. When conditions require and with the Authority's permission, Temporary Bypass Pumping will be allowed. No more than one section of sewer (between manholes) may be isolated at any one time. When this is done flow must be pumped around the isolated area and back into the existing system. All this shall be done without causing sewer backups. In no case will residents be without sewer service overnight.

B. When Temporary Bypass Pumping is required, the Contractor shall be required to plug the manhole section in which the work is being done and provide a temporary bypass pumping system from the upstream manhole to the downstream manhole. The temporary bypass pumping system shall consist of a minimum of two (2) pumps, one to be a standby, each capable of pumping the peak anticipated flows, the required lengths of pipe, and all temporary power, etc.

C. No sewer section shall be shut down unless residents affected by the shut down are notified at least twenty-four (24) hours in advance so that they may make preparations for same.

D. It shall be the Contractor's responsibility to provide whatever temporary facilities that are needed in order to collect and dispose of sewage from the individual homes in the area of construction.

E. Pumping between the hours of 7:00 P.M. and 7:00 A.M. will not be permitted. The Contractor shall make what watertight temporary sewer connections that are necessary at the end of the work day in order that the sewer and laterals can flow by gravity, uninterrupted, without the need for temporary pumps. Also, no temporary pumping will be permitted on Sunday.

F. Flows shall be bypassed in such a way that basements are protected from back flows. The Contractor shall not allow the sewage to surcharge into basements.

G. At no time will the Contractor be permitted to pump the sewage either directly or indirectly onto the ground or street or into any storm sewer, stream, drainage ditch or water course.

H. The Contractor shall provide a portable generator or make whatever temporary electrical connections are required for operation of the temporary pumps if they are electrically operated.

1.9 POWER, WATER, ETC., FOR TESTING

A. The Contractor shall pay for all natural gas, water and/or electricity required for testing of installed Work. Labor and supervision required for making tests shall be provided by the Contractor for the installed work involved.

1.10 OFFICES AND STORAGE

A. The Contractor shall, for his own use, provide and maintain such temporary office facilities as he may require and such watertight storage sheds with floors as may be required for storage of his materials which might be damaged by weather.

B. Depending on the extent of the project, the Authority at its discretion may require a temporary office for its Engineer. After first obtaining a building permit from the Township code enforcement department, the Contractor shall provide a lockable office, with a minimum space of 600 square feet for the Engineer. For duration of the entire project construction, provide this office with:

1. Adequate lighting, regular toilet facilities of the non-chemical type with drain to existing sewer system or to a holding tank, heating, ventilation and air conditioning throughout.

2. Daily janitorial services

3. Telephone
   a. Provide two (2) telephone lines, one for telecommunications and one for a FAX machine.
   b. Provide telephone with capacity of placing calls on hold, transferring calls and conference calling.
   c. Provide one automatic phone answering/recording device.
   d. Provide facsimile machine (FAX) complete with paper supplies and maintenance.

4. Provide hot and cold water to office, properly insulated.

5. Furniture and equipment as follows:
   a. One (1) desk, with swivel chair and two (2) side chairs
   b. One (1) lockable, four (4) drawer file cabinets
   c. One (1) draftsman's stool and one (1) drafting table with a 36-in. x 60-in. top
   d. One (1) copying machine complete with paper supplies and maintenance
   e. One (1) first-aid cabinet complete with supplies.
   f. One (1) water cooler

C. Materials stored in the open at the Project site shall be stored on planks or other dunnage as necessary to keep materials from contact with the ground and shall be covered with tarpaulins for protection from weather.

D. All temporary offices and storage facilities shall be removed by their installer when no longer required.

** END OF SECTION **

Section 02110: CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SCOPE

A. Description of Work
   1. Provide all labor, material and equipment to perform all clearing and grubbing as shown on the Drawings and as specified herein.

B. Related Work Specified Elsewhere
   Contractor shall obtain specific direction from the Engineer regarding the following:

   1. Removal of peat, moss, lignite and vegetable matter below ground other than as specified in this section and Section 02220, EARTHWORK FOR UTILITIES.
   2. Pruning, shearing and trimming of trees, shrubs and bushes.
   3. Stripping and stockpiling topsoil, other than as specified in this section and Section 02220, EARTHWORK FOR UTILITIES.
   4. Soils erosion, EROSION AND SEDIMENT CONTROL PLAN shown on the Drawings.

A. Streets, roads, adjacent property and other works to remain shall be protected throughout the Work.

B. Existing trees, shrubs and bushes:
   1. Trees shall be protected by fencing, barricades, or wrapping as may be required.
   2. Shrubs and bushes shall be protected by fences or barricades as may be required.
   3. Shallow-rooted plants shall be protected at ground surface under and in some cases outside the spread of branches by fences, barricades or ground cover protection as may be required.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Federal, State and Local laws and code requirements shall control the disposal of trees and shrubs.

PART 2 EXECUTION

2.1 GENERAL

A. When working within temporary or permanent Rights-of-Way, use every means possible to protect from injury and damage, all property, including trees, shrubbery, lawns, fences, buildings, walls, roads, water courses, natural features or any improvements thereto, which may exist. Do not willfully or maliciously injure or destroy trees, shrubs or vegetation and do not remove or cut them without permission of the Authority.

B. All operations must be confined to the width of the Rights-of-Way secured by the Authority or property lines unless further restrictions are shown on the Drawings and specified in Section 01010, SUMMARY OF THE WORK. All damage done to property resulting from the Contractor's negligence shall be repaired without charge to the satisfaction of the Authority with the exception of

those items (trees, shrubbery, etc.) that must be removed for construction and have been agreed upon beforehand, in writing, between the Contractor and Authority.

2.2 CLEARING

A. Limits of clearing shall be within the Rights-of-Way, to limits shown on the Drawings or to limits staked on the ground by the Authority.

B. Trees in construction zones or Rights-of-Way shall not be removed until inspected and/or tagged by the Authority or its representative.

1. No trees shall be removed within the construction zone or Rights-of-Way, except the following:
   a. Trees or vegetation within PennDOT's Rights-of-Way shall not be removed or altered unless a separate specific permit is obtained from the District Roadside Development Specialist authorizing such removal or alteration.
   b. Trees within an excavated area such as footing or trench.
   c. Trees whose root system will be destroyed by the excavation with the approval of the Engineer.
   d. Trees that interfere with the movement of the Contractor's equipment with the approval of the Engineer. Any trees that interfere with the movement of the Contractor's equipment shall be reviewed by the Engineer before they are removed.

C. All trees bordering any construction zone or Right-of-Way shall be protected by acceptable methods. Trees damaged by the Contractor will be either repaired or replaced as determined by the Authority or his Representative at the Contractor's expense.

D. Vegetation within the areas to be cleared, which may be designated to be saved by the Authority shall be left standing and uninjured.

E. Remove trees, sapling, shrubs, bushes, vines and undergrowth within the limits of clearing to the heights above ground given in the following table:

Type of Vegetation	Height of Clearing
Trees over 6-inches in diameter	12 inches
Shrubs, saplings, bushes and trees under 6 inches in diameter	3 inches
Vines and undergrowth	2 inches

F. Stumps

1. Stumps required to be removed shall be to a depth of 18 inches. This depth shall be measured from existing ground surface or proposed finished grade, whichever is the lower.

2. Engineering requirements shall control removal of stumps under fills, foundations, or any construction in contact with the stumps.

2.3 GRUBBING

A. Limits of grubbing shall coincide with the limits of clearing.

B. Remove all stumps, roots over 4 inches in diameter, and matted roots within the limits of grubbing to the depths below. Such depths shall be measured from the existing ground surface or the proposed finish grade whichever is the lower.

Location	Depth of Grubbing
Footings	36 inches
Walks	12 inches
Roads	18 inches
Parking Areas	12 inches
Lawn Areas	8 inches
Fills	12 inches

2.4 TRIMMING OF TREES

A. When required, with the Authority's and/or Property Owner's approval, trees shall be trimmed to remove branches or roots which interfere with construction or traffic. Paint all cut branches and roots with wound paint as recommended for the application.

B. No trees or vegetation shall be removed or altered within PennDOT's rights-of-way unless a separate specific permit is obtained from the District Roadside Development Specialist authorizing such removal or alteration.

2.5 SALVAGE

A. Material that is to be salvaged, as a result of the clearing operations, shall include the following items which are to be turned over to the Property Owner if the Property Owner so desires.

1. Logs over 12 inches, butt diameter
2. Branches over 6 inches, butt diameter
3. Parts suitable for use as mulch
4. Live plants suitable for replanting

B. Cut logs and branches into cordwood, 2 feet-6 inches in length and store on site where acceptable to the Engineer and Property Owner.

C. All salvageable material not desired by the Property Owner shall be removed as part of the Work.

2.6 DISPOSAL

A. Burning of materials on the site will not be permitted.

B. Removal:

1. Material to be removed shall be removed from the site daily as it accumulates.

2. Should the Contractor elect to continue work beyond normal working hours, material to be removed shall not be allowed to accumulate for more than 48 hours.

3. Disposal of surplus material within PennDOT's rights-of-way is prohibited. All surplus material must be disposed of as the work progresses and shall not be stored on PennDOT's rights-of-way for future removal.

C. Dumping

1. Surplus material shall not be permitted to be dumped within the Contract area at any location.

2. Prior to depositing surplus material at any off-site location, the Contractor shall obtain a written agreement between himself and the owner of the property on which the disposal is proposed. The agreement shall state that the owner of the property gives permission for the Contractor to enter and deposit the material at no expense to the project owner. A copy of the agreement shall be furnished to the Authority. Contractor's disposal shall comply with all Federal, State and Local laws and regulations.

**** END OF SECTION ****

PART 1 - GENERAL

1.1 SCOPE

A. Description of Work

1. Provide all labor, material and equipment to excavate pipe trenches and backfill after the installation of the pipe, all in accordance with the Drawings and as specified herein.

B. Related Work Specified Elsewhere

1. Clearing, Section 02110, CLEARING AND GRUBBING
2. Rock Excavation, Section 02230, ROCK EXCAVATION
3. Piping, Section 02551, SANITARY SEWERS AND APPURTENANCES
4. Concrete, Section 03301, CAST-IN-PLACE CONCRETE

1.2 LINES AND GRADES

A. Grades

1. Pipes shall be laid true to the lines and grades shown on the Drawings. The grade shown on the profile is the invert to which the Work must conform. Work not conforming to the lines and grades shall be removed and reinstalled to the proper depths and locations by the Contractor at his own expense.

2. The Contractor is responsible for maintaining the line and grade. The pipe shall be checked at each manhole to assure that it is on the correct line and grade.

B. Locations of Lines

1. The locations of the proposed lines are shown on the Drawings.
2. Approximate depths are shown on the Drawings.
3. The Engineer reserves the right to make changes in lines and grades of pipe lines and in locations of pipes and manholes when such changes may be necessary or advantageous.

C. Changes in Pipe Location or Grade

1. The Authority will allow no claims for changes in locations or grade unless such changes are made after trenching has been done.

2. All changes in locations or grade within PennDOT's right-of-way will require prior approval of PennDOT. The Developer, based on information provided by the Engineer, shall submit a supplemental permit application to PennDOT.

1.3 TRENCHING REGULATIONS

A. In open trenching on State, County and Township highways, the Contractor shall be governed by the conditions, restrictions and regulations made by the PA Department of Transportation, the County Commissioners, and the Township Supervisors. All such regulations shall be in addition to the ones set down in these Specifications.

PART 2 - PRODUCTS

2.1 BACKFILLING MATERIALS

A. Suitable Materials

1. General

   a. Suitable material, when used as backfill in paved areas, shall be capable of being compacted as specified in paragraph "*Compaction and Testing in Paved Areas*" in Part 3 of this Section of these Specifications.

   b. The final determination of suitability of materials for backfill purposes shall be made by the Engineer.

2. Type 1 Material
   a. Excavated material from the trench or materials from other sources which are free from large clods, roots or stones larger than 2 inches.

3. Type 2 Material
   a. Excavated material from the trench or materials from other sources which are free from large clods, roots or stones larger than 8 inches.

B. Crushed Stone

1. Crushed stone shall be not washed, with fines present to stabilize it in the trench. If amount of fines is insufficient, then stone screenings shall be added to extent required to stabilize it in the trench. Crushed stone shall be as specified in PennDOT Publication 408, Section 703 *Aggregate* and as specified below.

2. Crushed stone **bedding and haunching** for sewer pipes shall be AASHTO #57 (formerly known as PennDOT No. 2B), as specified in PennDOT Publication 408, Section 703 *Aggregate* and as shown in table below:

Square Mesh Sieve Size	Percent Passing by Weight
1½-inches	100
1 inch	95-100
½-inch	25-60
#4	0-10
#8	0-5

3. Crushed stone **backfill (initial and final) in Township roads** shall be PennDOT No. 2A as specified in PennDOT Publication 408, Section 703 *Aggregate* and as shown in table below:

Square Mesh Sieve Size	Percent Passing by Weight
2 inches	100
¾-inch	52-100
⅜ -inch	36-70
#4	24-50
#16	10-30

4. Crushed stone **backfill in State highways** shall be as specified by PennDOT or, in the absence of specific direction from PennDOT, stone shall be PennDOT No. 2A.

5. Sharp stones and crushed rock (larger than ¾-inch) shall be excluded from bedding material.

C. Concrete

1. Concrete used for cradles, thrust blocks, or encasement shall be High Early Strength concrete (3,750 psi) as specified in Section 03301, CAST-IN-PLACE CONCRETE. Tests of concrete for this usage are waived.

2.2 WARNING TAPE

A. Underground marking tape shall be placed at two levels above all sewer mains and laterals. Tape shall be 3 inches wide and imprinted with a continuous warning message (*Caution, Sewer Line Buried Below*) repeated every 24 inches.

1. Metallic Detection Tape shall be placed approximately 1 foot below subgrade, above all sewer mains and laterals, and have a metallic lining. Tape shall be *Sentry Line Detectable* tape by Reef Industries , or approved equal.

2. Early Warning Tape shall be placed approximately 18 inches above all sewer mains and laterals. Tape shall be *Terra-Tape* by Reef Industries , or approved equal.

B. Tapes shall have the following physical properties:

Property	Detection	Warning	Test Method
Thickness (min,)	5.0 mils	4.0 mils	ASTM D-2103
Std. Weight	28.0 lbs/1,000 sq ft.	18.5 lbs/1,000 sq ft.	ASTM D-2103
Tensile Strength/3" width	70.0 lb.-ft.	30.0 lb.-ft.	ASTM D-882
	4600 psi	2500 psi	
Elongation	100%	800%	ASTM D-882
PPT Resistance	8.0 lbf	14.0 lbf	ASTM D-2582

PART 3 - EXECUTION

3.1 EXCAVATION

A. General

1. Perform all excavation of every description and of whatever substances encountered to the depth shown on the Drawings.

2. All excavated materials not required for fill or backfill shall be removed from the site of the Work by the Contractor, but none shall be deposited on private property until written consent of the property owner has been filed with the Engineer.

3. All excavation, unless otherwise authorized by the Engineer, shall be made by open cut. Side walls of trenches shall be kept vertical and shall be properly braced.

4. Trenches shall be excavated true to line so that the trench width is not more than necessary or allowed by the Engineer.

5. Care shall be taken not to excavate below the depth specified.

1. Rock excavation, when needed, shall be done in accordance with Section 02230, ROCK EXCAVATION.

C. Excavation Below Grade

1. Where the bottom of the trench, by mistake of the Contractor, is taken out to a greater depth than specified for a given pipe bedding the trench shall be brought back to grade as follows:
   a. Where the pipe was to be supported by crushed stone cradle, crushed stone embedment, concrete encasement or concrete cradle, the over-excavation shall be filled with crushed stone so as to comply with the requirements for crushed stone foundation.

2. Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.

3. This additional material required due to the over-excavation shall be furnished and installed by the Contractor at his own expense.

D. Blasting

1. Blasting, when needed, shall be done in accordance with the specification for blasting in Section 02230, ROCK EXCAVATION.

2. As required, no blasting will be permitted within PennDOT Rights-of-Way until the Contractor has provided the required insurance on PennDOT prescribed forms, obtained approval from PennDOT, and delivered a copy of same to the Authority. The Contractor

shall make arrangements to complete all of the above in sufficient time so as not to cause any delays in the Work.

3.2 EXCAVATION NEAR EXISTING UTILITIES AND STRUCTURES

A. Attention is directed to the fact that there may be water pipes, drains and other utilities in certain locations. These utilities have been indicated on the Drawings, but the completeness or accuracy of the information given is not guaranteed.

B. All water or other utility lines shall be located on the ground with pipe locating equipment well ahead of the work at all times. All such locations shall be plainly marked by coded paint symbols on pavement or by marked stakes in the ground. Such locations shall be established at least 50 feet in advance of all trench excavation. Arrangements for all such location work shall be provided by the Contractor.

C. As the excavation approaches pipes, conduits or other underground structures, digging by conventional trenching machine methods shall be done with extreme care. Manual excavation may be necessary to locate underground utilities and/or structures.

D. When excavating within 2 feet (vertical or horizontal) of a utility (especially gas or oil) line, the Contractor shall use the manual method of excavation. At no time will conventional trenching equipment be permitted under these conditions.

E. Excavation near structures will not be allowed closer to the structure than the depth of the excavation below the bottom of the foundation without shoring the excavation with sheeting.

F. The Contractor shall carefully protect from disturbance and damage all land monuments and property markers until an authorized agent has witnessed or otherwise referenced their locations. These monuments and/or markers shall then only be removed when authorized by the agent or Township. Monuments and/or markers shall be reinstalled by the Contractor, using a Professional Land Surveyor registered in the Commonwealth of Pennsylvania, to the satisfaction of the property owner and/or Township.

3.3 PROTECTION OF EXISTING STRUCTURES

A. All existing pipes, poles, wires, fences, curbing, property-line markers and other structures which must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the Contractor.

B. In case of damage to any structure, the Contractor shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. If the owner of the structure wishes to make his own repairs, the Contractor shall reimburse the owner of the structure for all the time and materials required to make the repairs.

C. When the owner(s) of the damaged structures do not wish to make the repairs themselves, all damage shall be repaired by the Contractor or, if not promptly done by him, the Authority may have the repairs made at the expense of the Contractor.

D. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs.

3.4 CARE AND RESTORATION OF PROPERTY

A. Excavating machinery and cranes shall be operated with care to prevent damage to existing structures, paving and/or wires.

B. It is suggested that to protect the pavement and shoulders, all equipment should have rubber wheels or runners and should have rubber, wood or similar protective pads between the outriggers and the surface unless otherwise authorized by the Township, PennDOT or County Highway Department. In the event that other than rubber equipped machinery is authorized for use, the pavement and shoulders should be protected by the use of matting, wood or other suitable protective material having a minimum thickness of 4 inches. In any event, it shall be the Contractor's responsibility to take whatever steps are necessary to protect pavement and shoulders.

C. The Contractor must exercise care not to damage paving, curb, inlets, sidewalks, etc., beyond the limits of his Work. Any damages to areas outside these limits shall be replaced in kind by the Contractor at his own expense, to the satisfaction of the Authority unless so indicated on the Drawings to be replaced.

D. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

3.5 TRENCHING

A. Trenches shall be dug to the depth required by the Contract Documents adding, however, to such depths the thickness of the pipe and the required bedding. The width of the trench shall be as described in previous Paragraph 3.1, A. A recess sufficiently large enough to receive the couplings, where applicable, and to permit making the joints, shall be cut out of the bottom of the trench.

B. During installation, upon encountering quicksand or a wet spongy material, the Contractor shall determine the actual depth of the soft material. Once the depth of the soft material has been determined, one of the following methods of construction shall be used, as determined by the Engineer:

1. Installation by the quicksand excavation method
2. Crushed stone foundation
3. Concrete encasement

3.6 TUNNELLING

A. Prior to undertaking any tunneling, the Contractor shall have a professional engineer, licensed to practice in the State in which the construction work is being accomplished, prepare a design and outline the proposed tunneling methods, procedures and shoring requirements to be followed. An informational copy of these data shall be furnished to the Engineer before beginning the tunneling.

B. In the case of tunneling under a roadway, railroad or stream bed, the method of tunneling may be specified on the Drawings. If the type of tunneling is specified, the Contractor is still responsible to have a licensed engineer prepare shoring requirements and installation procedures, etc.

C. Tunneling shall be limited to these areas depicted on the Drawings.

3.7 TUNNELLING UNDER TREES, CURBS, ETC.

A. In areas where specific trees, curbs, etc. are designated to be saved, excavation may be made by alternate sections of open cut and wedge tunnel. Design of this method of excavation shall be done by the Contractor's engineer as described in paragraph 3.6 above.

B. Backfilling of the tunnel section shall be by the use of mechanical tampers, starting at the wedge and working progressively away from the wedge.

C. If the wedge tunnel method is deemed unfeasible, an alternate method of tunneling shall be designed by the Contractor's engineer.

3.8 SHEETING AND SHORING

A. Where sheeting, shoring, bracing, or trench boxes are used, they must be designed by a Professional Engineer licensed to practice in Pennsylvania. Said Engineer shall provide the Contractor with a certification signed and sealed by him stating that the design of the sheeting and bracing conforms to all applicable requirements of the Pennsylvania Construction Safety Code and the Occupational Safety and Health Act. Copies of this certification shall be submitted to the Engineer.

B. Trenches shall, at all times, be properly protected to prevent accidents, caving of the sides of the trench or breaking of the ground outside of the lines of the trenches proper or damage to buildings or other structures along the line of construction. Underground structures of all types shall be protected by the Contractor, who shall use all necessary shoring, bracing or other appliances for the protection of same. Care must be taken not to damage in any way water mains, water service pipes, drain pipes, sanitary or stormwater sewers, gas mains, oil mains, electric conduits or other utilities or structures encountered.

C. The Contractor must follow the proposed sheeting plans submitted. No deviations may be made from the filed procedure without first submitting a revised sheeting and bracing plan, signed and certified as required for the original submission, by the same licensed Professional Engineer who prepared the original submission.

D. No shoring shall be left in place unless so authorized by the Engineer. All sheeting and bracing not to be left in place shall be carefully removed in such a manner as not to endanger the construction or other structures. All voids left or caused by withdrawal of sheeting shall be immediately backfilled with well-compacted material.

E. When installing pipe, the sheeting and shoring shall not project below a point one (1) foot above the top of pipe, except during quicksand excavation or to stabilize trench bottom.

F. When installing pipe, sheeting must be placed below the pipe invert in order to stabilize trench bottoms. The sheeting shall be left in place from the trench bottom to a point 1 foot, 6 inches above the top of the pipe, and the remainder of the sheeting cut and removed before final backfilling.

3.9 QUICKSAND EXCAVATION

A. Where quicksand excavation is encountered, the Contractor shall drive either tight tongue and groove wooden sheet piling or steel sheet piling to a depth which will effectually cut off the flow of sand. Well points and other methods shall then be used to dewater the trench. Excavation and construction shall follow as rapidly as possible thereafter. A satisfactory foundation must, however, be secured either by close tongue and groove planking held by piling or some other acceptable method. Where pipe is to be constructed through quicksand excavation, the trench shall be carried to a sufficient depth below the grade line to permit the pipe to be encased in concrete, on as a minimum a 2-inch by 10-inch plank, platform or cradle.

B. The Contractor shall comply with Paragraph 3.8, A of this Section of the Specifications for design of the sheet piling.

3.10 TRENCHING IN ADVANCE OF PIPE LAYING

A. The trench for the pipe lines shall not be opened for a distance of more than 100 feet at any one time. At no time will the Contractor be permitted to leave the trench open at the end of a working day.

B. If concrete is to be installed for pipe cradle or encasement, longer lengths of trench may be left open with the Authority's approval, provided that:
   1. All trenching regulations are met (refer to paragraph 1.3, "Trenching Regulations")
   2. All trenches are properly secured and protected.
   3. Trenches are completely safety fenced around the entire trench area.

3.11 KEEPING TRENCH DRY

A. All groundwater that may be found in the trenches and any water which may get into them from any cause whatsoever shall be pumped or bailed out so that the trench shall be dry during pipe laying period. No water shall be permitted to reach concrete until it has set sufficiently. All water pumped from the trenches shall be disposed of in compliance with the applicable state and local regulations of the appropriate governing body. The Contractor shall provide a minimum of two pumps for each trench opened in wet ground, one operating and one standby. The standby pump shall be of a size that will replace the largest operating pump.

B. The Contractor shall contact the PADEP and/or Montgomery County Conservation District and determine if any permits are required for trench dewatering. The Contractor is also advised that proper erosion and sediment control practices shall be employed, which may include silt traps at dewatering locations.

C. The Contractor shall provide and place all necessary flumes or other channels of adequate size to carry temporarily all streams, brooks, stormwater or other water which may flow along or across the lines of the pipe line. All flumes or channels thus utilized shall be tight so as to prevent leakage

into the trenches. Water pumped from trenches shall be led to a natural watercourse in accordance with the EROSION AND SEDIMENT CONTROL PLAN shown on the Drawings.

3.12 FOUNDATION

A. Crushed Stone - For Foundation

1. In all bedding conditions where a suitable supporting soil or rock stratum occurs at a depth greater than required on the Construction Details or Drawings but less than 2 feet below the pipe or where moderately unstable soil conditions are encountered or where the trench is excavated below the specified depth or where required by the Engineer, the foundation shall be modified as follows:

   a. Except in the case of over-excavation where no extra excavation will be required, the trench shall be excavated to the depth necessary to reach the suitable supporting stratum. Crushed stone shall be spread in 4-inch layers, and each layer shall be compacted with 20-pound hand or pneumatic tampers.

   b. The foundation shall carry vertically from the supporting stratum up to the required level depending on the pipe diameter and the type of bedding specified.

2. When the above method of stabilizing trenches with crushed stone is unfeasible, the Contractor shall proceed when requested by the Engineer as described in Paragraph 3.9, QUICKSAND EXCAVATION.

3.12 PIPE EMBEDMENT

A. General

1. Contractor shall take care to avoid contact between the pipe and compaction equipment. The tampers shall be hand or pneumatic of the proper size to operate between trench wall and pipe without damaging the pipe.

2. Contractor shall not use compaction equipment directly over the pipe while placing the pipe embedment to ensure that such equipment will not damage or disturb the pipe.

3. Pipe embedment shall, in all cases, extend up so 18 inches of cover has been built up over the pipe.

4. Refer to the Construction Details at the end of this Section for pipe embedment details.

6. All pipes shall have early warning tape as described in paragraph 2.2 of this Section.

B. Crushed Stone Embedment

1. Bedding

   a. All pipes shall be bedded in crushed stone, with the trench excavated to the depth shown on the Construction Details. The crushed stone shall be placed in the trench for its full width to uniformly support the pipe at the required line and grade.

2. Crushed Stone Cradle (or Haunching)

   a. All pipe shall be supported in a crushed stone cradle. This cradle shall be constructed in accordance with the Construction Details. The crushed stone shall be placed in the trench for its full width to uniformly support the pipe at the required line and grade. Suitable recesses shall be provided in the cradle to permit adequate clearance for bells, couplings or similar projections.

   b. Cradle material shall be spread in 4-inch layers, and each layer shall be compacted with tampers until the bedding has reached the spring line of the pipe.

   c. The balance of the stone embedment to 18 inches above the pipe shall be spread and compacted in 4-inch layers with (a) crushed stone in traffic areas, as required by the Authority or PennDOT, or (b) suitable material type 1 in non-traffic areas.

3. Initial Backfilling of Pipe (Crushed Stone Embedment)

   a. This portion of the pipe trench shall be backfilled with crushed stone to provide crushed stone embedment, installed as described under Paragraph 3.12 of this Section.
   b. When concrete cradle is used, the initial backfill will start at the top of the concrete and then continue as specified above.
   c. When concrete encasement is used, the initial backfill of crushed stone will not be required. However, a 12" layer of crushed stone shall be placed above the concrete encasement.
   d. The tampers shall be of the proper size to operate between trench wall and pipe without damaging the pipe.

C. Concrete Encasement

1. Where specified or required in the field, the pipe shall be supported by Concrete Encasement.

2. The trench shall be excavated to a minimum depth as shown on the Construction Details. The excavated space shall then be completely filled with, and the entire pipe encased in concrete such that the concrete encasement measures a minimum 1 foot above the top of the pipe. The total minimum width of the Concrete Encasement shall equal the width of trench excavation. Unless otherwise shown on the Drawings or specified herein, concrete shall be High Early Strength concrete (3,750 psi) in accordance with the requirements of Section 03301, CAST-IN-PLACE CONCRETE. Freshly poured concrete shall be maintained free from ground water for at least the first four hours. No backfilling of the trench shall begin until the concrete has cured or a minimum time period of 4 hours has elapsed after the encasement has been poured. Authorization from the Engineer is required prior to backfilling. Steel reinforcing, if required, shall be as shown on the Drawings or Construction Details.

D. Concrete Cradle

1. Where unstable conditions are encountered, the pipe shall be supported on Concrete Cradles. Concrete Cradles shall be installed where no suitable supporting soil or rock stratum exists within 2 feet of the bottom of the pipe.

2. The concrete cradle shall be furnished and installed equal to the "Concrete Encasement," except that only that portion of the encasement at and below the horizontal diameter of the pipe shall be poured, forming a true cradle under the bottom half of the pipe.

3. The balance of the initial backfill to 18 inches above the pipe shall be as specified above.

3.14 FINAL BACKFILLING

A. General

1. No backfilling shall be done before the Engineer gives permission. After pipes have been checked for alignment and bedding, the backfilling may be started. Backfill material may be deposited in the trench either by hand or machine. A sufficient number of men shall be available to spread the backfill in uniform layers.

2. Backfill material shall be spread in 4-inch layers in State highways and in 6-inch layers in all other trench areas and each layer shall be compacted with tampers until the required total depth of bedding has been built up.

3. At least 30 inches of cover over the top of the pipe shall be provided before the trench is wheel-loaded.

4. At least 48 inches of cover shall be provided before using mobile trench compactors of the hydrohammer or impactor type. These compactors shall only be used after the pipe has been properly backfilled in accordance with these Specifications.

5. The bedding shall be compacted to not less than 95% of the maximum dry density as determined by ASTM D1557, achieved at each level on the day that the backfill is placed and compacted.

6. Compaction by puddling or water jetting shall <u>not</u> be allowed.

B. Visual Sewer Inspection

1. After the gravity sewers have been laid and initial backfill placed to 18 inches above the pipe, a light will be flashed between manholes, or, if the manhole has not yet been constructed, between the location of manholes, by means of a flashlight or mirrored light, to determine whether the alignment of the main is true and whether any pipe has been displaced subsequent to laying. If alignment is correct and no other defects are disclosed, backfilling may be continued. If the inspection shows poor alignment of the main, misplaced pipe or other defects, such defects shall be remedied by the Contractor before the work of backfilling proceeds.

C. Backfilling in **Non-Traffic Areas** (Grass, Earth Plots or Sidewalks)

1. Backfilling Trench to Finished Grade after Initial Backfilling

a. After initial backfilling has been compacted as specified above, the remainder of the trench shall be backfilled with suitable material (Type 2). When the material excavated from the trench is deemed unsuitable for backfilling, the Contractor shall supply and install either suitable material (Type 2) from outside sources or, at his option, "Select Backfill" at no additional cost.

b. Final backfilling material may be dumped into trench by front end loader then compacted.

2. Settlement

a. If settlement occurs, additional backfill shall be deposited and mechanically compacted to the required elevation.

D. Backfilling in **Traffic Areas** other than PennDOT Highways or Improved Shoulders. (Streets, Parking Lots, Driveways, Township Shoulders and PennDOT Unimproved Shoulders)

1. Backfilling Trench to Underside of Paving after Initial Backfilling

a. After initial backfilling has been compacted as specified above, backfill the remainder of the trench with crushed stone compacted in layers not to exceed 6 inches using a mechanical tamper up to the bottom elevation of the pavement structure.

E. Backfilling in **PennDOT Highways** and Improved Shoulders

1. Backfilling in PennDOT Highways shall be in accordance with Pennsylvania Department of Transportation Regulations, 67 PA Code, Chapter 459, governing "*Occupancy of Highways by Utilities.*"

F. Backfilling in County Highways

1. Backfilling in County Highways shall be in accordance with the Montgomery County Highway Department Regulations.

G. Backfilling in Paved Areas

1. When backfilling in paved areas, the backfill material shall be placed or stored on the side of the operation farthest from the road, metal or pavement unless otherwise authorized by the Township or PennDOT and in such a manner that there will be no interference with the flow of water in any gutter, drain, pipe, culvert, ditch or waterway. The remaining excavated material must be removed from the site each day as the Work progresses.

3.15 COMPACTION AND TESTING IN PAVED AREAS

A. In all paved areas, the backfill shall be thoroughly compacted over and around the pipe by use of vibratory compactors and/or rollers or, where these cannot be used, by mechanical or hand tamping. Backfilling shall be compacted to not less than ninety-five (95%) percent of maximum dry density as determined by ASTM D1557. Compaction shall be achieved at each layer of backfill on the day that the backfill is placed and compacted.

1. In addition, in PennDOT Highways the more stringent requirements (PennDOT Publication 408, Section 210 and/or Section 601) will govern the subgrade compaction, requiring compaction to not less than 97% (100% for top 3 feet) of the required dry weight density, as determined according to AASHTO T99, method C. .

B. The optimum moisture content and the maximum density of each type of material used for trench backfill shall be determined by "*Tests for Moisture-Density Relations of Soils, using 10-pound Rammer and 18-inch Drop*" (ASTM D1557 or AASHTO T-180).

C. The field moisture content of materials being compacted shall be determined by "*Laboratory Determination of Moisture Content of Soil*" (ASTM D2216). The field density of compacted material shall be determined by "*Test for Density of Soil in Place by the Sand-Cone Method*" (ASTM D1556) or test for density of soil and aggregate in place by nuclear method (Shallow Depth) (ASTM D-2922).

D. When directed by the Authority, a soils engineering and testing laboratory shall perform sufficient tests and inspection procedures both in the field and lab to insure that the provisions of this Specification are met.

1. A random method using PTM No. 1 (Pennsylvania Testing Method) for selecting actual test sites shall be employed.

2. The testing and control firm shall be selected by the Engineer and paid by the Contractor.

E. After testing is completed and reports are provided, all subgrades below the paving will be examined by the Engineer before any paving is authorized.

F. The responsibility of the Soils Engineering and Testing Laboratory is to the Engineer, to whom that firm must promptly, faithfully and accurately report the results of its tests and inspections. The firm must, in addition, work in coordination with the Contractor, making all tests required by the Contract. The reports must state whether or not the reported results comply with Contract requirements. The testing and control firm shall promptly type and deliver all its reports to the Resident Inspector with a copy to the Contractor, and shall mail two copies to the Engineer.

G. The Engineer reserves the right to change the Testing Laboratory. The Engineer will notify the Contractor when a change is made and the reason for the change.

3.16 DISPOSAL OF MATERIAL

A. Excavated material shall be so placed as not to unreasonably interfere with travel. All macadam and other street surfacing, surface loam and sod shall be kept separate from the remainder of the excavated material.

B. Upon completion of the backfilling, the property shall be cleaned, all surplus material removed and the surface restored to the condition in which it was, before ground was broken.

C. Unless otherwise specified, all materials left over shall become the property of the Contractor. Also, underground structures removed, such as brick, concrete and sewer pipe, shall become the property of the Contractor, unless otherwise noted on the Drawings. If the Contractor shall fail to

promptly remove surplus material, the Authority may have the material removed and charge the cost thereof as money paid to the Contractor. All surplus excavation shall be removed from the site of the Work by the Contractor, but none shall be deposited on private property until written consent of the property owner has been filed with the Engineer. The Contractor's disposal shall comply with all Federal, State and Local laws and regulations.

3.17 MAXIMUM TRENCH WIDTH

A. During pipe installation, the Contractor shall limit the width of trench excavation.

1. The maximum width of trench excavation shall be equal to the bell or band of the pipe plus 12 inches on each side plus 6 inches on each side for shoring or trench box:

Nominal Pipe Diameter (inches)	**Trench Width** (inches)
6	42
8	44
10	46
12	48
15	51

2. Typical cutbacks on both sides of the trench for paving restoration shall be as follows:

Location	**Cutback**
State Highways	12 inches
Driveways	12 inches
Municipal Streets	12 inches
Other paved areas	12 inches

3. Replacement work beyond Maximum Trench Width for paving shall be in accordance with Paragraph "Care and Restoration of Property."

**** END OF SECTION ****

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. Provide all labor, material and equipment to excavate rock and dispose of same, as specified herein.

2. Provide the services of an experienced, licensed blasting company to submit a blasting plan and perform blasting, as specified herein.

3. Provide the services of a professional engineer or geologist to monitor blasting and submit reports, as specified herein.

B. Related Work Specified Elsewhere

1. Trench Excavation, Section 02220, EARTHWORK FOR UTILITIES.
2. Road Restoration, Section 02602, REPAVING.

1.2 DEFINITION

A. The word "rock", wherever used as the name of an excavated material or material to be excavated, shall mean boulders and pieces of concrete or masonry exceeding 1 cubic yard in volume; or solid ledge rock which cannot be excavated with a 1.0-cubic yard, heaped capacity, 30-inch-wide bucket on a track-mounted power excavator equivalent to a Caterpillar Model 345B, L-Series II at not less than 321 HP flywheel power and a bucket curl force of at least 110,250 lb.-ft., and which, in the opinion of the Engineer, requires for its removal drilling and blasting, wedging, sledging, barring, or breaking up with power-operated tools.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Observe all municipal ordinances and State and Federal laws relating to the transportation, storage, handling and use of explosives.

B. The licensed blaster(s) shall at all times, have his license on the work site and shall permit examination thereof by official having jurisdiction.

PART 2 PRODUCTS

2.1 EXPLOSIVES

A. Where blasting is permitted, explosives shall be kept on the site only in such quantity as may be needed for the work under way and only during such time as they are being used.

B. Explosives shall be stored in a secure manner, separate from all tools and flammable substances.

C. Caps or detonators shall be safely stored at least 100 feet distant from the explosives.

D. When the need for explosives has ended, all such materials remaining at the site shall be promptly removed from the premises.

PART 3 EXECUTION

3.1 GENERAL

A. Excavate rock (as defined above), if encountered, to the lines and grades indicated on the Drawings or as required herein and dispose of the excavated material.

B. Rock in pipe trenches shall be excavated below the bottom of the pipe barrel as follows:

Nominal Pipe Diameter (inches)	**Depth Below Pipe** (inches)
4 - 16	6
18 - 48	8
54 - 84	10

3.2 BLASTING

A. Blasting will not be permitted near an existing facility if the Owner of the facility (utility company, federal, state, or local agency) prohibits the use of blasting near their facility.

1. No blasting will be permitted within PennDOT's Rights-of-Way until the Contractor has executed an approved Blasting Bond in an amount to be determined by PennDOT.

B. All operations involving explosives shall be conducted by experienced licensed blasters only, with all possible care to avoid injury to persons and damage to property.

C. Blasting shall be done only with such quantities and strengths of explosives and in such manner as will break the rock approximately to the intended lines and grades and yet will leave the rock not to be excavated in an unshattered condition.

D. Care shall be taken to avoid excessive cracking of the rock upon or against which any structure will be built, and to prevent damage to existing pipes or other structures and property above or below ground.

E. Blasting areas shall be well covered with blasting mats where required to prevent flyrock.

F. Sufficient audible warning shall be given to all persons in the vicinity of the work before a charge is exploded, in accordance with all local, state, and/or federal regulations. Flagmen shall be employed to stop or direct traffic as required.

G. All blasts will be monitored with a seismograph in the field by a Testing Agency who will be selected and paid by the Contractor.

H. Before any blasting is carried out, the Contractor shall submit to the Engineer three (3) copies of the blasting report in accordance with Section 01300, SUBMITTALS, prepared by a professional

engineer or geologist licensed in Pennsylvania containing specific recommendations for blasting. The report shall (a) include sketches showing blast locations and adjacent existing utilities, structures, etc., (b) cover the amount of charge and firing times, ground velocities, energy ratios, accelerations and displacements, (c) describe potential effects on adjacent utilities or structures, (d) include the names and license numbers of the individuals who will be doing the blasting and (e) outline the field monitoring program. Should the report indicate potential damage to existing facilities, the Contractor will not be allowed to utilize blasting. The Contractor shall, prior to preparing his bid, investigate the feasibility of blasting and make appropriate provisions in his bid.

I. The Contractor shall pre-cut paving before blasting to prevent paving from heaving beyond normal trench width. However, this does not relieve the Contractor from the responsibility of repairing damaged paving beyond trench width. If the paving is damaged beyond trench width by the Contractor's blasting activities, the road shall be reconstructed (½-width as a minimum) to the standards of the agency responsible for the road.

J. Prior to blasting, the Contractor shall perform a pre-blast survey of adjacent existing facilities, and shall provide a report to the Engineer. The Contractor shall, at his own expense, repair any blasting damage claimed by owners of adjacent facilities which is not documented as pre-existing by the pre-blast survey.

K. At the end of each Work day remove all wires from blast holes and pick up and dispose of all blasting wires that are lying around the Work area.

L. If carbon monoxide monitoring is determined to be necessary, the Contractor shall cooperate with the Testing Agency by drilling monitoring holes at required locations.

3.3 EXCESS ROCK EXCAVATION

A. If rock is excavated beyond the limits specified, the excess excavation, whether resulting from overbreakage or other causes, shall be backfilled, by and at the expense of the Contractor, as specified below:

1. Pipe Trenches

    a. In pipe trenches, excess excavation below the elevation of the bottom of the pipe bedding shall be refilled to the proper grade, using crushed stone. Refilling with suitable material will not be permitted.
    b. Excess excavation beyond the specified trench width shall be filled with the specified backfill that is applicable for that section of the trench.
    c. Refer to specification Section 02220, EARTHWORK FOR UTILITIES for definition of crushed stone and backfill material.

2. Structures
    a. In excavations for structures, excess excavation in the rock beneath foundations shall be filled with concrete which shall be Class A or Class B, at the option of the Contractor. Other excess excavation shall be filled with earth as specified in the Section 02220, EARTHWORK FOR UTILITIES.

3.4 SHATTERED ROCK

A. If rock below normal depth is shattered due to drilling or blasting operations and such shattered rock, in the opinion of the Engineer, is unfit for foundations, and/or pipe bed, the shattered rock shall be removed and the excavation shall be backfilled as described above in "EXCESS ROCK EXCAVATION". All such removal and backfilling shall be done by the Contractor at no cost.

3.5 BLASTING RECORDS

A. All blasting shall be field monitored using seismographic type equipment under the supervision of a professional engineer or geologist licensed to practice in Pennsylvania.

B. The Contractor shall keep and submit to the Authority, with a copy to the Engineer, an accurate record of each blast. The record shall show (a) date and time of each blast (b) general location of each blast, (c) depth and number of drill holes, (d) the kind and quantity of explosive used, (e) the delay pattern, (f) general weather conditions (wind direction, temperature, etc.), (g) ground velocity and displacements and (h) any other data required for a complete record.

**** END OF SECTION ****

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. Provide all labor, materials and equipment necessary to furnish and install all piping, fittings, valves and appurtenances as shown on the Drawings and/or as specified herein.

2. Unless specifically noted on the Drawings or in the specifications, the pipe material for the force main shall be Ductile Iron and/or PVC Pipe.

B. Related Work Specified Elsewhere

1. Submittals, Section 01300, SUBMITTALS
2. Clearing, Section 02110, CLEARING AND GRUBBING
3. Earthwork, Section 02220, EARTHWORK FOR UTILITIES
4. Rock, Section 02230, ROCK EXCAVATION
5. Manholes, Section 02560, MANHOLES
6. Concrete, Section 03301, CAST-IN-PLACE CONCRETE

C. Piping Items (included, but not limited to)

1. Piping
2. Valves
3. Fittings and related appurtenances

1.2 SUBMITTALS

A. Shop Drawings and Catalog Cuts

1. Submit to the Engineer for his review, fully detailed shop drawings and/or legible catalog cuts of all items included within this Section. Submissions shall be in accordance with Section 01300, SUBMITTALS.

B. Test Reports

1. All tests on materials referred to within this Section shall be made by a recognized and accepted testing laboratory at the Contractor's expense. Tests shall be made in accordance with ASTM or Federal Specification requirements, and certified copies of all test reports shall be submitted to the Engineer.

PART 2 PRODUCTS

2.1 DUCTILE-IRON PIPE

A. General

1. Ductile-iron pipe shall be bell and spigot type, centrifugally cast and conforming to standard specifications of American National Standards Institute, ANSI A21.51, Ductile-Iron

thickness Class dependent upon size of pipe and depth of cover for Laying Condition Type "2" (minimum Class 52), with slip-on joint of type that employs a single modified bulb shape grooved rubber gasket to effect the joint seal. Inside contour of bell shall provide a seat for the gasket, and an internal bead in the socket shall fit into the groove in the gasket. Plain end of the pipe shall be slightly tapered to ease its sliding fit with the gasket when joint is being made. All pipe and fittings for force mains shall have a double cement-lining, conforming to ANSI A21.4. Standard bituminous coating shall be provided on the exterior of all pipe and fittings.

B. Fittings for Ductile-Iron Pipe

1. Fittings for Ductile-Iron Pipe may be either gray or ductile iron conforming to latest issue of ANSI A21.10 for short body Gray and Ductile Iron Fittings, for 250 psi water pressure, plus water hammer, and shall be made with mechanical joint ends conforming to ANSI A21.11.

C. Painting Cast Iron and Ductile Iron Pipe and Fittings

1. Extent of Painting
   Interior surfaces of pipe and fittings shall be coated with a coal-tar epoxy.

2. Surface Preparation
   The pipe and fittings shall be painted at the pipe and fittings company's plant. The pipe shall be blown free of all dirt and debris and brushed clean before painting.

3. Painting
   The coal tar epoxy shall be Koppers Bitumastic No. 300-M as produced by Koppers Company, Inc., equivalent of Valspar Co. or equal. Apply the coal tar epoxy to pipe interior at a per coat rate recommended by Paint Manufacturer to provide a final dry film thickness of 20 mils. Each coat shall differ enough in color that application of subsequent coats may be easily followed.

2.2 POLYVINYL CHLORIDE (PVC) PIPE

A. Wastewater Pressure Sewer (3-inch and under)

1. The polyvinyl chloride (PVC) pipe shall be manufactured in accordance with ASTM D-3034 *Specifications for Type PSM Poly Vinyl Chloride) (PVC) Sewer Pipe and Fittings* having a minimum wall thickness equal to SDR-21 (Standard Diameter Ratio) as noted in the ASTM Specification.

2. The pipe and fittings shall be joined by the elastomeric gasket system conforming to ASTM D-3212 *Specifications for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.*

3. The critical sealing dimensions of the bell, spigot and gasket shall be in accordance with the manufacturer's standard dimensions and tolerances.

4. The elastomeric gasket shall be rubber and shall comply with the physical requirements of ASTM F-477 *Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.*

2.3 VALVES

A. Sewage Combination Air Release/Air Vacuum Valves

1. The sewage combination air release and air (SCAVV) vacuum valves shall be furnished and installed on the sewage force main as shown and located on the Drawings and as specified herein.

2. The sewage air release valve unit of the combination air valve shall be designed and constructed with a long body and float stem so that the operating mechanism will always be kept free from contact with sewage during the continuous purging of air, while the transmission main is under operating pressure. The mechanism shall be also designed to allow air to re-enter the valve and force main, whenever loss of pressure occurs in the main.

3. The mechanism, elongated stem and float shall be designed so that the discharge orifice of this valve will be fully closed tight, when the float is raised about ½-inch by the sewage entering the inlet at the bottom of the valve body.

4. The discharge orifice seat, mechanism and valve stem shall be constructed of stainless steel, complying with ASTM Specifications. The orifice needle shall be constructed of stainless steel and Buna-N. The mechanism lever pins and float shall be constructed of high strength stainless steel, complying with ASTM A-240. The body and cover shall be constructed of cast iron complying with ASTM A-48, Class 35.

5. Dependent on the manufacturer's recommendation, the valve inlet shall be 2-inch size and the discharge orifice shall be 5/16 inch to release 55 SCFM (standard cubic feet of free air per minute), for a system with a flow 0 to 2,500 gpm and operating pressure from 0 to 50 psi. For a system with a flow more than 2,500 gpm and/or a pressure more than 50 psi, the manufacturer shall be consulted.

6. This sewage release valve shall also be provided with complete back-flushing and cleaning accessories and hose comprised of: (a) one 1-inch blow-off valve near bottom of valve body; (b) quick disconnect couplings; (c) ½-inch shut-off valve at top of valve body; and (d) section of rubber hose with quick disconnect coupling. The sewage air release valve shall be Model No. 48BWA as manufactured by the Val-Matic Valve Corp., Lyons, Ill., or equal.

7. The Sewage Air/Vacuum Valve Unit of each combination air valve shall be designed and constructed with a long body and float stem with a float at each end, arranged so that the larger bottom float will seat the upper float and shut off the discharge of the valve body. The operation of this valve shall be designed to allow large volumes of air to be discharged when the transmission main is being filled, and permit large volumes of air to reenter the valve and prevent vacuum whenever pressure drops in the main. This valve shall remain closed after the initial purging of the transmission main, and the main remains under operating pressure.

8. The body and cover of these valves shall be constructed of cast iron, and the floats, stem and trim shall be of stainless steel complying with the respective ASTM Specifications noted for the sewage air release valves. The orifice seat shall be Buna-N.

9. These sewage air/vacuum valves shall have inlet and discharge orifice sizes having adequate venting capacities to properly purge the transmission main while being filled with sewage, and allow the reentry of sufficient quantities of air at the proper rate, to protect the force main upon drop or loss of pressure.

10. For a system with a flow 0 to 2,500 gpm and maximum operating pressure of 150 psi. The air/vacuum valve shall have a 2 inch inlet and a 2 inch outlet and have a venting capacity of not less than 450 SCFM. at a pressure differential of 5 psi. For a system with a flow more than 2,500 gpm and/or an operating pressure more than 50 psi, the manufacturer shall be consulted.

11. The air vacuum valve unit shall also be provided with backflushing accessories and hose as specified above for the sewage air release type valve, with the same size fittings.

12. The combination air release/air vacuum valve shall be as manufactured by Val-Matic Corp; Apco or equal, completely assembled at the factory; each assembly tested at 300 psi hydrostatic pressure and each complete unit shipped fully assembled.

13. The combination sewage air release and air vacuum valves shall be Model 48/302 BWA as manufactured by the Val-Matic Valve & Manufacturing Corp., Lyons, Ill., or equal.

B. Sewage Air-Release Valves (SARV)

1. These valves shall be designed and constructed with a long body and float stem so that the operating mechanism will always be kept free from contact with sewage during the continuous purging of air while the force main is under operating pressure.

2. The mechanism, elongated stem, and float shall be designed so that the discharge orifice of this valve will be fully closed when the float is raised about ½-inch by the sewage entering the inlet at the bottom of the valve body.

3. The discharge orifice seat, mechanism, and valve stem shall be constructed of stainless steel, complying with ASTM Specifications. The orifice needle shall be constructed of Buna-N. The mechanism lever pins and float shall be constructed of high strength, stainless steel, complying with ASTM A-240. The body and cover shall be constructed of cast iron, complying with ASTM A-48, Class 30.

4. For a system with a flow 0 to 2,500 gpm and operating pressure from 0 to 50 psi, the valve inlet shall be 2 inch size and the discharge orifice shall be 5/16 inch to have a venting capacity of at least fifty five (55) SCFM. For a system with a flow more than 2,500 gpm and/or an operating pressure more than 50 psi, the manufacturer shall be consulted.

5. This sewage air valve shall also be provided with back-flushing and cleaning accessories and hose including 1-inch blow-off valve near bottom of valve body; quick disconnect couplings and ½-inch shut-off valve at top of sewage valve; and section of rubber hose with quick disconnect coupling. Inlet valve shall be a 2-inch bronze gate valve with accompanying companion flanges, the air release valve with bottom inlet shall be factory tested.

6. The sewage air release valve shall be a 2-inch, Model 48 BWA as manufactured by Val-Matic, Lyons, Ill., or equal.

7. The Contractor shall provide instructions on the operation of the valve to Owner's operating personnel prior to Owner's acceptance of force main.

8. The sewage air release valves shall be as manufactured by the Val-Matic Valve & Manufacturing Corp., Lyons Ill, or equal.

PART 3 EXECUTION

3.1 RESTRAINTS

A. General

1. All pipe bends, elbows and fittings shall be restrained. In addition, all pipe joints located within the designated Restraining Zones shall also be restrained.

B. Ductile Iron pipe restraints

1. The method of restraining shall be by means of Mechanical Joint Restraints, *Megalug* Series 1100 as manufactured by EBAA Iron Sales Inc.

2. In addition, all joint(s) located within the Restraining Zones shall be Mechanical Joint.

C. Installation

1. Pipe restraints shall be installed in accordance with manufacturer's recommendations.

D. Thrust Blocks

1. Fittings, horizontal, and vertical changes of alignment shall be secured in place with suitable concrete foundation or thrust blocks as detailed in the construction details.

E. Restraining Zones

1. All pipe joints within the following distances from horizontal and vertical changes of alignment, measured in all directions, shall be provided with mechanical joint pipe and retainer glands.

Pipe Diam.	**Horizontal or Vertical Up Bends**				**Vertical Down Bends**		
(inches)	90° bend	45° bend	22° bend	11° bend	45° bend	22° bend	11° bend
6	20	8	4	4	24	14	8
8	24	10	6	6	30	18	10
10	30	12	8	8	36	22	12
12	34	14	10	10	42	24	14
16	44	18	12	12	54	30	16

3.2 DUCTILE IRON INSTALLATION

A. Pipe Installation - General

1. All pipe, fittings and appurtenances shall be carefully inspected in the field before lowering into the trench. All pieces found to be defective shall be rejected. Such rejected pipe shall be clearly tagged in such a manner as not to deface or damage it, and the pipe shall then be removed from the job site by the Contractor at his own expense.

2. Any conflicts during the installation of piping shall be brought to the attention of the Inspector.

B. Handling

1. Pipe and accessories shall be handled in such a manner as to insure delivery of the work in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. No other pipe or material of any kind shall be placed inside of any pipe or fitting any time after the coating has been applied.

C. Cutting

1. Cutting of pipe shall be done in a neat manner by a method which will not damage the pipe. All cutting of pipe shall be done by means of mechanical cutters of an approved type.

D. Placing, Laying

1. Before lowering and while suspended, the pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged or unsound pipe will be rejected. Pipe shall be laid with the bells facing in the direction of laying and for lines on an appreciable slope bells shall face up-grade.

E. Coupling DIP with Push-On Rubber Gasket Joints

1. Gasket seat in the socket and the gasket should be wiped with a cloth. The gasket should be placed in the socket with the large round end entering first, then sprung into gasket seat so that the groove fits over the bead in the seat. A thin film of lubrication should then be applied to the inside surface of the gasket that will come in contact with the entering pipe. Only non-toxic vegetable soap lubricant as recommended by pipe manufacturers shall be used. Mineral oil or petroleum base lubricant shall never be used.

2. The plain end of the pipe to be entered, should be wiped clean and placed in approximate alignment with the bell of the pipe to which it is to be joined. In some cases, it might be desirable to apply a thin film of lubricant to the outside of the plain end for about one (1) inch back from the end. After lubrication, the plain end of the pipe should then be lifted and started into the socket so that it is in contact with the gasket. The joint should be made up with entering pipe deflected at an angle.

3. When pipe is cut in the field, the cut end shall be conditioned so that it may be used to make up the next joint. The outside of the cut end should be tapered back about 1/8 inch at an angle of about thirty (30) degrees with the center line of the pipe by using a coarse file or

portable grinder. The operation should remove any sharp, rough edges which otherwise might injure the gasket.

4. When installing rubber gasket joint pipe in below freezing temperatures, keep lubricant and gaskets workable by leaving them in hot water bath when not actually in use or in a heated storeroom.

5. With "Push-On Joints", the joint deflection angle should not exceed amounts recommended by the manufacturer.

F. Mechanical Joints

1. Mechanical joints shall conform to ANSI A21.11, latest issue, be of stuffing box type, adapted for use of a gasket, cast-iron gland and bolts.

2. In making each mechanical joint, the surfaces with which the rubber gasket comes in contact shall be brushed thoroughly with a wire brush just prior to assembly to remove all loose rust or foreign material and to provide clean surfaces, which should be brushed with soapy water just prior to slipping the gasket over the spigot end and into the bell. Soapy water brushed over the gasket prior to installation also removes loose dirt, and lubricates the gasket as it is forced into its retaining space.

3. The sequence of assembly is to be as follows:
   a. The gland followed by the rubber gasket shall be placed over the spigot end which is inserted into the socket.
   b. The gasket shall be pushed into position so that it is evenly seated in the socket.
   c. The gland shall then be moved into position against the face of the gasket.
   d. Bolts shall then be inserted and made finger tight.

4. When tightening bolts, it is essential that the gland be brought toward the pipe flange evenly maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolts next to the bolts at either side, and last the remaining bolts. This cycle is to be repeated until all bolts are within the following range of bolt torque:

Pipe Size (inches)	**Range of Torque** (ft.-lb.)	**Bolt Size**	**Length of Wrench** (inches)
4-24	75 - 90	3/4 inch	10 in

5. The above torque load may be applied with torque measuring or indicating length of wrench recommended above. If effective sealing is not attained at the maximum torque indicated above, the joints should be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation will not be permitted.

3.3 PVC PIPE INSTALLATION

A. Handling

1. PVC sewer pipe and fittings shall be stored either inside or outdoors. If it is stored outdoors for long periods, it shall be protected from direct exposure to sunlight.

2. PVC sewer pipe and fittings shall be stored in such a way so that the surfaces to be mated are protected from physical damage and are kept as clean as possible.

3. The pipe shall be stored by providing support at each end and intermediate support at 5-foot intervals along the length of the pipe. The pipe shall be stored in such a way as to prevent sagging or bending.

4. Any pipes showing damage or discoloration due to exposure to sunlight, in the sole discretion of the Engineer, will be rejected and shall not be used for the sewer system.

B. Joints

1. The joints shall be assembled in accordance with manufacturer's recommended procedure.

2. Lubricants, if necessary for the assembly of the elastomeric gasket joint, shall not support bacterial growth nor have any deteriorating effect on pipe, fitting or gasket materials and shall be the type recommended by the pipe manufacturer.

C. Pipe Installation

1. Installation shall be made in accordance with ASTM D 2321, "*Underground Installation of Flexible Thermoplastic Sewer Pipe*".

2. Any field cutting and fitting of the PVC plastic sewer main shall be done in accordance with procedures and techniques specified by the pipe manufacturer.

3. The pipe and fittings shall be installed in accordance with Section 02220 - EARTHWORK FOR UTILITIES.

4. During the installation and backfill of the pipe, care must be taken to prevent movement of the pipe.

PART 4 - TESTING

4.1 TESTING

A. All pipe testing shall be performed by Contractor at his expense in presence of Engineer.

B. Hydrostatic Testing (DIP Force Main):

1. Upon completion of the force main, it shall be tested as one complete unit from beginning to end, filled with water.

2. Testing shall be performed and passed in accordance with AWWA C600. Testing procedures shall be modified by the following stipulation:
   a. The point of testing shall be at the low point of each system at 150% of operating pressure or at 75 psi, whichever is greater.

3. The Contractor shall use the latest issue of AWWA C600 when performing the pressure test.

B. Air Testing (Low Pressure PVC Sewer)

1. Low pressure air test of pressure sewers shall be in accordance with Uni-Bell PVC Pipe Association UNI-B-6-98, *Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe* (latest version), except as specified hereinafter. Each sewer run will be tested separately both (a) as the construction progresses, before trench surface restoration, and (b) after road restoration, prior to dedication.

2. Equipment shall be as manufactured by Cherne Industrial, Inc. of Edina, Minnesota; N.B. Products, New Britain, PA, or equal. Equipment used shall meet the following minimum requirements:

   a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.

   b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

   c. All air used shall pass through a single control panel.

   d. Three individual hoses shall be used for the following connections:
      (1) One hose from control panel to pneumatic plugs for inflation.
      (2) One hose from control panel to sealed line for introducing low pressure air.
      (3) One hose from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

3. Procedures

   a. After a section of pipe including laterals has been backfilled in accordance with the specifications, the pipe cleaned, and the pneumatic plugs have been checked by the above procedure, the plugs shall be placed in the line at each end. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 6 psig greater than the average ground water back pressure. At least two (2) minutes shall be allowed for the air pressure to stabilize.

   b. After the stabilization period with 6 psig minimum pressure remaining in the pipe, the air hose from the control panel to the air supply shall be disconnected. The portion of the sewer being tested shall be termed "Acceptable," if the time required for the pressure to decrease 0.5 psig is greater than 5 minutes.

**** END OF SECTION ****

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. Provide all labor, materials and equipment necessary to furnish and install all sanitary sewers and appurtenances as shown on the Drawings and specified herein.

2. The work consists of, but is not limited to, furnishing and installing pipe, materials for joint connections, house or building laterals to point indicated on Drawings, specials, fittings and appurtenances thereto.

B. Related Work Specified Elsewhere

1. Utility location, Section 01030, LOCATIONS OF EXISTING LINES.
2. Submittals, Section 01300, SUBMITTALS.
3. Clearing, Section 02110, CLEARING AND GRUBBING.
4. Earthwork, Section 02220, EARTHWORK FOR UTILITIES.
5. Rock, Section 02230, ROCK EXCAVATION.
6. Force Main and Low Pressure Sewer, Section 02511, FORCE MAIN.
7. Manholes, Section 02560, MANHOLES.
8. Concrete, Section 03301, CAST-IN-PLACE CONCRETE.

A. Shop Drawings

1. Submit shop drawings, cuts and/or samples of all materials to be used in the construction of the sewer lines. Submittals shall be in accordance with Section 01300, SUBMITTALS.

B. Test Reports

1. Tests of pipe shall be made by the pipe manufacturer in accordance with requirements of ASTM and/or ANSI.

2. Certified copies of the tests made by the manufacturer or by a reliable commercial laboratory, acceptable to the Engineer, shall be submitted to the Engineer prior to the first shipment of pipe.

1.3 PIPE MATERIALS

A. Application

1. The type and specification of the pipe materials shall be dependent on the application:

Material	Requirement	Standard
Gravity Sewer	PVC-SDR-26	ASTM D-3034
Deep Sewer (>16')	DIP	ANSI 21.51
or	PVC-DR-18	AWWA C-900
Laterals (4"/6")	PVC-SDR-26	ASTM D-3034
Low Pressure Sewer	PVC-SDR-21	ASTM D-3034
Force Main	DIP	ANSI 21.51

PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE

A. Pipe and Fittings

1. The polyvinyl chloride (PVC) pipe, 8 inches through 15 inches, shall be manufactured in accordance with ASTM D-3034 *Specifications for Type PSM Poly Vinyl Chloride) (PVC) Sewer Pipe and Fittings* having a minimum wall thickness equal to SDR-26 (Standard Diameter Ratio) as noted in Table 1 of the ASTM Specification.

2. The polyvinyl chloride (PVC) pipe, 18 inches through 27 inches, shall be manufactured in accordance with ASTM F-679 *Specifications for Poly Vinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings* having a minimum wall thickness equal to T-1 as noted in Table 1 of the ASTM Specification.

3. The pipe shall be "bell and spigot" type wherein the bell is integral to the pipe. For pipe with belled ends, the thickness of the wall in the bell may be considered satisfactory if the bell was formed on pipe meeting the requirements of the applicable standards.

B. Joints

1. The pipe and fittings for 8-inch and larger diameter shall be joined by the elastomeric gasket system conforming to ASTM D-3212 *Specifications for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.*

2. The critical sealing dimensions of the bell, spigot and gasket shall be in accordance with the manufacturer's standard dimensions and tolerances.

3. The elastomeric gasket shall be rubber and shall comply with the physical requirements of ASTM F-477 *Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.*

2.2 DUCTILE-IRON PIPE WITH RUBBER GASKET JOINTS

A. General

1. Ductile-iron pipe shall be bell and spigot type, centrifugally cast and conforming to standard specifications of American National Standards Institute, ANSI A21.51, Ductile-Iron thickness Class dependent upon size of pipe and depth of cover for Laying Condition Type "2" (minimum Class 52), with slip-on joint of type that employs a single modified bulb shape grooved rubber gasket to effect the joint seal. Inside contour of bell shall provide a seat for the gasket, and an internal bead in the socket shall fit into the groove in the gasket. Plain end of the pipe shall be slightly tapered to ease its sliding fit with the gasket when joint is being made. All pipe and fittings shall have a double cement-lining, conforming to ANSI A21.4. Standard bituminous coating shall be provided on the exterior of all pipe and fittings.

B. Fittings for Ductile-Iron Pipe

1. Fittings for Ductile-Iron Pipe may be either gray or ductile iron conforming to latest issue of ANSI A21.10 for short body Gray and Ductile Iron Fittings, for 250 psi water pressure, plus water hammer, and shall be made with mechanical joint ends conforming to ANSI A21.11.

C. Painting Cast Iron and Ductile Iron Pipe and Fittings

1. Extent of Painting
   a. Interior surfaces of pipe and fittings shall be coated with a coal-tar epoxy.

2. Surface Preparation
   a. The pipe and fittings shall be painted at the pipe and fittings company's plant. The pipe shall be blown free of all dirt and debris and brushed clean before painting.

3. Painting
   a. The coal tar epoxy shall be Koppers Bitumastic No. 300-M as produced by Koppers Company, Inc., equivalent of Valspar Co. or equal. Apply the coal tar epoxy to pipe interior at a per coat rate recommended by Paint Manufacturer to provide a final dry film thickness of 20 mils. Each coat shall differ enough in color that application of subsequent coats may be easily followed.

2.3 APPURTENANCES

A. Stoppers for Open Ends of Pipe

1. Stoppers shall be provided for the open end of each wye fitting, and lateral and manhole. This stopper shall be compatible to type of joint material being used.

PART 3 EXECUTION

3.1 HANDLING PVC PIPE

A. PVC sewer pipe and fittings may be stored either inside or outdoors. If it is stored outdoors for long periods, it shall be protected from direct exposure to sunlight. Pipe showing discoloration

due to exposure to the sunlight will be rejected, at the sole discretion of the Engineer, and shall not be used for the sanitary sewer system.

B. PVC sewer pipe and fittings shall be stored in such a way so that the surfaces to be mated are protected from physical damage and are kept as clean as possible.

C. The pipe shall be stored by providing support at each end and intermediate support at 5-foot intervals along the length of the pipe. The pipe shall be stored in such a way as to prevent sagging or bending.

3.2 HANDLING OF DUCTILE-IRON PIPE

A. Pipe and accessories shall be handled in such a manner as to insure delivery on the work site in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. No other pipe or material of any kind shall be placed inside of any pipe or fitting at any time after the coating has been applied.

3.3 SPECIALS ("Y" BRANCHES)

A. Wherever necessary, the Contractor shall lay "Y" branches of the same material and strength as the sewer main for the purpose of making building connections. The "Y" branches shall be laid at an angle as shown on the Construction Details.

B. The spur of the "Y" branch shall be supported by crushed stone in accordance with Standard Construction Details. "Y" branches shall not be backfilled until location has been inspected by the Engineer.

3.4 SADDLES

A. The saddle location shall be determined in the field. After selecting the location, the hole in the sewer main shall be cut with an approved type of tapping machine. No Hand Cutting will be allowed.

B. The saddle shall be properly located over the hole and held in place with the straps provided with the saddle, in accordance with the construction details.

3.5 BUILDING CONNECTIONS

A. Building connections from sewer to property line, or to the point as required, shall be laid by the Contractor. Building laterals shall be laid in accordance with Standard Construction Details.

B. Building connections under concrete roads of the State Highway shall be made in tunnel where required. Backfill in tunnel shall be made with concrete to meet the requirements of the State Highway Department for backfill in tunnel.

C. In general, specifications for materials, workmanship and watertight construction for building connections shall be the same as for sewers, and should the Contractor undertake to lay building connections for private owners, such work shall also be done according to these specifications and under inspection of the Township and/or Authority.

3.6 DEEP CUT LATERALS

A. Where required (generally where the sewer depth exceeds 10 feet), deep cut laterals shall be constructed as per Standard Construction Details. All pipe shall conform to specifications. Care shall be taken to have all the joints perfectly made and the alignment correct.

3.7 STOPPERS

A. Stoppers shall be securely installed in the open end of each wye fitting, lateral and manhole stub. The stopper shall make a watertight closure of the pipe bell end of the pipe.

3.8 PROTECTING AND KEEPING PIPE CLEAN

A. During construction, the mouth of the completed pipe shall always be kept properly closed with a suitable plug to prevent the entrance therein of any water, earth, stones or other debris. The Contractor shall also take any and all measures to keep the pipe clean and free from deposits and protect the pipe from damage.

B. If the pipe is damaged from any cause or becomes either partly or completely filled with dirt, stones, sand or other debris, the Contractor shall make all necessary repairs and remove at his own expense all such material. Upon refusal to do so, it will be done by the Authority and the cost thereof shall be charged as money paid to the Contractor.

3.9 PIPE LAYING

A. After the trench has been brought to the proper grade as heretofore specified, the pipe and specials shall be laid.

B. Care shall be taken to lay the pipe to true lines and grades. Every pipe laid shall be tested as to grade and alignment. Care must be taken to fit the joints together properly so that the centers of the pipes shall be in one and the same straight line, and so as to give an opening of even thickness, all around between spigot end of pipe and the socket end of specials and fittings. Each section of pipe shall rest upon the pipe bed for the full length of its barrel, with recesses excavated to accommodate bells and joints. The bottom of the trench shall be shaped to give substantially uniform circumferential support to the bottom quadrant of each pipe when earth bedding is used. Any pipe that has its grade or joints disturbed after laying shall be taken up and re-laid. The interior of all pipe shall be thoroughly cleaned of all foreign matter, before being lowered into the trench, and shall be kept clean during laying operations by means of plugs or other approved methods. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions, or the weather, are unsuitable for such work. In all cases, water shall be kept out of the trench until the concrete cradle, where used, has hardened. Every precaution necessary to obtain watertight construction for all joints must be taken. This same precaution must be taken for all connections with manholes.

3.10 INSTALLING PVC PIPE

A. Pipe Installation

1. Installation shall be made in accordance with ASTM D-2321, *Underground Installation of Flexible Thermoplastic Sewer Pipe.*

2. Any field cutting and fitting of the PVC plastic sewer main shall be done in accordance with procedures and techniques specified by the pipe manufacturer.

3. The pipe and fittings shall be installed in accordance with Section 02220 - EARTHWORK FOR UTILITIES.

4. During the installation and backfill of the pipe, care must be taken to prevent movement of the pipe.

B. Joints

1. The joints shall be assembled in accordance with the manufacturers recommended procedure.

2. Lubricants, if necessary for the assembly of the elastomeric gasket joint, shall not support bacterial growth nor have any deteriorating effect on pipe, fitting or gasket materials and shall be the type recommended by the pipe manufacturer.

3.11 ASSEMBLY OF DUCTILE-IRON PIPE

A. Cutting of pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method which will not damage the pipe. All cutting of pipe shall be done by means of mechanical cutters of an approved type or types. Wheel cutters shall be used wherever practicable.

B. Before lowering and while suspended, the pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged, or unsound pipe will be rejected. Deflections from a straight line or grade, made necessary by vertical curves or horizontal curves or offsets, may be made with the pipe except that the deflection shall not exceed 5 degrees for sizes through 12 inches. If the required alignment requires deflections in excess of those specified above, the Contractor shall either provide, at his own expense, special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the limit set forth above. The spigot shall be centered in the bell and the pipe pushed into position and brought into true and specified alignment. Except where necessary in making connections with other lines, pipe shall be laid with the bells facing in the direction of laying and for lines on an appreciable slope bells shall face up-grade.

C. Coupling DIP with Rubber Gasket Joints

1. The gasket seat in the socket and the gasket should be wiped with a cloth. The gasket should be placed in the socket with the large round end entering first. It can then be sprung into the gasket seat so that the groove fits over the bead in the seat. A thin film of lubricant should then be applied to the inside surface of the gasket that will come in contact with the

entering pipe. Only non-toxic vegetable soap lubricant as recommended by pipe manufacturer shall be used. Mineral oil or petroleum base lubricant shall never be used.

2. The plain end of the pipe to be entered should be wiped clean and placed in approximate alignment with the bell of the pipe to which it is to be joined. In some cases it might be desirable to apply a thin film of lubricant to the outside of the plain end for about one inch back from the end. When sub-freezing temperatures prevail, the joint should assemble easier if lubricant is applied only to the gasket. After lubrication, the plain end of the pipe should then be lifted and started into the socket so that it is in contact with the gasket. The joint should be made up with entering pipe deflected at an angle.

3. The joint should be made by exerting sufficient force on the entering pipe so that its plain end is moved past the gasket (which is thereby compressed) until it makes contact with the base of the socket. This can be accomplished by one of the methods recommended by the Pipe Manufacturer, by crowbar, fork tool or jack type tool.

D. Rubber Gasket Joint Assembly with Field Cut Pipe

1. When pipe is cut in the field, the cut end shall be conditioned so that it may be used to make up the next joint. The outside of the cut end should be tapered back about 1/8 inch at an angle of about 30 degrees with the center line of the pipe by using a coarse file or a portable grinder. The operation removes any sharp, rough edges which otherwise might injure the gasket.

E. When installing Rubber Gasket Joint Pipe in below freezing temperatures, keep lubricant and gaskets workable by leaving them in hot water bath when not actually in use, or in a heated storeroom.

F. The joint deflection angle should not exceed amounts recommended by manufacturer of pipe.

G. Paint Touch-Up of Interior Surfaces

1. Before placement in the field, all areas abraded in transit will be touched up with two (2) coats of the coal-tar epoxy using any additional bonding agent to obtain a proper bond as required by the paint manufacturer. When each joint has been completed, the interior surfaces at the joint shall be fully covered with two (2) coats of the coal-tar epoxy using any necessary bonding agent if recommended by the paint manufacturer to obtain a proper bond. The Contractor shall make certain that when coatings at joints have been completed, that the interior surface of the pipe has a continuous, unbroken coating.

3.12 TESTS

A. General

1. The Contractor shall perform the following required tests and shall furnish all apparatus and materials needed for these tests, the cost of which shall be included in the appropriate bid item for testing.

Testing Required	
Pre-Paving (>30 days after installation)	**Post-Paving (prior to Dedication)**
Leakage	Leakage
Deflection	
	Internal TV Inspection

2. After backfilling has been completed, the pipes cleaned and before permanent paving has been installed, the Contractor shall make those tests shown in the preceding table to ascertain that there is no broken pipe, leaking joints or deflected pipe sections. Pipes failing these tests shall be repaired, or removed at once by the Contractor to the satisfaction of the Engineer.

3. The sewer lines and laterals shall be tested for leakage between manholes as the work progresses by one of the following methods as determined by the Engineer. The specified method of testing between manholes may vary depending on field conditions.

   a. Low Pressure Air Test

   b. Infiltration or Exfiltration Test
      (1) When 10 feet or more difference in grade occurs between manholes, the Air Testing method shall be used.

4. A deflection test will be required for PVC pipe in addition to the above leakage tests.

5. An internal TV inspection of the installed sewer shall be performed. The sewer shall be TV inspected after paving has been installed and prior to activation/use of the sewer.

6. All tests will be witnessed by the Authority and/or the Engineer.

B. Air Testing for Leakage (for pipes up to and including 24 inches diameter)

1. Low pressure air test of sewers and laterals shall be in accordance with Uni-Bell PVC Pipe Association UNI-B-6-98, *Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe* (latest version), except as specified hereinafter. Each manhole run will be tested separately both (a) as the construction progresses, before trench surface restoration, and (b) after road restoration, prior to dedication. The pre-paving test shall preferably be performed with not more than four (4) manhole runs constructed ahead of testing.

2. Equipment shall be as manufactured by Cherne Industrial, Inc. of Edina, Minnesota; N.B. Products, New Britain, PA, or equal. Equipment used shall meet the following minimum requirements:

   a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.

   b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
      (1) All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 9 psig. The plugs must hold against this pressure without having to be braced.

   c. All air used shall pass through a single control panel

   d. Three individual hoses shall be used for the following connections:
      (1) One hose from control panel to pneumatic plugs for inflation.
      (2) One hose from control panel to sealed line for introducing low pressure air.
      (3) One hose from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

3. Procedures

   a. After a manhole reach of pipe, including laterals, has been backfilled in accordance with the specifications, the pipe cleaned, and the pneumatic plugs have been checked by the above procedure, the plugs shall be placed in the line at each manhole. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average ground water back pressure, but not less than 6 psi nor greater than 9 psi. At least two (2) minutes shall be allowed for the air pressure to stabilize.

   b. After the stabilization period with 6 psig minimum pressure remaining in the pipe, the air hose from the control panel to the air supply shall be disconnected. The portion of the sanitary sewer (line) being tested shall be termed "Acceptable," if the time required for the pressure to decrease 0.5 psig is greater than the following specified times:

Pipe Diam. (inches)	**Time** (minutes) for Pressure Drop, based on Pipe Length (feet)					
	≤150	**200**	**250**	**300**	**350**	**400**
6	6	6	6	6	6	6
8	8	8	8	8	9	10
10	10	10	10	12	14	16
12	12	12	14	17	20	23
15	14	18	22	27	31	36

c. In areas where a high ground water table (ground water back pressure) is known to exist, the Contractor shall install a ½-inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The plastic tube shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height of water in the plastic tube in feet shall be divided by 2.3 to establish the pounds of ground water back pressure that will be added to all readings. (For example, if the height of water is 11½ feet, then the added ground water back pressure shall be 5 psig. This increases the 5 psig to 10 psig. The allowable drop of 0.5 pound and the timing remain the same.)

C. Infiltration or Exfiltration Methods

1. General

a. Infiltration or exfiltration tests of sewers and laterals shall be as specified hereinafter. Each manhole run will be tested separately as the construction progresses, before surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.

2. Infiltration Test

a. Infiltration tests will be acceptable only when the ground water can be established as imposing a minimum 6 foot head at the pipe invert.

b. Plug the upstream manhole and make measurement of the flow at the downstream manhole. Amount of leakage from any section of the sewer shall not exceed the allowable gallonage as stated hereinafter per inch diameter of pipe per mile per 24 hours.

3. Exfiltration Test

a. Exfiltration tests will be acceptable only when a minimum internal head of 6 feet of water can be maintained above the invert of the pipe.

b. The leakage limit shall not exceed the leakage allowance as stated hereinafter per inch diameter per mile per 24 hours.

c. When using the exfiltration test method, the average internal pressure in the system under test shall not be greater than 5 pounds per square inch (11.6 feet of head), and the maximum internal pressure in any part of the system under test shall not be greater than 10.8 pounds per square inch (25 feet of head).

4. Leakage Allowance

   a. Maximum allowable leakage for either infiltration or exfiltration shall be:

Pipe Material	Allowable Leakage (gallons per inch-diam. per mile of pipe per 24 hrs.)
PVC	50
DIP	50
RCP	100

D. Deflection Test - PVC only

1. General

   a. Deflection testing shall be performed on all portions of the PVC sewer system. This test shall be performed in sections between manholes at least 30 days but not more than 12 months after final backfilling has been completed and tested in the area, and the pipe tested for leakage.

   b. Deflection testing shall be performed in accordance with the procedure outlined below.

2. Maximum Deflection

   a. The maximum allowable deflection for all installed PVC sewer pipe shall not exceed 5% of the pipe internal diameter.

3. Testing Apparatus

   a. Deflection testing shall be performed with a "go, no-go" mandrel which is sized to such dimensions that it will not "go" when encountering deflection greater than permissible. The outside diameter of the mandrel shall be based on the type of PVC pipe installed:

Nominal Pipe Diameter	Mandrel Diameter (inches)	
	SDR-26	DR-18
8	7.38	7.44
10	9.23	9.15
12	10.98	10.91

   b. The test mandrel shall be constructed, at the Contractors expense, according to dimensions to be approved by the Engineer. A shop drawing of the mandrel to be used shall be submitted by the Contractor and approved by the Engineer prior to testing.

   c. The test mandrel shall have stamped identification indicating, (1) nominal pipe diameter, (2) PVC pipe dimension ratio, (3) deflection allowance and (4) outside

diameter of mandrel. The test mandrel shall be similar to those manufactured by Cherne Industries.

4. Deflection Testing Procedure

   a. Completely flush the line making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel.

   b. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line. A #18 masonry twine (79.25 mm) shall be used as the pull rope for the mandrel testing.

   c. After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.

   d. Connect a retrieval rope to the back of the mandrel to pull it back if necessary.

   e. Remove all the slack in the pull rope and place a tape marker on the rope at the ends of the pipe.

   f. Draw mandrel through the sewer line. If any irregularities or obstructions are encountered in the line, corrective action shall be taken as required.

   g. If a section with excessive deflection is found, it shall be located and excavated. The pipe shall be inspected for damage; if any damaged pipe is found, it shall be replaced at the Contractors expense; if pipe is not damaged, replace and thoroughly tamp the haunching and initial backfill; replace remainder of backfill.

   h. Re-test this section for deflection.

E. Internal TV Inspection

1. The Contractor shall provide all labor, material and equipment to furnish closed circuit television inspection of sewer lines, complete with still pictures, videotapes and written report of the inspection.

2. The party performing the TV inspection shall have not less than two (2) years' experience in the closed circuit television inspection of sewer lines. The Authority may require evidence in the form of records from previous sewer inspections to substantiate any claims concerning the ability of the Contractor and his equipment to perform as required.

3. All sewer lines shall be cleaned prior to TV inspection. "Light cleaning" methods can be used to remove deposits. Equipment such as balls, scooters, high pressure water jetting equipment, brushes and/or swabs will be permitted.

4. All debris resulting from cleaning operations shall be permitted to pass through the sewer system, but shall be flushed down to and removed form the downstream manhole of the sewer line section being cleaned and deposited into containers for removal. All the above debris shall be removed from the job site by the Contractor and disposed of in a manner approved by the Engineer at the Contractor's expense.

5. Inspection will be commenced at the section to be examined which is farthest upstream, and further, will be commenced at the upstream end of each section. The terminal section will be that section immediately upstream of the last (lowest) manhole.

6. Photographs shall be taken when directed by the Engineer at specific locations.

7. Submit a report of closed circuit television inspection, in duplicate, which report shall note the conditions found which are indicative of leaks, breaks, growths, misalignment or other adverse conditions. Still pictures shall be taken at the time of the television inspection at the direction of the Engineer depicting the conditions found as delineated above, and shall accompany the report. The stations at which pictures are taken shall be noted in the report by numerical designation and station and the pictures numbered to correspond. Report shall include a list of laterals with applicable house number and station to properly locate each lateral. Report shall provide sufficient information to locate and define the extent of damage to the sewer.

8. Submit a video tape or tapes of the entire closed circuit television inspection, with audio description of the location of the sewer being inspected, size of sewer, and any defects, cracks, leaks, or sags identified. The video tape report shall in no way relieve the Contractor from preparing and submitting the written report described above. The video tapes shall become property of the Authority at the completion of the project.

F. Test Failures

1. If the installation fails to meet the stated test requirements, the Contractor at his own expense shall determine the source of leakage, repair or replace all defective materials and/or workmanship failing to meet tests and shall retest same until proven acceptable to the Engineers.

2. In the event the result(s) of the test(s) does not fall within the allowable range of acceptance, the Contractor shall take whatever corrective action is necessary including replacement of the said pipe, etc., to bring the result(s) of the test(s) to within the allowable range of acceptance.

3. All unsuccessful testing shall be done at the expense of the Contractor. At the successful completion of retesting payment for testing will be made.

**** END OF SECTION ****

PART 1 - GENERAL

1.1 SCOPE

A. Description of Work

1. Provide all labor, materials, tools and equipment necessary to furnish and install manholes as indicated on the Drawings, Construction Details and as herein specified.

2. The Contractor shall be responsible for all work in this Section of the Specifications.

B. Related Work Specified Elsewhere

1. Concrete, Section 03300, CAST-IN-PLACE CONCRETE
2. Trenching, Section 02220, EARTHWORK FOR UTILITIES

1.2 MANHOLE TYPES

A. All manholes used in the construction shall be the precast type, as described below and as specified on the Drawings or elsewhere in these Specifications.

1. Precast Concrete Manholes:
   a. Manholes shall be made up of precast concrete sections of which the top section shall be corbelled. Bottom section may be precast concrete or cast-in-place concrete. The type of manhole base shall be at the Contractor's option, but shall comply with Authority standards.

2. Brick Manholes:
   a. Brick manholes may be used only if specifically approved by the Engineer.

1.3 SUBMITTALS

A. Shop Drawings and Manufacturer's Literature

1. Submit shop drawings or manufacturer's "cuts" of all manhole items such as covers and frames, steps, type of connection for pipe to manhole wall, manhole section joint material and precast sections in accordance with Section 01300, SUBMITTALS.

2. The Contractor shall submit to the Engineer, for review, the type of manhole base he intends to use if he elects to use precast manholes.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE MANHOLES AND COMPONENTS

A. General

1. Manholes shall be made of precast concrete sections of which the top section shall be eccentric (or flat slab top for shallow manhole applications, if specifically approved by the

Engineer). The bottom section shall be a precast concrete manhole base.

2. Poured in place bases will not be acceptable, unless specifically approved by the Engineer.

3. All precast manhole sections shall be manufactured in accordance with and meet the requirements of specification ASTM C-478, latest revision.

4. All precast manhole sections shall be manufactured by the wet cast method.

5. The minimum compressive strength of the concrete for all sections shall be 4,000 psi. The maximum allowable absorption of the concrete shall not exceed 9 percent of the dry weight. Tests, when required, shall be in accordance with ASTM C-497, "*Determining Physical Properties of Concrete Pipe or Tile*", latest revision.

6. Steel reinforcement for all manhole diameters shall be in accordance with ASTM C-478, latest revision.

B. Standard Manhole

1. The manholes shall be constructed of precast reinforced concrete manhole sections. The sections shall be a minimum of four feet in diameter for pipe sizes up to and including 20 inches internal diameter (For pipes with an internal diameter between 21 and 36 inches, the manhole shall be 5 feet in diameter, unless otherwise noted).

2. The sections shall conform to the requirements of "*Specification for Precast Reinforced Concrete Manhole Sections*" (ASTM C-478, latest revision). Joints shall be sealed with a preformed plastic gasket that meets all the requirements of ASTM C-990, "*Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections*", Butyl-Lok as manufactured by A-Lok Products Corporation, Trenton, New Jersey or D-Lok rubber gasket as specified to meet the requirements of ASTM specification C-443, as supplied by Atlantic Concrete Products Company, Tullytown, PA or an approved equal.

3. Manhole Bases

   a. Manhole bases shall be precast reinforced concrete. Poured in place bases will not be acceptable, unless specifically approved by the Engineer.

   b. The bases shall be monolithically cast and shall consist of a manhole bottom and a wall which shall extend a minimum of 10 inches (254 mm) above the top of the highest influent sewer. The top of the base section shall be carefully formed to receive the tongue of the barrel section. There shall be a minimum distance of 4 inches between the invert of the lowest effluent sewer and floor of the precast base to provide for the construction of a formed invert and bench wall within the manhole. No more than two lift inserts or holes shall be cast in the bases.

   c. All precast manhole bases shall have pipe to manhole flexible seals as manufactured by A-LOK Products Corporation Tullytown, PA., "A-LOK full compression seals" or an approved equal. Pipe seals shall be cast into manhole bases according to the

following schedule:

Pipe/Seal Diam. (inches)	**Reqd. Manhole Diameter** (feet)
≤ 20 inches	4-foot
21-30 inches	5-foot
33-42 inches	6-foot

Flexible pipe to manhole seals shall meet all the test and performance requirements of ASTM specification C-923, "*Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals*". Installation of pipe to manhole flexible seals shall be made in accordance with the manufacturer's suggested specifications.

d. All precast manhole bases and walls shall have a minimum thickness according to the following schedule:

Manhole Diameter (feet)	**Base Thickness** (inches)	**Wall Thickness** (inches)
4-foot	8 inches	5 inches
5-foot	8 inches	6 inches
6-foot	8 inches	7 inches

4. Risers and Top Section

a. The top of base walls, the ends of reinforced concrete risers and the bottom ends of precast tops shall be so formed that when risers and tops are assembled with the base, they will make a continuous manhole. Joints shall be of such design as will permit effective joining and placement without irregularities in the interior wall surface of the manhole.

b. Manhole barrels shall consist of riser and top section with a minimum wall thickness of 5 inches, or as specified in the previous table. The top section shall be an eccentric conical section with thickened upper walls with the smallest inside diameter equal to 30 inches to receive the manhole frame and cover. No more than two (2) lift inserts shall be cast in each barrel or top section.

c. Manhole riser and top sections shall be designed, manufactured, tested, finished and marked in accordance with this specification and "*Specifications for Precast Reinforced Concrete Manhole Sections*" (ASTM C 478 Latest Revision).

d. Manholes shall be constructed by the wet process method and shall have a maximum slump of 3½ inches to 4½ inches. A letter of certification shall be submitted to the Engineer stating that these requirements have been attained.

C. Joint Material

1. The joint material shall be a preformed flexible plastic gasket. It shall consist of hydrocarbon plastic and vulcanized rubber and shall be capable of meeting the following conditions:
   a. Hydrocarbon plastic content: 50-70% by weight per ASTM D 297
   b. Volatile matter: 2.0% max. by weight per ASTM D 6
   c. Specific gravity, 77°F-1.20 to 1.35 per ASTM D 71
   d. Ductility, 77°F 5.0 cm min. per ASTM D 113
   e. Softening Point, ring and ball, 320°F min. per ASTM D 36
   f. Penetration, cone 77°F, 150 gm, 5 sec., in 0.1 mm. - 50-120 per ASTM D 217
   g. Flash point, C.O.C., 600°F min. per ASTM D 92
   h. Fire point, C.O.C., 625°F min. per ASTM D 92
   i. Inert mineral filler 30-50% by weight
   j. Material, when in place, shall not leak at joints while being subjected to 10 PSI test for 24-hr. period.
   k. No sagging of vertical and overhead 1 inch wide joints shall be detected while being subjected to temperature of 135°F for period of 5 days.
   l. No visible deterioration of compound when immersed separately in solution of acid, alkalies and saturated hydrogen sulfide, for period of 30 days.

2. Sealing compound shall be supplied in extruded rope-form of suitable cross-section and of such sizes as to seal the joint space when the sections are set in place. The sealing compound shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half to facilitate application of the sealing compound.

D. Pipe Connections to Precast Manhole Bases and/or Sections

1. The type and method of the pipe connection to the manhole base or section shall be in accordance with one of the following methods.

   a. When PVC pipe is used, a special manhole adaptor coupling shall be grouted into the wall of the base at the time of casting. The adaptor shall be sized for the size pipe intended for connection. The manhole wall shall be formed entirely around the adaptor at time of casting. The adaptor coupling shall be supplied by the pipe manufacturer.

   b. When DIP is used or the connection is cored into the manhole, a "Link-Seal" joint as detailed in the Construction details shall be installed.

2.2 MANHOLE STEPS

A. Manhole steps shall be constructed from a copolymer polypropylene plastic (CPP) with a ½-inch diameter, grade 60 steel reinforcing bar embedded inside, as per the attached Standard Details. CPP shall conform to ASTM D-4101. The steel for the reinforcing bar shall conform to ASTM A-

615. Manhole steps shall be Type PS-2-PFSL as manufactured by M.A. Industries Inc., Peachtree City, Georgia or approved equal.

B. Manhole steps shall be cast into the walls of risers and conical top sections at the factory, and shall be aligned vertically and spaced so as to be on equal centers in the assembled manhole at a maximum distance apart of 12 inches and extend out of the wall a minimum of 7 inches for cast-in-place walls and minimum of 6 inches for brick and precast manholes. Steps shall be located a minimum of 6 inches from the ends of riser and top sections, and shall be securely embedded in manhole risers and tops by mortar.

C. Manhole step dimensions shall meet the requirements of OSHA Standard 1910.27 for fixed ladders.

2.3 MANHOLE FRAMES AND COVERS

A. General

1. Castings shall be heavy duty gray cast iron, meeting ASTM A-48 Specifications, designed for HS-25 live loading as designated by AASHTO.

2. Castings shall be free from cracks, holes, swells and cold shuts. All manhole castings shall be made accurately to the pattern and to the dimensions shown on Drawings, and shall be planed where marked, or where otherwise necessary to secure perfectly flat and true surfaces. All lids which "rock" and do not lie solid after construction is finished will be condemned and must be replaced by perfect lids.

3. No plugging, burning in or filling will be allowed. Covers must fit the frames in any position. All castings shall be carefully coated, both inside and out, with coal-tar pitch varnish. The varnish shall be made from a good quality of coal-tar, with sufficient oil added to make a smooth coating, tough and tenacious when cold, and not brittle nor with any tendency to scale off.

B. Standard Type Manhole Frame and Cover

1. Shall conform to details on the Construction Details and be standard sheet casting. A label saying "DANGER – SEWER - DO NOT-REMOVE COVER" shall be cast on the cover in letters 2 inches high. Two (2) pick holes shall be located diametrically opposite and two (2) fixed lifting rings shall also be located diametrically opposite. Frame base shall have four (4) 1-inch diameter holes in it to receive the anchor bolts. Provide "0" ring gasket in cover.

C. Watertight Covers

1. Manholes at specific locations indicated on the Drawings shall each be equipped with a watertight cover. Each of these manholes shall be of standard construction, equipped with Frame and Cover conforming to details on the Construction Details. A label saying "DANGER – SEWER - DO NOT-REMOVE COVER" shall be cast on the cover in letters 2 inches high. Frame and Cover shall be watertight type with stainless steel bolts, machined bearing surfaces and flat neoprene gasket.

D. Watertight Manhole Insert

1. General
   a. All manhole shall be equipped with a watertight insert manufactured from corrosion proof material suitable for atmospheres associated with sanitary sewer systems.

2. The Insert
   a. The insert shall be made from High Density Polyethylene Copolymer material that meets ASTM Specification Designation D 1248 Class A, Category 5, Type III. (The insert shall have a minimum impact brittleness temperature of 105°F or less.) The thickness shall be a uniform 1/8 inch or greater. The insert shall be manufactured to the dimensions as shown on the Drawings to allow easy installation within the manhole frame.

3. Venting
   a. The insert shall have a system of relieving pressure from the manhole or relieving a vacuum in the manhole. The venting system shall contain NO moving parts which could be affected by grit accumulations nor have any parts subject to corrosion. The venting system shall not allow water to completely fill the insert, which during freezing weather could freeze and lift the manhole cover.

4. Manufacturer
   a. The insert shall be manufactured by Parson Plastics, Inc., P.O. Box 4474, Reading, PA 19606 or equal.

E. Anchor Bolts

1. Anchor bolts for bolting manhole frame to the precast manholes shall be made of ¾-inch diameter galvanized all-thread steel rods with a minimum 2½-inch projection through the bars of the frame. The all-thread steel rods shall have a 5-inch hook for embedment in the manhole top. The all-thread steel rod, washer and nuts shall be galvanized.

2. Four bolt slots or inserts shall be cast into the manhole top, positioned at 90 degrees at the time of manufacture.

3. The concrete inserts for use in pre-cast manholes shall be in accordance with Federal Spec. WW-H-171C (Type 18). Cinch anchoring will not be permitted.

F. Mastic

1. Mastic for use between manhole frame and manhole top shall be equal to that as specified for "Joint Material" in Paragraph 2.8, D of this section of the Specifications.

2.4 MORTAR

A. Composition of mortar shall conform to "*Mortar for Unit Masonry*," ASTM C 270, Type N.

2.5 CONCRETE AND GROUT

A. Concrete shall be in accordance with Section 03301, CAST-IN-PLACE CONCRETE.

B. Grout shall be "Masterflow 713 Grout" manufactured by Master Builders, or "Non Shrink 5 Star Grout" manufactured by U.S. Grout Corporation or equal. Grout shall be capable of meeting the test requirements of ASTM C 827.

2.6 CRUSHED STONE

A. Crushed stone shall be in accordance with the crushed stone specified in Section 02220, EARTHWORK FOR UTILITIES, of these Specifications.

2.7 FIELD MADE PIPE CONNECTIONS

A. The type of pipe connection for brick manholes and cast-in-place bases for precast manholes shall be in accordance with one of the following types depending on the pipe material being used.

1. When PVC pipe is used, a special manhole adaptor shall be furnished. The adaptor shall be sized for the size pipe intended for connection.

2. When DIP is used or the connection is cored into the manhole, a "Link-Seal" joint as detailed in the Construction details shall be installed.

B. The proper joint type or adaptor shall be supplied by the pipe manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. Schedule

1. Manholes shall be constructed promptly as the sections of the sewer between them are completed.

2. As soon as manholes are completed, the Contractor shall remove all loose brick, mortar and debris.

B. Groundwater

1. All groundwater shall be kept away from newly installed manhole until the manhole has been properly set and a watertight job is obtained. The Contractor shall use extra care in embedding pipes in the manhole to obtain watertight joints. Manholes that admit any noticeable groundwater after completion must be repaired in a manner satisfactory to the Engineer and at such time as they may specify. If manhole cannot be made watertight to the satisfaction of the Engineer, the manhole shall be removed and replaced at the Contractor's expense.

C. Drop Connections

1. In all manholes, where the grade line of one sewer is 2-feet or more higher than that of the other or where specifically noted on the Drawings, the connection shall be made by means of a "drop connection." Pipe and specials used shall conform to the piping specifications and/or as shown on the Construction Details. Concrete for encasing pipe shall be 4,000 psi strength, poured against undisturbed earth.

2. For encasing PVC pipe in concrete, the complete rise cannot be poured until the bottom section is cured, see the Construction Details for the limit of pour.

D. Line and Grade

1. Care shall be taken to have all pipes laid to correct lines and grades as established for the project.

3.2 PRECAST MANHOLES

A. Handling

1. All precast manhole components shall be lifted and moved by use of suitable lifting slings and plugs that will not damage the precast manhole lip.

2. Manholes shall be visually inspected for damage at the site by the Engineer. The Engineer shall determine at his discretion if damaged manhole sections can be repaired or rejected and removed from the site.

3. All damage to precast sections (including cracks, breaks and chips) shall be thoroughly repaired in the presence of the Engineer. Repair and patching of minor breaks shall be done by chipping and scarifying the defective area before application of grout. Sufficient time shall be allowed for curing before the precast sections are put together. Concrete cast-in-place bases shall be specially formed and keyed to accommodate the bottom precast section.

B. Painting (Interior)

1. Extent of Painting

a. Interior surfaces of all manholes shall be painted with an epoxy resin coating.

b. The first three (3) manholes downstream of a force main connection shall be internally lined with a corrosion resistant PVC liner, as specified in section 4.1 hereinafter.

2. Surface Preparation

a. The manholes shall be painted at the manufacturer's plant and shall be aged seven (7) days before being painted. The concrete shall first be wire brushed clean and then blown free of all dirt, debris and residue before painting.

b. No slurry mix shall be used on the interior of manholes. If the manholes have been steel troweled on the interior surfaces, they shall be sandblasted (brush blast) and then blown free of all residue to provide a proper bonding surface.

3. Painting
   a. The epoxy shall be Ponamid 54-W-23, as produced by Pennsbury Coatings, Division of MAB Company, or equal. Apply at least two (2) coats of the epoxy to manhole interior at a per coat rate recommended by the paint manufacturer to provide a final dry film thickness of 10 to 14 mils. Each coat shall differ enough in color that application of subsequent coats may be easily followed.

4. Certification
   a. Prior to shipment to the job site, the Contractor shall furnish and deliver to the Engineer, a certification from the manhole manufacturer stating that the manhole being furnished has been painted in accordance with this specification.

C. Site Inspection of Precast Sections

1. Precast sections shall be subject to rejection at the Engineer's discretion on account of failure to conform to any of the specification requirements. In addition, individual sections of manholes may be rejected because of any of the following:

   a. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
   b. Defects that indicate imperfect proportioning, mixing, and molding.
   c. Surface defects indicating honey-combed or open texture.
   d. Damaged or cracked end, where such damage would prevent making a satisfactory joint.
   e. Any continuous crack having a surface width of 0.01 inch (0.25 mm) or more and extending for a length of 12 inches or more, regardless of position in the section wall.

D. Bitumastic Coating (Exterior)

1. Exterior surfaces of all manholes shall be coated with bitumastic. Coating shall be Cooper Black No. 760, as manufactured by Coopers Creek Chemical Corp., or equal.

2. At least three (3) coats shall be applied giving a total dry film thickness of a minimum of 32 mils.

3. If the Contractor applies the coating at the site, each precast section shall have the exterior concrete surface blown free of all dirt and debris and brushed clean, prior to setting the precast sections in place, and then be coated with bitumastic.

4. After installation, damaged surfaces shall be recoated in accordance with the coating manufacturer's recommendation to give the required 32 mils dry film thickness.

5. The Contractor shall provide a certification to the Engineer stating that the exterior manhole coating is in accordance with the manufacturer's recommendations and that there is a minimum of 32 mil of material on all manholes.

E. Placement of Precast Manhole Bases

1. All precast concrete bases shall be installed on a foundation layer of crushed stone which shall have a minimum depth of 6 inches. The crushed stone shall conform to the quality and grading requirements specified in Section 703.3 of the Pennsylvania Department of Transportation Specifications Form 408 for No. 1B-Type C crushed stone coarse aggregate. The sub-base shall be leveled and then compacted to a minimum depth of 6 inches before the base is set. The stone shall extend up around the pipes to at least the spring line of the pipe. The maximum extent of the stone shall be in accordance with the pipe encasement details.

2. All pipe openings shall have pipe-to-manhole flexible seals as previously mentioned.

3. Pipes entering precast sections of manholes shall be installed as follows depending on the type of pipe material used.
   a. When PVC pipe is used, insert the pipe into the adaptor coupling provided with the base.
   b. When DIP is used or the connection is cored into the manhole, a "Link-Seal" joint as detailed in the Construction details shall be installed.

4. In constructing "Drop Manholes", the Contractor shall use one of the following methods:
   a. Encase and support the riser and incoming pipe with concrete down to undisturbed earth as shown on the Detail Sheet. Encasing the riser with brick will not be acceptable. Care shall be taken to have all pipes laid to correct lines and grades before concreting is undertaken.
   b. Install precast base with a 90 degree bend precast into the base section and protect the vertical pipe with precast Drop Collars.

F. Placement of Cast-In-Place Manhole Bases

1. The bases shall be constructed of cast-in-place, reinforced concrete, and shall consist of the manhole bottom including the shaped invert and a wall which shall extend a minimum of 6 inches above the top of the highest inflowing sewer.

2. Manhole bases, including bottoms, inverts and walls shall be formed using standard metal forms designed specifically for this use.

3. The concrete to be used shall be 4,000 psi strength.

4. The bases shall rest upon a base of sound, level, and undisturbed earth. If required to reach a sound foundation, Contractor shall furnish and install crushed stone to provide a stable base.

5. Before pouring a cast-in-place base, the downstream and upstream pipes shall be set to proper grade so the pipe ends will be flush with the inside of the manhole. If PVC pipe is being used, place the coupling or rubber gasket around the pipe before pouring the base.

When pouring the concrete base, a concrete bedding shall be placed under the pipes out to the first pipe joint as indicated on the Construction Details. Standard metal forms supplied by the manhole manufacturer shall be used for the work in constructing the bases. The form shall include a ring at the top to form a groove to receive the first precast riser section. Flow channels shall be formed as the base is cast so as to conform to the inside diameter of the pipes.

G. Placement

1. Manhole sections shall not be set by wedging or placing shims to secure proper level and manholes shall not be backfilled without the permission of the Engineer.

2. All lift holes shall be plugged with non-shrinking grout.

H. Grade Adjustment Rings

1. The top of all precast manholes may be brought to proper grade for receiving manhole frames by using precast concrete grade rings to a height of not more than 8 inches. All work shall be laid plumb, straight, level, square and true.

2. Mortar used in setting manhole frames shall be prepared by thoroughly mixing: one (1) volume of Type II Portland Cement with three (3) volumes of sand and sufficient clean water to produce a rich mass of uniform consistency. Mixing mortar on the ground or any paved surface shall not be permitted. Sand to be used in making mortar shall be clean, well graded, and shall pass a standard No. 4 sieve.

3. All mortar to be used in joining manhole sections, filling lift holes in risers, and in sealing pipe joints of manholes shall be a mixture of non-shrink grout.

4. Masonry shall not be constructed during cold weather (air temperature below 40°F) unless necessary precautions are observed, as permitted by the Engineer.

3.4 FLOW CHANNELS AND BENCH WALLS

A. The method of constructing flow channels and bench walls is dependent on which manhole base has been installed:

1. In precast bases, the flow channels and bench walls in each manhole shall be carefully formed of mortar and brick, or concrete.

2. In cast-in-place bases, the flow channels and bench walls are monolithically constructed with the base.

B. The minimum depth of flow channel shall be equal to ¾ the diameter of the largest sewer in the manhole to which it connects. The channel shall be graded to give a smooth, uninterrupted flow through the manhole.

C. Bench walls shall be pitched a minimum of 1 inch per foot but not more than 2 inches per foot from the inside periphery of the manhole to the edge of the flow channel.

D. The Contractor has the option to pour the flow channels or to have them precast by the manhole manufacturer.

3.5 MANHOLE FRAMES AND COVERS

A. Manhole frames and covers shall be brought to proper grade, as previously noted and shown on the Detail, and set in a ½-inch bed of mastic that shall completely fill the space between the manhole frame and top of manhole. The frame shall be anchored in place with the four (4) ¾-inch diameter anchor bolts which shall be securely embedded in the top of the manhole.

3.6 MANHOLE INSERTS

A. The manhole frame rim shall be cleaned of all dirt and debris before placing the manhole insert upon rim.

B. The manhole insert shall be fully seated around the manhole frame rim.

3.8 TESTS

A. General

1. After the gravity sewers and manholes have been installed and backfilled, the manholes shall be tested for leakage.

2. The Contractor may select vacuum testing or water testing as specified below.

B. Test Procedure (utilizing a Vacuum Test)

1. All lines entering and leaving each manhole shall be plugged and plugs securely braced to prevent the vacuum from pulling the plugs out of the pipe. The vacuum test shall be performed after the frame and cover are installed. When the manhole to be tested is located in a roadway, the vacuum test shall be done after paving binder is placed. Lift holes shall be plugged with a non-shrinking grout. Provide all the necessary hardware to perform the vacuum test as manufactured by NPC Systems, Inc., Milford, NH or equal. With the vacuum testing equipment in place proceed with the following:

   a. Inflate the compression band to affect a seal between the vacuum base and the manhole.
   b. Connect the vacuum pump to the outlet port with the valve open.
   c. Draw a vacuum of 10 inches of Hg.
   d. Close the valve.

2. A manhole will be considered acceptable if it takes more than the following times for the vacuum to drop from 10-inch of Hg to 9-inch of Hg regardless of depth:

Manhole Diameter	Min. Acceptable Time for Pressure Drop (seconds)
4-foot	60 seconds
5-foot	75 seconds
6-foot	90 seconds

C. Alternate Test Procedure (utilizing Water)

1. All sewers entering and leaving each manhole shall be plugged. Those manholes which are constructed in a high ground water table location shall be allowed to remain plugged for a period of not less than four (4) hours, after which the quantity of inward leakage accumulation shall be measured by bailing and measuring and/or computation against depth of water and diameter of the manhole. Those manholes constructed above the ground water table shall be filled with water to the top of the cast iron frame and allowed to stand until the walls are well soaked. The manhole shall then be refilled to the full or overflow point and remain undisturbed for a period of not less than four (4) hours. The loss of water shall be measured by refilling to the top with a pre-measured quantity of water and/or computation against depth of water loss and diameter of the manhole.

2. Gain or loss by the respective methods shall not exceed the following:

Manhole Section	Maximum Leakage (gal. per hour per vertical ft. of depth)
Top Section	0.02 gal.
Cone Section	0.03 gal.
4-foot diameter barrel section	0.04 gal.
5-foot diameter barrel section	0.05 gal.
6-foot diameter barrel section	0.06 gal.

PART 4 - SPECIAL CONDITIONS

4.1. MANHOLE LINER

A. Where indicated on the drawings, the manholes, pumping station and/or force main manholes shall be internally lined with a corrosion resistant PVC liner.

B. This liner shall have dove-tail ribs so it can be integrally and securely cast into the concrete structure.

C. The Liner shall be white in color in order to reflect light.

D. The Liner shall be Dura-Plate 100 as manufactured by A-LOK Products, Tullytown, PA., or equal.

**** END OF SECTION ****

PART 1 - GENERAL

1.1 SCOPE

A. Description of Work

1. Contractor shall provide all labor, material and equipment to furnish and install all repaving in areas of paving disturbed or damaged by the construction work.
2. Work shall be in accordance with the Drawings and/or as specified herein.
3. The Contractor and Engineer shall, prior to construction, make a visual reconnaissance of all paved areas, determining the actual condition of paving. Notes, photographs, videotapes, etc., shall be made and kept on file at the Engineer's office for possible future reference.
4. If during the construction work, the Contractor damages the existing paving outside the limits of paving, even though he previously determined that he would not damage the paving, it shall be his responsibility to replace the paving outside the paving limits to its original condition. No additional compensation shall be provided for replacing the paving in kind outside the limits of paving.
5. Contractor is responsible for PennDOT specifications and inspection requirements when performing work within State roadways.

B. Related Work Specified Elsewhere

1. Restoration of non-paved areas: Section 02810, RESTORATION OF DISTURBED AREAS.

1.2 QUALIFICATIONS

A. Applicable Specifications

1. Commonwealth of Pennsylvania, Department of Transportation Specification, Publication 408, current edition.
2. Commonwealth of Pennsylvania, Department of Transportation "Occupancy of *Highways by Utilities*" 67 PA Code Chapters 41 and 459, current edition.
3. Commonwealth of Pennsylvania, Department of Transportation "*Bituminous Concrete Mixtures, Design Procedures and Specifications for Special Bituminous Mixtures,*" Bulletin 27, current edition.
4. Commonwealth of Pennsylvania, Department of Transportation "*Specifications for Bituminous Materials,*" Bulletin 25, current edition.
5. Commonwealth of Pennsylvania, Department of Transportation "*Producers of Bituminous Mixtures*" Bulletin 41, current edition.

B. Qualifications

1. Contractor shall be experienced in paving and use the proper equipment as required by Pennsylvania Department of Transportation.

1.3 NOTIFICATIONS

A. The Contractor shall notify all companies and authorities that have existing utilities in the streets that are to be overlaid, to raise their valve boxes, manholes or other affected system appurtenances.

1.4 SUBMITTALS

A. In accordance with Section 01300, SUBMITTALS, submit for the Engineer's review the type of "Winter Mix" temporary repaving that will be used during the winter months.

PART 2 - PRODUCTS

2.1 AGGREGATE

A. The crushed aggregate shall conform to the applicable provisions of Section 703, AGGREGATES, in Commonwealth of Pennsylvania, Department of Transportation Specifications, Publication 408. Aggregate Producer must be in current PennDOT Bulletin 14 "*Aggregate Producers*" at time aggregates are to be installed". All aggregates are subject to field testing.

2.2 BITUMINOUS MATERIALS

A. The bituminous materials shall conform to the applicable provisions of Bulletin No. 25 of the Commonwealth of Pennsylvania, Department of Transportation. Bituminous Mixtures supplier must be in current PennDOT Bulletin 41 "*Producers of Bituminous Mixtures*" at the time bituminous mixtures are to be installed. All bituminous mixtures are subject to field testing.

2.3 CONCRETE MATERIALS FOR STREETS

A. The concrete materials for streets shall conform to the applicable provisions of Section 704, CEMENT CONCRETE, in Commonwealth of Pennsylvania, Department of Transportation Specifications, Publication 408.

2.4 CONCRETE MATERIALS FOR WALKS AND DRIVEWAYS

A. The concrete materials for walks and driveways in Right-of-Ways, other than State Highways, shall be 3500 psi, air-entrained, 4' slump concrete and shall conform to the specifications of Section 03301, CAST-IN-PLACE CONCRETE.

B. The concrete materials for walks and driveways, in State Highway Rights-of-Way, shall be Class A in accordance with Section 704, CEMENT CONCRETE in Commonwealth of Pennsylvania, Department of Transportation Specification, Publication 408.

2.5 MANHOLE ADJUSTING RINGS

A. Reinforced precast concrete grade adjustment rings shall be used for raising manhole covers. The maximum total thickness of the adjustment rings shall be eight (8) inches.

PART 3 - EXECUTION

3.1 GENERAL

A. Permanent paving can only be done during the following time periods:

Road Ownership	Paving Period
Franconia Township	April 15 to October 15
PennDOT	April 1 to October 31

Bituminous paving mixtures shall not be placed when surfaces are wet or when the air or surface temperature is 40°F or lower.

B. Permanent paving shall include but not be limited to replacement of all traffic lane striping, traffic markings, paving reflectors or markers and traffic signal loop detectors.

3.2 RAISING MANHOLE COVERS AND VALVE BOXES

A. Install the adjusting rings in all sewer and storm manholes that require adjusting to meet the elevation of the repaving.

B. Coordinate the raising of all valve boxes and/or manhole covers belonging to other utilities.

C. Contractor shall be responsible to see that all such items as mentioned above are adjusted to the new paving elevation.

3.3 TEMPORARY PAVING

A. General

1. Temporary paving shall be installed immediately after pipe and backfill have been installed in paved areas.

B. Temporary Paving between March 1 and October 31

1. Where the actual width of the trench at the top is less than 6 feet the temporary paving shall consist of 2-inch compacted depth of hot-mixed, hot-laid bituminous concrete, conforming to requirements of Section 305, *Bituminous Concrete Base Course*, PennDOT, Publication 408 placed on top of compacted backfill, and maintained for a minimum of ninety (90) days.

2. Where the actual width of the trench at the top is 6 feet or more the temporary paving shall be a minimum 2-inch compacted depth conforming to requirements as specified above.

C. Temporary Repaving between November 1 and the end of March

1. Where the actual width of the trench at the top is less than 6 feet, the temporary paving shall consist of 2-inch compacted depth of bituminous stockpile patching material (cold patch) in accordance with PennDOT Bulletin 27, and Publication 408 placed on top of the compacted backfill, and maintained for a minimum of ninety (90) days.

2. Where the actual width of the trench at the top is 6 feet or more, the temporary paving shall be a minimum 2-inch compacted depth conforming to requirements as specified above.

3.4 SURFACE PREPARATION

A. In preparation for permanent paving, temporary bituminous paving and any cold patch material installed for temporary paving shall be removed.

B. Prior to the replacement of the base course, the edges of the existing base and surface courses must be prepared as follows:

1. In State Highways, the edges shall be saw-cut 12 inches on each side of the trench.

2. In Township streets, the edges shall be saw-cut 12 inches on each side of the trench for the binder course and milled an additional 12 inches on each side for the wearing course. The paving shall be done in accordance with Franconia Township Standard Detail, *Permanent Road Restoration Within Township Roads*.

C. Remove all material within the trench and "cut-back" area to sub-grade ready for the base course.

D. The subgrade for all repaved areas shall be thoroughly compacted to the proper distance below and parallel with the prescribed level of the base course. The subgrade shall be completely tamped in an approved manner prior to placing the base course. Compaction shall conform to the Density Requirements in Section 210, *Subgrade*, in PennDOT Specifications, Publication 408 which requires the subgrade to be compacted to not less than 100% of the determined dry-weight density.

E. A tack coat shall be applied in accordance with Section 460, *Bituminous Tack Coat*, in PennDOT Specifications, Publication 408.

3.5 TOWNSHIP AND/OR COUNTY ROADS

A. Base Course

1. Base courses of bituminous concrete shall be prepared and installed in accordance with Section 305, *Bituminous Concrete Base Course*, in PennDOT Specifications, Publication 408.

2. The base course of BCBC shall be compacted greater than or equal to 90% and less than 97% of the daily maximum theoretical density, in accordance with PennDOT Specifications, Publication 408.

B. Binder Course

1. After thoroughly compacting the bituminous concrete base course, allow bituminous concrete base course to uniformly cool to 140 degrees Celsius or less before applying the binder course.

2. The binder course shall be constructed of ID2 in accordance with Section 421, *Bituminous Binder Course ID-2*, in PennDOT Specifications, Publication 408, current edition.

C. Wearing Course

1. After thoroughly compacting the binder course, it shall be allowed to uniformly cool to 140 degrees Celsius or less before applying the wearing course. Where the wearing course is not installed the same day as the binder course, the binder course shall be cleaned of all foreign substances and tack coated prior to applying wearing course. Where the surface course meets an existing paving, such as a side road, a "V" cut shall be made in the existing surface to receive the new paving.

2. The bituminous surface and binder course shall be constructed of ID-2 in accordance with Section 421, *Bituminous Binder Course ID-2* and Section 420, *Bituminous Wearing Course ID-2*, in PennDOT Specifications, Publication 408.

3. The binder and wearing course shall be compacted greater than or equal to 92% and less than 97% of the daily maximum theoretical density, in accordance with PennDOT Specifications, Publication 408.

3.6 MILLING

A. Milling, where indicated on the Drawings, shall be to the depth indicated and be in accordance with Section 420, *Milling of Bituminous Pavement Surface* in PennDOT Specifications, Publication 408.

B. Materials removed shall become the property of the Contractor.

3.7 OVERLAY

A. Where a surface course is required over existing roads, the surfaces to be covered shall be cleaned of all foreign substances and any irregularities removed or filled in. A tack coat shall be applied in accordance with Section 460, *Bituminous Tack Coat*, in PennDOT Specifications, Publication 408, after which the surface course will be applied in accordance with Section 420, *Bituminous Wearing Course ID-2*.

1. The overlay shall be compacted greater than or equal to 92% and less than 97% of the daily maximum theoretical density, in accordance with PennDOT Specifications, Publication 408.

B. Where the overlay meets the existing paving a neat cut shall be made in the existing surface in accordance with the Construction Details.

C. Where overlays are to be placed over existing paving, the base and binder trench paving shall be installed such that the top of the binder paving is flush with existing adjacent paving.

3.8 DRIVEWAYS

A. Stone and gravel drives shall be covered to their existing surface with 2A stone.

B. Paved drives shall be restored with BCBC, 4" minimum thickness or match existing, whichever is greater, and 1 ½" ID2 wearing course. Drives shall be re-paved in accordance with Franconia Township Standard Details.

3.9 STATE HIGHWAYS

A. General (Paving requirements in accordance with PennDOT job requirements)

1. Repaving in State Highways shall be in accordance with "*Occupancy of Highways by Utilities*" 67 PA Code Chapter 459.

B. Flexible Base Pavement

1. High early strength concrete restoration method.

   a. The base course shall be replaced with a minimum of eight (8) inch high early strength concrete to the elevation of the existing crushed aggregate base course. The high early strength concrete shall then be cured in accordance with section 501.3(n) of PennDOT Publication 408. If a trench exceeds four feet in width, No. 6 reinforcing bars shall be installed in the concrete base course, placed at 6-inch centers measured longitudinally in the direction of the trench, with a 2-inch clearance on each end and a 3-inch clearance on the bottom.
   b. Following the concrete curing, a tack coat of E-1 bituminous material or SR tack coat shall be applied in accordance with section 460, of PennDOT Publication 408.
   c. After the tack coat has cured, the bituminous binder and/or wearing course shall be placed so as to conform to the existing type of road binder and wearing courses.

2. Bituminous Concrete Method

   a. The permanent base course shall consist of bituminous concrete meeting the requirements of section 305, of PennDOT Publication 408 and having a minimum depth of five inches or a depth equal to the existing base course, whichever is greater.
   b. The permanent binder and surface course shall be placed in accordance with the depths of the existing bituminous surface, but in no case shall the binder course be less than two (2) inches of ID-2 and the wearing course be less than one and a half (1½) inches of ID-2.

C. Restoration of Plain or Reinforced Cement Concrete Pavements

1. The replacement base shall consist of high early strength concrete equal in depth to the original concrete pavement.

2. On existing reinforced cement concrete pavements, reinforcing steel and expansion tie bolts shall be placed in accordance with Roadway Construction Standard RC-26.

3. The surface shall be restored as follows:

   a. The surface shall be cured in accordance with section 501.3(n) of PennDOT Publication 408. After surface corrections have been completed and just before the concrete becomes non-plastic, the surface shall be given a textured finish in accordance with section 501.3(m)4 of PennDOT Publication 408.

b. Surface restoration of a cement concrete pavement which has a bituminous surface shall be done in accordance with section 41.8(h)(1) of Pennsylvania Department of Transportation "Occupancy of Highways by Utilities" 67 PA Code.

D. Shoulder Restoration

1. Paved and Stabilized Shoulders
   a. Paved and stabilized shoulders shall be reconstructed and restored to a serviceable condition, of the same type as existed before the start of work. Full 2A stone backfill, mechanically tamped in 6-inch lifts to a density of 95% of modified proctor density (ASTM D-1557) is required.

2. Other Shoulders
   a. Retained suitable material which complies with section 206.2 of PennDOT Publication 408 may be used for backfill, up to within 18-inches of final grade. The final 18-inches of backfill shall consist of No. 2 RC aggregate or suitable material.

3.10 SEALING

A. All joints between the new paving and the existing paving and where the new paving abuts other materials such as curbs and manhole frames shall be sealed with PennDOT asphalt cement PG64-22.

3.11 THICKNESSES

A. The Contractor shall contact the appropriate agency having jurisdiction over the roadway in which the work is being constructed to determine the thicknesses of all base courses, binder course, surface courses, and stone and gravel drives.

3.12 DELIVERY TICKET (PAVING MATERIALS)

A. A delivery ticket indicating the quantities and types of paving material shall be submitted at the time of delivery. The complete delivery ticket shall be given to the Engineer at the time material is delivered. Failure to deliver such complete ticket to the Engineer will be cause for the Engineer to reject paving material.

3.13 SURFACE IDENTIFICATION

A. In accordance with "*Occupancy of Highways by Utilities*", 67 PA Code, Chapter 459, a mark of identification shall be placed at the nearest edge of the cut closest to the edge of the improved surface for each opening or impairment made within the improved surface of a State Highway.

B. The paint shall be of a durable wearing quality and shall be color coded as follows:

1. Blue Water lines
2. Green Sewer lines

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. Provide all labor, materials, tools and equipment to furnish and install topsoil, fertilizer, lime, seed and/or sod where required or disturbed.

2. Areas disturbed by construction excavation and trenching for pipes shall be restored to original condition by the Contractor, upon completion of backfilling. Restoration work shall be done when weather conditions are suitable in spring and fall of the year.

3. Types and quantities of soil conditioners, fertilizers, and seed mixtures shall be as specified on the Drawings and/or in this specification, or as recommended by the local State Agricultural Agent.

B. Related Work Specified Elsewhere

1. Clearing and grubbing: Section 02110, CLEARING AND GRUBBING
2. Earthwork: Section 02220, EARTHWORK FOR UTILITIES

1.2 RECOMMENDATION OF AGRICULTURAL AGENT

A. Two (2) one-pint samples from each source of topsoil proposed for use shall be forwarded to the local State Agricultural Agent for his recommendations as to types and quantities of soil conditioners, fertilizers, and seed mixtures to be applied for a dense, vigorous growth of perennial lawn-quality grass. If a better seed is recommended by the Agricultural Agent than the minimum specified herein, then the Agricultural Agent's recommendation will govern.

1.3 SUBMITTALS

A. In accordance with the Section 01300, SUBMITTALS, submit proposed names of fertilizers, sod and seed mixtures together with their composition to the Engineer for review.

PART 2 PRODUCTS

2.1 TOPSOIL

A. Topsoil shall be a natural, fertile, friable soil, typical of productive soils in the vicinity, obtained from naturally well drained areas, neither excessively acid nor alkaline, and containing no substances harmful to grass growth.

B. Topsoil shall not be delivered to the site in frozen or muddy condition.

C. Topsoil stockpiled during construction may be used if it meets the above requirements.

2.2 FERTILIZERS

A. The fertilizers shall be of the composition as specified on the Drawings, herein, or as recommended by the Agricultural Agent.

2.3 SEED

A. The seed shall be of the composition as specified on the Drawings, herein, or as recommended by the Agricultural Agent.

B. Seed shall be of an approved mixture, new crop, clean, high in germinating value and low in weed seed. Seed shall be obtained from a reliable seed company and shall be accompanied by certificates relative to mixture purity and germinating value.

2.4 SOD

A. Sod shall be live, fresh, and of similar mix as used in seeding lawns. It shall be suitable character for the purpose intended and for the soil in which it is to be planted.

B. All the sod for sodding shall be at least 8 inches wide, not less than 12 inches long, and shall have at least 1½ inches in thickness, of dirt on its roots. Broken or damaged sod shall not be used.

2.5 JUTE NETTING

A. Jute mat shall be cloth of a uniform plain weave of undyed and unbleached single jute yard, 48 inches in width plus or minus 1 inch and weighing an average of 1.2 pounds per linear yard of cloth with a tolerance of plus or minus five percent (5%), with approximately 78 warp ends per width of cloth and 41 weft ends per linear yard of cloth. The yarn shall be of a loosely twisted construction having an average twist of not less than 1.6 turns per inch and shall not vary in thickness by more than one-half of its normal diameter.

B. Paper fabric with synthetic netting shall be biodegradable paper. The netting shall be interconnected and the paper interwoven by strips. The rolls should be no less than 60 inches and weigh an average of 0.23 pounds per square yard.

C. Staples for anchoring soil stabilization matting shall be made of 12 to 20 inch lengths of No. 8 plain iron wire.

PART 3 EXECUTION

3.1 UNCULTIVATED AREAS

A. All uncultivated areas that are disturbed by the Contractor's operation shall be restored to their original condition with similar materials.

B. Areas shall be cleaned and all surplus materials removed.

3.2 CULTIVATED AREAS

A. General

1. Existing seeded and/or planted areas disturbed by the construction and all areas indicated on the Drawings shall be loamed, fertilized and seeded or sodded.

2. Furnish and apply soil conditioners, fertilizers and seed as specified on the Drawings, herein, or as recommended by the Agricultural Agent.

B. Topsoil

1. After acceptance of rough grading, the Contractor shall place the topsoil on all areas indicated on the Drawings and on other grassed areas damaged by his operations. Topsoil shall be at least eight (8) inches deep.

2. All topsoil from stripping which is not used at the job site shall be removed from the site and deposited as requested by property owner.

C. Fertilizing and Rolling

1. Soil conditioners and fertilizers shall be spread and thoroughly worked into the topsoil, in accordance with the Drawings, specified herein or recommendations of the agent. Then the topsoil shall be raked until the surface is finely pulverized and smooth and shall be compacted with rollers, weighing not over 100 pounds per linear foot of tread, to an even surface conforming to the prescribed lines and grades. Minimum depth shall be 6 inches after compaction.

D. Seeding

1. Seeding shall be done when specified herein in Paragraph 3.4 or on the Drawings or when approved by the County Agent.

2. If there is a delay in seeding during which weeds grow or soil is washed out, the Contractor shall remove the weeds or replace the soil before sowing the seed, without additional compensation. Immediately before seeding is begun, the soil shall be lightly raked.

3. Seed shall be sown at the approved rate, on a calm day and preferably by machine, but if by hand, only by experienced workmen. Water seeding will not be permitted.

4. One half the seed shall be sown in one direction and the other half at right angles. Seed shall be raked lightly into the soil to a depth of ¼-inch and rolled with a roller weighing not more than 100 pounds per linear foot of tread.

5. The surface shall be kept moist by a fine spray until the grass shows uniform germination over the entire area. Wherever poor germination occurs in areas larger than three (3) square feet, the Contractor shall reseed, roll, and water as necessary to obtain proper germination.

6. The Contractor shall water, weed, cut, and otherwise maintain and protect seeded areas as necessary to produce a dense, healthy growth of perennial lawn grass.

E. Sodding

1. Sodding shall be required if the grades exceed 2-to-1 slope.

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

3. A sufficient quantity of water shall be applied to all sod after laying, to insure immediate growth.

3.3 JUTE NETTING

A. Site Preparation

1. In general, jute and paper matting shall be used on the critical slopes or as required, to prevent seed and/or sod washout and soil erosion.

2. Shape and grade the waterway, channel or area to be protected, as required.

3. Remove rocks, clods over 1½ inches in diameter, sticks and other material that will prevent contact of the matting with the soil surface.

B. Lime, Fertilizer and Seed

1. Lime, fertilize and seed in accordance with the applicable seeding standard except that for jute matting one-half of the seed may be applied prior to laying the matting and the remaining seed applied after laying the matting.

C. Installing Netting

1. Start laying the matting from the top of the channel or slope and unroll downgrade so that one edge of the strip coincides with the channel center. Lay a second strip parallel to the first on the other side of the channel and allow at least a 2-inch overlap for jute matting. If one roll of matting does not extend the length of the channel, continue downhill with additional rolls.

2. Secure the matting by burying the top end of jute strips in a trench 4 inches or more deep. Tamp the trench full of soil. Reinforce with a row of staples driven through the jute about 4 inches downhill from the trench. These staples should be about 10 inches apart. Then staple the overlap in the channel center. These staples should be 3 to 4 feet apart. The outside edges may be stapled similarly at any time after the center has been stapled. Closer stapling along the sides is required where concentrated water may flow into the channel.

3. Succeeding strips of matting, farther down the channel or slope, are secured in a similar manner. Strips of matting on the swale slopes should be layed and secured as above to a height of 3 feet above base of swale.

4. Where one roll of jute matting ends and another roll begins, the end of the top strip overlaps the trench where the upper end of the lower strip is buried. Make the overlap at least 4 inches and staple securely.

D. Erosion Stops

1. At any point, jute matting may be folded for burying in silt trenches and secured as were the upper ends. This checks water flow and erosion that may begin under the matting. It also gives improved tie-down. The procedure is recommended on the steeper slopes of sandy soil and gentler slopes subject to seepage. Spacings vary from 25 to 100 feet as required by the Engineer.

E. Diversions

1. Where diversions outlet into the waterway, the outlet should be protected with matting used in the same manner as in the main channel. The matting for the outlet is laid first so that matting in the main channel will overlap the outlet strip.

F. Matting Soil Contact

1. Get contact between matting and soil by rolling after laying, stapling and seeding are complete. Perfect contact is vital to keep water flow over, not under, the matting.

G. Inspection

1. After job completion, make sure the matting is in contact with the soil at all places and that critical areas are securely stapled down.

3.4 PERMANENT SEEDING (MINIMUM REQUIREMENT)

A. Sandy, Dry Soils

1. Optimum Seeding Dates: February 15 to May 1

2. Seed Mixtures

Type "B"	**Application** (pounds per Acre)
Redtop	10
Red Fescue (Creeping's or Chewing's)	40
Blackwell Switchgrass	10
Reed Canary grass	10
Weeping Lovegrass	10
Perennial Ryegrass	5
Kentucky-31 Tall Fescue	15

B. All except Sandy, Dry Soils

1. Optimum Seeding Dates: February 15 to May 1 or August 15 to October 15

2. Seed Mixtures

Type "A"	Application (pounds per Acre)
Kentucky Bluegrass	20
Red Fescue (Creeping's or Chewing's)	35
Kentucky-31 Tall Fescue	20
Redtop	10
Perennial Ryegrass	10
White Clover	5

3.5 INSPECTION AND ACCEPTANCE

A. At the beginning of the next planting season after that in which the permanent grass crop is sown, the seeded areas will be inspected. Any section not showing dense, vigorous growth at that time shall be promptly reseeded by the Contractor at his own expense.

** END OF SECTION **

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. Provide all labor, material and equipment to furnish and install all concrete as shown on the Drawings and specified herein.

1.2 APPLICABLE SPECIFICATIONS

A. The Contractor shall follow the practices and standards of the following American Concrete Institute specifications which are made part of this specification:

1. ACI-214, "Recommended Practice for Evaluation of Compression Test Results of Field Concrete"
2. ACI-304, "Recommended Practice for Measuring, Mixing and Placing Concrete"
3. ACI-305, "Recommended Practice for Hot Weather Concreting"
4. ACI-306, "Recommended Practice for Cold Weather Concreting"
5. ACI-613, "Recommended Practice for Selecting Proportions for Concrete"

B. The Contractor shall also follow the ASTM standards which are made part of this specification:

1. ASTM C150, "Specification for Portland Cement"
2. ASTM C33, "Specification for Concrete Aggregates"
3. ASTM A615, "Specification for Deformed Billet Steel Bars for Concrete Reinforcement"

1.3 SUBMITTALS

A. All submittals shall be in accordance with Section 01300, SUBMITTALS.

B. Submittals shall include, but also not be limited to, the following:
1. Type and brand of cement used
2. Design mix
3. Delivery tickets

1.4 CLASS OF CONCRETE

A. All concrete work on this Contract not located in State Highway Rights-Of-Way shall be 4,000 psi strength, except for the following items which shall be High Early Strength concrete (3,750 psi):

1. Concrete Cradle
2. Concrete Encasement

B. All concrete work located in State Highway Rights-of-Way shall be PennDOT Class A as specified in the latest published version of PennDOT Form 408.

1. All concrete noted on the Construction Details which references other concrete, shall be changed to PennDOT Class A concrete for Work in the State Highway Rights-of-Way.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement shall be an acceptable brand of Portland cement, ASTM C150, Type I. In the event field conditions require, and the Engineer finds it acceptable, a high-early strength Portland Cement, Type III may be used if certified mill test indicate the tricalcium aluminate (Ca_3Al) content at less than 8%. Only one brand of cement shall be used in this work.

B. Water shall be clean, free from organic or vegetable matter, acid, alkali, or other injurious elements.

C. Fine Aggregate shall be clean hard natural sand or manufactured sand, or a combination of both and shall conform to ASTM C33.

D. Coarse Aggregate shall be hard, durable, uncoated crushed stone, gravel or air cooled blast-furnace slag conforming to ASTM C33. Maximum size of coarse aggregate shall not be larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear distance between reinforcing bars, whichever is least. In no case shall the maximum size exceed 1½ inches.

E. All reinforcing bars shall conform to ASTM A615 Grade 60.

F. Wire for fabrication of the welded wire fabric shall conform to ASTM A82.

2.2 PROPORTIONING

A. Concrete mix shall have a consistency enabling it to be readily worked into all corners of the form and around all reinforcing by usual methods of placing and consolidating without permitting segregation or excessive free water.

B. All concrete on project shall be air-entrained, and the air content shall be 5% $\pm$ 1%.

C. Concrete mix shall be proportioned by an acceptable independent testing and/or inspection laboratory at the Contractor's expense. The design shall provide the following minimum 28-day compressive strengths:

1. All Concrete (except the following) – 4,000 psi
2. High Early Strength concrete – 3,750 psi
3. PennDOT Class A Concrete – 3,300 psi (in accordance with Section 704, *Cement Concrete*, of PennDOT Publication 408)

D. Regardless of the strengths shown by testing, all Class A concrete shall have a maximum water cement ratio of 5 gallons per sack of cement, and a minimum cement factor of 6 sacks per cubic yard of concrete. Class B concrete shall have limits of 6 and 5 respectively.

E. The slump of the concrete mix shall be 4 inches.

F. Concrete design mix shall be submitted to the Engineer for review before work commences. No concrete shall be placed until the Engineer has reviewed and accepted the design mix.

2.3 NON-SHRINK GROUT

A. Non-Shrink, Non-Metallic Grout shall be "Sika Grout 212" by Sika Corporation, Lyndhurst, NJ, or equal.

B. The epoxy compound shall be "Sika Armatec 110" by Sika Corporation, Lyndhurst, NJ.

2.4 GROUT

A. Grout shall be a Portland Cement Grout made from Type II cement, sand and 3/8 inch crushed stone plus a water reducer. Mix shall be designed for a 28-day strength of 4,000 psi with a minimum cement content of 700 pounds per cubic yard, and a slump of four (4) inches.

PART 3 INSTALLATION

3.1 DELIVERY OF CONCRETE

A. A delivery ticket shall be submitted with each batch at the time of delivery. Failure to render such ticket to the Contractor's Job Superintendent shall automatically be cause for rejection of the concrete. The delivery ticket shall show the following:
   1. Batch Plant identification and/or location
   2. Time that truck left batch plant
   3. Design Strength of concrete
   4. Slump of concrete
   5. Air Entrainment of concrete

B. The Contractor's Job Superintendent shall write on the back of the delivery ticket:
   1. The time of arrival of the truck mixer on the site
   2. The time of deposit of the concrete from the truck
   3. The place of deposit of the concrete

C. The completed delivery ticket shall be delivered to the Engineer. Failure to deliver such completed ticket to the Engineer will be cause for the Engineer to reject the deposited concrete at any time and cause it to be removed and replaced at the Contractor's expense.

D. No concrete shall be deposited on the job when it has contained its mix water longer than 60 minutes.

3.2 PLACING CONCRETE

A. Before placing concrete, all construction debris, water and ice shall be removed from the places to be occupied by the concrete.

B. Rock surfaces upon which concrete is to be placed shall be level, free from oil, water, mud, loose semi-detached or unsound rock fragments and rough enough to assure bond with concrete.

C. Where reinforcing bars are required, said bars shall be securely tied to prevent displacement during the pouring operation.

D. Concrete shall be deposited in approximately horizontal layers not to exceed 15 inches in thickness to avoid flowing.

E. Falling concrete shall be closely confined in a drop chute of the proper size to within two or three feet of the place of deposit in the forms and the final drop must be vertical to avoid segregation of aggregates. In no case shall concrete be deposited from a height that will cause separation of the aggregates.

F. Concrete shall be mixed in such quantities as required for immediate use and shall be placed while fresh before loss of slump occurs. Retempering by adding water to restore slump lost during excessive mixing or due to too long a lapse of time since initial mixing will not be permitted.

G. All slabs shall be placed for full thickness in one operation without any change in proportions.

3.3 TEMPERATURE OF CONCRETE

A. Concrete, when deposited, shall have a temperature ranging between a minimum of 50°F and a maximum of 90°F.

B. When the temperature of the surrounding air is below 40°F or above 90°F, concreting shall be done in accordance with the recommendations noted in ACI-306 and ACI-305, respectively.

3.4 GROUTING

A. Grout shall be installed in accordance with ACI 302.

3.5 PROTECTION OF NEW WORK

A. All freshly placed concrete shall be adequately protected from mechanical injury or by action of the elements until such time as the concrete is thoroughly set.

3.6 CURING

A. Curing shall be started immediately upon completion of the finishing operation. Curing shall continue uninterrupted for a minimum period of 14 days unless a longer period is hereinafter specified. Rapid drying upon completion of the curing period shall be prevented. At no time during the curing period shall the temperature of the concrete be permitted to drop below 40°F.

3.7 DEFECTIVE CONCRETE

A. Defective concrete is defined as concrete in place which does not conform to strength, shapes, alignments and/or elevations as shown on the Drawings.

B. All defective concrete shall be removed and replaced in a manner meeting with the Engineer's satisfaction.

**** END OF SECTION ****