

# **DEVELOPER'S SPECIFICATIONS**

**FOR**

**BOROUGH OF BONNEAUVILLE  
ADAMS COUNTY, PENNSYLVANIA**

**JANUARY 2009**

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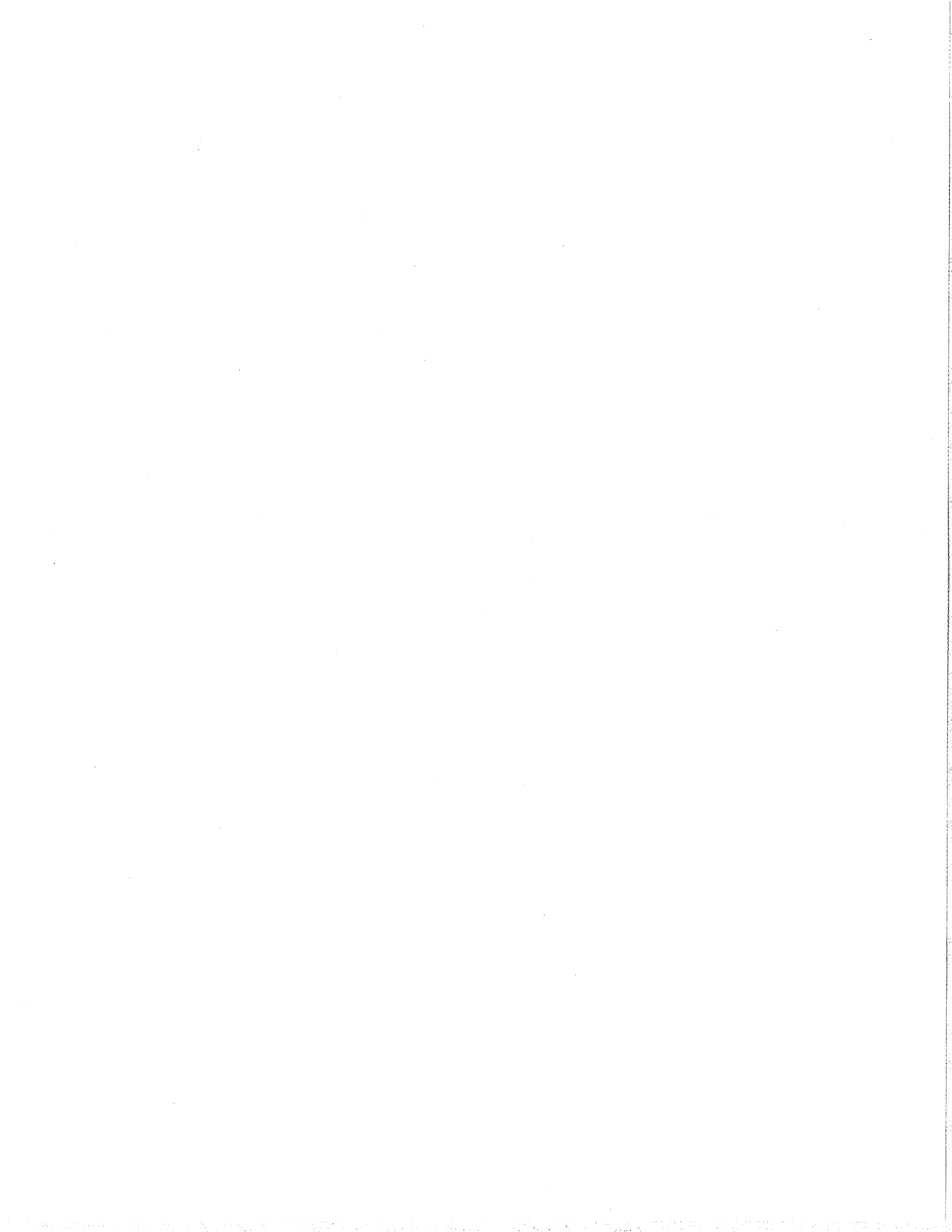
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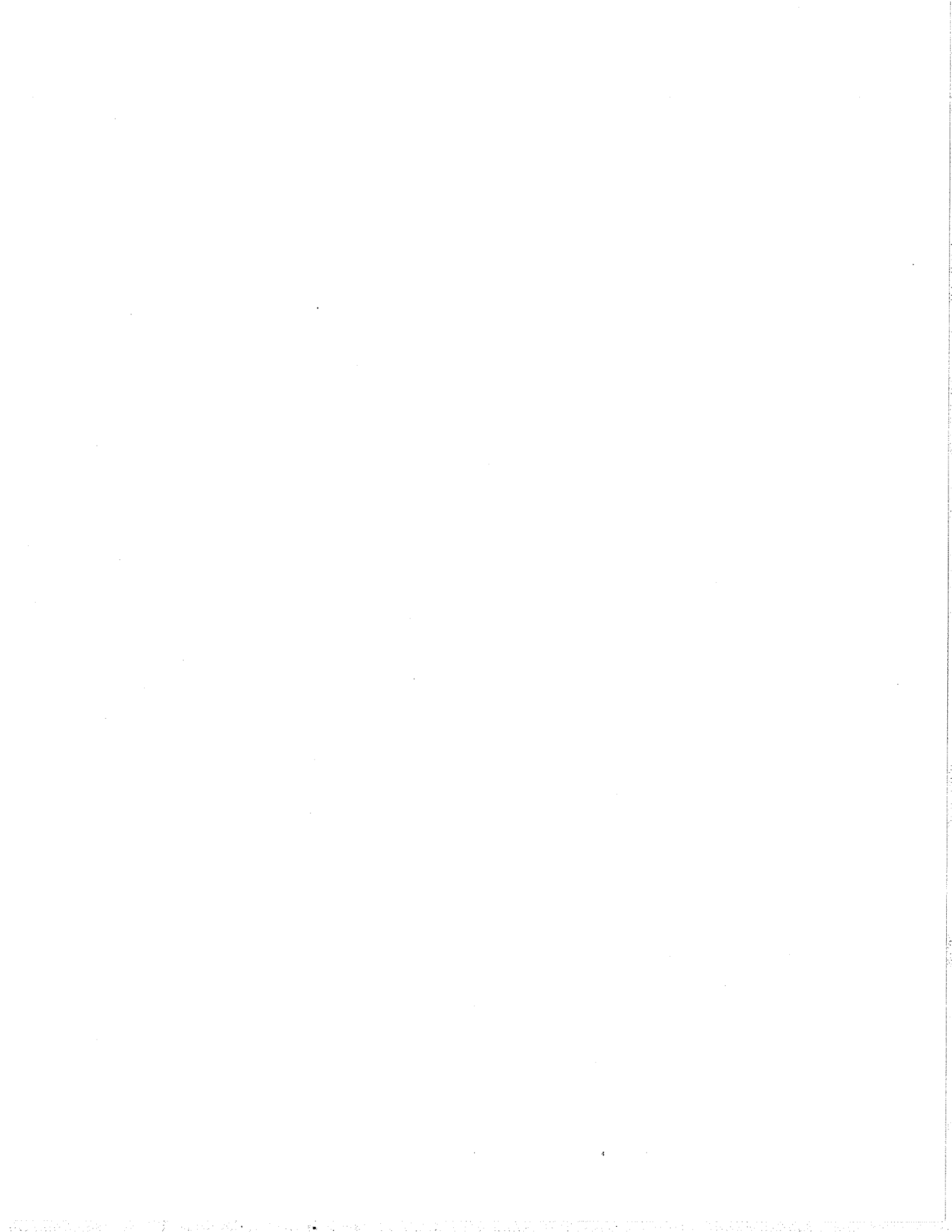
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### Standards for Wastewater Pumping Stations

# **SPECIFICATIONS**



# **DIVISION 1 - GENERAL REQUIREMENTS**



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**SECTION 01010  
GENERAL REQUIREMENTS****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Contractor/Developer shall provide labor, materials, equipment and services, and perform all operations required for complete installation of all items and work in these specifications and as indicated on the Drawings. Drawings shall be considered construction drawings approved by the Borough or its engineer in accordance with the Code of Ordinances of the Borough of Bonneauville.

**1.02 OBTAINING DOCUMENTS**

- A. Copies of the Developer's Specifications may be obtained at the office of the Engineer upon payment of a non-refundable fee of \$30.00 plus tax and shipping for each set; inquiries directed to Betty McKinley, Technical Services, (717)852-1433. Make checks payable to Print-O-Stat, Inc

**1.03 REFERENCED STANDARDS AND SPECIFICATIONS**

- A. References are made to the Pennsylvania Department of Transportation specifications. Unless otherwise noted, the State specifications referred to are the Department of Transportation Publication 408/2000 Specifications, as amended. Reference in the State Specifications to "State", "Chief Engineer", or "Department" shall be interpreted as the Engineer as herein defined.

**1.04 PERMITS AND CERTIFICATES**

- A. The Contractor/Developer will secure and pay for all construction permits and licenses, and will pay all governmental charges and inspection fees necessary for the prosecution of the Work, unless specifically stated otherwise.

**1.05 COMPLIANCE WITH LAWS, ORDINANCES CURRENTLY IN EFFECT**

- A. Contractor/Developer shall comply with all applicable laws, ordinances and codes of the appropriate jurisdiction having control and effect upon the work of this Contract. Before installing any work, the Contractor/Developer shall inform himself on any law, ordinance or code affecting the work; and, where this law, ordinance or code is at variance with these specifications or drawings, the Contractor/Developer shall report the discrepancy to the Engineer in writing for his resolution to remove the discrepancy.



- B. Should the Contractor/Developer elect to ignore the conditions stipulated in paragraph 1.05 (A) above and proceed with the work or variance with any applicable ordinances or code, the Contractor/Developer shall remove such work without cost to the Borough and proceed with the work in a manner as specified by the Engineer.
- C. Contractor/Developer shall comply with applicable laws and ordinances governing the disposal of surplus excavation, materials, debris and rubbish on or off the project and commit no trespass on any public or private property in any operation due to or connected with the work.

#### **1.06 ACT 199**

- A. Contractor/Developer shall take all precautions and utilize all facilities required to protect existing utilities and structures in compliance with Act 199 of the General Assembly of Pennsylvania. The Contractor/Developer shall advise each utility company not less than three nor more than ten working days in advance of intent to excavate, do demolition work or use explosives and give the location of the job site.

#### **1.07 STREET CONSTRUCTION**

- A. Placing of the wearing course shall not take place until 75% of the residential homes or units are constructed.

#### **1.08 PROGRESS SCHEDULE**

- A. Contractor/Developer shall submit a construction progress schedule and update monthly thereafter, indicating the order in which the Work is to be performed, including dates for the start of the various parts of the Work, estimated dates of completion of each part and, as applicable:
  - 1. The dates at which special detail drawings will be required; and
  - 2. Respective dates for submission of Shop Drawings, the beginning of manufacture, expected delivery dates, installation and testing of materials, supplies and equipment.
- B. No work shall begin unless the requirements above are met.

#### **1.09 MUNICIPAL POTABLE WATER WELL CAPACITY REQUIREMENT**

- A. The Borough will not accept a municipal potable water well with a permitted capacity of less than 30 gpm. Well capacity shall be based on continuous operation over a one year period.

**1.10 GUARANTEE**

- A. Contractor/Developer shall warrant and guarantee his Work, materials and equipment for a period of one year from the date of OWNER's approval.

**PART 2 - PRODUCTS (NOT USED)****PART 3 - EXECUTION****3.01 FIELD INSPECTION**

- A. Field inspection will be required and provided by the Borough or its representative. Inspection will also include witnessing of testing. The Borough shall have the authority to halt construction if construction is not being done according to specifications. A final inspection of all facilities is required before acceptance by the Borough. Any inspection costs incurred by the Borough will be the responsibility of the Contractor/Developer.

**3.02 CLEANING UP**

- A. The Contractor/Developer shall continuously keep the work, the site and adjacent properties free from accumulations of waste materials, excess excavation, rubbish and windblown debris resulting from construction operations. Remove waste materials, excess excavation, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the project site.
- B. Provide continuous dust control during construction. Maintain temporary paving areas during the period prior to permanent paving.
- C. At the completion of the work, or each major portion thereof, the Contractor/Developer shall remove surplus materials, tools, construction equipment and machinery, and leave the site clean. Upon completion of construction, clean and flush existing storm rains in the area of construction.

**3.03 TERMINAL INSPECTION**

- A. Two months prior to expiration of the one year guarantee period, the Contractor/Developer shall make an inspection of the work in the company of the Engineer and the Owner. The Engineer and the Owner shall be given not less than five days' notice prior to the anticipated date of terminal inspection.
- B. Where any portion of the work has proven to be defective and requires replacement, repair or adjustment, the Contractor/Developer shall immediately provide materials and labor necessary to remedy such defective work and shall execute such work without delay until completed to the satisfaction of the

Engineer and the Owner, even though the date of completion of the corrective work may extend beyond the expiration date of the guarantee period.

**END OF SECTION**

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**SECTION 01300  
SUBMITTALS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Shop Drawings
  2. Product data
  3. Record Drawings
  4. Submittal procedures

**1.02 PREPARATION OF SUBMITTAL**

- A. Provide a permanent label, title block or transmittal letter for each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
- B. Include the following information on the label or transmittal letter for processing and recording action taken:
1. Project Title
  2. Date
  3. Buchart-Horn, Inc., 445 West Philadelphia Street, York, PA
  4. Name and address of Contractor
  5. Name and address of subcontractor
  6. Name and address of supplier
  7. Name of manufacturer
  8. Number and title of appropriate Specification Section
  9. Drawing number and detail references, as appropriate
  10. Contract Name
- C. Provide a space approximately 8" x 4" on the label or beside the title block on Shop Drawings to record the Contractor's/Developer's review and approval prior to submitting to the Engineer.
- D. Submittals that fail to conform to these requirements will be returned without any action for correction by the Contractor/Developer. No extension of Contract Time will be authorized because of submittals being returned without action because of failure to comply with these regulations.
- E. Package each submittal appropriately for transmitting and handling.
- F. Transmit each item with a transmittal letter similar to AIA Form G810. Identify Project, Contractor/Developer, subcontractor, major supplier; identify pertinent

Drawing sheet and detail number, and Specification Section number; identify deviations from Contract Documents. Provide space for Contractor/Developer and Engineer review stamps.

### **1.03 COORDINATION AND SCHEDULING**

- A. Schedule: Submit a schedule for all submittals; indicate the date of submittals and date of return.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay. Submittals are to be transmitted to the Engineer.
- C. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
- D. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
- E. Schedule a minimum of two (2) weeks for handling and review for each submittal. Schedule additional time for review if submittal must be coordinated with subsequent submittals.

### **1.04 SHOP DRAWINGS**

- A. The Contractor/Developer shall submit shop drawings to the Engineer.
- B. At the time of submission, the Contractor/Developer shall call to the Engineer's attention, in writing, any deviations that the shop drawings may have from the requirements of the Drawings and Specifications.
- C. The Contractor/Developer shall submit the shop drawings marked as either "Submitted as Specified" or "Submitted as Equal to Specified."
  - 1. Where any article is specified by trade name or name of manufacturer with the clause "or equal," it is intended to establish the quality of the article. If the Contractor/Developer proposes to use material or equipment of another manufacturer as an "or equal" to the specified material or equipment, all shop drawings shall conform to the following requirements, conditions, and procedures:
    - a. Substitution of equipment or materials other than those specified will be permitted, providing, in the opinion of the Engineer, such equipment or material is equal to or better than that specified. The decision of the Engineer with respect to approval or disapproval of

- any material or equipment proposed to be substituted as an "or equal" is final. The Contractor/Developer shall have no claim of any sort by reason of such decision.
- b. If the Contractor/Developer proposes to substitute materials or equipment as "or equal" to those specified, it shall be his responsibility to furnish complete, specific, detailed information from the manufacturer or supplier of the material or equipment he proposes to furnish, in which the requirements of the Contract Specifications are shown to be met. This shall consist of a point by point comparison of the Contract Specification requirements with the material or equipment proposed to be furnished. In the event the Contract Specifications mention a model number or other designation and manufacturer in lieu of the detailed description and manufacturer, a point by point comparison of the equipment specified under the Contract and that proposed to be substituted shall be furnished. The burden of responsibility to furnish this information is with the Contractor/Developer. If incomplete or irrelevant data is submitted as evidence of compliance with the Contract Specifications, the data will be returned and the request for approval will be denied.
- D. All shop drawing information must be submitted in a timely fashion to allow a thorough review by the Engineer and to ensure that delivery of the equipment coincides with the construction schedule. Failure of the shop drawings to comply with the specifications, requiring subsequent resubmittals, may adversely affect the construction schedule. Any such delays are solely the responsibility of the Contractor/Developer.
- E. The Engineer's comments will include specific details as to what or where the shop drawings do not comply with the Drawings or Contract Specifications. The Engineer shall review only such data and details as are transmitted to him by the Contractor/Developer. The Contractor/Developer shall coordinate between all suppliers and subcontractors.
- F. Two copies of the approved shop drawings will be returned by the Engineer.
- G. The Contractor's/Developer's attention is specifically directed to the fact that no items shall be fabricated, nor equipment or materials ordered, nor any construction performed prior to approval by the Engineer of shop drawings applicable thereto.

#### **1.05 PRODUCT DATA**

- A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and

article number. Show reference standards, performance characteristics and capacities, wiring and piping diagrams and controls, component parts, finishes, dimensions, and required clearances.

- B. Modify manufacturers' standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- C. Manufacturers' Instructions: When required in individual Specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation start-up, adjusting and finishing in quantities specified for product data.

## **1.06 RECORD DRAWINGS**

- A. The Contractor/Developer is required to keep an up-to-date set of Record Drawings (As-Constructed Drawings) for the project. In addition, the Contractor/Developer shall identify the location of all new piping installed, existing piping to remain and existing piping to be abandoned as it is installed or uncovered during the construction period. No trenching for piping shall be backfilled until the piping has been located by the Contractor/Developer. Up-to-date is defined as containing modifications for work performed within the past 30 days. The record drawing information shall include but not be limited to the following:
  - 1. All dimensional changes. Degree of dimensioning shall equal that of the original drawing
  - 2. All site work modifications such as roadways, sidewalks, grading, etc.
- B. The Contractor/Developer shall make the final record drawings available to the Borough in a CADD file at the completion of the project.

## **1.07 DESIGN DRAWINGS**

- A. Where indicated in the technical specifications, submit Design Drawings prepared by a Professional Engineer registered in the Commonwealth of Pennsylvania.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.01 SUBMITTAL REQUIREMENTS**

- A. Transmit submittals in accordance with approved progress schedule.

- B. Quantities: Submittal shall be made in the following quantities unless additional quantities are indicated in the material specification section.
1. Shop Drawings: 6 blue or black line prints.
  2. Product Data: 6 copies.
  3. Samples:
    - a. Full Size: One.
    - b. Product Variation Limitation: Samples as required to indicate variation in color, texture, pattern, or other characteristics.
- C. Apply Contractor's/Developer's stamp, signed or initialed, certifying Contractor's/Developer's review of submittal; verification of products, field dimensions and field construction criteria; and coordination of information with requirements of work and Contract Documents.

### **3.02 ENGINEER'S ACTION (SHOP DRAWINGS)**

- A. Except for submittals for record, information or similar purposes, where action and return are required or requested, the Engineer will review each submittal, mark to indicate action taken and return.
- B. Review is for general compliance with Contract Documents. No responsibility is assumed for correctness of dimensions or details.
- C. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be marked, as follows, to indicate the action taken.
1. "No Exceptions Taken": Work covered by submittals receiving this stamp may proceed provided it complies with the Contract Documents.
  2. "Approved As Noted": Work covered by submittals receiving this stamp may proceed as noted provided the Contractor/Developer takes no exception(s) to the notation(s).
  3. "Make Corrections Noted and Return": Submittal receiving this stamp must be corrected and resubmitted.
  4. "Rejected - See Remarks": Submittals receiving this stamp are rejected in their entirety and must be resubmitted.
- D. The shop drawing submittal information must comply totally with the specifications, or else it will be stamped "Make Corrections Noted and Return." The Contractor/Developer is therefore responsible for thoroughly reviewing the shop drawing information before forwarding it to the Engineer. The shop drawing information submitted must clearly indicate compliance with the specifications by enumerating the specified performance, materials of construction, protective coatings, size, etc. If compliance with the specification is not clearly defined or ambiguous, the shop drawing information will have to be resubmitted in its entirety.



- E. No work may proceed unless submittals have received a stamp indicating "No Exceptions Taken" or "Approved As Noted".

**3.03 ENGINEER'S ACTION (DESIGN DRAWINGS)**

- A. The Engineer's review will be for completeness only. Missing information will be identified in writing to the Contractor/Developer and a request for resubmittal will be made. Complete design drawing submittals will be so noted and returned to the Contractor/Developer.

**END OF SECTION**

# **DIVISION 2 - SITE WORK**



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**SECTION 02100  
CLEARING AND GRUBBING****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
  - 1. Clearing
  - 2. Grubbing
  - 3. Stripping and stockpiling topsoil
  - 4. Debris disposal
  
- B. Related Work specified elsewhere:
  - 1. Section 02220 - Earthwork
  - 2. Section 02221 - Trenching, Backfilling and Compacting
  - 3. Section 02485 - Finish Grading and Seeding
  
- C. Definitions:
  - 1. Clearing is defined as the removal of trees, brush, down timber, rotten wood, rubbish, any other vegetation, and objectionable material at or above original ground elevation not designated to be saved; clearing also includes removal of fences, walls, guard posts, guard rail, signs, and other obstructions interfering with the proposed work.
  - 2. Grubbing is defined as the removal from below the surface of the natural ground of stumps, roots and stubs, brush, organic materials, and debris.

**1.02 JOB CONDITIONS**

- A. The Contractor/Developer may clear all obstructions within the permanent and construction rights-of-way or property except those specifically indicated on the Contract Drawings or specified to be saved or restored.
  
- B. Obstructions specifically designated to be saved or restored will be marked by the Engineer.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
  
- B. Burning Permits: Submit two copies of each on-site burning permit if such permits are required by local jurisdictional authorities.

- C. Permits for Disposal of Debris:
1. Arrange for disposal of debris resulting from clearing and grubbing to locations outside the Owner's property and obtain written agreements with the owners of the property where the debris will be deposited.
  2. Submit two copies of the agreement with each property owner releasing the Owner from responsibility in connection with the disposal of the debris.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Temporary Fencing:
1. Temporary fencing shall be 6' high. Fencing shall be firmly attached to posts placed on 6 ft. centers. Posts shall have a 2 ft. depth of bury. Temporary fence shall be made of flexible high density orange polyethylene for maximum visibility and strength, two-inch square mesh design, non-conducting, non-toxic, and resistant to acid and corrosion.
- B. Wood Tree Guards:
1. Wood posts: 2"x4"
  2. Wood stringers: 2"x2"
- C. Wrapping Materials:
1. Burlap: AASHTO M182, Class 1
  2. Krinkle-kraft waterproof paper: 4" width
- D. Tree Wound Dressing: Antiseptic and waterproof, asphalt base.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Mark areas to be cleared, the areas to be grubbed, and items to be saved with stakes, flags, paint or plastic colored ribbon for the approval of the Engineer.
- B. Protect benchmarks, utilities, existing trees, shrubs and other landscape features designated for preservation with temporary fencing or barricades satisfactory to the Engineer.
- C. No material shall be stored or construction operation carried on within 4 feet of any tree to be saved or within the tree protection fencing.
- D. When a private enclosure fence encroaches on the work area, notify the property owner at least 5 days in advance of the clearing/grubbing operations to permit the owner to remove it, construct a supplemental fence, or make such

other arrangements as may be necessary for security purposes; in failure of the property owner to reasonably proceed with the work required to secure his property, carefully remove the fence, in whole or in part, and neatly pile the materials onto the owner's property.

### **3.02 UTILITY RELOCATIONS**

- A. Inform utility companies, individuals and others owning or controlling facilities or structures within the limits of the work which have to be relocated, adjusted or reconstructed in sufficient time for the utility to organize and perform such work in conjunction with or in advance of the Contractor's/Developer's operations.
- B. Comply with the provisions of Act 187.

### **3.03 CLEARING**

- A. Confine clearing to within the permanent and construction rights-of-way or property.
- B. Fell trees in a manner that will avoid damage to trees, shrubs, and other installations which are to be retained.
- C. Where stumps are not required to be grubbed, flush-cut with ground elevation.

### **3.04 GRUBBING**

- A. Grub areas within the construction limits to remove roots and other objectionable material to a minimum depth of 8".
- B. Remove all stumps within the cleared areas except those designated to be saved as indicated on the plans.

### **3.05 STRIPPING AND STOCKPILING TOPSOIL**

- A. Strip topsoil to whatever depth it may occur from areas to be excavated, filled, or graded and stockpile at a location approved by the Engineer for use in finish grading. Topsoil shall not be removed from the site unless otherwise authorized by the Engineer.

### **3.06 DEBRIS DISPOSAL**

- A. Trees, logs, branches, brush, stumps, and other debris resulting from clearing and grubbing operations shall become the property of the Contractor and shall be legally disposed.

- B. Do not deposit or bury on the site debris resulting from the clearing and grubbing work.
- C. Debris may be burned on-site if local ordinances allow open-air burning, if required permits are obtained, and if burning operations are conducted in compliance with local ordinances and regulations.

### **3.07 RESTORATION**

- A. Repair all injuries to bark, trunk, limbs, and roots of remaining plants by properly dressing, cutting, tracing and painting, using approved arboricultural practices and materials.
- B. Replace trees, shrubs and plants designated to be saved which are permanently injured or die during the life of the Contract as a result of construction operations with like species acceptable to the project Owner.
- C. Remove protective fences, enclosures and guards upon the completion of the project.
- D. Restore guard posts, guide rail, signs and other interferences to the condition equal to that existing before construction operations.

**END OF SECTION**

**SECTION 02220  
EARTHWORK****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work Of This Section Includes, but is not limited to:
  - 1. Excavation and Backfill for Structures
  - 2. Dewatering
  - 3. Sheet piling and Shoring
  - 4. Site Grading
  
- B. Related Work Specified Elsewhere:
  - 1. Section 02221 - Trenching, Backfilling & Compacting
  - 2. Section 02485 - Finish Grading and Seeding

**1.02 QUALITY ASSURANCE**

- A. Testing Agency: Density testing shall be performed by an independent soils testing laboratory engaged and paid for by the Contractor/Developer and approved by the Engineer.
  
- B. Referenced Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. D698 Test for Laboratory Compaction Characteristics of Soil Using Standard Effort
    - b. D1556 Test for Density and Unit Weight of Soil in Place by the Sand Cone Method
    - c. D2922 Test for Density of Soil and Soil Aggregate in Place by Nuclear Methods
    - d. D5080 Test for Rapid Determination of Percent Compaction
  - 2. Pennsylvania Department of Transportation (PennDOT): Publication 408/2000 Specifications, as amended

**1.03 JOB CONDITIONS**

- A. Proceed with caution in the areas of utility facilities and expose them by hand or other excavation methods acceptable to the utility owner.
  
- B. Erect sheet piling, shoring, and bracing as necessary for protection of persons, improvements, and excavations.
  
- C. Furnish and maintain barricades, signs and markings for excavated areas.



- D. Select and install a system of dewatering to accomplish groundwater control in excavations.
- E. Preserve, protect and maintain operable existing drainage ways, drains and sewers.

#### **1.04 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Certificates:
  - 1. Submit a Certificate of Compliance, together with supporting data, from the materials supplier attesting that the composition analysis of backfill materials meets specification requirements.
  - 2. Submit certified density testing results from the soils testing laboratory.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS - GENERAL**

- A. On site or imported natural soils as approved by Engineer.
- B. Load bearing fill is defined as earth fill or rock fill required for bearing loads imposed by structures or pavement subject to motor traffic and all earth materials necessary to raise the grade from an existing elevation or prepared foundation elevation to the finished elevation in a designated fill area which cannot tolerate settlement. All load bearing fill and backfill shall be compacted to 95% of the standard proctor maximum dry density as determined by ASTM D698.
- C. Nonbearing fill shall be free of roots, rock larger than 3" in size and building debris, capable of minimum compaction of 90% standard proctor density at optimum moisture content established for the soil material by ASTM D698.

#### **2.02 MATERIALS FOR BACKFILLING, LOAD BEARING FILLS OR EMBANKMENTS**

- A. Well-graded soil aggregate mixture, consisting of inorganic on-site cut soils with rock fragments less than 3 inches nominal diameter and less than 20% by weight of the mass, less than 30% of particles finer than No. 200 sieve, liquid limits less than 50, and plasticity indices greater than 10. Alternatively, PennDOT 2RC and No. 2A coarse aggregate would be acceptable.
- B. Total content of gravel or rock fragments larger than 1/2" shall not exceed 20% by weight of the mass.

- C. Backfill shall not contain topsoil, organic matter, debris, cinders, or frozen material.

### **2.03 SELECT GRANULAR MATERIAL**

- A. Compacted in areas of overexcavation in load bearing areas.
- B. Crushed stone or gravel aggregate conforming to Select Granular Material (PennDOT 2RC), Section 703.3, Publication 408/2000 Specifications.

### **2.04 SOURCE OF MATERIALS**

- A. Use materials for fill from this Contract if they meet the requirements specified herein. If sufficient material meeting these requirements is not available from required excavation, obtain requisite material from other sources.
- B. Use only material which has been approved as to quality, location of source and zone of placement in the fill.
- C. The Engineer has the right to reject material at the job site by visual inspection, pending sampling and testing.

## **PART 3 - EXECUTION**

### **3.01 ROUGH GRADING**

- A. Rough grade to uniform contours; form foundations for embankments and load bearing fills.
- B. Construct the finished subgrade to vary not more than 1" above or below the elevation shown.
- C. Rough grade to prevent ponding of water in any area; install temporary swales if necessary to improve surface drainage.
- D. Complete embankment slopes to vary not more than 6" from the slope line shown.
- E. In saturated areas indicating sponginess and instability during earth moving operations shall be excavated and prepared to receive acceptable fill materials as specified; material excavated due to unsuitability shall be removed from site.
- F. Excavated subsoil materials to be used for fill materials shall be approved by Engineer; materials rejected by Engineer shall be removed from the site.

**3.02 FOUNDATION PREPARATION OF NEW LOAD BEARING AREAS**

- A. A load bearing area is defined as an area supporting loads of a structure or pavement area subject to motor traffic.
- B. After excavating to foundation subgrade elevation, the independent testing agency shall perform soil bearing tests to confirm bearing capacity of the subgrade meets or exceeds the minimum safe bearing capacity noted on the Drawings. If the subgrade does not meet the minimum safe bearing capacity noted on the Drawings, the Engineer will review and provide direction for change in the work.
- C. The entire exposed natural soil of the load bearing area shall be proof-rolled with no less than 10 complete coverages of vibratory compaction equipment (minimum of (1) 10,000 lb. smooth drum roller capable of a combined active and passive pressure of 30,000 pounds); all soft spots or irregularities within the natural soil, disclosed as the proof-rolling progresses, shall be excavated to sound material and then backfilled or leveled to grade as hereinafter specified; Engineer shall be so advised by Contractor/Developer that additional excavation is necessary to achieve satisfactory proof-rolling. Suitable backfill to replace unacceptable soil in load bearing areas shall be select granular material.
- D. If rock is exposed at design footing grades, the rock shall be over-cut one foot and replaced with select stone fill. No additional payment will be made for this work.

**3.03 SHORING, SHEETING AND BRACING**

- A. Install shoring, sheeting and bracing to comply with Federal, State and local code requirements. Responsibility for the safety of the work, personnel and structures rests solely with the Contractor/Developer.
- B. Carry the bottom of the support system to depth below the main excavation, adequate to prevent ground movement.
- C. Follow the excavation closely with sheeting and shoring placement.
- D. Perform excavation for the installation of sheeting carefully to minimize the formation of voids.
- E. If unstable material is encountered during excavation, take measures to contain it in place and prevent ground displacement.

- F. Have sufficient quantity of material on hand at all times for sheeting, shoring, bracing and other operations for the protection of the work and for use in case of accident or emergency.
- G. Leave sheeting and shoring in place as long as possible, compatible with the placing and compacting of backfill.

### **3.04 EXCAVATION - GENERAL**

- A. Excavate to the neat lines or setback lines for mixed face conditions and grades indicated on the Drawings.
- B. Excavate in sequence and stages which will not subject permanent or temporary structures, installations, or surfaces to unstable conditions.
- C. Excavate as required to provide sufficient working space to permit placing, inspection, and completion of the structures.
- D. Shape excavations accurately to the cross-sections and grades indicated.
- E. Support the sides of excavations as specified or required.
- F. Keep excavations free from water.
- G. Fill all openings and fractures in the excavation bottom and sides with cement grout to preclude potential development of soil piping and pinholes. Obtain Engineer's written approval of the foundation excavation before placing any foundation stone bedding or construction concrete.

### **3.05 EXCAVATION WITHIN LOAD BEARING FILL AREAS**

- A. After completion of the fill placement and compaction specified under this Specification the independent testing agency will perform test to confirm soil densities in compliance with these specifications and the Drawings; if they do not, compaction and lab tests must be redone. Receive approval of the Engineer, and then footing can begin.
- B. Footing Inspections: The Contractor/Developer shall submit results prepared by an independent testing facility regarding inspection of the excavations for the building foundations; he shall verify, using Method ASTM D1556 or D2922, that specified compaction has been achieved to support the design and that no loose pockets exist beneath the bearing surfaces of the footing excavations.

**C. Backfilling:**

1. Any excavation (such as for utilities, walls, footings, etc.) done within the load bearing fill area shall be backfilled with load bearing fill material with placement and compaction as described in this Section.
2. Where load bearing backfill is placed against walls, either (1) the difference in elevation of the top of the load bearing fill on either side of the wall shall not be allowed to exceed 1'-0" or (2) the wall shall be adequately braced.

**3.06 BLASTING**

- A. No blasting will be permitted.

**3.07 BACKFILLING STRUCTURES**

- A. Do not commence backfilling around any structure until such structure has been examined and approved by the Engineer.
- B. Do not place backfill until the requirements for concrete curing and waterproofing have been complied with and, if required, test cylinders for the particular structure indicate that the concrete has attained the compressive strength specified.
- C. When backfilling against structures and where applicable, place backfill material in equal lifts and to similar elevations on opposite sides of structures in order to equalize opposing horizontal pressures. Place material in uniform increments over fill area.
- D. Protect structures from damage by construction activity, equipment, and vehicles. Repair or replace damaged structures to the satisfaction of the Borough.

**3.08 EMBANKMENT AND FILLS**

- A. Do not place fill on any part of the embankment foundation until such areas have been examined and approved.
- B. Do not place fill on frozen surface.
- C. Place embankment fill in layers of uniform thickness for entire width so that each layer can be uniformly compacted.
- D. Avoid accumulation of large pieces of material at one location; fill voids and interstices with fine materials.

- E. Compact embankment materials of fills within 5 feet of structures using lightweight compactors; do not overstress the structures.
- F. Construct the finished subgrade to vary not more than 1/2" above or 1" below the elevation shown; complete embankment slopes to vary not more than 6" from the slope line shown.
- G. Place fill material over the fill areas and spread in loose horizontal layers, not exceeding equipment manufacturer's recommended uncompacted thickness; cobble size rock fragments may be placed in the lower three feet in areas where the fill is greater than eight feet; all rock shall have interstices filled with smaller rock sizes; work fill material in a direction parallel to the long axis of the fill section unless otherwise approved by the Engineer; the gradation and distribution of fill material shall be such that the area will be free from lenses, pockets, and layers of material differing substantially in texture or gradation from surrounding material; after spreading, harrow fill material if necessary to break up large pieces and blend materials.
- H. Where compacted fill is to be placed on a slope, bench the slope in horizontal and vertical faces of such width and depth as to provide adequate keying of the fill into the slope; in places where the movement of large equipment is restricted, place fill material in maximum 4" layers and compact with smaller vibratory rollers or power tampers; take particular care to thoroughly compact in areas where fill is placed against exposed bedrock.
- I. Density Testing:
  - 1. Conduct density tests at locations as directed by the Engineer during backfilling operations.
  - 2. Determine density by ASTM D1556 or ASTM D2922.

### **3.09 MOISTURE CONTROL**

- A. Control moisture content of fill materials to  $\pm 2\%$  of the optimum moisture content as determined by ASTM D698; material that is too wet may be spread and scarified on the fill surface and permitted to dry, until the moisture content is within specified limits; when fill material is too dry, sprinkle each layer of the fill and work moisture into the material until a uniform distribution within the specified limits is obtained; if, in the opinion of the Engineer, the top surface of a partial fill section becomes too dry to permit a suitable bond, scarify loosen the dried surface, dampen the loosened material and compact the moistened material.
- B. Keep the top plane of load bearing fill areas under construction sloped for drainage; when rain or inclement weather is expected, flat roll the top of embankment to seal it.

**3.10 SURFACE DRAINAGE**

- A. Intercept and divert surface drainage away from the excavation by the use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- C. Remove the surface drainage system when no longer required.
- D. Remove debris and restore the site or sites to original condition.

**3.11 DRAINAGE AND DEWATERING OF EXCAVATED AREAS**

- A. Provide and maintain ditches to collect surface water and seepage which may enter the excavations and divert.
- B. Install a dewatering system to keep excavations dry and free of water.
- C. Maintain water level below subgrade until concrete work or backfill, or both, have been completed to offset uplift pressures.
- D. Dispose of precipitation and subsurface water clear of the work. Provide necessary sediment and erosion control plan requirements.
- E. During dewatering operations, water discharged to a watercourse must be clear and free of silt, mud and other deleterious materials. Construct and maintain settling ponds to prevent stream degradation. Comply with the requirements for dewatering or discharging to a watercourse as required by Federal, State or local codes.
- F. Backfill drainage ditches, sumps, and settling basins when no longer required with granular material or other material as approved by the Engineer.

**3.12 FINISHING**

- A. On completion of the work, clean ditches and channels and finish the site in a neat and presentable condition. Slope areas to provide positive drainage.
- B. Place topsoil and seed all areas disturbed by construction as specified in Section 02485, Finish Grading and Seeding, unless otherwise indicated.

**END OF SECTION**

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**SECTION 02221  
TRENCHING, BACKFILLING AND COMPACTING****PART 1 - GENERAL****1.01 DESCRIPTION****A. The Work of This Section Includes, but is not limited to:**

1. Trench excavation, backfill and compaction
2. Support of excavation
3. Pipe bedding requirements
4. Control of excavated material
5. Restoration of unpaved surfaces

**B. Related Work Specified Elsewhere:**

1. Section 02220 - Earthwork
2. Section 02485 - Finish Grading and Seeding
3. Section 02510 - Bituminous Paving
4. Section 02575 - Paving Restoration
5. Section 02610 - Sanitary Sewer Pipe
6. Section 02615 - Water Mains

**C. Applicable Standard Details:**

1. 5177 Pipe Bedding Details
2. 5178A Pipe Trench Detail
3. 5179 Concrete Cradle and Encasement Details
4. 5180A Stream Crossing Detail
5. 5190 Clay Dike Detail
6. 5195 Thrust Block for Vertical Bends
7. 5196 Thrust Block for Bends, Tees, and Caps

**1.02 QUALITY ASSURANCE****A. Testing Agency: Density testing shall be performed by an independent soils testing laboratory engaged and paid for by the Contractor/Developer and approved by the Engineer.****B. Referenced Standards:**

1. Pennsylvania Department of Transportation (PENNDOT):
  - a. Publication 203, Work Zone Traffic Control
2. American Society for Testing and Materials (ASTM):
  - a. D698 Test for Laboratory Compaction Characteristics of Soil Using Standard Effort
  - b. D1556 Test for Density and Unit Weight of Soil in Place by the Sand Cone Method



c. D2922 Test for Density of Soil and Soil Aggregate in Place by Nuclear Methods

C. Density Testing:

1. Conduct a minimum of two (2) density tests per manhole section or 500 linear feet of pipeline. Conduct one (1) test in the lower half of the trench and one (1) test in the upper half of the trench at locations as directed by the Engineer during backfilling operations. If any test fails, the Contractor/Developer shall take remedial steps to correct the compaction and rerun the test until compliance with the density requirements are shown. A density test that fails does not count toward the number of tests to be taken. The cost of the initial test and any required retesting is the responsibility of the Contractor/Developer.
2. Determine density by ASTM D1556 or ASTM D2922.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Certificates:
1. Submit, prior to delivery of the material to the job site, a Statement of Compliance from the materials supplier, together with supporting data, attesting that the composition analysis of pipe bedding and select material stone backfill materials meets specification requirements. Should a change in source of materials be made during construction, submit a new Statement of Compliance from the new source for approval before the material is delivered to the job site.
  2. Submit certified density testing results from the soils testing laboratory.
- C. Agreements with Property Owners: Prior to storing or disposing of excavated materials on private property, submit a copy of the written agreement with the property owner.

**1.04 JOB CONDITIONS**

- A. Control of Traffic: Employ traffic control measures in accordance with Pennsylvania Department of Transportation Publication 203, "Work Zone Traffic Control".
- B. Protection of Existing Utilities and Structures:
1. Take all precautions and utilize all facilities required to protect existing utilities and structures. In compliance with Act 187 of the General Assembly of Pennsylvania, advise each Utility at least 3 working days in advance of intent to excavate, do demolition work or use explosives and

- give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.
2. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.
  3. Immediately report to the Utility and the Engineer any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
  4. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.

## **PART 2 - PRODUCTS**

### **2.01 PIPE BEDDING MATERIAL**

- A. Type IV Bedding Material: Crushed stone or gravel aggregate conforming to AASHTO No. 8 as specified in Section 703.2, Publication 408/2000 Specifications.

### **2.02 BACKFILL MATERIAL**

- A. Select Granular Material Backfill: Crushed stone or gravel aggregate conforming to Select Granular Material (2 RC), Section 703.3, Publication 408/2000 Specifications.
- B. Select Backfill Material (State Highways, Township Roads, Service Drives, Shoulders and Embankment):
  1. From top of pipe bedding material to subgrade elevation:
    - a. Select Material Stone Backfill as specified in paragraph 2.02.A.
- C. Suitable Backfill Material (Other than State Highways, Township Roads, Shoulders and Embankment):
  1. From top of pipe bedding material to 24" over top of pipe:
    - a. Material excavated from the trench if free of stones larger than 2" in size and free of wet, frozen, or organic materials.
  2. From 24" above pipe to subgrade elevation:
    - a. Material excavated from the trench if free of stones larger than 8" in size and free of wet, frozen, or organic materials.
- D. Unsuitable Backfill Material: Where the Engineer deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with select material

stone backfill as specified in paragraph 2.02.A or suitable foreign backfill material.

### 2.03 CLAY DIKE MATERIAL

- A. Clay dike material conforming to the following:
1. Percent passing the #200 sieve - 70%
  2. Unified Soil Classification - Soils CL & CH
  3. Plastic Index - >10

### 2.04 DETECTABLE UNDERGROUND UTILITY MARKING TAPE

- A. Tape shall consist of a minimum 5-mil (0.005") overall thickness, with no less than a 35 gauge (0.00035") solid aluminum foil core. The foil must be visible from BOTH sides. The layers shall be laminated together with the extrusion lamination process, not adhesives. Further, there shall be NO inks or printing extending to the edges of the tape. The adhesive will NOT contain any dilutants, pigments or contaminants and is specially formulated to resist degradation by elements normally encountered in the soil. All printing shall be encased to avoid ink rub-off.
- B. Test Data:

<u>Property</u>	<u>Method</u>	<u>Value</u>
Thickness	ASTM D2103	5.0 mils
Tensile strength	ASTM D 882	25 lbs./inch (5500 psi)
Elongation	ASTM D 882-88	<50% at break
Printability	ASTM D2578	>50 dynes/cm <sup>2</sup>
Flexibility	ASTM D 671-81	Pliable hand
Inks	Mfg. specs.	Heat set Mylex
Message repeat	Mfg. specs.	Every 20"
Foil	Mfg. specs.	Dead soft/annealed
Top layer	Mfg. specs.	Virgin PET
Bottom layer	Mfg. specs.	Virgin LDPE
Adhesives	Mfg. specs.	>30%, solid 1.5#/R
Bond strength	Boiling H <sub>2</sub> O @ 100°C	5 hours w/o peel
Colors	APWA code	See below

- C. Color Code shall be as follows:
1. Safety Red: Electric power, distribution and transmission and municipal electric systems.
  2. High Visibility Safety Yellow: Gas and oil distribution and transmission, dangerous materials, product and steam.

3. Safety Alert Orange: Telephone and telegraph systems, police and fire communications, and cable television.
4. Safety Precaution Blue: Water systems and slurry pipelines.
5. Safety Green: Sanitary and storm sewer systems.
6. Safety Brown: Force mains, reclaimed water lines and effluent reuse lines.
7. Alert Purple: Reclaimed non-potable water lines.

### **PART 3 - EXECUTION**

#### **3.01 MAINTENANCE AND PROTECTION OF TRAFFIC**

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

#### **3.02 CUTTING PAVED SURFACES**

- A. Where excavation includes breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the centerline of the trench. Cut offsets at right angles to the centerline of the trench. Saw cut concrete surfaces; saw cut other hard surfaces or make straight cuts with jackhammer. No paving shall be broken except that which has been previously cut.
- B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

#### **3.03 BLASTING**

- A. Blasting will be permitted except in areas where the proximity of structures, underground facilities, or public safety precludes the use of explosives. Nothing in this section shall relieve the Contractor of his responsibilities for damages, nor shall it result in any responsibility to the Owner or the Engineer precluded in the General Conditions.
- B. Blasting work shall be supervised by licensed and experienced personnel and performed in conformance with applicable Federal, State and local codes.

**3.04 TRENCH EXCAVATION**

- A. Topsoil Stripping and Stockpiling: Strip topsoil encountered during trench excavation to its full depth and stockpile for reuse.
- B. Depth of Excavation:
1. Gravity Pipelines:
    - a. Excavate trenches to the depth and grade shown on the profile drawings for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.
    - b. Excavation for laterals shall provide a straight uniform grade from the main pipeline or riser stack to the elevation at the right-of-way line, plus that excavation necessary for placement of pipe bedding material.
  2. Pressure Pipelines:
    - a. Excavate trenches to the minimum depth necessary to place required pipe bedding material and to provide 4' from the top of the pipe to the finish ground elevation, except where specific depths are otherwise indicated on the Drawings.
    - b. Where unsuitable bearing material is encountered in the trench bottom, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete cradle can be placed. If no concrete cradle is to be installed, refill the trench to required pipeline grade with pipe bedding material.
    - c. Where the Contractor/Developer, by error or intent, excavates beyond the minimum required depth, backfill the trench to the required pipeline grade with pipe bedding material.
- C. Width of Excavation:
1. Excavate trenches, including laterals, to a width necessary for placing and jointing the pipe and for placing and compacting bedding and backfill around the pipe.
  2. Shape trench walls completely vertical from trench bottom to at least 24" above the top of the pipe.
  3. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.
  4. Where rock is encountered in the sides of the trench, remove the rock to provide a minimum clearance between the pipe and rock of 6".
- D. Length of Open Trench: Do not advance trenching operations more than 400' ahead of completed pipeline.

**3.05 SUPPORT OF EXCAVATION**

- A. Support excavations with sheeting, shoring, and bracing or a "trench box" as required to comply with Federal and State laws and codes. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of the Contractor/Developer in any other manner shall be repaired at the Contractor's/Developer's expense.
- B. Withdraw shoring, bracing, and sheeting as backfilling proceeds unless otherwise directed by the Engineer.

**3.06 CONTROL OF EXCAVATED MATERIAL**

- A. Keep the ground surface within a minimum of 2' of both sides of the excavation free of excavated material.
- B. In areas where pipelines parallel or cross streams, ensure that no material slides, is washed, or dumped into the stream course. Remove cofferdams immediately upon completion of pipeline construction.
- C. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural watercourses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.
- D. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.
- E. Do not place or store excavated material on private property without a written agreement signed by the property owner.

**3.07 DEWATERING**

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Maintain storm drainage facilities, gutters, and natural surface watercourses open and in operation. Provide and install temporary facilities to maintain excavations free

of water as required. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water. When mechanical equipment is utilized to control water conditions, provide and maintain sufficient standby units onsite.

- D. Comply with Federal, State and Local requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

### **3.08 PIPE BEDDING REQUIREMENTS**

- A. Type IV Bedding:
  - 1. Depth of bedding material aggregate as shown on Standard Detail 5177.
- B. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

### **3.09 PIPE LAYING**

- A. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

### **3.10 THRUST RESTRAINT**

- A. Provide pressure pipe with concrete thrust blocking or use restrained joint fittings at all bends, tees, valves, and changes in direction, in accordance with the Specifications, Drawings and Standard Details 5195 and 5196.

### **3.11 BACKFILLING TRENCHES**

- A. After pipe installation and inspection, backfill trenches from trench bottom or from the top of pipe bedding material, whichever is greater, to 12" above the crown of the pipe with specified backfill material hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified density around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material.
- B. Exposed Joints for Testing:
  - 1. The Contractor/Developer has the option to test the pipe prior to backfilling the trench. If this option is selected, install reaction blocks where required and place 2' of thoroughly compacted backfill over the pipe leaving pipe joints partially exposed.

2. If the Contractor/Developer elects to completely backfill the trench prior to testing, he shall be responsible for locating and uncovering leaks which may cause the test to fail.
- C. Lift Thickness Limitations:
1. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations. However, if the equipment manufacturer's lift thickness recommendation is followed and the specified density is not obtained, the Contractor/Developer shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified density.
  2. Compact each layer of backfill to 95% of the standard proctor maximum dry density as determined by ASTM D698.
  3. Notwithstanding the specified requirements for trench backfill compaction, trenches that settle below the surrounding grade prior to final completion shall be filled to surrounding grade level with appropriate materials.

### **3.12 STREAM CROSSINGS**

- A. Construct pipeline stream crossings as shown on Standard Detail 5180A.
- B. After backfilling, protect the surfaces of the disturbed area within the stream channel with a 1 foot thick layer of rip rap stone.

### **3.13 CLAY DIKES**

- A. Install clay dikes adjacent to stream crossings as shown on Standard Detail 5180A and where indicated on the Drawings.
- B. Construct dikes impervious to the flow of water by backfilling the trench with compacted clay as shown on Standard Detail 5190.

### **3.14 UTILITY MARKING TAPE**

- A. Install detectable utility marking tape as specified in Section 02615 above all plastic pressure pipelines, 12"-18" below final grade.

### **3.15 DISPOSAL OF EXCAVATED MATERIAL**

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



**3.16 RESTORATION OF UNPAVED SURFACES**

- A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.
- B. Restore grassed areas in accordance with Section 02485, Finish Grading and Seeding.

**END OF SECTION**

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**SECTION 02312  
TV INSPECTION OF PIPELINES  
(NEW PIPELINES)**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
  - 1. Pipeline Flushing and Cleaning
  - 2. Post-installation TV Inspection of Sewer Pipelines
  - 3. Audio-Video Taping of Pipeline Interior

**1.02 QUALITY ASSURANCE**

- A. Video output from camera(s) used must be capable of producing a minimum of 600 lines of horizontal resolution at center; optimum imagery with minimum illumination; and meet the requirements of EIA Standard Video Signal.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Submit completed tape cassettes, identified by tape number, project name, street name, right-of-way property name, and manhole numbers.
- C. Tapes shall become the property of the Owner.
- D. Contractor/Developer shall submit cleaning and television inspection logs for each section of new sewer line installed and two copies of color videotapes (for Owner and Engineer) for all work performed. These logs shall include as a minimum: stationing and location of lateral services, lot numbers, wyes or tees, clock references, pipe joints, infiltration/inflow defects, cracks, leaks, offset joints, and any other information required by the Engineer/Owner in assessing the final acceptance of the sewer.

**1.04 JOB CONDITIONS**

- A. Contractor/Developer shall provide all water, electricity, and other utilities required to complete the work of this section.

**PART 2 - PRODUCTS**

**2.01 TAPE CASSETTES**

- A. 1/2" VHS format video cassettes.

- B. Audio track containing simultaneously recorded narrative commentary and evaluations of the electrographer describing in detail the condition of the pipeline interior.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Flush and clean the new pipeline interiors to remove all dirt, sand, stones, and other materials from the pipe to ensure clear view of the interior conditions.
- B. Intercept flushed debris at the next downstream manhole by use of weir or screening device, remove and dispose of debris at a site approved by the Owner.

#### **3.02 CLOSED-CIRCUIT TV CAMERA SYSTEM**

- A. Utilize camera(s) specifically designed and constructed for closed-circuit sewer line inspection. Utilize camera equipment with the capability to view each lateral connection at multiple angles (pan and tilt camera).
- B. Utilize camera capable of moving both upstream and downstream; minimum 1,000 feet horizontal distance with 1 setup; direct reading cable footage meter.
- C. Picture quality and definition shall be to the complete satisfaction of the Engineer and if unsatisfactory, the equipment shall be removed and replaced with equipment of satisfactory quality.

#### **3.03 PIPELINE INSPECTION**

- A. Audio-video tape sections of sewer pipeline between manholes designated by the Engineer.
- B. Identify and record locations of flat grades, dips, deflected joints, open joints, broken pipe, protrusions into pipeline, and points of infiltration.
- C. Locate and record all service connections.
- D. Record locations of pipeline defects and connection horizontal distance, in feet, and direction from manholes.

**END OF SECTION**

**SECTION 02420  
SITE DRAINAGE****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
  - 1. Storm Drainage Piping
  - 2. Headwalls and Endwalls
  - 3. Inlets
  - 4. Manholes
  - 5. Drainage Channels and Swales
  - 6. Rip Rap
  
- B. Related Work specified elsewhere:
  - 1. Section 02220 - Earthwork
  - 2. Section 02221 - Trenching, Backfilling & Compacting
  - 3. Section 03310 - Concrete for Utility Construction

**1.02 REFERENCES**

- A. American Association of State Highway and Transportation Officials (AASHTO)
  
- B. Pennsylvania Department of Transportation (PennDOT):
  - 1. Form 408/2000 Specifications, latest revision.
  - 2. Publication 72, Standards for Roadway Construction

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
  
- B. Submit certification attesting that materials meet or exceed the specification requirements.
  
- C. Submit detailed shop drawings of inlets and endwalls. Drawings to be sealed by a Professional Engineer registered in the state where work is located.

**1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Precast Concrete Units:
  - 1. After fabrication and curing, transport the units to the job site. Protect until required for installation.
  - 2. Handle to avoid damage to surfaces, edges and corners and to avoid creation of stresses within the units.

**PART 2 - PRODUCTS****2.01 STORM DRAIN PIPE**

- A. Storm pipe shall be a minimum 15 inch diameter; corrugated, smooth lined, polyethylene pipe and fittings, AASHTO M294, Type S, of the sizes indicated on the Drawings and conforming to Form 408/2000 Specifications, Section 601.2(a)6.
- B. Reinforced Concrete Pipe and Fittings, AASHTO M170, of the sizes indicated on the Contract Drawings and conforming to Form 408/2000 Specifications, Section 601.2(a)3a.

**2.02 RIP RAP STONE**

- A. Rip rap shall be in accordance with Section 850, Form 403/2000 Specifications.

**2.03 CONCRETE**

- A. Section 03310

**2.04 ENDWALLS, END SECTIONS, HEADWALLS AND INLETS**

- A. Sections 605 and 616 of Form 408/2000 Specifications, and Publication No. 72, Standard Drawing RC-31 Endwalls, RC-33 End sections and RC-34 Inlets.
- B. Concrete for drainage structures as specified in Section 03310.
- C. All pipes to be fitted with endwall, headwall, end section, or inlet. Inlets or manholes are required at change in direction or grade.
- D. Manholes: Refer to Section 02601.

**PART 3 - EXECUTION****3.01 TRENCHING, BEDDING, AND BACKFILL**

- A. Conform to the requirements specified in Section 02221.

**3.02 PIPE LAYING**

- A. Clean and inspect pipe before lowering into the trench; start pipe laying at the low end and proceed upgrade, unless otherwise approved by the Engineer; bed the pipe for its full length.
- B. Lay bell and spigot pipe with the spigot inserted the full depth of the socket and with the bell end upgrade.
- C. Replace broken or otherwise damaged pipe, and keep pipe clean of deposits and debris; piping, as laid, shall be approved by the Engineer before the trench is backfilled.

**3.03 CONSTRUCTION**

- A. Locate inlets and endwalls as indicated on the Drawings; perform excavation as specified in Section 02221.
- B. Construct endwalls as indicated on Standard Drawing RC-31, Publication No. 72, and of the type indicated on the Drawings.
- C. Construct inlets as shown on Standard Drawing RC-34, Publication No. 72.
- D. Construct inlets of either precast sections or cast-in-place construction to the dimensions as indicated on the Drawings.
  - 1. Place precast units on a 6" compacted crushed stone subbase.
  - 2. Construct cast-in-place units on undisturbed earth.
  - 3. Unless units are cast-in-place, use precast concrete rings to adjust the grade; mortar in place.
- E. Construct drainage channels and swales to the lines and grades and cross-sections indicated on the Drawings.
- F. Where rip rap slope protection and ditch lining is indicated on the Drawings, construct to the lines and grades indicated and in accordance with Section 850.3, Form 408/2000 Specifications.

**3.04 BACKFILLING**

- A. Backfill structures only after examination by the Engineer.
- B. Perform backfilling and compaction as specified in Section 02221.

**END OF SECTION**



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**SECTION 02485**  
**FINISH GRADING AND SEEDING****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
  - 1. Placing topsoil
  - 2. Soil conditioning
  - 3. Finish grading
  - 4. Seeding
  - 5. Maintenance
  
- B. The "Seeding Restoration Table" at the end of this section lists specific seeding restoration requirements.
  
- C. Related Work specified elsewhere:
  - 1. Section 02220 - Earthwork
  - 2. Section 02221 - Trenching, Backfilling & Compacting

**1.02 QUALITY ASSURANCE**

- A. Soil and soil supplement testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor/Developer and approved by the Engineer.
  
- B. Collect soil samples under the direction of the Engineer.
  
- C. Reference Standards:
  - 1. Pennsylvania Department of Transportation (PennDOT); Publication 408/2000 Specifications.
  - 2. Pennsylvania Seed Act of 1965, Act 187, as Amended.
  - 3. Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86(3P.S.68.2), as Amended.
  - 4. Pennsylvania Agricultural Liming Materials Act of 1978, P.L. 15, No. 9(3P.S.132-1), as Amended.
  - 5. Rules for Testing Seeds of the Association of Official Seed Analysts.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.



**B. Certificates:**

1. Prior to use or placement of material, submit a Statement of Compliance from the materials suppliers, together with supporting data, attesting that the composition of the following products meets specification requirements.
  - a. Fertilizer - Analysis content and percent of each.
  - b. Lime - Analysis content and percent of each.
  - c. Seed mixture(s) - State percentage of mixtures, purity, germination and maximum weed seed content of each grass mixture.
2. Submit certified soil sample analyses, including laboratory's recommended soil supplement formulation, topsoil analysis - State pH, texture, organic content, and macro nutrients.

**1.04 PRODUCT DELIVERY, STORAGE AND HANDLING****A. Seed:**

1. Deliver seed fully tagged and in separate packages according to species or seed mix.
2. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

**PART 2 - PRODUCTS****2.01 TOPSOIL**

- A. All topsoil stripped from the site and stockpiled may be reused provided the following requirements are met:
  1. Have a pH of between 6.0 and 7.0; contain not less than 2% nor more than 10% organic matter as determined by AASHTO T194.
  2. Fertile friable loam, sand loam, or clay loam which will hold a ball when squeezed with the hand, but which will crumble shortly after being released.
  3. Free of clods, grass, roots, or other debris harmful to plant growth. Free of pests, pest larvae, and matter toxic to plants.

**2.02 SEED**

- A. Fresh, clean, dated material from the last available crop and within the date period specified, with a date of test not more than 9 months prior to the date of sowing.
- B. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance.
- C. All seeds will be subject to analysis and testing.

- D. Seed mix in accordance with Seeding Restoration Table.
- E. Individual species comprising 20% or less of the total seeding mixture may be of one variety. All varieties utilized shall have a mean quality rating of 7.0 or higher as listed in Table 1, for the Pennsylvania, University Park, high maintenance test plot, the USDA National Turfgrass Evaluation Program, 301-504-5125, <http://hort.unl.edu/ntep>.

TABLE 1 - GRASS AND AGRICULTURAL SEEDS

<u>Individual Species</u>	<u>Minimum Guaranteed Purity (Percent)</u>	<u>Maximum Weed Seed (Percent)</u>	<u>Minimum Guaranteed Germination (Percent)</u>
Kentucky Bluegrass ( <i>Poa pratensis</i> ) min. 21 lb. per bushel	98	0.20	80
Perennial Ryegrass ( <i>Lolium perenne</i> )	98	0.15	90
Tall Fescue ( <i>Festuca arundinacea</i> )	98	0.15	85
Crownvetch ( <i>Coronilla varia</i> )	99	0.10	70
Red Fescue ( <i>Festuca rubra</i> )	98	0.15	85
Annual Ryegrass ( <i>Lolium multiflorum</i> )	98	0.15	90
Timothy ( <i>Phleum pratense</i> )	98	0.25	95
Birdsfoot Trefoil Mixture ( <i>Lotus corniculatus</i> ) A mixture of 1/2 Viking & 1/2 of either Empire, Norcen, or Leo	98	0.10	80
Redtop ( <i>Agrostis alba</i> )	92	0.15	80

### 2.03 FERTILIZER

- A. Liquid formulations may be used in lieu of dry formulations, provided the rate of application is adjusted to apply the same quantities of nitrogen, phosphorus and potassium per unit area as specified for dry formulations.

- B. Basic Dry Formulation Fertilizer: Analysis 0-20-20 and as defined by the Pennsylvania Fertilizer Law.
- C. Starter Fertilizer: Analysis 10-5-5 or 12-6-6 and 12-18-10 or 18-24-10 as defined by the Pennsylvania Fertilizer Law.
- D. Contractor/Developer must submit soils samples to an approved laboratory for fertilizing recommendations. Recommendations shall be submitted to Borough for his review and decision relating to modifying the application rate as shown on the Seeding Restoration Table.

#### **2.04 LIME**

- A. Pulverized agricultural limestone conforming to Section 804.2(a), Publication 408/2000 Specifications.
- B. Provide all lime in accordance with application rates shown in the Seeding Restoration Table, or as recommended by the soil test laboratory.

#### **2.05 INOCULANT**

- A. Inoculate leguminous seed before seeding with nitrogen fixing bacteria culture prepared specifically for the species.
- B. Do not use inoculant later than the date indicated by the manufacturer.
- C. Protect inoculated seed from prolonged exposure to sunlight prior to sowing.
- D. Reinoculate seed not sown within 24 hours following initial inoculation.

#### **2.06 EROSION CONTROL FABRIC**

- A. Shall be a knitted construction of yarn with uniform openings interwoven with strips of biodegradable paper, furnished in rolls with 4-mil opaque polyethylene base as protection for outdoor storage.
- B. Fabric 0.2 pound per square yard.

#### **2.07 JUTE MATTING**

- A. Shall be heavy weight, minimum 0-9 pound per square yard, jute mesh with 1" opening.

**2.08 FABRIC/MATTING ANCHORS**

- A. Staples for fastening fabric to ground shall be minimum 11 gauge wire, "U" shaped, with a 1" crown and 6" legs.

**2.09 MULCHING MATERIALS**

- A. Mulches for seeded areas shall be one, or a combination, of the following:
1. Wheat or oat straw; thoroughly threshed.
    - a. Cured to less than 20% moisture content by weight.
    - b. Containing no stems of tobacco, soybeans, or other coarse or woody material, free of mature seed bearing stalks or roots of prohibited or noxious weeds.
  2. Wood Cellulose:
    - a. Containing no growth or germination-inhibiting substances.
    - b. Green-dyed and air-dried.
    - c. Packages not exceeding 100 pounds.
    - d. Moisture Content: 12%  $\pm$ 3%
    - e. Organic Matter (Dry oven basis): 98.6%  $\pm$ 0.2%
    - f. Ash Content: 1.4%  $\pm$ 0.2%
    - g. Minimum Water-Holding Capacity: 100%
- B. Mulch Binders:
1. Emulsified Asphalt AASHTO M140, Grade SS-1
  2. Cut Back Asphalt AASHTO M81, RC 250
  3. Nonasphaltic Emulsion - Natural Vegetable Gum Blended with Gelling and Hardening Agents
  4. Polyvinyl Acetate Emulsion Resin, Containing 60% ( $\pm$  1%) Total Solids by Weight

**PART 3 - EXECUTION****3.01 TIME OF OPERATIONS**

- A. Conduct seeding operations during the times specified in the Seeding Restoration Table.

**3.02 PREPARATION OF SUBGRADE**

- A. "Hard pan" or heavy shale:
1. Plow to a minimum depth of 6".
  2. Loosen and grade by harrowing, discing, or dragging.
  3. Remove surface stones over 3" in any dimension and other debris.

- B. Loose loam, sandy loam, or light clay:
  - 1. Loosen and grade by harrowing, discing, or dragging.
  - 2. Remove surface rocks over 3" in any dimension and other debris.

### **3.03 PLACING TOPSOIL**

- A. Place topsoil and spread over the prepared subgrade to obtain the required depth and grade elevation. Final compacted thickness of topsoil not less than 4 inches.
- B. Roller weighing over 120 pounds per foot of width shall not be used for compaction.
- C. Remove all materials unsuitable or harmful to plant growth, and legally dispose off site.
- D. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry; do not handle topsoil when frozen or excessively wet.
- E. Finish surface of topsoil shall be smooth, even and true to lines and grades with no ponding areas.

### **3.04 TILLAGE**

- A. After seed bed areas have been brought to proper compacted elevation, thoroughly loosen to a minimum depth of 5" by discing, harrowing, or other approved methods.
- B. Do not work topsoiled areas when frozen or excessively wet.
- C. Liming:
  - 1. Distribute limestone uniformly at the rate indicated by the soil test.
  - 2. Thoroughly incorporate into the topsoil to a minimum depth of 4" as a part of the tillage operation.
- D. Basic Fertilizer:
  - 1. Distribute basic fertilizer uniformly at the rate indicated by the soil test.
  - 2. Incorporate into soil to depth of 4" by approved methods as part of tillage operation.

### **3.05 FINISH GRADING**

- A. Remove unsuitable material larger than 2" in any dimension.

- B. Uniformly grade surface to the required contours without the formation of water pockets.
- C. Distribute starter fertilizer at the rates indicated on the Seeding Restoration Table, or as recommended by the soil test laboratory.
- D. Incorporate starter fertilizer into the upper 1" of soil.

### **3.06 SEEDING**

- A. Uniformly sow specified seed mix by use of approved hydraulic seeder, power-drawn drill, power-operated seeder or hand-operated seeder.
- B. Do not seed when winds are over 15 mph.
- C. Upon completion of seed covering, roll the area with a roller, exerting a maximum force of 65 pounds per foot width of roller.

### **3.07 MULCHING**

- A. Mulch within 48 hours of seeding.
- B. Place straw mulch in a continuous blanket at a minimum rate of 1,200 pounds per 1,000 square yards.
- C. Anchor straw mulch by use of twine, stakes, wire staples, plastic nets, or asphalt or chemical mulch binder. Apply binders by the manufacturer's method and rate.
- D. Apply wood cellulose fiber hydraulically at a rate of 320 pounds per 1,000 square yards; incorporate as an integral part of the slurry after seed and soil supplements have been thoroughly mixed.
- E. Protect structures, pavements, curbs, and walls to prevent asphalt staining.
- F. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.

### **3.08 MAINTENANCE**

- A. Contractor/Developer shall be responsible for maintenance of seeded work.
- B. Maintenance includes watering, weeding, two initial mowings, cleanup, edging, and repair of washouts or gullies.

- C. Keep seeded areas moist to a depth of 3" for a period of 14 days following seeding.
- D. Those areas which do not show a prompt catch of grass within 24 days of seeding shall be reseeded until complete grass catch occurs.
- E. When the grass reaches an average height of 3", cut to a height of 2"; irregularities or depressions which show up at this time shall be leveled and reseeded.
- F. Contractor's/Developer's maintenance shall continue until all areas are grassed and free from bare spots or off-color areas, and turf areas are accepted.

SEE ATTACHED SEEDING RESTORATION TABLE

**END OF SECTION**

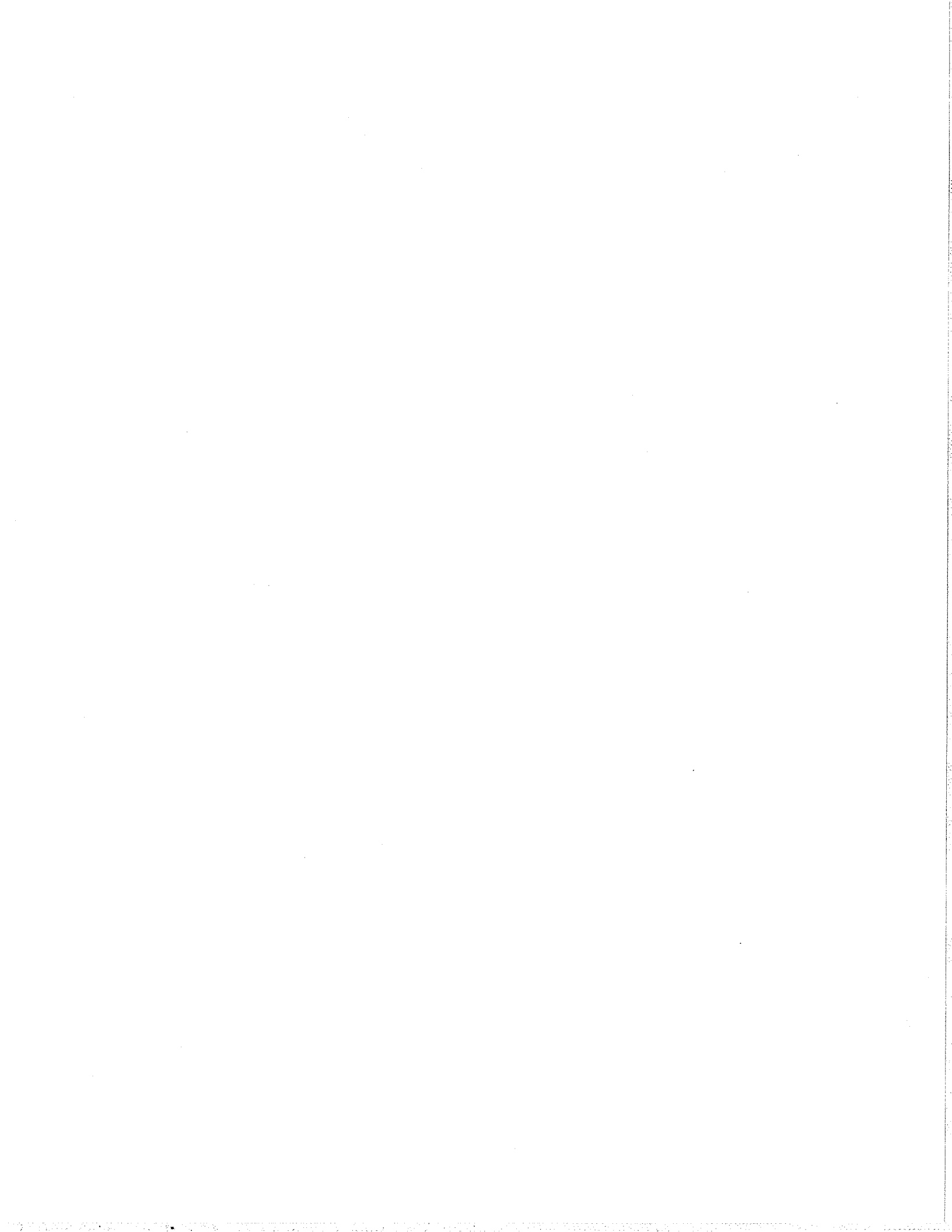
**SEEDING RESTORATION TABLE**

RESTORATION CONDITION	TOPSOIL	LIME*	BASIC FERTILIZER	STARTER FERTILIZER	SEED MIX & SOWING RATE (% BY WEIGHT)
Temporary Cover (**)	N/A	N/A	N/A	N/A	100% Annual Ryegrass Sow 9# per 1,000 Sq.Yds. Mar thru May/Aug thru Sept
Roadside, Non-mowed	Yes	100# per 1,000 Sq.Ft.	No	10-5-5 @ 50# per 1,000 Sq.Ft. <u>or</u> 12-6-6 @ 33# per 1,000 Sq.Ft.	80% Kentucky 31 Fescue 20% Pennlawn Red Fescue Sow 21# per 1,000 Sq.Yds. Mar thru May/Aug thru Sept
Roadside, Mowed	Yes	100# per 1,000 Sq.Ft.	No	10-5-5 @ 50# per 1,000 Sq.Ft. <u>or</u> 12-6-6 @ 33# per 1,000 Sq.Ft.	50% Kentucky Bluegrass 30% Pennlawn Red Fescue 20% Perennial Ryegrass Sow 21# per 1,000 Sq.Yds. Mar thru May/Aug thru Sept
Bank Areas, Steeper than 3:1 slopes	Yes	100# per 1,000 Sq.Ft.	No	12-18-10 @ 18# per 5,000 Sq.Ft. <u>or</u> 18-24-10 @ 20# per 5,000 Sq.Ft.	45% Crownvetch 55% Annual Ryegrass Sow 9# per 1,000 Sq.Yds. Any time except Sept.-Oct.
Lawns	Yes	100# per 1,000 Sq.Ft.	0-20-20 50#/1,000 Sq.Ft.	12-18-10 @ 18# per 5,000 Sq.Ft. <u>or</u> 18-24-10 @ 20# per 5,000 Sq.Ft.	50% Kentucky Bluegrass 30% Pennlawn Red Fescue 20% Perennial Ryegrass Sow 21# per 1,000 Sq.Yds. Mar thru May/Aug thru Sept
Fields and Pasture, Non- cultivated	No	No	No	10-5-5 @ 50# per 1,000 Sq.Ft. <u>or</u> 12-6-6 @ 33# per 1,000 Sq.Ft.	100% Timothy Sow 9# per 1,000 Sq.Yds. Mar thru May/Aug thru Sept
Fields, Cultivated	No	No	No	10-5-5 @ 50# per 1,000 Sq.Ft. <u>or</u> 12-6-6 @ 33# per 1,000 Sq.Ft.	100% Annual Ryegrass Sow 9# per 1,000 Sq.Yds Mar thru May/Aug thru Sept
Woods, Sparse	No	No	No	10-5-5 @ 50# per 1,000 Sq.Ft. <u>or</u> 12-6-6 @ 33# per 1,000 Sq.Ft.	100% Red Fescue Sow 36# / 1,000 Sq.Yds. Mar thru May/Aug thru Sept
Woods, Dense	No	No	No	No	Stabilize soil with bio- Degradable netting and paper fabric material

\* Unless lesser rate indicated by soils tests

\*\* Unless otherwise specified in the Erosion and Sedimentation Control Plan





**SECTION 02510  
BITUMINOUS PAVING****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
  - 1. Temporary Paving
  - 2. Bituminous paving
- B. Related Work specified elsewhere:
  - 1. Section 02220 - Earthwork
  - 2. Section 02221 - Trenching, Backfilling and Compacting

**1.02 QUALITY ASSURANCE**

- A. Use only materials which are furnished by a bulk bituminous concrete producer regularly engaged in production of hot-mix, hot-laid bituminous concrete and as listed in PennDOT Bulletin 41, List of Commercial Producers of Bituminous Mixtures.
- B. Referenced Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. ASTM D698 Test for Laboratory Compaction Characteristics of Soil Using Standard Effort.
  - 2. Pennsylvania Department of Transportation (PennDOT):
    - a. Form 408/2000 Specifications
    - b. Regulations Governing Occupancy of Highways by Utilities (67 PA Code, Chapter 459)
    - c. Publication 27 - Specification for Bituminous Materials (Bulletin 27)
    - d. Publication 37 - Specification for Bituminous Materials (Bulletin 25)
    - e. Publication 41 - List of Commercial Producers of Bituminous Mixtures (Bulletin 41)
    - f. Publication 203 - Work Zone Traffic Control

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Submit material certificates attesting that each material item complies with or exceeds the specification requirements.
- C. Submit batch tickets for each load of bituminous concrete delivered to the project site.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

**1.05 JOB CONDITIONS**

- A. Weather Limitations:
  - 1. Construct bituminous base courses only when the air and surface temperature is above 35 degrees F and when base is dry.
  - 2. Construct binder and wearing courses only when the air and surface temperature is above 40 degrees F and when base is dry.
  - 3. Aggregate base courses may be placed when the air temperature is above 35 degrees F and rising. Do not place aggregate base course material on soft, muddy or frozen areas.
- B. Establish and maintain required lines and grades, including crown and cross-slope, for each course during construction.
- C. Take measures to control traffic to allow safe and expeditious movement of all traffic through the work area.
- D. Employ traffic control measures in accordance with Publication 203 - Work Zone Traffic Control.
- E. Restore existing paving outside the limits of the work, when damaged or in any way rendered defective by Contractor's/Developer's operations or his movement of equipment, to its original condition at the expense of the Contractor/Developer.
- F. Top of final pavement shall be a minimum of 1/2" above manhole covers.

**1.06 TESTING**

- A. Thickness Testing:
  - 1. Obtain a minimum of one (1) 6" diameter core sample for each 1,000 square yards of paving or fraction thereof, for test of depth of bituminous material courses.
  - 2. Take core samples at locations as directed by the Engineer after final compaction rolling.

3. Bituminous concrete courses deficient more than 1/4" from the specified depth in any one sample, or uniformly more than 1/8" in three or more samples, shall be removed and replaced to the correct depth.
  4. Refill and compact test holes with material acceptable to, and under the direction of, the Engineer.
- B. Surface Smoothness:
1. Test finished surface of each bituminous concrete course for smoothness using 10' straightedge applied parallel with, and at right angles to, centerline of paved area.
  2. Surfaces will not be acceptable if exceeding 1/4" tolerance for smoothness.
  3. Check surfaces areas at intervals as directed by the Engineer.
  4. Ponding to a depth of 1/4" over a 20 square foot area shall be corrected as directed by the Engineer.
- C. Density Testing:
1. Acceptance will be based on the results of nuclear density tests performed by a licensed nuclear gage operator, employed by an independent testing laboratory paid by the Contractor/Developer, and witnessed by the Engineer.
    - a. Use one of the following nuclear gages or equal:
      - 1) Troxler electronics, Model 3411B
      - 2) Campbell Pacific Nuclear, Model MC-2
      - 3) Seaman Nuclear, Model MC-2
    - b. Use nuclear gage calibrated in accordance with AASHTO test method T-238-86. Submit certification of annual calibration of gages and documentation of licensed operator's training to the Engineer. Recalibrate any gage which is damaged and/or repaired.
  2. A minimum of one (1) test per each 1,000 square yards or portion thereof meeting the requirement below will be required for each course.
    - a. Binder and Wearing Courses  $\geq$  92 percent of Theoretical Density
    - b. Bituminous Base Course  $\geq$  88 percent of Theoretical Density
    - c. Subgrade  $\geq$  100 percent of Theoretical Density
    - d. Stone Base Course  $\geq$  100 percent of Theoretical Density

## **PART 2 - PRODUCTS**

### **2.01 PAVING MATERIALS**

- A. ID-2 Bituminous Wearing Course, Section 420.
- B. ID-2 Bituminous Binder Course, Section 421.
- C. Bituminous Prime Coat, Section 461.

- D. Bituminous Tack Coat, Section 460.
- E. Subbase, Section 350.
- F. Bituminous Concrete Base Course, Section 305.

## **2.02 PAVEMENT CONSTRUCTION**

- A. All Borough street construction shall be a minimum of the following:
  - 1. Subbase - 8" of 2A stone
  - 2. Binder Course - 2"
  - 3. Wearing Course - 1-1/2"

## **2.03 AUXILIARY MATERIALS**

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or AASHTO M 248, Type N.
  - 1. Color: As indicated.
- B. Glass Beads: AASHTO M 247, Type 1.

## **PART 3 - EXECUTION**

### **3.01 TEMPORARY PAVING**

- A. Place temporary paving immediately upon completion of trench backfilling. Unpaved trenches shall not remain unpaved longer than three (3) working days after backfilling.
- B. Grade and compact subgrade material, then place and compact crushed stone base course to the required thickness.
- C. Place temporary paving material. Compact to required minimum thickness with trench roller having minimum 300 pounds per inch-width of compaction roll.
- D. Continuously maintain temporary paving to the satisfaction of the Engineer, as required by permit requirements, and the local road department(s).
- E. Temporary paving on roads must remain in place for a minimum of 90 days.

### **3.02 PREPARATION**

- A. Prepare subgrade in accordance with Section 210, Form 408/2000 Specifications.

**3.03 FINISH GRADING OF THE SUBGRADE**

- A. Grade parallel to the finish surface.
- B. At the time of compaction, maintain the subgrade material's moisture content not more than 2 percentage points above optimum moisture content for that material.
- C. Compact to 100 percent maximum density determined in accordance with ASTM D698.
- D. Check grade and slope at minimum 25 foot intervals.
- E. Correct all surface irregularities exceeding ½ inch by loosening the surface and removing or adding material as required. Compact the corrected area and recheck grade and slope.

**3.04 CRUSHED AGGREGATE BASE COURSE**

- A. Construct in accordance with the requirements of Section 350.3, Form 408/2000 Specifications, and to the lines, grades and thicknesses indicated on the Drawings.

**3.05 BITUMINOUS PAVING, GENERAL**

- A. Construct bituminous concrete paving to the lines, grades and thicknesses as shown on the Drawings and as specified in Section 401.3 of Form 408/2000 Specifications, except as modified herein.
- B. Examine the areas and conditions under which hot-mix bituminous concrete paving is to be installed.
- C. Do not proceed until unsatisfactory conditions detrimental to the proper and timely completion of the work have been corrected in a manner acceptable to the Engineer.

**3.06 PLACING THE MIX**

- A. Place bituminous concrete mixture on prepared surface, spread and strike-off.
- B. Lay bituminous paving mixtures when the temperature is not more than 15 degrees F below the minimum temperature shown on the bituminous material supplier's bill of lading and when not exceeding the maximum specified temperature.
- C. Place inaccessible and small areas by hand.

- D. Place each course to required grade, cross-section, and compacted thickness.
- E. Paver Placing:
  - 1. Place in strips not less than 10' wide, unless otherwise acceptable to the Engineer.
  - 2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
  - 3. Complete bottom course for a section before placing top course.
- F. Hand Placing:
  - 1. Spread, tamp and finish mixture using hand tools in areas where machine spreading is not possible, as acceptable to the Engineer.
  - 2. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature.
- G. Joints:
  - 1. Longitudinal Joints: Pub. 408/2000 401.3.j.1.
  - 2. Transverse Joints: Pub. 408/2000 401.3.j.2.
  - 3. Other Joints: Pub. 408/2000 401.3.j.3.
- H. Clean all surfaces to be in contact with bituminous mixtures and apply tack coat. Apply a tack coat to the bituminous base or binder coat when, in the opinion of the Engineer, the surface is not satisfactory for direct placement of paving.
- I. Seal all joins with AC-20.

### **3.07 COMPACTING**

- A. Begin rolling when mixture will bear roller weight without excessive displacement.
- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- C. Breakdown Rolling:
  - 1. Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge.
  - 2. Check crown, grade, and smoothness after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.
- D. Second Rolling:
  - 1. Follow breakdown rolling as soon as possible, while mixture is hot.
  - 2. Continue second rolling until mixture has been thoroughly compacted.

- E. Finish Rolling:
  - 1. Perform finish rolling while mixture is still warm enough for removal of roller marks.
  - 2. Continue rolling until all roller marks are eliminated and the course has attained maximum density.
  
- F. Patching:
  - 1. Remove to full depth, and replace paving areas mixed with foreign materials and defective areas.
  - 2. Cut-out such areas and fill with fresh, hot bituminous concrete.
  - 3. Compact by rolling to maximum surface density and smoothness.

### **3.08 PROTECTION**

- A. After final rolling, do not permit vehicular traffic on pavement until it has cooled to 140 degrees F or less. Artificial cooling by use of water or other means will not be permitted.
  
- B. Erect barricades to protect paving from traffic until mixture has cooled and attained its maximum degree of hardness.

### **3.09 FIELD QUALITY CONTROL**

- A. General:
  - 1. Test the in-place bituminous concrete courses for compliance with requirements for thickness and surface smoothness as specified in 1.05.A of this Section.
  - 2. Repair or remove and replace unacceptable paving as directed by the Engineer and retest.

### **3.10 PAVEMENT MARKING**

- A. Shall be as indicated on Drawings.
  
- B. Allow paving to age for thirty (30) days before starting pavement marking.
  
- C. The Engineer will determine the need for cleaning prior to painting operations. Satisfactorily clean and dry the pavement surface. Blow or sweep free of loose dirt and other debris.
  
- D. Paint shall be applied in a wet-film thickness of 15 mils +/- 1 mil using a highway mechanical marking machine.
  
- E. A one coat application will be acceptable, provided complete cover and specified thickness is attained; otherwise, apply an additional application.



- F. Protect markings until paint is dry and track free. Repaint marked or damaged areas as directed by the Engineer.

**END OF SECTION**

**SECTION 02601  
MANHOLES****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
1. Precast Concrete Manholes
  2. Concrete Manhole Bases
  3. Manhole Steps
  4. Manhole Covers and Frames
- B. Related Work specified elsewhere:
1. Section 02602 - Manhole Base Liner
  2. Section 02603 - Manhole Protective Liner
  3. Section 02221 - Trenching, Backfilling & Compacting
  4. Section 02610 - Sanitary Sewer Pipe
  5. Section 02651 - Sewer and Manhole Testing
  6. Section 03310 - Concrete for Utility Construction
- C. Applicable Standard Details:
1. 5100B Plans of Manhole Base
  2. 5100G Precast Manhole Base Detail
  3. 5106 Standard Shallow Precast Manhole
  4. 5107 Standard Deep Precast Manhole
  5. 5109 Precast Manholes, Typical all joints
  6. 5109A Manhole Cover with Anchor Bolt
  7. 5110C Manhole Step Details
  8. 5115 Sanitary Sewer Manhole Frame and Cover
  9. 5116 Heavy Duty Watertight Manhole Frame and Cover with Gasket in Frame
  10. 5119A Type A Drop Manhole Details, PVC Pipe
  11. 5120A Type B Drop Manhole Details, PVC Pipe

**1.02 QUALITY ASSURANCE**

- A. Pennsylvania Department of Transportation (PennDOT):
1. Publication 408/2000 Specifications.
- B. American Society for Testing and Materials (ASTM):
1. A48 Specification for Gray Iron Castings
  2. A496 Specifications for Steel Wire, Deformed, for Concrete Reinforcement
  3. C32 Specification for Sewer and Manhole Brick

4. C270 Specifications for Mortar for Unit Masonry
  5. C478 Specifications for Precast Reinforced Concrete Manhole Sections
  6. C497 Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile
  7. C923 Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
  8. C990 Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
  9. D448 Standard Sizes of Coarse Aggregate for Highway Construction
  10. D4101 Specification for Propylene Plastic Injection and Extrusion Materials
- C. Federal Country-of-Origin Marking Law:
1. United States Federal Law requires that imported castings (manhole frame and covers) are subject to specific country-of-origin markings in order to legally enter the United States.
- D. Where force mains discharge to the sewer, all downstream manholes shall be lined within 1,500 feet of the discharge. Refer to Sections 02602 and 02603.

### **1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Submit certification from material suppliers attesting that materials meet or exceed specification requirements.
- C. Shop Drawings:
1. Submit detailed shop drawings of manhole sections and precast bases if used.
  2. Submit detailed shop drawings of manhole frames and covers.
  3. Submit detailed shop drawings of manhole steps.
- D. Submit manufacturers' descriptive literature and installation instructions for the resilient pipe-to-manhole connection and for the joint sealant compound.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Crushed Stone Subbase: ASTM D448, Size 57 (AASHTO —43)
- B. Manhole Brick: ASTM C32, Grade MS, Solid

C. Masonry Mortar: ASTM C270, Type S

D. Cement Concrete: Section 03310

## 2.02 MANHOLES

A. Precast Concrete Manhole Sections:

1. Conforming to ASTM C478, with 5.5%  $\pm$ 1% air-entrained cement concrete.
2. Provide flat slab top sections for manholes less than 4' deep or as indicated on Drawings.
3. Provide eccentric cone sections for manholes greater than 4' in depth, except as indicated on Drawings.
4. Provide 24" minimum access opening.
5. Precast riser sections of length to suit.
6. Base to be integral with first riser section, minimum height of riser - 24".

B. Exterior Coating:

1. Factory applied bitumastic coating to manhole exterior.
2. Prepare surface for coating application in accordance with coating manufacturer's instructions.
3. Apply coating to minimum 20-mil dry film thickness.

C. Manhole Steps:

1. Steel reinforced copolymer polypropylene meeting the following specifications:
  - a. ASTM C478
  - b. ASTM C497, Method of test
  - c. ASTM D4101, PP0344B33534Z02 copolymer polypropylene
  - d. ASTM A496, D20, 1/2" reinforced rod

D. Manhole Frames and Covers:

1. Cast Iron Castings: AASHTO M306/ASTM A48, AASHTO M105/Class 35B or better; free of bubbles, sand and air holes, and other imperfections. Designed for AASHTO Highway Loading H-25.
2. Cover Gasket: One piece O-ring gasket factory installed in a machined dovetail groove in the frame.
  - a. Gasket material of neoprene composition having good abrasion resistance, low compression set Type D, 40 durometer hardness and suited for use in sanitary sewer manholes.
  - b. Gluing of gasket is not permitted.
3. Contact surfaces machined and matched.
4. Cast cover inscription with pipeline service:
  - a. Comply with Federal Country-of-Origin Markings law required on imported castings.

- b. For sanitary sewer, inscription shall read: "Bonneauville Sanitary Sewer"
5. East Jordan Iron Works 1045AGS, or equal.
6. Watertight assembly where required:
- a. Bolt cover to frame with 4 1/2"-13 stainless steel hex bolts, with stainless steel washer and neoprene washer.
  - b. Watertight assembly shall have same frame and cover dimensions as non-watertight assembly.
  - c. Assembly shall be East Jordan Iron Works 1045-12ZPT, or equal.
- E. Joint Sealant: ASTM C990.
- F. Resilient Pipe-to-Manhole Connection: ASTM C923.
- G. High Density Polyethylene Manhole Adjusting Rings:
1. 100% recycled polyethylene
  2. Rings shall meet the following:

<u>Property</u>	<u>ASTM</u>	<u>Value</u>	<u>Unit</u>
Melt Index	D 1238	0.49	G/10 min.
Density	Estimated	0.94-.096	G/cm <sup>2</sup>
Tensile Strength @ Yield	D 638	3,453	PSI
Elongation @ Yield	D 638	122	%
Flexural Modulus	D 790	147,771	PSI
Izod Impact Strength	D 256	7.12	Ft-lb/in
Hardness (Shore D)	D 2240	63.1	---
Head Deflection Temp	D 648	174°F	@66 PSI
Shrinkage	D 955	0.032	In/In

3. Manufacturer: Ladtech, Inc. (877-235-7464), or equal.
- H. Manhole Encapsulation System:
1. Provide wrapping around manhole rings and joints.
  2. Wrap material shall meet the following properties:

	<u>Test Standard</u>	<u>Unit</u>	<u>Results</u>
<b>Adhesive:</b>			
Softening Point	ASTM E28	0 (°F)	100 (212)
Lap Shear Strength	DIN 30 672	N/cm <sup>2</sup> (psi)	8 (12)
<b>Backing:</b>			
Tensile Strength	ASTM D638	MPa (psi)	20 (2900)
Elongation	ASTM D638	%	600
Hardness	ASTM D2240	Shore D	45
Abrasion Resistance	ASTM D1044	mg	45
<b>Sleeve:</b>			
Peel Strength	ASTM D1000	N/cm pli	15 (g)
Water Absorption	ASTM D570	%	0.05
Low Temp. Flexibility	ASTM D2671D	0 (°F)	-40 (-40)

3. Manufacturer: WrapidSeal as manufactured by Canusa, (281-367-8866).

## **PART 3 - EXECUTION**

### **3.01 EXCAVATION**

- A. Perform excavation to the line and grade indicated on the Drawings and as specified in Section 02221 - Trenching, Backfilling and Compacting.
- B. Location and depth of manholes as indicated on the Drawings.

### **3.02 CONSTRUCTION**

- A. Construct watertight manholes of precast concrete sections of the type indicated on the Drawings.
- B. Construct 4' diameter manholes unless otherwise indicated. Manholes 12' and deeper shall be minimum 5' inside diameter.
- C. Construct drop connections of the required type as indicated on Standard Details 5119A and 5120A. Encase drop connection in concrete.
- D. Provide precast concrete bases.
  1. Install precast bases as shown on Standard Detail 5100G.
    - a. Set the precast base on 6" crushed stone subbase.
    - b. Provide a sealed, flexible resilient connection between pipe and precast base section.
- E. Flow Channels:
  1. Form flow channels in manhole bases as indicated on the Standard Details.

2. Slope channels uniformly from influent invert to effluent invert, minimum 1" drop.
  3. Construct bends of the largest possible radius. Form channel sides and invert smooth and uniform; free of cracks, holes or protrusions.
- F. Do not permit pipe to project more than 2" into the manhole.
- G. Joint Sealant:
1. Seal joints between precast concrete manhole sections with joint sealant compound as indicated on Standard Detail 5109.
  2. Apply joint sealant compound in accordance with instructions of the manufacturer. Place compound on the interior and exterior sides of the joint to be squeezed out by the weight of the upper section.
  3. Trowel sealant compound smooth with manhole interior.
  4. Do not apply rigid mortar to the joints between manhole sections.
- H. Install manhole sections with steps in proper vertical alignment.
- I. High Density Polyethylene Manhole Rings:
1. Use high density polyethylene manhole rings to achieve elevation indicated for frame and cover.
  2. Do not adjust elevation more than 1 ft. with rings.
  3. Seal joints between rings with joint sealant compound.
- J. Install manhole frames and covers.
1. Set top of frames at finished grade elevation or other elevation indicated on the Drawings.
  2. Anchor manhole covers installed in unpaved areas as indicated on Standard Detail 5109A.
  3. Seal joint between manhole frame and manhole with joint sealant compound.
- K. Manhole Encapsulation System:
1. Install system around manhole rings and at joints in accordance with the manufacturer's instructions.

### **3.03 BACKFILLING**

- A. Test manhole as specified in Section 02651 prior to backfilling.
- B. Perform backfilling as specified in Section 02221 - Trenching, Backfilling and Compacting.

- C. Place backfill in approximately equal lifts on opposite sides of manhole to equalize opposing horizontal pressures.

**END OF SECTION**





**SECTION 02602  
MANHOLE BASE LINER****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
  - 1. Fiberglass Reinforced Plastic (FRP) Base Liner
- B. Related Work specified elsewhere:
  - 1. Section 02601 - Manholes
  - 2. Section 02603 - Manhole Protective Liners
  - 3. Section 02651 - Sewer and Manhole Testing

**1.02 QUALITY ASSURANCE**

- A. FRP base liner shall be suited for welded connection to High Density Polyethylene (HDPE) or Polypropylene Random Copolymer (PP-R) concrete protective liner on the manhole walls and tops as shown on the plans.
- B. Base liner and HDPE or PP-R concrete protective liner (CPL) shall be designed and installed to create an impermeable lining on the concrete structure's interior surface to protect the concrete surfaces from deterioration and to make the structure watertight.
- C. American Society for Testing and Materials (ASTM):
  - 1. A510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
  - 2. A853 Specification for Steel Wire, Carbon, for General Use
  - 3. C443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
  - 4. C478 Specifications for Precast Reinforced Concrete Manhole Sections
  - 5. C923 Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
  - 6. C990 Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
  - 7. D1308 Test Method for Effects of Household Chemicals on Clear and Pigmented Organic Finishes
  - 8. D2152 Test Method for Adequacy of Fusion of Extruded Poly (vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
  - 9. D3034 Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

10. F789 Specification for Type PS-46 and Type PS-115 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings

### 1.03 SUBMITTALS

- A. General: Submit in accordance with Section 01300.
- B. Submit certification from material suppliers attesting that materials meet or exceed specification requirements.
- C. Shop Drawings:
  - 1. Submit detailed shop drawings of base liner.

## PART 2 - PRODUCTS

### 2.01 GENERAL REQUIREMENTS

- A. The manhole base liner shall be a rigid, mechanically bonded, non-structural sewer system fitting complying with the appropriate ASTM and CSA fitting standard for the pipes to be connected. The manufacturer shall be GU Florida, Inc. As furnished by Terre Hill Concrete Products or equal.
- B. The depth of the main through channel shall be equal to the diameter of the largest pipe. The depth of each lateral channel shall be equal to or greater than the diameter of the lateral pipe.
- C. Unless otherwise requested by the engineer, channel slopes shall be the minimum, consistent with providing for a self cleansing velocity at half bore flow conditions and exceeding the sum of hydraulic losses due to entrance, exit and friction.
- D. The minimum thickness of the liner shall be 1/8 inches (3.0 mm).
- E. The benching part of the base liner shall be impressed with an effective anti-skid pattern.
- F. The geometry of each socket on the liner shall meet the current fitting standard for the pipe to be connected as follows:
  - 1. PVC pipes: ASTM F789 and ASTM D3034
  - 2. Other pipes: When other approved pipes are to be connected to the liner, the socket geometry and gasket shall meet the requirements of the appropriate ASTM standards.
- G. All pre-formed base liner units shall be proportioned for compatibility with the specified precast concrete units. The terminal edges of the liner shall extend

no less than 3/4 of an inch into the base. The geometry of the liner shall comply with "STANDARD DIMENSIONS FOR GU MANHOLE LINER COMPONENTS FOR USE IN STORM AND SANITARY SEWER SYSTEMS" by GU INDUSTRIES INC.

- H. A fiber backed Polyethylene welding strip shall form an integral part of the base liner edge for manholes specified to be lined with HDPE or PP-R liner.

## 2.02 BASE LINER PROPERTIES

- A. The liner shall be constructed from fiberglass reinforced polyurethane meeting the following composition requirements and incorporating the manufacturers' area and point bonding system:
1. Minimum length of fibers = 0.625 inches.
  2. Glass content between 12% and 15% by weight.
  3. Fiberglass weight between 400 and 425 linear yards per pound.
  4. Fiberglass type to be E GLASS.
- B. There shall be no surface degradation of the liner when tested according to ASTM D1308 using the following reagents at 16 hour exposure.

Nitric Acid	69%
Hydrochloric Acid	38%
Acetic Acid	60%
Ammonia	28%
Sodium Hydroxide	5.25%
Sulphuric Acid	50%
Acetone	
Unleaded Gasoline	
Turpentine	

- C. There shall be no evidence of chemical attack on the material when tested according to ASTM D2152.
- D. There shall be no evidence of surface defects after testing the liner material in accordance with CSA-B45-M93 Clauses 5.2.2.1 to 5.2.2.4.
- E. The channels shall have a smooth, non-porous surface with a Manning Friction Coefficient no higher than 0.009.
- F. Bonding aggregate shall be pre-washed, kiln-dried, fractured 3/8 inch gravel having a well graded particle size distribution complying with the table below with the minimum size = 3/16 inch and maximum size = 3/8 inch. Aggregate shall be applied uniformly at a rate of 3.5 lb/square foot. with sufficient exposed surface area to ensure complete and homogeneous bonding with the fiberglass

reinforced polyurethane, as well as with the concrete during the precast process.

Particle size distribution (ASTM E-11)

<u>Sieve No</u>	<u>% Passing</u>
03.75	100
0.25	100
4	98 - 100
6	50 - 80
8	5 - 15
16	0 - 2

- G. Bonding wire shall be grade 1006, 10 gauge cold drawn wire having a tensile strength of 75,000 psi, formed into coils of 2 inch diameter. The steel shall comply with ASTM A510 and ASTM A853.

## 2.03 GASKETS

- A. Gaskets for joining pipes to the manhole base liner shall be as approved by the pipe manufacturer, shall conform to the current ASTM C443 or ASTM 923 standard, and shall be installed according to the gasket manufacturers instructions.
- B. Gaskets used between the precast manhole sections (base, risers, cones, and adjustment rings) shall comply with ASTM C990 or ASTM C443 and shall be installed according to the precast manufacturer's instructions.
- C. Place only a single strip of gasket towards the exterior of the joints to prevent entrapped air blowouts and oozing of the sealant on the liner surface.

## PART 3 - EXECUTION

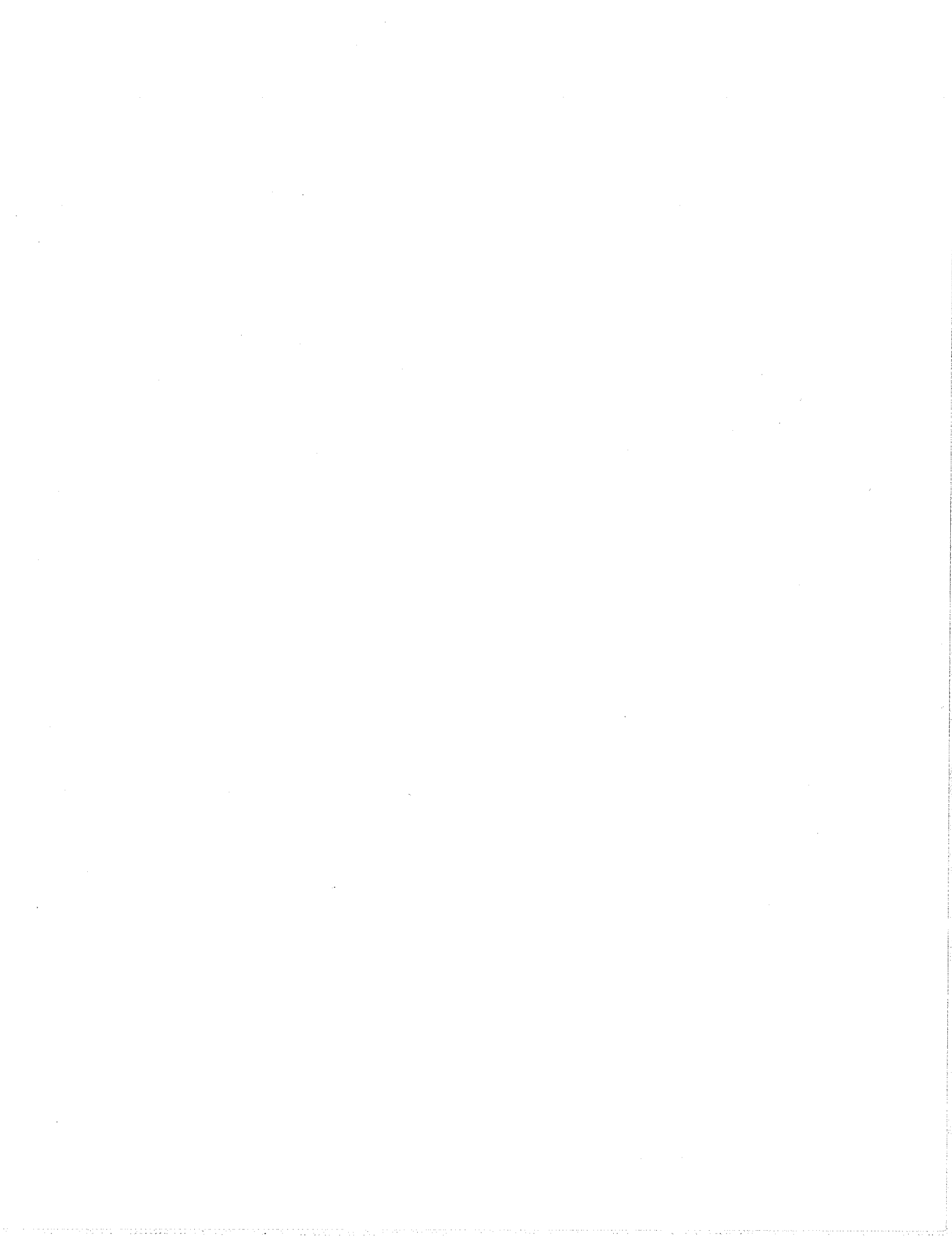
### 3.01 GENERAL REQUIREMENTS

- A. The base liner shall be installed in the precast concrete structure by Terre Hill Concrete Products or other approved GU applicator.
- B. Field installation shall be in strict conformance with the manufacturers recommendations "Methods for Handling and Installation of GU Manhole Lined Concrete Structures".
- C. Pipes shall be joined to the base liner in accordance with the gasket manufacturers recommendations.

**3.02 PRECAST MANUFACTURING**

- A. The FRP base liner shall be adequately supported during placement and curing of the concrete to prevent deformation of any part of the liner.
- B. When placing concrete on the FRP liner component, the concrete shall be vibrated to ensure complete bonding with the aggregate and wire of the liner. The design of the concrete mix shall provide required strength and density. The concrete shall be free from voids, honeycombing, cracks, spalls and other material defects.
- C. Precast concrete composite manhole components shall comply with ASTM C478 as modified by this specification. Where required by the engineer, the outside surfaces of the precast concrete manhole shall be coated with an approved waterproofing material applied in accordance with the coating manufacturers recommendations.

**END OF SECTION**



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**SECTION 02603  
MANHOLE PROTECTIVE LINER****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
  - 1. Manhole Protective Liner
- B. Related Work specified elsewhere:
  - 1. Section 02601 - Manholes
  - 2. Section 02602 - Manhole Base Liner
  - 3. Section 02651 - Sewer and Manhole Testing

**1.02 QUALITY ASSURANCE**

- A. Concrete Protective Liner (CPL) shall be designed and installed to create an impermeable lining on the concrete surfaces to protect them from deterioration.
- B. The liner shall be repairable at any time during the life of the structure.
- C. American Society for Testing and Materials (ASTM):
  - 1. D638 Test Method for Tensile Properties of Plastics
  - 2. D792 Test Method for Density and Specific Gravity (Relative Density) of Plastics Displacement
  - 3. D1238 Test Method for Alkali-Solubility of Wool
  - 4. D1637 Test Method for Tensile Heat Distortion Temperature of Plastic Sheeting.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Submit certification from material suppliers attesting that materials meet or exceed specification requirements.
- C. Shop Drawings:
  - 1. Submit detailed shop drawings of manhole liner.

**PART 2 - PRODUCTS****2.01 MATERIALS**

- A. Liner shall be AGRU Sure Grip® CPL system with high density polyethylene (HDPE) or polypropylene random copolymer (PP-R) with a minimum thickness of 2 mm (0.0787 inch) as furnished by Terre Hill Concrete Products, or equal.



- B. All HDPE liner sheets and anchors shall be extruded during a single manufacturing process. Anchoring studs shall not be welded or mechanically attached to the liner. The minimum anchoring stud concentration shall be 39 studs per square foot. The anchoring stud shall have a pull out resistance of 112.5 lbs/stud.
- C. Flat non-anchored liner sheet, used for overlapping joints, shall have a minimum thickness of 3 mm (0.1181 inch). The cap strip shall be capable of spanning across a maximum gap of one inch that may occur at the joint between precast sections without damage to the lining.

## 2.02 PHYSICAL PROPERTIES

- A. The AGRU Sure Grip® CPL systems and welding rod shall be manufactured from the same resins and meet the following properties:

Property	Testing Method	Units	HDPE	PP-R
Density	ASTM D792	g/cm <sup>3</sup>	0.945	1.78
MFI (Melt Flow Index)	ASTM D1238	g/10min	(190/5)	(190/5)
Heat Reversion (Dimensional Stability)	ASTM D1637	%	<3	<3
Yield Stress	ASTM D638	PSI	≥2175	≥2900
Elongation of yield.	ISO527-3 Specimen 1B	%	≥10-	≥12
Elongation	ISO527-3 specimen 1B	%	>450	>200
Fire Classification	UL-94		94-HB	94-HB
Max. Working Temperature		° C ° F	60 140	90 194

## PART 3 - EXECUTION

### 3.01 FABRICATION

- A. Liner material shall be fitted and secured in the form prior to placing the concrete.

- B. All joints within each precast section shall be sealed by extrusion welding performed by AGRU certified welders, before shipment to the job site. Joints between precast sections shall be welded in the field by Terre Hill Concrete Products; Taylor Precast; US-Precast; or certified equal.
- C. Manhole steps shall not be used. Steps PS-6-ALF by MA Industries, Inc. or approved equal shall be used to suspend ladders only when indicated on the manhole schedule. The joint between the step and liner shall be shop welded as shown on the drawings.

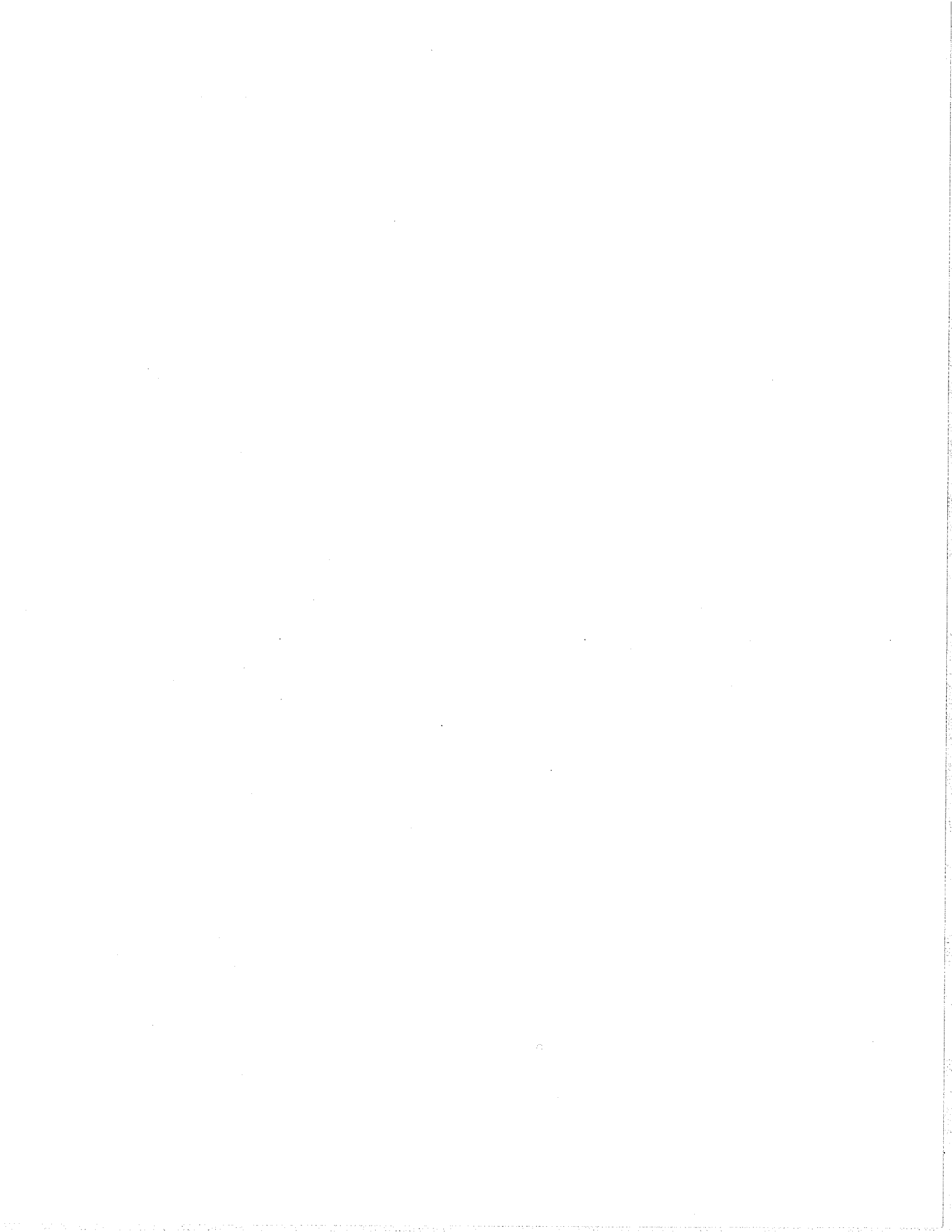
### **3.02 ASSEMBLY**

- A. The responsibility of providing a leak free precast structure rests on the utility contractor installing the lined structure. Welding cannot occur when concrete joints leak.
- B. Place only a single strip of gasket towards the exterior of the precast section joints to prevent entrapped air blowouts and oozing of the sealant on the liner surface.

### **3.03 FIELD WELDING**

- A. All welding shall be performed by AGRU certified welders in accordance with the published directives and procedures of the manufacturer. Completion of welding shall provide a monolithic concrete protective liner.
- B. The following welding methods are acceptable
  1. Extrusion welding. (For all final welds).
  2. Wedge welding.
  3. Butt welding.
  4. Hot air welding.
- C. The joint areas shall be clean, dry, and free of oil and lubricants. The prepared edges shall be free of chips and notches detrimental to maximum fusion of the weld.
- D. All welded joints shall be finish welded with an extrusion weld, spark tested for leaks and visually inspected.

**END OF SECTION**



**SECTION 02606  
CURED-IN-PLACE PVC MANHOLE LINER  
(FOR EXISTING MANHOLES)**

**PART 1 - GENERAL****1.01 DESCRIPTION OF WORK**

- A. This work shall include the furnishing of all labor, materials, and equipment for the rehabilitation of an existing manhole with a cured-in-place PVC composite liner.
- B. The manhole liner shall be manufactured to the shape of the manhole. The fibrous portion of the liner shall be saturated with a modified epoxy resin, then pressurized and cured in-place.
- C. A removable inflation bladder shall be pressurized between ½ - 5 pounds per square inch. The bladder will be removed upon completion of the curing.
- D. The exposed surface of the liner shall be white PVC.

**1.02 LINER PERFORMANCE REQUIREMENTS**

- A. Liner shall be of the type that allows rehabilitation of a concentric, eccentric or flat top manhole without removing the manhole ring and top section or corbel.
- B. The liner shall be installed and cured in place via controlled curing by heat and pressurization in the manhole to complete the curing process.
- C. The lining of the manhole shall result in a structure to the shape and contour of the existing manhole. The liner shall be installed and substantially bond to the interior manhole substrate and be watertight, free of any joints or openings other than pipe inlets, outlets and the cover frame opening.
- D. All linings shall be designed with independent structural hoop strength for full height hydrostatic pressure as if the liner were a secondary vessel inside the existing manhole. The manufacturer shall design adequate liner thickness into the system with or without additional fiberglass layers.

**1.03 QUALITY ASSURANCE**

- A. Reference Standards: Comply with applicable provisions and recommendations of the following:
  - 1. ASTM D 695-96 Standard Test Method for Compressive Properties of Rigid Plastics.

**1.04 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Copies of the manhole dimensions, installation instructions, and manufacturer's product data sheet to be submitted for the Engineer's review.
- C. Calculations for the round manhole lining that demonstrate hoop strength under maximum hydrostatic conditions shall be submitted. The calculation shall assume zero liner adhesion to the existing structure, but assume lateral support from the existing wall. The calculated hoop stress shall be less than 11% of the compressive strength as determined by appropriate ASTM test method.

**PART 2 - PRODUCTS****2.01 MATERIALS**

- A. Manhole interior walls and benches shall be patched with cementitious patching/plugging compounds as manufactured by Tamms, Inc., or approved equal.
- B. Channel reconstruction cement shall be speed-crete as manufactured by Tamms, Inc., formed Portland cement concrete of 4,000-psi compression strength, or approved equal.
- C. As a minimum the manhole liner systems shall be composed of a multiple layered composite. The primary layer shall be manufactured from 20 mils PVC with 10 ounce per square yard polyester fleece. The surface hairs of the fleece must be embedded in the molten PVC during the manufacturing process of the PVCP laminate. Glued laminates are not allowed.
- D. The fibrous body will be impregnated with a modified epoxy resin. Add fiberglass and resin, for additional liner thickness.  
Multiplexx Liner™ PVCP:  
PVCP20-10=86 mils. (20 mill PVC & 10 oz Fleece). (i.e. no fiberglass)  
PVCP20-28=88 mils. (20 mill PVC, 10 oz Fleece & 18 oz Fiberglass).  
PVCP20-34=110 mils. (20 mill PVC, 10 oz Fleece & 24 oz Fiberglass).  
PVCP20-custom mils (20 mill PVC, 10 oz Fleece & Fiberglass as required).
- E. Liner Thickness: The anticipated hydrostatic head "h" in feet above the bottom of the invert and the Radius "R" in feet of the structure shall determine the necessary liner thickness "t" in mils.

**2.02 APPLICABLE MANUFACTURERS**

- A. Products specified by named manufacturers are specified as a standard of quality.
  - 1. PVCP, Multiplexx™ Liner System

**2.03 ACCEPTABLE LINER INSTALLERS.**

- A. Licensees of Terre Hill Composites, a division of Terre Hill Concrete Products, Terre Hill, PA, is the supplier of the PVCP Multiplex Liner System. U.S. Patent number 5,106,440, 6,540,438 B2 and 6,540,439 B2. Phone: (717) 445-3100, Fax: (717) 445-3108.

**PART 3 - EXECUTION****3.01 MAINTAINING WASTEWATER FLOWS**

- A. Plug the pipes entering the manhole and line the flow channel to the edge of the pipe. Trim all pipe openings and restore the flow.

**3.02 PRE-INSPECTION**

- A. Prior to beginning work, the manhole shall be visually inspected and any areas of apparent structural damage shall be reported to the Owner.

**3.03 CLEANING**

- A. All surfaces of the manhole shall be cleaned with a high-pressure water-jet sprayer with an operating pressure of at least 3,500 psi. Pressure wash the manhole to remove all dirt, grease, sand, and surface contaminants on the wall and floor leaving a clean damp surface.
- B. Badly deteriorated and pitted pre-cast manholes and brick manholes, with missing bricks and grout, shall be muddied back to form a smooth compatible surface for the liner.

**3.04 PLUGGING RECONSTRUCTION**

- A. The stopping of active hydrostatic infiltration shall be accomplished by using Tamms cementitious products Speed Crete and Powder X, as manufactured by Tamms Industrial, Division of LaPorte Construction Chemicals, Mentor, Ohio, Hydro-gel by prime resins or approved equal.
- B. Water infiltration can also be stopped using expansion type grouts such as 3M or Avanti.

**3.05 CHANNEL RECONSTRUCTION**

- A. Remove all loose grout and rubble of existing channel. Rebuild channel if required by shaping and repairing slope of shelves or benches. Work shall include alignment of inflow and out flow ports in such manner to prevent the deposition of solids at the transition point. All inverts shall follow the grades of the pipe entering the manhole. Changes in direction of the sewer and entering branch or branches shall have a true curve of as large a radius as the size of the manhole will permit. Channels shall be shaped to allow entrance of maintenance equipment into pipes including buckets, TV camera, etc.

**3.06 LINER INSTALLATION**

- A. Installation shall be by an installer that is qualified by the liner manufacturer. The CONTRACTOR shall include the furnishing of all materials, equipment, tools, and labor as required for the rehabilitation of the manholes selected, including the installation of the interior liner.
- B. The installation of the approved liner system shall be in strict accordance with the manufacturer's instructions. This shall include the preparation, installation, inflation, curing, and finishing operations, required for the completion of the manhole rehabilitation process.
- C. All safety rules and regulations applicable laws and insurance requirements shall be observed in storing, handling, use and application of the liner materials, resins and any solvents.
- D. Ventilation shall be provided to the workers at all times.

**3.07 WATERTIGHT SEAL AT PIPE PENETRATIONS AND OTHER OPEN/CUT LINER EDGES**

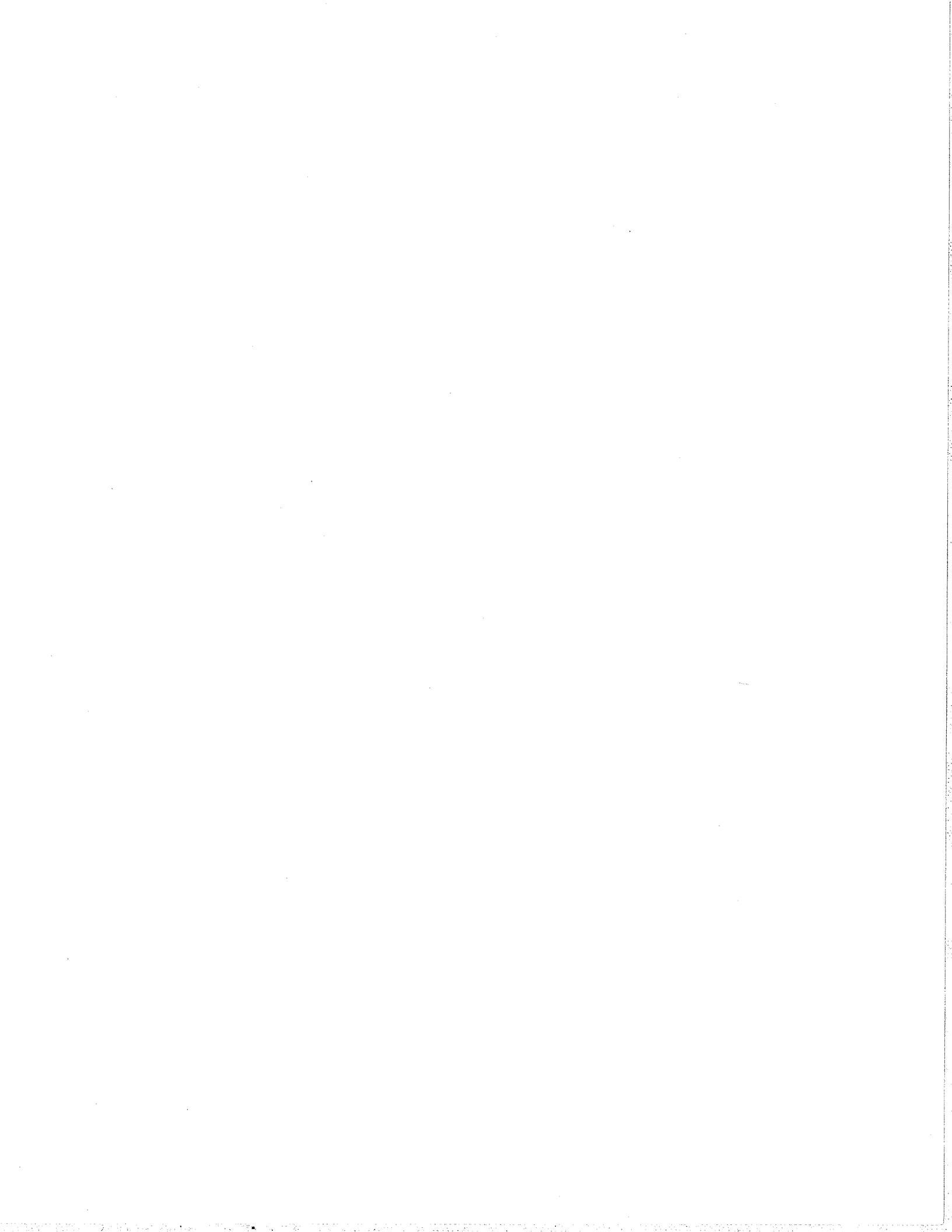
- A. "Connect-cure" liners shall be installed and cured at the pipe penetrations.
  - 1. The host influent and effluent pipes (whether lined or not lined) shall be prepared to assure watertight seal between the "connect-cure" liner and host pipe.
  - 2. The "connect-cure" liner shall overlap sufficiently in the manhole to assure a watertight seal at the manhole liner interface.
  - 3. The "connect-cure" liner shall extend sufficiently into the influent and effluent pipes to allow insertion of plugs for vacuum testing of the manhole.
- B. A watertight seal shall be provided at all other open/cut liner edges by means of excess resin in the "wet out" liner, sealing with mastic, or other means in accordance with the manufacturer's recommendations.

**PART 4 - WARRANTY**

- A. The CONTRACTOR shall warrant to the Owner in writing the installation, fabrics, and resins to be free of defects in workmanship and materials for a period of ten years.

**END OF SECTION**





**SECTION 02610  
SANITARY SEWER PIPE****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
1. Sanitary sewer gravity and pressure pipelines
  2. Laterals/service connections
- B. Related Work specified elsewhere:
1. Section 02221 - Trenching, Backfilling and Compacting
  2. Section 02601 - Manholes
  3. Section 02651 - Sewer and Manhole Testing
- C. Applicable Standard Details:
1. 5177 Pipe Bedding Details
  2. 5178A Pipe Trench Detail
  3. 5179 Concrete Cradle and Encasement Details
  4. 5180 Vertical Water Main Clearance
  5. 5180A Stream Crossing Detail
  6. 5187 Lateral Detail
  7. 5187A Sloped Riser Lateral Detail
  8. 5187B Vertical Riser Lateral Detail

**1.02 QUALITY ASSURANCE**

- A. Reference Standards:
1. American Society for Testing and Materials (ASTM):
    - a. ASTM D1784 Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
    - b. ASTM D3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
    - c. ASTM D3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
    - d. ASTM F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
  2. American National Standards Institute (ANSI):
    - a. ANSI/AWWA C104/A21.4 Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water
    - b. ANSI/AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3" through 48", for Water and Other Liquids

- c. ANSI/AWWA C111/A21.11 Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
  - d. ANSI/AWWA C151/A21.51 Ductile-Iron Pipe Centrifugally Cast
- B. Materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner, or acid solder will be rejected.

### **1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Submit each manufacturer's certification attesting that the pipe, pipe fittings, joints, joint gaskets and lubricants meet or exceed specification requirements.

### **1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Do not place materials on private property without written permission of the property owner.
- B. During loading, transporting and unloading, exercise care to prevent damage to materials.
- C. Do not drop pipe or fittings.
- D. Avoid shock or damage at all times.
- E. Take measures to prevent damage to the exterior surface or internal lining of the pipe.
- F. Do not stack pipe higher than recommended by the pipe manufacturer.
- G. Store gaskets for mechanical and push-on joints in a cool, dry location out of direct sunlight and not in contact with petroleum products.

## **PART 2 - PRODUCTS**

### **2.01 POLYVINYL CHLORIDE (PVC) SEWER PIPE**

- A. Gravity Sewer Pipe and Fittings:
  - 1. 4" to 15" Nominal Pipe Size: ASTM D3034, SDR-35; Material - ASTM D1784, 12454-B
  - 2. Flexible Elastomeric Seals: ASTM D3212
  - 3. Seal Material: ASTM F477
  - 4. For sewers deeper than 18' use SDR-26 PVC pipe.

**2.02 DUCTILE-IRON PIPE**

- A. Pipe, ANSI/AWWA C151/A21.51; standard cement mortar lining, ANSI/AWWA C104/A21.4, outside coated.
  - 1. Pipe - 3" to 12": Pressure Class - 350 psi
- B. Ductile Iron Fittings:
  - 1. ANSI/AWWA C110/A21.10; 150 psi pressure rating.
  - 2. Fitting to be cement mortar lined and outside coated as for ductile iron pipe.
- C. Joints (ANSI/AWWA C111/A21.11): Where not specifically indicated on the Contract Drawings, joints may be either mechanical joint or push-on joint.
- D. Rubber Gaskets, Lubricants, Glands, Bolts and Nuts: ANSI/AWWA C111/A21.11.

**2.03 FLEXIBLE COUPLINGS**

- A. Elastomeric plastic sleeve resistant to chemicals and normal sewer gases leakproof and rootproof; positive seal against infiltration and exfiltration; stainless steel clamp bands.
- B. Manufacturer: Fernco, Davison Michigan, or equal.

**PART 3 - EXECUTION****3.01 PREPARATION**

- A. Perform trench excavation to the line and grade indicated on the Drawings and as specified in Section 02221 - Trenching, Backfilling and Compacting.
- B. Unless otherwise indicated on the Drawings, provide for a minimum cover of 4 feet above the top of piping laid in trenches.
- C. Provide pipe bedding as specified in Section 02221 - Trenching, Backfilling and Compacting for each type of pipe used.
- D. Provide Type IV pipe bedding for all pipe.
- E. Place aggregate in a manner to avoid segregation, and compact to the maximum practical density so that the pipe can be laid to the required tolerances.

**3.02 LAYING PIPE IN TRENCHES**

- A. Give ample notice to the Engineer in advance of pipe laying operations.
- B. Use laser alignment instruments.
- C. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.
- D. Lay pipe proceeding upgrade with the bell or groove pointing upstream.
- E. Lay pipe to a true uniform line with the barrel of the pipe resting solidly in pipe bedding material throughout its length.
- F. Excavate recesses in pipe bedding material to accommodate joints, fittings and appurtenances.
- G. Do not subject pipe to a blow or shock to achieve solid bearing or grade.
- H. Lay each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.
- I. Clean and inspect each section of pipe before joining.
- J. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement.
- K. Use lubricant recommended by the pipe or fitting manufacturer for making joints.
- L. If unusual joining resistance is encountered or if the pipe cannot be fully inserted into the bell, disassemble joint, inspect for damage, reclean joint components, and reassemble joint.
- M. Assemble joints in accordance with recommendations of the manufacturer.
- N. Push-on Joints:
  - 1. Clean the inside of the bell and the outside of the spigot.
  - 2. Insert rubber gasket into the bell recess.
  - 3. Apply a thin film of gasket lubricant to either the inside of the gasket or the spigot end of the pipe, or both.
  - 4. Insert the spigot end of the pipe into the socket using care to keep the joint from contacting the ground.
  - 5. Complete the joint by forcing the plain end to the bottom of the socket.

6. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot is fully inserted.
- O. Coupled Joints: Assemble in accordance with the manufacturer's recommendations.
- P. Disassemble and remake improperly assembled joints using a new gasket.
- Q. Grade Check:
  1. Check each pipe installed as to line and grade in place.
  2. Correct deviation from grade immediately.
  3. A deviation from the designed grade as shown on the Drawings, or deflection of pipe joints, will be cause for rejection.
- R. Place sufficient backfill on each section of pipe, as it is laid, to hold firmly in place.
- S. Clean interior of the pipe as work progresses; where cleaning after laying is difficult because of small pipe size, use a suitable swab or drag in the pipe and pull forward past each joint immediately after the jointing has been completed.
- T. Keep trenches and excavations free of water during construction.
- U. When the work is not in progress, and at the end of each workday, securely plug open ends of pipe and fittings to prevent trench water, earth, or other substances from entering the pipes or fittings.

### **3.03 WYE BRANCHES AND TEES**

- A. Install wye branches or pipe tees at locations indicated on the Drawings concurrently with pipe laying operations.
- B. Use standard fittings of the same material and joint type as the pipeline into which they are installed.
- C. For taps into an existing pipeline, use a saddle wye or tee with stainless steel clamps.
- D. Mount saddles with solvent cement or gasket and secure with metal bands.
- E. Layout holes with a template and cut holes with a mechanical hole cutter.

**3.04 LATERALS**

- A. Construct laterals from the wye branch to a terminal point at the right-of-way or property line or as designated on the Drawings and in accordance with Standard Detail 5187.
- B. Where the depth of the main pipeline warrants, construct riser type laterals from the wye branch in accordance with Standard Detail 5187A or 5187B.
- C. The determination as to the type of riser, slope, and depth of lateral pipe at the termination point will be made by the Engineer in the field.
- D. Install an approved watertight plug, braced to withstand pipeline test pressure thrust, at the termination of the lateral.
- E. Install a wye at the right-of-way line. Extend a clean-out line to grade from wye and cap. Plug end of wye that is open.

**3.05 NEW LATERALS ON EXISTING SEWER LINES**

- A. New laterals installed on an existing sewer shall include concrete support under the wye fitting. Concrete shall extend a minimum of 1 foot under the existing sewer beyond the edge of the new fitting.

**3.06 CAST-IN-PLACE CONCRETE CONSTRUCTION**

- A. Conform to the applicable requirements of Section 03310 - Concrete for Utility Construction.

**3.07 CRADLES AND ENCASEMENT**

- A. Provide concrete cradles and encasement for pipeline where indicated on the Drawings, or as directed by the Engineer, and in accordance with Standard Detail 5179.

**3.08 STREAM CROSSINGS**

- A. Construct sanitary sewer pipeline stream crossings in accordance with Standard Detail 5180A.
- B. Provide concrete encased mechanical joint ductile-iron pipe backfilled with minimum 3" size stone to the level of the stream bed, between the limits of the stream crossing.

- C. Do not backfill until concrete has achieved its initial set and concrete work is examined by the Engineer.

**3.09 BACKFILLING TRENCHES**

- A. Backfill pipeline trenches only after examination of the pipe laying by the Engineer.
- B. Backfill trenches as specified in Section 02221 - Trenching, Backfilling and Compacting.

**END OF SECTION**





**SECTION 02615  
WATER MAINS****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
1. Water Distribution Lines and Fittings
- B. Related Work specified elsewhere:
1. Section 02221 - Trenching, Backfilling & Compacting
  2. Section 02640 - Valves and Fire Hydrants
  3. Section 02642 - Water Service Connections
  4. Section 02653 - Testing & Disinfecting Water Mains
  5. Section 03310 - Concrete for Utility Construction
- C. Applicable Standard Details:
1. 5177 Pipe Bedding Details
  2. 5180A Stream Crossing Detail
  3. 5195 Thrust Block for Vertical Bends
  4. 5196 Thrust Block for Bends, Tees and Caps
  5. 5302 Water Main Crossing Storm Drain or Sanitary Sewer
  6. 5304 Curvature of Ductile Iron Pipelines

**1.02 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
1. ASTM D3139 Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals
- B. American National Standards Institute (ANSI):  
American Water Works Association (AWWA):
1. ANSI/AWWA C104/A21.4 Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water
  2. ANSI/AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3" through 48", for Water and Other Liquids
  3. ANSI/AWWA C111/A21.11 Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
  4. ANSI/AWWA C151/A21.51 Ductile-Iron Pipe Centrifugally Cast Polyvinyl Chloride (PVC) Pressure Pipe, 4" Through 12", for Water Distribution
  5. ANSI/AWWA C900

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300
- B. Submit manufacturers' catalog information for each type of pipe, fittings, couplings, adapters, gaskets and assembly of joints for approval of the Engineer; include manufacturers' recommendations for deflection in pipe joints.
- C. Submit a Statement of Compliance, together with supporting data, from the materials suppliers of each type of pipe, fitting, gasket, lubricant or other joint materials attesting that each of the products provided meets or exceeds specifications requirements.

**1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Do not place materials on private property without written permission from the property Owner.
- B. During loading, transporting and unloading, exercise care to prevent damage to materials.
- C. Do not drop pipe or fitting.
- D. Avoid shock or damage at all times.
- E. Use padded slings, hooks and tongs to prevent damage to the exterior surface or internal lining of the pipe.
- F. Pipe may be strung along alignment where approved by the Engineer.
- G. Do not stack higher than Maximum Stacking Heights shown in AWWA C600 or as recommended by the pipe manufacturer.
- H. Keep interior of pipe and fittings free from dirt or other foreign matter.
- I. Store gaskets for mechanical and push-on joints in cool location out of direct sunlight and not in contact with petroleum products.

**PART 2 - PRODUCTS****2.01 PIPE, FITTINGS AND JOINTS**

- A. Polyvinyl Chloride (PVC) Plastic Pipe:
  - 1. Pipe:
    - a. Cast Iron Pipe Equivalent OD Pipe: AWWA C900, 150 psi Pressure Class, SDR18.
  - 2. Manufactured from Polyvinyl Chloride 1220.

3. National Sanitation Foundation Seal of Approval required for use with potable water.
  4. Joints:
    - a. Push-on: ASTM D3139
  5. Fittings:
    - a. Push-on: Class suitable for use with pipe specified.
- B. Cast or Ductile Iron Fittings for PVC Pressure Pipe: ANSI/AWWA C110/A21.10.

## 2.02 DUCTILE-IRON PIPE FOR STREAM CROSSINGS

- A. Pipe, ANSI/AWWA C151/A21.51; standard cement mortar lining, ANSI/AWWA C104/A21.4, outside coated.
1. Pipe - 3" to 12": Pressure Class - 350 psi
- B. Ductile Iron Fittings:
1. ANSI/AWWA C110/A21.10; 150 psi pressure rating.
  2. Fitting to be cement mortar lined and outside coated as for ductile iron pipe.
- C. Joints (ANSI/AWWA C111/A21.11): mechanical joint
- D. Rubber Gaskets, Lubricants, Glands, Bolts and Nuts: ANSI/AWWA C111/A21.11.

## 2.03 PIPE ACCESSORIES

- A. Wall Sleeves and Wall Pipes:
1. Cast Iron: ASTM A48, Class 30B
  2. Ductile Iron: ASTM A536, Grade 60-40-18
  3. Mechanical Joint, ANSI/AWWA C111/A21.11
  4. Integral cast intermediate wall collar
- B. Wall Seals:
1. Assembly of synthetic rubber links connected with corrosion resistant bolts; when the bolts are tightened, Delrin plastic pressure plates compress the rubber links to fill the annular space between the pipe and the wall sleeve to form a watertight seal.
  2. All wall seals located in penetrations through new walls that are below grade shall be installed in a cast iron wall sleeve that conforms to the requirements of this specification section or installed in a steel wall sleeve. This steel wall sleeve shall consist of a piece of standard weight steel pipe with an integral steel anchoring collar. This anchoring collar shall be 1/4" thick, shall project 3" beyond the pipe outer wall and shall be welded to the pipe around its entire periphery. No sleeves are required if hole is core drilled through a new or existing concrete wall.

3. Century-Line prefabricated sleeves as manufactured by the Thunderline Corporation, Belleville, Michigan may be used in lieu of steel or cast iron sleeves for wall seal application.

## 2.04 DETECTABLE UNDERGROUND UTILITY MARKING TAPE

- A. Tape shall consist of a minimum 5-mil (0.005") overall thickness, with no less than a 35 gauge (0.00035") solid aluminum foil core. The foil must be visible from BOTH sides. The layers shall be laminated together with the extrusion lamination process, not adhesives. Further, there shall be NO inks or printing extending to the edges of the tape. The adhesive will NOT contain any dilutants, pigments or contaminants and is specially formulated to resist degradation by elements normally encountered in the soil. All printing shall be encased to avoid ink rub-off.

- B. Test Data:

<u>Property</u>	<u>Method</u>	<u>Value</u>
Thickness	ASTM D2103	5.0 mils
Tensile strength	ASTM D 882	25 lbs./inch (5500 psi)
Elongation	ASTM D 882-88	<50% at break
Printability	ASTM D2578	>50 dynes/cm <sup>2</sup>
Flexibility	ASTM D 671-81	Pliable hand
Inks	Mfg. specs.	Heat set Mylex
Message repeat	Mfg. specs.	Every 20"
Foil	Mfg. specs.	Dead soft/annealed
Top layer	Mfg. specs.	Virgin PET
Bottom layer	Mfg. specs.	Virgin LDPE
Adhesives	Mfg. specs.	>30%, solid 1.5#/R
Bond strength	Boiling H <sup>2</sup> O @ 100°C	5 hours w/o peel
Colors	APWA code	See below

- C. Color Code shall be as follows:

1. Safety Red: Electric power, distribution and transmission and municipal electric systems.
2. High Visibility Safety Yellow: Gas and oil distribution and transmission, dangerous materials, product and steam.
3. Safety Alert Orange: Telephone and telegraph systems, police and fire communications, and cable television.
4. Safety Precaution Blue: Water systems and slurry pipelines.
5. Safety Green: Sanitary and storm sewer systems.
6. Safety Brown: Force mains, reclaimed water lines and effluent reuse lines.
7. Alert Purple: Reclaimed non-potable water lines.

**2.05 LOCATION WIRE**

- A. Provide #12 stranded copper wire on top of PVC water mains for future location of main.

**2.06 PIPE ACCESSORIES**

- A. Wall Sleeves and Wall Pipes:
1. Cast Iron: ASTM A48, Class 30B
  2. Ductile Iron: ASTM A536, Grade 60-40-18
  3. Mechanical Joint, ANSI/AWWA C111/A21.11
  4. Integral cast intermediate wall collar
- B. Wall Seals:
1. Assembly of synthetic rubber links connected with corrosion resistant bolts; when the bolts are tightened, Delrin plastic pressure plates compress the rubber links to fill the annular space between the pipe and the wall sleeve to form a watertight seal.
  2. All wall seals located in penetrations through new walls that are below grade shall be installed in a cast iron wall sleeve that conforms to the requirements of this specification section or installed in a steel wall sleeve. This steel wall sleeve shall consist of a piece of standard weight steel pipe with an integral steel anchoring collar. This anchoring collar shall be 1/4" thick, shall project 3" beyond the pipe outer wall and shall be welded to the pipe around its entire periphery. No sleeves are required if hole is core drilled through a new or existing concrete wall.
  3. Century-Line prefabricated sleeves as manufactured by the Thunderline Corporation, Belleville, Michigan may be used in lieu of steel or cast iron sleeves for wall seal application.
- C. Flange Adapters:
1. For connecting plain-end pipe to flanged valves, fittings and pumps, constructed of ductile iron with 125 lb. flange drilling; anchor to plain-end pipe by means of setscrews conforming to ANSI B16.1. Provide with Buna-N gasket. Temperature range -20°F to 150°F; working pressure as follows:
    - a. 2" to 12" - 175 psi
    - b. 14" to 24" - 150 psi
    - c. 30" to 48" - 100 psi
  2. Setscrews shall prevent pullout up to working pressure specified plus 100 psi surge pressure.
- D. Flange Coupling Adapters:
1. For joining plain-end pipe to flanged valves, fittings and pumps.
  2. Mechanical Joint, ANSI/AWWA C111/A21.11. Provide all flanged coupling adapters with anchor studs.

- E. Couplings (Interior):
1. Factory pre-assembled couplings for plain-end pipe.
  2. Sleeve: Carbon steel, minimum yield of 30,000 psi.
  3. Followers: Steel
  4. Bolts and Nuts: High-strength, low-alloy steel with heavy, semi-finished hexagon nuts.
  5. Gaskets: Grade 60
  6. Finish: Enamel
  7. Anchor studs
  8. Manufacturer: Smith-Blair, Type 411, or equal.
- F. Couplings (Buried Service):
1. Factory pre-assembled couplings for plain-end pipe.
  2. Sleeve: Ductile iron
  3. Followers: Ductile iron
  4. Bolts and Nuts: Stainless steel
  5. Gaskets: Grade 60
  6. Finish: Fusion bonded epoxy
  7. Manufacturer: Smith-Blair, Type 441, or equal.
- G. Transition Couplings (Interior):
1. Factory pre-assembled couplings for plain-end pipe.
  2. Sleeve: Carbon steel, minimum yield of 30,000 psi.
  3. Followers: Steel
  4. Bolts and Nuts: High-strength, low-alloy steel with heavy, semi-finished hexagon nuts.
  5. Gaskets: Grade 60
  6. Finish: Enamel
  7. Manufacturer: Smith-Blair, Type 413, or equal.
- H. Transition Couplings (Buried Service):
1. Factory pre-assembled couplings for plain-end pipe.
  2. Sleeve: Ductile iron
  3. Followers: Ductile iron
  4. Bolts and Nuts: Stainless steel
  5. Gaskets: Grade 60
  6. Finish: Fusion bonded epoxy
  7. Manufacturer: Smith-Blair, Type 441, or equal.
- I. Reducer Couplings (Interior):
1. Factory pre-assembled couplings for plain-end pipe.
  2. Sleeve: Carbon steel, minimum yield of 30,000 psi.
  3. Followers: Steel
  4. Bolts and Nuts: High-strength, low-alloy steel with heavy, semi-finished hexagon nuts.
  5. Gaskets: Grade 60
  6. Finish: Enamel

7. Manufacturer: Smith-Blair, Type 415, or equal.
- J. Reducer Couplings (Buried Service):
  1. Factory pre-assembled couplings for plain-end pipe.
  2. Sleeve: Ductile iron
  3. Followers: Ductile iron
  4. Bolts and Nuts: Stainless steel
  5. Gaskets: Grade 60
  6. Finish: Fusion bonded epoxy
  7. Manufacturer: Smith-Blair, Type R441, or equal.

### **PART 3 - EXECUTION**

#### **3.01 EXCAVATION**

- A. Excavate trenches as specified in Section 02221 - Trenching, Backfilling and Compacting.
- B. Provide at least 4'- 0" of cover from the top of the pipe to the finished grade elevation.

#### **3.02 PIPE BEDDING**

- A. Type IV pipe bedding for pipelines, as specified in Section 02221 - Trenching, Backfilling and Compacting.
- B. Shape recesses for the joints or bell of the pipe by hand.
- C. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

#### **3.03 PIPE LAYING**

- A. Clean and inspect each length of pipe or fitting before lowering into the trench.
- B. Do not lower pipe into the trench except that which is to be immediately installed.
- C. Lay pipe to a uniform line with the barrel of the pipe resting solidly in pipe bedding material throughout its length.
- D. Excavate recesses in pipe bedding material to accommodate joints, fittings, and appurtenances.
- E. Do not subject pipe to a blow or shock to achieve solid bearing or grade.



- F. Lay each section of pipe in such a manner as to form a close concentric joint with adjoining section and to avoid offsets.
- G. Lubricate pipe and gaskets as recommended by the manufacturer; assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement.
- H. Grade Check:
  - 1. Check each pipe installed as to line and grade in place.
  - 2. Correct deviations immediately.
  - 3. Deflection of pipe joints in excess of maximum recommended by manufacturer will be cause for rejections.
- I. Install fittings and valves as pipe laying progresses; do not support weight of fittings and valves from pipe.
- J. When the work is not in progress, and at the end of each work day, securely plug the ends of pipe and fittings to prevent trench water, earth, or other substances from entering the pipes or fittings.
- K. Backfill concurrently with pipe laying to hold installed pipe in place.
- L. Install detectable utility marking tape above all plastic pressure pipeline, 12" to 18" below final grade as per Section 02221.
- M. Install #12 stranded copper wire on top of PVC water mains. Extend wire through valve boxes with extra wire to extend 2 feet above grade with wire secured to inside of valve box with clip.
- N. When pipe laying is terminated for any reason, provide at least 24" of backfill over all pipe except the last piece laid.
- O. Push-on Joints:
  - 1. Clean the inside of the bell and the outside of the spigot.
  - 2. Insert rubber gasket into the bell recess.
  - 3. Apply a thin film of gasket lubricant to either the inside of the gasket or the spigot end of the pipe, or both.
  - 4. Insert the spigot end of the pipe into the socket using care to keep the joint from contacting the ground.
  - 5. Complete the joint by forcing the plain end to the bottom of the socket.
  - 6. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot is fully inserted.
- P. Mechanical Joints:
  - 1. Wash the socket and plain end.
  - 2. Apply a thin film of lubricant.
  - 3. Slip the gland and gasket over the plain end of the pipe.

4. Apply lubricant to gasket.
  5. Insert the plain end of the pipe into the socket and seat the gasket evenly in the socket.
  6. Slide the gland into position, insert bolts, and finger-tighten nuts. Tighten bolts, 180-degrees apart alternately, to uniform tightness.
  7. Coat all bolts and nuts with bitumastic paint after installation.
- Q. Coupled Joints: Assemble in accordance with manufacturer's recommendations.
- R. Install service connections as specified in Section 02642.

### **3.04 CUTTING PIPE**

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

### **3.05 DEFLECTION**

- A. When it is necessary to deflect water mains from a straight alignment horizontally or vertically, do not exceed limits as follows:
  1. PVC Pipe: Per manufacturers' recommendations.

### **3.06 THRUST RESTRAINT**

- A. Provide pressure pipeline with restrained joints or concrete thrust blocking at all bends, tees, and changes in direction; construct concrete thrust blocking in accordance with Standard Details 5195 and 5196. If restrained joints are utilized, submit design calculations showing determination of restrained lengths and submit joint restraint details. Method of joint restraint shall utilize devices specifically designed for the application for which manufacturer's data is available for the application. Submit manufacturer's literature for approval.

### **3.07 SPECIAL CONDITIONS**

- A. Connections:
  1. Wherever an existing water main is to be cut and closed, or extended or connected to the proposed new lines, construct connections as shown on the Drawings.
  2. For connecting pipe of different materials, use transition fittings as recommended by the manufacturer and approved by the Engineer.
- B. Stream Crossings:
  1. Install water mains crossing streams as shown on Standard Detail 5180A.

- C. Wall Sleeves:
  - 1. Provide pipes passing through concrete or masonry construction with sleeve or wall pipe fittings of type and size indicated.
  - 2. Provide sleeves two pipe sizes larger than the water mains, unless otherwise specified or shown.
  
- D. Wall Seals:
  - 1. Provide watertight wall seals between pipe and wall sleeve where pipes penetrate building walls, foundations or slabs.
  - 2. Annular space between pipe and wall sleeve shall be sealed with mechanical seal consisting of interlocking synthetic rubber links shaped to fill the space and assembled with bolts and a pressure plate under each bolt head and nut, and when squeezed the rubber links shall form a watertight seal with the pipe sleeve.

### **3.08 TESTING AND DISINFECTING**

- A. Test and disinfect water mains as specified in Section 02653 - Testing and Disinfecting Water Mains.

**END OF SECTION**

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**SECTION 02640**  
**VALVES AND FIRE HYDRANTS****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
  - 1. Water Main and Service Valves
  - 2. Fire Hydrants
  
- B. Related Work specified elsewhere:
  - 1. Section 02615 - Water Main Pipe
  - 2. Section 02642 - Water Service Connections
  
- C. Applicable Standard Details:
  - 1. 5303 Fire Hydrant Settings
  - 2. 5303A Fire Hydrant Setting Using Tie-Rods

**1.02 QUALITY ASSURANCE**

- A. Reference Standards:
  - 1. American National Standards Institute (ANSI); American Water Works Association (AWWA):
    - a. ANSI/AWWA C500 Gate Valves, 3" through 48" NPS, For Water and Sewage Systems
    - b. ANSI/AWWA C502 Dry-Barrel Fire Hydrants

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
  
- B. Certificates: Submit a Statement of Compliance, together with supporting data, from the materials suppliers attesting that valves, hydrants, and accessories provided meet or exceed ANSI/AWWA Standards and specification requirements.
  
- C. Product Data: Submit manufacturer's latest published literature including illustrations, installation instructions, maintenance instructions and parts lists.

**1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Prepare valves, hydrants and accessories for shipment according to AWWA Standards and seal valve, hydrant and meter ends to prevent entry of foreign matter into product body.

- B. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

## **PART 2 - PRODUCTS**

### **2.01 GATE VALVES**

- A. Resilient Seated:
1. Mechanical joint or push-on joint.
  2. Iron body, ASTM A126, Class B; non-rising bronze stem, ASTM B584.
  3. Gate 4", 6", 8" Buna S encapsulated cast iron, A126, Class B: 10", 12" Buna S encapsulated ductile iron, A536, Grade 65-45-12.
  4. O-ring of Buna N. ANSI/AWWA C509; valve body, inside and out, to be coated in accordance with AWWA C550; 200 psi working pressure. Open counterclockwise.

### **2.02 VALVE BOXES**

- A. 12" Valves and Smaller: Domestic cast iron, two-piece, screw type.
- B. Valves Larger than 12": Domestic cast iron, three-piece, screw type; round base.
- C. Cast iron lid (Drop Type).

### **2.03 FIRE HYDRANTS**

- A. Dry-barrel break-away type conforming to AWWA C502.
1. Bury Depth: 4'-6", or as indicated on the Drawings.
  2. Inlet Connection: 6".
  3. Valve Opening: 5-1/4".
  4. Mechanical Joint or Bell End.
  5. Corrosion resistant bolts and nuts.
  6. National Standard Thread.
  7. Paint: Yellow with red cap and white reflector top.
- B. One pumper, two hose nozzles.
1. Two 2-1/2" hose nozzles and one 4-1/2" steamer nozzle.
  2. Attach nozzle caps by separate chains.

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**PART 3 - EXECUTION****3.01 GENERAL**

- A. Determine the exact location and size of valves and hydrants from the Drawings; the Standard Details represent typical details only; obtain all necessary clarification and directions from the Borough or Engineer prior to the execution of work.
- B. Perform trench excavation, backfilling and compaction in accordance with Section 02221.
- C. Install pipe and tubing in accordance with Sections 02615 and 02642 and the applicable Standard Details.

**3.02 GATE VALVES**

- A. Install valves in conjunction with pipe laying; set valves plumb.
- B. Provide buried valves with valve boxes installed flush with finished grade.
- C. Furnish one tee wrench to the Borough.

**3.03 FIRE HYDRANTS**

- A. Install fire hydrants as shown on Standard Detail 5303 or 5303A as applicable; provide support blocking and drainage gravel as shown; do not block drain hole.
- B. Set hydrants plumb with pumper nozzle facing the roadway; set hydrants with centerline of pumper nozzle at least 18" above finished grade and the safety flange not more than 6" nor less than 2" above grade.
- C. Paint hydrants in accordance with local color scheme.
- D. After hydrostatic testing, flush hydrants and check for proper drainage.

**END OF SECTION**



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**SECTION 02642**  
**WATER SERVICE CONNECTIONS****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
1. Tapping water mains by installation of corporation stops or other suitable fittings or couplings.
  2. Installation of service pipe and fittings and curb stops.
- B. Related Work specified elsewhere:
1. Section 02221 - Trenching, Backfilling & Compacting
  2. Section 02615 - Water Mains

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards:
1. American National Standards Institute (ANSI):
    - a. B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
  2. American Society for Testing and Materials (ASTM):
    - a. B62 Specification for composition Bronze or Ounce Metal Castings
    - b. B88 Specification for Seamless Copper Water Tube
    - c. D2447 Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80 Based on Outside Diameter
    - d. D2666 Specification for Polybutylene (PB) Plastic Tubing
    - e. D2737 Specification for Polyethylene (PE) Plastic Tubing
    - f. D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials
  3. American National Standards Institute (ANSI)/American Water Works Association (AWWA):
    - a. ANSI/AWWA C500 Gate Valves, 3 through 48 inch NPS, for Water and Sewage Systems
    - b. ANSI/AWWA C800 Underground Service Line Valves and Fittings

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.



- B. **Manufacturer's Literature:** Submit manufacturer's literature for each size and type of corporation stop, curb stop, curb box, meter setting and pipe, fitting or coupling.
- C. **Shop Drawings and Samples:** Submit shop drawings, and samples as directed, of all products to be assembled by the Contractor/Developer at site for prior approval of the Engineer.
- D. **Certificates:** Submit a Statement of Compliance, together with supporting data, from the materials suppliers attesting that products and materials provided meet or exceeds specification requirements.

#### **1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. **Product Delivery:** During loading, transporting and unloading of all materials and products, exercise care to prevent any damage.
- B. **Storage:** Store all products and materials off the ground and under protective coverings and custody, away from walls and in a manner to keep these clean and in good condition until used.

### **PART 2 - PRODUCTS**

#### **2.01 PIPE OR TUBING AND FITTINGS**

- A. **Polyethylene (PE) Plastic Tubing and Pipe:**
  - 1. **Pipe and Tubing:**
    - a. Pipe: ASTM D2447, Schedule 40 or Schedule 80.
    - b. Tubing: ASTM D2737, 160 psi pressure rating, PE3408.
  - 2. National Sanitation Foundation Seal of Approval for use with potable water required.
  - 3. **Fittings:**
    - a. Suitable for use with pipe or tubing supplied.
    - b. Manufactured from ASTM D3350 materials.

#### **2.02 TAPPING ACCESSORIES**

- A. **Tapping Sleeves:**
  - 1. Mechanical Joint, or as indicated on the Drawings.
  - 2. 200 psi working pressure.
  - 3. Outlet Flange: ANSI B16.1, Class 125.
- B. **Tapping Valves:**
  - 1. ANSI/AWWA C515.
  - 2. Inlet Flange, Class 125.

**2.03 CORPORATION STOP ASSEMBLY**

- A. Corporation Stops:
  - 1. Brass or Red Brass alloy body conforming to ASTM B62.
  - 2. Inlet end threaded for tapping according to ANSI/AWWA C800.
  - 3. Outlet end suitable for service pipe specified.
  
- B. Service Saddles:
  - 1. Double strap min. 3" wide stainless steel band designed to hold pressures in excess of the working pressure of the pipe.

**2.04 CURB STOP ASSEMBLY**

- A. Curb Stops:
  - 1. Brass or Red Brass alloy body conforming to ASTM B62.
  - 2. Ball Type Valve.
  - 3. Positive Pressure Sealing.
  - 4. Insert PVC sleeves on all curb stops over valve. Extend sleeve to grade with removable plug.
  
- B. Curb Boxes and Covers:
  - 1. Cast Iron body, Extension Type or Buffalo Type.
  - 2. Minneapolis or Arch Pattern Base.
  - 3. Drop lid with inscription 'Water'.

**2.05 ACCESSORIES**

- A. Provide insert sleeves on all service connections.

**PART 3 - EXECUTION****3.01 PREPARATION**

- A. Establish location of curb stops and meter boxes for each service connection. Curb stops shall be located 1-foot from the edge of sidewalk on the house side. If no sidewalk is installed, developer shall obtain approval from Borough concerning curb stop location.
  
- B. Excavate trench to the line and grade shown on the Drawings and as specified; jack or bore service lines underneath paved highways where approved by the Engineer.

**3.02 CONNECTIONS**

- A. General: Provide pipe joints and coupling materials suitable in size, design and material of pipe and service fittings with which it is used.
- B. Screwed Joints: Use sharp cut threads of standard gauge and length; after threading, ream all pipe ends to the size of bore and clean out all chips; sufficient quantity of select pipe dope of graphite and oil shall be used for lubrication of assembly.

**3.03 TAPPING WATER MAINS**

- A. Each connection for different kind of water mains shall be tapped using suitable materials, equipment and methods approved by the Engineer.
- B. Provide service clamps for all mains other than those of cast or ductile iron.
- C. Screw Corporation Stops directly into a tapped and threaded iron main at 10 and 2 o'clock positions on the main's circumference; locate corporation stops at least 12" apart longitudinally and staggered.
- D. In case of plastic pipe water mains, provide full support for the service clamp all around the circumference of the pipe, with minimum 2" width of bearing area; exercise care against crushing or any other damage to the water mains at the time of tapping or installing the service clamp or Corporation Stop.
- E. Use proper seals or other devices to ensure that no leaks are left in the water mains at the points of tapping; do not backfill and cover the service connection until approved by the Engineer.

**3.04 SERVICE LINE AND FITTINGS**

- A. Use bends to connect the service pipe or tubing to the tapping fitting or corporation stops to provide flexibility to counteract the effects of settlement or expansion/contraction in the line.
- B. Lay each section of the service line in a manner to form a tight joint with the adjoining section; avoid offsets, kinks or awkward bends to ensure a smooth flow line.
- C. Clean and inspect each pipe and part of the fitting before installing and assemble to provide a flexible joint; use joints or lubricants recommended by the manufacturers and as specified by the Engineer.

- D. Install service fittings and appurtenances on suitable brick or concrete supports as shown on the Drawings and Standard Details; do not use earth, rocks, wood or other organic materials as supports.
- E. Prevent displacement of pipes and fittings at the time of placing concrete for thrust blocks or for any structures and until initial setting of concrete is assured.
- F. Operate each corporation and curb stop before and after installation.
- G. When the work is not in progress and at the end of each work day, securely plug the ends of pipe and fittings to prevent any dirt or foreign substances from entering the lines.
- H. Provide concrete thrust blocking or restrained joints at all bends, tees and changes in direction.
- I. Test and disinfect mains and service lines as specified in Section 02653.

**END OF SECTION**



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**SECTION 02651  
SEWER AND MANHOLE TESTING****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
  - 1. Vacuum Testing Sewer Manholes
  - 2. Testing Gravity Sewer Pipelines:
    - a. Low-pressure Air Test
    - b. Infiltration Test
  - 3. Deflection Testing Plastic Pipelines
  
- B. Related Work specified elsewhere:
  - 1. Section 02601 - Manholes
  - 2. Section 02610 - Sanitary Sewer Pipe

**1.02 QUALITY ASSURANCE**

- A. Reference Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. C1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test
    - b. D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
  
- B. Test Acceptance:
  - 1. No test will be accepted until the results are below the specified maximum limits.
  - 2. The Contractor/Developer shall determine and correct the causes of test failure and retest until successful test results are achieved.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
  
- B. Submit the following prior to start of testing:
  - 1. Testing procedures
  - 2. List of test equipment
  - 3. Testing sequence schedule
  - 4. Provisions for disposal of flushing and test water
  - 5. Certification of test gauge calibration
  - 6. Deflection mandrel drawings and calculations

**1.04 JOB CONDITIONS**

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

**PART 2 - PRODUCTS****2.01 VACUUM TESTING EQUIPMENT**

- A. Vacuum pump
- B. Vacuum line
- C. Vacuum tester base with compression band seal and outlet port
- D. Shut-off valve
- E. Stop watch
- F. Plugs
- G. Vacuum gauge, calibrated to 0.1" Hg

**2.02 AIR TEST EQUIPMENT**

- A. Air compressor
- B. Air supply line
- C. Shut-off valves
- D. Pressure regulator
- E. Pressure relief valve
- F. Stop watch
- G. Plugs
- H. Pressure gauge, calibrated to 0.1 psi

**2.03 INFILTRATION TEST EQUIPMENT**

- A. Weirs

**2.04 DEFLECTION TEST EQUIPMENT**

- A. Go, No-Go mandrels
- B. Pull/retrieval ropes

**PART 3 - EXECUTION****3.01 TESTING MANHOLES**

- A. General: Testing using air shall be done whenever possible prior to backfilling to assist in locating leaks. Joint repairs are to be done on both outside and inside of the joint to ensure a permanent seal. Manholes shall be tested with manhole frame set in place.
- B. Vacuum test in accordance with ASTM C1244 and as follows:
  1. Plug all pipe openings; take care to securely brace the plugs and pipe.
  2. Inflate the compression band to effect a seal between the vacuum base and the structure; connect the vacuum pump to the outlet port with the valve open; draw a vacuum to 10" of Hg; close the valve; start the test.
  3. Test:
    - a. Determine the test duration for the manhole from the following table:

VACUUM TEST TABLE  
Manhole Diameter    Test Period

48"	60 sec.
60"	75 sec.
72"	90 sec.

- b. Record the vacuum drop during the test period; if the vacuum drop is greater than 1.0" of Hg during the test period, the manhole shall be repaired and retested; if a vacuum drop of 1" of Hg does not occur during the test period, the test shall be discontinued and the manhole will be accepted.
- c. If the vacuum test fails to meet a 1" Hg drop in the specified time after repair, the unit shall be subjected to repair and retest as necessary.



**3.02 PIPELINE PREPARATION**

- A. Backfill trenches in accordance with Section 02221.
- B. Flush pipeline to remove debris; collect and dispose of flushing water and debris.
- C. Clean pipelines by propelling a snug fitting rubber ball through the pipeline with water from the upstream manhole to the downstream manhole.
- D. TV Inspection of Pipeline:
  - 1. All new sewer shall be televised. Refer to Section 02312.
- E. Plug outlets, wye-branches and laterals; brace plugs to offset thrust.

**3.03 TESTING GRAVITY SEWER PIPELINES**

- A. Low-pressure Air Test:
  - 1. Test each newly installed section of gravity sewer line between manholes.
  - 2. Slowly introduce air pressure to approximately 4.0 psig.
    - a. If ground water is present, determine its elevation above the springline of the pipe for every foot of ground water above the springline of the pipe, increase the starting air test pressure reading by 0.43 psig; do not increase pressure above 10 psig.
  - 3. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or the increased test pressure as determined above if ground water is present. Start the test.
  - 4. Test:
    - a. Determine the test duration for a sewer section with a single pipe size from the following table. No allowance will be made for laterals.

**AIR TEST TABLE**  
Minimum Test Time for Various Pipe Sizes

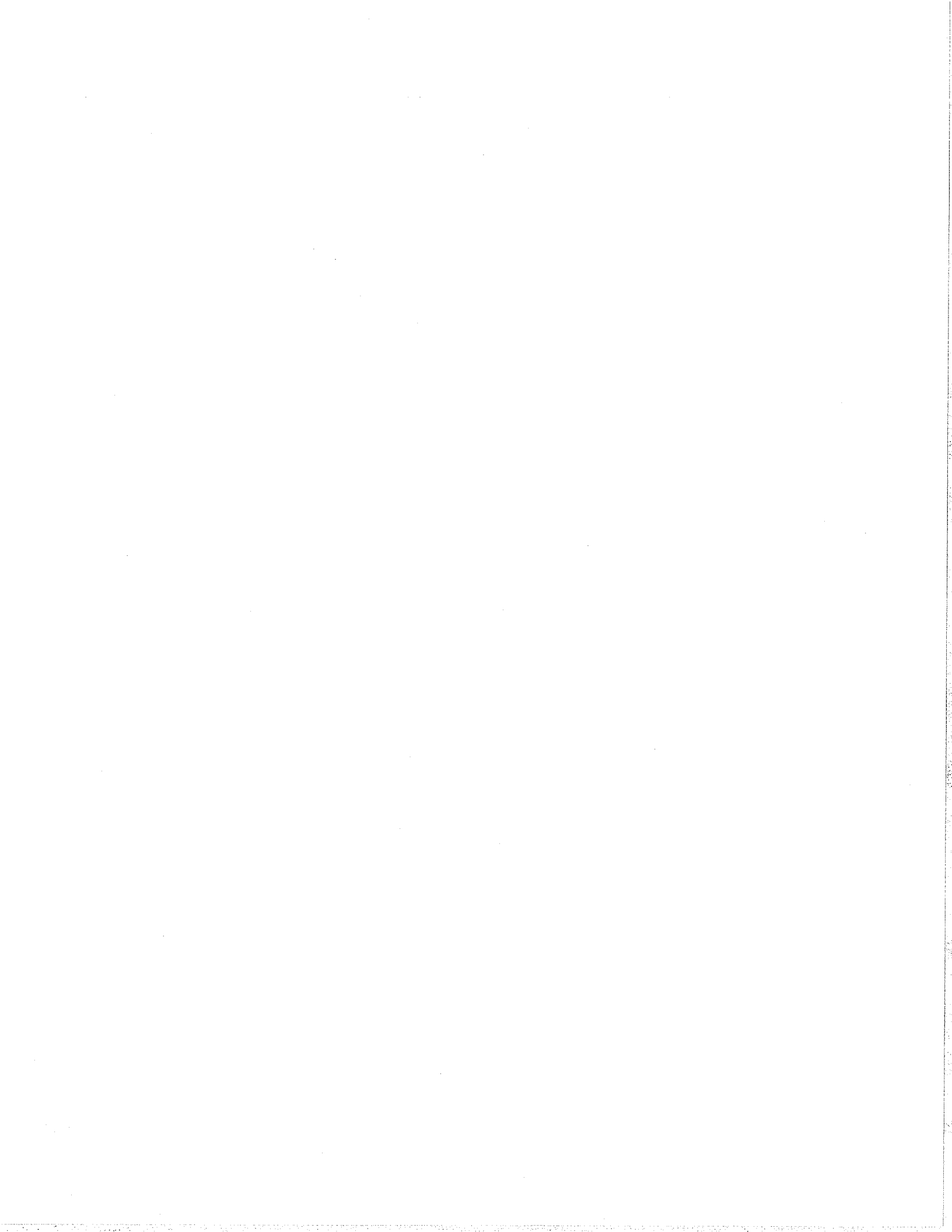
Nominal Pipe Size, inches	T(time), min/100 ft	Nominal Pipe Size, inches	T(time), min/100 ft.
3	1.0	21	5.0
4	1.1	24	5.5
6	1.5	27	6.25
8	2.0	30	7.0
10	2.5	33	8.0
12	3.0	36	8.5
15	3.5	42	10.0
18	4.25	48	11.5

- b. Record the drop in pressure during the test period; if the air pressure has dropped more than 1.0 psig during the test period, the line is presumed to have failed; if the 1.0 psig air pressure drop has not occurred during the test period, the test shall be discontinued and the line will be accepted.
  - c. If the line fails, determine the source of the air leakage, make corrections and retest; the Contractor/Developer has the option to test the section in incremental stages until the leaks are isolated; after the leaks are repaired, retest the entire section between manholes.
- B. Infiltration Test:
1. Use only when gravity pipeline is submerged in ground water a minimum of 4 feet above the crown of the pipe for the entire length being tested; obtain prior approval of the Engineer.
  2. Maximum Allowable Infiltration: 100 gallons per inch of pipe diameter per mile per day for any one section under test, including the allowances for leakage from manholes. This test shall be performed with a minimum positive head of two feet.

### **3.04 DEFLECTION TESTING OF PLASTIC SEWER PIPE**

- A. Perform vertical ring deflection testing on all portions of PVC and ABS sewer piping, in the presence of the Engineer, after backfilling has been in place for at least 30 days but not longer than 12 months.
- B. The maximum allowable deflection for installed plastic sewer pipe shall be limited to 5% of the original vertical internal diameter.
- C. Perform deflection testing using a properly sized rigid ball or 'Go, No-Go' mandrel; the rigid ball(s) or mandrel(s) shall be provided at the Contractor's/Developer's expense and subject to the approval of the Engineer.
- D. The rigid ball or mandrel shall have a diameter not less than 95% of the base or average inside diameter of the pipe as determined by the specific ASTM Specification to which the pipe is manufactured. The pipe shall be measured in compliance with ASTM D2122.
- E. The test shall be performed without mechanical pulling devices.
- F. Pipe exceeding the allowable deflection shall be located, excavated, replaced, and retested.

**END OF SECTION**



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**SECTION 02653**  
**TESTING AND DISINFECTING WATER MAINS****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work Of This Section Includes, but is not limited to:
1. Testing water pipeline:
    - a. Hydrostatic pressure testing
    - b. Leakage testing
  2. Disinfecting:
    - a. Preliminary flushing
    - b. Chlorine application methods
    - c. Final flushing
    - d. Bacteriological testing
- B. Related Work Specified Elsewhere:
1. Section 02615 - Water Mains
  2. Section 02640 - Valves and Fire Hydrants
  3. Section 02642 - Water Service Connections

**1.02 QUALITY ASSURANCE**

- A. Testing Agency: Bacteriological testing shall be performed by a testing laboratory approved by the State Health Department, engaged and paid for by the Contractor/Developer and approved by the Engineer.
- B. Referenced Standards:
1. American National Standards Institute (ANSI); American Water Works Association (AWWA):
    - a. ANSI/AWWA B300 Standard for HypoChlorites
    - b. ANSI/AWWA B301 Standard for Liquid Chlorine
    - c. ANSI/AWWA C600 Standard for Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances, Section 4, Hydrostatic Testing
    - d. AWWA C651 Standard for Disinfecting Water Mains
- C. Test Acceptance:
1. No test will be accepted until the results are below the specified maximum limits.
  2. The Contractor/Developer shall, at his own expense, determine and correct the sources of leakage and retest until successful test results are achieved.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Test Procedures: Submit a testing sequence schedule including a list of testing equipment to be used.
- C. Certificates:
  - 1. Submit a Statement of Compliance, together with supporting data, from the materials suppliers attesting that the chlorine form composition provided meets specification requirements.
  - 2. Submit, prior to starting testing, certification attesting that the pressure gauges to be used have been calibrated and are accurate to the degree specified in Part 2, Products.
- D. Test Reports: Submit two copies of the testing laboratory certified test reports of each bacteriological test.

**PART 2 - PRODUCTS****2.01 HYDROSTATIC TEST EQUIPMENT**

- A. Hydro pump
- B. Pressure hose
- C. Test connections
- D. Water meter
- E. Pressure gauge, calibrated to 0.1 lbs./sq.in.
- F. Pressure relief valve

**2.02 DISINFECTING CHEMICALS**

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

**PART 3 - EXECUTION****3.01 PREPARATION**

- A. Backfill trenches in accordance with Section 02221.

- B. Provide the water line under test with reaction thrust blocking; hydrostatic testing shall not begin until the concrete thrust blocking has set; allow 2000 psi 28-day strength concrete to set (cure) for a minimum of 7 days prior to testing; if High Early Strength 3,000 psi 3-day strength concrete is used, hydrostatic testing may not begin until the concrete has set a minimum of 2 days.

### 3.02 TESTING WATER LINES

- A. Hydrostatic Testing: Test each newly installed section of water line by hydrostatic test procedure in accordance with the recommended practice established by AWWA, Standard C600, Section 4, hydrostatic testing, as modified hereinbelow.
1. Pressure Test:
    - a. Conduct pressure tests for a period of not less than 2 hours at 150 psig or at a pressure of not less than 1.25 times the working pressure based upon the elevation of the lowest point in line under test corrected to the elevation of the test gauge, but shall not exceed 150 psi.
  - B. Observe joints, fittings and valves under test; remove and renew cracked pipe, joints, fittings, and valves showing visible leakage; retest.
    1. Leakage Testing:
      - a. Conduct the leakage test concurrently with the pressure test for the 2-hour period at the specified test pressure.
      - b. Water pipe installation is deemed to have failed the leakage test if the leakage obtained is greater than that determined by the formula or the leakage exceeds 10 gal per inch pipe diameter in 24-hours.

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

Where:

L is allowable leakage in gallons/hour

N is number of joints in the section tested

D is nominal diameter of pipe in inches

P is average test pressure in pounds per square inch gauge

- c. If the line under test contains sections of various diameters, the allowable leakage shall be the sum of the computed leakage for each size.
- d. If test results indicate that the pipe has leakage greater than specified, locate and repair the defective joints, fittings, pipe or valves and retest until leakage is within allowable limits; repair visible leaks regardless of the amount of leakage.

### 3.03 DISINFECTION

- A. General:
1. After completion of satisfactory pressure and leakage testing, disinfect the water lines in accordance with the recommended practice established in AWWA Standard C651; conduct water line disinfection in the following steps:
    - a. Preliminary flushing
    - b. Chlorine application
    - c. Final flushing
    - d. Bacteriological tests
- B. During construction, place calcium hypochlorite granules at the upstream end of the first section of pipe, at the upstream end of each branch main and at 500-ft. intervals. (Refer to Table 1 at the end of this section for quantity of granules to be used.)
1. **CAUTION:** This procedure must not be used on solvent welded plastic or on screwed joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.
- C. Preliminary Flushing - Use one of the following two methods:
1. Prior to disinfection, except when the tablet method is used, flush the line with pipe cleaning plugs or "pigs"; these "pigs" shall be polyurethane blown elastomer foam bullets hydraulically propelled; the "pigs" shall have the ability to negotiate fabricated mitered bends and short radius elbows and pass through tees, crosses, and multi-dimensional sizes of pipe and valves; the "pigs" shall be approved for use in potable water systems by governing regulatory agency; dispose of flushing water used with "pigs".
  2. Prior to disinfection, except when the tablet method is used, the main shall be filled to eliminate air pockets and shall be flushed to remove particulates; the flushing velocity in the main shall be not less than 2.5 fps unless the Engineer determines that conditions do not permit the required flow to be discharged to waste; (Refer to Table 3 at the end of this section for the rates of flow to produce a velocity of 2.5 fps in pipes of various sizes.) Flushing water shall be safely disposed of in a manner acceptable to the governing regulatory agency.
- D. Chlorine Form: The chlorine form to be applied to the system shall be either liquid chlorine, calcium hypochlorite or sodium hypochlorite; the Engineer's written approval of the chlorine form to be used is required.

**E. Chlorine Application:****1. Tablet Method:**

- a. **CAUTION:** The tablet method cannot be used unless the main is kept clean and dry during construction because the preliminary flushing step must be eliminated; do not use the tablet method in mains having diameters over 24 in.
- b. During construction, place 5g calcium hypochlorite tablets in each section of pipe and place one such tablet in each hydrant, hydrant branch and other appurtenances to achieve the required dose of 25 mg/l available chlorine; (Refer to Table 2 at the end of this section for the proper number of 5g calcium hypochlorite tablets needed.) attach all the tablets inside and at the top of the main with an adhesive; there shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe; attach the tablets before the pipe section is placed in the trench and mark their position on the section so it can be readily determined that the pipe is installed with the tablets at the top.
- c. When pipeline installation is completed, fill the main with water at a rate such that water within the main will flow at a velocity not greater than 1 fps; retain the water in the pipe for 24 hours; if the water temperature is less than 41°F, retain the water in the pipe for at least 48 hours; position valves so that the strong chlorine solution in the main being treated will not flow into water mains in active service.

**2. Continuous Feed Method:**

- a. The continuous feed method consists of placing calcium hypochlorite granules in the main during construction (at the option of the Engineer), completely filling the main to remove all air pockets, flushing the completed main to remove particulates and filling the main with potable water chlorinated so that after a 24-hour holding period in the main there will be a free chlorine residual of not less than 10 mg/l.
- b. At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water entering the new main will not have less than 25 mg/l free chlorine; assure this concentration is provided by measuring chlorine concentration; Engineer shall approve of the method before proceeding with disinfection.
- c. During the application of chlorine, position valves so that the strong chlorine solution in the main being treated will not flow into water mains in active service.
- d. Retain the chlorinated water in the main for a 24-hour period. During the 24-hour treatment, operate valves, curb stops and hydrants in order to disinfect appurtenances and pipe branches; at the end of



this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/l of free chlorine.

3. Slug Method:

- a. The slug method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/l in order that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 hours.
- b. Chlorinate the main as specified in AWWA C651, Section 5.3.
- c. During the 3-hour treatment, operate all valves, curb stops and hydrants in order to disinfect appurtenances and pipe branches.

F. Final Flushing:

1. Flush the heavily chlorinated water from the system under treatment until the chlorine concentration in the water leaving the system is no higher than that generally prevailing in the system or is acceptable for domestic use.
2. Comply with Federal, State and local laws when discharging the flushed chlorine solution.

G. Bacteriological Testing:

1. After final flushing is completed and before the water main is placed in service, test the line for bacteriological quality.
2. Collect a minimum of one sample at the end of each new main for each test, and one sample of the incoming water from the existing water system for comparison.
3. Collect samples in sterile bottles treated with sodium thiosulphate.
4. Sampling tap shall consist of corporation stop installed in the main with copper tube gooseneck assembly through which a portion of the chlorinated water has been allowed to flow; sterilize the tap, valves and pipe in a manner similar to the sterilization of the main; do not use hose or fire hydrant to collect samples.
5. Provide bacteriological test reports to the Borough and the Engineer; failure to meet State health standard requirements will be cause for the Contractor/Developer to rechlorinate and retest the system, at no additional cost to the Borough.
6. If trench water has entered the main, or if in the opinion of the Engineer, excessive quantities of dirt or debris have entered the main, take bacteriological samples at intervals of approximately 200 ft. from the water that has stood in the main for at least 16 hours after final flushing has been completed.

SEE ATTACHED TABLES  
END OF SECTION

TABLE 1  
Ounces of Calcium Hypochlorite Granules to be Placed at  
Beginning of Main and at each 500-ft Interval

Pipe Diameter(in.)	Calcium Hypochlorite Granules (Oz)
4	1.7
6	3.8
8	6.7
10	10.5
12	15.1
14 and larger	$D^2 \times 15.1^*$

\*D is the inside pipe diameter in feet  $D = \frac{d}{12}$

TABLE 2  
Number of 5g Hypochlorite Tablets Required for Dose of 25mg/l <sup>a</sup>

Pipe Diameter (inches)	Length of Pipe Section (feet)				
	13	18 or less	20	30	40
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

<sup>a</sup> Based on 3.25g available chlorine per tablet, any portion of tablet rounded to next higher number.

TABLE 3  
Required Flow and Openings to Flush Pipelines \*  
(40 psi Residual Pressure in Water Main)

Pipe Diameter (inches)	Flow Required to Produce 2.5 fps Velocity in Main (gpm)	Size of Tap, in. (mm)			Hydrant Outlets	
		1(25)	1½ (38)	2(51mm)	No. of Taps on Pipe**	Number Size (inches)
4	100	1	--	--	1	2-1/2
6	220	--	1	--	1	2-1/2
8	400	--	2	1	1	2-1/2
10	600	--	3	2	1	2-1/2
12	900	--	--	2	2	2-1/2
16	1600	--	--	4	2	2-1/2

\* With a 40 psi pressure in the main with the hydrant flowing to atmosphere, a 2-1/2" hydrant outlet will discharge approximately 1000 gpm; a 4-1/2" hydrant nozzle will discharge approximately 2500 gpm.

\*\* Number of taps on pipe based on discharge through 5 ft. (1.5 m) of galvanized iron (GI) pipe with one 90° elbow.

TABLE 4  
Chlorine Required to Produce 25 mg/l Concentration in 100 Ft. of Pipe

Pipe Diameter (inches)	100% Chlorine lbs.	1% Chlorine Solution Gal.
4	.013	.16
6	.030	.36
8	.054	.65
10	.085	1.02
12	.120	1.44
16	.217	2.60

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**SECTION 02731  
WELL ABANDONMENT****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The work of this Section includes, but is not limited to, well abandonment.

**1.02 SCOPE**

- A. It is the intent and purpose of this Section to prescribe the abandonment of a drilled and cased public water supply well.
- B. The Contractor shall provide all materials, labor and equipment necessary to complete or perfect any portion of the Work in a substantial manner and in compliance with the specifications requirements, implied or intended, without additional compensation including materials, devices or methods peculiar to the apparatus or system furnished and installed by the Contractor.
- C. The Owner reserves the right to exclude or limit items of Work described in these specifications.
- D. The items of Work include, but are not limited to:
  - 1. Well Abandonment and Sealing

**1.03 WELL ABANDONMENT CRITERIA**

- A. Abandonment of wells shall conform to the American Water Works Association (AWWA) Standard A100 for Deep Wells, and to the Pennsylvania Department of Environmental Protection (DEP) rules and regulations.
- B. Well driller must be certified.
- C. Well driller shall complete and execute Well abandonment form at the end of this Section and submit to Owner upon completion of Work.

**1.04 SCHEDULING AND SEQUENCING**

- A. A minimum of ten (10) days notice must be provided to Owner and DEP prior to abandoning well.
- B. Commence work promptly and execute in such order and at such times as is most expedient to proceed with the work with safety during all stages of construction.

- C. The Engineer reserves the right to direct that certain portions of the work be commenced and completed before work on other portions is started.

## **PART 2 - PRODUCTS**

### **2.01 NEAT CEMENT GROUT**

- A. Neat Cement Grout:
1. Grout shall consist of a mixture of API Class G (or Class B similar to ASTM C150 Type II) and water in the ratio of 0.67 cu. ft. of water per 94 lb. sack weighing approximately 118 lbs./cu. ft. A maximum of six (6) percent by weight bentonite and two (2) percent by weight of calcium chloride may be added.

## **PART 3 - EXECUTION**

### **3.01 PUMP AND PIPING REMOVAL**

- A. Remove and properly dispose of submersible well pump, piping, and wiring using appropriate well construction equipment.
- B. Fill open bore hole with neat cement grout to near the bottom of the casing using a grout pump or tremie tube.
- C. Attempt to remove entire length of well casing. Attempts must continue for a minimum of one (1) hour. If casing cannot be removed, excavate around well and remove to five (5) foot below grade.
- D. Continue filling well as specified above with neat cement grout to top of casing or five (5) foot below grade.
- E. Backfill excavation with suitable material and restore surface to original condition.

SEE ATTACHED EXHIBIT

**END OF SECTION**

**WELL ABANDONMENT FORM**

CONTRACTOR/AGENT: \_\_\_\_\_ REGISTRATION NO. \_\_\_\_\_

DATE: \_\_\_\_\_ TYPE OF SITE OR PROGRAM: \_\_\_\_\_

1. WELL LOCATION: (Show sketch of location on back of this Form.)

Municipality: \_\_\_\_\_ County: \_\_\_\_\_

Quadrangle: \_\_\_\_\_  
(Road, community, subdivision, lot no.)

Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_

2. OWNER AND ADDRESS: \_\_\_\_\_

3. TOPOGRAPHY: (Circle) hilltop, slope, stream terrace, valley, stream channel, draw, local depression, flat

4. USE OF WELL: \_\_\_\_\_ WELL DIAGRAM: sketch a diagram showing depth of well

5. DEPTH OF WELL: \_\_\_\_\_ DIAMETER casing (if present) \_\_\_\_\_,  
grouting OF WELL: \_\_\_\_\_ materials, perforations, etc.

6. AMOUNT OF CASING REMOVED: \_\_\_\_\_ DIAMETER: \_\_\_\_\_

7. SEALING MATERIAL:

	<u>Neat Cement</u>	<u>Sand Cement</u>
Bags (94 lb)	_____	_____
Gals of Water	_____	_____
Yds of Sand	_____	_____

OTHER MATERIAL: \_\_\_\_\_ AMOUNT: \_\_\_\_\_

8. EXPLAIN METHOD OF EMPLACEMENT OF MATERIAL: \_\_\_\_\_

9. CERTIFICATION: We hereby certify that this well abandonment record is true and exact, and was accomplished on \_\_\_\_\_ day of the month of \_\_\_\_\_, \_\_\_\_\_, with our active participation and that we are qualified to participate in such abandonment actions.

SIGNATURE OF PARTICIPANT: \_\_\_\_\_

DATE: \_\_\_\_\_ ADDRESS: \_\_\_\_\_

SIGNATURE OF PARTICIPANT: \_\_\_\_\_

DATE: \_\_\_\_\_ ADDRESS: \_\_\_\_\_

NYE, J.D., September 1987, Abandoned Wells - How One State Deals with Them, Water Well Journal, pp. 41-46.

RENZ, M.E., May 1989, In Situ Decommissioning of Ground Water Monitoring Wells, Water Well Journal, pp. 58-60.

U.S. ENVIRONMENTAL PROTECTION AGENCY, 1975, Manual of Water Well Construction Practices, Office of Water Supply, EPA-570/9-75001.

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**SECTION 02732  
TEST WELL DRILLING****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The work of this Section includes, but is not limited to, Test well drilling

**1.02 SCOPE**

- A. It is the intent and purpose of this Section to prescribe the construction of a single-cased drilled test well.
- B. The Contractor/Developer shall provide all materials, plant, labor and equipment necessary to complete or perfect any portion of the Work in a substantial manner and in compliance with the specifications requirements, implied or intended, without additional compensation including materials, devices or methods peculiar to the apparatus or system furnished and installed by the Contractor/Developer.
- C. The Owner reserves the right to exclude or limit items of Work described in these specifications.
- D. The items of Work include, but are not limited to:
1. Test Well Drilling
  2. Casing Installation
  3. Estimating Well Yield
  4. Well Abandonment and Sealing

**1.03 WELL CRITERIA**

- A. Test wells shall conform to the American Water Works Association (AWWA) Standard A100 for Deep Wells, and to the Pennsylvania Department of Environmental Protection (PADEP) rules and regulations.

**1.04 SCHEDULING AND SEQUENCING**

- A. Commence work promptly and execute in such order and at such times as is most expedient to proceed with the work with safety during all stages of construction.



**PART 2 - PRODUCTS****2.01 CASING PIPE**

- A. All casing pipe shall be new, comply with ASTM A53 and of minimum weight and dimensions as follows:

<u>Nominal Size</u>	<u>Outside Diameter</u>	<u>Wall Thickness</u>	<u>Weight Per Foot Plain Ends</u>
6"	6.625"	0.280"	18.97 lbs.
8"	8.625"	0.322"	28.55 lbs.
10"	10.750"	0.365"	40.48 lbs.
12"	12.750"	0.375"	49.56 lbs.

Minimum wall thickness for various depths specified in AWWA A100 shall be maintained provided the minimum weight and dimensions specified hereinbefore are complied with.

- B. Casing shall have approved drive shoes, either welded or screwed joints, heat treated SAE 1040 steel ring, Rockwell C hardness 30-32.

**PART 3 - EXECUTION****3.01 WELL CONSTRUCTION**

- A. Construct wells by use of a cable-tool (Churn-type) or air rotary drilling machine.
- B. Provide test well with a casing pipe installed to a firm seating and bottom sealed in bedrock. Extend casing a minimum of 3 feet above grade.

**3.02 SUBSURFACE SAMPLES AND DRILLING RECORDS**

- A. Well Log:
1. Maintain an accurate log of the well as it is being drilled on a form similar to Exhibit I, attached at the end of this Section.
  2. Record the location of the top and bottom of each stratum penetrated and the elevation at which each water-bearing zone is encountered.
  3. Measure and record static water level in the well at the beginning and end of each workday.
  4. Take samples of the formation at every change in strata and at least every 5-feet of drilled depth.

**3.03 ESTIMATION OF WELL YIELD**

- A. During drilling of the well, estimate as closely as possible the yield of the well based on approximate measurements of well overflow by weir, bucket, bailer or other appropriate method.
- B. Maintain a record of the yielding zones in the well, including the depth of each zone and the approximate quantity of water encountered in gallons per minute (gpm).

**3.04 WELL DEVELOPMENT**

- A. Develop the well by industry-standard methods and in accordance with AWWA A100 to obtain maximum yield per foot of drawdown.
- B. Development shall not exceed 2-hours without written authorization by the Owner.

**3.05 TESTING**

- A. After completion of the well to the required depth, the Owner may direct the Contractor/Developer to:
  - 1. Cease work and seal the well, or
  - 2. Further develop and test the well.

**3.06 TEMPORARY CASING CAP**

- A. After completion of the test well, install a suitable threaded, flanged, or welded cap or compression seal designed and constructed to prevent either tampering with the well or the entrance of contaminants into it.

**3.07 TEST WELL ABANDONMENT AND SEALING**

- A. If a test well is not considered successful, seal and plug the test well.
- B. PADEP's guidance on well abandonment procedures shall be followed.
- C. Restore ground surface to as nearly as possible to its original condition.

SEE ATTACHED EXHIBIT

**END OF SECTION**



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**SECTION 02734  
PRODUCTION WELL DEVELOPMENT****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this Section includes, but is not limited to, development of a test well into a production well.
- B. Related Work specified elsewhere:
  - 1. Section 02732 - Test Well Drilling

**1.02 SCOPE**

- A. Modification of a minimum 6" diameter test well to a minimum 6" diameter single-cased potable water well for municipal supply and the associated well development and testing.
- B. Contractor/Developer shall provide all materials, plant, labor and equipment necessary to complete or perfect any portion of the Work in a substantial manner and in compliance with specification requirements, implied or intended, including materials, devices or methods peculiar to the apparatus or system furnished and installed by the Contractor/Developer.
- C. All work must be performed in accordance with PA DEP regulations and policy.

**1.03 SCHEDULING AND SEQUENCING**

- A. Commence work promptly and execute in such order and at such times as are most expedient to permit work to proceed with safety during all stages of construction.
- B. The Engineer reserves the right to direct that certain portions of the work be commenced and completed before work on other portions is started.

**PART 2 - PRODUCTS****2.01 NEAT CEMENT GROUT**

- A. AWWA A100, Section 7.3.1 - Prepare with not more than 5 gallons potable water per sack.

**2.02 CASING PIPE**

- A. New steel pipe, ASTM A120 and AWWA A100, having minimum weight and dimensions as follows:

Nominal Size	Outside Diameter	Minimum Thickness	Weight Per Foot Plain Ends
6"	6.625"	0.280"	18.97 lbs.
8"	8.625"	0.322"	28.55 lbs.
10"	10.750"	0.365"	40.48 lbs.
12"	12.750"	0.375"	49.56 lbs.

- B. Provide casing with approved drive shoes. Casing may have either welded or screwed joints, heat treated SAE 1040 steel ring, Rockwell C hardness 30-32.

**PART 3 - EXECUTION****3.01 GENERAL**

- A. Developer shall coordinate all work with the Borough, beginning with plans to drill a test well. Communication to the Borough shall provide sufficient notice to coordinate Borough or Borough Engineer presence during all procedures as required. Communications shall be detailed and accurate.
- B. The intent of this Section is to prescribe the procedure for construction of single-cased municipal potable water production wells.

**3.02 WELL DEVELOPMENT AND CLEAN OUT**

- A. Surge and clean to the bottom of the well with one of the following techniques:
1. Surging and pumping with a solid or valved surge block closely fitting the diameter of the hole being surged; simultaneously pump with the surging at rates up to 1-1/2 times the design capacity of the well; periodically pump out fines drawn into the well.
  2. Air pressure surging with intermittent application of air through a rotary drill stem or air pipe until all zones of the well yield water free of turbidity when surged and backwashed; size the equipment to pump the well by the air-lift principle at 1-1/2 to 2 times the design capacity of the well.

**3.03 PLUMBNESS AND ALIGNMENT TEST**

- A. Conduct a plumbness and alignment test in the presence and to the satisfaction of the Borough.

- B. Perform the test following construction of the well and before test pump equipment is installed.
- C. Notify the Borough at least 24 hours in advance of scheduled time of testing.
- D. Records of deflection readings and all other pertinent information shall be kept and made a part of the permanent well log and record.
- E. Test the well for plumbness and alignment by lowering a 40' section of pipe, or similar rigid dummy of the same length, to the bottom of the well.
- F. The outer diameter of the pipe or dummy shall not be more than 1/2" smaller than the inside diameter of that part of the casing or hole being tested.
- G. The plumb shall pass freely the entire depth of the well.
- H. Should the plumb or dummy fail to move freely throughout the entire length of the casing and hole, or should the well vary from the vertical in excess of two-thirds of the smallest inside diameter of that part of the well being tested per 100 feet of depth, the plumbness and alignment of the well shall be corrected and retested by the Contractor/Developer at his own expense.
- I. Should the Contractor/Developer fail to correct the faulty alignment and plumbness, the Borough may refuse to accept the well.
- J. The Borough may waive the requirements for plumbness if in his judgement:
  - 1. The Contractor/Developer has exercised all possible care in constructing the well, and the defect is due to circumstances beyond his control;
  - 2. The utility of the completed well will not be materially affected; or
  - 3. The cost of necessary remedial measures will be excessive.
- K. In no event will the provisions of this Article with respect to alignment be waived.

### **3.04 WELL DISINFECTION**

- A. After the well has been inspected and/or modified as directed by the Borough, clean and disinfect the well.
- B. Remove all foreign substances including tools, rope, cement, and other materials from the well.
- C. Thoroughly swab the casing pipe top with alkali to remove oil, grease and joint dope.

- D. Prior to disinfection, scrub and clean the test pumping equipment of foreign material and install in the well.
- E. Disinfect the well in accordance with AWWA A100, Section 11 and as specified herein; add a stock chlorine solution, of sufficient strength to produce a 50 ppm residual concentration of available chlorine throughout the well; add the solution to the well at different intervals from top to bottom and then agitate to distribute it evenly throughout the well.
- F. The disinfecting agent shall be left in the well for a period of at least 12 hours.
- G. All accessible portions of the well above water level shall be maintained in a damp condition with water containing the required concentration of disinfecting agent for a period of not less than 30 minutes.
- H. After a contact period of 12 or more hours, pump the well to clear it of disinfecting agent.
- I. Exercise special care, taking whatever steps are necessary, to prevent potential damage to aquatic life or vegetation from the purged water.
- J. The Contractor/Developer shall discharge the disinfecting water at a reduced rate, over land, to nearest creek so that the chlorine concentration is less than 5 ppm or reduce the chlorine concentration by the addition of sulfur dioxide.

### **3.05 YIELD AND DRAWDOWN PUMPING TEST**

- A. All applicable requirements and regulations issued by the Potomac River Basin, PADEP, and Adams County concerning aquifer testing must be followed.
- B. A general understanding of the hydrogeologic structure of the pumping test area shall be reviewed from available publications data so that appropriate wells can be chosen as observation wells for the monitoring network. The monitoring network proposed to observe during the aquifer test must be clearly defined. Monitor as many onsite and offsite wells, springs, piezometers and surface water sources as are necessary to accurately describe the well/aquifer relationship. Existing Borough wells in the vicinity shall be monitored at the Borough's discretion.
- C. Monitor potential changes in stream flow and associated wetlands in the vicinity of the site. Install weirs and/or piezometers as necessary to make that assessment.

- D. Show on a map of appropriate scale the locations that will be observed during the aquifer test.
- E. Plot and analyze all observation well data. Analyze offsite effects and calculate aquifer parameters with the data collected during the aquifer test.
- F. An observation point may be an existing well with appropriate construction that is not being pumped during the aquifer test or a well constructed for the sole purpose of obtaining water level measurements. At least two observation points are required, although it is strongly recommended that a minimum of three be used as this will generally provide a more representative test and result in a better final analysis.
- G. Observation points shall be located at increasing distances from the pumping well so that at least one logarithmic cycle of distance-drawdown data is provided. A typical spacing would be approximately 100, 400 and 1,000 feet from the production well. Observation point locations will generally vary depending on the location of property boundaries, rock type, rock structure, inferred flow directions, existing well locations, and type of aquifer. Actual distances and orientation of observation points relative to the production well (pumping well) may be constrained by topographic limitations or land availability. In anisotropic aquifers, it is recommended that a pair (one in each direction) of observations wells be oriented perpendicular to the pumping well so that preferential flow can be evaluated.
- H. The effect of withdrawal on nearby wells, springs, wetlands, streams or other surface of subsurface water features shall also be monitored. As appropriate, water levels in wells shall be monitored and any available information (construction details, depth, diameter, geology, etc.) shall be included. Surface water bodies with no outflow such as ponds and wetlands shall be monitored via staff gages and/or piezometers. A piezometer may be installed adjacent to the surface water body being monitored, if the screened interval is representative of the aquifer material that is associated with the surface water body. Surface water bodies with outflow such as streams, ponds or wetlands shall be monitored in both the upstream and downstream directions via weirs, flumes, stilling wells and /or piezometers. Spring flow or stage shall be monitored utilizing weirs, flumes and piezometers to characterize the hydrogeologic effects of the pumping test withdrawal. The pumping well shall be fitted with a calibrated flow meter that provides a constant flow rate measurement and a totalizer.
- I. Prior to the aquifer test, background water level measurements shall be taken from the production well, all observation points and other water resources of concern. Electronic pressure transducers shall be used with automatic data logging equipment at no more than 15 minute intervals over at least a 72-hour



period to establish natural water level trends. Especially for confined aquifers, antecedent barometric pressure shall also be recorded, preferably on-site at the same frequency as the water levels.

- J. Each production well shall be evaluated for its maximum production yield, even though its actual permitted withdraw may be lower. A step-drawdown test and analysis shall be performed to determine a sustainable pumping rate for the aquifer test. There shall be at least 3 successive equal stages (more may be necessary) of increased pumping with the well's approximate maximum yield in the middle of the three stages. At each step, the pumping rate is held constant generally for 30 minutes to 1 hour to assess drawdown response. The intent is to reach a pseudo steady state during the two initial steps. The pumping rate is increased at a constant fraction (e.g., increments of one-third for 3 steps) with the next to last step having a rate equal to the wells maximum production rate. Drawdown in the pumping well shall be recorded every 5 minutes during each step with automatic electronic equipment. When a step-drawdown test is performed prior to the aquifer test, water levels must be allowed to recover to at least 90 percent of the original prepumping level. The constant-rate aquifer test may not be a continuation of the last step of the step-drawdown test. The data produced from the step test must clearly exhibit the well's maximum sustainable yield.
- K. The constant rate pumping test shall be conducted for a period of 72 hours. Electronic pressure transducers shall be used with automatic data logging equipment. A logarithmic cycle shall be used for the pumping well and any monitoring well that may potentially have an instantaneous reaction to the pumping well drawdown. The logarithmic scale shall be used for both drawdown and recovery to allow details of the early drawdown and recovery curves to be evaluated. The following is a recommended schedule:
- |                   |                  |
|-------------------|------------------|
| 0-5 minutes:      | every second     |
| 5-10 minutes:     | every one minute |
| 10-30 minutes:    | every 5 minutes  |
| After 30 minutes: | every 15 minutes |

Prior to the 72-hour constant pumping test, the totalizer on the flow meter shall be recorded. The flow meter totalizer shall be recorded again when the pump is turned off at the end of the 72-hour pumping period so that an average pumping rate can be established.

- L. After termination of the test, water level recovery in the production well and observation points shall be recorded using the same frequency for draw down measurements, with the time that pumping stops as the starting time. A logarithmic scale shall be utilized in the pumping well so that early recovery data can be clearly recorded. For other water resources of concern (other than

the pressure transducers), water levels or flows shall be recorded every 1 to 3 hours. The recovery period must be monitored for at least 24 hours or until water levels have recovered by 90 percent, whichever is longer.

- M. PADEP shall be notified prior to any aquifer testing.
- N. Review the Surface Water Identification Protocol (SWIP) requirements and determine if they are applicable. Contact PADEP at least two weeks in advance of the aquifer test to schedule a new source microscopic particulate evaluation (MPE), if necessary.
- O. The production well shall be pumped at maximum sustainable rate as determined by the step-drawdown test and discharge must be kept within 5 percent of the constant rate.
- P. The discharge rate must be checked frequently at the beginning of the test and periodically throughout the test. Significant variations in pumping rates may be grounds for rejecting the results of an aquifer test. The discharge must be conveyed away from the pumping well, observation wells and other monitoring points to prevent artificial recharge of the aquifer.
- Q. All applicable local and state erosion and sedimentation controls must be adhered to. The county conservation district must be contacted to determine if an erosion and sedimentation plan is required for the drilling and aquifer test discharges.
- R. PADEP approval is required to discharge the water from the aquifer test directly into any of the waters of the Commonwealth.
- S. Wells drilled as observation points shall eventually be converted to properly constructed (grouted annular openings and locking well caps) monitoring wells or they shall be properly abandoned. Refer to the AWWA standard for water wells or to PADEP's guidance on well abandonment for information on proper well abandonment.
- T. Upon completion, the following post-drilling information must be submitted as part of and in addition to the permit application. The information must be submitted in a hydrogeologic report signed and sealed by a professional geologist licensed in the Commonwealth of Pennsylvania. The report shall include the following information:
  - 1. Geologic setting of the project area with emphasis on hydrogeologic aspects. Supply appropriate citations if taken from published literature.
  - 2. Lithologic log for each well drilled, provided by a qualified geologist. The log shall identify:

- a. Lithology, color, minerals, grain size and shape, sorting, nature of contact, etc.
  - b. All formation changes.
  - c. All water bearing zones and associated yields.
  - d. Static water level.
3. As-built cross section for each well showing:
- a. Type, size, weight and depth of all casing.
  - b. Drive shoe(s).
  - c. Amount and type of grout.
  - d. Static water level.
  - e. Screened intervals.
  - f. Water bearing zones with associated yields.
4. Minimum 72-hour constant rate aquifer test data and analysis. State methods of analysis used (i.e., Theis Method) along with justification for method and any variations from method assumptions. Aquifer characteristics shall be determined using time and distance drawdown methods, along with appropriate justification and discussion. Note that fluctuating flow rates or excessive precipitation during the aquifer test may invalidate the aquifer test. Include the following information:
- a. Pre-pumping static water level.
  - b. Depth of pump setting.
  - c. Starting and ending time of test cycles.
  - d. Pumping rate.
  - e. Step-test drawdown data and semi-log graph. Log-log, and /or linear plots may also be applicable for diagnostic purposes.
  - f. Semi-log time-drawdown curve(s) for production and observation points. Log-log, and /or linear plots may also be applicable for diagnostic purposes.
  - g. Semi-log time-recovery curve(s), for production and observation points. Log-log, and /or linear plots may also be applicable for diagnostic purposes.
  - h. Plot recovery draw down against ratio  $t/t'$  in the manner found in Driscoll.
  - i. Identify and explain irregularities, abrupt slope changes, etc. in any of the above-mentioned graphs and curves.
  - j. Raw draw down and recovery data from the production well and all observation points - include time since pumping began (in minutes), water elevations (from below ground level), draw down (in feet and tenths of feet), and discharge (in gpm). This data shall be summarized in a Microsoft Excel spreadsheet.
  - k. Distance-draw down curve(s) - must have at least two observation points for reference.
  - l. Precipitation.
5. Aquifer characteristics--show equations used, units and calculations.
- a. Hydraulic conductivity.

- b. Transmissivity.
- c. Storage coefficient.
- d. Specific capacity.
6. Dependable well yield with justification.
7. Monitor as many onsite and offsite wells, springs, piezometers and surface sources as are necessary to accurately describe the well/aquifer relationship. Install weirs or piezometers as necessary to monitor potential changes in stream flow. Plot and analyze all observation well data. Analyze off site effects and calculate aquifer parameters with the data collected during the aquifer test.
8. Any other information that describes the hydraulic characteristics of the aquifer and demonstrates the suitability of the proposed source.
9. All graphs, charts, analysis etc. must be clearly labeled and self-explanatory. Reference all maps and aquifer analysis methods. The calculations and conclusions in the hydrogeological report must be easily understood and able to be reproduced given the data provided.
10. Provide a plot plan or detailed sketch that clearly shows:
  - a. Production and observation point locations.
  - b. Discharge point.
  - c. Nearby private and public wells.
  - d. Pre-pumping water table contours or potentiometric surface; show natural groundwater flow direction.
  - e. Estimated zone of contribution.
  - f. Zone of influence.
  - g. Zone I wellhead protection area.
  - h. Surface water bodies, including wetlands.
  - i. Aquifer test monitoring and discharge points.
  - j. Sources of contamination within the zone of contribution.
11. Include the following sampling results:
  - a. New source sampling matrix for each production well.
  - b. Microscopic Particulate Analysis, if applicable, for each production well.
12. A copy of the completed Water Well Completion Report.
13. Comments from the Potomac River Basin Commission if their approval is required.
14. Copies of any executed deed restrictions that show the supplier's ability to control the Zone I wellhead protection area.
15. Describe potential impacts that pumping the new well(s) will, or could have, on adjacent wetlands, surface water bodies, private wells, springs or other adjacent surface and subsurface water features. Discuss how the new source is hydraulically connected to the impacted feature, the anticipated extent of impact, and any proposed remediation or mitigation.

**3.06 WATER SAMPLES AND ANALYSES**

- A. Collect and test the water from the well according to the requirements set forth in the Pennsylvania Department of Environmental Protection's (PADEP's) New Source Sampling Requirements and as required by PADEP for the Borough.
- B. Unless otherwise specified and/or required by PADEP, bacteriological, radiological and chemical quality tests shall be taken during the final hour of the yield and draw down test, and samples shall be "split" with PADEP for comparison. Analysis performed shall be consistent with PADEP new source permitting requirements.
- C. The Contractor/Developer is responsible to assure that all PADEP-required analysis are conducted. All analysis is to be performed by a PADEP-certified laboratory.
- D. Perform a bacteriological test after the well has been disinfected and the chlorine has been removed by pumping; failure to obtain negative (good) bacteriological results will be cause to repeat the disinfection procedures and testing, at the expense of the Contractor/Developer.
- E. Sample Collection:
  - 1. Collect samples in sterilized or specially prepared bottles obtained from the PADEP-certified laboratory making the analyses.
  - 2. Collect samples from the pump discharge; avoid contamination of the water, the bottle, or the cap.
  - 3. Collect samples for chemical and radiological analyses in strict accordance with the testing laboratory sampling instructions.
  - 4. Special attention must be given to sample preservation as directed by the laboratory engaged to perform sample analyses.
  - 5. Collect three 100 ml samples for bacteriological analyses taken at not less than 15-minute intervals during the final two hours of the pumping test.
  - 6. Deliver samples, packed in ice, to the laboratory as soon as possible and in no event more than 20 hours after collection.
  - 7. Identify samples as to geographic location, date, time, method of collection, point of collection, water bearing formation(s), depth and diameter of well, water level and yield, and Contractor/Developer.
- F. Laboratory tests for physical, chemical, microbiological and radiological analyses shall be performed at the Contractor's/Developer's expense by a laboratory certified by the Pennsylvania Department of Environmental Protection; analytical techniques and methods shall be as prescribed in 'Standard Methods for the Examination of Water and Waste Water', a joint

publication of the American Public Health Association, American Water Works Association, and Water Pollution Control Federation.

### **3.07 WELL GROUTING**

- A. After the well has been tested and if found suitable for use, fill the annular space between the wall of the well bore hole and the casing pipe with grout.
- B. Place the grout mixture in one continuous mass, upward from the bottom of the casing through a grout pipe in such a manner as will insure the filling of the entire annular space.
- C. Drilling, pumping, or other well work will not be permitted within 72 hours after grouting is completed; grout shall not be placed prior to the pumping test without written approval of the Borough.
- D. The upper entrance of the casing shall be temporarily sealed during test pumping to preclude debris from filling the annular cavity between the casing and bore hole wall.

### **3.08 TEMPORARY CASING CAP**

- A. After completion of the well, install a suitable threaded or flanged cap or compression seal designed and constructed to prevent either tampering with the well or the entrance of contaminants into it.

### **3.09 WELL SCREEN AND CASING**

- A. If casing is needed to case-off overburden material in the well hole, and the remainder of the well hole is comprised of competent bedrock that will not require the installation of a well screen, the casing shall be made of carbon steel and shall be properly seated into competent bedrock. Prior to proceeding with the installation of any casing, the Borough of Bonneauville shall be notified.
- B. If well screen must be used to mitigate the effects of a collapsing well hole, both the screen and casing shall be made of stainless steel. The well screen shall be slotted by the manufacturer.

(SEE ATTACHED EXHIBITS)

**END OF SECTION**

EXHIBIT I  
RECORD OF WELL PUMPING TEST

Well No. \_\_\_\_\_

Sheet No. \_\_\_\_ of \_\_\_\_

Well Location: \_\_\_\_\_

Owner: \_\_\_\_\_

Physical Characteristics

Well Casing Elevation: \_\_\_\_\_ Ground Elevation: \_\_\_\_\_

Test Reference Point: \_\_\_\_\_

Test Pump Make, Model and Impeller: \_\_\_\_\_

Test Pump (Capacity and Head Characteristics): \_\_\_\_\_

Pump Setting (Feet below reference point): \_\_\_\_\_

Pumping Test Results

Time	GPM	Water Level (Ft Below Ref Pt)	Drawdown (Feet)	Water Clarity*

\* Clear, muddy, turbid, sandy, etc.

Date \_\_\_\_\_

Signature \_\_\_\_\_  
Firm \_\_\_\_\_







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**SECTION 02745**  
**VALVE VAULTS AND METER BOXES (CONCRETE)**

**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
1. Valve and Meter Vaults
  2. Meter Boxes
- B. Related Work specified elsewhere:
1. Section 02221 - Trenching, Backfilling & Compacting
  2. Section 02615 - Water Mains
  3. Section 02640 - Valves and Fire Hydrants
  4. Section 02642 - Water Service Connections
  5. Section 03310 - Cast-in-Place Concrete

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards:
1. Pennsylvania Department of Transportation (PennDOT): Publication 408/2000 Specifications, as Amended.
  2. American Society for Testing and Materials (ASTM):
    - a. ASTM A48 Specification for Gray Iron Castings
    - b. ASTM C139 Specification for Concrete Masonry Units
    - c. ASTM C270 Specification for Mortar for Unit Masonry
    - d. ASTM C890 Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
    - e. ASTM C891 Practice for Installation of Underground Precast Concrete Utility Structures
    - f. ASTM C913 Specification for Precast Concrete Water and Wastewater Structures

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Shop Drawings and Product Data: Submit, as requested, detailed shop drawings and manufacturer's latest published literature for meter boxes, vaults, and frames and covers.
- C. Certificates: Submit manufacturer's certification for all products attesting materials meet or exceed specification requirements.

**1.04 PRODUCT DELIVERY, HANDLING AND STORAGE**

- A. Exercise care in handling precast concrete products to avoid chipping, cracking and breakage.

**PART 2 - PRODUCTS****2.01 BASIC MATERIALS**

- A. Masonry Mortar: ASTM C270, Type S.
- B. Concrete Block: ASTM C139.
- C. Preformed Plastic Joint Sealant Compound: Self-adhering, cold-applied sealant conforming to Federal Specification SS-S-00210.
- D. Cast Iron: ASTM A48, Class 30 or better; free of bubbles, sand and air holes, and other imperfections.

**2.02 PRODUCTS**

- A. Concrete Vaults:
  - 1. Precast Reinforced Concrete Vault: Watertight precast reinforced concrete designed to ASTM C890, A16 live loading, and manufactured to conform to ASTM C913.
  - 2. Cast-in-Place Concrete Vault: Concrete shall be Class AA, Structures and Miscellaneous, in conformance with Section 704 and Table A of Publication 408/2000 Specifications; reinforcing shall meet ASTM A615, Grade 40.
  - 3. Either precast concrete or cast-in-place concrete is acceptable.
  - 4. Concrete vaults shall be complete with inlet and outlet pipe openings, access covers, and steps as required.
  - 5. Inlet and outlet pipe openings shall be provided with cast iron wall sleeves.
- B. Valve and Meter Vault Frames and Covers: Domestic cast iron. Contact surfaces machined and matched. Word "Water" cast into the cover.
- C. Precast Concrete Meter Boxes: (Use in sidewalks, lawns and other non-vehicle areas.)
  - 1. Minimum 4000 psi concrete.
  - 2. Minimum 2" wall thickness.
  - 3. Reinforcement: 6 x 6 10/10 wire mesh.
  - 4. Separate cast iron cover and lid.

- D. Meter Box Covers and Lids:
  - 1. Cast iron lid, minimum 12" opening.
  - 2. Words "Water Meter" cast into the lid.
  - 3. Bronze worm lock with standard waterworks pentagon bolt head.
  - 4. Lid with a recess to engage a lug on the key permitting the key to become a handle for lifting the lid.
  
- E. Valve Wrenches and Lid Keys:
  - 1. Cadmium plated cast steel.
  - 2. Supply keys and wrenches for each type vault and meter box; provide Owner with one set for each ten units, or a fraction thereof, installed.

### **PART 3 - EXECUTION**

#### **3.01 EXCAVATION**

- A. Excavate to the line and grade as specified in Section 02221.
  
- B. Location and depth of vaults and meter boxes as shown on the approved construction drawings.

#### **3.02 FOUNDATION**

- A. Provide compacted crushed stone subbase foundation for precast concrete structures; crushed stone shall meet AASHTO M43, Size 67.
  
- B. Construct subbase foundations for cast-in-place concrete and unit masonry structures on undisturbed earth.

#### **3.03 CONSTRUCTION**

- A. Meter Boxes: Provide precast concrete meter boxes for meters Size 1" and under; adjust meter box covers to finished grade.
  
- B. Vaults:
  - 1. Construct valve and meter vaults of precast or cast-in-place reinforced concrete.
  - 2. Do not erect masonry when ambient temperature is below 45°F, unless it is rising, and at no time when the temperature is below 40°F, except by written permission of the (Engineer) (Architect).
  - 3. Seal vault joints watertight with preformed plastic joint sealant compound. Apply asphalt waterproofing to exterior walls.
  - 4. Seal annular space between pipe and wall sleeves with mechanical seal consisting of interlocking synthetic rubber links shaped to fill the space

and assembled with bolts and a pressure plate under each bolt head and nut. Install cast iron vault covers and frames; adjust to finished grade elevation.

### **3.04 BACKFILLING**

- A. Backfill only after Engineer's inspection of the vault or meter box.
- B. Backfill as specified in Section 02221.

**END OF SECTION**

# **DIVISION 3 - CONCRETE**



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**SECTION 03310**  
**CONCRETE FOR UTILITY CONSTRUCTION****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of this section includes, but is not limited to:
1. Cast-in-place Cement Concrete Construction
  2. Reaction and Support Blocking
  3. Cradles and Encasement
- B. Related Work specified elsewhere:
1. Section 02221 - Trenching, Backfilling & Compacting
  2. Section 02575 - Paving Restoration
  3. Section 02601 - Manholes
- C. Applicable Standard Details:
1. 5120A Type B Drop Manhole Detail, PVC Pipe
  2. 5179 Concrete Cradle and Encasement Details
  3. 5187A Sloped Riser Lateral Detail
  4. 5187B Vertical Riser Lateral Detail
  5. 5195 Thrust Block for Vertical Bends
  6. 5196 Thrust Block for Bends, Tees, Caps

**1.02 REFERENCES**

- A. Pennsylvania Department of Transportation (PennDOT): Publication 408/2000 Specifications.
- B. American Society for Testing and Materials (ASTM):
1. ASTM C31 Methods of Making and Curing Concrete Test Specimens in the Field
  2. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
  3. ASTM C42 Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
  4. ASTM C94 Ready Mixed Concrete
  5. ASTM C143 Test Method for Slump of Portland Cement Concrete
  6. ASTM C172 Method of Sampling Fresh Concrete
  7. ASTM C173 Test Method for Air Content of Freshly Mixed Concrete - Volumetric Method
  8. ASTM C231 Test Method for Air Content of Freshly Mixed Concrete - Pressure Method



**1.03 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Submit certification from the concrete producer attesting that the cement concrete conforms to the State Specifications for the class of concrete being used.
- C. Submit certified results of compressive strength tests performed by an independent testing laboratory.
- D. Submit detailed shop drawings of reinforcing steel.

**PART 2 - PRODUCTS****2.01 CEMENT CONCRETE**

- A. Ready-mixed, conforming to Section 704, cement concrete, Pub. 408/2000 Specifications.
- B. Requirements for State approved batch plants, design computations and plant inspection shall not apply; the acceptability of concrete will be based on conformance with the Cement Concrete Criteria specified below and the results of the specified tests.
- C. Cement Concrete Criteria:
  - 1. Class A:
    - a. 28-day compressive strength: 3300 psi
    - b. Slump: 1 to 3 inches
  - 2. Class C:
    - a. 28-day compressive strength: 2000 psi
    - b. Slump: 2 to 6 inches
  - 3. High Early Strength:
    - a. 3-day compressive strength: 3000 psi
    - b. Slump: 1 to 3 inches
  - 4. Cement Factor and Maximum Water-Cement Ratio conforming to Table A, Section 704.1(b), Pub. 408/2000 Specifications.

**2.02 REINFORCEMENT STEEL**

- A. Reinforcement Bars:
  - 1. New billet-steel bars conforming to ASTM A615.
  - 2. Deformed, Grade 60.

- B. Steel Wire Fabric: Conforming to Section 709.3, Pub. 408/2000 Specifications.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Comply with applicable paragraphs of Section 1001, Pub. 408/2000 Specifications for construction requirements including formwork, curing, protection and finishing of cement concrete.
- B. Excavate and shape trench bottoms and sides to accommodate thrust block forms, encasement, manhole bases, inlets and vaults.
- C. Support pipe, valves and fittings at the required elevation with brick or concrete block. Do not use earth, rock, wood, or organic material as supports.

#### **3.02 CONSTRUCTION**

- A. Construct cast-in-place vaults, inlets, endwalls, curbs, sidewalks and miscellaneous reinforced structures of Class A concrete; Class A concrete shall be central-plant-mixed.
- B. Construct manhole bases, reaction and support blocking, cradles, encasements, and miscellaneous mass concrete of Class C concrete; Class C concrete may be from a mobile cement concrete plant or truck-mixed.
- C. Provide spacers, chairs, bolsters, ties and other devices for properly placing, spacing, supporting and fastening reinforcement in place.
- D. Place concrete utilizing all possible care to prevent displacement of pipe or fittings; return displaced pipe or fittings to line and grade immediately.
- E. Insure tie rods, nuts, bolts and flanges are free and clear of concrete.
- F. Do not backfill structures until concrete has achieved its initial set, forms are removed, and concrete work is inspected by the Engineer.
- G. Perform backfilling and compaction as specified in Section 02221 - Trenching, Backfilling and Compacting.

#### **3.03 CONCRETE SIDEWALKS**

- A. Sidewalks shall be 3300 psi air entrained concrete; sidewalk slabs 5" thick.

- B. Subgrade shall be properly prepared and thoroughly wetted before placing concrete.
- C. Unless otherwise indicated:
  - 1. Construct sidewalks in separate slabs 20' in length except for closures; slabs separated by 1/4" thick transverse expansion joints.
  - 2. Between expansion joints, divide slabs into blocks 5' in length by scoring transversely.
  - 3. Slabs more than 5' in width, score longitudinally in center.
  - 4. Scoring shall extend at least a third of slab thickness into slab.

### **3.04 CONCRETE CURBS**

- A. Construct of 3300 psi concrete with air entrainment  $5\% \pm 1$ , where indicated on Drawings; use expansion material between curbs and sidewalks and at control joints.
- B. Curbs shall include one construction joint every 20' and place 3/4" thick premolded expansion joint filler material at structures and at the end of the work day.

### **3.05 FIELD TESTS OF CONCRETE DURING CONSTRUCTION**

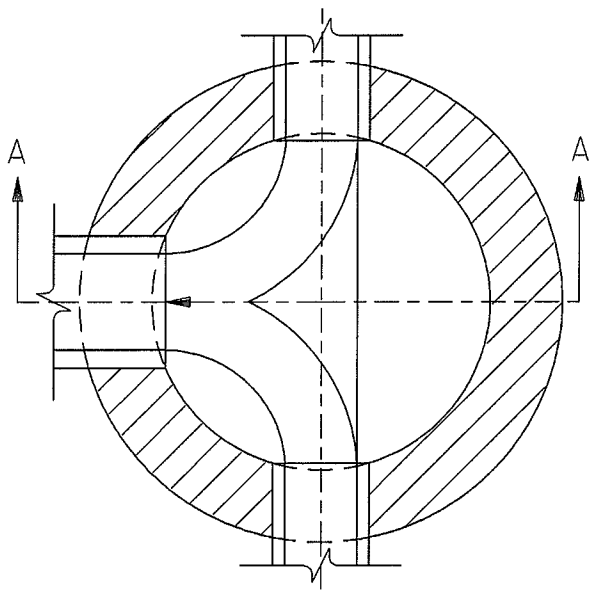
- A. Perform compressive strength tests for each 50 cubic yards and slump tests and air content tests for each 10 cubic yards of each class of concrete placed, or fraction thereof.
- B. Retain an independent testing laboratory to test cylinders.
- C. Keep a slump cone and an airmeter in close proximity to all concrete placements.
- D. Sample concrete in accordance with ASTM C172.
- E. Determine slump in accordance with ASTM C143.
- F. Determine air content in accordance with ASTM C231 or ASTM C173 as applicable.
- G. Test Cylinders:
  - 1. Cast at least 5 cylindrical test specimens for each batch.
  - 2. Test two cylinders at 7 days; test two cylinders at 28 days.
  - 3. Hold the remaining cylinder in reserve for testing in the event that any of the other cylinders are damaged prior to testing.
  - 4. Prepare and cure test cylinders in accordance with ASTM C31.

5. Determine concrete compressive strength in accordance with ASTM C39.
  6. Compute and evaluate in accordance with ASTM C94.
- H. If test cylinders fail to meet compressive strength requirements, the Engineer may require additional core tests in accordance with ASTM C42 at the expense of the Contractor/Developer.

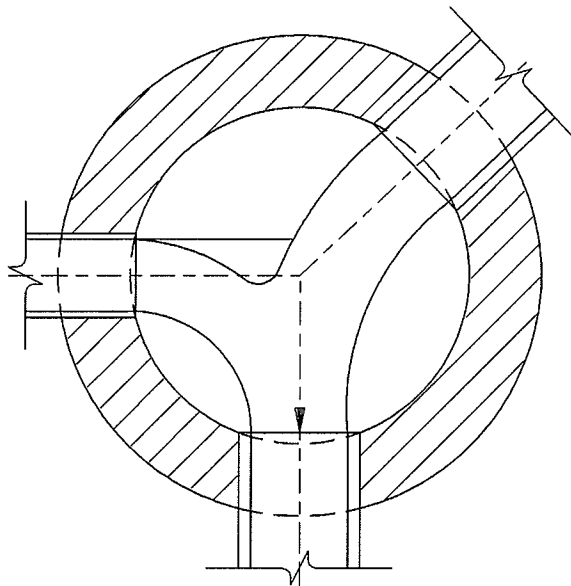
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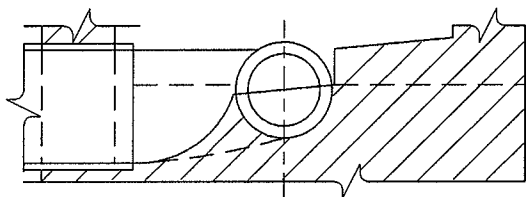
# STANDARD DETAILS



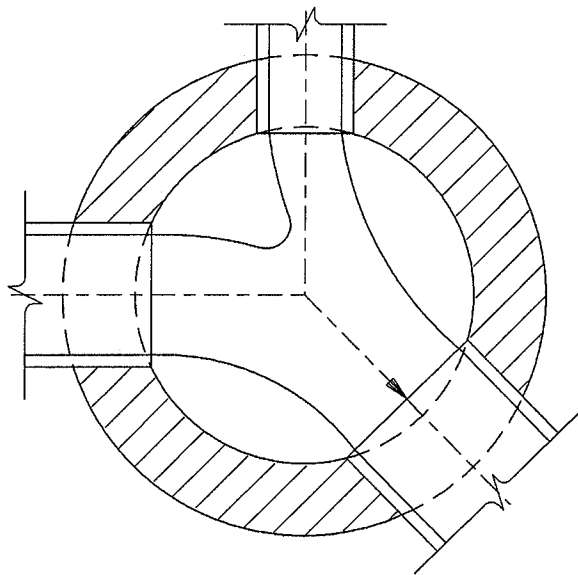
PLAN



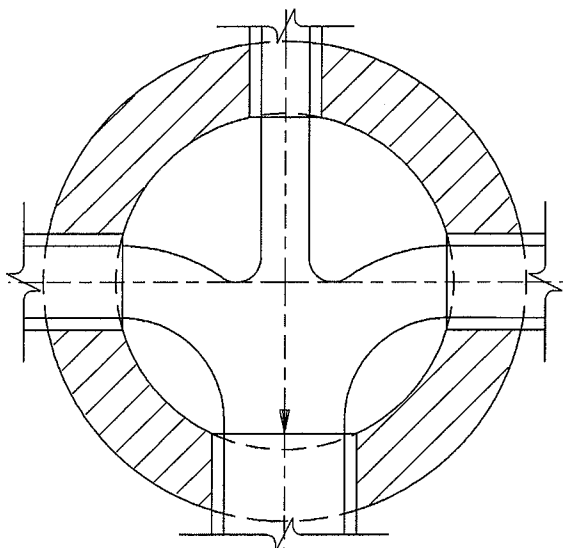
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SECTION A - A



PLAN



PLAN

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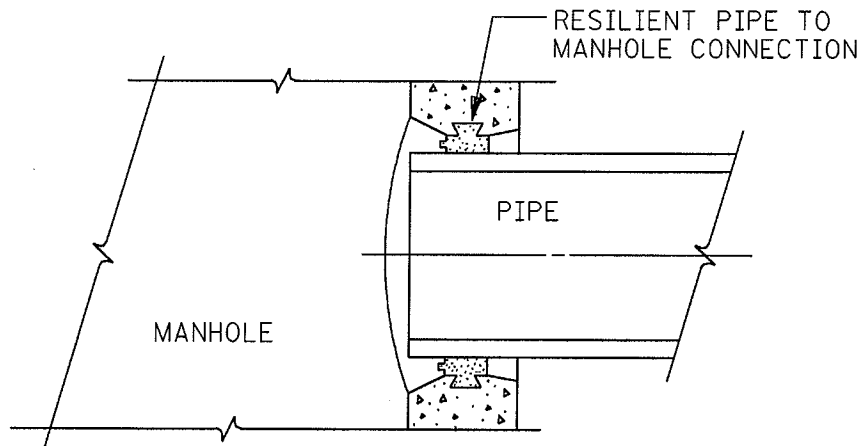
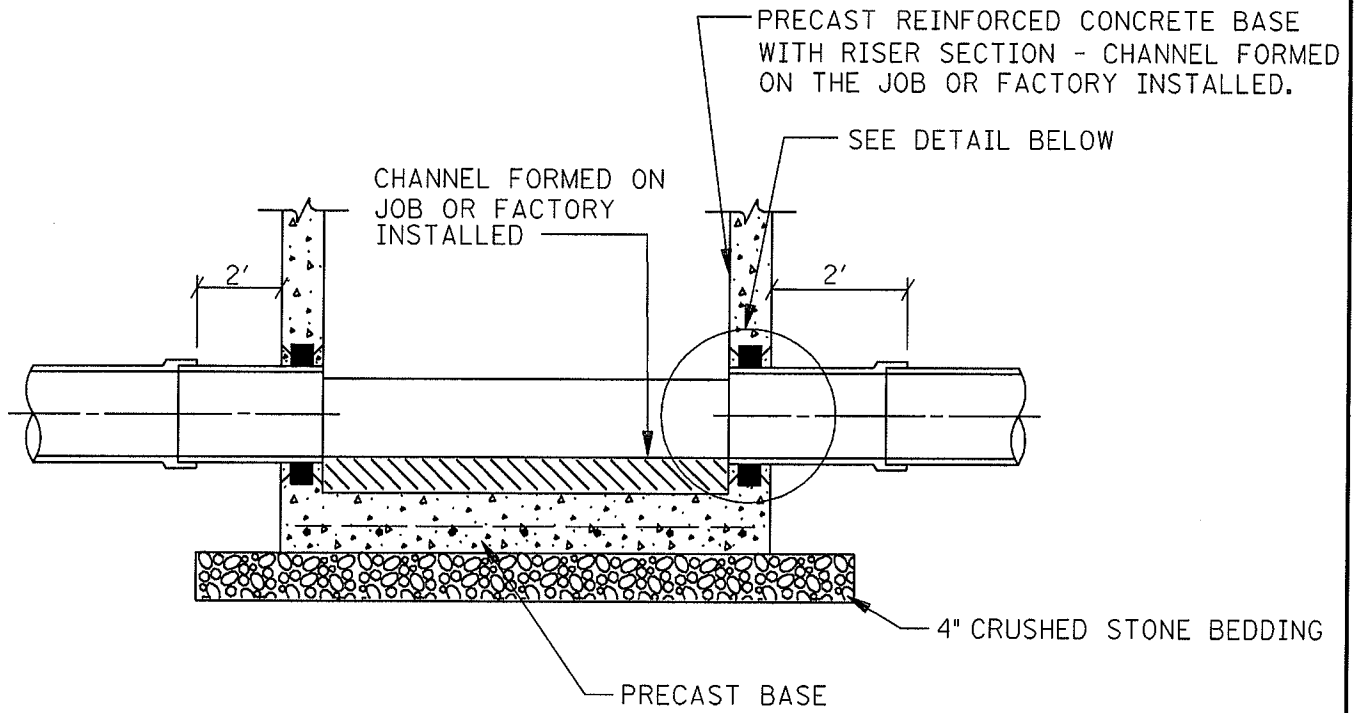
**BUCHART  
HORN, INC.**  
Consulting Engineers and Planners

PLANS OF MANHOLE BASE

APPROVED BY

DATE APPROVED

DETAIL NO.  
**5100B**



DETAIL

DRAWN BY

DATE

CHECK BY

DATE



Consulting Engineers and Planners

PRECAST MANHOLE BASE  
DETAIL

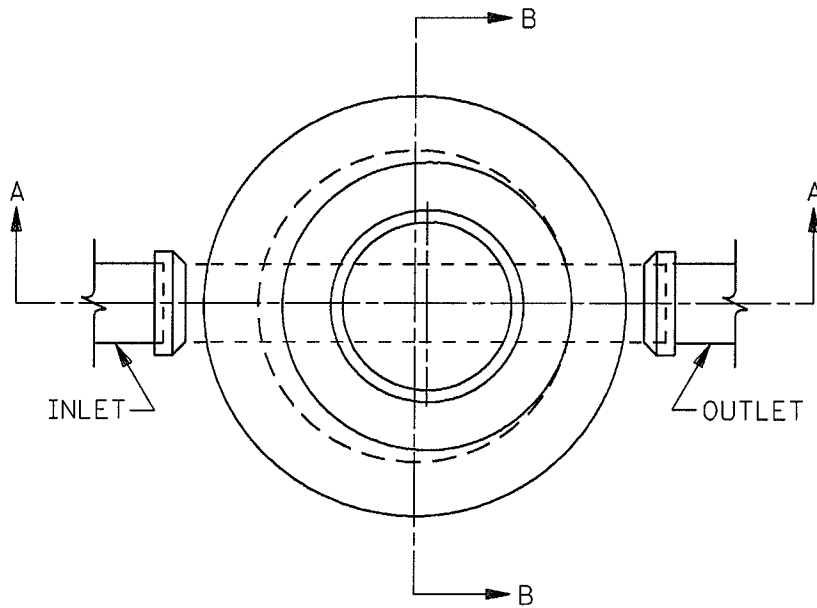
APPROVED BY

DATE APPROVED

DETAIL NO.

5100G





PLAN

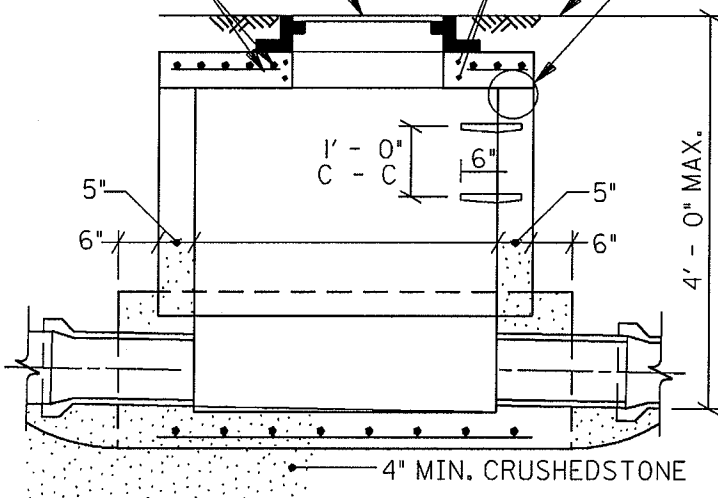
IF PRECAST LID IS USED, JOINT SHALL BE COVERED W/PREFORMED JOINT SEALANT COMPOUND PRIOR TO INSTALLATION OF CONCRETE COVER.

C.I. MANHOLE FRAME & COVER

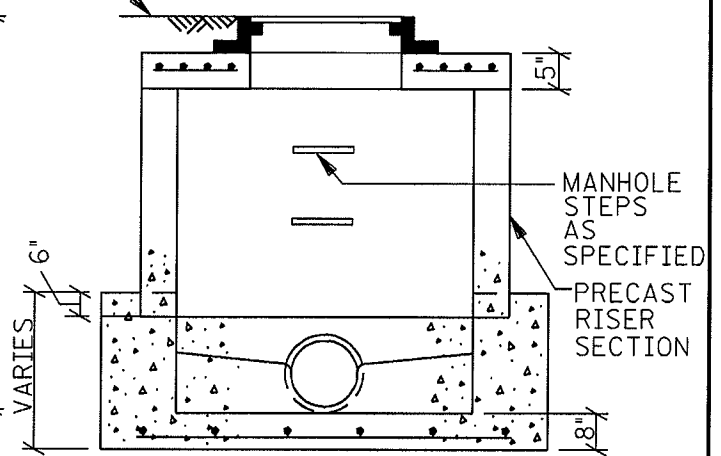
#4 @ 3" E.W.

2 - #5 BARS AROUND

FINISH GRADE



SECTION A - A



SECTION B - B

STANDARD SHALLOW PRE-CAST MANHOLE

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DATE  
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DATE



Consulting Engineers and Planners

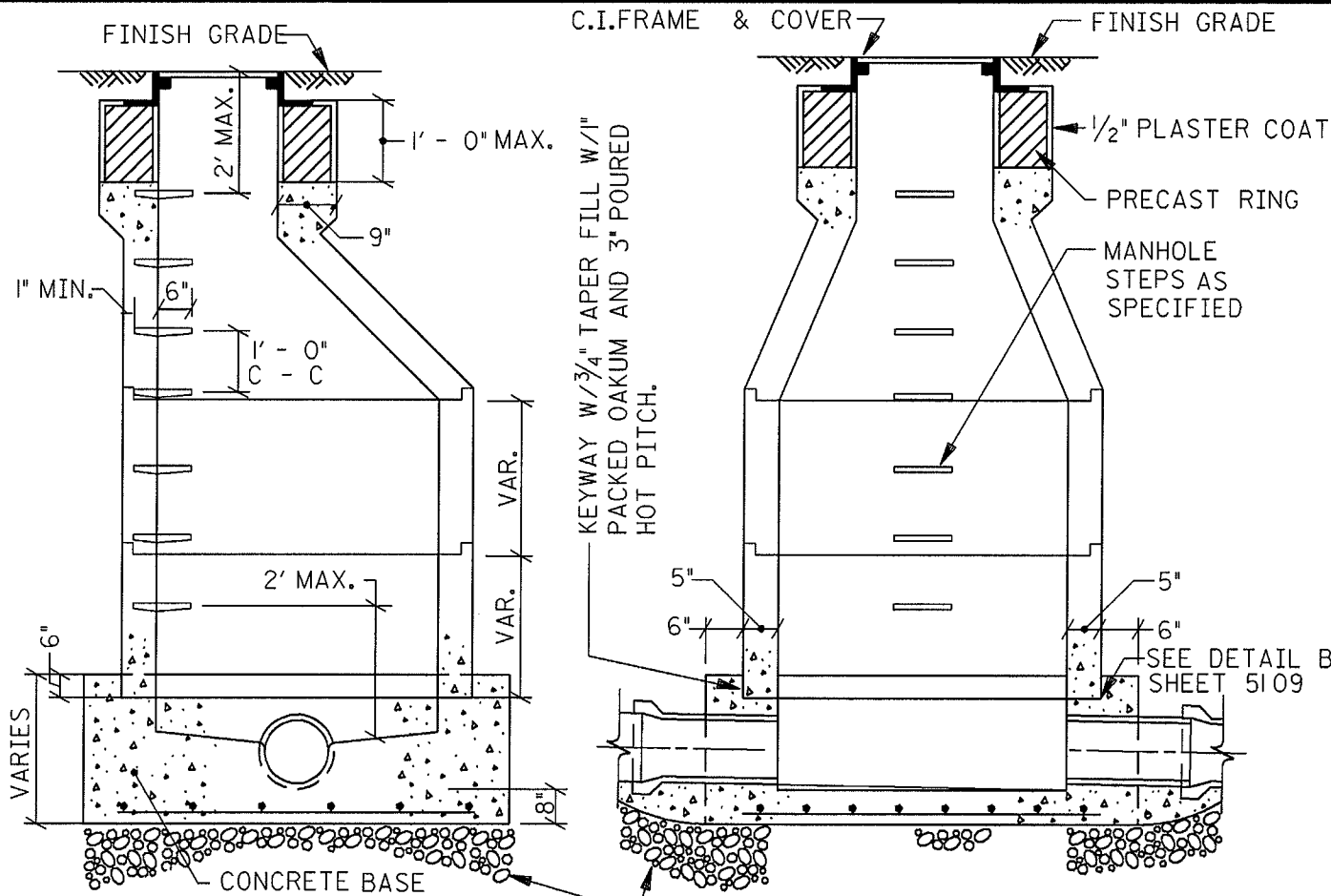
STANDARD SHALLOW  
PRE-CAST MANHOLE

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DATE APPROVED

DETAIL NO.

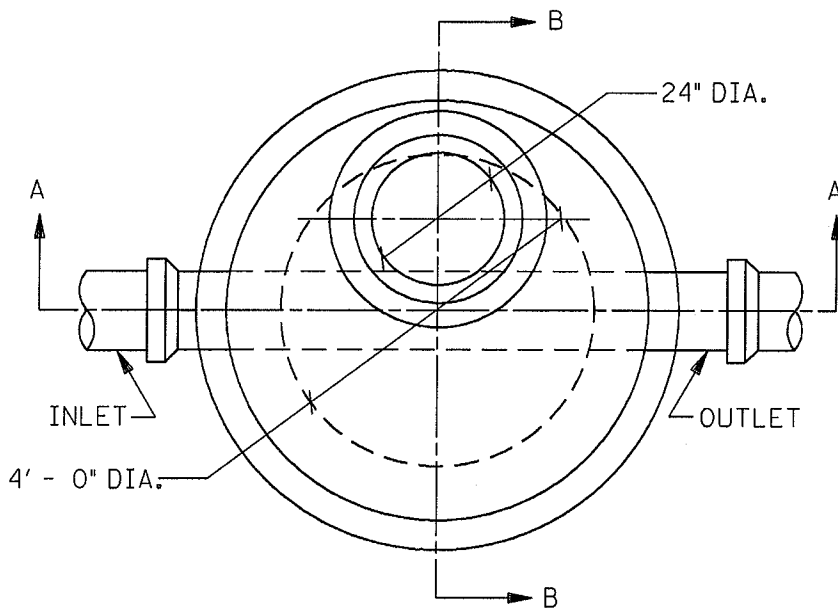
5106



SECTION B - B

SECTION A - A

DETAIL OF STANDARD DEEP PRE-CAST MANHOLE



PLAN: PRE-CAST CONC. MANHOLE

NOTES:

SEE SHEET 5100B FOR BASE DETAIL.

SEE SHEET 5110C FOR STEP DETAIL.

SEE SHEET 5109 FOR JOINT DETAIL.

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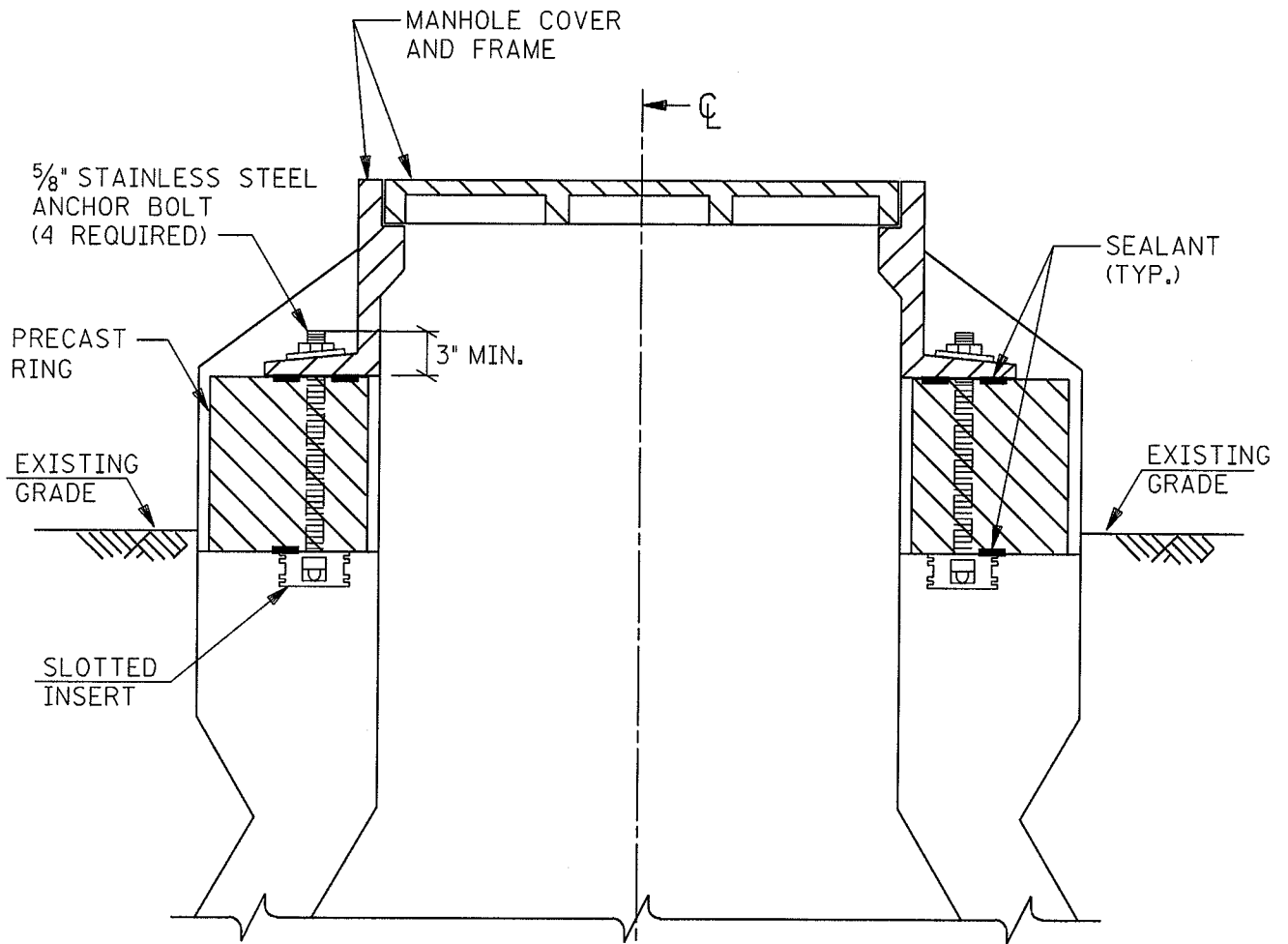
Consulting Engineers and Planners

STANDARD DEEP  
PRE-CAST MANHOLE

APPROVED BY

DATE APPROVED

DETAIL NO.  
5107



MANHOLE COVER WITH ANCHOR BOLT

NO SCALE

USE ONLY WHEN M.H. COVER AND FRAME  
EXTEND ABOVE GRADE

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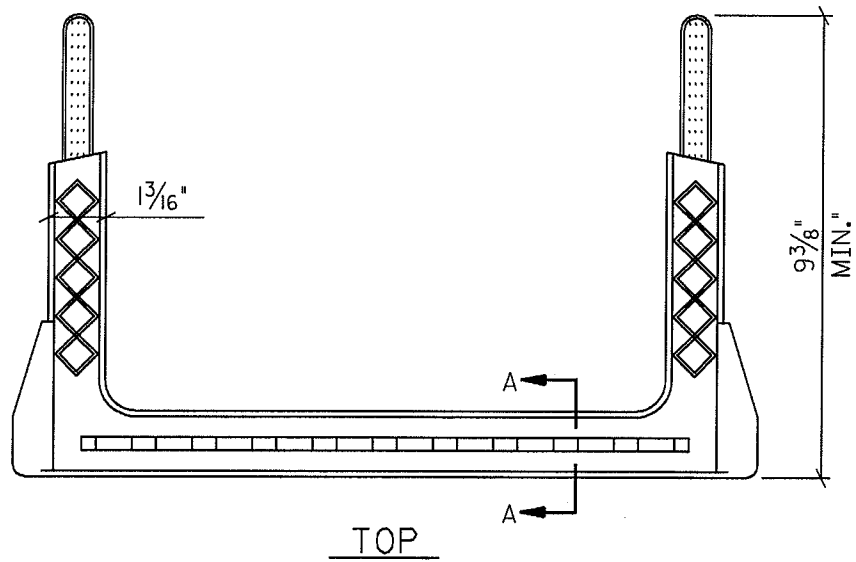
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MANHOLE COVER WITH  
ANCHOR BOLT

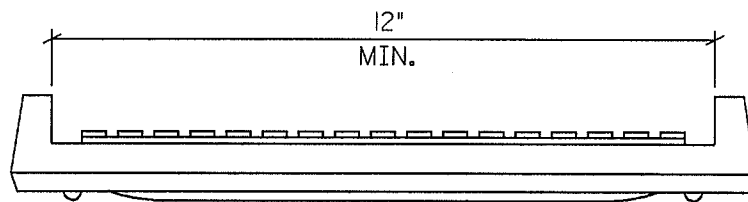
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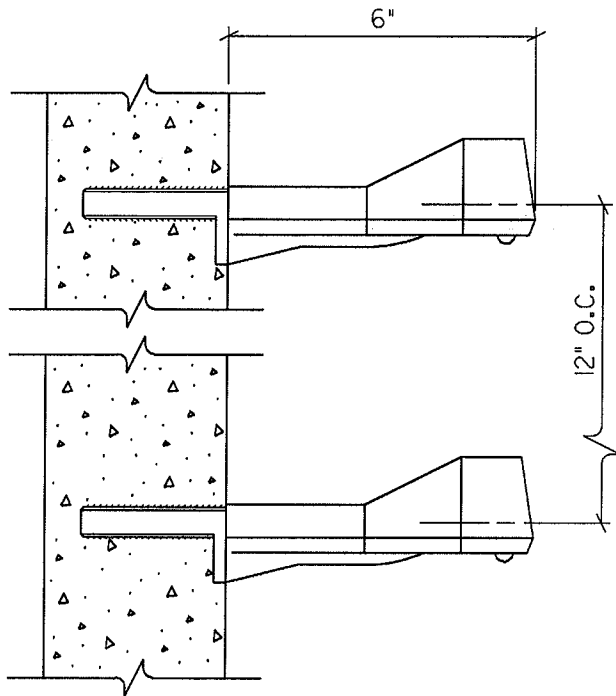
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5109A



TOP

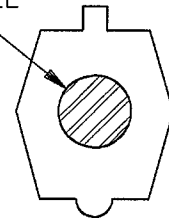


FRONT



ELEVATION

1/2" GRADE 60 STEEL REINFORCEMENT



SECTION A-A

NOTES:

MANHOLE STEPS TO BE COPOLYMER POLYPROPYLENE PLASTIC

DISTANCE FROM RIM OF MANHOLE TO TOP STEP SHALL NOT BE GREATER THAN 2 FT.

DISTANCE FROM BOTTOM STEP TO FLOOR OF MANHOLE SHALL NOT BE GREATER THAN 2 FT.

MANHOLE STEP DETAIL

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DATE



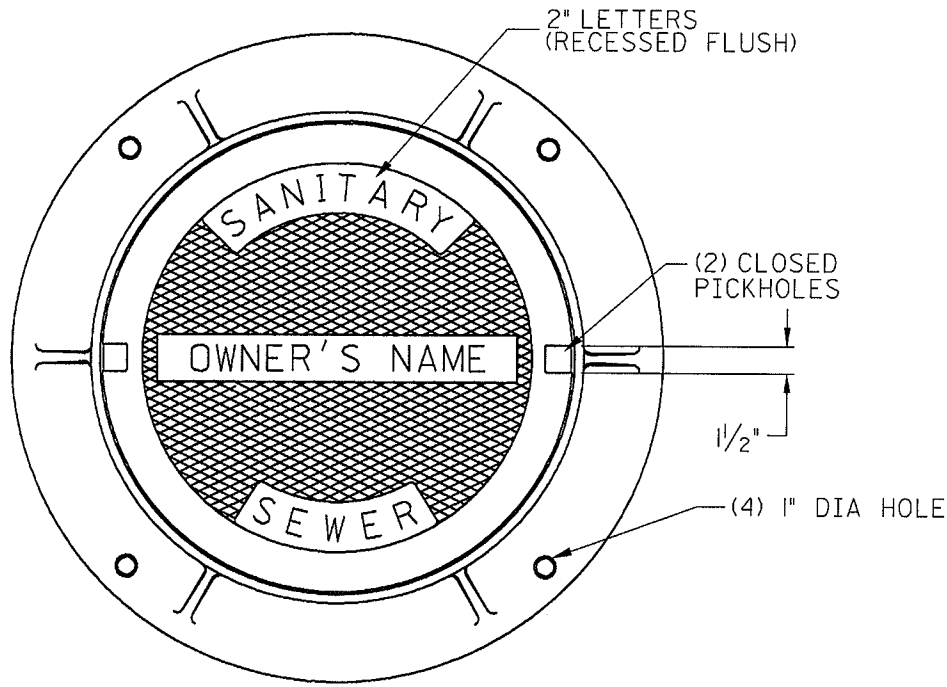
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MANHOLE STEP DETAIL

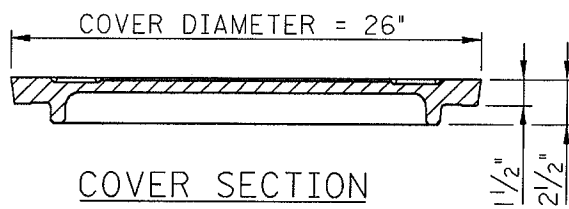
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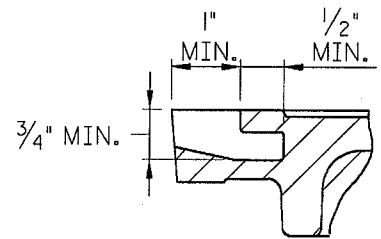
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5110C



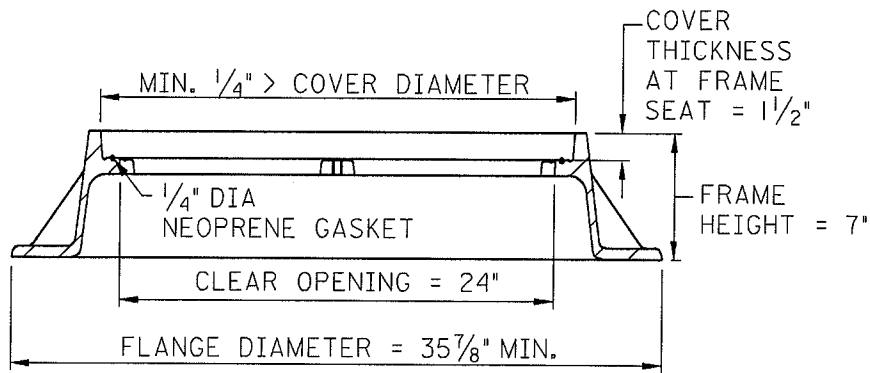
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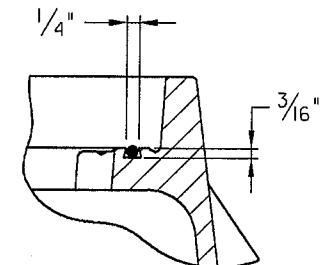
COVER SECTION



PICKHOLE DETAIL



FRAME SECTION



GROOVE DETAIL

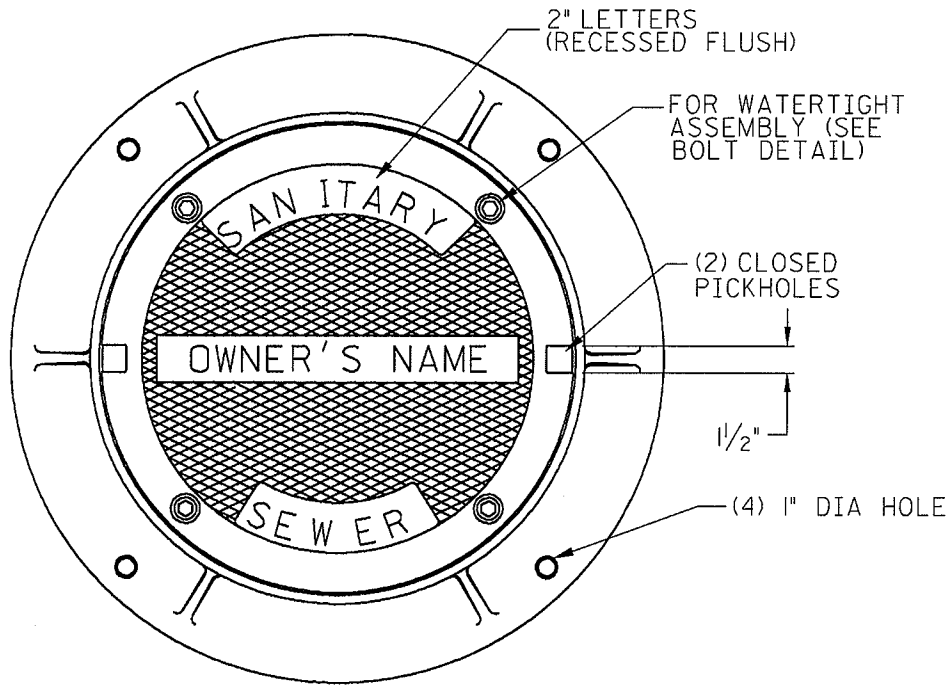
NOTE: MINIMUM H-25 LOAD RATING

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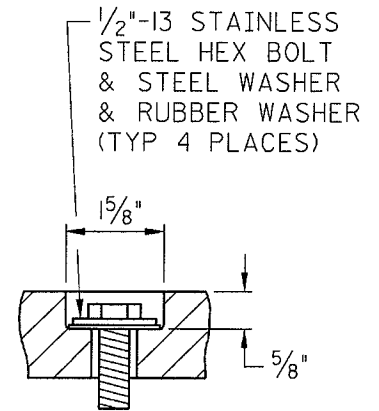
**bh**  
**BUCHART**  
**HORN, INC.**  
 Consulting Engineers and Planners

HEAVY DUTY  
 MANHOLE FRAME & COVER  
 W/ GASKET IN FRAME

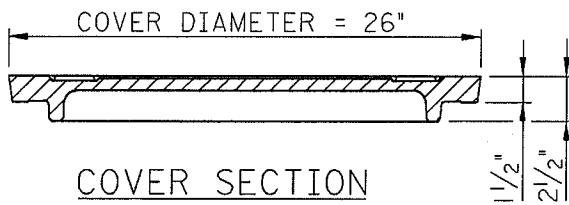
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DATE APPROVED	
DETAIL NO.	5115A



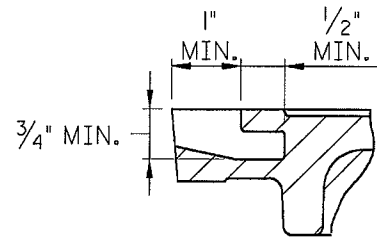
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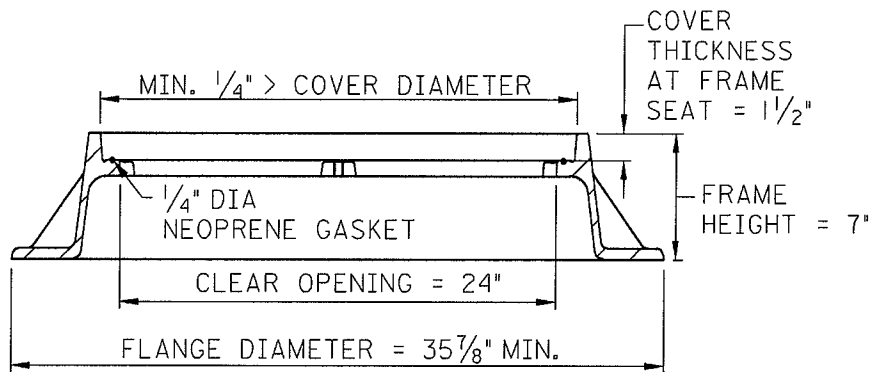
BOLT DETAIL



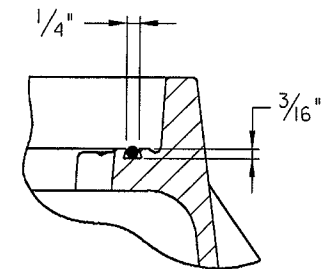
COVER SECTION



PICKHOLE DETAIL




FRAME SECTION



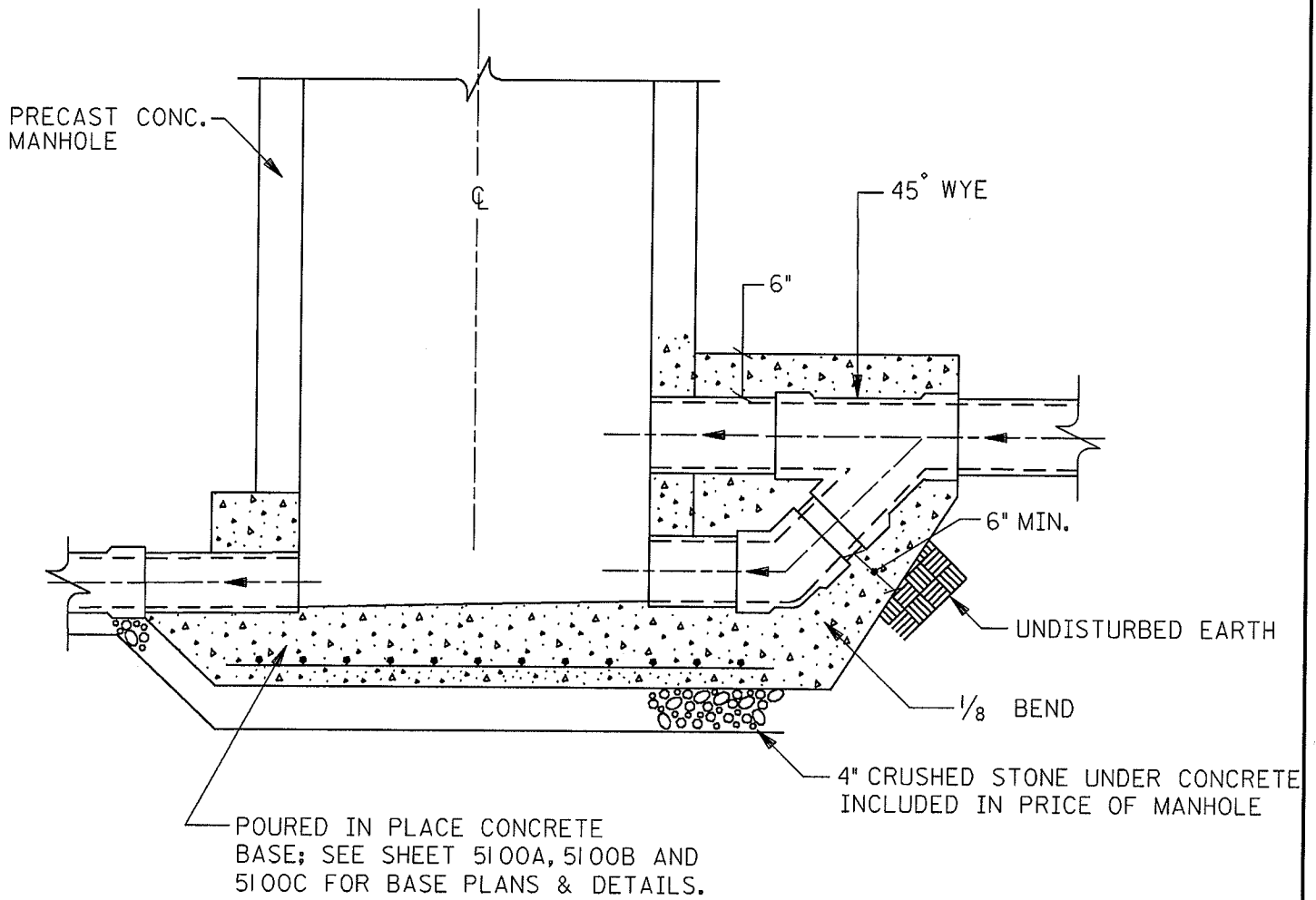
GROOVE DETAIL

NOTE: MINIMUM H-25 LOAD RATING

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DATE	
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DATE	

HEAVY DUTY WATERTIGHT  
MANHOLE FRAME & COVER  
W/ GASKET IN FRAME

APPROVED BY
DATE APPROVED
DETAIL NO. 5116A



ELEVATION  
TYPE A DROP MANHOLE DETAILS

<u>SIZE OF SEWER</u>	<u>MIN. DROP</u>	<u>MAX. DROP</u>
8"	1' - 9"	2' - 8"
10"	2' - 0"	2' - 10"
12"	2' - 2"	3' - 3"
* 15"	3' - 2"	6' - 8"

**NOTE:**

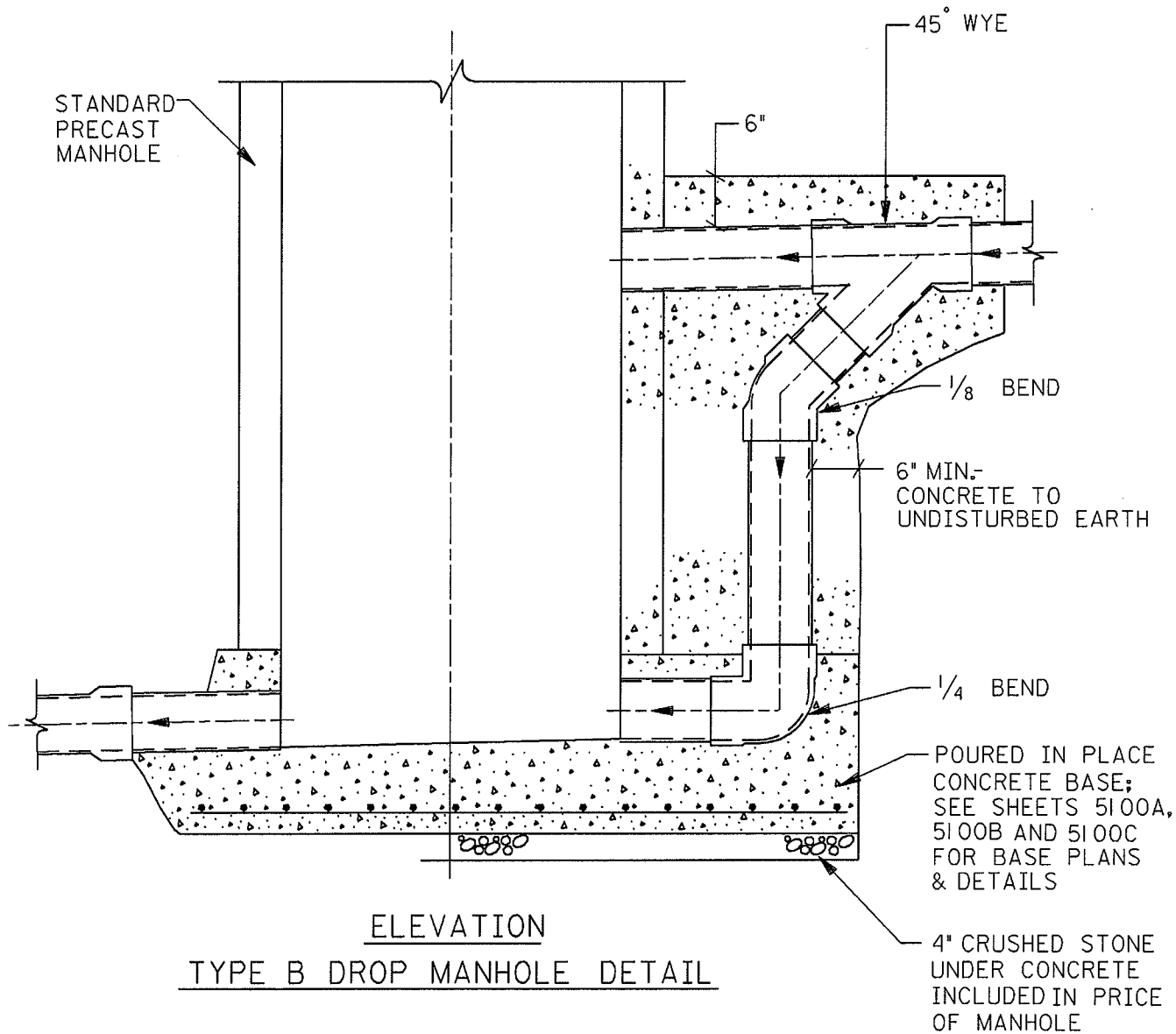
1. CONCRETE INCLUDED IN UNIT PRICE BID FOR DROP MANHOLE CONNECTION.
2. \* - INDICATES DIMENSIONS FROM FABRICATED FITTINGS.

DRAWN BY \_\_\_\_\_  
DATE \_\_\_\_\_  
CHECK BY \_\_\_\_\_  
DATE \_\_\_\_\_



P.V.C. PIPE  
TYPE A DROP  
MANHOLE DETAILS

APPROVED BY \_\_\_\_\_  
DATE APPROVED \_\_\_\_\_  
DETAIL NO.  
**5119A**



SIZE OF SEWER	MIN. DROP
8"	2' - 8"
10"	2' - 10"
12"	3' - 3"
* 15"	6' - 8"

NOTES:

1. \* - INDICATES DIMENSIONS FROM FABRICATED FITTINGS.

DRAWN BY

DATE

CHECK BY

DATE



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P.V.C. PIPE  
TYPE B DROP  
MANHOLE DETAILS

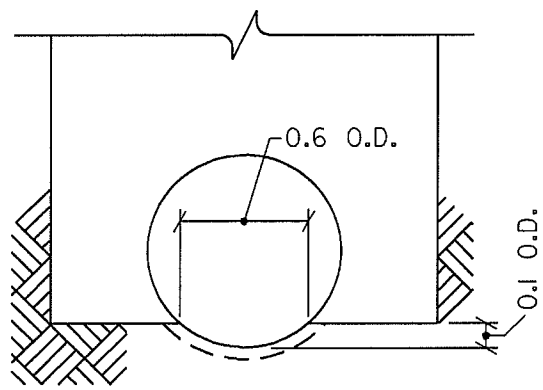
APPROVED BY

DATE APPROVED

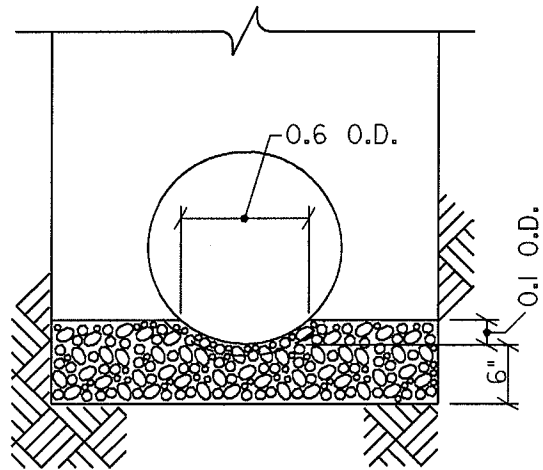
DETAIL NO.

5120A

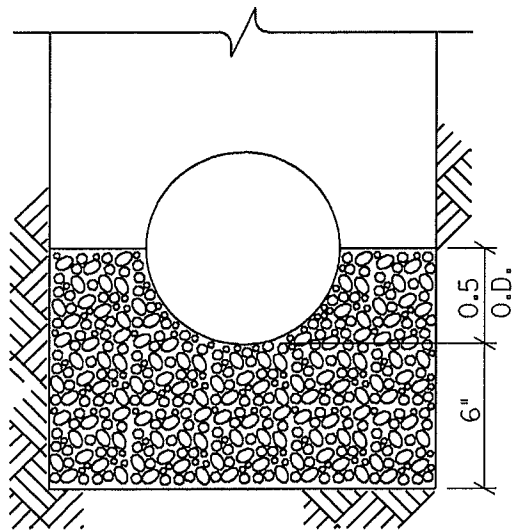




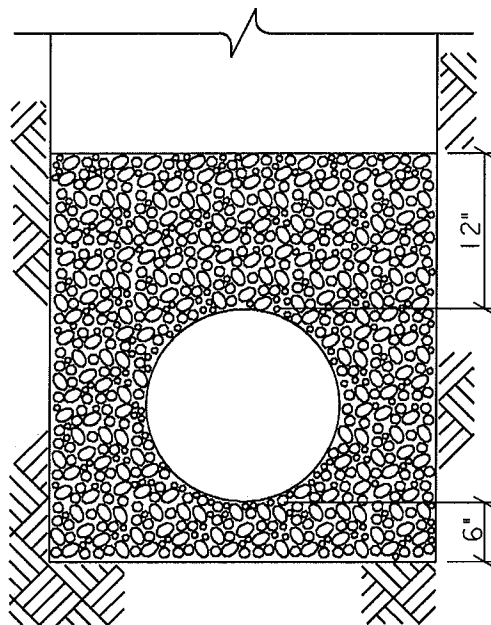
TYPE I BEDDING



TYPE II BEDDING



TYPE III BEDDING




TYPE IV BEDDING

NOTES:

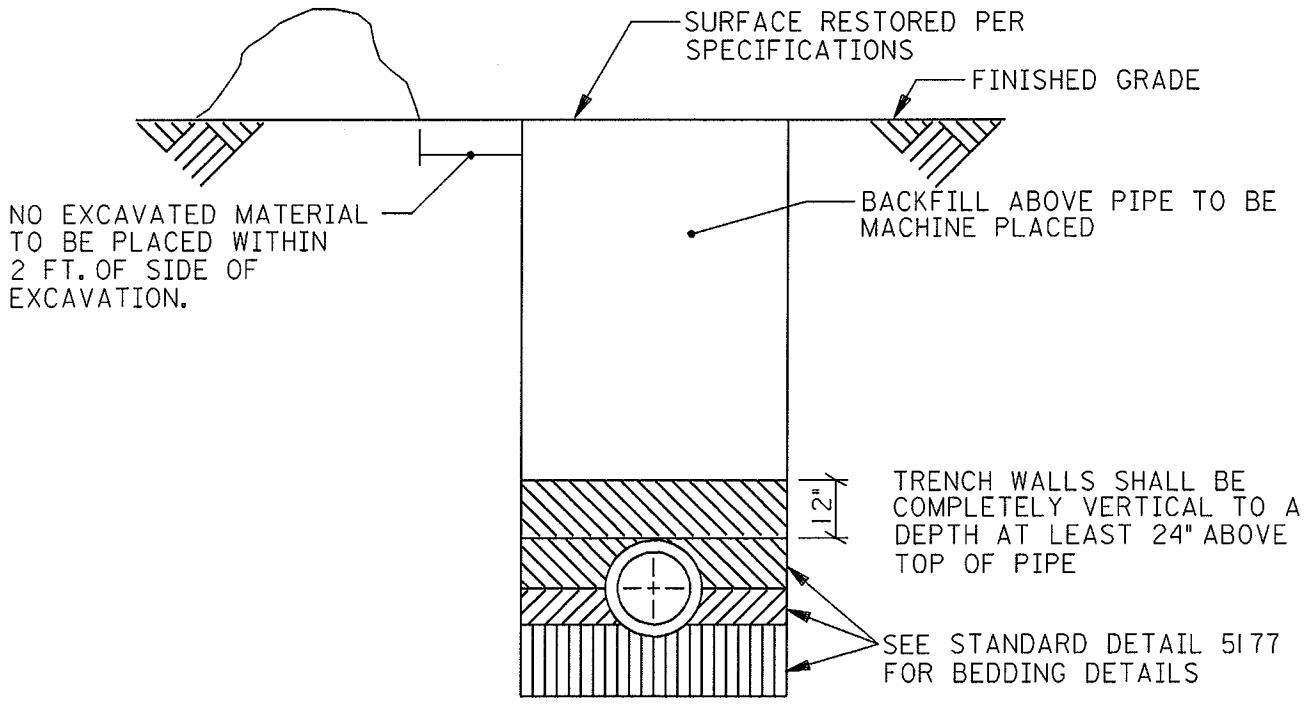
TRENCH BOTTOM TO BE FREE OF WATER BEFORE PLACING BEDDING.  
 SHAPE RECESSES FOR BELL OF PIPE BY HAND.  
 BACKFILL ABOVE BEDDING WITH SPECIFIED BACKFILL MATERIAL.

DRAWN BY	
DATE	
CHECK BY	
DATE	

  
**BUCHART  
HORN, INC.**  
 Consulting Engineers and Planners

PIPE BEDDING  
 DETAILS


APPROVED BY	
DATE APPROVED	
DETAIL NO.	5177

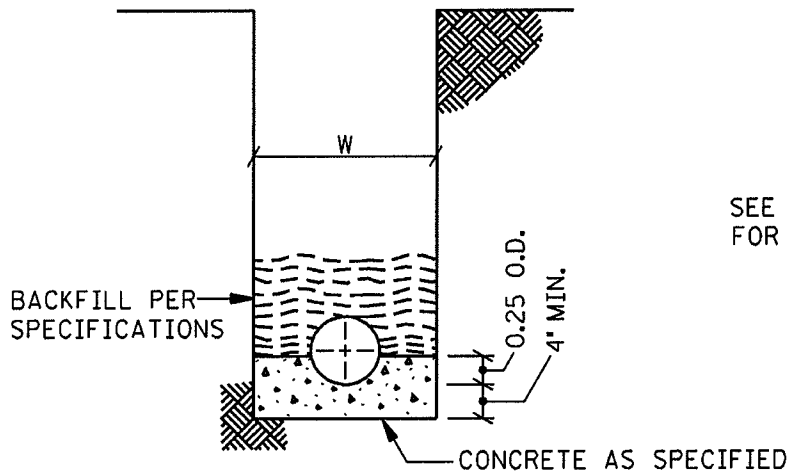


SECTION

NOTES: SHORING REQUIRED FOR ALL TRENCHES IN ACCORDANCE WITH OSHA AND APPLICABLE REGULATIONS LAWS & SAFETY CODES.

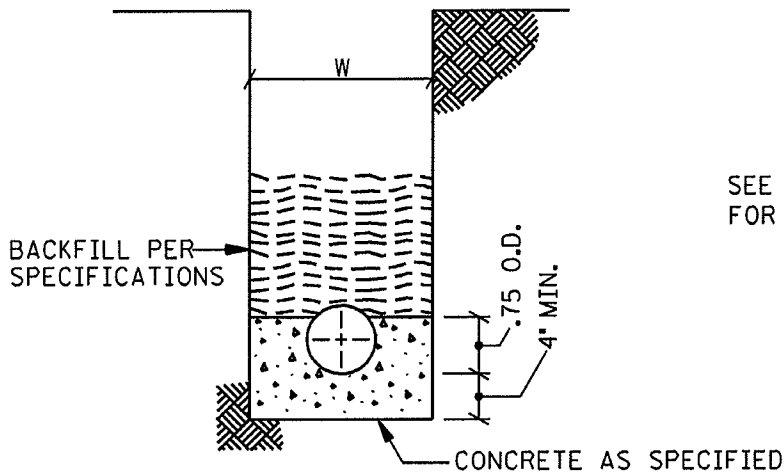
PLACE BACKFILL AROUND PIPE BY HAND AND COMPACT IN 6" LAYERS.

DRAWN BY	 <b>BUCHART HORN, INC.</b> Consulting Engineers and Planners	PIPE TRENCH DETAIL	APPROVED BY
DATE			DATE APPROVED
CHECK BY			DETAIL NO.
DATE			5178A



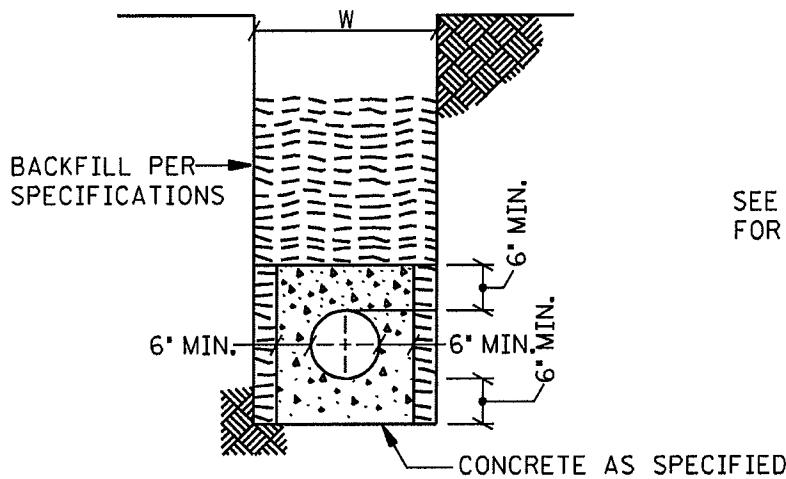
SEE DETAIL SHEET 5003  
FOR PAYMENT QUANTITIES.

LOW CONCRETE CRADLE



SEE DETAIL SHEET 5004  
FOR PAYMENT QUANTITIES.

HIGH CONCRETE CRADLE



SEE DETAIL SHEET 5005  
FOR PAYMENT QUANTITIES.

CONCRETE ENCASEMENT TYPE I

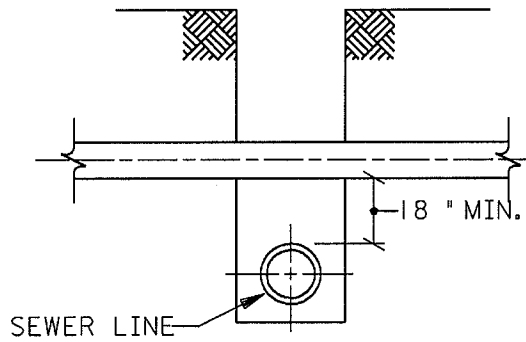
CONCRETE CRADLE AND ENCASEMENT DETAILS

DRAWN BY  
DATE  
CHECK BY  
DATE



CONCRETE CRADLE AND  
ENCASEMENT DETAILS

APPROVED BY  
DATE APPROVED  
DETAIL NO.  
5179



SECTION

VERTICAL WATER MAIN CLEARANCE

NOTES:

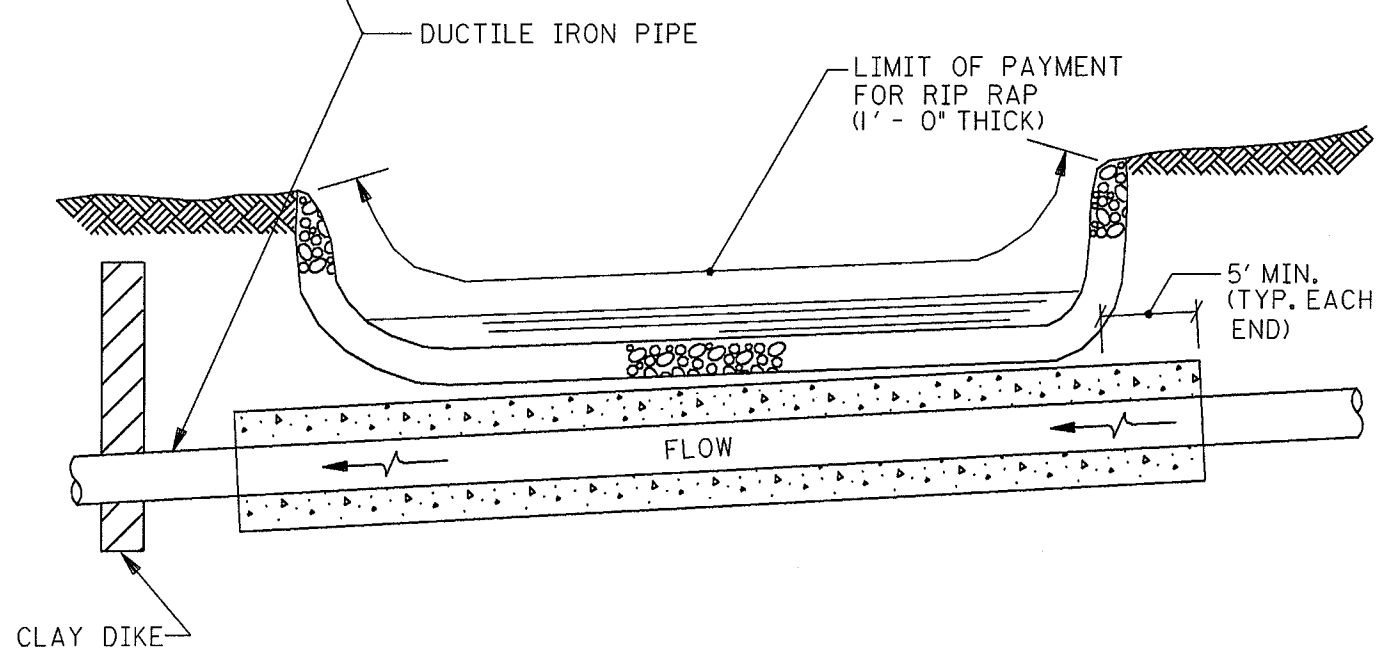
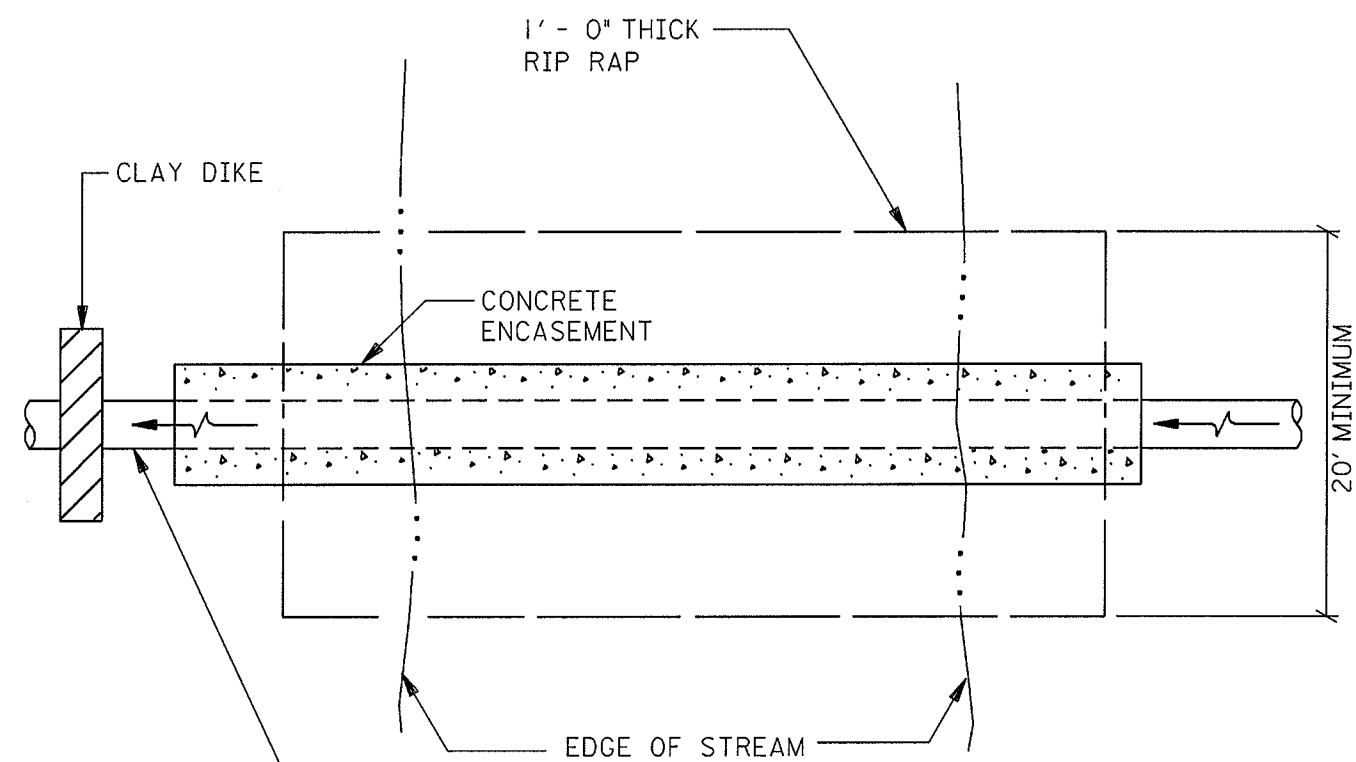
1. IF JOINT ON WATER MAIN IS WITHIN LIMITS OF SEWER TRENCH, INSTALL MECHANICAL BELL JOINT CLAMP.
2. IF CLEARANCE IS LESS THAN 18" ENCASE SEWER PIPE 6 FT. EACH SIDE OF WATER MAIN.
3. IN NO CASE SHALL THE SEWER PIPE CONTACT ANY WATER MAIN, SERVICE LINE OR APPURTENANCE.

DRAWN BY	
DATE	
CHECK BY	
DATE	

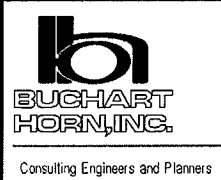
  
**BUCHART  
HORN, INC.**  
 Consulting Engineers and Planners

VERTICAL WATER  
 MAIN CLEARANCE

APPROVED BY	
DATE APPROVED	
DETAIL NO.	5180

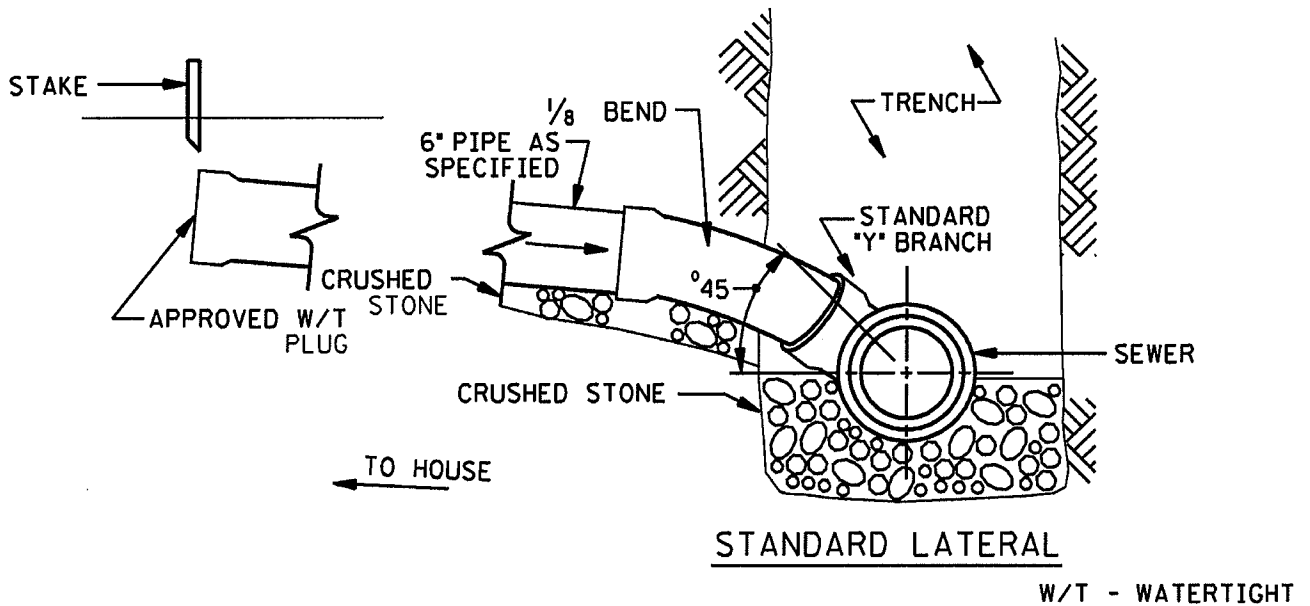
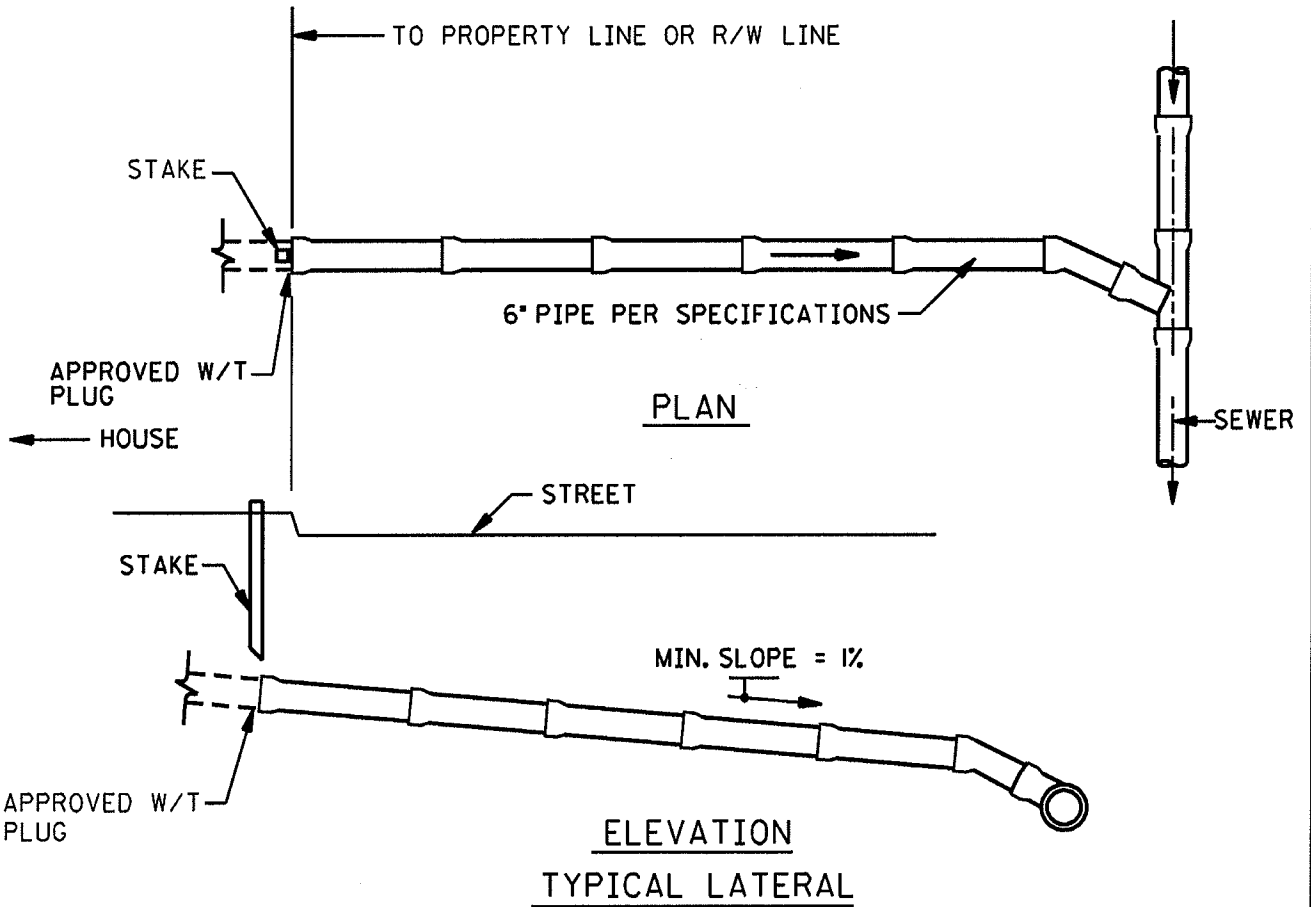


DRAWN BY \_\_\_\_\_  
 DATE \_\_\_\_\_  
 CHECK BY \_\_\_\_\_  
 DATE \_\_\_\_\_



STREAM CROSSING  
 DETAIL

APPROVED BY \_\_\_\_\_  
 DATE APPROVED \_\_\_\_\_  
 DETAIL NO.  
**5180A**



STANDARD HOUSE CONNECTION DETAILS

DRAWN BY  
DATE  
CHECK BY  
DATE



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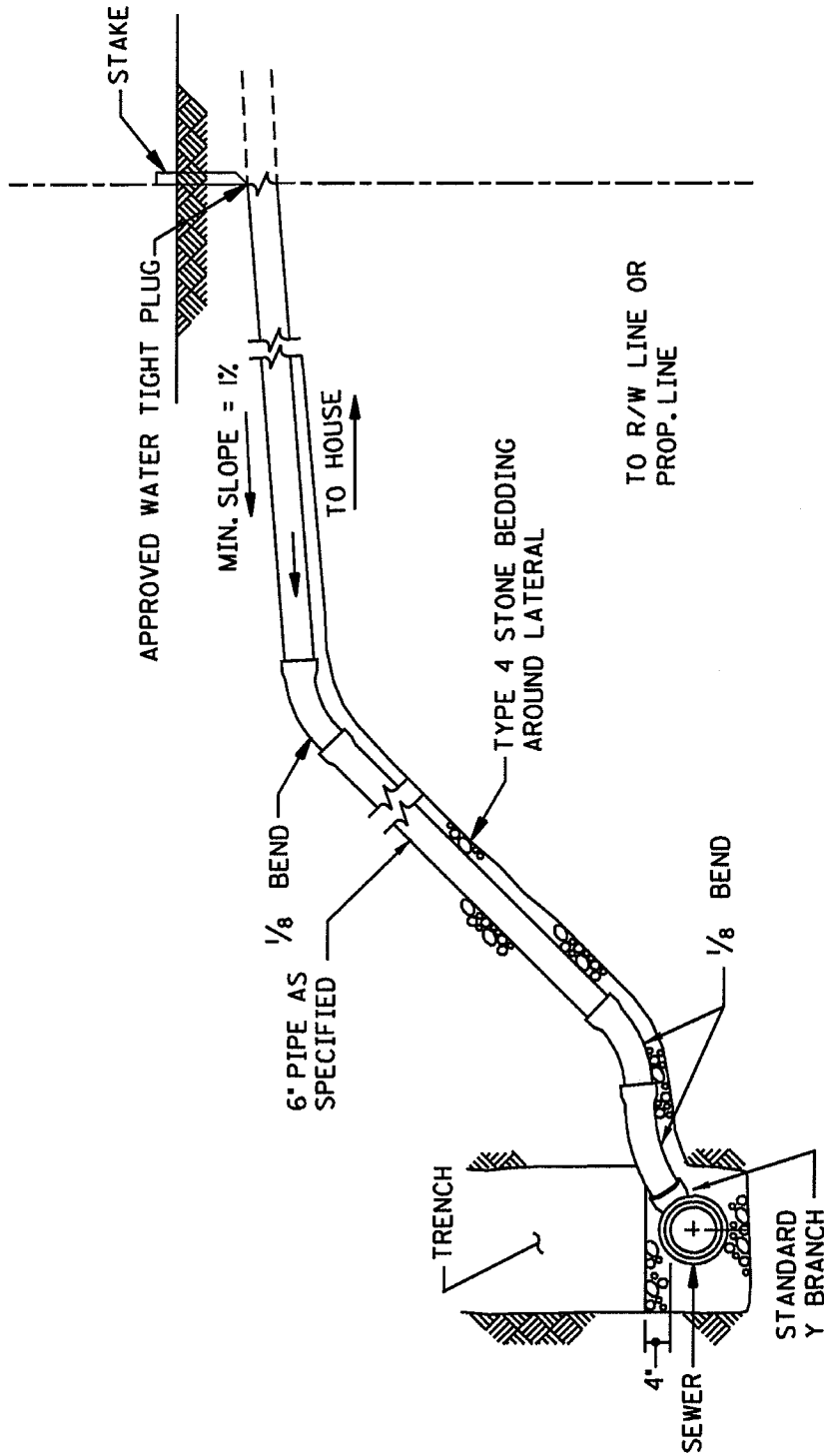
LATERAL DETAIL

APPROVED BY

DATE APPROVED

DETAIL NO.

5187



NOTE: END OF LATERAL TO HAVE APPROVED WATER TIGHT PLUG.

SLOPED RISER LATERAL DETAIL

NO SCALE

DRAWN BY  
DATE  
CHECK BY  
DATE



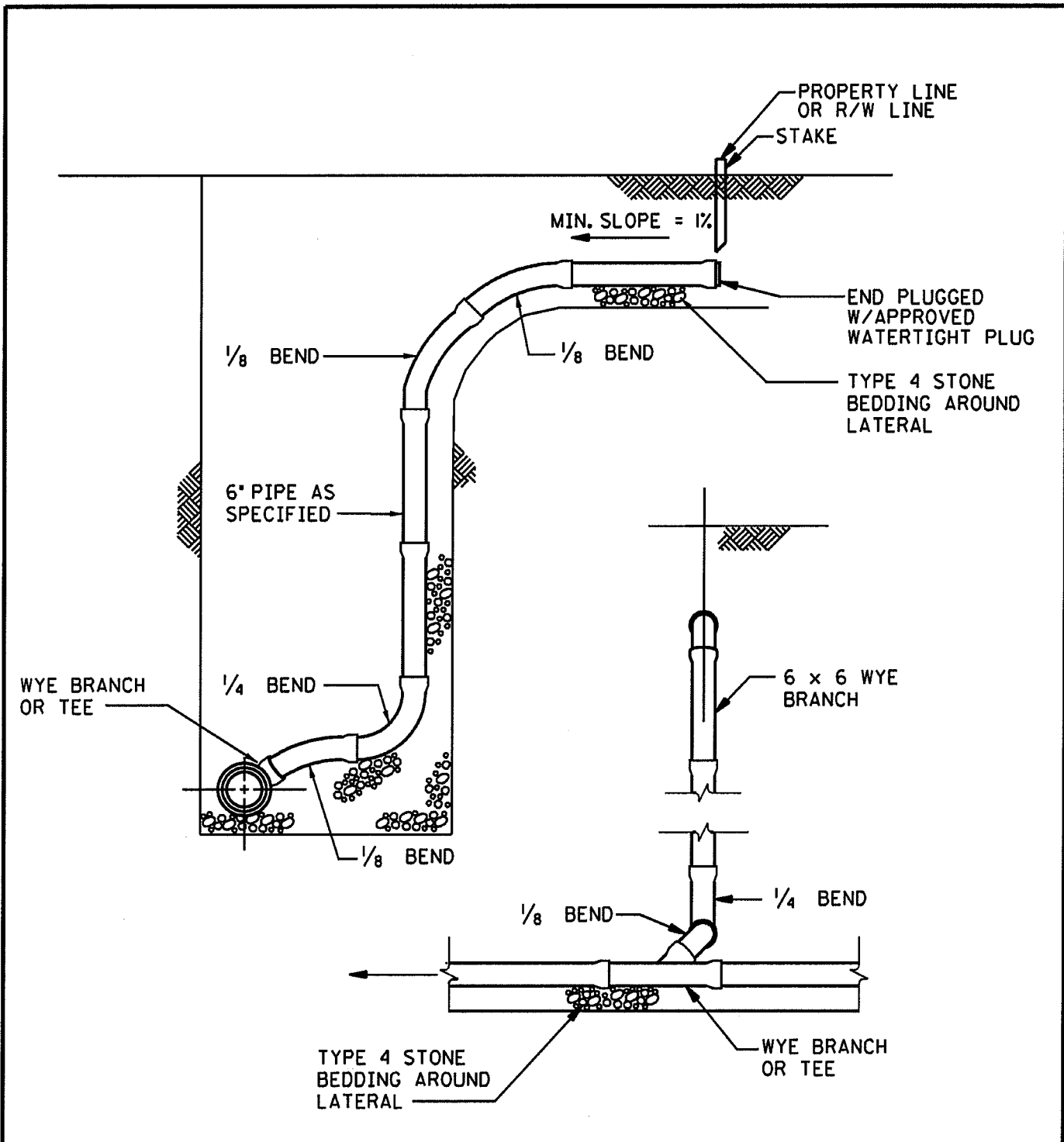
Consulting Engineers and Planners

SLOPED RISER LATERAL DETAIL

APPROVED BY

DATE APPROVED

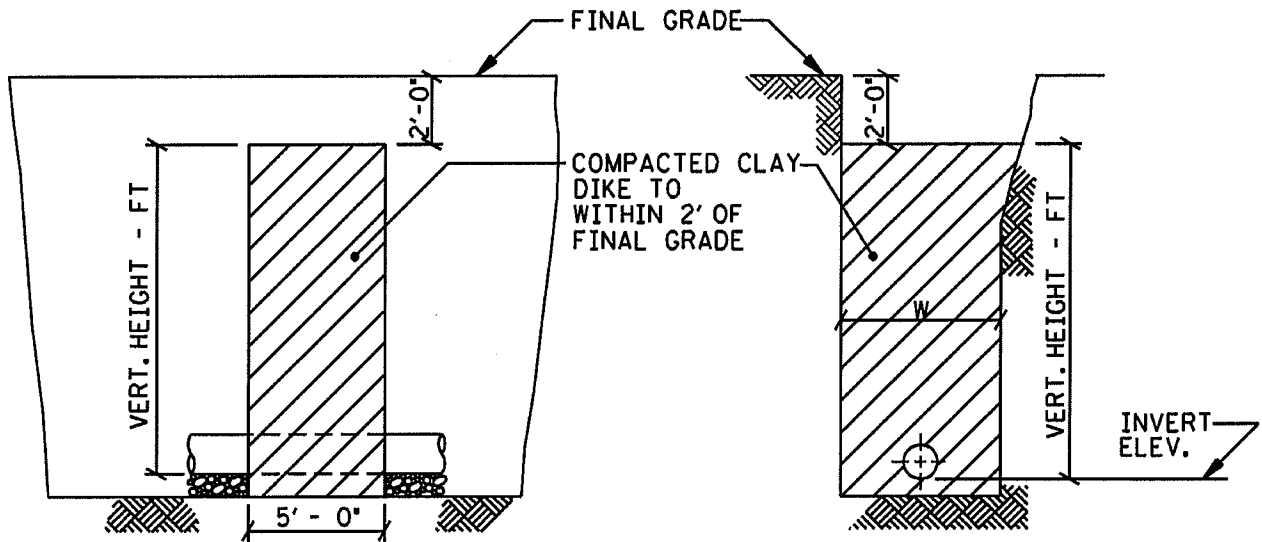
DETAIL NO.  
5187A



SIDE VIEW  
VERTICAL RISER LATERAL DETAIL

DRAWN BY DATE CHECK BY DATE	 <b>BUCHART HORN, INC.</b> Consulting Engineers and Planners	<h2 style="margin: 0;">VERTICAL RISER LATERAL DETAIL</h2>	APPROVED BY DATE APPROVED DETAIL NO. <b>5187B</b>
--------------------------------------	---	---	--





1. COMPACTED CLAY DIKES SHALL EXTEND VERTICALLY FROM UNDISTURBED GROUND AT BOTTOM OF TRENCH TO WITHIN TWO (2') FEET OF FINAL GRADE, AND FROM UNDISTURBED GROUND ON TRENCH SIDES FOR FULL WIDTH OF TRENCH.
2. EACH CLAY DIKE SHALL CONSIST OF CLAY CONTAINING NO MORE THAN 15% (BY VOLUME) STONE NOT LARGER THAN TWO (2") INCHES IN DIAMETER. CLAY SHALL BE PLACED IN SIX (6") INCH LIFTS AND COMPACTED BY MECHANICAL TAMPER TO NOT LESS THAN 95 PERCENT OF MAXIMUM DENSITY AT OPTIMUM MOISTURE CONTENT.

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DATE  
CHECK BY  
DATE



Consulting Engineers and Planners

## CLAY DIKE DETAIL

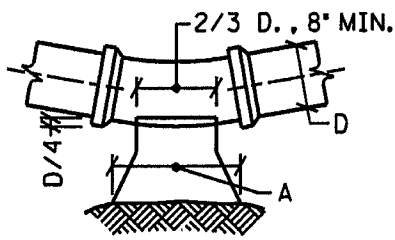
APPROVED BY

DATE APPROVED

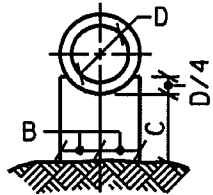
DETAIL NO.

5190

## BUTTRESS FOR VERTICAL BENDS

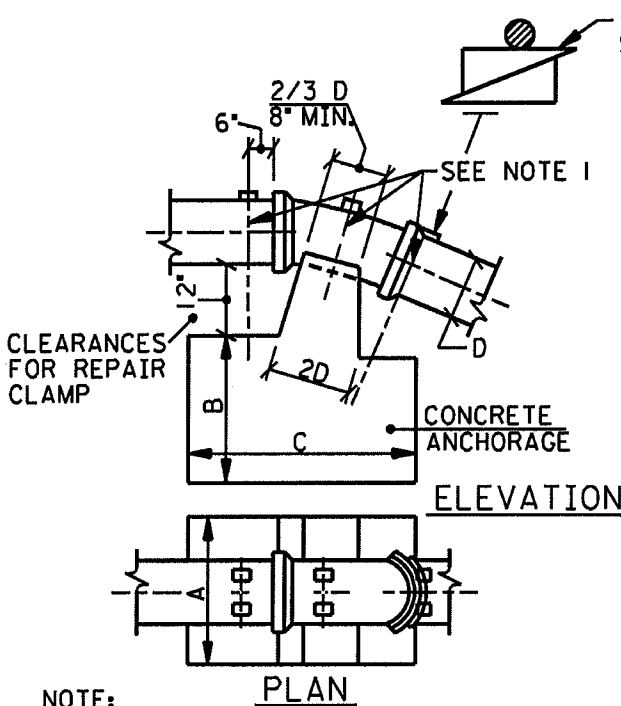


PLAN



SECTION

BUTTRESS DIMENSIONS							
BEND		SIZE					
		4"	6"	8"	10"	12"	16"
11 1/4°	A	4"	6"	8"	10"	1'-0"	1'-4"
	B	5"	7"	8"	9"	10"	1'-0"
1/32	C	5"	7"	7"	8"	8"	9"
	A	6"	9"	1'-0"	1'-6"	1'-9"	2'-3"
22 1/2°	B	6"	7"	7"	8"	10"	1'-0"
	C	6"	7"	7"	8"	8"	9"
45°	A	10"	1'-3"	1'-8"	2'-1"	2'-6"	3'-4"
	B	7"	7"	8"	9"	11"	1'-3"
1/8	C	7"	7"	8"	10"	11"	1'-3"



ELEVATION

PLAN

## ANCHORAGE FOR VERTICAL BENDS

ANCHORAGE DIMENSIONS							
BEND		SIZE					
		4"	6"	8"	10"	12"	16"
11 1/4°	A	1'-4"	1'-6"	1'-6"	2'-6"	3'-0"	4'-0"
	B	1'-0"	1'-6"	1'-9"	2'-0"	2'-6"	2'-6"
1/32	C	2'-0"	2'-0"	2'-6"	3'-0"	3'-0"	4'-0"
	A	1'-8"	2'-0"	3'-4"	3'-8"	4'-0"	4'-4"
22 1/2°	B	1'-6"	1'-9"	2'-3"	2'-3"	2'-3"	2'-6"
	C	2'-0"	3'-0"	2'-8"	3'-10"	4'-0"	5'-9"
45°	A	2'-3"	2'-6"	3'-0"	4'-0"	4'-6"	5'-2"
	B	1'-9"	2'-6"	2'-9"	3'-0"	3'-6"	4'-0"
1/8	C	2'-6"	3'-0"	4'-0"	4'-6"	4'-9"	6'-6"

**NOTE:**

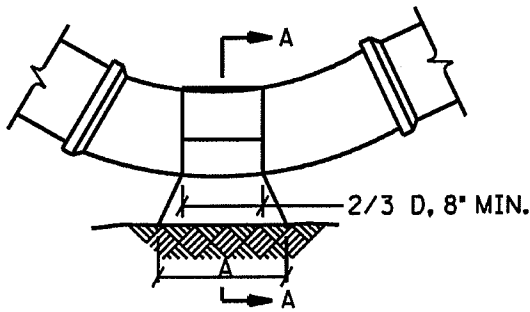
1. USE 3 #6 REINFORCING BARS AS SHOWN. IMBED 30 DIAMETERS IN CONCRETE AND PAINT EXPOSED SURFACE WITH 2 COATS OF APPROVED BITUMINOUS PAINT.
2. ALL CONCRETE TO BE CLASS AS SPECIFIED FOR MASS CONCRETE.
3. ALL BUTTRESSES TO BE CARRIED TO UNDISTURBED EARTH.
4. BUTTRESS DIMENSIONS SHOWN ARE MINIMUM. DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3,000 PSF AND STATIC WATER PRESSURE OF 150 PSI WHERE PRESSURE EXCEEDS 150 PSI OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3,000 PSF. SPECIAL BUTTRESS DESIGN IS REQUIRED.
5. USE DIMENSIONS SHOWN UNDER 4" PIPE FOR ALL PIPES LESS THAN 4" ø.

DRAWN BY \_\_\_\_\_  
 DATE \_\_\_\_\_  
 CHECK BY \_\_\_\_\_  
 DATE \_\_\_\_\_

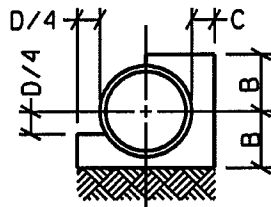


### THRUST BLOCK VERTICAL BENDS

APPROVED BY \_\_\_\_\_  
 DATE APPROVED \_\_\_\_\_  
 DETAIL NO.  
**5195**

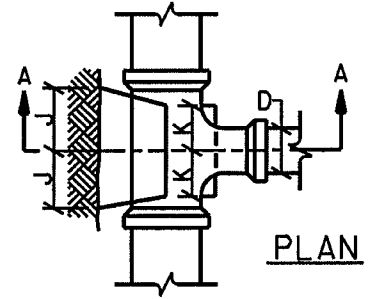


PLAN

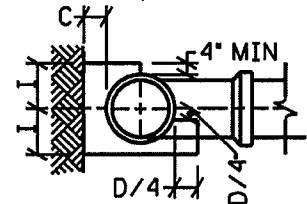


SECTION A-A

D = PIPE DIAMETER

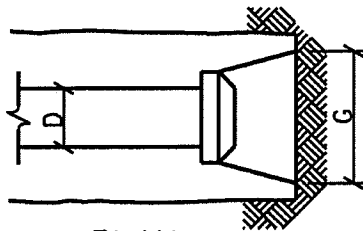


PLAN

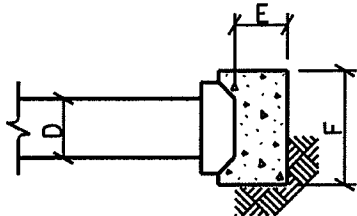


SECTION A-A

**BUTTRESS FOR HORIZONTAL BENDS**



PLAN



SECTION

**BUTTRESS FOR CAPS**

**NOTES:**

1. ALL BUTTRESSES TO BE CARRIED TO UNDISTURBED EARTH.
2. ALL CONCRETE TO BE AS SPECIFIED FOR MASS CONCRETE
3. BUTTRESS DIMENSIONS SHOWN ARE MINIMUM DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3,000 PSF AND STATIC WATER PRESSURE OF 150 PSI WHERE PRESSURE EXCEEDS 150 PSI OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3,000 PSF SPECIAL BUTTRESS DESIGN IS REQUIRED.
4. USE DIMENSIONS SHOWN UNDER 4" PIPE FOR ALL PIPES LESS THAN 4"Ø.

**BUTTRESS FOR TEES**

**BUTTRESS FOR HORIZONTAL BENDS**

BEND °	SIZE OF BRANCH - D						
	4"	6"	8"	10"	12"	16"	
11 1/4°	A	4"	6"	8"	10"	1'-0"	1'-4"
	B	5"	7"	8"	9"	10"	1'-0"
1/32	C	5"	7"	7"	8"	8"	9"
	A	6"	9"	1'-0"	1'-6"	1'-9"	2'-3"
22 1/2°	B	6"	7"	8"	9"	10"	1'-0"
	C	6"	8"	9"	10"	11"	1'-2"
1/16	A	10"	1'-3"	1'-8"	2'-1"	2'-6"	3'-4"
	B	7"	7"	8"	9"	11"	1'-3"
45°	C	7"	8"	9"	10"	11"	1'-2"
	A	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	5'-0"
90°	B	6"	6"	9"	1'-0"	1'-3"	1'-6"
	C	1'-6"	1'-10"	1'-9"	1'-8"	1'-7"	1'-5"
1/4	E	6"	6"	8"	8"	10"	1'-0"
	F	9"	1'-0"	1'-4"	1'-8"	2'-0"	2'-9"
CAPS	G	11"	1'-5"	1'-11"	2'-5"	2'-10"	3'-9"
	C	6"	8"	9"	10"	1'-0"	1'-2"
TEES	H	6"	8"	9"	10"	1'-0"	1'-2"
	I	6"	9"	1'-0"	1'-3"	1'-5"	1'-11"
	J	4"	6"	8"	10"	1'-0"	1'-4"
	K	6"	6"	8"	8"	8"	10"

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DATE  
CHECK BY  
DATE



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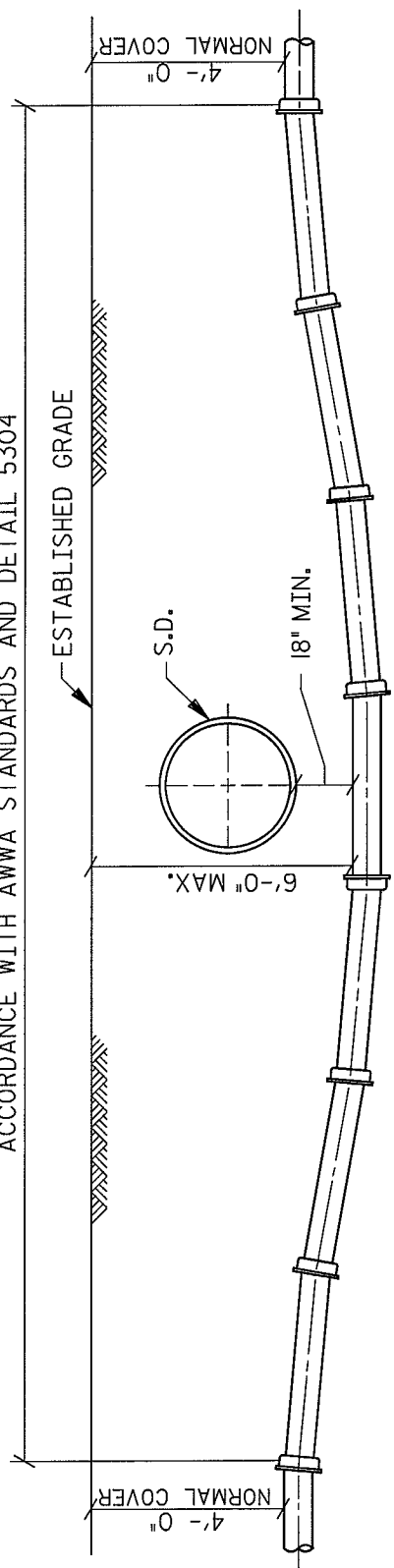
**THRUST BLOCK FOR BENDS, TEES & CAPS**

APPROVED BY

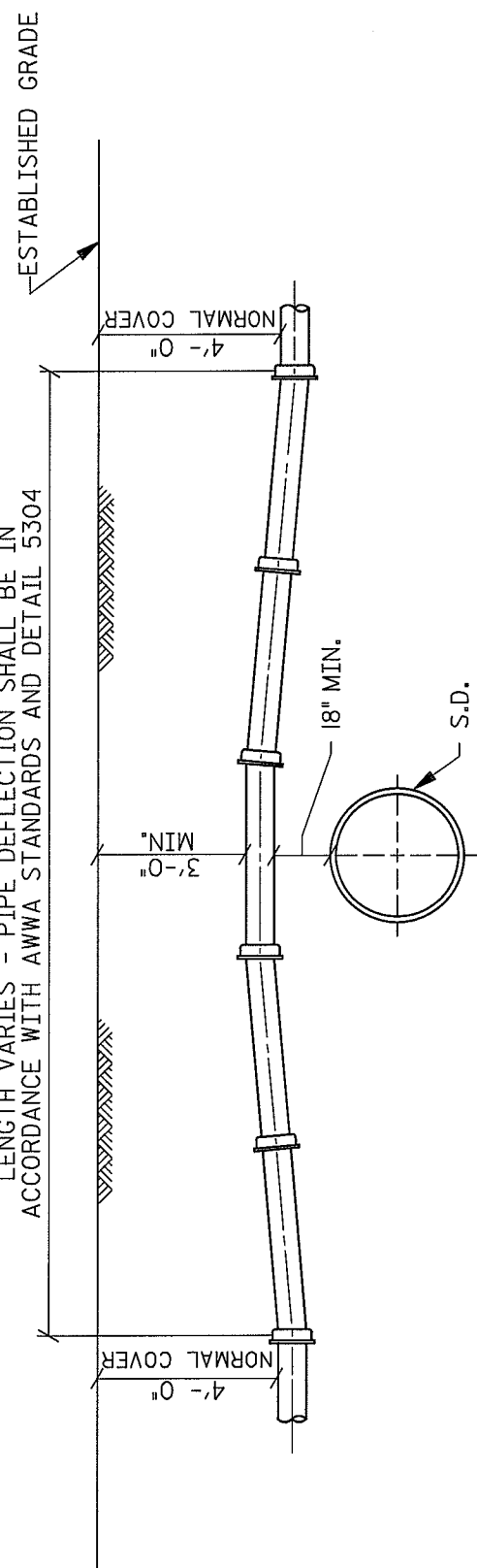
DATE APPROVED

DETAIL NO.  
**5196**

LENGTH VARIES - PIPE DEFLECTION SHALL BE IN ACCORDANCE WITH AWA STANDARDS AND DETAIL 5304



LENGTH VARIES - PIPE DEFLECTION SHALL BE IN ACCORDANCE WITH AWA STANDARDS AND DETAIL 5304

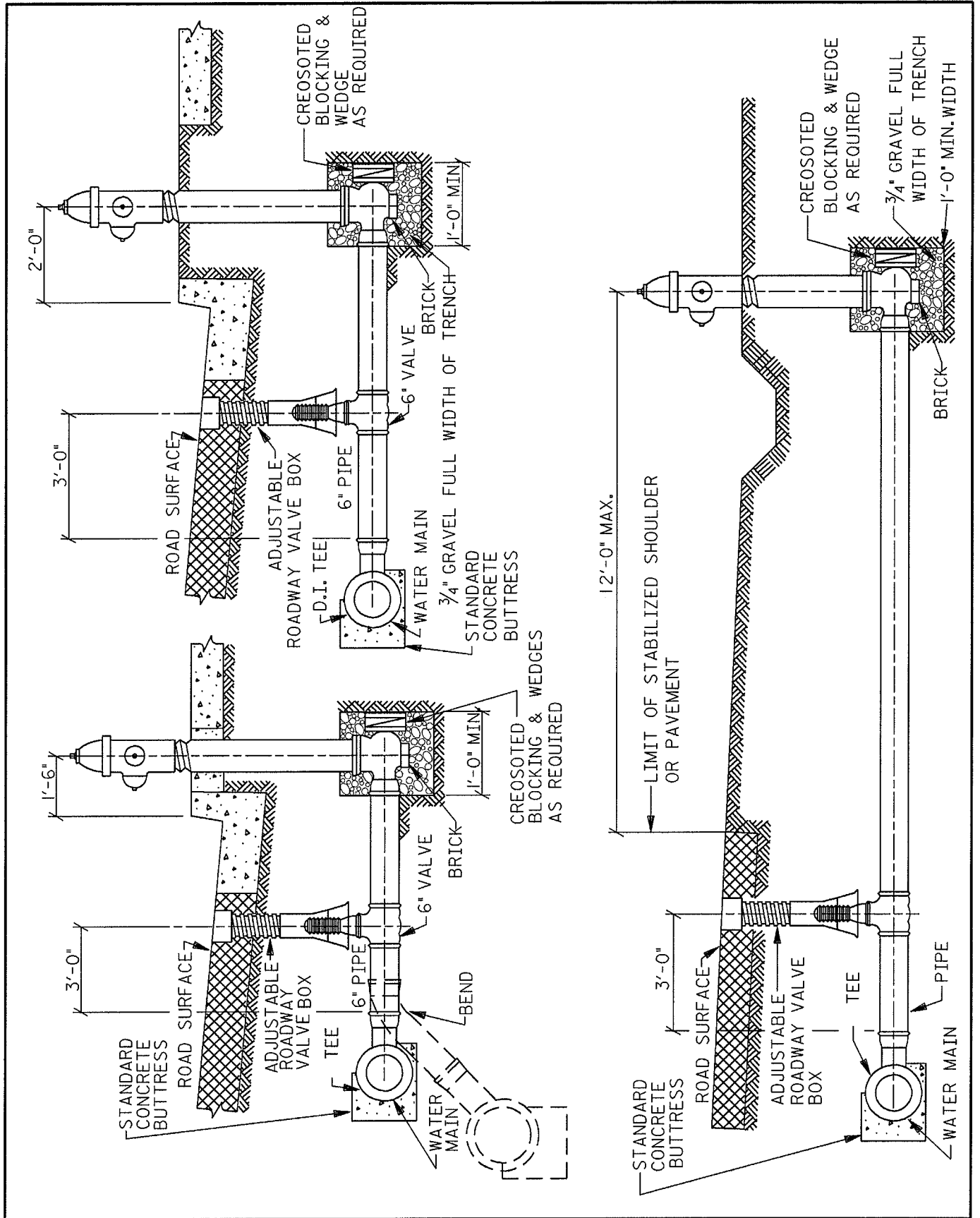


DRAWN BY DLS  
 DATE 8-27-93  
 CHECK BY  
 DATE



WATER MAIN  
 CROSSING STORM DRAIN

APPROVED BY  
 DATE APPROVED  
 DETAIL NO. 5302



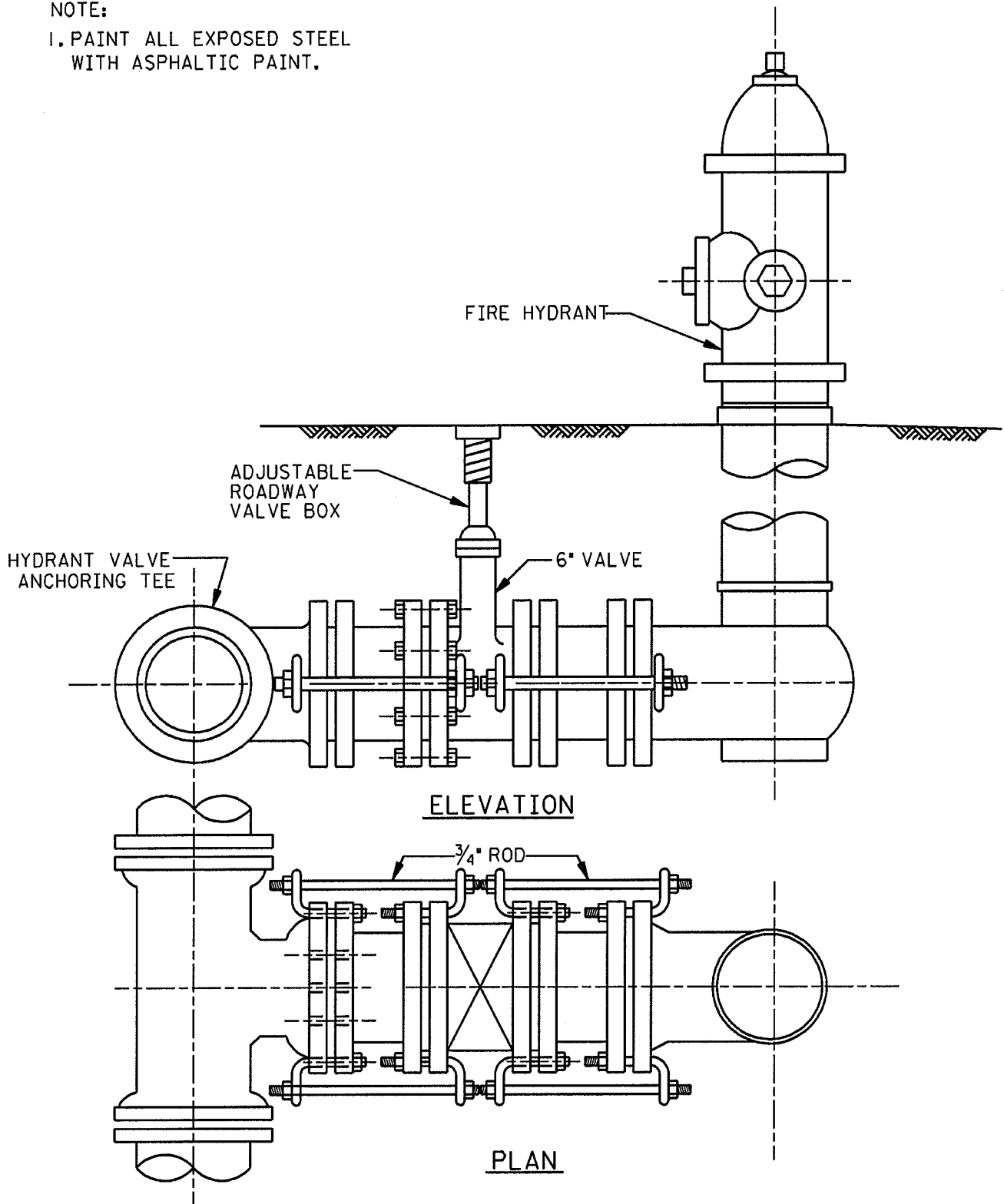
DRAWN BY DLS  
 DATE 8-27-93  
 CHECK BY  
 DATE

**b**  
**BUCHART**  
**HORN, INC.**  
 Consulting Engineers and Planners

FIRE HYDRANT SETTINGS

APPROVED BY  
 DATE APPROVED  
 DETAIL NO. 5303

NOTE:  
 1. PAINT ALL EXPOSED STEEL  
 WITH ASPHALTIC PAINT.



DRAWN BY DLS  
 DATE 8-27-93  
 CHECK BY  
 DATE

**b**  
**BUCHART**  
**HORN, INC.**  
 Consulting Engineers and Planners

FIRE HYDRANT  
 SETTING USING  
 TIE RODS

APPROVED BY  
 DATE APPROVED  
 DETAIL NO.  
**5303A**

PUSH ON JOINTS


PIPE SIZE	DEFLECTION ANGLE DEGREES	MAXIMUM DEFLECTION INCHES		MINIMUM RADIUS FEET	
		LENGTH		LENGTH	
		18'	20'	18'	20'
4"	5	19	21	205	230
6"	5	19	21	205	230
8"	5	19	21	205	230
10"	5	19	21	205	230
12"	5	19	21	205	230
14"	3*	11	12	340	380
16"	3*	11	12	340	380
18"	3*	11	12	340	380
20"	3*	11	12	340	380
24"	3*	11	12	340	380
30"	3*	11	12	340	380
36"	3*	11	12	340	380

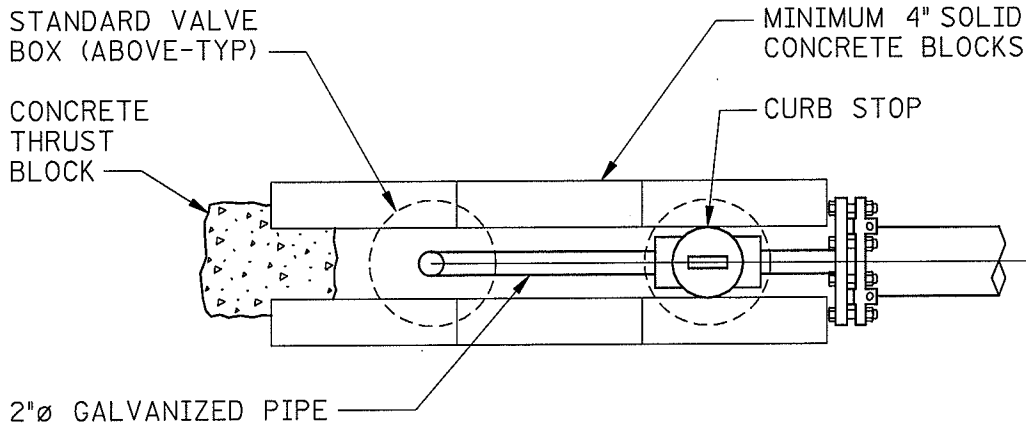
\*FOR 14-IN. AND LARGER PUSH ON JOINTS, MAXIMUM DEFLECTION ANGLE MAY BE LARGER THAN SHOWN ABOVE. CONSULT THE MANUFACTURER.

MECHANICAL JOINTS

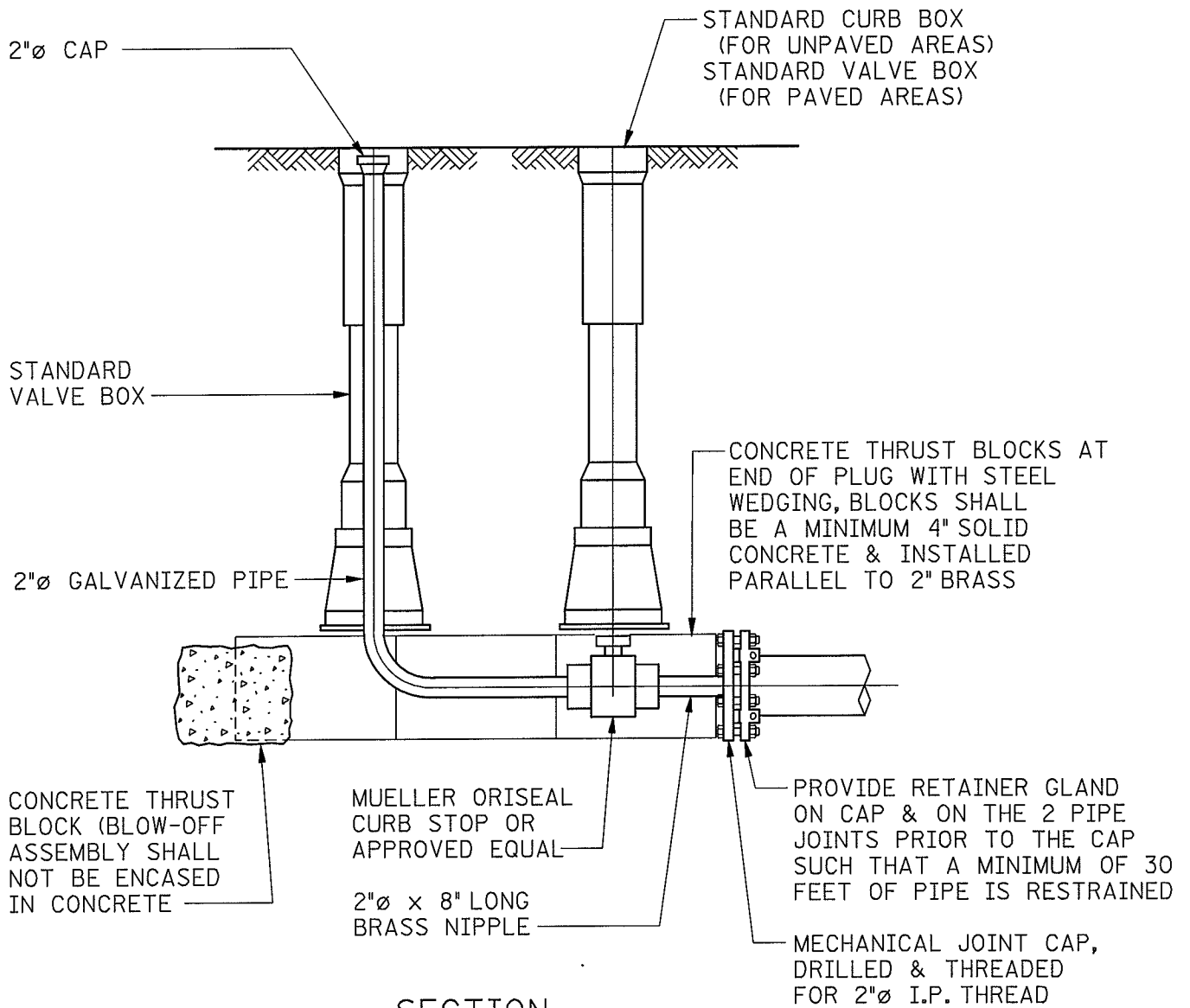
PIPE SIZE	DEFLECTION ANGLE DEG-MIN	MAXIMUM DEFLECTION INCHES		MINIMUM RADIUS FEET	
		LENGTH		LENGTH	
		18'	20'	18'	20'
4"	8 - 18	31	35	125	140
6"	7 - 07	27	30	145	160
8"	5 - 21	20	22	195	220
10"	5 - 21	20	22	195	220
12"	5 - 21	20	22	195	220
14"	3 - 35	13.5	15	285	320
16"	3 - 35	13.5	15	285	320
18"	3 - 00	11	12	340	380
20"	3 - 00	11	12	340	380
24"	2 - 23	9	10	450	500
30"	2 - 23	9	10	450	500
36"	2 - 05	8	9	500	550

REF: AWWA C600-87 TABLES 4 AND 5

DRAWN BY DLS	 BUCHART HORN, INC. Consulting Engineers and Planners	CURVATURE OF DUCTILE IRON PIPELINES	APPROVED BY
DATE 8-27-93			DATE APPROVED
CHECK BY			DETAIL NO. 5304
DATE			



PLAN



SECTION

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DATE  
CHECK BY  
DATE



Consulting Engineers and Planners

BLOW-OFF DETAIL

APPROVED BY

DATE APPROVED

DETAIL NO.  
5308



# APPENDIX

BONNEAUVILLE BOROUGH

STANDARDS FOR  
WASTEWATER PUMPING STATIONS

TABLE OF CONTENTS

Section I	Design Criteria . . . . .	1
Section II	Summary of Design Criteria . . . . .	9
Section III	Application Form for Wastewater Pumping Station . . . .	10

## SECTION I

### DESIGN CRITERIA

#### BOROUGH OF BONNEAUVILLE

#### DESIGN CRITERIA FOR WASTEWATER PUMPING STATIONS

##### A. General

The purpose of this document is to establish minimum technical and design standards for developers and engineers for the design and acceptance of wastewater pumping stations within the service area of the Borough. The standards are intended to ensure uniformity and quality of construction for wastewater pumping stations throughout the Borough. Any deviation from the standards contained herein shall be subject to the approval of the Borough Engineer. Plans and specifications shall be prepared and certified by a professional engineer registered in the Commonwealth of Pennsylvania.

Certain equipment manufacturers have been noted herein for the purposes of establishing standards for: The level of quality for materials and workmanship, reliability, ease of maintenance, and minimization of spare parts inventory. The pumping station and all appurtenant equipment and materials shall be new and unused.

##### B. Design Data

- 1) All work shall be in accordance with the requirements of the Pennsylvania Department of Environmental Protection (PA-DEP) and the PA-DEP Domestic Wastewater Facilities Manual (DEP # 1357-8/91), or most recent revision.
- 2) Pumps shall be capable of handling the maximum peak hourly flow with one unit out of service.

##### C. Site Requirements

- 1) The pumping station site shall be protected by a chain link fence 6 ft. in height. One 3-foot walk-through gate and one 10-foot drive-through gate shall be provided.
- 2) Access to the station shall be via a dedicated asphalt or concrete paved road of single lane width. In unusual cases, curbs and gutters may be required by the Borough Engineer. In no case shall the profile grade exceed 15 percent.
- 3) All grounds are to be landscaped and seeded for grass. Slopes requiring mowing shall not exceed 15 percent.

- 4) The pumping station shall be designed to remain fully operational and accessible during a one hundred (100) year flood event.
- 5) The pumping station shall be located within dedicated easements.

#### D. Pumping Station Building

- 1) The building shall have a minimum 8 foot clear ceiling height, 12 ft. overall width and 20 ft. overall length. The size may be altered at the discretion of the Borough Engineer to provide adequate clearance for equipment operation and maintenance. The building shall have one 6'-0" x 6' - 8" fiberglass or aluminum insulated double door with key lock and stainless steel hardware. The building shall have no windows.
- 2) Key locksets to Borough's existing master-key system. Deliver four (4) master keys to the Borough.
- 3) A minimum of 2'-6" of unobstructed floor space shall be provided in all directions around the pumping equipment or as otherwise accepted by the Borough Engineer.
- 4) A ventilator shall be provided using forced air as opposed to exhaust. Ventilation requirements are 12 air changes/hour for continuous duty or 30 air changes/hour for intermittent duty. A ventilation louver shall be provided on the wall opposite to the ventilation fan.
- 5) No manholes or wet well entrances shall be located inside the pumping station building.
- 6) Water service shall be provided by one 3/4-inch hose bib and sink located inside the building. A backflow preventer shall be provided.
- 7) Sufficient electric heat shall be provided so as to prevent freezing inside the building at -10°F ambient temperature.
- 8) One outside entry light shall be provided near the entrance door. Provide adequate illumination for all areas in the station and the control panel, a minimum of 2 watts illumination per square foot shall be provided. This lighting shall be supplied by the required number fluorescent type lighting fixtures, each having two (2) 40 watt fluorescent tubes and separate ballasts. A light switch shall be located adjacent to each door opening. Lighting circuit shall be protected by a thermal magnetic circuit breaker.
- 9) A minimum of two 110 volt receptacles shall be provided with ground fault protection and waterproof covers.

- 10) In general, the building type and architecture should match and compliment adjacent buildings and properties. It shall also meet all applicable building codes.

#### E. Wet Well

- 1) All penetrations through the slab to the wet-well shall be sealed to prevent sewer gas leakage. The wet well shall be lined as specified for lining new manholes. See Section 02603.
- 2) An aluminum door shall be provided for access to the wet well sized to provide a minimum 30" x 30" clear opening. The door shall have a 300 lbs./sq. ft. load rating with automatic hold open arm.
- 3) The bottom of the wet-well shall be sloped 1:1 toward the pump suction inlet to minimize solids settling. Slope shall begin below pumps off elevation.
- 4) The wet-well shall have a ductile iron 4-inch vent pipe with a 180° turn-down outside of the building.
- 5) An aluminum ladder or manhole rungs of corrosion resistant materials shall be provided to provide access to the bottom of the wet-well.
- 6) For 3-inch pumps passing 2.5-inch solids, a strainer basket to remove rags shall be required. The strainer basket bars shall be 2 in. on center and the basket mounted on guide tracks and removable without entering the wet-well. The basket and guide tracks shall be constructed of welded aluminum and anchored with stainless steel nuts and bolts. Provide aluminum winch stand for removal of basket.
- 7) The wet-well volume shall be of sufficient capacity to ensure that the time between pump run cycles is within the requirements of the electric motor manufacturer. For duplex pumping stations with alternating pumps, the wet-well cycle time between pump on and pump off levels shall be a minimum of 10 min. for motor sizes less than 15 HP or 15 min. for motor sizes greater than 15 HP when the inflow to the wet well is one-half of the pump rated capacity.
- 8) Provide adequate distance between the pump off level and the pump suction intake pipe to prevent vortexing.

#### F. Pumps & Valves

- 1) The pumps shall be located above grade inside the pump station building. Pumps shall be suction lift pumps as manufactured by Gorman-Rupp. All valves, discharge piping and controls shall be furnished by Gorman-Rupp. Pumps shall be self-priming, Super T-

Series. Pumps shall have a large cover plate opening to allow for unclogging and removal of the impeller. Each pump shall be equipped with the following:

- a) Spring assisted discharge check valve with cover plate for removal of internal components
  - b) Discharge plug valve
  - c) Air release valve, automatic, spring assisted, diaphragm type, stainless steel fittings
  - d) Suction and discharge pressure gauges, glycerin-filled, 3½ inch diameter, resilient mount, stainless steel fittings
  - e) Drain valve with quick connect piping, 1-1/4 inch, stainless steel fittings
  - f) High pump temperature thermostat
- 2) Adjustment of the pump impeller face clearance (distance between impeller and wear plate) shall be maintained by external shimless coverplate adjustment, utilizing collar and adjusting screw design for incremental adjustment of clearances by hand. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings. Additional clearance adjustment shall be accomplished by moving the entire rotating assembly towards the wear plate by removal of stainless steel shims from the rotating assembly side of the pump.
- 3) The shaft bearings shall be isolated from the seal cavity with an air gap to provide positive protection of the bearings in the event of a seal leak and to provide for external monitoring of the seal integrity.
- 4) All pumps shall be non-clog design capable of passing a minimum 2-1/2-inch sphere for 3-inch pumps and a minimum 3-inch sphere for larger pumps through all openings within the pump.
- 5) For any design flow, a minimum of two fixed speed pumps shall be provided; each capable of pumping in excess of the peak hourly flow.
- 6) Provide Borough Engineer with a copy of the certified test data. Suction lift pumps must include certified reprime performance tests.
- 7) All valves shall have ports designed to pass 3-inch spherical solids.
- 8) Provide the following spare parts:
- a) One complete rotating assembly
  - b) Two spare pump mechanical seals (complete), and with it all gaskets, seals, sleeves, and "o"-rings required to be replaced during replacement of the seals
  - c) Two sets of rotating assembly adjustment shims
  - d) Two quarts of seal lubricant
  - e) Two cover plate "o"-rings
  - f) Two rotating assembly "o"-rings
  - g) Two impellers
  - h) Two wear plates with hexnuts and lockwashers

- i) Two impeller socket head capscrews
  - j) Two impeller washers
  - k) Two seal plate gaskets
  - l) Two suction flap valve assemblies
  - m) Two bearing cap gaskets
- 9) Each pump shall be driven by a 1750 rpm, open dripproof motor with v-belt drive power transmission. Motors shall not be overloaded at the design condition or at any head in the pump operating range. Each motor shall be NEMA rated with cast iron frame and copper windings.

#### G. Pump Control Panel

- 1) Pump controls shall be manufactured by the pump manufacturer to insure that the pumping equipment is properly coordinated and to insure complete compatability with the pumps.
- 2) The pump control panel shall be manufactured by a UL panel builder and the assembly shall bear a serialized UL label for "Enclosed Industrial Control Panels". All wiring, workmanship, and schematic wiring diagrams shall be in compliance with the National Electric Code (NEC).
- 3) Electrical components shall be as manufactured by Allen-Bradley, General Electric, or Furnas. Circuit breakers shall have through the door operating mechanisms to prevent the door from opening when the breakers are in the "on" position. Motor starters, relays and selector switches shall be NEMA rated.
- 4) Level control system shall be an electronic pressure switch air bubbler wet well level controller with digital readout of wet well level. The pump controller shall be equipped with high wet-well level alarm capability. Level control shall utilize two (2) industrial rated air pumps.
- 5) Control voltage shall be provided by a transformer mounted inside the pump control panel.
- 6) Elapsed time meters shall be provided for each pump on the motor control panel.
- 7) Pumps and pump control panel shall be constructed and tested as a unit at the pump manufacturer's facility prior to shipment.

#### H. Electrical

- 1) Electrical service shall be 3-phase, 480, 240, or 208 volt. Phase conversion equipment to convert single phase power to three phase power shall not be acceptable.

- 2) Design shall include all arrangement with utility company to provide power to facility. Design shall be in accordance with all utility company requirements.
- 3) The main electrical panel shall be service entrance rated with a main circuit breaker and circuit breakers to feed building loads.
- 4) A surge protection device shall be provided on the main service panelboard.
- 5) Station shall be equipped with an automatic dialing remote monitoring system. Provide the following minimum alarm conditions; high water alarm, high pump temperature, power failure, engine overcrank, battery failure, and high engine temperature.
- 6) A separate float switch shall be wired directly to the automatic telephone dialer to serve as an independent high water alarm.

#### I. Electrical Power Backup

- 1) Standby engine to drive one pump during failure of utility power and during scheduled exercise periods. Engine shall be powered by natural gas or LP gas. Provide 115 volt battery charger to maintain the charge on the 12 volt DC battery supplied with the engine. Provide separate DC powered electronic pressure switch liquid level controls to operate engine only when the water level in the wet well reaches the pump on elevation. The exhaust from the engine shall be vented to the outside via flexible stainless steel piping.
- 2) If LP gas is used, provide calculations on storage tank sizing. The LP gas tank and fuel supply piping shall be sized to adequately furnish the engine with LP gas when the temperature reaches 10 degrees F and the tank is 60% full. LP gas pipe size shall be per engine supplier's recommendations.
- 3) Provide thermally actuated intake and exhaust assemblies consisting of louvers, actuator assembly, mounting frame, and external screen. Air intake vents shall progressively open at 75 degrees F and progressively close at 60 degrees F as a result of thermal expansion or contraction of wax-like material contained in an enclosed plunger actuator.
- 4) All equipment shall be wired for automatic restart capability after restoration of power.

#### J. Force Main

- 1) Force main material of construction shall be ductile iron pipe.
- 2) Depth of cover shall be a minimum of 4' - 0".
- 3) A by-pass connection with a quick connect coupling and shut-off plug valve shall be installed inside the pump station building on the discharge header to allow for bypass pumping into the force main.



- 4) Force main line velocities should be between 2.5 - 4.5 FPS.
- 5) Minimum force main pipe diameter is 6-inch, unless otherwise approved by the Borough Engineer.

#### K. Start-Up

- 1) Start-up and equipment check operations shall be performed by an authorized service technician from the original equipment manufacturer.
- 2) The Borough Engineer shall be notified forty-eight hours prior to start-up and a Borough representative shall be present during the period of start-up.
- 3) A copy of the technician's start up report showing all field data control, set points and equipment condition shall be furnished to the Borough Engineer.
- 4) Sufficient water for start-up and equipment check shall be the responsibility of the developer.

#### L. Submittals

At the time of application the following shall be submitted to the Borough Engineer:

- 1) A completed application form (attached).
- 2) All calculations and assumptions for the system head curve, total dynamic head, flow quantification, wet-well volume, pump duty cycle at average and peak daily flow, force main line velocity, as well as any other design calculations.
- 3) Site plan showing subject pumping station relative to area under development and the existing sewer system.
- 4) Building blueprints for the pumping station.
- 5) All pump curves.

Prior to acceptance of the pumping station, the following shall be submitted to the Borough Engineer:

- 1) Six copies of the equipment submittal drawings.
- 2) Three copies of the manufacturer's O/M manuals for all mechanical and electrical equipment.

- 3) Recommended spare parts list from the equipment manufacturer.
- 4) One copy of manufacturer's certified test data including reprime performance tests.

#### M. Protection of Equipment

- 1) The pumping station should be placed into service soon after delivery of the equipment. If operation is delayed, the equipment including controls shall be stored indoors free from excessive dust in a low humidity, heated environment.

#### N. Clean-Up

- 1) In State Highways, Municipal and Private Roads and improved private property, the Developer shall ensure that the Contractor cleans up as the work progresses and shall maintain his construction areas in a clean condition up until acceptance by the Borough, without regard to who caused the need for clean-up. In unimproved areas, the Contractor shall clean-up before acceptance of the work by the Borough.

#### O. Installation

- 1) Install wastewater pump station in accordance with manufacturer's instructions.
- 2) Provide necessary piping, fittings, and valves as required for a complete operable unit as intended.

#### P. Start-Up

- 1) Upon completion of installation, examine, adjust and test each pump for proper operation under the direction of the manufacturer's field engineer.
- 2) Check and adjust liquid level control and alarm settings.

#### Q. Performance Testing

- 1) Test each pump with clean water through minimum of four complete cycles including high-level and low-level conditions to demonstrate correct sequence of pump operation, control settings, alarm settings, freedom from pump vibration, noise and overheating.
- 2) Demonstrate provision for pump removal and replacement.

## SECTION II

### SUMMARY OF DESIGN CRITERIA

DESIGN PARAMETER	DESIGN VALUE
1. FLOW DEVELOPMENT	
a. Single family dwellings, GPD/capita	100
b. Others	text or manuals
2. RATIO OF PEAK HOURLY FLOW/DESIGN AVERAGE FLOW	4.0
3. SITE	
a. Fence	chain link, 6' height
b. Roadway	all weather, single lane, <15% grade
c. Maximum landscaped slope, %	15
d. Flood protection, flood event	100 Yr.
4. BUILDING	
a. Minimum clear ceiling height, ft.	8
b. Unobstructed floor space around pumps, ft.	2'-6"
c. Ventilation requirements, air changes/hr	12 continuous, 30 intermittent
d. Potable water service line, in	3/4
e. Interior lighting, 2 bulb, 40W fixtures	2 watts/SF minimum
f. Interior electrical receptacles, 110 volt	2
5. WET-WELL	
a. Minimum wet-well bottom slope	1:1
b. Detention time between pump run cycles, min.	15 for >15 HP; 10 for ≤ 15 HP motor
6. PUMPS	
a. Maximum pumping rate	>peak flow
b. Minimum number of pumps	2
c. Pump type	suction lift, constant speed
7. ELECTRICAL	
a. Incoming service, volt/phase	208/230/460, 3 phase
b. Control voltage, volts	110
8. FORCE MAIN	
a. Pipe material of construction	ductile iron
b. Minimum depth of cover, ft.	4
c. Line velocities, fps	2.5 - 4.5

SECTION III

APPLICATION FORM FOR WASTEWATER PUMPING STATION

**A. General Information**

- 1. Name of project served \_\_\_\_\_
- 2. Total area served, acres \_\_\_\_\_
- 3. Estimated start of construction \_\_\_\_\_
- 4. Estimated completion date \_\_\_\_\_

**B. Applicant**

I, the undersigned, am fully aware that the statements made in this application for approval of a wastewater pumping station are true, correct and complete to the best of my knowledge.

\_\_\_\_\_  
Signature of Applicant

\_\_\_\_\_  
Mailing Address

\_\_\_\_\_  
Name and Title

\_\_\_\_\_  
Telephone Number

\_\_\_\_\_  
Representing

\_\_\_\_\_  
Date

**C. Engineer**

This is to certify that this application has been prepared under my direction and the plans and specifications for this wastewater pumping station have been designed by me and are in conformance with sound engineering practices.

\_\_\_\_\_  
Signature of Applicant

\_\_\_\_\_  
Mailing Address

\_\_\_\_\_  
Name and Title

\_\_\_\_\_  
Telephone Number

\_\_\_\_\_  
Representing

\_\_\_\_\_  
Date

**D. Critical Elevations**

- 1. 100 year flood \_\_\_\_\_
- 2. Top of pumping station slab \_\_\_\_\_
- 3. Influent line in wet-well \_\_\_\_\_
- 4. Bottom of wet-well \_\_\_\_\_
- 5. Pump on \_\_\_\_\_
- 6. Pump off \_\_\_\_\_

**E. Quantification of Design Flow**

	UNITS	@	GAL/UNIT	GPD
1. Single Family Dwellings	_____	@	_____	_____
2. Condominiums, Apartments	_____	@	_____	_____
3. Swimming Pools	_____	@	_____	_____
4. Motels	_____	@	_____	_____
5. School	_____	@	_____	_____
6. Commercial	_____	@	_____	_____
7. Industrial	_____	@	_____	_____
8. Other	_____	@	_____	_____
Totals:				
Average Daily Flow			_____	GPD
Minimum Daily Flow			_____	GPD
Peak Hourly Flow			_____	GPD
Peaking Factor			_____	

**F. Design Information**

- 1. Head
  - a. Static head, ft \_\_\_\_\_
  - b. Total dynamic head, ft \_\_\_\_\_
  
- 2. Wet-Well
  - a. Effective Volume between pump and off, CF \_\_\_\_\_
  - b. Detention time at peak hourly flow, min. \_\_\_\_\_
  - c. Min. time between pump starts \_\_\_\_\_
  - d. Ventilation present \_\_\_\_\_
  - e. Strainer basket present \_\_\_\_\_
  
- 3. Pumps
  - a. Pump manufacturer/Model No. \_\_\_\_\_
  - b. Number of pumps \_\_\_\_\_
  - c. Type of pumps \_\_\_\_\_

- d. Pump capacity
  - No. 1 \_\_\_\_\_ GPM @ \_\_\_\_\_ TDH; \_\_\_\_\_ HP
  - No. 2 \_\_\_\_\_ GPM @ \_\_\_\_\_ TDH; \_\_\_\_\_ HP

e. Pump controller  
 Manufacturer/Model No. \_\_\_\_\_

4. Force Main

- a. Pipe material of construction \_\_\_\_\_
- b. Pipe diameter, inches \_\_\_\_\_
- c. Line velocity with one pump on \_\_\_\_\_
- d. Depth of cover, ft. \_\_\_\_\_

5. Electrical

- a. Electrical service supplier \_\_\_\_\_
- b. Voltage, Phase \_\_\_\_\_
- c. Automatic restart capability \_\_\_\_\_
- d. Alarm manufacturer/Model No. \_\_\_\_\_
- e. Emergency service provision \_\_\_\_\_

6. Building

- a. Interior 3/4" hose bib present \_\_\_\_\_
- b. Minimum unobstructed distance around equipment, ft. \_\_\_\_\_
- c. Overhead support beam present \_\_\_\_\_
- d. Ventilator present \_\_\_\_\_
- e. Number of 110 volt electrical receptacles \_\_\_\_\_
- f. Area of building, SF \_\_\_\_\_

7. Submittals attached with this application

- (Yes/No)
- a. Calculations \_\_\_\_\_
  - b. Site plan \_\_\_\_\_
  - c. Building blueprints \_\_\_\_\_
  - d. Pump curves \_\_\_\_\_