

- b. The Standard Drawings may be used as a guide for planning of meter pit installations.

#### 4.08 Combined Domestic and Fire Line Water Meters

- a. Only meters approved by the National Board of Fire Underwriters shall be installed in water lines providing both domestic and fire service. Requests to install a meter in a water line providing both domestic and fire demands should be made to the District a minimum of 90 days in advance of construction.
- b. Unless otherwise approved by the District, a combined domestic and fire line meter must be installed in a pit large enough to accommodate the meter, meter bypass and all valves and piping, all in accordance with Standard Drawings.
- c. The location of the meter pit must be approved by the District in advance of construction.
- d. Meter pits must have an approved ring and cover of sufficient size (25-1/2 inches minimum) opening for installation and removal of the meter.
- e. The meter loop (3-inch through 6-inch) must set on the floor of pit, not the riser. The maximum depth of the meter pit (inside dimension) shall be 8 feet. The minimum depth of the meter pit (inside dimension) shall be 7 feet.
- f. Water meter loops for combined domestic and fire line water meters must have both inlet and outlet valves.
- g. Water meters must have a bypass around the meter of sufficient size to supply the property while the meter is being serviced.

#### 4.09 Water Regulators

- a. Where required by the District, a water regulator designed for 150 psi shall be installed in all domestic service lines. Refer to the Standard Drawings.
- b. One regulator must be installed upstream of the water meter. The customer may also install another regulator downstream of any irrigation supply branch line, downstream of the meter.

#### 4.10 Inspection of Services for All New and Replacement Service Lines

- a. Water service lines shall be inspected by the District and the inspection shall include an inspection of the service line from the curb stop to the foundation and an inspection of the meter installation to include all of those items contained within Sections 4.01 through 4.10 of these Specifications. The trench backfill compaction shall meet the requirements of these Specifications.

#### 4.11 Repair and Replacement of Existing Service Lines

- a. Responsibility. The property Owner is responsible for the repair and maintenance of the water service line from the curb stop to the house or other building.
- b. Leaks occurring on a water service line between the curb stop and the house or building shall be repaired as necessary to include backfilling and restoration of property at the property owner's expense. However, the District will, if requested to do so, shut off the water service line at the curb stop. To preclude unnecessary waste of water, if repairs are not initiated within a reasonable period of time, the District may, at its discretion, shut off the water service until repairs have been affected.
- c. The property owner is responsible for all damages that may occur to other property, real or personal, including property of the District, that were caused by failure to repair and maintain the water service line, or from leaks occurring on a water service line or from bursting or other failure of the water line.
- d. Leaks occurring between the curb stop and the corporation shall be repaired by the District.
- e. When a doubt exists concerning the location of a leak, the District will determine the general location of the leak. This will be done by turning off the service at the curb stop. When this action causes the leak to stop flowing, the homeowner or property Owner will be responsible for repair of the line at a location

between the curb stop and the structure served. When the leak continues to flow after turn off, the District will be responsible for repair of the line at a location between the curb stop and the main.

4.12 Service Line - General Notes

- a. All work on fabrication and installation of meter boxes shall conform to the following codes, latest edition:

International Building Code  
Building Code for Reinforced Concrete (ACI)  
American Welding Society Specifications

All material or components considered defective by the District shall be rejected and immediately removed from the site at no expense to the District.

The Contractor shall verify and coordinate the dimensions of all openings, meters, inserts, etc., with the District and manufacturer.

## **Water Service Quality Control Regulations**

- 5.01 General. This document is adopted by the Strasburg Sanitation and Water District to promote and sustain the high quality of drinking water furnished to the District's water customers; to protect the public potable water supply system of the District from the possibility of contamination or pollution by backflow, back-siphonage or backpressure; to promote the elimination or control of existing cross connections, actual or potential; and to provide for the maintenance of a continuing program of cross connection control.
- a. The authority to implement and maintain this program of cross connection control is contained in the following legislative actions:
    - (1) Colorado Revised Statute, Title 25
    - (2) Colorado Department of Health and Environment Cross Connection Control Rule 11.39.
    - (3) Colorado Primary Drinking Water Regulation Section 39 of 5 CCR 1002-11.
    - (4) CDPHE Safe Drinking Water Program Policy Number DW-007
    - (5) U.S. Environmental Protection Agency, Cross Connection Control Manual (1973) E.P.A. - 43070-73-002 Section 3.
    - (6) Uniform Plumbing Code of the International Plumbing and Mechanical Officials, Chapter 10, Sections 1001, 1002, 1003.
    - (7) Safe Drinking Water Act of 1974 (Amended 1986 and 1996).
    - (8) Strasburg Sanitation and Water District Resolution
  - b. Reference manuals adopted for guidelines on cross connection control:
    - (1) Manual of Cross Connection Control, Foundation for Cross Connection Control and Hydraulic Research, University of California.
    - (2) CDPHE Colorado Cross Connection Control Manual – May 2016
    - (3) Cross Connection Control Committee, Pacific Northwest Section AWWA Manual of Accepted Procedures and Practices.
    - (4) Recommended Practice for Backflow Prevention and Cross Connection Control AWWA Manual M-14.
    - (5) Definitions of terms used in this regulation are those contained in "Manual of Cross Connection Control," Foundation for Cross Connection Control and Hydraulic Research, University of California.
    - (6) CDPHE Water Quality Control Division Safe Drinking Water Program Policy Backflow Prevention and Cross-Connection Control Rule Implementation Policy DW-007, June 2018
  - c. General Requirements
    - (1) Backflow prevention devices are to be installed in an accessible location to facilitate maintenance, testing and repair. Standard Drawings show various installations.
    - (2) All backflow devices shall be installed immediately downstream of the water meter.
    - (3) Before installing the backflow prevention device, pipelines should be thoroughly flushed to remove foreign material.
    - (4) In no case will it be permissible to have connections or tees between the meter and service line backflow prevention device.
    - (5) In no case will it be permissible to connect the relief valve discharge on reduced pressure zone devices into a sump, sewer, drainage ditch, etc.
    - (6) Backflow prevention valves are not to be used for the inlet or outlet valve of the water meter.

Backflow preventer test cocks should never be used as supply connections and should be plugged except when being tested.

- (7) In order to ensure that backflow prevention devices continue to operate satisfactorily, it will be necessary that they be tested at the time of installation. Testing shall be required on reduced pressure zone devices and all testable devices. Such tests will be conducted in accordance with the Colorado Cross-Connection Control Manual (May 2016). The contractor accomplishing installation shall be responsible for initial testing of the new equipment. Reporting of testing procedures and results shall be made by the contractor to the District on forms provided by the District.

Refer to the section titled "Testing and Maintenance" in these Standard Specifications for periodic testing of all testable devices.

- (8) See Section 5.02 for guidance on different backflow applications as to where Double Check Valve vs. Reduced Pressure Zone Device are applicable

d. Standards for Backflow Prevention Devices

- (1) Any backflow prevention device required herein shall be of a model and size approved by the District. The term "APPROVED BACKFLOW PREVENTION DEVICE" shall mean a device that has been manufactured in full conformance with the standards established by the American Water Works Association (AWWA) entitled:

AWWA C506-Standards for Reduced Pressure Principle and Device, current edition, and have met completely the laboratory and field performance specifications of the Foundation for Cross Connection Control and Hydraulic Research (FCCC & HR) of the University of Southern California established by:

Specifications of Backflow Prevention Devices, 7th Edition, August 1985; Revised, or the most current issue.

AWWA and FCCC & HR Standards and Specifications have been adopted by the District. Final approval shall be evidenced by a "Certificate of Approval" issued by an approved testing laboratory certifying full compliance with said AWWA Standards and FCCC & HR Specifications.

- (2) Only "Approved Backflow Prevention Devices" shall be used. In general, the District will consider acceptance of devices manufactured by the following manufacturers:

Reduced Pressure Zone Device / Double Check Valve

Zurn Wilkins  
Ford Meter Box Company  
FEBCO  
Mueller Co.  
Watts

- (3) Backflow devices used on fire lines shall have O.S. & Y. valves and be listed by the National Fire Protection Association.

e. Installation

- (1) Backflow prevention devices shall be installed in accordance with manufacturer's recommendations.
- (2) Backflow prevention device installations shall be inspected and approved for use by the District. Inspections can be scheduled by calling (303) 622-4443.
- (3) All reduced pressure zone backflow devices shall be installed in a horizontal position. Double check valves on residential diameter services may be installed in any position provided the device is accessible for maintenance, removal and replacement. Other installations shall be subject to the individual review and approval of the District.
- (4) A pressure vacuum breaker shall only be used where the device is never subjected to backpressure

and installed a minimum of 12 inches above the highest piping or outlet downstream of the device in a manner to preclude backpressure.

- (5) An atmospheric vacuum breaker shall be used only where the device is:
  - (a) never subjected to continuous pressure, and
  - (b) installed on the discharge side of the last control valve and above the point of usage, and
  - (c) installed with the air inlet in a level position and a minimum of 6 inches above the highest piping on outlet it is protecting.
- (6) A single check valve is not considered to be a backflow prevention device.
- (7) Double check valve assemblies may be installed in below grade vaults when these vaults are properly constructed in accordance with Standard Drawings.
- (8) Reduced pressure backflow preventers will be installed above ground. Below ground reduced pressure backflow preventers will only be allowed with prior **written** approval from the Colorado Department of Health and Environment's Cross Connection Control Department Head. The unit should be placed at least 12 inches to 24 inches above the finish grade to allow clearance for the repair work. A concrete slab at finish grade is recommended. Proper drainage should be provided for the relief valve and may be piped away from the location, provided it is readily visible from above grade and the relief valve is separated from the drain line by a minimum of double the diameter of the supply line. A modified vault installation may be used if constructed with ample side clearances. Freezing is a major problem in this area. Precautions should be taken to protect above ground installations and additional accommodations for heat may be required.
- (9) Reduced pressure zone backflow preventer may be installed in a basement provided with an adequate drain with an effective opening of twice the diameter of the device.

f. Testing and Maintenance

- (1) It will be the duty of the customer/user at any premises where the backflow prevention devices are installed to have certified inspections and operational tests made of the devices at least once per year. In those specific instances where the District deems the hazard to be great enough, it will require certified inspections at more frequent intervals. These inspections and tests shall be at the expense of the water user and shall be performed by water utility personnel or by a certified technician approved by the District, the Colorado Department of Health, or the Water Distribution and Wastewater Collection Systems Certification Council.
- (2) The customer shall notify the District 48 hours in advance of when the tests are to be performed so that the District's representative may witness the tests if so desired. The devices shall be repaired, overhauled or replaced at the expense of the customer/user whenever the device(s) are found to be defective. Records of all such tests, repairs and overhauls shall be kept, with a copy sent to the District.
- (3) The customer is required to schedule a private certified tester to perform the annual test and furnish the District with a copy of the test, pursuant to the aforementioned stipulation.
- (4) Existing devices shall be sealed by the technician performing the test at the completion of the test.
- (5) All testing gauges shall be checked for accuracy and be kept in good operating condition.
- (6) The District retains the authority to check the installation and operation of any backflow device. However, the District will not test the installation for compliance of the backflow prevention installation and will rely upon the results of the independent inspection scheduled and paid for by the customer.

g. Right of Entry

The District water utility representative(s) assigned to inspect premises relative to possible hazards shall carry proper credentials of his/her office, upon exhibit of which he or she shall have the right of entry during usual business hours to inspect any and all buildings and premises for cross connections in the performance of his or her duties.

This right of entry shall be a condition of water service in order to provide assurance that the continuation of service to the premises will not constitute a menace to health, safety and welfare of the people throughout the District's potable water distribution system. Where building security is required, the backflow device should be located in an area not subject to security.

h. Violations

- (1) Failure of the customer to cooperate in the installation, maintenance, testing or inspection of backflow prevention devices required by this regulation shall be grounds for the discontinuance of water service to the premises or the requirement for an air-gap separation from the public potable water system.
- (2) Service of water to any premises may be discontinued by the District after written notification if unprotected cross connections exist on the premises, or if any defect is found in an installed backflow prevention device, or if a backflow prevention device has been removed or bypassed. Service shall not be restored until such conditions or defects are corrected.
- (3) Discontinuance of service may be summary, immediate and without written notice whenever, in the judgment of the General Manager, such action is necessary to protect the purity of the public potable water supply or the safety of the water system.

5.02 Cross Connection Control & Backflow Prevention - Criteria List

a. Abbreviations

A/G - Air Gap Separation  
 R/P - Reduced Pressure Zone Device  
 D/C - Double Check Valve Assembly  
 P.T.V.B. - Pressure Type Vacuum Breaker

b. Type of Establishment

Device Required

|   |                |
|---|----------------|
| Apartments and condominiums - 4 stories or more                   | R/P            |
| Apartments and condominiums - 4 stories or less                   | R/P            |
| Auxiliary water systems   | R/P            |
| Belted meter installations  | R/P            |
| Buildings - 4 stories or more                                     | R/P            |
| Cafeteria, restaurant, or any food handling establishment         | R/P            |
| Car Wash  | R/P            |
| Child day care center   | R/P            |
| Fire Line (toxic chemicals added)                                 | R/P            |
| Fire Line (no chemicals)  | D/C            |
| Food processing/packing plant                                     | R/P            |
| Greenhouse  | R/P            |
| Hospital, dental or medical facility                              | R/P            |
| Hotels and motels - single and multi-structures, 3-stories & less | R/P            |
| Irrigation System   | R/P - P.T.V.B. |
| Kennels - dog/cat   | R/P            |
| Laboratory- chemical or medical                                   | R/P            |
| Laundromat  | R/P            |
| Lease space (shopping centers, warehouse, main water supply)      | D/C, R/P       |
| Manufacturing/Processing Plant                                    | R/P            |
| Mobile equipment (landscape, lawn, tree                           | A/G variance   |

|  |                |
|--|----------------|
| spraying, water hauling)                                 | by review only |
| Morgue, mortuary, or autopsy facility                    | R/P            |
| Nursing home/retirement home                             | R/P            |
| Office or warehouse except as otherwise described herein | D/C, R/P       |
| Pet shops  | R/P            |
| Photo developing lab                                     | R/P            |
| Planned Unit Development                                 | R/P            |
| Plating facilities                                       | R/P            |
| Printing shop  | R/P            |
| Private well supply                                      | A/G            |
| Storage tanks for fire water                             | D/C            |

Type of Establishment

Device Required

|  |               |
|--|---------------|
| Recirculated water   | R/P           |
| Reflecting ponds, swimming pools, fountains,<br>open ponds, etc. | R/P           |
| Residences, single-family including townhomes                    | R/P           |
| Schools - Colleges w/Lab   | R/P           |
| Sewage treatment plant   | R/P           |
| Solar system   | R/P by review |
| Transportation terminal  | R/P           |
| Veterinary Services  | R/P           |

NOTE: Other types of establishments may require protection via air gaps or backflow prevention devices depending on the equipment and/or plumbing arrangements utilized therein. These shall be considered individually, at the discretion of the District. All of the establishments listed below will require review by the District and a determination made as to the need for a backflow prevention device.

- Barber shop or college
- Beauty shop or college
- Buildings - three stories or less
- Department store

## PART II

### WASTEWATER COLLECTION SYSTEM STANDARD SPECIFICATIONS

#### Chapter 1 - General

- 1.01 Authority. These Specifications are promulgated by the Strasburg Sanitation and Water District. The interpretation, enforcement, and revision of these Specifications is hereby delegated to the General Manager of the District.
- 1.02 Effective Date of Specifications. These Specifications shall be in effect fifteen (15) calendar days after adoption by the District board and shall supersede all former standard specifications for installation of sanitary sewer mains within the District.
- 1.03 Revisions, Amendments or Additions. These Specifications may be revised, amended or added to. Such revisions, amendments and additions shall be binding and in full force and effect when adopted in the manner set forth in Section 1.02.
- 1.04 District Control. These Specifications will apply to the installation, operation and maintenance of all wastewater collection facilities under the control of the Strasburg Sanitation and Water District.
- 1.05 Organization and Interpretation of Specifications. These Specifications are composed of written Standards of Engineering Practice, Material Specifications and Standard Drawings. The interpretation of any section or of differences between sections, when appropriate, shall be made by the General Manager of the District and his/her interpretation shall be binding and controlling in its application.
- 1.06 Definitions. As used in these Specifications, or in any of the drawings where these Specifications govern, unless the context shall otherwise require, the following words defined shall have the meanings herein ascribed:
- a. District Manager. The Manager of the District or his/her designated representative.
  - b. Engineer. The Engineer or consultant of the District, acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them.
  - c. Collection System. Sewer mains, together with all appurtenant and necessary manholes, clean outs, taps, service pipes, and associated materials, property and equipment collecting sanitary sewage from individual customers.
  - d. Wastewater Main or Sanitary Main. That portion of the wastewater system which collects sewage from users to the District wastewater treatment plant, excluding service lines.
  - e. Service Line. The sewage collection pipeline extending from the premises down to and including the connection to the wastewater or sanitary main.
  - f. Applicant for System Extension. Any person, association, corporation, entity, or government agency desiring sanitary sewer service for premises under their control, often a subdivider, a developer or an owner.
  - g. Main Extension. Extensions to the existing collection system network.
  - h. Contractor. In the context of these Specifications a person or persons, co-partnership or corporation employed by an applicant for the purpose of installing wastewater system extensions or replacements.
  - i. Inspector. The authorized representative of the District assigned to the project.
  - j. Standard Drawings. District Standard Drawings are a part of these Specifications.
  - k. District. The Strasburg Sanitation and Water District responsible for overseeing the wastewater system's operations.



1.07 Abbreviations. All references to documents or specifications shall be the latest edition or revision thereof:

- a. ASTM American Society for Testing and Materials
- b. ANSI American National Standards Institute
- c. NSF National Sanitation Foundation
- d. OSHA Occupational Safety and Health Act
- e. USGS United States Geological Survey
- f. CIP Cast Iron Pipe
- g. DIP Ductile Iron Pipe
- h. PVC Polyvinyl Chloride-Plastic Pipe

## Design Provisions

- 2.01 Planning Considerations. The land use and population densities approved for the District shall be used to determine wastewater facility design parameters. Where approved master plans do not exist, the following criteria shall be used unless specific approval for other criteria has been given by the District.
- a. Design Period: The sewer systems shall be designed for the estimated ultimate tributary population. The tributary areas shall be studied to determine the area for each projected land use.
  - b. Population densities including public use lands:
    - (1) Single-family units at 2.8 persons per unit.
    - (2) Multi-family and condominiums at 2.1 persons per unit.
    - (3) Four (4) single-family units per acre.
    - (4) Sixteen (16) multi-family cluster housing or condominiums per acre.
  - c. Per capita flows: Sewer systems shall be designed on the basis of not less than the following unless other values are specifically authorized by the District:
    - (1) One hundred (100) gallons per person per day.
    - (2) Three hundred (300) gallons per capita per day peak flow for submains and laterals.
    - (3) Two hundred fifty (250) gallons per capita per day peak flow for main trunk, interceptor or outfall sewers.
    - (4) Infiltration of 100 gallons per day per inch of diameter per mile per manhole run for new systems. New system installations which will service a portion of the existing collection system will require an infiltration/bleeding allowance as established by the District.
    - (5) Commercial land uses at 1400 gallons per acre per day with a peak factor of 2.
    - (6) Industrial land uses at 1600 gallons per acre per day with a peak factor of 3.
    - (7) Public use, park and open space at 1000 gallons per day with a peak factor of 2.
- 2.02 Minimum Size. No public sewer shall be less than 8 inches in diameter. No building sewer shall be less than 4 inches in diameter.
- 2.03 Minimum Depth. In general, sewers shall be designed deep enough to drain basements and to prevent freezing. No public mains shall be less than 5 feet deep measured from the top of pipe unless special protection is required. Special protection shall consist of:
- (a) Less than 5 feet but more than 3 feet of cover requires ductile iron, cast iron, reinforced concrete encasement or arch.
  - (b) Less than 3 feet of cover requires ductile iron or cast iron with reinforced concrete encasement.
- No building sewer shall be less than 5 feet deep in traffic areas without similar special protection listed above except that concrete driveways may be substituted for protection of service lines.
- 2.04 Minimum Slopes. All sewers shall be designed to transport average sewage flows at mean velocities of 2 feet per second based on a Manning's roughness factor of 0.013. The slope between manholes shall be uniform. In no case shall the slope be less than the following for sewer mains and services:

### MINIMUM GRADE TABLE

| <u>Services</u>      |  |
|----------------------|--|
| <u>Pipe Diameter</u> | <u>Slope</u>   |
| 4 Inches             | 2% or 1/4 inch per foot                                  |
| 4 Inches             | Ductile iron or cast iron pipe - 1% or 1/8 inch per foot |
| 6 Inches             | 1% or 1/8 inch per foot                                  |

## Mains and Services

| <u>Pipe Diameter</u> | <u>Slope</u> |
|----------------------|--------------|
| 8 Inches             | .50%         |
| 10 Inches            | .35%         |
| 12 Inches            | .29%         |
| 15 Inches            | .23%         |
| 18 Inches            | .17%         |
| 24 Inches            | .13%         |

2.05 High Velocity Protection. In the case of sewers where the slopes are such that over 15 percent grades are attained, special provisions as determined by the District shall be made to prevent excessive erosion of material surfaces or displacement by impact. Such high velocity protection shall be shown on detail drawings and approved by the District on a case-by-case basis.

2.06 Alignment. Standard location for sewers, unless some major interference prevents, is along the centerline of the street, easement or right-of-way. In streets less than 36 feet wide and alleys, the standard location shall be parallel to but removed 2 feet from the center line. Manholes shall be located so as to prevent storm water entrance. Proposed sewer lines which may conflict with the placement of other underground facilities will require prior approval of the sewer placement location by the controlling agencies whose facilities are affected. Locations other than those specified will require specific approval of the District.

### 2.07 Pipe Alignment in Manholes

- a. Intersections. All pipes shall have free discharge into the collection system. Where possible, the flow line of the intersecting pipe shall be the spring line (horizontal center of pipeline) of the collection sewer. All manhole inverts shall be designed with a 0.1 foot drop except for changes in alignment in excess of 30° shall have a 0.3 foot drop in the invert through the manhole. Changes in direction at intersections shall not be greater than 90°.

When the intersecting pipe is smaller in diameter than the pipe exiting the manhole, the crown or inside-top of the intersecting pipe shall match the crown or inside-top of the main pipe entering the manhole. In no case shall the difference in elevation between the flowline of the pipe exiting the manhole and the flowline of the intersecting sewer be less than 0.3 feet.

- b. Increasing Size. When sewers are increased in size with no intersecting sewers, the invert of the larger sewer shall be lowered sufficiently to maintain the same energy gradient.

2.08 Manhole Location. Manholes shall be installed at the end of each line, at all pipeline intersections, changes in grade, size, alignment and at distances not greater than 400 feet. Manholes must be located to allow unassisted and unrestricted access by District maintenance vehicles. Lines and manholes located in areas where access, in the opinion of the District, is not possible, will not be approved for construction.

### 2.09 Manhole Details

- a. Manhole Sizes. The inside diameter of the manhole shall not be less than 4 feet on lines 8 inches through 10 inches in diameter; not less than 5 feet on lines 12 inches through 18 inches in diameter; not less than 6 feet on lines in excess of 24 inches in diameter for standard design manholes (see Drawing No. 2 for standard manhole design).
- b. Drop Manholes. External drop manholes will be permitted only in extreme and special conditions where approval has been granted by the District. As a general criteria, a minimum difference in elevation of 4 feet between the inlet and outlet is required before considering use of external drop manhole design. The external drop sections must be totally encased in reinforced concrete and placed on an adequate foundation. Developer shall submit design of proposed drop manhole to District for approval.

- c. Manhole Channels. The flow channel shall be made to conform to the slope and shape of the sewer pipe entering and exiting the manhole. The channel shall be formed from cast-in-place concrete to a cross-section matching the circular pipes. The channel shall be constructed with vertical walls from a point one-half the pipe diameter above the channel flowline as shown in the standard drawings. At intersections with other lines, channels shall be formed with a curve to minimize turbulence. The flow channel shall be constructed to have a depth equal to the pipe diameter. Refer to Drawing No. 2.
- d. Manhole Gaskets. The pipes entering and exiting the manhole shall be equipped with a manhole gasket placed around the pipe and cast in the base. If a precast base is used, a watertight seal shall be obtained by use of a premanufactured rubber gasket in the precast base section equal to a Kor-N-Seal boot.
- e. Rings and Covers. The ring and cover shall be constructed of cast iron for traffic bearing conditions and cast aluminum or cast iron for non-traffic bearing conditions. All manholes located outside of dedicated street or alley rights-of-way will be designed and constructed with a locking type cover and the ring bolted to the concrete cone. Grade adjustment rings or blocks between the ring and cover and the concrete cone cap shall not exceed 6 inches. See Standard Drawings Nos. 4 and 5.
- f. Watertightness. Precast concrete manhole joints shall be made watertight. Manholes of brick or segmented block shall not be used in the sanitary sewer system.
  - (1) Each precast manhole segment shall be joined with a rubber "O" ring, Ram-Nek, Con-Seal or similar approved material. A double application of Ram-Nek, or equal, is required in areas where groundwater is present or could be present.
  - (2) All interior concrete manhole surfaces above the flow channel shall receive a 3/8" to 1/2" thick coating of cement grout. Concrete surfaces shall be thoroughly wetted and damp prior to the application of cement grout. Liquid membrane curing compound shall be applied to the finished cement grout surface to facilitate proper curing. Where exterior cement grouting is required, it shall be applied prior to the application of dampproofing material and the liquid membrane curing compound shall be deleted. Exterior cement grout shall be film cured utilizing polyethylene sheets.
  - (3) All exterior concrete manhole surfaces shall be coated with coal tar dampproofing material. Where ground water is present or, in the opinion of the District, groundwater could be present, all exterior concrete manhole surfaces shall also receive a 3/8" to 1/2" thick coating of cement grout. The need for exterior cement grouting will be determined by the District.
  - (4) Dampproofing materials shall be applied to clean, dry surfaces in accordance with the coating manufacturer's written instructions/recommendations and the following:
    - 1. Preparation
      - a. Examine surfaces to receive dampproofing to assure conditions are satisfactory for application of materials
      - b. Remove dirt, dust, sand, grit, mud, oil, grease and other foreign matter
      - c. Brush down surfaces to remove all loose scale, fins, dust, etc.
      - d. Complete surface preparation in accordance with manufacturer's recommendations
    - 2. Application
      - a. General
        - 1) Apply in three (3) coats with high pile rollers or by spray equipment
          - a) Minimum air pressure: 90 psi
          - b) Spray apply in a fine mist
        - 2) Provide adequate forced ventilation when applying coating in enclosed spaces
        - 3) Do not use benzol or other volatile solvents for thinning coating
      - b. First coat
        - 1) Apply only when surface of concrete is dry and at a suitable temperature for adequate penetration
        - 2) Thin as recommended by manufacturer
        - 3) Apply for maximum penetration
        - 4) Absorbed by concrete within 5 to 30 minutes of application so no continuous

film remains on surface

- c. Second coat: Cover surface with 5 mil film
  - d. Third coat: Produce a high gloss 5 mil film
  - e. Cure material as recommended by manufacturer
  - f. Do not cover with backfill until installation is accepted by inspector
- g. Stub Outs from Manholes. Stub outs from manholes shall not exceed 40 feet except for lines which will be extended in the future. Whenever practical, designs to complete the manhole run shall be submitted to the District Superintendent for review to insure proper grade and alignment for future construction. Future extension of stub outs shall be of like material using the same grade and alignment.
- h. Design Features for Deep Manholes. Manholes which are more than sixteen (16) feet from the finished cover to the pipe invert shall be considered deep manholes subject to special design. The items given below shall be given special attention and subject to approval by the District.
- (1) Intermediate platforms constructed with manhole shaft offsets shall be governed by the OSHA regulations. Regardless of the application of OSHA regulations, an offset intermediate platform will be required on any manhole greater than 24-feet in depth at no more than 12-foot intervals.
  - (2) Structural integrity of precast or cast-in-place concrete structures shall be verified and certified by the responsible design professional for all manholes in excess of 16-feet in depth. Specific attention shall be given to concrete thickness, reinforcing design and concrete strength.

2.10 Relation to Water Mains. Sewer lines shall be located a minimum of 10 feet horizontally from existing or proposed water mains and the sewer lines shall be a minimum of 18 inches clear distance vertically below the water main. If this clear distance is not feasible, the crossing must be designed and constructed so as to protect the water main from potential cross connections and minimize the potential for structural damage to either pipeline. Minimum protection shall consist of the installation of an impervious and structural sewer as follows:

- a. Where the sewer pipe is above the water main, regardless of separation, one length of ductile iron pipe at least 18 feet long centered over the water main and jointed to the sanitary sewer pipe with a manufactured adapter specifically for such jointing shall be installed. It shall include rubber gasketed fittings with stainless steel tightening bands. The joints shall be enclosed in a concrete collar at least 6 inches thick and extending at least 6 inches either side of the joint.
- b. Where the sewer is beneath the water main but less than 18 inches clear distance vertically, the sewer pipe of any material shall be encased in reinforced concrete. Encasement shall be at least 6 inches thick and extend a distance of 10 feet on either side of the water main crossing. Reinforcing shall consist of a minimum of four No. 4 bars placed at quarter points around the pipe being encased.

The above-described protection from potential cross connections shall apply to service lines as well as sanitary sewer mains where the above described protection and special installation is required.

2.11 Stream and Drainage Channel Crossings

- a. All stream and drainage channel crossings shall be ductile iron pipe encased in reinforced concrete where the installation is below the flow line of the stream or drainage channel.
- b. Crossings less than 4 feet below existing or proposed channel bottoms shall be supported by reinforced concrete caissons constructed in accordance with the approved special design.
- c. Where the pipeline crossing will be above the stream or drainage channel flow line, special approval and design will be required by the District. All details of the design shall be submitted to the District for review and approval.

2.12 Railroad and Highway Crossings

- a. All work shall be accomplished in accordance with the appropriate permit issued by the responsible agency having jurisdiction over the work.
- b. Crossings under railroads and highways shall consist of polyvinyl chloride (PVC), ductile iron or coal tar enamel lined steel pipe (carrier pipe) laid inside a steel pipe conduit (casing pipe), which is placed

beneath the track or roadway. The steel conduit pipe (casing pipe) shall be jacked horizontally through the ground on substantially the grade of the sewer, with due allowance for the bells or joints of the carrier pipe. As the pipe is jacked along, the earth shall be excavated from the face and removed so that it will not be necessary to force the pipe through solid ground. Specifications for materials and installation of the railroad or highway agency shall govern.

- c. The casing pipe diameter for 16-inch and smaller carrier pipes shall be a minimum of 8 inches larger than the carrier pipe and the casing pipe diameter for larger than 16-inch diameter carrier pipe shall be a minimum of 12 inches larger than the carrier pipe.
- d. After the conduit has been completed, the carrier pipe shall be placed inside and blocked in exact position and grade with a support at least every 8 feet and behind each bell or coupling. A minimum of three blocks or other points of support shall be installed to prevent displacement by floating.
- e. Each end of the casing pipe shall then be plugged tight around the carrier pipe and inside the casing pipe. The plug may consist of an 8-inch brick wall laid up with Portland cement mortar or a prefabricated rubber boot with stainless steel tightening bands specifically for sealing casing pipe ends.

#### 2.13 Service Lines (Building Sewers)

- a. Service lines and stub outs from main sewers shall be extended to each property at a point 5 feet inside the property line and generally 5 feet above the low lot corner.
- b. Stub outs from a sewer main may be made to an unoccupied lot provided it is part of an officially platted and recorded subdivision. Such stubs shall be extended to 5 feet inside property line and plugged with a watertight and airtight cap or plug insert. Plugging or capping shall be sufficient to perform air testing of the pipeline. Records of the depth and location of the end of the service stub shall be recorded by party responsible for construction and submitted to the District for future reference.
- c. Four-inch diameter service lines shall have a maximum length of 250 feet. A 4-inch diameter cleanout shall be installed on the service lines where the total length exceeds 100 feet and at 75 foot intervals thereafter up to a maximum of 250 feet in length. The cleanout shall have a proper waterproof cap. For cleanout access, a prefabricated formed wye with a riser pipe shall be installed to the finished grade.

Service lines projected to be longer than 250 feet in length shall have pipe 6 inches in diameter or as otherwise required by the District. Provisions for cleanouts shall also apply to pipelines 6 inches in diameter.

- d. No service line within the District's service area will serve more than one property or customer. Each house, building or business shall have an individual connection to the sewer main and service line from the main to the structure served.
- e. All service lines for commercial buildings or multi-family buildings shall be no less than 6-inches in diameter.
- f. Any service line requiring 3 or more bend fittings between the sewer main line and building served shall be constructed with a cleanout at intervals specified above. If 3 or more bend fittings are required in a service line with a length less than 100 feet, a cleanout shall be installed at the midpoint of that section.

#### 2.14 Pump Station Design Parameters. Design of pump stations within the District's collection system shall be accomplished on a case by case basis. Pump stations shall not be used wherever gravity sewer service is available. Preliminary considerations and a rationale for the need of the pump station shall be reviewed in detail with the District's Manager and Engineer prior to proceeding with preliminary and final design. Lift station design shall be in accordance with the Colorado Department of Health and Environment's latest design criteria manual. As general guidelines for planning purposes, any pump station considered by the District must include, but is not necessarily limited to the following design features:

- a. Dry pit or wet well mounted pumping equipment.
- b. Multiple pumps.
- c. Standby power generation or dual source of power supply.
- d. Ventilation, heating and dehumidification equipment.
- e. Automatic controls.

- f. Remote alarm system for operating functions.

## 2.15 Sanitary Sewerage Plan Submittal Requirements

- a. Plans and Specifications. Three (3) copies of all plans and specifications for facilities to be installed under these rules and regulations shall be furnished to the District. One (1) copy will be returned to the applicant when approved by the District and bear evidence of such approval or comments requiring correction.
- b. Plan Content. As a minimum, the following information shall be required on all plans.
  - (1) Plan View: The plan view shall show streets, alleys, rights-of-way and utility easements with the location and size of the sewers, locations and distance between manholes, the slope and other appurtenances indicated. It is desirable for plans to show the proposed size and location of service stubs and the location of all existing or proposed underground utilities and structures located within 20 feet horizontally or vertically, of the centerline of the proposed sewer extension. (The scale is optional, however, 1"=50' is commonly used.)
  - (2) Profile View: The profile view with vertical and horizontal grids shall show the existing ground surface (grey scale) and proposed surface (solid). Also, show the proposed sewer with elevations of manhole rims and inverts, the distance and grade between manholes and elevations of utility crossings.
  - (3) Detail drawings: Special detail drawings, made to scale, shall clearly show the nature of design and construction of the following :
    - (a) Special sewer appurtenances such as non-standard manholes, inverted siphons and elevated sewers.
    - (b) Special joints and utility or storm sewer crossings.
    - (c) Stream and drainage channel crossings with elevations of normal high and low water levels.
- c. Supporting Data: Submit with the plans and specifications all necessary supporting data to fully describe the proposed installation. This data shall include but not necessarily be limited to a copy of the recorded plat of the subdivision in which the improvements are proposed to be installed and copies of dedicated rights-of-way and easements in which improvements are proposed to be installed. Submit copies of necessary permits from other governmental or private agencies having jurisdiction in the area of the proposed work.

Should a site application for a collection system extension be required by the Colorado Department of Health , the individual party responsible for construction of the facility shall also be responsible for obtaining this site approval.
- d. Upon completion of construction and prior to acceptance by the District, two (2) copies of "as-constructed" plans shall be submitted to the District for record. The two (2) copies shall be complete with all "as-constructed" information together with a certification by the party responsible for construction that all data thereon is accurate and represents actual "as-constructed" conditions. One (1 ) copy shall be a transparency suitable for reproduction. "As-constructed" plans shall be submitted within two weeks of completion of the sanitary sewer construction in any identifiable phase of a development. No authorization to connect to the system or discharge to the system will be allowed until the "as-constructed" documents have been received and accepted by the District.
- e. All plans, specifications and supporting documents shall be prepared by or under the direct supervision of a professional engineer registered to practice in the State of Colorado. All plans and specifications shall bear the seal and registration number and name of said registered professional engineer.

2.16 Sewage System and Trench and Foundation Drains

- a. In no case shall any trench drains, foundation drain or other drainage fixture be connected to the District's system which may introduce any wastewater other than sanitary sewage into the system.
- b. All piping material incorporated into the District's sanitary sewage system shall not be white unless utilizing Schedule 40 PVC. At the time of the preparation of these specifications, the predominant pipe color is green. All trench or foundation drainage piping shall be white to preclude accidental cross-connection of the drainage systems.



## **Pipe and Manhole Materials**

### 3.01 PVC Pipe and Fittings (Polyvinyl Chloride)

#### a. Conformance

ASTM 3034; Standard Dimension Ratio (SDR) shall be maximum of 35.

#### b. Joints

ASTM D3212; Bell and spigot, push-on with single rubber gasket.

Jointing of dissimilar pipe materials shall be accomplished with a specially manufactured rubber connection with stainless steel tightening bands (Mission Rubber Company, Fernco or equivalent).

Solvent Cement Joints may be used for 4-inch and 6-inch pipe.

#### c. Length of Joints

The length of joints for flexible conduits shall not exceed 12-1/2 feet for grades less than one percent.

#### d. Criteria for Acceptance. Pipe which has any of the following visual defects will not be accepted.

- (1) Improperly formed pipe such that pipe intended to be straight has an ordinate, measured from the concave side of the pipe exceeding 1/16 inch per foot of length.
- (2) Pipe which is out-of-round to prohibit proper jointing.
- (3) Improperly formed bell and spigot ends or bells which are less than 1-1/2 inches in length.
- (4) Pipe which is fractured, cracked, chipped or damaged in any manner.
- (5) Pipe that has been damaged during shipment or handling.
- (6) Pipe or fittings not properly marked as required by the following specifications.

#### e. Marking of Material. The following shall be clearly shown on the exterior of the pipe:

- (1) Manufacturer's name.
- (2) Appropriate ASTM designation.
- (3) Appropriate SDR number of 4-inch and 6-inch pipe.
- (4) Homemark.

#### f. Material Handling and Storage. Avoid damage to pipe from impact, bending, compression or abrasion during handling and storage.

Store pipe on flat surface which provides even support for the pipe barrel with bell end overhanging. Do not stack pipe higher than 5 feet. Do not store pipe and fittings in direct sunlight for extended periods (greater than two to three weeks). Any discoloration of the pipe material shall be evidence of ultraviolet damage and shall be reason for rejection and the removal from the project.

Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun.

Use only nylon protected sling to handle pipe. The use of hooks, bare cables or chains will not be permitted.

For pipe slopes less than one percent, the maximum pipe joint length shall be 13 feet.

#### g. All PVC pipe installed in the District's sanitary sewer system including mains and services shall be non-white in color. White sewer pipe shall not be acceptable as trench and foundation drain piping used in the District shall be white to better assure that there is no accidental connection between the two separate drainage systems.

- h. PVC pipe shall not be installed at depths in excess of fourteen (14) feet without specific approval of the District.

### 3.02 Ductile Iron Pipe

- a. Conformance

ANSI 21.51; Thickness Class 50, unless otherwise required for internal or external loading.

Fittings shall conform to ANSI 21.10 for flanged, mechanical joints and push-on joints (AWWA C110 or C153).

- b. Joints

- (1) Mechanical Joint: ANSI A21.11
- (2) Push-On: ANSI A21.11
- (3) Flanged: ANSI B16.1, 125 lb. drilling
- (4) Rubber Gaskets: AWWA C111 (ANSI A21.11)

- c. Protective Coatings

- (1) Exterior Coating: Manufacturer's standard coating approximately 1 mil thick.
- (2) Interior Lining: Interior lining shall consist of standard thickness, cement mortar in conformance with ANSI A21.4 standards.

- d. Criteria for Acceptance. In addition to any deficiencies covered by the reference specifications above, any of the following visual defects will not be accepted.

- (1) Improperly formed pipe such that pipe intended to be straight has an ordinate, measured from the concave side of the pipe exceeding 1/16 inch per foot of length.
- (2) Pipe which is out-of-round to prohibit proper jointing.
- (3) Pipe which is fractured, cracked, chipped or damaged in any manner.
- (4) Pipe that has been damaged during shipment or handling.
- (5) Pipe which has lining which is fractured, cracked, chipped or damaged in any manner and would not provide satisfactory service under the conditions intended.

- e. Marking of Material & Certification of Manufacturer. All materials shall be marked with the name of the manufacturer of origin. Manufacturer will provide a certification to the District that all products supplied to the project site are in conformance with these specifications.

- f. Material Handling and Storage. Handle pipe fittings and accessories using lifting hoist or skidding to avoid shock or damage. Do not drop such materials. Do not allow pipe unloaded on skidways to be skidded or rolled into pipe previously unloaded. Protect the pipe coatings and linings from damage during delivery and handling.

### 3.03 Manholes. Except as otherwise specifically approved by the District, manholes shall be precast concrete and manufactured in accordance with the referenced specifications. See standard drawing No. 4.

- a. Conformance

Precast concrete in conformance with ASTM C478.

b. Size of Manholes

| <u>Size of Sewer<br/>Main</u> | <u>Inside Diameter of<br/>Manhole</u> |
|-------------------------------|---------------------------------------|
| Up to 10 inches               | 4'                                    |
| 12 through 18 inches          | 5'                                    |
| 24 inches and above           | 6'                                    |

c. Cement

All cement used in manhole construction shall be Type II or Type IIIA. All concrete shall have a 28-day compressive strength of at least 4,000 pounds per square inch (psi).

Rubber gasketed joints for pre-cast manhole sections shall be an R-4 joint and designed in accordance with ASTM C443.

Manhole joints may be joined with flexible plastic/rubber gaskets constructed of Ram-Nek, Rubber-Nek, Con-Seal or equivalent.

3.04 Cast-in-Place Concrete. All cast in place concrete utilized in sanitary sewer construction shall have a minimum compressive strength of 3000 psi at 28 days unless specifically required otherwise by the project.

a. Aggregates

Conform to ASTM C33, maximum size shall be 3/4 inch nominal diameter.

b. Cements

Portland Cement in accordance with ASTM C150, Type II or IIIA will be used for all concrete.

c. Admixtures

Air entraining admixtures will be permitted in conformance to ASTM C260. Maximum entrained air shall be 6.5% and minimum shall be 5.0%. Water reducing and retarding admixtures may be utilized with the specific approval of the District. Such admixtures shall be in conformance with ASTM C493. Flyash or calcium chloride are not permitted for use.

d. Water/Cement Ratio

Maximum water cement ratio shall be 0.45.

e. Slump

Maintain within the following limits:

1" minimum, 3" maximum for all concrete to be incorporated in sanitary sewerage facilities.

3.05 Castings

a. Cast Iron

(1) Conformance: ASTM A48

(2) Applicable Items: Manhole rings and covers with non-slip surface with "SEWER" cast in the cover. Combined weight will not be less than 300 pounds. Ring shall be a minimum of 4 inches in height.

3.06 Steps. All manholes shall have steps at a maximum of 16 inches vertical spacing unless otherwise specifically directed by the District.

a. Conformance: Federal Spec. QQ-A-200/8.

b. Material: Aluminum with drop front design or safety nosing and non-skid grooves.

- c. Width: 12 inches.
- d. Capacity: 1000 pounds at 6 inches from wall.  
1500 pounds at 4 inches from wall.

OR

- a. Material: Plastic (co-polymer polypropylene) with 1/2" diameter Grade 60 steel reinforcement as manufactured by M.A. Industries, Inc.
- b. Design Equipment: PS-2-PFS Manhole Step with non-skid grooves and safety nosings or drop front design.

3.07 Cement Mortar

Conformance: ASTM A270, Type M.

3.08 Cement Grout

- a. Cement

Portland Cement in accordance with ASTM C150, Type II or II LA

- b. Sand

Clean, well-graded, natural sand in accordance with ASTM C33

- c. Proportioning

One part Portland Cement, 2½ parts sand, by weight, with minimum water required for placement and hydration

3.09 Non-Shrink Grout

Approved commercial factory mix product made especially for intended use. Utilize non-metallic chemical grout for non-shrink applications.

3.10 Dampproofing Material

Coal tar solution type coating; Tnemec "47-461 Foundation Coating," International "Intertuf 100," Carbolite "Bitumastic Super Service Black" or similar approved material

## **Pipe Installation**

4.01 **Earthwork.** See Standard Water Distribution Drawing No. 9 for typical pipe trench detail. See Standard Wastewater Collection System drawing No. 1 for bedding detail.

a. **Embedment Materials.** All water and sanitary sewer mains are to receive one of the following embedment materials extending from the bottom of the excavation to 12 inches over the pipeline.

(1) **Concrete.** The pipeline embedment with concrete shall utilize concrete having a 28-day compressive strength of a minimum of 3000 psi and other characteristics as set forth in these Specifications.

(2) **Granular Material.** Well-graded, crushed stone or gravel meeting the requirements of ASTM C33, Gradation 67 (3/4" to No.4).

(3) **Fine Granular Material.** Natural or manufactured sand meeting the following requirements:

### **Well-Graded Sand**

| <u>Sieve Size</u> | <u>Total Percent Passing by Weight</u> |
|-------------------|--|
| 3/8               | 100                                    |
| No. 4             | 95 – 100                               |
| No. 8             | 80 – 100                               |
| No. 16            | 50 – 85                                |
| No. 30            | 25 – 60                                |
| No. 50            | 10 – 30                                |
| No. 100           | 2 – 10                                 |

(4) **Squeeze Sand**

| <u>Sieve Size</u> | <u>Total Percent Passing by Weight</u> |
|-------------------|--|
| 3/8 inch          | 100                                    |
| No. 200           | 0 - 5                                  |

(5) **Selected Backfill.** Selected soil free from rocks, clods or stones greater than 1-1/2" in any dimension as approved by the District's representative. Granular material, fine granular material or squeeze sand may be substituted for selected backfill.

b. **Backfill Materials**

(1) **Suitable Material.** Soil obtained from the excavation that is free of frozen material, stumps, roots, brush, other organic matter, debris and other items. In addition, suitable material shall meet the following requirements:

(2) **Upper Portion of Trench.** Material placed within one (1) foot of pavement subgrade or finished surface in unimproved areas shall be soil free from rocks, greater than 6 inches in nominal diameter.

(3) **Other Portions of Trench.** Material within 6 inches below and 12 inches above the pipe shall contain particles of a size to conform to the embedment class required but in no case shall it contain rocks greater than 1-1/2 inches in any dimension. From a point 12 inches above the pipeline to within one (1) foot of the pavement subgrade or finished surface in unimproved areas, maximum size of any rock in the trench backfill shall be 18 inches nominal diameter.

(4) **Public Highways.** Provide and install material in conformance with the Colorado Department of Transportation requirements where they do not conflict with other provisions of these regulations. Should a conflict exist, submit a request for

clarification to the District in writing prior to proceeding with work.

- (5) Flowable Fill. At the District's option, or if required by the right-of-way's governing body, utility trench backfill meeting the following requirements (flowable fill), may be used in lieu of native backfilling in any excavation regardless of width or depth. Concrete slurry type full depth backfill will not be allowed within the public right-of-way. Compaction and testing of utility trench backfill will not be required if material meeting the following specification is used:

**FLOWABLE FILL SPECIFICATIONS**

| <b><u>Ingredient</u></b>    | <b><u>lbs / cubic yard</u></b> |
|-----------------------------|--------------------------------|
| Cement                      | 43 (0.47 sack)                 |
| Water                       | 325 (39 gallons or as needed)  |
| Coarse Aggregate (Size #57) | 1700                           |
| Sand (ASTM C-33)            | 1845                           |

c. Trench Backfilling and Compacting

- (1) Place backfilled material above embedment materials in a manner to prevent damage or misalignment of the pipeline. Place in lifts of a thickness necessary to acquire the specified backfill density or in conformance with other regulatory requirements. Backfilled material shall conform to the requirements of Section 3.10.b of these specifications.
- (2) Backfill Density Requirements. Unless otherwise specified or required by local governing authority, all backfill should be placed in a manner to achieve the density specified below.
- State Highway  
100% of maximum in shoulder areas  
Flowable Fill within all paved areas
  - Paved roadways, sidewalks and other areas to receive pavement  
95% of maximum density for entire trench depth
  - Gravel roadways  
95% of maximum density for entire trench depth
  - Sodded or lawn areas over a dedicated easement or right-of-way  
90% of maximum density
  - Zone 6" below to 12" above pipe  
95% of maximum density for all pipelines
  - Adams / Arapahoe County  
100% of maximum in paved areas parallel to traffic  
95% in shoulder areas  
Flowable Fill in paved areas perpendicular to traffic

d. Field Quality Control

- (1) Density Testing and Control. Density testing as may be required by the District's representatives shall be the responsibility of the Contractor and/or Developer. Results of such density testing shall be reported directly to the District by the testing agency. All reports shall be submitted with the seal and signature of a registered professional engineer experienced in the testing of soil materials.
- (2) Soil Compaction Tests. Conduct in accordance with the requirements of ASTM D698-07 or AASHTO T99, "Standard Method of Test for Moisture Density Relations of Soils Using a 5.5 lb. Rammer and a 12 inch Drop." Use method A, B, C or D as appropriate on soil condition and judgment of the testing laboratory. Samples tested shall be representative of

materials to be placed (or altered). Obtain optimum moisture density curve for each type of material or combination of materials encountered or utilized. Use test results as a basis for compaction control. Testing includes Atterberg Limits, grain size determination and specific gravity.

#### 4.02 Pipe Laying

- a. Begin pipe laying at the lowest point, unless directed otherwise by the District, and install the pipe with the spigot ends pointing in the direction of flow.
- b. Unless required or directed otherwise by the District, lay all pipe straight between changes in alignment and at uniform grade between changes in grade or slope.
- c. As each length of pipe is placed in the trench, the joint shall be completed in accordance with the pipe manufacturer's recommendations and the pipe shall be brought to the correct line and grade. The offset at the invert shall be less than 1% of the inside pipe diameter.
- d. The length of joints for curvilinear sewer shall be determined by the radius using joint deflection not exceeding the manufacturer's recommendations, three degree couplings or a combination of both. Bending of the pipe material to achieve the curvature shown on the plans shall not be permitted.
- e. Secure the pipe in place with Class B bedding material tamped under and around the pipe. Do not walk on small diameter conduit or otherwise disturb any conduit after jointing has been completed.
- f. All foreign matter or soil shall be removed from the inside of the pipe before it is lowered into its position in the trench and shall be kept clean at all times during and after laying. All openings along the line of the sewer shall be securely closed and during suspension of work at any time, suitable pipe plugs or closures shall be placed to prevent water, soil or other materials from entering the pipeline.

#### 4.03 Fittings, Couplings, Wyes and Saddles

- a. Fittings, couplings, wyes and saddles shall be the same material as the pipeline or as specifically manufactured for a particular installation.
- b. Jointing of dissimilar materials shall be permitted only with approval of the District representative. Jointing of such dissimilar materials shall be through the use of fittings, couplings, wyes, saddles, adapters or adhesives specifically manufactured for such transitions.

#### 4.04 Service Lines. See Standard Drawing No. 7

- a. Prepare subgrade in accordance with Part III of these regulations.
- b. Connect all service lines to mains with a tee or tee saddle in the top one-half of the sewer main. Connections made in the lower half or at mid-point of the main shall have prior approval of the District and may require the installation of a backflow prevention device.
- c. Connection of service lines to mains
  - 1) Tee saddles with rubber gaskets to be placed between the saddle and the main line of pipe, secured in place with stainless steel bands are required.
  - 2) Connection to the main line piping shall be made by cutting a hole using the appropriate hole template, tapping machine or hole saw no more than ¼-inch larger in diameter than the template outline.
  - 3) A 1/8 or 1/16 bend shall be used from the tee fitting to attain the desired grade and slope for the service line piping.
  - 4) The tee saddle shall be furnished with an intergal rubber gasketed bell.
  - 5) All service line piping between the main line and the property line of the property to be serviced shall be pipe in accordance with these specifications with intergal rubber gasketed pushon joints.
  - 6) In general, no change in horizontal alignment will be permitted between the connection at the main line and the property line of the property being serviced.

- d. Service line connections shall be separated by a minimum of 3 feet measured center to center along the main.
- e. Plug all service line stubs with water and air tight cap or plug unless the service line will be immediately connected to a building sewer.

Where new street construction is proposed immediately following construction of sanitary sewer facilities, extend the service line to 5 feet inside the property line, install the appropriate plug and mark with a vertical wood marker extending above the surface and having dimensions of 2" x 4" minimum.

- f. The Contractor and/or Developer shall provide complete as-built information on each service line connection installed within his/her work. As a minimum this information shall include the location of the connection to the main referenced to the nearest manhole or other permanent improvement, the location of the end of the service line stub, the direction of the service line as it relates to surrounding permanent surface improvements, the size, the material of construction and the date and name of the installer. All such information shall be provided to the District's representatives for incorporation into the District's permanent records.
- g. Connection of service lines and service line construction shall be accomplished by experienced, qualified personnel with adequate equipment. The District's representative shall have authority to reject work and may not permit work to be accomplished unless done by qualified personnel.

#### 4.05 Manholes

- a. Cast-in-place concrete manhole base
  - 1) Prepare the subgrade and excavation in accordance with the specifications.
  - 2) Provide reinforcing, grade 60 reinforcing bar, No. 4 at 12-inches on center each way for manholes 12-feet or less in depth. Place steel at 8-inches on center each way on manholes in excess of 12 feet in depth.
  - 3) Place concrete against undistributed soil to the depth, thickness and other dimensions shown on detailed drawings.
  - 4) Finish and cure the cast-in-place concrete for a minimum period of 24 hours prior to placing precast manhole sections on the cast-in-place base.
  - 5) Maintain ground water below the bottom of the cast-in-place concrete for a minimum period of 24 hours following placement of concrete by maintaining pumping equipment in operation below the subgrade of the manhole base.
  - 6) Concrete shall contain a minimum of 564 lbs of Type 2 portland cement per cubic yard (6 sacks mix), be placed with a maximum slump of 2 inches with maximum size course aggregate of ¾-inch (ASTM C33).
- b. Provide segmental precast concrete barrel sections a maximum of 4 feet in length with preformed flexible gasket material between each barrel section as jointing material or install rubber gaskets in precast R-4 joint grooves per manufacturer's recommendations.
- c. Provide dampproofing of all manhole joints.
  - 1) Provide interior dampproofing consisting of a 3/8" to 1/2" thick layer of cement grout extending a minimum of 4" each side of all manhole segment joints. Work the cement grout in the joint to completely fill all voids.
  - 2) Provide exterior dampproofing consisting of a 3/8" to 1/2" thick layer of cement grout extending a minimum of 4" each side of all manhole segment joints. Work the cement grout in the joint to completely fill all voids.
  - 3) When ground water is present or potentially present in the opinion of the District representatives, a double application of Ram-Nek, or equal, and an application of cold tar epoxy dampproofing material shall be applied to the completed manhole structure after installation of cement grout and prior to backfilling. During construction of all dampproofing measures ground water shall be maintained below the subgrade elevation in the manhole excavation during the time sufficient for all materials to properly cure, no less than 24 hours.



- d. Provide one, one (1) foot high barrel section beneath a reducing ring or cone cap to bring the manhole ring and cover to within 6 inches of desired grade.
- e. Provide precast concrete 2-inch-high grade adjustment rings to bring the ring and cover to desired grade. A maximum of three grade adjustment rings are permitted. A maximum dimension of 2 feet shall be permitted between the manhole ring and the top manhole step.
- f. Where the manhole base is constructed from cast-in-place concrete, the sewer pipes entering the base shall be cut to length to match the inside of the manhole barrel and set to grade. Manhole gaskets shall be placed over the pipe and centered between the end of the pipe and the outside of the cast-in-place base. The cast-in-place base shall then be constructed to the lines and grades required by the District's standard specifications and the accepted plans. Sewer pipe shall not be laid through the manhole base and the concrete base and/or invert placed around the pipe.

Where preformed rubber "boots" such as Kor-N-Seal boots are used in precast manhole bases, manhole gaskets on the pipe are not required.

- g. Where intersecting pipelines or pipelines requiring deflections at manholes require that the invert of the manhole be shaped to match the pipe cross sections, such construction shall be accomplished in accordance with the detail drawings of these specifications. Form the flow line configuration of intersecting pipes to allow for free uninterrupted flow of sanitary sewage through and out of the manhole. All channel inverts shall be finished smooth by steel troweling. All inverts shall be placed and finished with a single pour of cast-in-place concrete. Placement of grout and/or other material to repair and/or reshape the manhole invert shall not be permitted unless specifically approved by the District's representative.
- h. Cast-in-place bases for manholes shall be constructed in a manner to provide for a smooth level surface on which vertical barrel sections shall be placed. Completely watertight joints shall be made utilizing preformed flexible gasket material or a precast concrete base section may be utilized. The manhole shall be constructed such that no single section varies from true vertical by more than two percent of the section length.
- i. All manholes constructed in the District shall have the ring and cover elevations set at final street grades or at a point not more than 6 inches above the existing ground in non-traffic areas unless directed otherwise by the District. The Developer/Contractor shall be responsible for adjusting the manhole rings and covers to the final elevations.
- j. In areas where street paving will be placed, the manhole ring adjustment shall be accomplished in a two-step process prior to placement of pavement. The manhole ring shall be constructed 0.5 feet below finished pavement surface elevation. Pavement shall then be placed in accordance with the applicable rules, regulations and specifications. Following completion of paving, the sanitary sewer manhole rings will be raised by the Developer/Contractor to finished grade in accordance with the specifications of the District.
- k. The ring shall be adjusted with precast concrete rings a maximum of 0.5 feet in height. Cement grout shall be placed to adjust the ring to conform to the surface. A concrete collar shall be placed around the adjusting rings and the ring of the manhole up to a point 2 inches below finished grade. Paving material shall then be placed over the concrete and match the surrounding pavement surface. Tack coat material shall be placed between new and existing asphaltic concrete surfaces, the manhole casting and the concrete collar.

## **Testing of Pipelines and Appurtenances**

5.01 **Infiltration.** Use where ground water may be above the pipeline invert.

- a. Infiltration tests shall be conducted on each segment of the sanitary sewer system where it could be anticipated that ground water may rise above the flow line of the pipeline. Tests shall be conducted by placing an approved calibrated V-notch weir in the line just above the next lower manhole and plugging the line just above the next higher manhole. Sufficient time will be allowed to permit the water level behind the weir to stabilize before reading. Any foreign material hanging to the weir will be dislodged before reading. Successive readings shall be taken until consistent results are obtained.
- b. The maximum allowable infiltration shall be 100 gallons per day per inch of pipe diameter per mile of pipe.
- c. Each segment of pipeline between manholes or other major appurtenances must satisfy and pass the infiltration tests.
- d. Should it be determined that the infiltration rate is in excess of that permitted by these regulations, any repair and/or replacement of pipelines, manholes or other appurtenances shall be at the Contractor's and/or Developer's expense. Satisfactory repair and replacement shall be accomplished prior to the consideration of acceptance of any facility by the District.
- e. The Contractor and/or Developer will furnish all labor, equipment and materials required to accomplish such testing.

5.02 **Air Test.** All segments of sanitary sewer mains shall be subjected to an air pressure test. Where ground water levels are above the conduit, increase the test pressures given below to compensate for the pressure on the conduit from the ground water.

- a. The Contractor may conduct an initial air test of the sewer main line after compaction of the backfill but prior to the installation of any service lines. Such tests shall be considered for the Contractor's convenience in quality control of the project construction. Final consideration for acceptance of the sanitary sewer by the District shall be based on satisfactory completion of testing with all service line stubs installed.
- b. Preparation of Tests: Flush and clean the sewer line prior to testing in order to wet the pipe surfaces and produce more consistent results. Plug and brace all openings in the main sewer line and the upper end of any connections. Check all pipe plugs with a soap solution to detect any air leakage. If leaks are found, release the air pressure, eliminate the leaks and start the test procedure over again.
- c. Procedure of Test: Add air until the internal pressure of the sewer line is raised to approximately 4.0 psi gage at which time the flow of air shall be reduced and the pressure maintained between 3.5 and 4.5 psi gage for a sufficient time to allow the air temperature to come to equilibrium with the temperature of the pipe.
- d. After the temperature has stabilized the pressure shall be permitted to drop to 3.5 psi gage at which time a stop watch or a sweep second hand watch shall be used to determine the time lapse required for the air pressure to drop to 3.0 psi gage.
- e. If the time lapse is less than that shown in the table, the Contractor shall make the necessary corrections to reduce the leakage to acceptable limits.
- f. If the time lapse exceeds that shown in the table, the pipe shall be presumed to be within acceptable limits for leakage.

| Pipe Dia.(in.) | Minimum Time (min:sec) | Length For Minimum Time (ft.) | Time for Longer Length (L, ft.) (sec) | LENGTH (ft.) |       |       |       |
|----------------|------------------------|-------------------------------|---------------------------------------|--------------|-------|-------|-------|
|                |                        |                               |                                       | 100          | 200   | 300   | 400   |
| 4              | 1:53                   | 597                           | 0.190L                                | 1:53         | 1:53  | 1:53  | 1:53  |
| 6              | 2:50                   | 398                           | 0.427L                                | 2:50         | 2:50  | 2:50  | 2:51  |
| 8              | 3:47                   | 298                           | 0.760L                                | 3:47         | 3:47  | 3:48  | 5:04  |
| 10             | 4:43                   | 239                           | 1.187L                                | 4:43         | 4:43  | 5:56  | 7:54  |
| 12             | 5:40                   | 199                           | 1.709L                                | 5:40         | 5:42  | 8:33  | 11:24 |
| 15             | 7:05                   | 159                           | 2.671L                                | 7:05         | 8:54  | 13:21 | 17:48 |
| 18             | 8:30                   | 133                           | 3.846L                                | 8:30         | 12:49 | 19:14 | 25:38 |
| 21             | 9:55                   | 114                           | 5.235L                                | 9:55         | 17:27 | 26:11 | 34:54 |
| 24             | 11:20                  | 99                            | 6.837L                                | 11:24        | 22:48 | 34:11 | 45:35 |
| 27             | 12:45                  | 88                            | 8.653L                                | 14:25        | 28:51 | 43:16 | 57:42 |

Safety: The air test may be dangerous if proper precautions are not taken. All plugs must be sufficiently braced to prevent blowouts and the pipeline must be completely vented before attempting to remove the plugs.

As a safety precaution, pressurizing equipment shall be provided with a regulator setting of 5 psi to avoid over-pressurizing and damaging an otherwise acceptable line.

#### 5.03 Alignment Testing

- a. Each section of pipeline on a linear alignment between manholes will be subject to testing by lamping by the District's representatives to determine where proper alignment has been accomplished and whether any displacement of the pipe has occurred during construction.

The Contractor and/or Developer shall provide suitable assistance to the District's representative in accomplishing this work. The Contractor and/or Developer shall be responsible for repairing any alignment, displaced pipe or other defects discovered during this testing in accordance with these specifications.

- b. For pipelines installed at grades less than 1%, a minimum of 90% of the full pipe cross section shall be visible at the opposite end of the segment being observed.
- c. For pipelines installed at grades greater than 1%, a minimum of 75% of the full pipe cross section at the opposite end of the segment shall be observed.
- d. The determination of the acceptability of the pipeline alignment by lamping shall rest solely with the District's representative and his decision shall be final.
- e. Pipelines not meeting the requirements of the alignment tests shall be completely excavated, removed, and re-laid on prepared bedding material, backfilled and compacted in accordance with these specifications and then subjected to infiltration, air pressure and alignment testing.

#### 5.04 Deflection Tests

- a. Proper construction in accordance with these specifications and the manufacturer's recommendations should result in a vertical deflection of the pipe less than 5% of the internal diameter. At the option of the District, the Contractor and/or Developer may be required to perform testing to determine conformance with this requirement.
- b. Should the District determine that deflection testing is required, the Contractor and/or Developer shall provide all necessary equipment, labor and other facilities. Data supplied by the pipe manufacturer's

representative for dimensional quality shall be utilized.

- c. Should the vertical deflection of the pipe be found to exceed 5% of the internal diameter, the Contractor will remove the pipe, install proper bedding, replace the pipeline material and properly place and compact all backfill material in accordance with these specifications. Any areas removed and replaced shall be subject to infiltration, air pressure and alignment testing.

5.05 Vacuum Tests

- a. All manholes shall be vacuum tested prior to CCTV inspection operation and acceptance by the District Engineer.
- b. All lift holes and pipes penetrating the manhole are to be plugged, sealed, braced, and secured. A vacuum will be drawn and the vacuum drop over a specified time period will be reported.
- c. An effective seal is required between the vacuum base and the manhole rim.
- d. The test head gauge should be placed at the top of the manhole or per the manufacturer's recommendations.
- e. A vacuum of 10 inches of mercury should be drawn within the manhole, vacuum line valve closed, and vacuum pump shut off. The time should be recorded for the vacuum to drop to 9 inches of mercury.
- f. The manhole vacuum test is considered passing if the time for the vacuum drop in mercury exceeds the values indicated in the following table.

| Depth of Manhole (ft.) | Diameter of Manhole (ft.) |    |     |
|------------------------|---------------------------|----|-----|
|                        | Time (sec.)               |    |     |
|                        | 4'                        | 5' | 6'  |
| 8                      | 20                        | 26 | 33  |
| 10                     | 25                        | 33 | 41  |
| 12                     | 30                        | 39 | 49  |
| 14                     | 35                        | 46 | 57  |
| 16                     | 40                        | 52 | 67  |
| 18                     | 45                        | 59 | 73  |
| 20                     | 50                        | 65 | 81  |
| 22                     | 55                        | 72 | 89  |
| 24                     | 59                        | 78 | 97  |
| 26                     | 64                        | 85 | 105 |
| 28                     | 69                        | 91 | 113 |
| 30                     | 74                        | 98 | 121 |

- g. If a manhole fails the initial vacuum test, then the District Engineer shall be informed of repairs, the manhole supplier should be notified of defects, repairs shall be made, and the manhole retested until a satisfactory test is obtained.

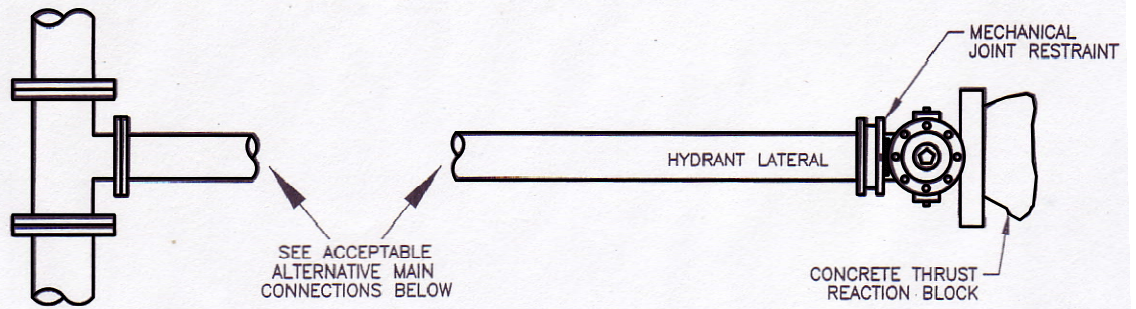
5.06 Internal Video Inspection

- a. All sewer main construction in the District shall be inspected with internal video camera and recording equipment.

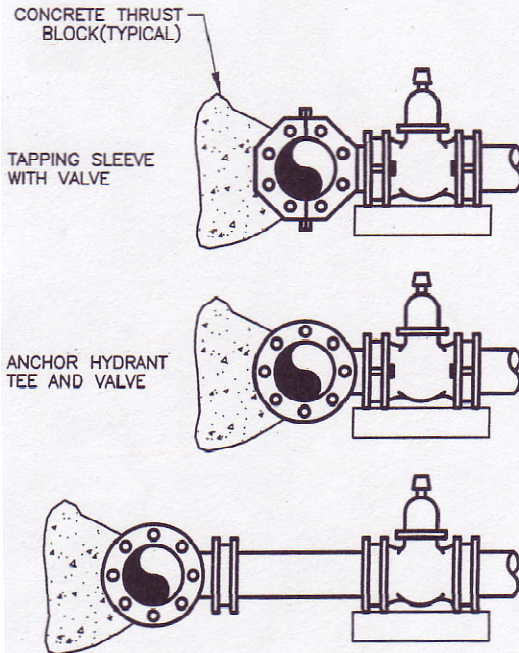
- 1) Coordination with the District shall be required as to cleaning and/or flushing prior to any internal video inspection.
- b. All costs of the internal video inspection shall be borne by the Contractor and/or Developer.
- c. The individual and/or company and permanent video tape recording shall be subject to the acceptance and approval of the District.

**PART I**

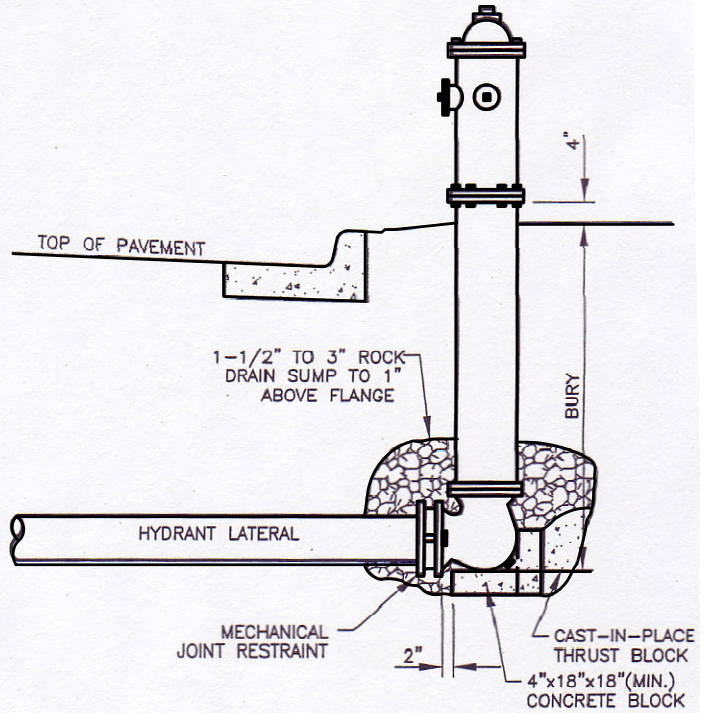
**WATER DISTRIBUTION  
STANDARD DRAWINGS**



**PLAN**



MJ HYDRANT TEE WITH 30" SPACER PIPE AND VALVE. USE MECHANICAL JOINT RESTRAINT AT EACH MECHANICAL JOINT.



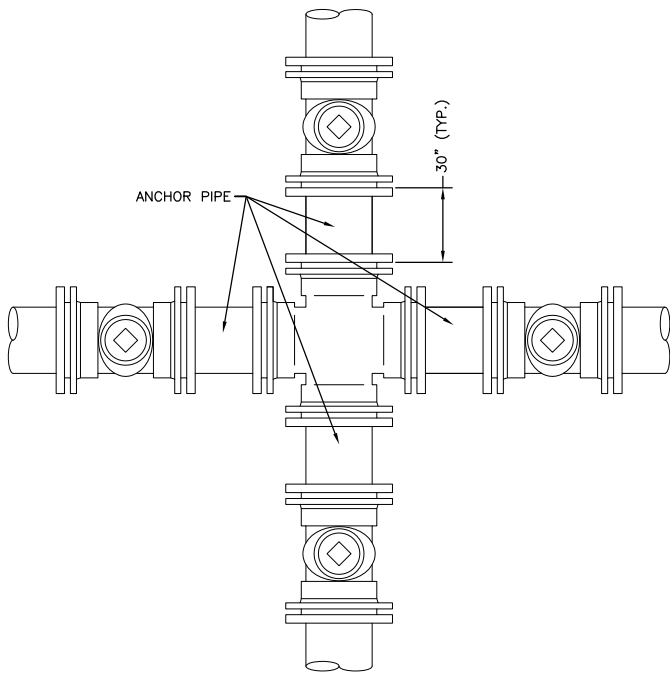
**NOTES:**

1. TIE BACK RODS:  
MAX. ROD LENGTH = 10'  
MIN. ROD LENGTH = 4'
2. MECHANICAL JOINT RESTRAINTS SHALL BE USED WITH ANCHOR & TIE RODS AND CONCRETE THRUST BLOCKS.

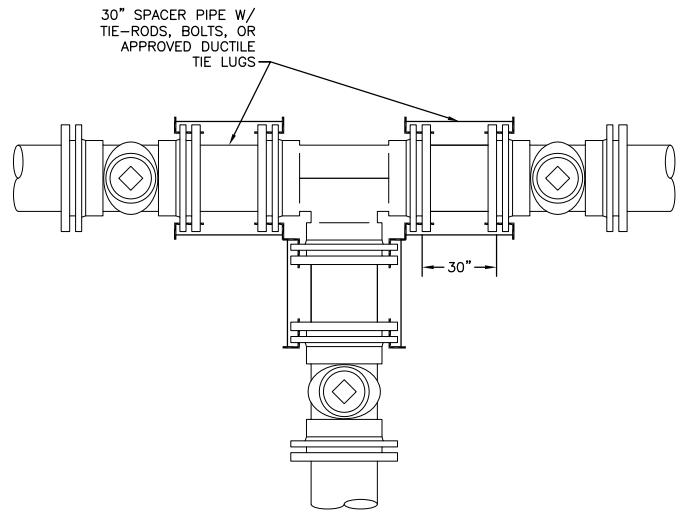
**STRASBURG SANITATION AND WATER DISTRICT**

**FIRE HYDRANT INSTALLATION**

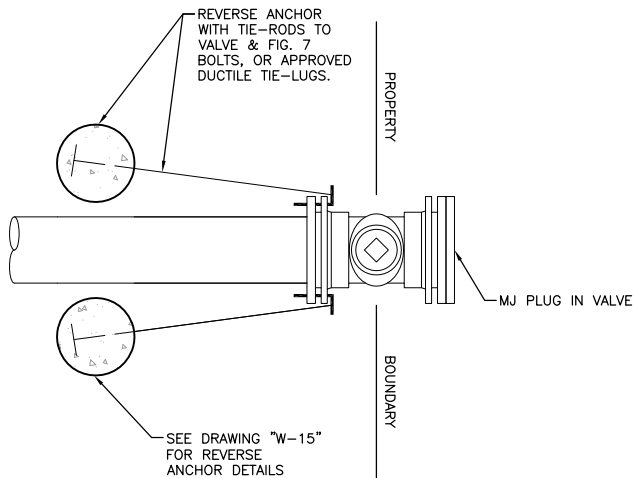
|                 |                      |          |             |
|-----------------|----------------------|----------|-------------|
| APPVD.          | DATE:                | SUVD.    | DATE:       |
| CHECKED         | DATE:                | SHEET OF | Scale: NONE |
| DESIGN          | DATE:                | JOB NO.  |             |
| PLOTTED L. OTTO | DATE: 11/82          | PA NO.   |             |
| REVISION        | 2/86, 7/90, 10/31/16 |          |             |



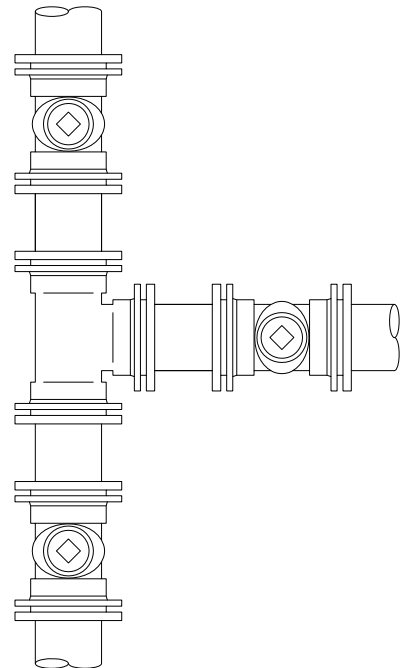
CROSS OR TEE W/  
ANCHOR PIPES



CROSS OR TEE W/  
SPACER PIPE & TIE-RODS



AT END OF LINE USE  
REVERSE ANCHOR WITH  
TIE BACK RODS



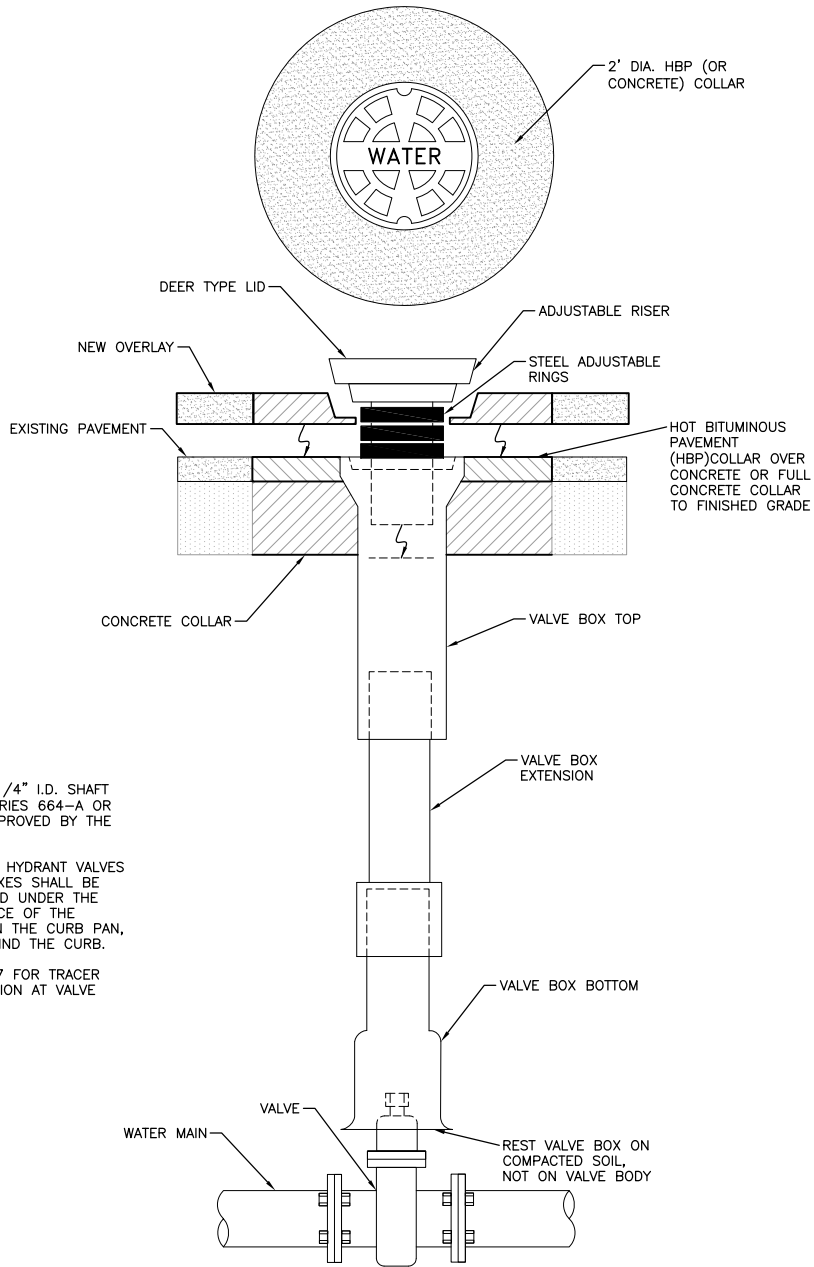
WITH MJ ANCHOR TEE

GENERAL NOTES:

1. ON ANY VALVE INSTALLATION NEAR A FITTING, THE VALVE SHALL BE ANCHORED BY RODS, REVERSE ANCHOR, AND MECHANICAL JOINT RESTRAINTS. 3/4" ALL-THREAD RODS SHALL BE USED WITH FIG. 7 BOLTS OR APPROVED DUCTILE TIE-LUGS FOR DEAD-END VALVES AND/OR PLUGS. ALL METALLIC COMPONENTS SHALL BE WRAPPED IN POLYETHYLENE TUBING.
2. ANCHOR PIPE OR FOSTER COUPLINGS MAY BE SUBSTITUTED FOR SPACER PIPE AND RODS.
3. THE CONCRETE REVERSE ANCHORS USED SHALL BE SIZED AS INDICATED ON DRAWING 11.
4. SEE DRAWING 14 FOR APPLICATION OF MECHANICAL JOINT RESTRAINTS.
5. SEE DRAWING 3 FOR VALVE BOX INSTALLATION.

|  |            |         |                |
|--|------------|---------|----------------|
| <b>STRASBURG SANITATION<br/>AND WATER DISTRICT</b> |            |         |                |
| <b>VALVE INSTALLATION AND LOCATION</b>             |            |         |                |
| APPVD.   | DATE:      | SUVYD.  | DATE:          |
| CHECKED  | DATE:      | SHEET   | OF Scale: NONE |
| DESIGN   | DATE:      | JOB NO. |                |
| PLOTTED L. OTTO                                    | DATE: 1/83 | PA NO.  |                |
| REVISION   | 10/31/16   |         |                |





**NOTES:**

1. SLIP-TYPE 5-1/4" I.D. SHAFT TYLER PIPE SERIES 664-A OR EQUIVALENT APPROVED BY THE DISTRICT.
2. MAIN AND FIRE HYDRANT VALVES AND VALVE BOXES SHALL BE LOCATED IN AND UNDER THE DRIVING SURFACE OF THE STREET, NOT IN THE CURB PAN, CURB, OR BEHIND THE CURB.
3. SEE DRAWING 7 FOR TRACER WIRE INSTALLATION AT VALVE BOXES.

|  |                |             |             |
|--|----------------|-------------|-------------|
| <b>STRASBURG SANITATION AND WATER DISTRICT</b> |                |             |             |
| <b>VALVE BOX INSTALLATION</b>                  |                |             |             |
| APPVD.   | DATE:          | SUVYD.      | DATE:       |
| CHECKED  | DATE:          | SHEET       | OF          |
| DESIGN   | DATE:          | JOB NO.     | Scale: NONE |
| PLOTTED  | B. MAC         | DATE: 11/82 | PA NO.      |
| REVISION                                       | 2/86, 10/31/16 |             | <b>3</b>    |