

## **XVIII. LOW PRESSURE SEWERS**

Pressure sewers are permitted in the CMUD sewer system only in areas that are specifically designated for pressure sewer service. These areas are designated in the 1990 CMUD Lake Area Study and are primarily in the areas bordering Lake Norman, Lake Wylie and Mountain Island Lake where gravity service would involve numerous small lift stations. Material and construction specifications and Standard Details for pressure sewer connections are included in Section XVI of this document.

### **A. Design of Pressure Sewer Systems**

The developer shall have all pressure sewers designed by a professional engineer licensed in North Carolina. In addition to drawings and specifications, the developer shall include a design memorandum detailing the design procedures used for the pressure sewer system. The design memorandum shall include:

1. Hydraulic calculations demonstrating that the total dynamic head (TDH) does not exceed 100 feet at any existing or potential grinder pump location.
2. Profiles of all pressure sewer lines demonstrating that the system will be under positive pressure at all time. Specifically, the discharge elevation shall be above all intervening high points.
3. Calculations indicating determination of pressure main sizing. Initial pipeline sizing shall be based on providing a minimum of 3.0 foot per second (fps) velocity at a discharge calculated according to the following equation:

$$Q \text{ (in gpm)} = 15 + 0.5D$$

where: D = The number of dwelling units upstream of the reach under investigation.

4. Calculation of final pipe size may be adjusted based on evidence from hydraulic calculations, provided that such calculations indicate that a minimum of 2.0 fps can be achieved in all lines with no more than 5% (or a minimum of 2) pumps operating simultaneously through the line under determination.
5. Determination of Hazen-William coefficient. A Hazen-Williams coefficient, C, of 140 to 150 may be used, provided that if C=150, the nominal pipe size only may be used, and an allowance for minor losses associated with fittings should be included in the hydraulic calculations.
6. Calculation of Impeller Diameters for each pump. The impeller diameter of individual pumps in a system with varying pump elevations shall be sized such that full size impellers are used at pumps at the lowest elevations, and reduced size impellers are used at higher pumps such that the total TDH of any one pump is within 20% of all other pumps.

7. Calculations of the maximum flow discharged from the pressure sewer system with all pumps operating. This condition will be experienced upon restoration of power following a system wide power outage. If the maximum flow calculated, including other pressure sewers, exceeds the rated maximum pumping capacity of any downstream pump stations, the discharge shall be into a gravity sewer of sufficient diameter and length to provide 150 gallons of storage capacity per grinder pump within the gravity pipeline. All gravity sanitary sewers shall be constructed in accordance with the ***Requirements and Specifications for Sanitary Sewer Construction***.
8. Private pressure sewers shall connect to the CMUD maintained system at a stub from the property line side of the dual ball valve/check valve assembly according to the service connection Standard Details (See Pressure Sewer Material Specifications).

**B. Material And Installation Specifications For Low Pressure Sanitary Sewer**

Unless superseded or modified by a Special Provision, all materials, apparatus, supplies, methods of manufacture, or construction shall conform to the specifications for same contained in this Section. National material standards (ASTM, ANSI, etc.) referred to herein shall be considered to be the latest revisions only.

The Engineer may waive certain requirements of these Material and Installation specifications, provided that the Contractor requests such waiver in writing and provided that the function of the material is not impaired. The Contractor may request to substitute for a material that has been specified. The Engineer, in writing only, may accept or reject such request.

1. Piping: All pressure sewer piping shall be ductile iron, or PVC as specified below. All pressure sewer force main within street or highway rights-of-way shall be clearly identified with green plastic locator tape made specifically for that purpose. The tape shall be marked with black lettering clearly identifying the pipeline as sanitary sewer. The tape shall be Type III Detectable Marking Tape as manufactured by Lineguard, Inc., or approved equal.
  - a. Ductile Iron Pressure Sewer: All ductile iron pipe furnished shall be Pressure Class 350, conforming to the requirements of ANSI/AWWA C-151/A21.51 and shall have a cement mortar lining in accordance with AWWA C-104. DIP shall be furnished with push-on joints in accordance with AWWA C-111.
  - b. PVC Pressure Sewer: Unless amended on the Construction Drawings, all four, six and eight-inch pressure sewer may be PVC 1120, furnished in accordance with AWWA Standard C-900, and shall be Pressure Class 150 with a SDR of 18 or less. All three inch and smaller pressure sewer mains may be PVC 1120 pipe furnished in accordance with ASTM D-2241, and shall be Pressure Class 160 with an SDR of 26 or less. PVC Pressure Pipe shall be made from materials whose Cell Classifications are either Class 1245A or 1245B, and shall be furnished in lengths of 20 feet. Lesser lengths will be

accepted to allow the proper placement of fittings, valves, etc. All PVC Pipe will be shipped, stored, and strung at the project in such a manner as to be protected from total accumulated exposure to sunlight and possible ultraviolet radiation of no more than four (4) weeks.

Pipe jointing for all main line pipe shall be by ELASTOMERIC GASKET JOINTS only, conforming to ASTM standard D-3139. Pipe Bells for all pipes three-inch and larger shall be integral to the pipe; sleeve couplings are not allowed.

Whenever a 4-inch or larger PVC pressure sewer crosses over or within 1.5 feet below a water main, the PVC pipe shall be replaced with ductile iron pipe as specified above. For lines smaller than three-inches, the PVC pipe may be installed within a length of 3-inch or 4-inch Ductile Iron Pipe. The ductile iron pipe shall extend not less than 10 feet on each side of the water main.

2. Fittings: All fittings for pipes four-inch and larger shall be Ductile Iron or Cast Iron. All fittings for pipes smaller than 4-inch shall be solvent weld PVC.
  - a. Cast Iron and Ductile Iron Fittings: All cast iron or ductile iron fittings shall be Pressure Class 250, mechanical joint fittings, in accordance with AWWA C-110 or pressure class 350 compact fittings in accordance with AWWA C-153. All fittings shall be furnished bell and bell unless otherwise indicated on the drawings. All fittings shall have a cement mortar lining of standard thickness in accordance with AWWA C-104.
  - b. PVC Fittings: PVC fittings for pressure sewer mains shall be Schedule 80 fittings furnished in accordance with ASTM D-2467 with solvent weld joints installed according to ASTM D-2855.
3. Valves: All valves on pressure sewer mains shall be plug or ball valves as specified below. Valve operation shall be open left.
  - a. Plug Valves: All valves on pressure sewer mains shall be eccentric plug valves as follows:
    1. Plug valves shall be non-lubricated, with a plug facing of a material specifically recommended by the valve manufacturer for the indicated service and shall have stainless steel permanently lubricated upper and lower plug stem bearings. Valve seats shall be nickel. Valves shall be designed with adjustable seals which are replaceable without removing the bonnet. The bearing and seal area shall be protected with grit seals.

Area of port opening for all valves shall be no less than 81% of full pipe area.

12-inch and smaller valves shall be rated at 175 psi. 14-inch and larger valves shall be rated at 150 psi. Bi-directional shut off is required.

Plug valves shall be as manufactured by Dezurik Corporation, Milliken Valve Co., Keystone Valve, or approved equal.

- a) Buried valves four-inches and larger and other valves specifically indicated shall have mechanical joint ends conforming to ANSI A21.11.
  - b) Buried valves three inches and smaller shall have schedule 80 threaded ends and shall be connected to the pressure main by schedule 80 PVC threaded by socket adapters.
- 2) Buried plug valves shall have 2-inch operating nuts within 10-inches to 15-inches below finish grade.
  - 3) Extension stems, stem guides, operating levers, and other miscellaneous items required for a complete installation shall be provided in accordance with the requirements and recommendations of the manufacturer.
  - 4) Buried plug valves shall be provided with adjustable valve boxes. Valves boxes shall be cast iron conforming to ASTM A-48, Class 30. Valve box castings shall be fully bituminous seal coated. Valve box shall be Tyler 462A or equal.
- b. Thermoplastic ball valves: Thermoplastic ball valves shall be used at each service connection and shall be made of PVC Thermoplastic. The valves shall be furnished with teflon seats and true union threaded ends. Thermoplastic ball valves shall be as manufactured by Hayward, Incorporated or approved equal.
  - c. Thermoplastic ball check valves: Thermoplastic ball check valves shall be used at each service connection and shall be made of PVC Thermoplastic. The valves shall be furnished with elastomeric seats and true union threaded ends. Thermoplastic ball check valves shall be as manufactured by Hayward, Incorporated or approved equal.
4. Service Boxes and Lids: All service connections and clean outs shall be placed in an appropriately sized box, in accordance with the Standard Details, and shall be as manufactured by Brooks Products Company (36 Series) or approved equal.

Concrete boxes shall be made of concrete mix, 1-2-1, one part cement, two parts granite screenings, and one part 3/8" granite stone. The meter boxes shall be

concrete machine made and tamped with pneumatic tamps to ensure the proper density. All concrete items shall be steam cured 24 hours and yard cured for two weeks. All service connection boxes shall be made of green plastic with the physical dimensions shown in the Standard Details, and constructed of standard thermoplastic materials using the structural foam approach, and shall be as manufactured by Brooks Products Company (Series 1730). The plastic composition shall be uniform and substantially resistant to moderate acid attack, ultraviolet ray action, and weathering as may be encountered in outdoor application and semi-buried service.

Plastic lids shall be furnished with "snap lock" tabs, interchangeable with existing CMUD meter boxes, and imprinted with the words "Pressure Sewer" on the lid.

5. Installation of PVC Low Pressure Pipe: PVC pressure sewer main shall be installed substantially in accordance with the Standard Recommended Practices for UNDERGROUND INSTALLATION OF FLEXIBLE THERMOPLASTIC SEWER PIPE, ASTM D-2321. The following exceptions shall be taken to the Standard:

- a. Installing Valves and Fittings: Valves and fittings shall be installed in the manner specified for cleaning, laying and jointing pipe. Valves shall be installed at locations shown on the Plans and/or as directed by the Engineer.

- 1) Valve Boxes: A valve box shall be installed at every buried plug valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut, with the box cover flush with the pavement or other existing surface. Where the box is not in pavement, the top section shall be anchored by an 18" x 18" x 6" concrete pad, or an approved pre-cast concrete pad, set flush with the existing terrain. The top section will be grouted into the pre-cast concrete pad. The location of the valve will be identified by the letters "P.S.V." imprinted onto the curb adjacent to the pressure sewer valve.

- b. Alignment and Grade: Unless specifically approved by the Engineer, the curb must be in place and backfilled, and the area between curb and street right-of-way line graded smooth and to finished grade before the pressure sewer mains are installed. The pressure sewer mains shall be installed on the opposite side of the road from the water main and five feet behind the curb except as shown on the approved plans or as directed by the Engineer. In special circumstances, the Engineer may approve installation of pressure sewers before the curb is installed. In such cases, the street must be graded according to approved grading plans for the entire street right-of-way, the pressure sewer staked eight feet behind the proposed curb line with 90 degree offset stakes every 50 feet, and "cut sheets" provided showing the vertical distance between each offset stake and the trench bottom point. Such staking shall be done only by a surveyor registered in the State of North Carolina. The

pressure sewer shall be laid and maintained at the required lines and grades with fittings and valves at the required locations, spigots centered in bells, and all valve stems plumb.

After curb and gutter has been installed, the location and depth of the pressure sewer main and valves, etc., will be checked for conformance to CMUD standards. Any deficiencies will be corrected to the satisfaction of the Engineer prior to testing and activation of the mains.

Depth of Pipe Installation: Unless otherwise indicated on the Plans, or required by existing utility location, all pipes shall be installed with the top of the pipe at least 5.0' below the edge of the adjacent roadway pavement or 4.5' below the ground, above the pipe, whichever is greatest. The Contractor is instructed to check construction plans and blow-up views for additional requirements.

The Contractor may be required to vary the depth of the pipe to achieve minimum clearance from existing utilities while maintaining the minimum cover specified whether or not the existing pipelines, conduits, cables, mains, etc., are shown on the plans. PVC pressure sewer shall be installed with 12-inches clearance above other utilities or 18-inches clearance below other utilities.

- c. Testing: The water for testing purposes can be taken from the nearest available CMUD water main under the supervision of the Engineer's Inspector and leakage will be measured by the Inspector with a meter furnished by CMUD.

The Contractor shall use great care to be sure that all air is expelled from each section under test. If service connection or other openings are not available for the purposes of expelling air, the Contractor shall provide air release of sufficient size (as determined by the Engineer) in accordance with Standard Detail 1.

The test pressure will be 125 PSI at the low point of the section under test.

Allowable leakage will be determined by Table 6A, AWWA C-600 (See Section XIV.R-1.b) or by the formula  $L=0.000083(D)(S)$  where L is the allowable leakage in gallons per hour, S is the length of pipe under test in feet and D is the pipe diameter in inches. Add 0.0050 gal/hr. for each 1-1/2 inch lateral.

Required testing of pipelines and valves shall be done under the direct supervision of the Project Inspector. Field testing shall not negate the requirements for material certifications as contained in the material specification section of this contract. Unless otherwise directed by the Engineer, all testing will be completed prior to connection to any existing line. The Contractor shall provide open ventilation of confined spaces.

The Contractor shall be responsible for providing all equipment and personnel necessary to comply with OSHA confined spaces regulations.

On completion of the line or sections of the lines, connections and appurtenances, the line shall be filled and hydrostatically tested. All leaks and any defective material shall be repaired or replaced to the satisfaction of the Engineer and the tests repeated until the requirements of this specification are met. Any special equipment, pumps, etc. required to make the test shall be furnished and operated by the contractor as directed by the Inspector.

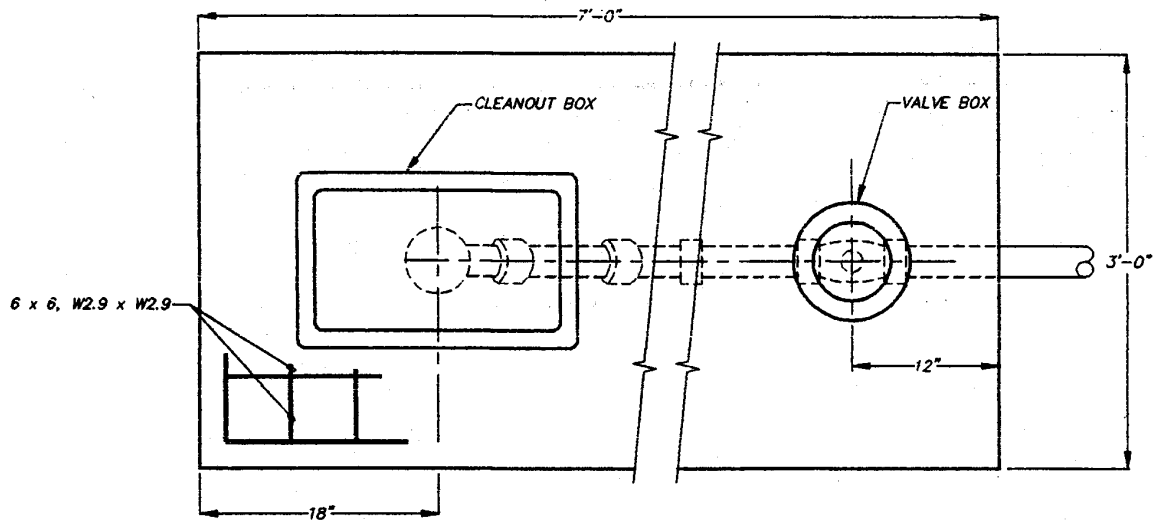
Specific procedures for testing mains are as follows:

- (a). Pressure and leakage tests will be run concurrently and for a duration of four hours except as modified below.
- (b). The Contractor will pressurize the line and verify that it is within allowable leakage before the official test is started.
- (c). During the official test, the Contractor is to maintain the pressure within " 5 PSI for the duration of the test period. The contractor will pump the line to full test pressure at the end of each hour AND when the test pressure drops 5 PSI. The contractor will record the time, meter reading and pressure reading before and after each pumping occurrence.
- (d). The Inspector will begin the test and remain at the job for the first hour, making sure that the test pressure is maintained within " 5 PSI. At the end of the first hour, with the line pumped to full test pressure, he will read the meter and record the first hour leakage. If the first hour leakage is within allowable, he will return at the end of the fourth hour and again read the meter. If the total leakage for the four hour period does not exceed four times the first hour leakage, the test will be terminated. If the total leakage exceeds four times the first hour leakage, but is still within allowable, the test will be held an additional hour. If the fifth hour leakage does not exceed the average hourly leakage for the first four hours, the test will be terminated at the end of the fifth hour. Otherwise, the test will be held until the leakage is non-increasing and within allowable for two consecutive hours.
- (e). If leakage exceeds allowable for the four hour test, the test will be terminated and re-scheduled after the Contractor has verified that actual leakage is within the allowable leakage, but no earlier than the next work day.
- (f). If the first hour leakage does not exceed 10% of the allowable, or if the allowable leakage rate does not exceed .4 gal/hr., the test may be terminated at the end of two hours provided the second

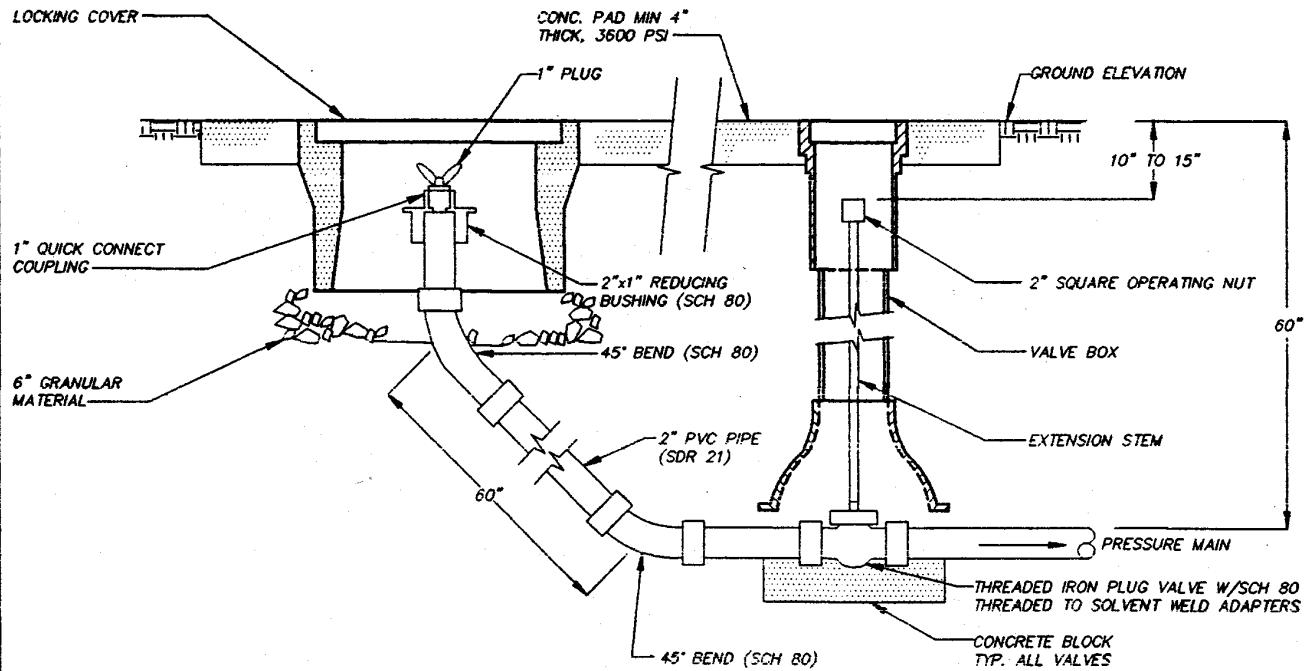
hour leakage does not exceed the first hour leakage. If the second hour leakage exceeds the first hour leakage, the test will be held for an additional period as described in Paragraph (d) above.

- (g). The maximum length of pipe tested in one test shall be 5,000 feet or as close to 5,000 feet as possible depending on valve spacing.
  - (h). During the last stages of the test and without any reduction in pressure, progressing in an orderly manner from the end opposite the test pump, each main line valve will be closed and pressure released to determine if it is holding test pressure (minimum 10 minutes per valve closing).
- d. 1.5" Service Connections: On 3-inch and smaller mains, the 1.5" laterals shall be connected to the street main with schedule 80 PVC solvent weld wyes. On 4-inch and larger mains, the 1.5 inch laterals shall be connected to the street main with a MJ tee plugged and tapped for a threaded by solvent weld schedule 80 PVC Adaptor. The 1.5" service lateral shall be completed to the property line where a service connection meter box shall be installed. The service connection shall contain the following fittings in accordance with the Standard Details, 45 degree solvent weld elbow, solvent weld nipple, solvent weld by threaded adapter, two (2) true union threaded ball valves, threaded adapter, threaded 1.5"x1.5"x1.5" tee, threaded adapter, threaded nipple, true union ball check valve, threaded x solvent weld nipple, 1.5"x1.25" solvent weld reducing bushing. The top of the 1.5" tee shall have a threaded 1.5" x .75" reducing bushing and a brass .75" hose bib.
- e. Partial Service Connections: Partial service connections shall be installed according to the Standard Details at the locations indicated on the Plans. The location for this future service connection stub-out shall be marked by cutting an "S" on the curb above the service. Also, a PVC encapsulated magnet shall be attached near the valve and cap for magnetic locating purposes.





**PLAN VIEW**



**ELEVATION**

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**STANDARD DETAIL  
PRESSURE SEWER**

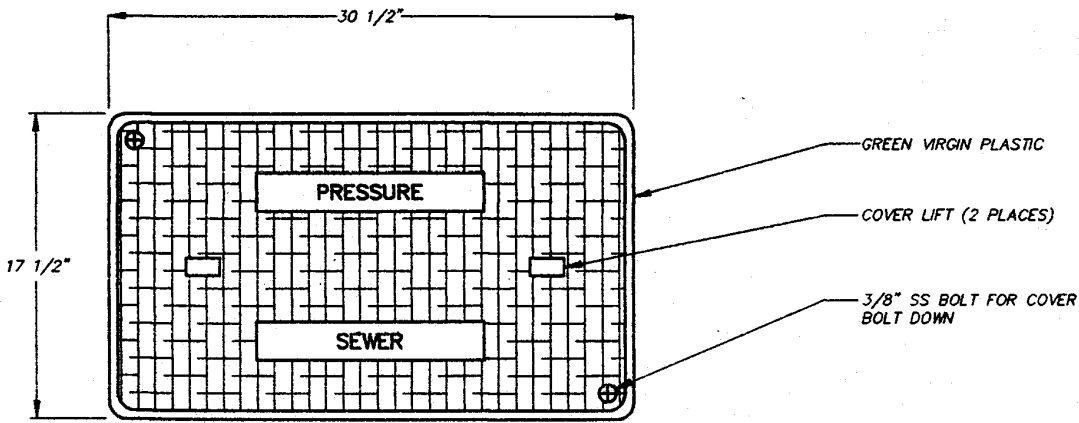
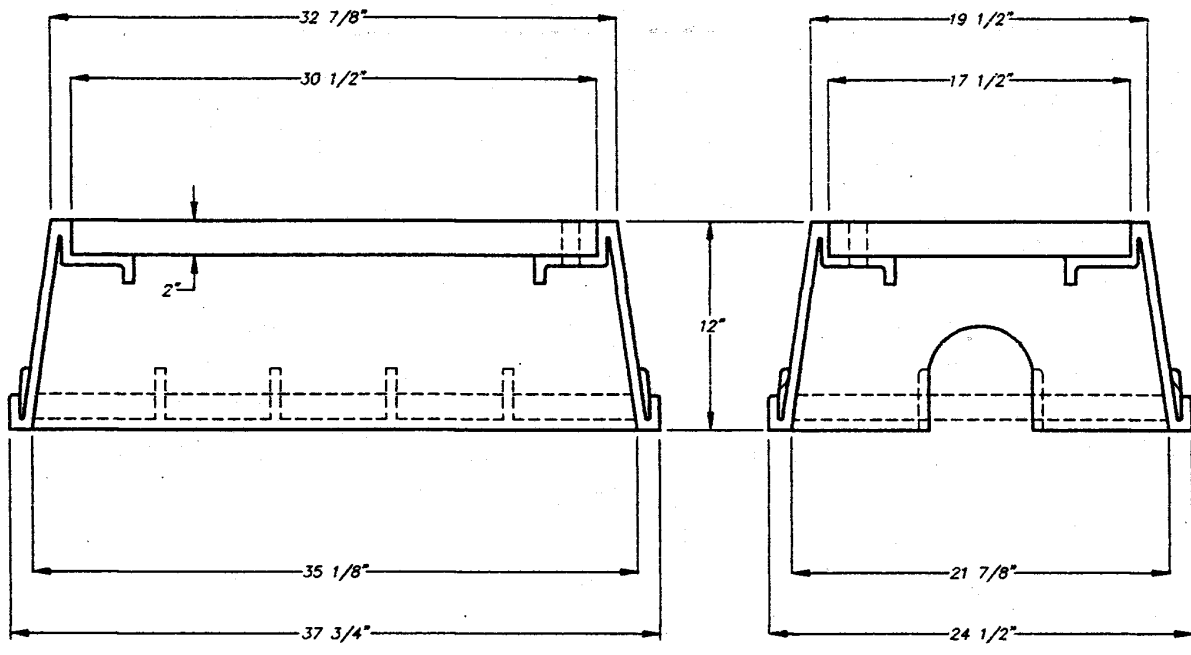
**CLEANOUT AT  
END OF MAIN**

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| Drawn By <b>KHP</b> | Project-Engr _____ | Approved By <b>K. O'Brien</b> | Date <b>7/14/95</b> | Sheet <b>2</b> Of _____ |
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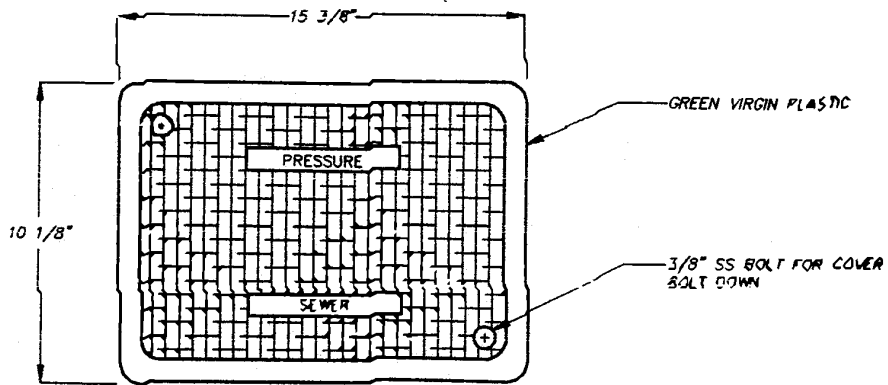
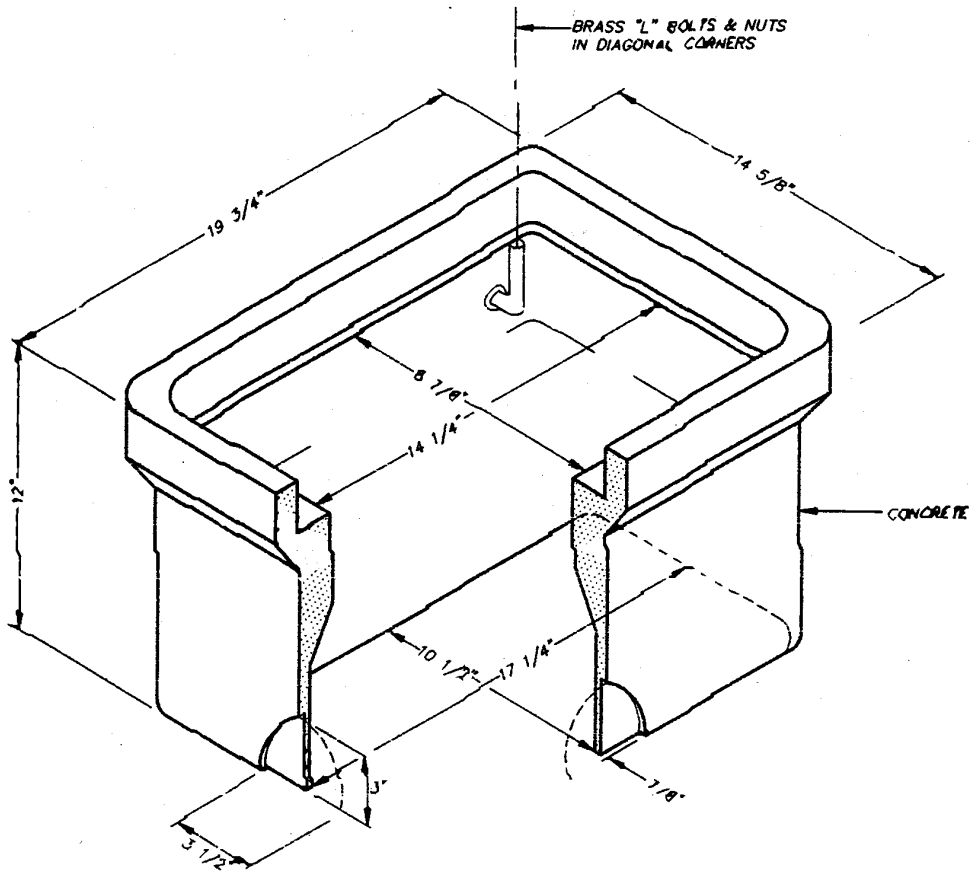
KHP/STW  
7/28/95



PLAN VIEW

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| <b>CHARLOTTE-MECKLENBURG<br/>UTILITY DEPARTMENT<br/>ENGINEERING DIVISION<br/>CHARLOTTE, NORTH CAROLINA</b>                             |   |   |   |
| Job No. _____ File No. _____<br>Scales _____<br>PLAN _____ NTS _____<br>PROFILE Hor. _____<br>Vert. _____<br>As Built _____ Date _____ |   | <b>STANDARD DETAIL<br/>PRESSURE SEWER</b><br><br><b>SERVICE BOX</b> |   |
| No. _____<br>Date _____<br>By _____<br>Revision _____  | Surveyed By _____<br>Designed By _____<br>Drawn By <b>KHP</b> | Project-Engr _____<br>Approved By <b>K.B. [Signature]</b>           | Date <b>1/14/94</b> Sheet <b>3</b> Of _____ |

1/28/94  
 KHP:JMG



PLAN VIEW

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

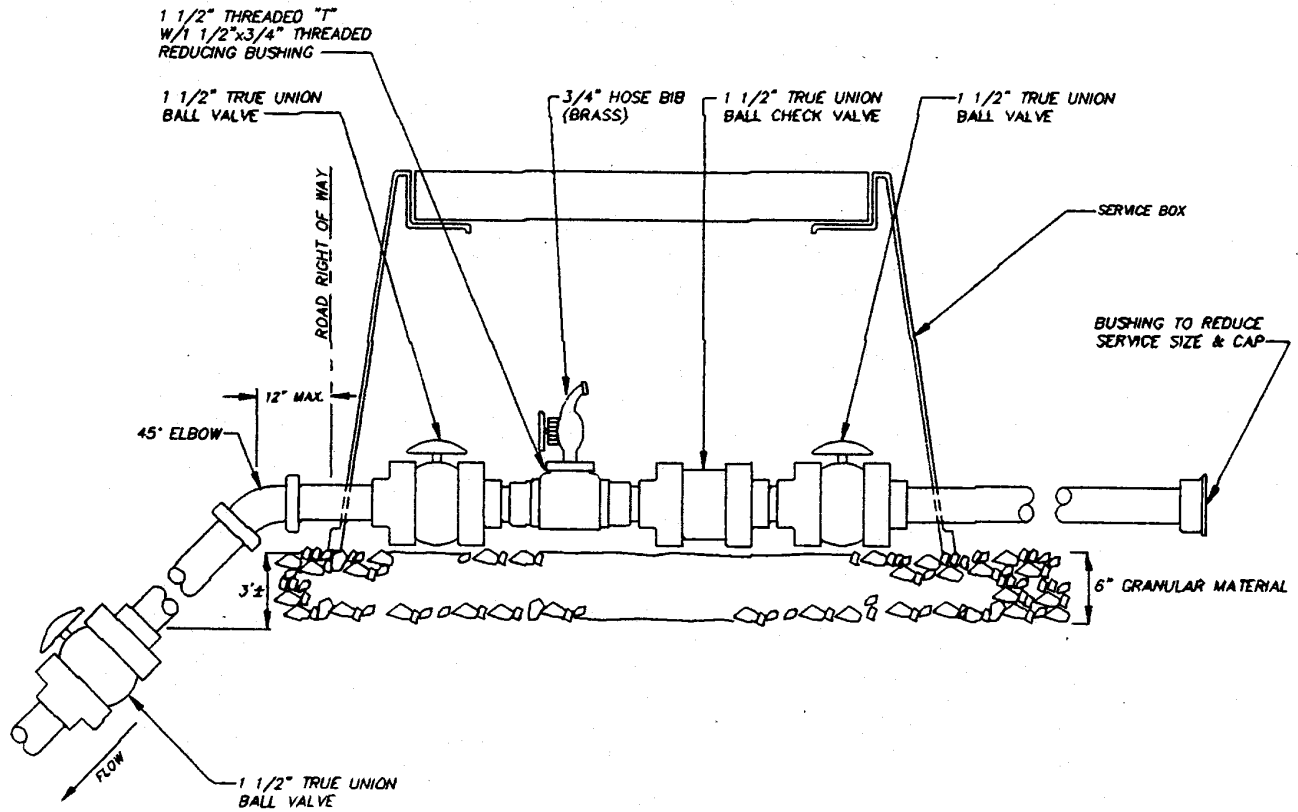
**STANDARD DETAIL  
PRESSURE SEWER**

**CLEANOUT BOX**

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| KHP      |              | KB          | 7/24 |              |

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**NOTES:**

1. SERVICES SHALL BE CENTERED IN THE LOT ROAD FRONTAGE.
2. BOX SHALL NOT BE IN SIDEWALKS OR DRIVEWAYS.
3. TOP OF BOX SHALL BE FLUSH WITH FINISH GRADE OF LOT.

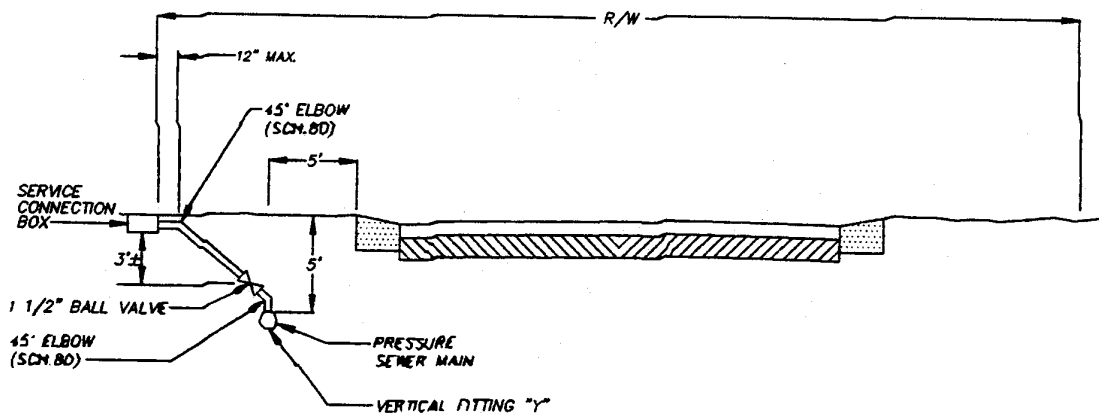
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ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
PRESSURE SEWER**

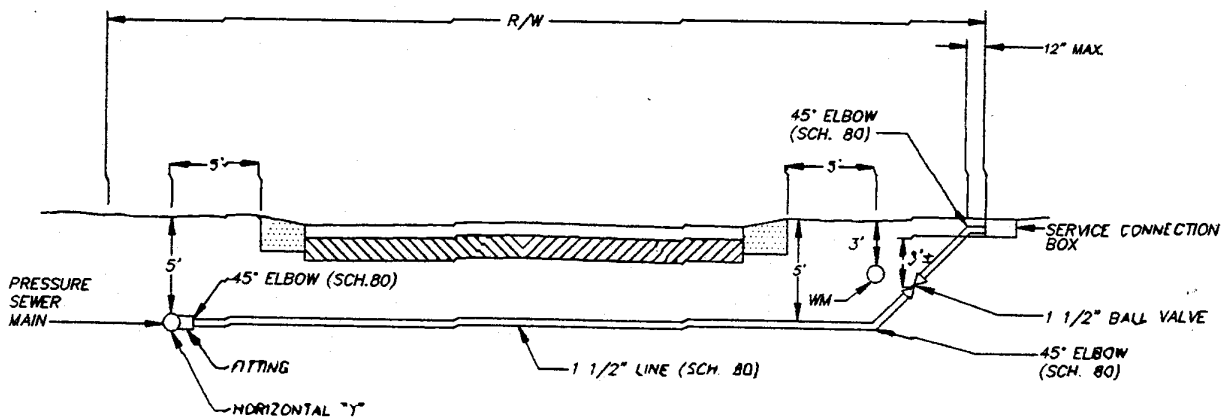
**SERVICE CONNECTION**

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**SHORT SIDE LATERAL SERVICE**

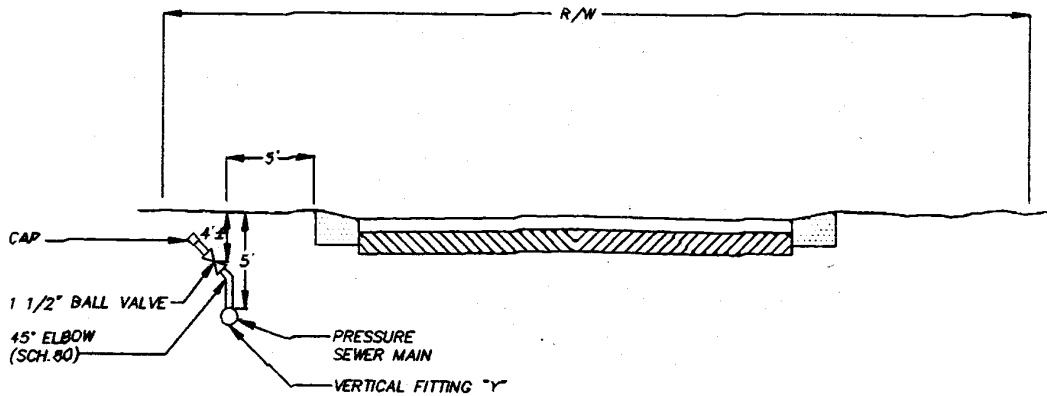


**LONG SIDE LATERAL SERVICE**

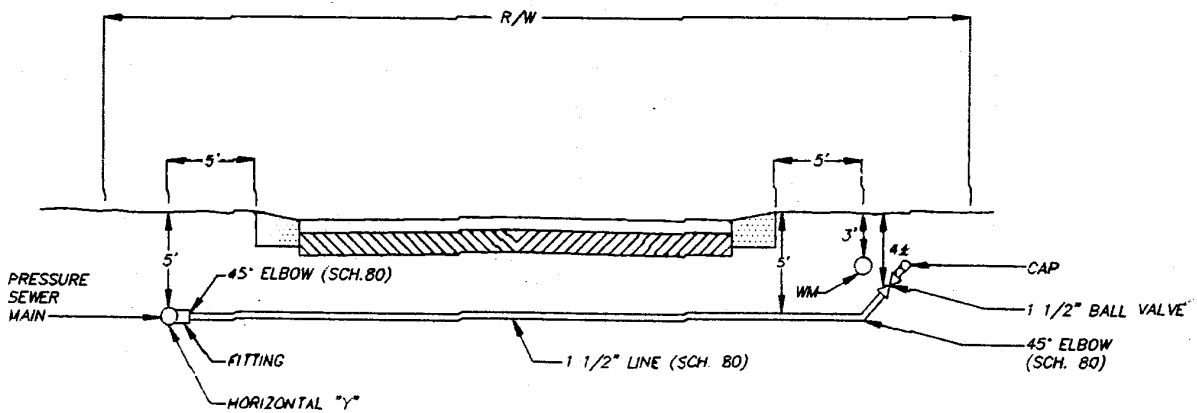
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

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| Job No. _____     | File No. _____     | <b>STANDARD DETAIL<br/>PRESSURE SEWER<br/><br/>LATERAL SERVICE</b> |
| PLAN _____        | Scale <b>NTS</b>   |  |
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| Revision _____    | Project-Engr _____ | Approved By <b>KBP</b>   |
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|                   |                    | Sheet <b>6</b> Of _____  |

1/5/94



**SHORT SIDE PARTIAL LATERAL SERVICE**



**LONG SIDE PARTIAL LATERAL SERVICE**

**NOTE:**

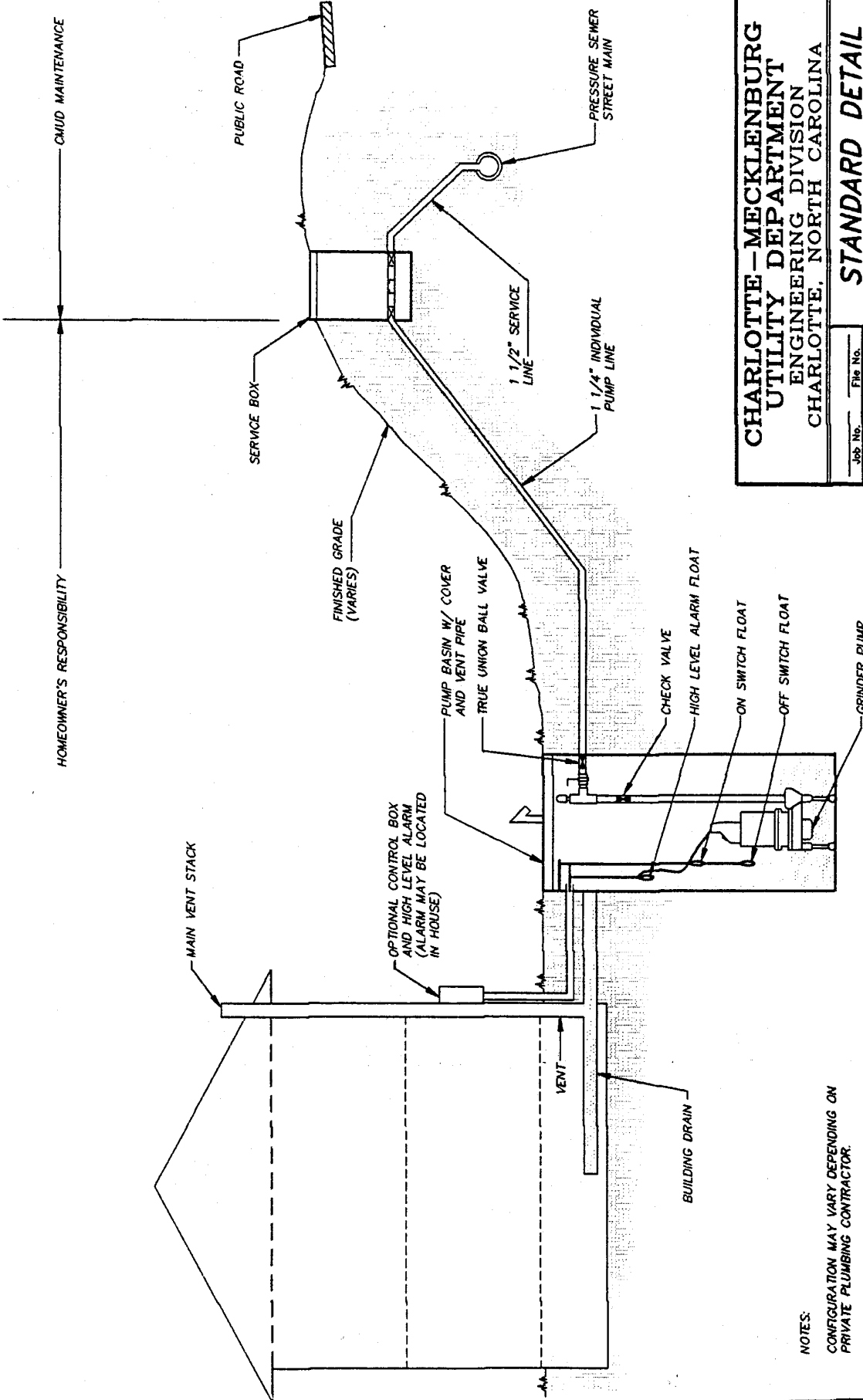
1. A PVC ENCAPSULATED MAGNET SHALL BE ATTACHED TO THE VALVE FOR MAGNETIC LOCATION PURPOSES.

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ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

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| Job No. _____     | File No. _____    | <b>STANDARD DETAIL<br/>PRESSURE SEWER</b> |
| Scales <u>NTS</u> |                   |   |
| PLAN _____        | Ver. _____        | <b>PARTIAL LATERAL<br/>SERVICE</b>        |
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|                   |                   | Project-Engr _____                        |
|                   |                   | Approved By <u>[Signature]</u>            |
|                   |                   | Date <u>1/28/95</u>                       |
|                   |                   | Sheet <u>7</u> Of _____                   |

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1/21/94



NOTES:  
 CONFIGURATION MAY VARY DEPENDING ON  
 PRIVATE PLUMBING CONTRACTOR.  
 ALL PRIVATE PLUMBING SHALL BE IN  
 ACCORDANCE WITH NORTH CAROLINA  
 BUILDING CODE.

**CHARLOTTE-MECKLENBURG  
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 CHARLOTTE, NORTH CAROLINA**

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| Job No. _____     | File No. _____     |
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**STANDARD DETAIL  
 PRESSURE SEWER  
 INDIVIDUAL GRINDER  
 PUMP SYSTEM**

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