

Town of Strasburg

Technical Design Manual

**Final Draft
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CHAPTER 1. Administration

1.1 Title

This document shall be known as the "Technical Design Manual of Strasburg, Virginia" ("TDM") and may be so cited.

1.2 Acknowledgement

The Town of Strasburg would like to take this opportunity to thank staff members and individuals within the development community that have provided their time and input of the changes set forth. The Town also acknowledges other municipalities who have provided language and guidance with this update.

1.3 Purpose and Intent

- A. By action dated April 1, 2013 The Town of Strasburg (Town) has adopted this Engineering Design Manual, to establish standards for the construction of streets, waste and wastewater infrastructure within the Town's boundaries and service areas. This Manual replaces the Manual dated 2003 and subsequent revisions thru 2010.
- B. This Manual will be amended and updated from time to time by staff to reflect the current trends in construction, and policy and procedures by the Town of Strasburg.
- C. Engineers, developers, applicants for new service, builders and installers may find guidance needed to prepare construction plans and specifications, and work through the administrative procedures that support their projects.
- D. Town of Strasburg staff can use this information to implement and administrate construction projects, conforming to established policies, standards and procedures.
- E. The Design and Construction Standards presented in this manual are the minimum standards to be followed by developers/owners for the Town of Strasburg, and are not intended to be used as a substitute for actual construction specifications and design computations.

1.4 Coordination with Unified Development Ordinance

- A. The Design and Construction Standards presented in this Technical Design Manual (TDM) and the Unified Development Ordinance (UDO) are the minimum standards applicable to new development projects in the Town of Strasburg, and are not intended to be used as a substitute for actual construction specifications and design computations.
- B. Additional technical standards and specifications are identified in the UDO and incorporated into this TDM by reference. It is the responsibility of the Applicant to confirm compliance with this TDM and the UDO.
- C. Procedural provisions are identified in the UDO.

1.5 Disclaimer

- A. All State documents included in this Manual are provided as a courtesy to the user/purchaser and are not associated with the fees charged by the Town of Strasburg. It is the responsibility of the user/purchaser to obtain updates on all State documents referenced in this manual.
- B. The purpose of this manual is to establish reasonable land development standards and guidelines for the protection and promotion of the general health, safety, and welfare of the Town of Strasburg's residents.
- C. Approval of plans and plats by the Town of Strasburg or its agencies pursuant to the ordinance and this manual, is not intended and shall not be deemed as a guarantee or warranty for any individual, landowner, or developer that any improvements will be designed, planned, constructed, or operated in any particular manner or be free from defects. Such approval shall create no duty or result in any liability on the part of the Town of Strasburg, its officials, or employees for any claim, demand, suit, or damages alleged to have resulted from the development, construction, existence, or operation of improvements constructed pursuant to such approved plans or plats. Further, no such approval shall operate as or be deemed as a waiver of any provision or requirement of the ordinance, or this manual, unless such waiver has been specifically granted in writing by the Town Manager. In the event that any aspect of any such approved plan or plat fails to comply with any provision or requirement of this ordinance, or this manual, in effect at the time of such approval, such provision or requirement of the ordinance, or this manual, shall take precedence over the approved plans, and development shall be in accordance with the ordinance and this manual.

1.6 Limitations

- A. Plans and specifications are valid for a period of five years from date of approval. If construction is not in progress at the end of this period, Town approval shall be void. Plans and specifications will then have to be submitted as a new project (if deemed necessary by the Town) and conform to the most current specifications.
- B. All designs must comply with the requirements of all applicable regulatory agencies including Virginia Department of Health (VDH), Virginia Department of Environmental Quality (DEQ), Virginia Department of Transportation (VDOT), Department of Recreation and Conservation (DCR) and Shenandoah County.
- C. Where a conflict occurs between this Manual and project-specific contract documents (specifications and drawings), the project-specific documents shall govern.
- D. Any material not listed in these standards and specifications or not currently accepted by the Town shall be approved prior to approval of the plans. At time of construction, the Town has the right to reject the material prior to acceptance of the project.
- E. Material that is not listed in the Town specifications must be provided during the design phase and prior to installation as follows:
 - 1. A cover letter along with two sets of manufacturer's certifications, and shop drawings and/or samples shall be sent to the Town's Director of Public Works.

2. After review, the Director will issue approval or denial of the submitted shop drawing to the submitter.
- F. Unapproved materials placed at a job site shall be subject to immediate rejection and barred from any further consideration.

1.7 Public Inquires

The Public may view the approved applications on file with the Town of Strasburg Public Works Department. In order to view the approved applications, the public must make an appointment with the Town of Public Works Department, no less than ten (10) business days prior to review the records. If requests are unusual or time consuming, it may require additional time to locate the files. The files may not leave the premises of the Town property without permission from the Director of Public Works and/or their designee and/or the Town Manager.

CHAPTER 2. Land Disturbance

2.1 General Construction Standards

- A. All construction shall be in strict accordance with approved plans and specifications. Any deviations or changes shall be submitted to the Town in writing for supplemental approval.
- B. The installation of new services on existing lines shall be done at time of utility construction. Application for, and installation of the service, shall be early in the project to ensure the work is completed in a cost efficient and timely manner.
- C. Prior to Construction, the Contractor will contact 811. The Contractor will be in compliance with all Commonwealth of Virginia Codes concerning underground utilities. Documentation shall be posted on site at all times for inspection.
- D. The contractor must have the approved construction drawings in his possession prior to construction. At least one (1) copy of the approved plans, with revisions must be kept on site at all times.
- E. A Storm water permit (SWPPP) from the Department of Conservation and Recreation will be required and provided prior to plan approval for developments over 1 acre in size. A copy of the permit must be posted onsite for inspection at all times.
- F. A copy of all permits and applications provided to Shenandoah County shall be provided to the Town of Strasburg. These permits shall be posted on site at all times for inspection.
- G. All water and sewer lines shall be constructed according to these plans. All linework shall meet all the requirements of the Town of Strasburg. The property owner is responsible for all water and sewer laterals from the town right-of-way to the residence.
- H. The Contractor shall coordinate with, and arrange for inspection with the Town, five business days prior to needing an inspection on-site.
- I. The exact locations of all water and sewer service lines on new mains are to be coordinated with the Town's inspector.
- J. Water laterals that cross under a street shall be encased in PVC pipe. The pipe shall be 3" diameter SDR21 or schedule 40 for 1" service laterals. The pipe shall be 4" diameter SDR21 or schedule 40 for 1 1/2" and 2" service laterals. It shall run 1' beyond the near sidewalk and the far sidewalk.
- K. The Town shall be responsible for the installation of all water meters up to 2". Before a permanent meter is set, the Town requires the following:
 - 1. The frame and cover be properly aligned with it meter box and setter
 - 2. The frame and cover be set to the final grade of the lot
 - 3. The distance between the top of the cover and the setter shall be between 18" and 21"

4. All components of the meter box assembly are to be in proper working order. It is the developer / contractor's responsibility to have the meter box assembly installed correctly.
- L. The location of the tap and the termination point of the lateral are to be coordinated with the Director of Public Works. An application for services must be made and fees paid.
- M. The contractor shall tie new water main installations into existing water mains. The Contractor shall tap all service laterals to new water mains. They will furnish the materials for and make the tap. The contractor must make application for and pay for the cost of this work.
- N. The Contractor shall tie in a new line to an existing manhole by core drilling the manhole.
- O. A double check valve backflow assembly is to be installed on any line (fire or domestic) that goes into a building. The assembly is to meet ASSE Standard No. 1015 or 1013. If the assembly is mounted inside a building, a remote readout is required.
- P. Ten (10) Gauge Solid CopperWire under ground rated shall be run with all utilities including: Water main and services - Sewer main and services. All splices/connections shall be water proof.
- Q. All easements shall be free of structures and vegetation.
- R. All Erosion and Sediment Control devices shall be constructed and maintained in accordance with the current "Virginia Erosion and Sediment Control Handbook".
- S. All finished grading, seeding, sodding or paving shall be done in such a manner to preclude, the ponding of water on the site, particularly adjacent to building and storm drain inlets, except as specifically noted. The site shall be sloped to drain at all times.
- T. Where plans call for matching existing pavement, the contractor shall provide cut joint and/or asphalt overlay in accordance with VDOT specifications.
- U. All radii and dimension lines are to be from the face of curb. All spot elevations are to the top of curb unless otherwise shown.
- V. Contractor shall be responsible for adjustments and/or reconstruction of all utility covers (manholes, frames and covers, valve boxes, covers, etc.) to match the finished grades of the affected areas of construction.
- W. The contractor is responsible for any damage to existing roads and utilities which occur as a result of project construction.
- X. Approval of the plan does not grant approval to trespass on offsite property.
- Y. During construction, the Town may require additional work by the contractor to be in accordance with the specifications.

2.2 Hydrology and Storm Water Management

2.2.1 Materials

- A. Within the right-of-way and/or easements, all structures and pipes shall be constructed of concrete. Any offsite drainage structure connecting directly into a structure, pipe or facility must be concrete.
- B. If the applicant wishes to use any material besides concrete pipe and/or structures on the site, they may do so, as long as the final connection to the Town's system is concrete. The Town will not accept responsibility of non-concrete piping and/or structures, and a maintenance plan for the piping and structures will need to be executed with the Town prior to permits being issued.

2.2.2 Easements

- A. Standard minimum easement width shall be determined as follows with minimum easement width to be based on the width of the trench necessary to unearth the pipe. The trench width shall be based on a 1:1 slope from the edge of the trench. Where multiple pipes or pipe sizes larger than 72 inches are installed, the edge of easement shall be a minimum of 5 feet clear of the outside edge of the outermost pipe. Criteria resulting in the greatest width shall be used.

Exhibit 2A: Standard Easement Width

Pipe Size Minimum	Easement Width
Up to 18 inches	15 feet
21-33 inches	20 feet
36-48 inches	24 feet
54-72 inches	30 feet

- B. For open channels, easement width shall generally be based on the width required to carry the design flow plus 5 feet on each side. Open channels will be in a minimum drainage easement of 15 feet.
- C. Easements are required to completely encompass the 10-year ponding area at all culverts and inlets, except that, where existing drainage structures are being improved, off-site easements on property not owned or controlled by the applicant shall not be required. Where the storm drainage easement for such culvert or inlet is a temporary easement, the ponding area easement may also be temporary.
- D. Easements are required around permanent water detention/retention facilities and floodplains, which shall cover not less than the 100-year ponding area, all access easements and downstream channels.

2.3 Storm Water Facility Maintenance

The Town of Strasburg requires the HOA to inspect and maintain the storm water facilities. Maintenance agreements and a fee schedule shall be set up on an annual basis to cover maintenance. Documents concerning the maintenance of the facilities shall be provided prior to approval of the plans.

2.4 Floodplains

The Town of Strasburg conforms to the Virginia Department of Conservation and Recreation, the Code of Virginia Section 10.1-602 and Section 411 of the Town Ordinance. Copies of studies, waivers and permits shall be provided to the Town.

2.5 Utility Placement

Underground installation of utilities, such as electric, telephone and cable television, shall be installed for new subdivision and site plan developments and to the extent possible in redevelopment projects. Such utilities shall be placed under the sidewalks or within the right-of-way when feasible. Water and Sewer utilities shall be placed in the center of the road way as per Sections 6 and 8 when feasible.

2.6 Adjacent Utilities

- A. Wherever possible, other utilities shall be placed no closer than ten feet horizontally or eighteen inches vertically (crossings) to water or sewer lines. The distances are to be measured inside edge to inside edge.
- B. Where water or sewer lines and other utilities cross or where terrain features may dictate, the Town reserves the right to have other utilities properly identified with a marker or other means of identification specifically approved by the Town.
- C. All new and/or replaced utilities shall be marked with non-detectable utility tape eighteen inches above the utility.

2.7 Easements

- A. Exclusivity. Town of Strasburg easements establish areas in which the landowner has agreed not to erect structures or use the land in ways that are in conflict with Town of Strasburg uses. As such, the easements may be considered exclusive for purposes of planting trees, grading, installation of structures (permanent or temporary) or installing other utilities. However, other utilities may cross Town of Strasburg easements at, or as nearly as possible, to a 90-degree angle. It is Town of Strasburg policy not to share easements with other utilities due to safety and liability issues, and to ensure the ability to repair or renovate facilities.
- B. Ownership vs. Easement. It is the preference of the Town of Strasburg that major facilities such as treatment plants, pumping stations, and water storage tanks are located on lots for which ownership has been deeded to the Town of Strasburg. The minimum lot size required by the Town of Strasburg for this purpose is one-half (0.5) acre. This requirement may change due to topographic conditions and is the decision of the Public Works Director and/or designee.
- C. Private Streets/Alleys/Parking Lots. A developer may wish to construct private street/alleys/parking lots. The private street must conform to the standards of this manual. Water and sanitary sewer systems located in private areas must be located within appropriate water and/or sanitary sewer easements conveyed to the Town of Strasburg. Where public ingress and egress is being conveyed to the Town of Strasburg, that easement is considered sufficient for water and sewer service branches.

- D. Blanket Easements. The use of “blanket” easements allows for flexibility in the location of facilities during construction. Typically this sort of conveyance is limited to strips of easement along lot frontages, where water meters are to be installed.
- E. Easement Plats. An easement plat will be prepared by a Land Surveyor, licensed in the Commonwealth of Virginia, establishing the metes and bounds of the area upon which easement is being conveyed and/or vacated. These will correspond to the approved construction plans for the project they support. Each Easement Plat will include the following note: “All structures located in any easement will be removed immediately at the owners expense.”
- F. Notary Block. Effective July 1, 2007, the laws of the Commonwealth of Virginia require that notary block be on the same page as the signature being witnessed, and that the notary’s registration number appear on each notary statement.
- G. Deed of Easement. Developers must submit Deeds of Easement prepared by their attorneys to the Town of Strasburg. The acceptance of the utility and bonds will not be released without an easement in place. It will be the responsibility of the Owner, Developer and/or designee to record the easement with Shenandoah County and provide evidence of the recorded easement to the Town of Strasburg prior to acceptance.

CHAPTER 3. Transportation

3.1 Purpose and intent

The purpose and intent of this chapter is to establish minimum standards for the planning, design, and construction of both public and private roadways, certain associated facilities and pedestrian and bicycle accommodations within the Town of Strasburg. The chapter is divided into sections establishing guidelines and criteria for Transportation Planning, Design and Construction Standards, Pedestrian and Bicycle Accommodations. It is the intent of the Town of Strasburg that all roads be dedicated for public use and maintained by the Town of Strasburg and/or by Virginia Department of Transportation (VDOT), except as may be permitted under the provisions of the Zoning Ordinance.

3.2 Reference Standards

The design engineer will comply with all relevant industry standards and federal, state and local regulations, including the following standards, which are incorporated into this document by reference:

American Association of State Highway Transportation Officials (AASHTO)

American Disabilities Act Guidelines (ADAG)

Institute of Transportation Engineers (ite)

Federal Highway Administration (FHWA)

Manual on Uniform Traffic Control (MUTCD)

Non-Motorized User Circulation System (NCUS)

Town of Strasburg Approved Materials List

Virginia Department of Transportation (VDOT); Road and Bridge Specifications

Virginia Strategic Highway Safety Plan

3.3 General Standards

All materials and specifications for roads shall be in accordance with the Virginia Department of Transportation (VDOT) and Specifications as set forth in the latest edition of the Road and Bridge Standards. All roads are to be designed to accommodate a loading of a SU-30 vehicle loading.

3.4 Transportation Planning

3.4.1 Road Way Classifications

A. Public Roads. The Town of Strasburg has adopted the current edition of VDOT Appendix B – Road Design Manual – Subdivision Street Design Guide (right-of-way widths shall be a minimum width of 50' with a minimum travel lane width of 12 feet), for all publicly dedicated roads.

B. Private Roads

1. Private Roads shall be a minimum width of 24 feet wide (measured from back of gutter pan to back of gutter pan and/or to edge of roadway) and the right of way width shall be a minimum of 50 feet for townhouses, and multifamily homes. The applicant must also demonstrate that there is adequate parking on and off street parking with the most up to date Parking Generation calculations from the Institute of Transportation Engineers (ite). However all of these roads shall remain private, and will be maintained for the lifetime of the development by the Homeowners Association (HOA) that will be required to be established prior to approval of the construction plans.
2. Private Roads are still required to follow the guidelines and standards of VDOT Appendix B – road Design manual – Standard Subdivision Guide or may be pitched to one side “not crowned” to reduce the need for storm water improvements. Private roads shall also be indicated on all plans and plats. Plats and deeds shall include a disclosure statement, indicating that Town services will be limited.
3. Private roads shall also include all future maintenance descriptions, and indicate the responsible party who will be taking care of the maintenance for the property. The plan should have a schedule on routine tasks (mowing, cleaning) and a way to generate funding (an escrow account, other means) to pay for upgrades for non-routine maintenance tasks. Documentation shall be provided to the town demonstrating prior to the approval of the plats.

3.4.2 Facility Planning Guidelines

- A. The streets within and contiguous to any development shall be designed and constructed so as to ensure coordination with other existing or planned streets within the general area as to width, grade, location, and drainage. Existing and planned streets shall be deemed to include, without limitation, streets depicted in the Community Plan, Comprehensive Plan and existing or planned streets in existing or future adjacent or contiguous to adjacent subdivisions. For purposes of this paragraph 2.a, "Streets" includes "Roadways" as described in this Section.
- B. When a subdivision or other development site abuts one side of any public road in the State highway system, the subdivider shall be required to dedicate one-half of the total right-of-way or easements necessary to make such road conform to VDOT and Town standards, including accommodations for pedestrians and bicycles. The subdivider may be required to dedicate more or less right-of-way or easement to make appropriate horizontal and vertical adjustments to such road.
- C. Vehicular access from off road parking and service areas shall be so combined, limited, located, designed, and controlled so as to channel traffic from and to such areas conveniently, safely, and in a manner that minimizes traffic friction and promotes free traffic flow on roads without excessive interruption.
- D. Whenever a proposed development contains or is adjacent to an arterial or major collector road, direct access shall be evaluated and the Director of Public Works and/or Town Manager may require that provisions be made for the future elimination or reduction of direct access through methods such as the creation of a parallel road system, combined lot access, and other methodologies as determined appropriate.
- E. Reserve strips (spite strips) controlling access to public roads shall be prohibited as defined in the VDOT Subdivision Street Ordinance.

- F. The transportation system proposed for subdivision or other development shall safely accommodate non-motorized users. Design shall address both internal circulation as well as connections to existing and planned contiguous roads and bike and pedestrian facilities. In the absence of existing and planned contiguous bike and pedestrian facilities, reservations are encouraged to the most logical access points for adjacent parcels.

3.5 Traffic Calming

The Town promotes the use of traffic calming measures to improve safety for non-motorized street users and pedestrians in accordance with VDOT's adopted policies and standards. During street layout and design, the issue of traffic calming should be considered. Early consideration can minimize future speeding problems and improve the livability of the neighborhood. If the street layout cannot be designed to encourage target speeds, traffic calming treatments may be appropriate. The type of treatment chosen for incorporation in the design depends on the function and traffic volume of the roadway segment. When traffic-calming measures are proposed, such measures may be shown on the construction plans and profiles and/or site plan submissions. If desired, a comprehensive traffic calming design, designating proposed measures such as but not limited to signage, striping, narrower roadways, chokers, raised crosswalks and roundabouts, can be submitted for review and approval for the entire development with the first preliminary subdivision application. In such cases, subsequent applications shall make reference to the approved comprehensive traffic calming design and the traffic calming measures should be appropriately provided on the current application.

3.6 General Design Requirements

The following standards are intended to protect the public health, safety and welfare in addition to enhancing transportation efficiency.

- A. Roads shall be configured to avoid floodplain unless no other alternative alignment is feasible, and to limit stream crossings.
- B. Roads shall be laid out in such a manner as to intersect as nearly as possible at right angles (within 10 degrees of 90 degrees)
- C. Road jogs with center lines offsets of less than 225 feet shall not be allowed. A road jog is defined as a through traffic movement in an urban or high volume road situation which may make two changes of directions at successive intersections. Public street intersection spacing shall be accordance with VDOT standards.
- D. A road which permanently ends with a cul-de-sac or turn-around (not including dead end roads which end at a temporary turn-around) shall not exceed the lengths set forth below. Measurement of the length shall be taken along the centerline from the road's intersection with an existing or proposed through road to the center of the cul-de-sac or turn around.

Exhibit 3A: Cul-de-sac Length

Development Type Allowable	Maximum Length
Commercial, retail, industrial, office	1,000 feet
Rural Non-residential	3,500 feet
Single-family, Detached	1,500 feet
Single-family, Townhouse	1,000 feet

Development Type Allowable	Maximum Length
Multi-family residential	1,000 feet

3.6.2 Additional criteria for cul-de-sacs or turn-arounds include:

- A. Grades for cul-de-sac turnarounds shall not exceed 6 percent measured along face of curb or edge of pavement.
- B. The geometry for a cul-de-sac or turn around shall have a radius of no less than 40 feet at the property line and no less than 30 feet at the face of curb or edge of pavement line. Other types of turn arounds may be considered for private roadways.
- C. Developments with a single point of ingress/egress shall provide a secondary point of access for emergency vehicle use if the length of road, measured along the centerline from the point of beginning of the ingress/egress to the front of the most remote lot, exceeds the maximum allowable length as may be permitted by the Director of Public Works and/or Town Manager. Such emergency vehicle access easement shall be an 20 foot wide easement, which shall contain a 16 foot wide graded and compacted travel-way, centered in the easement. The grade or slope of the emergency vehicle access travel-way shall not exceed 6 percent at any point along the centerline in the travel-way. A typical section of the proposed emergency vehicle access easement and travel-way shall be included in the land development submission.
- D. Multi-phased developments, with an approved concept development plan or preliminary plat showing more than one ultimate point of access, shall be required to meet this requirement for individual phases, sections or plats, on ultimately planned through roads.
- E. Length criteria as contained within this section shall not be applicable for divided roadways with medians and the above criteria shall apply beyond the point where the divided section ends.
- F. The Town discourages the use of landscape islands within cul-de-sacs.
- G. Landings shall be provided for public roadways and private roadways at intersections to ensure adequate grade and sight distance at intersections. The maximum grade along the landing for private roadways shall not exceed 3% or the cross slope of the intersecting road, whichever is greater. Breakover shall not exceed 6%. The minimum length of landing shall be 50 feet. Landings for public streets shall meet VDOT standards.
- H. Landing shall be defined as that section of a roadway which is adjacent to an intersection and utilized for vehicle stacking.
- I. Breakover is the difference between the centerline grade of an intersection roadway and the cross slope of the intersecting roadway.
- J. Excepting driveway access to single residential lots, roadways intersecting with a public roadway shall have a minimum length of 50 feet between curb returns and/or curb cuts.
- K. Traffic control signage and lane markings provided on private roadways shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). When a signal is warranted, signalization shall meet VDOT standards.

3.6.3 Private Road Design and Pipe Stem Driveway Requirements

Private roadways may be designed with a curb and gutter section or a shoulder section.

- A. Shoulder sections shall have stabilized shoulders which may be paved, gravel, or sodded grass surface. Shoulders shall meet VDOT slope requirements.

Exhibit 3B: Shoulder Easement

Roadway Cross Section	Easement Limit
Curb and Gutter	Six feet behind the face of curb.
Shoulder Section	The edge of shoulder and as necessary to accommodate roadside drainage.

- B. Private roadways shall be designed to accommodate an SU-30 design vehicle (AASHTO) and to accommodate emergency. The travel way inside radius at an intersection shall be a minimum of 25 feet.
- C. Where parking is provided on the roadway, pavement width shall be increased appropriately. Parking geometry designs shall meet the requirements of this section.
- D. An entrance permit shall be secured from the Virginia Department of Transportation, and/or the Town of Strasburg in order to tie into an existing VDOT and/or Town of Strasburg maintained road.
- E. Sidewalks shall be placed within the public access easements. Handicap accessible ramps and provisions, in accordance with State and Federal requirements, shall be provided at roadway intersections with curb gutter.
- F. Roadway design details which are not standard designs used by VDOT, such as CG-6R or YI-1 components, shall be submitted as detailed drawings to the Director of Public Works for approval.
- G. All private roadways and access easements identified in this chapter that serve 3 or more lots, require construction plans and profiles for the subdivision the roadways or access easements are to serve.
- H. All private roadways must have a minimum stopping sight distance of 275 feet, with a minimum intersection sight distance of 350 feet.
- I. Maximum grades of private roadways are 8%, with a minimum radius of 480 feet and a vertical curve design of 35 mph.
- J. Pavement section minimum shall be 6 inch aggregate base course (VDOT 21B) and a 2 inch bituminous surface course on a properly prepared and compacted subgrade in accordance with VDOT Road and Bridge Specifications.
- K. Concrete sections shall comply with VDOT Specified mix's and approved by the Town of Strasburg.

3.6.4 Pavement Thickness Design Standards

- A. The methods and materials used in the construction of all roads shall conform to the current VDOT Road and Bridge Specification, unless herein modified.

- B. Pavement shall be design based on the current VDOT Pavement Design Guide for Subdivision and Secondary Roads in Virginia.
- C. Required thicknesses of subbase, base course, and top or surface course for public roads shall be in accordance with current VDOT standards.
- D. Preliminary subbase depth and pavement design shall be based on an assumed design CBR value of 6, if soil tests have not been performed. For private roadways with an Average Daily Traffic in excess of 400 VPD, soil tests of the as-constructed subgrade shall be performed for the actual determination of CBR value. The required subbase thickness and pavement design may be modified prior to the placement of the subbase.
- E. Pavement design assumes that the number of Heavy Commercial Vehicles (HCV), consisting of Trucks, Buses, etc., with 4 tires or greater, will not exceed 5 percent of the total projected traffic. If the total projected traffic includes more than 5 percent of such vehicles, an equivalent projected traffic shall be equal to (Average Daily Traffic (in VPD)) + (20 X Number of HCV over 5 percent).
- F. Pavement in commercial areas shall be of a heavy duty design in the major cartways and loading areas, and at dumpster pads to accommodate the anticipated vehicle loads. This design shall be subject to approval of the Director. A minimum 6 inch depth 3000 psi (VDOT A-3) concrete section with steel reinforcement over 4 inches of aggregate shall be used for loading areas and dumpster pad areas.
- G. Alternative pavement design sections shall be encouraged. A request for approval of such designs shall be submitted with the site plan or construction plans and profiles and shall include the basis of design, calculations in accordance with current accepted engineering procedures and a justification for the exception to these standards. Technical information regarding the characteristics of the alternative materials of construction (e.g., brick or concrete pavers, pavement admixtures, pervious pavement, etc.) shall be provided as part of the request. The request may be submitted either as an integral part of the construction plans and profiles or site plans or separately for consideration.

3.7 Parking Geometry Standards

- A. Where four or more spaces are required by the Zoning Ordinance, parking areas shall be graded, well drained and provided with a surface of bituminous concrete or equivalent paving materials. All parking spaces shall be delineated and striped in accordance with this chapter.
- B. The following table shall represent the minimum size requirements for automobile parking spaces, except as specifically modified herein. (See the Zoning Ordinance for the required number of parking spaces per use.)

Exhibit 3C: Parking Space Dimensions

	Width	Length
Standard Head-In Parking	10'	20'
Parallel Parking	8'	22'

- C. Travelway aisle widths for standard car parking lots shall be provided in accordance with the following: 90 degrees - 22 feet; 60 degrees - 20 feet; and 45 degrees - 20 feet. A minimum travel aisle width of 25 feet shall be maintained adjacent to buildings. The minimum travel aisle width is 18 feet. Travelway aisle width shall be measured from the face of curb where there is no parking and from the back of the parking space where there is parking.
- D. Where wheel stops or curbing are provided for parking spaces, a 1 foot reduction in the stall length will be allowed, providing the resulting overhang does not encroach on the required open space areas and/or pedestrian access system.
- E. Parking spaces for handicapped persons and related access aisles, accessibility routes and signage for physically handicapped persons shall be provided in accordance with State and Federal requirements.
- F. Retaining walls, screen, landscaping and building walls shall be protected from vehicle contact, by a minimum of 5 feet clearance.
- G. Parking areas shall provide for safe pedestrian travel.
- H. A permanent turn-around shall be required when the dead-end aisle exceeds 500 feet, measured along the centerline of the dead-end aisle, from the last aisle or public roadway.
- I. Loading spaces shall be provided at commercial and industrial building sites. The design for the space shall accommodate an AASHTO WB-50 design vehicle. A loading space shall be a minimum of 15 feet in width and 30 feet in length. Loading space for tractor trailers shall be a minimum of 15 feet in width and 60 feet in length. The loading space shall not interfere with the circulation pattern of traffic.
- J. Loading spaces shall be accessible to the design vehicle with no more than two backing movements. The circulation pattern for the design vehicle should provide for forward movement only and shall discourage backing movements.
- K. No off-roadway loading area shall be used to satisfy the requirements for parking or stacking spaces. Loading areas shall be designed and located in a manner which does not interfere with the free circulation of vehicles within parking or stacking areas.

3.8 Driveways

- A. Driveways servicing Residential or Commercial properties must follow the VDOT Road and Bridge Standard guidelines, unless modified in the manual.
- B. No driveway slope shall be more than 10%. The slope shall be measured along the driveway centerline from the edge of the garage door/or back of slab to the property line and/or the driveway apron (which ever distance is less).
- C. The driveway should maintain the full width of the garage doors to the property line or 18 feet outside of the garage, whichever is less.
- D. Skewed driveways cannot exceed a 10:1 angle with the driveway apron or the garage.

- E. Curved driveways must be designed with a 12 foot minimum inside radius and a minimum 24 foot outside radius
- F. Tapered driveways cannot exceed a 10:1 angle of taper. When tapering greater than 10:1.
- G. Residential driveways shall be a minimum depth of 24 feet from the edge of the garage door/or back of slab to the property line and/or the back of the sidewalk.
- H. Roll top curbing is not permitted as driveway entrances
- I. Driveway depth shall be a minimum of 24 feet. The depth shall be measured along the driveway centerline from the edge of the garage door/or back of slab to the property line and/or the driveway apron (which ever distance is less).

3.9 Pedestrian and Bicycle Facilities

3.9.1 Intent

It is the intent of this section to facilitate the use of non-motorized transportation for the citizens of the Town of Strasburg. The Applicant shall provide sidewalks and shared use trails to provide access to the existing network of facilities. The network of trails shall be extended to all points of the developable property.

3.9.2 General Design Standards

- A. The sidewalk and/or trail shall be placed in a public access easement that extends at least two (2) feet beyond the outside of the sidewalk or trail on both sides.
- B. The sidewalk and/or trail shall meet the current standard of the American Disabilities Act Guidelines (ADAG).
- C. It is encouraged to develop activity centers (playgrounds, tot lots, open spaces) within high density residential areas. The activity centers must and will be maintained for the lifetime of the development by the Homeowners Association (HOA) that will be required to be established prior to approval of the construction plans.
- D. In commercial areas, the Applicant will provide sidewalks and/or crosswalks around their proposed facility for safe pedestrian movement.
- E. Sidewalks shall be provided on both sides of the roadway

3.9.3 Sidewalk Design

- A. Sidewalks shall be constructed on a subgrade compacted at optimum moisture, within ± 20 percent of optimum. The density of the subgrade shall be 95 percent when compared to the theoretical maximum density as determined in accordance with the requirements of VTM-1 (standard proctor) or compacted subgrade in accordance with VDOT Road and Bridge Specifications.
- B. Sidewalks shall be constructed of VDOT type A-3 concrete to a minimum depth of four (4) inches.
- C. The maximum cross slop allowed for sidewalks shall be $\frac{1}{4}$ inch per foot
- D. Sidewalks shall meet the design standards of ADAG.

- E. Sidewalks within right-of-way shall be constructed to standards of VDOT.
- F. Longitudinal slope shall be consistent with the adjacent roadway.
- G. CG-12 handicap ramps shall be provided at all roadway crossings. Design detail for the CG-12 handicap ramp shall be provided with the design plans.
- H. Sidewalks must meet all Federal and State Regulations.

3.9.4 Trails

- A. Trails are generally asphalt and are intended to accommodate both bicyclists and pedestrians comfortably.
- B. Trails shall comply with design guidelines in the appendix of this manual.
- C. Trails within a Town and/or VDOT right-of-way shall comply with VDOT standards
- D. Trails outside of a Town and/or VDOT right-of-way shall be designed and constructed to the current AASHTO and ADAG standards. The minimum width of trails shall be no less than six (6) feet wide.
- E. Trails in Naturally preserved areas (recreational, nature, fitness) that are access to open space will be constructed to NUCS guidelines.
- F. Trails should follow the natural topography as nearly as possible.

3.9.5 Bicycle Facilities

- A. If bicycle accommodations are provided on street, separate sidewalks or trails for pedestrians shall be provided either within of the right-of-way and/or within a public access easement.
- B. Bicycle accommodations shall conform to AASHTO and VDOT standards.
- C. Bicycle accommodations circulation plans shall be depicted on the construction plan and on all plats. A maintenance schedule on maintaining bicycle accommodations shall be included.
- D. Streets with on-street bicycle facilities shall have signage that is in accordance with FHWA and VDOT.

3.10 Maintenance of Traffic Plans (MOT)

A Maintenance of Traffic (MOT) Plan shall follow all the latest regulations of the Virginia Work Protection Manual, Uniform Traffic Control Devices, the Standard Highway Signs Book and VDOT Road and Bridge Standards. A MOT is required when road work will require more than two (2) days to complete. If work occurs on Route 11 and/or Route 55, the plan must be submitted to VDOT for approval and an approved copy submitted to the town. Town.

The Public Works Department has the authority to stop all construction.

CHAPTER 4. Water Distribution

4.1 Purpose and Intent

The purpose and intent of this chapter is to establish minimum standards for the planning, design, and construction of typical practices to be followed in the layout and design of water distribution systems. The information contained in this section must be applied in conjunction with the latest edition of the Waterworks Regulations 12 VAC 5-590-10 et. seq., as published by the Commonwealth of Virginia, Department of Health; and with other sections of this Manual.

4.2 Reference Standards

The design engineer will comply with all relevant industry standards and federal, state and local regulations, including the following standards, which are incorporated into this document by reference:

American Waterworks Association Standards (AWWA)

American Society of Sanitary Engineers (ASSE)

Bureau of Water Supply Engineering

Virginia Department of Health (VDH)

Virginia Waterworks Association

4.3 General Standards

Criteria listed in this section are minimums. Additional separations and clearances are to be furnished as practical to optimize each design. Attention shall be given to locating utilities so as to facilitate their re-excavation. Abnormal designs due to factors such as depth and magnitude of facility in determining the adequacy of each design, and may relax or increase dimensional requirements accordingly. In general, a design is to be sought which minimizes maintenance costs.

4.4 Hydraulic Requirements

4.4.1 Design Flows

- A. The water distribution systems and any extensions thereof shall have adequate capacity to supply the normal (average) and peak hour demands of all customers – domestic, public, commercial and industrial – while maintaining a pressure of not less than 20 pounds per square inch (psi) at all points of delivery. The Town of Strasburg further intends to provide a minimum static service pressure if 30 psi or better to all customers. If considering an extension at higher elevations, such that lesser service pressures could result, the designer should consult with the Director of Public Works to evaluate options for enhancing pressure.
- B. Throughout the Town of Strasburg's Central System, extensions shall be capable of delivering, on the day of maximum customer demand, flows required for the fire protection to within 300 feet of each building to be served, while maintaining a residual pressure of not less than 20 psi. Flows required for

fire protection shall be in accordance with the National Fire Protection Association Standards. For fire flow requirements in community water systems, see Section 7.2.J Capacity of Waterworks (12 VAC5-590-690).

- C. Designs of water systems, including pumping facilities, shall be based on the Town of Strasburg’s current Water System Modeling Report and take into the following considerations:
 - 1. The general design factors established in the Waterworks Regulations.
 - 2. The estimated tributary population for a period of 30 years hence.
 - 3. The entire service area, built-out according to current residential, commercial, and industrial uses; and allowable land use, as established by the Town of Strasburg Community Plan.
 - 4. Future commercial development at a population equivalent not less than 30 people per acre.
 - 5. Future industrial development at a population equivalent not less than 40 people per acre.
 - 6. Any applicable Area Facility Plans and Technical Memoranda.

- D. The following criteria will be used in estimating demands for water and accomplishing hydraulic design of the system:

Exhibit 4A: Water Demand (Minimum)

Residential Population	$N = \text{number of dwelling units} \times 3.5$
Residential: Average Daily Water Demand in Gallons per Day (gpd)	$R = N \times 100$
Commercial and Industrial: Average Daily Water Demand (gpd)	$C = \text{Number of Commercial and Industrial Employees} \times 100^*$ -Note: appropriate additional water demand allowance shall be made for commercial and/or industrial establishments of types having water demands in excess of 100 gpd per employee
School: Average Daily Water Demand (gpd)	$S = \text{Number of Staff and Students} \times 20$
Average Daily Water Demand (gpd)	$A = R + C + S$
Maximum Daily Water Demand (gpd)	$M = A \times 2$
Peak Hour Demand (gpd)	$P = M \times 2$
Peak Hour Demand in Gallons per minute (gpm)	$P / 1440$

4.4.2 Distribution Piping

Distribution piping design will be based upon providing flows and service pressures in accordance with the Town of Strasburg's standards. Hydraulic design of distribution piping will be based on pipe carrying capacities consistent with head losses determined in accordance with the Friction Loss Table.

Exhibit 4B: Friction Loss Table

Pipe Diameter	Hazen-Williams Coefficient "C"
6"	100
8"	110
10"	115
12" and greater	120

Exhibit 4C: Pipe Material Table

Pipe Material	Hazen-Williams Coefficient "C"
Ductile Iron (DIP)	120
PVC	130

4.4.3 Hydraulic Models

When requested, hydraulic models will be submitted to the Town of Strasburg for review. The following are minimum requirements for all models submitted.

- A. Provide a written model summary, area map, along with an electronic copy of the model for review. Identify the computer modeling software used to create the model. Submit all related database files to ensure the model will import into WaterGEMS software Version 8.
- B. Provide a map showing pipe network. Label all pipes, nodes, road names, north arrow, scale, number of units, unit type, demands and outline the division of different unit types.
- C. Demonstrate that the development(s) can meet the following demands: average day, maximum daily, peak hour, and maximum daily plus fire flow, throughout development.
- D. Model must represent the entire development, including each planned sequence of phases. Each phase of the development must be hydraulically adequate. The model must support the desired phasing.
- E. The system demands must be included in model to accurately represent system pressures.
- F. Identify model assumptions, including water source and calculated demands based on the number of units and the type of units in the development.
- G. State the required fire flow demands for each unit type and call out specific nodes that require different fire flow demands, such as a development of single family homes with a school; where the school requires a higher fire flow demand, the node needs to be identified.

4.5 Water Pipe Layout

- A. Redundant Supply. More than one extension from the existing system is required to serve subdivisions (5 homes or more) and commercial and industrial projects. Furthermore the water system shall be looped to eliminate dead ends. The maximum length of permanent dead-end water pipe is 300 feet.
- B. Distribution piping shall be laid on a loop or grid system. Primary grids shall be of 10-inch or larger diameter pipe and spaced at approximately 1/8 mile intervals. Secondary loops of 8-inch diameter will be placed everywhere else.
- C. Distribution piping design should eliminate parallel and/or multiple lines. If parallel lines are proposed, the applicant shall prepare a waiver, and submit to the Director of Public Works, prior to the submission of plans.
- D. Dead end mains shall not exceed a length of 300 feet beyond the last service lateral.
- E. All dead end lines shall terminate with a fire hydrant assembly. A dead-end line in a cul-de-sac shall terminate with a fire hydrant assembly.
- F. It is discouraged to use water lines less than eight (8) inches in diameter and larger than twelve (12) inches in diameter.
- G. Joint restraints are required if the water line slope is 20% or greater, at every valve and fitting, at all fire hydrants, and at all stream crossings, as required by the Town.
- H. The maximum curvature by joint deflection for water pipes equal to or less than 12-inch diameter is a 300 foot radius arc (3.5 degrees/joint with 18 foot pipe sections). For pipes larger than 12 inches, the maximum curvature by deflection is a 500 foot radius arc. When restrained joint pipe is specified, consult manufactures recommendations for maximum joint deflection.
- I. All piping must be capable of providing a minimum flow of three gallons per minute per connection at a minimum of 20 psi residual pressure.
- J. Piping shall be sized to provide fire flow of at least 1000 gpm at 20 psi residual pressure.
- K. Fittings and blockings should not be placed atop other utilities to avoid placement in disturbed ground.
- L. Any relocation of existing water facilities due to development is the responsibility of the Developer. Where grading is to occur, resulting cover on existing water pipe must remain above design minimum and below design maximum unless prior approval is granted by the Director of Public Works.
- M. Separation
 - 1. Provide a minimum 10 foot horizontal separation (outside to outside) with sanitary sewers, including manholes.
 - 2. Provide a minimum 6 foot horizontal separation (outside to outside) with storm drainage structures.

3. Provide a minimum 15 foot horizontal separation to a building or other above-ground structure.

N. Location

1. In the public right-of-way, placement must be in accordance with the Town of Strasburg Chapter 4 and Virginia Department of Transportation.
2. Along undivided roads, water pipes will be allowed under the pavement, a minimum 5 feet from the outside edge of pavement or gutter pan (7 feet from the face of standard curb and gutter). Where the pavement width is 24 feet or less, 3 foot horizontal separation from the gutter pan is permitted, if needed to attain separation from sanitary sewer. Generally centerline of water pipe should be located 8 feet off the centerline of subdivision streets, with sewer on the opposite side of street, resulting in the required 10 foot separation (outside to outside).
3. When located with sanitary sewer in curved streets, locate water on the outside of prominent turns. Such is intended to foster separation with sewer while minimizing the number of sanitary sewer manholes, and to provide undisturbed ground for the blocking of water pipe bends.
4. Keep the waterline on one side of the street as much as practical, crossing only where necessary to provide needed branches or where imperative for attaining separations with other utilities.

O. Surface Water Crossings

1. Where water pipe is to cross a natural stream or large engineered drainage channel, the water pipe is to be designed so as to ensure its integrity during flooding. Restrained joint piping may be employed. Provide valves to allow for the segment to be isolated, and a hydrant (preferably low in segment) to enable the segment to be flushed and tested. These appurtenances are to be beyond limits of 100 year flood waters.
2. Surface water crossings present special problems and should be discussed with the Town before final plans are prepared. The following is to be used as guidance for surface water crossings:
 - (a) All surface water crossings shall be a minimum of 3-feet underground. There will be no above water crossings allowed by the Town of Strasburg.
 - (b) Pipes shall be of special construction with flexible watertight joints.
 - (c) Valves shall be provided at both ends of the water crossing so that the section of pipe can be isolated for repairs or testing. All valves shall be easily accessible and not subject to flooding.
 - (d) Permanent taps shall be made for testing and for locating leaks.

- P. Sampling Stations. Sampling stations should be provided along the water main for testing. Stations shall be coordinated with the Director of Public Works during the design phase for the location of the station. Sampling stations shall conform to the following requirements:

1. The station shall be in a locked box, located a minimum of two feet behind the edge of curb and or pavement.
2. The bottom of the station shall sit level and flush to the finished grade.
3. A ten-foot easement shall be provided around the sampling station

Q. Future Extensions

1. Identify places where future extension of public or service pipe appears practical to allow service to other buildings or properties. Water pipe is to be constructed to beyond the area being developed, so as to terminate in a location from which it can readily be extended in the future. This will be beyond proposed pavements, past adjacent buildings, and beyond crossing storm drains that would otherwise be undermined during subsequent water installation. Provide a spur consisting of a pipe line valve, 20 feet of piping, dead-end anchor, and temporary blow-off assembly.
2. Future extensions, if constructed must comply with the standards set forth. No temporary lines will be relocated to a new elevation will be accepted.
3. In cases where the future extension will provide a loop that is necessary to support the subject project, provide the spur all the way to the site or subdivision boundary.
4. Easement for future lines must be conveyed, extending to the site or subdivision boundary. Associated temporary construction easement may also be needed, as dictated by the scope of the future installation.

R. Valves

1. Valves shall be installed at appropriate points in all pipes to permit interruption of flow to segments of the system, as needed to facilitate operation, maintenance, and repair.
2. Valves shall be provided so that no more than one commercial or multifamily building(s) are served from the segment.
3. Segments of waterlines that cross private lots are to be isolated.
4. Provide a valve on each side of a surface water crossing.
5. Provide valves in transmission and distribution lines to establish maximum 1,000 foot segments.
6. Where connecting to existing water pipes, the locations of existing valves and hydrants requiring operation shall be indicated on construction plans. If during construction, the valve(s) is found to be not operational or damage occurs, it is the responsibility of the contractor to replace the entire valve assembly.
7. Valves shall be located on all branches (tee, wye, and/or cross)
8. A water line that may be extended shall have a gate valve at the end. There shall be one full section of pipe on each side of the valve.

9. Butterfly valves will not be accepted.
10. Combination air release and air/vacuum valves shall be installed at high points where accumulation of air may interfere with flow.
11. Valves may be added or deleted during plan review as required by the Director Of Public Works for special operational reasons.

S. Horizontal Location

1. Specify a minimum cover of 3 feet for pipe of 12 inches or smaller diameter, and of 3.5 feet for pipe of 16 inches or larger diameter. Specify a minimum cover of 4 feet where the pipe passes below rip rap or is susceptible to extraordinary loadings.
2. Cover over existing water pipe shall not exceed 6.0 feet.
3. Water pipes crossing sewers and storm sewers (including service spurs) shall have a separation of at least 18 inches between the bottom of the water pipe.
4. When local conditions prevent a vertical water/sewer separation described above and water pipes pass under sewer, the following protection shall be provided subject to approval by the Director of Public Works.
 - (a) Provide vertical separation of at least 18 inches (outside to outside) between the bottom of the sewer and the top of the water line.
 - (b) Provide adequate structural support for the sewer to prevent excessive deflection of the joints and settling over the water line.
 - (c) A full section of the water pipe shall be centered at the point of the crossing so that joints shall be equidistant from the sewer.
5. Provide a minimum vertical clearance of 1.5 feet with other utilities. If water is atop other utilities, this requirement may be relaxed to as little as 1.0 foot, if such is critical to maintaining water's position on top.
6. Label clearances with all utilities.
7. Specify controlled fill wherever the water line is above the existing grade.
8. Where water pipe crosses a steel gas main or other underground facility with impressed current, or upon which impressed current may later be added, design will specify measures to prevent corrosion of the water pipe.

T. Easements. The minimum easement width shall be provided:

Exhibit 4D: Water Easement Width

Location	Minimum Width (feet)
Within pavement	15
Unpaved portions of lots	20
Undeveloped areas	30

Location	Minimum Width (feet)
Along lot lines of subdivisions or between structures	30

1. If a 16-inch waterline or larger is used and/or project specific easements may be larger.
2. Vehicular access from the street shall be allowed. The vehicle access will have a maximum slope of 8%.
3. Hydrants shall be surrounded by a 10 foot easement (minimum).

U. Hydrants

1. In residential areas, hydrants shall be installed such that there will be at least one hydrant within 300 feet of the nearest corner of any building.
2. In commercial, industrial, multi-family residential and townhouse areas, hydrants shall be placed such that a maximum of 300 feet of hose is required to reach any point on the exterior of all buildings.
3. A hydrant is required within 100 feet of the Siamese connection, also known as fire department connection (FDC), of a building's fire suppression system.
4. Locate hydrants a minimum of 50 feet from building being protected.
5. Hydrants are to come off the main by means of a tee and branch valve, or as part of a dead end assembly. Hydrants shall not come off the main at a cross.
6. Each permanent termination of water main must be by means of a fire hydrant.
7. When locating dead end fire hydrants ensure adequate space is provided for appurtenances up stream of hydrant.
8. No more than one hydrant is permitted on a dead-end 6-inch pipe. Such hydrants must be within 300 feet of a looped pipe.
9. At stream crossing, place one hydrant to enable draining, sampling and flushing of the segment between required isolation valves. Position hydrant as low in segment as practical, while keeping away from bed and banks of the natural water course.
10. Along transmission mains, provide hydrants at intervals not exceeding 1,000 feet.
11. Along ditch and shoulder roadways, fire hydrants should not be placed on the opposite side of road from the water main.
12. Locate hydrants a minimum of 3 feet behind the face of curb and in straight segments of curb as much as practical. The distance behind the face of curb may be increased at the Town of Strasburg's discretion where roadway design speed is 35 miles per hour and greater.
13. Provide a minimum separation of 5 feet between a hydrant and any driveway. Additional separation is desired.

14. Hydrants shall not be placed in area of concrete pavement.
15. Specify bollards where hydrants are unprotected by curb and gutter, placed in open space or at the rear of commercial/industrial buildings.
16. Fire hydrants are to be placed at high points of pipes, and at low points for 16-inch and larger pipes to facilitate release of air and flushing of the pipe, and require the use of a tangent tee.
17. Maximum depth of a fire hydrant is 7 feet (measured from the invert of the pipe to the finished grade). Wherever practical, select a hydrant placement that will allow for installation of a 7 foot hydrant or shorter.
18. Water services and fire lines are not allowed to connect to a hydrant's lead.

V. Fire Lines

1. All water lines serving a fire suppression system in a building shall be shown on the drawings.
2. All fire lines shall be owned and maintained by the property owner.
3. A valve shall be located on the fire line at the point it connects to the public water system.
4. The minimum size fire line shall be 6-inch ductile iron pipe (DIP).
5. Fire lines shall be downstream of service connections when located on dead end main.

4.6 Service Connections and Meters

4.6.1 Service Connection

- A. A separate water service connection is required for each premise.
- B. Water service shall only be from distribution lines.
- C. Special approval will be required for any taps over 12-inch services.
- D. Service connections shall not come off mains with reduced cover, or off deep mains.
- E. Service lines must only be profiled if they are 1.5-inch or larger in diameter.
- F. Provide a minimum 6 foot horizontal separation with sanitary laterals.
- G. Provide a minimum 5 foot separation with driveways.
- H. Provide a minimum 5 foot separation between water service connections along the main.
- I. The service line between the pipe and the meter shall be the same as the nominal meter size, except that $\frac{3}{4}$ inch -inch meters are supplied through a 1-inch line. Upsizing or reduction beyond the meter is permitted subject to the requirements of the Shenandoah County Building Inspections.

- J. The service line to a fire suppression system must branch off the pipe independently of other service demands. Where it leaves the pipe, the fire service shall include a valve of a minimum 6 inches in branch diameter. This valve shall be restrained to the tee.
- K. Service lines for multi-family structures shall enter building through the mechanical room.
 - 1. Service laterals shall be 1", 1 ½", or 2" diameter lines and shall include saddle, corporation stop, and meter box assembly or vault. Service lateral maximum depth shall be 48".
 - 2. Water lateral and meter box assembly or vault shall be placed at the center of the lot wherever possible. The meter box shall be set one foot beyond the property line.
 - 3. Water laterals that cross under a street shall be encased in PVC pipe. The pipe shall be 3" diameter SDR21 or schedule 40 for 1" service laterals. The pipe shall be 4" diameter SDR21 or schedule 40 for 1 1/2" and 2" service laterals. It shall run 1' beyond the near sidewalk and the far sidewalk.
 - 4. .
 - 5. Service for industrial and commercial areas shall be sized to provide the flows required by the industrial or commercial customer and shall be installed at the time the lot is developed. A gate valve must be installed within five feet of the building.

4.6.2 Meter Placement

- A. The location of outdoor water meters shall be shown on the plans. Meters are to be located outdoors, in underground meter boxes. No meters shall be located in a building/structure. Larger than 2" meters shall be located outdoors (in a vault) with a bypass line. The vault needs to be a minimum of 5 feet in diameter with a 2 foot clearance between the water meter and/or bypass line from the top of the interior of the vault structure and bottom of the structure. Plans showing the vault and details of the vault must be provided.
- B. 1 ½" and 2" meters shall have Ford custom setters with by-pass and check valves.
- C. ¾" water meters may be placed over storm sewer if there is a minimum 5-foot vertical clearance from top of storm sewer pipe and bottom of meter box.
- D. ¾" fire flow rated meters shall be specified where fire suppression sprinklers are used in single family or townhouse units. Developer is responsible for i
- E. For all services with meters 1.5-inches and larger, provide an approved backflow prevention device to accomplish the required service line protection. These devices are to be located in the building's mechanical room, within the service entrance. This requirement shall be noted on the site plan.
- F. The Town shall install meters for service lines.
- G. The Owner/Developer shall provide and install the meters for 3" and larger service lines. An additional meter shall also be provided to the Town. The meter manufacturer and model number shall be noted on the plans. Specifications on the meter shall be provided to the Town prior to plan approval.

- H. Meter size shall be shown on the plans.

4.6.3 Cross Connections and Backflow Prevention

- A. Provide a service and maintenance schedule for a backflow prevention device, and indicate the responsible parties to provide the regular inspection and maintenance information to the Town of Strasburg on a regular schedule.
- B. Where water is supplied to fixtures or systems deemed high hazard, the device providing service line protection is typically required to be one using the reduced pressure zone principle. High hazard fixtures and systems are associated with the following facilities, among others:
 - 1. Commercial greenhouses and nurseries
 - 2. Multi-use commercial, office, or warehouse facilities
 - 3. High rise buildings (four or more stories)
 - 4. Fire suppression systems with chemical additives
 - 5. Hospitals, mortuaries, clinics, veterinary establishments, nursing homes, and medical buildings
 - 6. Laboratories, and schools or colleges with laboratory facilities
 - 7. Food and beverage processing plants
 - 8. Health clubs with swimming pools, therapeutic baths, hot tubs or saunas
 - 9. Petroleum or natural gas processing or storage plants
 - 10. Car washes and laundries
 - 11. Pesticide or exterminating companies, and associated vehicles with storage or mixing tanks
 - 12. Farms where water is used for purposes other than typical household use
- C. All Service lines (fire and domestic) shall have an A.S.S.E. (American Society of Sanitary Engineers) approved backflow prevention assembly. Installation must be made in accordance with the Town of Strasburg Cross Connection Backflow Prevention Program.
 - 1. The backflow prevention device must be installed immediately after the water meter on domestic service lines, and immediately upon entering the structure on the fire service lines.
 - 2. Backflow prevention equipped with detector meters must be provided with a remote visual readout wired to an exterior wall.

4.7 Pump Stations

- A. Prior to design of any pumping station, alternatives should be reviewed to see if a pumping station can be avoided. If a pumping station is absolutely necessary, prior to design, the

- owner/developer/engineer shall meet with the Town to discuss the needs of the station and the basis of design.
- B. A pump report shall be furnished to the Town that includes the minimum information:
 - 1. Pump Number
 - 2. Pump Manufacturer
 - 3. Pump Definition (3 point curve or horsepower)
 - 4. Location Elevation (ft) of the Pump
 - 5. Pump Run Time Status (how long will the pump run and how long it will be off)
 - 6. Elevation (ft) of the Intake Grade
 - 7. Elevation (ft) of the Discharge Grade
 - 8. Discharge (gallons per minute (gpm))
 - 9. Head (ft)
 - C. A result report shall furnish the following minimum information
 - 1. Static conditions average day demand
 - 2. Maximum day demand
 - 3. Fire Flow Conditions at various nodes during maximum day demand
 - D. Prior to acceptance a complete sets of operation and maintenance manuals for all operating equipment and materials and the installation thereof, required by the project specifications shall be approved by the Town.
 - E. Pumping stations shall be protected against lightning.
 - F. A schematic drawing showing pipes and nodes with label superimposed on overall project site plan showing streets, buildings, natural drainage features and topography/contour lines with elevation data.
 - G. Water pumping stations or water storage tanks must be submitted to VDH for review and approval. These plans will be submitted to the VDH by the County after review and comment by the Town.
 - H. Pumping stations shall be located above ground. Underground facilities will not be accepted.
 - I. All driveway entrances must have a slope between 2% to 8%. The driveway must be constructed of asphalt with a minimum section of 1.5" Top Course SM-9.5A, 6" BM-25 and 10" 21B.
 - J. A 12-foot wide maintenance road shall be required.
 - K. Pump stations shall have three-phase 208 volt power to the site. No roto-phase units will be allowed.

- L. Pump facilities shall have an alternative power source provided in 208 volt three-phase. In addition to the alternative power source the station shall have a generator receptacle.
- M. No underground fuel storage tanks shall be allowed.
- N. A third (spare) pump shall be provided to the Town prior to acceptance.
- O. The alarm light and horn shall be 110 volt and have a silence switch.
- P. Underground power shall be provided wherever possible.

4.7.2 Adjacent Utilities

Adjacent utilities shall be in accordance with the standards as set forth in Section 3.8 of this manual.

4.7.3 Installation Requirements

- A. All water pipe and appurtenances shall be installed in accordance with best practice, with materials and workmanship of full quality. Materials and installation shall be in accordance with all applicable sections of American Waterworks Association Standards, with installation specifically conforming to AWWA C600, Installation of Ductile Iron Water Pipes; and with this Manual. The installing contractor shall be solely responsible for ensuring that appropriate and acceptable construction materials, means and methods are used.
- B. Backfill shall be placed promptly after inspection by the Town of Strasburg.
- C. Backfill shall be placed with 6-inch of #68 stone under the waterline. Then place #68 stone in 6-inch layers from the top of the pipe bedding to a point of 12-inches above the top of pipe. Crusher run shall be placed in 6-inch compacted lifts.
- D. Optimum moisture, within ±20 percent of the optimum. The density shall be 95 percent when compared to the theoretical maximum density as determined in accordance with the requirements of VTM-1 (standard proctor)
- E. Service connections must be stubbed to the property line before street is paved.
- F. The water released by cutting or opening existing pipes shall be removed and the excavations kept dry until all necessary work within the excavation has been completed.

4.7.4 Disinfection

Disinfection testing shall be performed after the pressure testing has been completed. All pipe and equipment shall be disinfected by the continuous feed method or the tablet method in accordance with AWWA C-65 1-86 or current revision.

- A. The Continuous Feed Method. Potable water shall be introduced into the pipe line at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/l. The chlorinated water shall remain in the pipe at least 24 hours, after which its chlorine concentration shall be at least 10 mg/l.

Grams of 11TH Powder Required for Dose of 50 mg/l*

Length of Section (feet)	Diameter of Pipe (inches)				
	2	6	8	10	12

13	0.60	5.56	9.88	15.45	22.24
18	0.85	7.69	13.69	21.39	30.80
20	0.95	8.56	15.21	23.76	34.22

*Based on 65% available chlorine in HTH powder.

- B. Tablet Method. Tablets shall be of calcium hypochlorite, containing 70 percent available chlorine by weight. They shall be placed at the top of each section of pipe and in appurtenances by an adhesive approved by the Town of Strasburg. Tablets shall not be completely covered by adhesive. After completion of the construction, the main shall be filled with water at a velocity of less than one foot per second. A minimum concentration of 50 mg/l of chlorine solution shall be in the system at this time. A concentration of 25 mg/l residual chlorine must be present after 24 hours. When water temperature is below 41° F (5° C), this method can only be used if the retention time is increased to a minimum of 48 hours.

Number of Hypochlorite Tablets Required for Dose of 50 mg/l*

Length of Section (feet)	Diameter of Pipe (inches)				
	2	6	8	10	12
13	1	2	2	3	5
18	1	2	3	5	6
20	1	2	3	5	7

*Based on ¾ grams of 70% available chlorine per tablet.

1. All valves and appurtenances shall be operated while chlorinated water is in the pipe line.
2. After the retention period, the main shall be flushed of the high chlorine water until the water leaving the system shows a chlorine concentration of less than 1 mg/l or no higher than that prevailing in the water used for flushing. After final flushing, a minimum of two water samples shall be collected 24 hours apart for bacteriological tests. During flushing, an acceptable dechlorination unit shall be utilized.
3. The samples shall be collected at regular intervals not to exceed 1,000 feet throughout the length of the pipe. The Contractor shall assist the Town in taking the bacteriological tests. These bacteriological tests must be analyzed by a State approved laboratory. The results of these samples must indicate the absence of coliform contamination. The costs of flushing and sampling are to be paid by the Contractor/Owner.
4. The disinfection tests must be satisfactorily completed prior to placing the line in service.
5. If a disinfection test fails, the chlorination/dechlorination procedure must be repeated until the required results are obtained (Sec. D Charges apply).
6. If at any time the water in an existing line becomes contaminated, this piping shall be disinfected as specified for new piping, back to the nearest gate valve or valves, or beyond those points as necessary to include all contaminated piping. On completion of disinfection, the piping shall be flushed thoroughly, and samples shall be taken. The after shall be proven safe for human consumption before acceptance of disinfection.

4.7.5 Acceptance Tests

- A. All lines shall be thoroughly flushed through the blow-offs and/or hydrants provided in accordance with AWWA C600 for final acceptance by the Town of Strasburg. Water used will be estimated by the Town of Strasburg and its cost charged to the developer.
- B. Water pipes shall be tested by the procedure outlined in AWWA C600, with the exception that test pressure shall be conducted at 150 percent of normal operating pressure at a minimum of 150 psi at 1000' maximum intervals.
- C. If the system needs to be shut down, the Town shall be given 72 hour notice prior to shut down. Furthermore, only Town of Strasburg Staff may operate valves within the system.

4.8 Corrosion Control

All storage tanks, pumping stations, vaults, treatment equipment, and similar facilities shall be protected from corrosion using project-specific design guidelines, which are not included within this discussion. The following is to be applied to all underground water, reclaimed water, and pressurized wastewater pipelines that are to be made of metallic pipe. In certain cases, upon completion of the Decision Process described below, the Town of Strasburg may choose to specify a nonmetallic piping material in an application that would otherwise be built of ductile iron.

4.8.1 Installation Requirements

All installations of corrosion control measures shall be made according to the approved construction plans and specifications for the project, the Standard Details and the Approved Materials List. Upon completion of the work, it shall be tested, operated, inspected and surveyed. Any and all repairs or replacement of defective or improperly installed corrosion control systems shall be made by the contractor, no additional cost to the Town of Strasburg.

4.8.2 A. Contractor Qualifications

- A. Installation, quality assurance, and testing personnel must have demonstrated experience with similar work. Resume of work experience shall be submitted to the Town of Strasburg for approval.
- B. Personnel shall be specifically named in qualification submittal and have completed at least three successful corrosion control systems within the last three years for underground pipelines of similar type, similar size and equal complexity.
- C. Personnel shall be a full-time contractor or subcontractor employees. Part-time or contract personnel hired only for this work will not be permitted.
- D. Only personnel approved by the Town of Strasburg shall be permitted. Personnel changes during course of project must be minimized and submitted by the Town of Strasburg at least two (2) weeks prior to plan implementation.
- E. The contractor shall oversee and certify installation and related testing, including pipe joint bonding, magnesium anode ground-beds, and corrosion control equipment.
- F. The contractor shall issue a letter of compliance indicating all corrosion control measures are satisfactorily installed and are in compliance with contract documents. The letter of compliance shall be signed by the contractor's responsible person.

4.8.3 B. Anodes

- A. The prepackaged anodes shall be installed where indicated. Prior to installation, remove all shipping covers from the anode (the packaged box shall not be removed). Install the anodes in existing soils (free from rocks, roots, organic material, trash or any other debris) and backfill with existing soil (as described above). Do not install the anode in sand, rock, or gravel backfill. Do not lower the anode into the excavation by the lead wire. If necessary, temporarily wrap a rope around the anode and lower the anode into the excavation by the rope. Remove the rope after the anode is installed. Provide a minimum spacing of two feet from other pipelines. Pre-soak the anode with 5 gallons of water after placement, but prior to backfilling.
- B. Anode header cable shall be buried a minimum of 18 inches below grade. Handle wire with care. All anode lead wire to header cable splices shall be made with a compression connector. Tape the splice with three layers of high voltage rubber splicing tape (50% overlap). Terminate the ends of the anode lead cable in the test stations.

4.8.4 Bonded Joints

All pipeline joints within the cathodic protection areas, including those on pipe, fittings, valves, all branch connections, shall be bonded with two insulated copper cables.

4.8.5 Test Station

- A. 1. Install test stations at the locations required. Test stations are to be located directly over the pipeline except in areas that would place the station in the roadway. Locate these test stations to the closest point at the edge of the road.
- B. Attach test wires as indicated using the proper thermite welding equipment and charges specified for the wire size and respective pipe material. Follow all procedures as outlined above.
- C. All test station wires shall be routed a minimum of 18 inches below finish grade. Maintain sufficient slack in the test wires so that the wires can extend a minimum of 18 inches from the compression thermal lugs for 0.25 inch bolt size. Install a shunt to connect the anode lead to the pipe lead where indicated on the design drawings.
- D. The test stations shall be set in poured concrete. Cathodic protection test station pad concrete shall be Class B concrete.
- E. The flush mounted test station lids shall be free of concrete and not cemented over.

4.8.6 Clearance Requirements

If 12" separation is not possible, positive separation shall be provided using glass mesh. A minimum of 6" separation shall be maintained from any foreign pipeline or structures.

4.8.7 Electrical Isolation

- A. Insulating Flanges: Approved insulating flanges shall be installed in accordance with specific design considerations.

- B. Insulating Unions: Approved insulating unions shall be installed in accordance with specific design considerations to isolate bimetallic service lines and other type connections that may create corrosion conditions from dissimilar metallic connections.
- C. Die-electric Pipe Materials: Approved die-electric pipe materials shall be used to isolate metallic pipe where specified as part of design consideration for foreign pipe line crossings as part of stray current mitigation considerations. Polyvinyl chloride and high density polyethylene pipe sections are permissible materials. Pipe materials, thickness design, and pipe specifications shall be provided by the Town of Strasburg.

4.8.8 Trench Excavation

The trench and backfill material around the pipeline shall be clean of all debris, such as trash, wood, and rocks. Strip forms at blockings.

CHAPTER 5. Wastewater Collection

5.1 Purpose and Intent

The purpose and intent of these wastewater collection design standards are intended to assist design engineers in the development of plans and specifications for the Town of Strasburg projects. The materials, configurations, and features described here represent the minimum acceptable level of quality expected in the wastewater collection design. These standards should not be construed as being a complete description of the necessary features for a particular pumping station design. Deviations from these standards must be approved by the Town of Strasburg during the Basis of Design phase of the project.

5.2 Reference Standards

The design engineer will comply with all relevant industry standards and federal, state and local regulations, including the following standards, which are incorporated into this document by reference:

Virginia Sewage Collection and Treatment Regulations

Virginia Building Code

Virginia Water Control Board

VDOT (Virginia Department of Transportation); Road and Bridge Specifications

Town of Strasburg Approved Materials List

5.3 General Standards

- A. The criteria listed in this section are minimums. Additional separations and clearances are to be furnished as practical to optimize each design. Attention shall be given to locating utilities so as to facilitate their re-excavation. The Town of Strasburg will consider factors such as depth and magnitude of facility in determining the adequacy of each design, and may relax or increase dimensional requirements accordingly. In general, a design is to be sought which minimizes maintenance costs.
- B. All materials used in the construction of the sewer system shall have the approval of the Town. AWWA and ASTM set forth only a set of standards for materials. Since these standards are quite broad, they may or may not meet the requirements or needs of the Town.
- C. Any materials not listed in these standards and specifications or not currently accepted by the Town shall be approved by the Town before installation.
- D. The following approval procedure shall be used:
 1. A cover letter along with two sets of manufacturer's certifications, and shop drawings and/or samples shall be sent to the Town's engineer.
 2. After his review, the engineer will issue a letter stating whether the product is acceptable or not.

- E. Unapproved materials placed on a job site shall be subject to immediate rejection and barred from any further consideration.
- F. Pipe - Polyvinyl chloride pipe (PVC): (See approved materials list)
 - 1. Gravity sewer main pipe with cover between 6 — 15 feet shall be SDR26.
 - 2. Force main pipe shall be DR18, C900 green labeled or cement lined ductile iron force sewer for 4" and larger, and 2" SDR21. ETI, Certain-Teed, Johns Manville, or our approved equal shall manufacture pipe.
 - 3. Gravity sewer lateral (4") pipe shall be SDR26.
- G. Pipe – Ductile Iron
 - 1. Gravity sewer main with cover greater than 15 feet shall be Ductile Iron Pipe.
 - 2. Ductile iron pipe shall conform to the requirements of AWWA Standard C 151. The pipe shall be cement lined in accordance with AWWA Standard C 104. Unless otherwise specified, the pipe shall have push-on joints meeting the requirements of AWWA Standard C111. The wall thickness of the pipe shall be Class 52. Pipe shall be manufactured by Griffin Pipe Co., Clow Corporation, or our approved equal.
- H. Manholes
 - 1. Manholes shall be pre-cast concrete conforming to ASTM C478 with eccentric cones and extended bases. Concrete shall conform to the requirements of ASTM C150. Joints shall be O-ring conforming to ASTM C361.
 - 2. Walls shall be a minimum of five inches thick and the base a minimum of eight inches thick.
 - 3. The diameter of the extended base shall be 12 inches greater than the outside of the barrel section.
 - 4. Manholes for sewer through 24 inches in diameter shall have a four foot inside diameter. Manholes for sewer greater than 24 inches in diameter shall have an inside diameter of six feet.
 - 5. Pre-cast inverts are acceptable.
 - 6. The exterior (to include adjustment rings) shall be covered with black asphalt Gilsonite paint such as LN-12, manufactured by Seaboard Asphalt Products Company, or our approved equal.
 - 7. Pipe shall be secured to the entry hole by a lock joint flexible manhole sleeve as manufactured by Chardon Rubber Co. or our approved equal.
 - 8. The joint(s) between the frame and cover, grade ring(s) and cone section shall be sealed by use of ¾" diameter concrete anchor bolts and one-inch nominal size butyl joint sealant. The sealant shall be CS 102 by Concrete Sealants, Inc., or our approved equal.
 - 9. Joints between sections shall be sealed with O-ring gasket and a one-inch nominal size butyl joint sealant. The butyl sealant shall be CS 102 by Concrete Sealants, Inc., or our approved

equal. The joint between the top section (cone or flat) and the frame base shall have the same sealant.

- I. Manhole Frames and Covers. (See approved materials list)
 1. Manhole frames and covers shall conform to ASTM A-48. The frame shall be drilled to permit using $\frac{3}{4}$ inch diameter bolts to secure it to the manhole. Four such bolts shall be used per frame. The words "Sanitary Sewer" shall be cast into the cover so as to be plainly visible. Standard manhole frames and covers shall be:
 - (a) Quality Water Products, style 40, Type A frame with cover labeled sewer
 - (b) B & C model 1012 frame with 1012-A cover
 - (c) East Jordon Iron Works, Inc., Product Number 154403.
 - (d) Our approved equal
 - (e) Covers shall be solid with two pick holes.
 2. Watertight manhole frames and covers shall be constructed of Quality Water Products, Model Pamtight (assembly No. REGIRIFD), with hex-head stainless steel bolts, or our approved equal. All manholes located in a water course must be water tight and 1-foot above the 100-year elevation water surface elevation.
 3. Areas that may experience heavy surface flows may require a solid cover as determined by the Director of Public Works.
- J. Fittings
 1. PVC fittings in gravity sewer lines shall have the same or greater SDR rating as the pipe used.
 2. Fittings used in sewer force mains shall be Class 350 ductile iron conforming to ASTM A53-72, minimum grade 70-50-05. Nominal thicknesses of fittings shall be equal to, or exceed, Class 54 ductile iron pipe thicknesses. Fittings shall be cement lined in accordance with AWWA C104-74. Radii of curvatures shall conform to AWWA C11-71. They shall be mechanical joint if buried and flanged if used in vault or pump station piping.
- K. Valves
 1. Gate valves and tapping sleeves and valves 3" through 24" shall be manufactured to meet and/or exceed all the AWWA requirements for resilient wedge valves. The following shall be required:
 - (a) The valve body shall be of ductile iron with a 250 psi working pressure.
 - (b) The valve wall thickness shall exceed the minimum AWWA C 153.
 - (c) The valve shall have a fusion bonded epoxy coating inside and out.
 - (d) The valve shall have a smooth, full diameter waterway with no recesses.

- (e) The valve stem shall be high-strength corrosion resistant bronze.
 - (f) The valve shall have upper and lower O-ring stem seals, with the upper O-rings field replaceable under pressure with valve in the open position.
 - (g) The valve shall have torque-minimizing thrust washers.
 - (h) The valve shall have cast into the body of the valve the material of manufacturer "Ductile Iron" (DI) and pressure rating 250 psi.
 - (i) The valve wedge and nut wrench shall be ductile iron and fully encapsulated with nitrile rubber
 - (j) Sealing gaskets shall be energized O-rings.
 - (k) The stuffing box shall be constructed of ductile iron.
 - (l) Mechanical joint gate valves 6" through 12" shall have anti-rotational bolt slots.
 - (m) Valves shall be listed by Underwriters Laboratories, Inc. and approved by Factory Mutual Research Corporation.
 - (n) Flanged face valve sizes 3" through 12" shall have 125 lb. flanges as required and shall be rising stem with hand wheel.
 - (o) Valve shall be equipped with ductile iron lifting lugs integrally cast in the stuffing box, allowing ease of handling and installation, minimizing possible damage of valve.
2. Check valves shall conform with the specifications in AWWA Standard C508. Valves shall be equipped with an outside weighted arm unless specified otherwise. Valves shall be manufactured by American Darling, or our approved equal.
 3. Sewage combination air release and air/vacuum valves shall have cast iron bodies with stainless steel floats. Other internal parts will be either stainless steel or bronze. Valves will be sized appropriately for each application. Valves shall be Val-MATIC Model VM-801BWA, or our approved equal.
- L. Valve Boxes. Valve boxes for gate valves shall be two piece cast iron with a 5 1/4" drop lid marked "sewer". Boxes shall be screw type adjustable with a 5 1/4" shaft diameter. Adjustment range shall be one foot. The box length shall be determined by depth of bury. The valve box shall be East Jordan Ironworks.
- M. Joint Restraints
1. Glands to restrain MJ fittings and pipe bells to DI pipe shall be EBAA Iron megalug series 1000, Ford uni-flange series 1400, or our approved equal.
 2. Glands to restrain MJ fittings and pipe bells to PVC pipe shall be EBAA Iron megalug series 2000PV, Ford uni-flange series 1500, or our approved equal.
 3. Glands to restrain PVC pipe bell to spigot shall be EBAA Iron megalug series 6500, Ford uni-flange series 1390, or our approved equal.

4. Glands to restrain DI push joint pipe bell to spigot shall be EBAA Iron Megalug Series 1700, Ford uni-flange series 1450, or our approved equal.

N. Sewer Laterals – Gravity Only

1. In new construction, wyes shall be used to connect the four-inch lateral to the sewer main.
2. In connecting to existing lines, , wyes, 18” stub pieces, and an approved coupling shall be used to connect the 4” lateral to the sewer main. (See details or approved materials list)
3. Allow saddles
4. Following the leg of the wye there shall be: (see detail?)
 - (a) A SDR26 spigot by gasket bell 45-degree bend.
 - (b) SDR26 gasket pipe and fittings as needed.
 - (c) Wye and 45 to make a cleanout (See Figure 17)
 - (d) A SDR26 spigot by SCDE 40 adapter.
 - (e) A SCH40 solvent weld cap (see Figure 15).

O. 2” Laterals - Forcemain Only

1. Saddles for PVC pipe shall be Ford style S 90 or our approved equal.
2. Corporation stops shall have an inlet threaded in accordance with AWWA standard C800 and a male iron pipe outlet. It shall be a Ford Series FB400 or our approved equal.
3. The connection at the property line will contain a two-inch ball valve with two-inch square operating nut. The valve shall be a Ford Series B 11 777 or our approved equal.

P. New Lines into Existing Manholes. All new openings into existing manholes shall be core drilled. The connection between the pipe and the manhole shall be made by Kor-N-Seal.

Q. Metering Station. Metering stations shall be rectangular in shape and contain a flume of appropriate size for present and future flows. A Sparling FT400-1 11 ultrasonic open channel flow transmitter used with a Sparling XD400- 110 open channel flow transducer shall monitor the flow. In non-flood areas, the metering station shall have a Bilco K2 access door or our approved equal. The door shall have a recessed hasp covered by a hinged lid flush with the surface. In flood areas, a watertight manhole frame and cover shall be required. Refer to Figure 18.

R. Cleanouts materials shall be specified as in Figure 17.

S. Blow Off Assemblies materials shall be specified in Figure 10.

T. Sewage Pump Stations, as provided in this TDM.

- U. Pipe Casings for sewer mains shall be sized in accordance with Figure 3. Casing pipe shall be steel and shall meet ASTM specifications A252 Grade 2, or Grade B.
- V. Pipeline Casing Spacers
 - 1. Manufactured steel and/or plastic casing spacers. Spacers shall be by PSI, Inc., Recon, or our approved equal.

5.4 Hydraulic Requirements

- A. Designs of sewer systems, including pumping facilities, shall be based the Town of Strasburg’s Community Plan, Zoning Ordinance, technical memoranda and any other pertinent documentation.
- B. Sewers serving out of town residents shall be designed on the basis of a population density resulting from the land uses listed in Shenandoah County documentation.
- C. Analysis shall be provided for all trunk and subtrunk sewers, and when required by the Town of Strasburg, for collecting sewers.
- D. In determining the required capacities of sanitary sewers, these factors shall be considered are peak hourly quantity of domestic sewage and additional maximum sewage or waste from commercial and industrial facilities.
- E. New sewer systems shall be designed on the basis of an average per capita flow of sewage from the equivalent population served of not less than 100 gallons per day (gpd). On this basis, the following unit factors shall be used in flow calculations:

Exhibit 5A: Wastewater Loadings

Single Family Detached Unit	350 gpd
Single Family Attached Unit	280 gpd
Multi-Family Dwelling Unit	280 gpd
Retail Space	The greater of 0.093 gpd/sq ft. or 30 persons per acre
Commercial/Office Space	The greater of 0.160 gpd/sq ft. or 30 persons per acre
Industrial Space	The greater of 0.160 gpd/sq ft. or 30 persons per acre

- F. Sewer capacity shall be designed to support peak hour flows (PHF) when running full, in accordance with the following equations where PFF is the peak flow factor and QAVG is the average daily flow in MGD:

$$PFF = 3.81(Q_{AVG})^{-0.187} \quad PHF = PFF(Q_{AVG})$$

- G. Where appropriate, alternative peaking factors to those determined above will be considered.
 - 1. Minimum peaking factors shall be as follows:

Exhibit 5B: Peak Factor

Category	Size	Factor
Lateral and building sewers	≤ 6-inch	4.0

Collector and trunk sewers	8-inch through 24 inch	2.5
interceptors	≥ 30-inch	2.0

2. Computations shall be based on the following values for Manning's formula "n":

Size	"n" Value
8-inch through 24-inch	0.013
>24-inch	0.012

- H. Unless evidence is presented to demonstrate a different flow from industry at ultimate development, the minimum allowance for industrial flow shall be determined by providing an equivalent population of 40 persons per acre or one (1) equivalent population per employee, whichever is greater, in the industrial area. "Area" shall include entire area planned for industry, except public road, street and highway rights-of-way, flood plains on which construction is prohibited, and "green zones" at least 100 feet in width separating industrial from residential areas on which construction is prohibited.
- I. The minimum allowance for flows from commercial areas shall be determined by providing an equivalent population of 30 persons per acre, or 1/2 equivalent population per employee, whichever is the greater, in the commercial area. Area shall include entire area zoned for commercial development, including off-street parking areas and landscaped areas, but excluding the rights-of-way of public roads, streets and highways, flood plains of streams on which construction is prohibited and "green zones" 100-feet or more wide separating commercial from residential areas, on which construction is prohibited.
- J. In cases where the above criteria are not applicable, an alternate design procedure may be submitted to Town of Strasburg for approval. A description of the procedure used and justification for the modifications for sewer design proposed shall be included with the Design Analyses and plans submitted for approval.
- K. Minimum size of public sewer is 8-inch diameter.
- L. The design must account for 400 percent of the average design flow.
- M. The minimum peak design flow for mains, trucks and/or interceptors shall be 300 percent of the average design flow.

5.5 Sewer Pipe Layout

- A. Facilities being decommissioned shall be abandoned and associated easements vacated. Manholes, structures, pipe and appurtenances are to be removed.
- B. At manholes, the minimum angle between influent and effluent lines is 90-degrees.
- C. Show sanitary sewer crossings on all applicable profiles of other utilities.
- D. Separations
1. Provide a minimum 10 foot horizontal separation (outside to outside) with water pipe, including manholes, in accordance with the Waterworks Regulations (12 VAC 5-590-1150).

2. Provide minimum 6 foot horizontal separation (outside to outside) with storm drainage piping and structures, including at sanitary manholes. Under no circumstances may any sewer cross beneath storm drainage structures.
 3. Provide minimum 15 foot horizontal separation with a building or any other above ground structure. This requirement may be increased for deep and/or large diameter sewers, as determined by the Town of Strasburg.
 4. Provide minimum 50 foot horizontal separation with wells. Show all wells within 100 feet of sanitary sewer easements.
- E. Pipe deflections will not be allowed.
- F. Location of Sewer
1. Manhole location in pavement is preferred. Locate manholes at crown of pavement if possible. Where separation requirements preclude manholes on crown or centerline, manholes should be placed in the center of the travel lane.
 2. In public roads containing both water pipes and sewer pipes, there will typically not be sufficient width to accommodate waterline with sewer on centerline. In this case, center manhole 5 feet from the centerline of the roadway. In such cases, waterline is typically located 8 feet from centerline, on opposite side of street, resulting in the required 10 foot separation (outside to outside).
 3. Locate manholes beyond spread of gutter's flow.
 4. Identify places where future extension of public or service pipe appears practical to allow service to other buildings or properties. Sewer is to be constructed to beyond the area being developed, so as to terminate in a location from which it can readily be extended in the future. This will be beyond proposed pavements, past adjacent buildings, and beyond adjacent or crossing waterlines or storm drains that would otherwise be undermined during subsequent sewer installation. Easement for the future line must be conveyed, extending to the site or subdivision boundary. Associated temporary construction easement may also be needed, as dictated by the scope of the future installation.
 5. Any relocation of existing sewer facilities due to development is the responsibility of the Developer. Where grading is to occur, resulting cover on existing sewer must remain above design minimum and may be considered excessive if resulting in total cover in excess of 15 feet. Encumbrance of pipes or manholes for future access and/or reexcavation will necessitate replacement in kind, in the form of a parallel facility.
 6. Sewers installed above existing grade shall be placed in controlled fill compacted at optimum moisture, within ± 20 percent of optimum. The density shall be 95 percent when compared to the theoretical maximum density as determined in accordance with the requirements of VTM-1 (standard proctor).
 7. Minimum slopes (percent(s)) of pipes are as follows:

Exhibit 5C: Pipe Slope (Minimum)

Size	Slope
6-inch	1.00
8-inch	0.50
10-inch	0.37
12-inch	0.29
16-inch	0.20
20-inch	0.14
24-inch	0.10
30-inch	0.06

- G. Minimum slopes for larger pipes will be determined on a case-by-case basis. Terminal upstream sections of sewers and those sections discharging into lift stations, sewage treatment plants, plant effluent into streams, etc., will require a minimum slope of double that indicated in above table.
1. Maximum slope on all gravity sewers is 10.00 percent.
 2. Minimum velocity is 2.25 feet per second for gravity flow. Maximum velocities should not exceed 15 feet per second (fps). Calculations shall be provided.
 3. Maintain minimum vertical separation of 2.0 feet if sewer is below and/or above another utility.
 4. Maintain a minimum cover of 6.0 feet. Cover may be reduced to 4.0 feet when justified in isolated instances at the upper reaches of the system, and where the pipe is located in grassy areas. Maximum cover is 15.0 feet for sanitary sewers.
 5. Gravity sewers less than or equal to 12-inch diameter shall be constructed of PVC SDR-26 where cover is less than 6 feet, or where cover exceeds 15 feet. Pipe specifications for all other diameters and materials shall be made in accordance with the Approved Materials List. Pipe material, pressure class, and/or dimension ratio must remain constant between manholes.
 6. Minimum cover at a stream crossing is 2 foot if in rock or 4 feet if in soil or alluvial deposits. Concrete encasement shall be provided where cover is less than 4 feet.
 7. Locate out of areas supporting foundations of structures. Where sewers are deep and in close proximity to structures, Town of Strasburg may request a loading plane diagram showing that the sewer may be excavated through conventional means without disturbance to the surrounding structure(s). Adequate easement must be provided so that future excavation and maintenance is feasible.
 8. Sewer stub connections for future build out is a minimum of 1.0 percent

5.6 Manholes

- A. Manholes shall be provided at the following locations:
1. All junctions, changes in horizontal alignment, changes in gradient, and temporary or permanent terminus of pipe;

2. Every 300 feet of developed length (8-inch through 16-inch diameter) and every 300 feet of developed length (greater than 16-inch diameter);
 3. Changes in pipe diameter;
 4. Lateral connections for laterals 6-inch diameter and larger.
- B. Pre Cast Manholes will only be accepted.
 - C. A minimum separation of 10 feet horizontally and 6 feet vertically from the exterior edge of the manhole to any utility.
 - D. No more than a maximum of 4 connecting sewer pipes (including laterals) can enter a single manhole.
 - E. The inside diameter of the manhole shall be a minimum of 4 feet. Pipe sizes larger than 24-inch diameter will require a minimum of 6 feet, and may need to be enlarged.
 - F. There should be a minimum of 6-inches between pipes in the manholes
 - G. Minimum depth of the manhole is 6 feet, with a maximum depth of 15 feet. Manholes maximum depth shall be measured from the rim to the lowest invert.
 - H. Inside the manhole, provide a maximum of 0.50 feet and a minimum of 0.15 feet between invert elevations of pipes of like diameters. When influent pipe is of smaller diameter than effluent pipe, its minimum invert elevation is that which results in matched elevations between crowns of influent and effluent pipes. Additional drop across manholes may be required to insure that a positive hydraulic grade is maintained across the manhole so that flows do not surcharge one or more of the influent pipes.
 - I. Drop connections shall be approved by the Director of Public Works prior to approval of plans and there shall be no more than a 5 foot drop.
 - J. The maximum slope within a manhole shall not exceed 2 percent.
 - K. "Doghouse" manholes are not permitted. Any manhole installed on an existing sewer pipe must be cut-in.
 - L. Heavy duty covers must be provided for all manhole lids.
 - M. All manholes located in a water course must be water tight and 1-foot above the 100-year elevation water surface elevation.
 - N. When crossing surface water, a manhole shall be placed on either side of the channel.
 - O. If the manhole is placed in undeveloped areas, the manhole must be 2-foot above the surrounding grade. No manhole shall be more than 4-feet above the surrounding grade.
 - P. Provide positive drainage around each manhole proposed.
 - Q. Cleanouts/handholds will not constitute as a manhole and will not be accepted into the Town system.
 - R. Pipe material from Manhole to Manhole shall remain the same.

- S. Exterior of manholes must be waterproof coated.
- T. Manholes shall not pond water in the inverts.

5.7 Easements

- A. Provide easements which are a minimum of:

Exhibit 5D: Sewer Easement Width

Location	Minimum Width (feet)
Within limits of pavement	15
Traversing unpaved portions of lots	20
Undeveloped areas	30
Along lot lines of subdivisions or between structures	30

- B. Easement requirements for gravity sewers larger than 12-inch diameter will be specified on a project-specific basis.
- C. Provide vehicular access to easement from street, including drop curb where applicable, and grade easement to allow vehicular traverse, with slopes not to exceed 8 percent. Access shall be to all manholes. Road shall be at least 10 feet wide and paved, graveled, or stabilized with an engineered product for all weather access by maintenance vehicles. This requirement may be reduced in environmentally sensitive areas.

5.8 Service Connections

- A. For each premises receiving service, provide one or more independent connection(s) to public sewer.
- B. Connections to single family homes shall be 4-inch minimum; connections to multifamily, commercial, and industrial buildings shall be 6-inch minimum.
- C. Services of single family dwelling (attached and detached) units are preferred to connect directly to pipe, not to manhole. Services of multi-family residential, commercial, and industrial premises are preferred to connect at a manhole.
- D. Laterals 6-inch diameter and larger must connect at a manhole. Additionally, manholes are required in lieu of clean-outs at all changes in horizontal alignment and vertical grade on all laterals 6-inch diameter and larger.
- E. Significant commercial/industrial users, as indicated in Town Code shall include grease interceptors, oil/water separators, and other pretreatment devices. These devices must connect with a lateral at a manhole prior to entering the town system.
- F. Significant commercial/industrial users, as indicated in Town Code shall provide a maintenance schedule and a list of responsible parties for removal and cleaning of the pretreatment devices.

- G. When connecting to pipe just outside a manhole, a minimum distance of 5.0 feet is required between outside wall of manhole and connection point.
- H. Laterals shall extend at exactly 90 degrees when directly connecting to sewer pipe.
- I. Provide minimum horizontal separation of 5.0 feet (center to center) between laterals directly connecting to sewer pipe.
- J. When connecting at a manhole, a lateral must describe no less than a 90 degree angle with effluent pipe.
- K. Laterals shall be located so as to minimize the number of bends in the subsequent extension of building sewer, taking into account all known architectural constraints or proposed structures.
- L. Laterals must be terminated at the Town's right-of-way or easement of the anticipated house site.
- M. Owner/developer shall not connect sewer lateral to clean out riser pipe.
- N. Lateral service from the rear of lots is discouraged, due to the typical encumbrance of pipes for maintenance.
- O. Provide minimum horizontal separation of 6.0 feet between lateral and driveway apron.
- P. Provide minimum horizontal separation of 6.0 feet between lateral and water service.
- Q. Maintain minimum vertical separation of 2.0 feet if service spur is above or below another utility.
- R. Laterals connecting at a manhole may match crown elevations with the highest influent sewer, or be higher.
- S. Laterals are to be at sufficient depth to allow sewer service to the lowest portion of a structure, including basement. A minimum slope of 2.08 percent to a point 2 feet below the lowest floor elevation, at the most remote portion of the building.
- T. Where depth of pipe would result in excess depth of lateral, the slope of the lateral may be increased from 2.08 percent (." :1') to 4.17 percent (." :1'). If further reduction of cover is warranted, specify a vertical offset (1:1 riser) in accordance with the Standard Details. Such vertical offsets must be 3.0 vertical feet or more, and must be exterior to right-of-way, easement, and traffic court.
- U. All lateral connections must be stationed in the profile of the sewer main.
- V. Show crossing laterals on profiles of storm drains and water pipes if vertical clearance (outside to outside) is less than 3.0 feet.
- W. Specify a clean-out where developed length reaches 100 feet.
- X. Specify a clean-out at the building's property line. Clean-outs must be shown in plan and profile of all commercial laterals. Clean outs must be surrounded by a 10 foot dedicated easement.
- Y. No drains subject to receiving storm water may be tributary to the sanitary sewer.

5.9 Force Mains

- A. The use of force mains shall be discussed with the Town Manager and Director of Public Works prior to use and approval of a force main. It is recommended that gravity feed system is preferred.
- B. The hydraulic design of force mains shall be based on the following:
 - 1. Force mains shall be designed for a minimum velocity of two (2.0) feet per second and a maximum velocity of eight (8.0) feet per second.
 - 2. The minimum size of force mains shall be four (4) inches in diameter, except for grinder pumps which shall be two (2) inches.
 - 3. An air release valve shall be placed at all high points in the force main as necessary to provide for air release that has accumulated in the pipe line.
 - 4. Force main piping and fittings shall be C-900 or cement-lined ductile iron pipe and shall be designed to meet the maximum pressure of the system.
 - 5. Force mains shall enter the gravity sewer system at a manhole or special junction chamber. The force main shall enter the termination structure with its centerline horizontal and at a point no higher than one (1) foot above the flow line of the receiving gravity sewer. Design of the force main termination structure shall ensure a smooth flow transition to the gravity flow section to prevent turbulence and release of gases. All interior walls of the force main termination structure shall be coated with coal-tar epoxy.
 - 6. Force mains shall be sufficiently anchored throughout the line length. The number of bends shall be as few as possible. Restrained joints shall be provided where restraint is needed.
 - 7. All force mains shall be tested at a minimum pressure of at least 50 percent (50%) above the design operating pressure, for at least 30 minutes. Leakage shall not exceed the amount given

5.10 Pumps/Grinders

Pumps/Grinders are not to be used in the collection system. Pumps may be added behind the cleanout on the owner's property, provided that the pump is maintained by the owner. If a pump is to be used by the owner, the Town of Strasburg shall be notified 2 weeks in writing prior to installation. Pumps/Grinders may also be only be used within a pump station or within the wastewater treatment plant.

5.11 Adjacent Utilities

Adjacent utilities shall be in accordance with the standards as set forth in this manual.

5.12 Installation Requirements

- A. All sewer pipe and appurtenances shall be installed in accordance with the best practice, with materials and workmanship of the best quality. Specifically, installations shall be in accordance with applicable sections of AWWA Standard C600 - Installation of Ductile Iron Water Pipes and AWWA Standard C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe.

- B. Blasting, where required, shall be done with care in accordance with all applicable Federal, State and local laws, ordinances and regulations, and shall not be done within a distance of 25 feet from a previously laid pipe or a previously installed structure.
- C. Backfill shall be placed promptly after inspection by the Town of Strasburg
- D. Backfill shall be placed with 6-inch mixture of Grade A sand with #68 stone under the sewer line and/ lateral. Then place #68 stone in 6-inch layers from the top of the pipe bedding to a point of 12-inches above the top of pipe. Crusher run shall be placed in 6-inch fills compacted at optimum moisture, within ± 20 percent of optimum. The density shall be 95 percent when compacted to the theoretical maximum density as determined in accordance with the requirements of VTM-1 (standard proctor).
- E. Lateral connections must be stubbed to the property line before street is paved.

5.13 Acceptance Tests

- A. No more than 5,000 feet of pipe shall be installed without testing. The contractor shall not proceed with further construction until the preceding section has been approved by the Town of Strasburg.
- B. Testing shall not be conducted until at least 7 days have elapsed after all concrete thrust blocking has been installed.
- C. At the cost of the contractor, all lines shall be inspected through use of closed circuit television inspection. Inspection shall take place prior to preparing the sub base, in which the contractor shall clean sewers prior to each television inspection. If interior of pipe shows poor alignment, incorrect joining, displaced pipe, leakage, or any other defect, the defect shall be remedied before acceptance.
- D. Completed sewers and laterals must hold at constant pressure for a minimum of no less than 15 minutes and 1 second 4 psi. A ball plug on each end of the segment shall be inserted at each end of the pipe. At one of the ball plug shall have a tube and gauge for the filling of air and pressure testing.. Installations of sewer and laterals shall exhibit zero exfiltration.
- E. All completed manholes shall be tested for leakage. Ball plug(s) on each interior connection of the manhole. A vacuum and mercury gauge shall be placed on the manhole frame and cover. The manhole shall hold a minimum of nine inches of mercury for no a time on less than the following:

Exhibit 5E: Manhole Leakage Testing

Depth	Pressure Change of 1 Hg Mercury (in inches)
8 feet and less	60 seconds
8 feet to 10 feet	75 seconds
10 feet to 12 feet	90 seconds
Above 12 feet	Approval is required for manholes deeper than 12 feet deep

- F. The Contractor shall provide the Town with inspection and calibration records of equipment as requested.

- G. Manholes may be tested with associated pipe. Where entire depth has not been included in the testing of pipe, the manholes shall be used to plug all lines into and out of the manhole being tested. The manhole shall be plugged independently and filled with water to the top.
- H. If the system needs to be shut down, the Town shall be given 72 hour notice to the Town prior to shut down.
- I. Hydrostatic pressure testing (Force Mains)
 - 1. Fill pipeline with water in accordance with these specifications for a minimum of 24 hours immediately prior to testing for leakage.
 - 2. Test piping under the greater of a hydrostatic pressure of 125 percent of the maximum expected working pressure at the high point of the line unless otherwise shown. Purge air from the pipeline through taps in the pipe prior to testing. Apply test pressure to the piping by means of a hand pump or other approved method and maintain pressure for minimum of two hours. The test pressure shall not vary by more than plus or minus 5 psi (35 KPA) at any time during the test.
 - 3. The leakage as determined by the preceding test shall not exceed the allowable leakage.
- J. Force main sewer line inspection and testing
 - 1. The Contractor will furnish meters and gauges for testing purposes.
 - 2. The Contractor shall test the force main for leakage in the presence of a Town inspector and incur the cost of the test. All tests shall be conducted in a manner to minimize interference with the Contractor's Work or progress. A maximum of 2,500 feet (800 meters) of force main may be tested at one time.
 - 3. Test each section of force main between adjacent valves separately. The maximum differential pressure across any valve during testing shall not exceed the test pressure recommended by the valve manufacturer. The Contractor shall provide all temporary bulkheads and thrust restraint to isolate the force main test section, and shall provide all long solid sleeves necessary to make the permanent connection to the system at no additional cost.
 - 4. Notify the Town when the Work is ready for testing. All labor, equipment, and materials shall be furnished by the Contractor, unless otherwise specified.
 - 5. Testing shall not be conducted until at least 7 days have elapsed after all concrete thrust blocking has been installed.
 - 6. The Town reserves the right to check the completed pipeline for vertical alignment prior to filling with water and testing.
 - 7. Install air relief/vacuum valves as indicated on the drawings and check each for proper operation prior to filling the force main for testing. If for any reason it is necessary to drain the force main, the Contractor shall take all precautions required to ensure the safety of personnel entering and inspecting the force main. When draining the force main, all air valves shall be rechecked for proper operation. This is required to avoid the formation of a vacuum lock which could prevent the water from properly draining and become a hazard to men working within

the pipeline if released. Pipelines containing large orifice valves shall be filled at a maximum rate of 1 foot per second (300 millimeters per second).

K. Leakage Test (Force Mains)

1. Conduct a leakage test concurrently with the pressure test. The pressure to be induced at the high point of the test section for the leakage test shall be equal to the elevation of the hydraulic gradient minus the high point elevation of the water main section to be tested, multiplied by 0.433, but never less than 100 psi. Maintain this pressure for a minimum of 2 hours.
2. The leakage as determined by the preceding test shall not exceed the allowable leakage as given by the following formula:

$$L = \frac{ND \sqrt{P}}{7,400}$$

Where:

L = Allowable leakage, in gallons per hour

N = Number of joints in the length of pipe tested

D = Nominal diameter of the pipe, in inches

P = Average test pressure during the leakage test, in pounds per square inch (gauge) (psi)

3. Valves shall be operated from the fully closed position to the fully open, and back to the fully closed position after the valve has been installed in the water line. Valve parts shall function smoothly in the manner intended or shall be corrected by the Contractor until satisfactory performance is demonstrated. Test valves 16-inches and larger diameter for leakage simultaneously with or immediately after successful testing of the water main. Each side of the valve gates shall be subjected to the same test pressures as required for the water main leakage test for two hours while the other side is depressurized. Allowable leakage shall not exceed 1.0 oz./hr./in. of nominal valve size.
4. When leakage occurs, defective pipe, valves, fittings, appurtenances or joints shall be located and repaired at the expense of the Contractor. If the defective portions cannot be so located, the Contractor, at his own expense, shall remove and reconstruct as much of the original Work as necessary to obtain a water main that does not exceed the allowable leakage upon retesting.
5. All visible leakage shall be eliminated. Should test results show displacement, damage or leakage in excess of allowable amount, the contractor shall repair the displacement and damage and eliminate the leakage. He shall retest until specified conditions are met, to the satisfaction of the Engineer, at no cost to the District and/or Town.
6. Should construction standards and or tests not be met, the Town shall reject all or any portion of the facilities. Any project or portion of a project rejected by the Town shall not be permitted to discharge into any previously approved system until the rejected system or portion of system has been repaired so as to meet all standards governing the construction of sewer mains.

7. All repair methods, other than replacement of the defective areas with new materials, shall be subject to prior approval of the Town. Grouted, collared, clamped, or otherwise patched-up gravity or force main sewer pipe will not be acceptable.
 8. Upon completion of such inspection or tests as required in these specifications, all foreign matter, (to include but not limited to sand, rock, dirt, concrete, joint sealant, gravel) shall be removed from all sewers and manholes before final approval is granted.
- L. Leakage Test (Wetwells)
1. Ex-Filtration Method
 - (a) Inflatable stoppers shall be used to stop all lines into and out of the wetwell to be tested. The stoppers shall be positioned in lines far enough from the wetwell to assure testing of those portions of the lines not otherwise tested. Once the wetwell has been filled with water to the top, a 12 hour soak shall be allowed prior to testing.
 - (b) The maximum leakage for hydrostatic testing shall be 0.015 gallons per foot of wetwell diameter per foot of wetwell depth per hour. The testing period shall be 24 hours.
 - (c) If the wetwell fails the test, necessary repair shall be made. The ex-filtration test and repairs shall be repeated until the wetwell passes the test.

5.14 Wastewater Pumping Stations

5.14.1 Scope

- A. Intent. These sewage pumping station (SPS) design standards are intended to assist design engineers in the development of plans and specifications for the Town of Strasburg projects. The materials, configurations, and features described here represent the minimum acceptable level of quality expected in pumping station design and reflect the goal of standardizing the Town of Strasburg equipment. These standards should not be construed as being a complete description of the necessary features for a particular pumping station design. Deviations from these standards must be approved by the Town of Strasburg during the Basis of Design phase of the project. The Town of Strasburg has the final authority regarding the acceptability of any particular pumping station design.
- B. Limitations. The sewage pumping station standards presented herein shall supplement the latest edition of the Sewage Collection and Treatment (SCAT) Regulations 9 VAC 25-790, as published by the Commonwealth of Virginia, Virginia Department of Environmental Quality (DEQ). The SCAT Regulations represent the minimum design requirements set forth by the DEQ. All aspects of the SCAT Regulations shall be adhered to. As the owner, the Town of Strasburg may identify and determine the need for standards and requirements that are more stringent than those contained in Part III of the SCAT Regulations. The Town of Strasburg reserves the right to amend or modify this publication without notice, and to interpret the meaning of all statements made herein.

5.14.2 References

The design engineer will comply with all relevant industry standards and federal, state and local regulations, including the following standards, which are incorporated into this document by reference:

Virginia Sewage Collection and Treatment Regulations

Virginia Building Code

Virginia Water Control Board

VDOT (Virginia Department of Transportation); Road and Bridge Specifications

Town of Strasburg Approved Materials List

5.14.3 Design Specifications

- A. Data and design calculations for pump stations and force mains shall be shown on the plans. Pump station capacity calculations, design elements, pump choice, station schedule and electrical data are to be given. Data and calculations for the total dynamic head (TDH) shall be shown and plainly noted (see Figure 19).
- B. Pump stations shall have three-phase 208 volt power to the site. No roto-phase units will be allowed.
- C. No underground fuel storage tanks shall be allowed.
- D. Pumps shall be wet-well mounted suction lift unless station is low volume.
- E. Submersible grinder pumps may be used if:
 - 1. Discharge pipe diameter is 3" or less
 - 2. The TDH is 80 feet or less
 - 3. The peak design flow is 100 gpm or less.
- F. A third (spare) pump shall be provided with each submersible grinder pump station.
- G. Suction lift stations shall be installed in a building (see figures 21, 22, and 23).
- H. Submersible grinder pump stations shall be installed per Figures 24, 25, and 26 and shall include gates and fencing as shown on detail 35.
- I. All pumping stations shall be equipped with a pump station bypass, as shown on Figure 32. No portable pump will be allowed.
- J. All pumps (suction or grinder) shall be 208 volt.
- K. The alarm light and horn shall be 110 volt and have a silence switch.
- L. A 12-foot wide maintenance road shall be required.
- M. A 6-foot high fenced-in area (20' x 20' minimum) with a 12-foot double drive gate shall be required at all grinder pump stations.
- N. Underground power shall be provided wherever possible.
- O. No electrical splices or boxes are to be installed inside the wet well.

- P. Two stainless steel bands shall be used to hold the influent pipe to the wet well sleeve.
- Q. Flanged ductile iron piping shall be used in suction lift wet wells. Connection between pump station discharge line and force main piping shall be by solid sleeve with megalugs.
- R. All driveway entrances must have a slope between 2% to 8%. The driveway must be constructed of asphalt with a minimum section of 1.5" Top Course SM-9.5A, 6" BM-25 and 10" 21B.
- S. Pump facilities shall have an alternative power source provided in 208 volt three-phase. In addition to the alternative power source the station shall have a generator receptacle.
- T. Telemetry units shall be Mission Model #110RTU.
- U. See figures 19 — 26.

5.14.4 Material Specifications

- A. Wet wells shall be precast concrete manholes. Concrete shall conform to ASTM C 150.
- B. Joints shall be O-ring conforming to ASTM C361. There shall be no steps in the wet well.
- C. Suction lift station wet wells shall be eight foot inside diameter. Walls, base, and flat top shall be a minimum of nine inches thick.
- D. Grinder station wet wells shall be six foot inside diameter. Walls shall be a minimum of seven inches thick, and the base a minimum of eight inches thick.
- E. The exterior of the wet well shall be covered with fibrous bit mastic waterproofing such as Tar Mastic 100 manufactured by Porter Paint Company.
- F. Pipe shall be secured to the entry hole by a lock joint flexible manhole sleeve as manufactured by Chardon Rubber Co. or our approved equal.
- G. Each sewage pump shall have an hour meter which shall record accumulated running time.
- H. Mercury float switches shall be used.
- I. Generator hookup receptacle shall be Crouse Hinds, cat. #AR1041-S22. 4W/4P.
- J. Alarm light shall be Edwards model No. 50-R and the horn shall be Edwards model No. 876-N5 or our approved equal.
- K. There shall be a four-inch galvanized mushroom vent in the wet well. It shall be vented to the atmosphere and contain a bug-proof screen.
- L. For new sewage pump stations, the automatic dialing alarm system shall be HIGH TIDE HT 900 with antenna, to be selected per site requirements as recommended by the manufacturer.
- M. Suction lift stations shall have:
 - 1. Pumps manufactured by Smith & Loveless.
 - 2. Self-priming vacuum pumps manufactured by Gast Manufacturing Co., or our approved equal.

3. A 0-10 minute adjustable time delay relay on each vacuum priming pump (to act as a pump failure sensor). Should a vacuum pump not be able to prime within a pre-set time, the vacuum prime pump will be shut off and an alarm sensor will indicate pump failure.
 4. Flanged ductile iron piping in the wet well. Connection between pump station discharge line and force main piping shall be by solid sleeve with Megalugs.
- N. Submersible grinder pump stations shall have:
1. Pumps manufactured by Barnes, Myers, or ABS
 2. Stainless steel or pultruded (fiberglass) guide rails
 3. Flanged ductile iron piping (for 4" lines) or SCH 80 PVC (for 2" and 3" lines) in the wet well and valve vault
 4. Any PVC discharge pipe shall be braced (stainless) every 5 feet.
 5. Hand wheels on gate valves
 6. A floor mounted stainless steel lifting hoist socket. It shall be for a Halliday Products hoist model No. D1A24B
 7. Electrical controls enclosure containing individual boxes for the items in the enclosure.
- O. Five (5) O & M manuals for each station shall be delivered to the Town's engineer.
- P. See Drawings 19 through 26.

5.14.5 Construction Specifications

- A. A 12-foot wide paved maintenance road shall be required with a paved turn-around at the station. The maintenance road shall have no less than a 2% slope and a maximum of 8% slope. The driveway must be constructed of asphalt with a minimum section of 1.5" Top Course SM-9.5A, 6" BM-25 and 10" 21B.
- B. A six-foot high fenced-in area (20' x 20' minimum), with a 12-foot double drive gate shall be required at all grinder pump stations.
- C. Underground power shall be provided wherever possible with wiring provided for an emergency generator.
- D. No electrical splices or boxes are to be installed inside the wet well.
- E. Two stainless steel clamps shall be used to hold the influent pipe to the wet well sleeve.
- F. Flanged ductile iron piping shall be used in the wet well. Connection between pump station discharge line and force main piping shall be solid sleeve with Megalugs.
- G. The top of the wet well shall be above the surrounding grade. Suction lift stations shall be 3 to 6 inches above grade and grinder stations shall be 6 to 12 inches above grade.

H. See Figures 19 through 26.

CHAPTER 6. Definitions and Notes

6.1 Definitions and Abbreviations

<u>Abbreviation</u>	<u>Key to Abbreviations</u>
AASHTO	American Association of State Highway Transportation Officials
ADAG	American Disabilities Act Guidelines
ASSE	American Waterworks Association Standards
AWWA	American Waterworks Association Standards
BMP	Best management practices
BODR	Basis of Design Report
LD	Land Development Program
CP	Capital Programs
CRZ	Critical Root Zone
EPA	Environmental Protection Agency
FDC	Fire department connection
FHWA	Federal Highway Administration
ITE	Institute of Transportation Engineers
LID	Low impact development
LOS	Level of Service
MUTCD	Manual on Uniform Traffic Control
NCUS	Non-Motorized User Circulation System
NFI	National Flood Insurance Program
OM	Operations and Maintenance
PM	Project Manager
SPS	Sewage Pumping Station
Town	Town of Strasburg
VDCR	Virginia Department of Conservation and Recreation

VDEQ	Virginia Department of Environmental Quality
VDOT	Virginia Department of Transportation
VDH	Virginia Department of Health
USGS	United States Geological Survey

6.2 Interpretation of Terms

- A. "Town of Strasburg" or "the Town" shall mean the Town Council, its employees, or authorized representatives. The Town of Strasburg shall hereinafter be referred to as the "Town" and be recognized as the policy making body over facilities herein described.
- B. "Owner" or "Developer" shall mean any person(s), group, corporation, or affiliations associated with or responsible for the initiation, design, and/or construction of facilities herein described. These facilities are intended to be under the jurisdiction of, and become a part of, the public utilities system of the Town.
- C. "Contractor" shall be any person(s), firm, group, corporation, or affiliations charged with the responsibility of constructing the facilities herein described, and subject to the provisions and regulations set forth herein.
- D. "Consultant" or "Engineer" shall mean a professional engineer registered to do business in the state of Virginia.
- E. "Surveyor" shall mean a professional surveyor registered to do business in the state of Virginia.

CHAPTER 7. Construction Details

7.1 Construction Drawings and Renderings

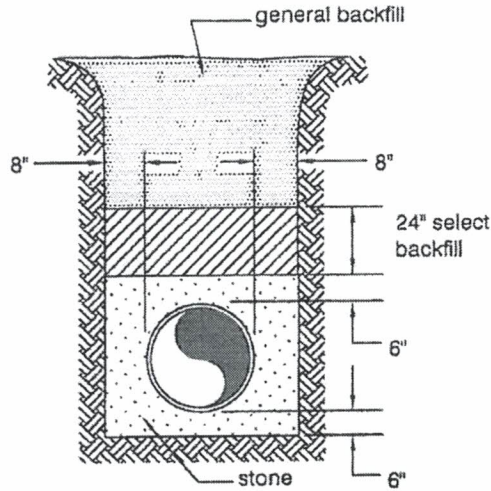
- 1 - Trench & Bedding
- 2 - Concrete Thrust Blocking
- 3 - Highway Crossing
- 4 -Stream Crossing
- 5 - ¾" and 1" Meter Installation
- 6 - 1 ½" and 2" Meter Installation
- 7 - 3" through 8" Meter Installation
- 8 - Gate Valve
- 9 - Fire Hydrant Assembly
- 10 - Blow-off Assembly
- 11 - Combination Air Release and Vacuum Valve Vault
- 12 - Standard Manhole
- 13 - Drop Manhole
- 14 - New Manhole on Existing Line
- 15 - Gravity Sewer Service Lateral
- 16 - Force Main Sewer Service Lateral
- 17 - Sewer Cleanout
- 18 - Sewer Metering Station
- 19 - Sewer Pump Station — Design Data
- 20 - Sewer Pump Station — Typical Wiring Diagram
- 21 - Suction Lift Sewer Pump Station — Plan View
- 22 - Suction Lift Sewer Pump Station — Section View
- 23 - Suction Lift Sewer Pump Station — Wet Well Cover
- 24 - Grinder Sewer Pump Station — Plan View

- 25 - Grinder Sewer Pump Station — Section View
- 26 - Grinder Sewer Pump Station — Electrical Controls
- 27 - Water and Sewer Line Marking System
- 28 - Concrete Pier and Water/Sewer Crossing Detail
- 29 - Restrained Joints — Valves and Dead Ends
- 30 - Restrained Joints Horizontal Bends
- 31 - Restrained Joints — Vertical Bends
- 32 - Sewer Pump Station Bypass
- 33 - Manhole Connection for Steep Pipe Slope (17% or Greater)
- 34 - Sewer Lateral for Main with Cover Greater than 15 Feet
- 35 - Double-Gate Fencing Detail for Pump Stations

Attach an approved materials list, update doc accordingly.

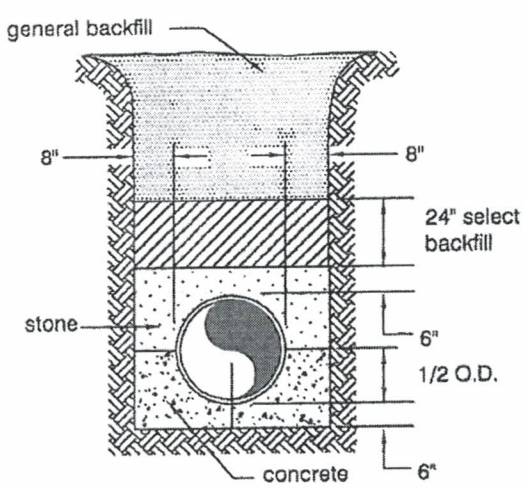
6. CONSTRUCTION DETAILS

- 1 - Trench & Bedding
- 2 - Concrete Thrust Blocking
- 3 - Highway Crossing
- 4 - Stream Crossing
- 5 - ¾" and 1" Meter Installation
- 6 - 1 ½" and 2" Meter Installation
- 7 - 3" through 8" Meter Installation
- 8 - Gate Valve
- 9 - Fire Hydrant Assembly
- 10 - Blow-off Assembly
- 11 - Combination Air Release and Vacuum Valve Vault
- 12 - Standard Manhole
- 13 - Drop Manhole
- 14 - New Manhole on Existing Line
- 15 - Gravity Sewer Service Lateral
- 16 - Force Main Sewer Service Lateral
- 17 - Sewer Cleanout
- 18 - Sewer Metering Station
- 19 - Sewer Pump Station — Design Data
- 20 - Sewer Pump Station — Typical Wiring Diagram
- 21 - Suction Lift Sewer Pump Station — Plan View
- 22 - Suction Lift Sewer Pump Station — Section View
- 23 - Suction Lift Sewer Pump Station — Wet Well Cover
- 24 - Grinder Sewer Pump Station — Plan View
- 25 - Grinder Sewer Pump Station — Section View
- 26 - Grinder Sewer Pump Station — Electrical Controls
- 27 - Water and Sewer Line Marking System
- 28 - Concrete Pier and Water/Sewer Crossing Detail
- 29 - Restrained Joints — Valves and Dead Ends
- 30 - Restrained Joints Horizontal Bends
- 31 - Restrained Joints — Vertical Bends
- 32 - Sewer Pump Station Bypass
- 33 - Manhole Connection for Steep Pipe Slope (17% or Greater)
- 34 - Sewer Lateral for Main with Cover Greater than 15 Feet
- 35 - Double-Gate Fencing Detail for Pump Stations

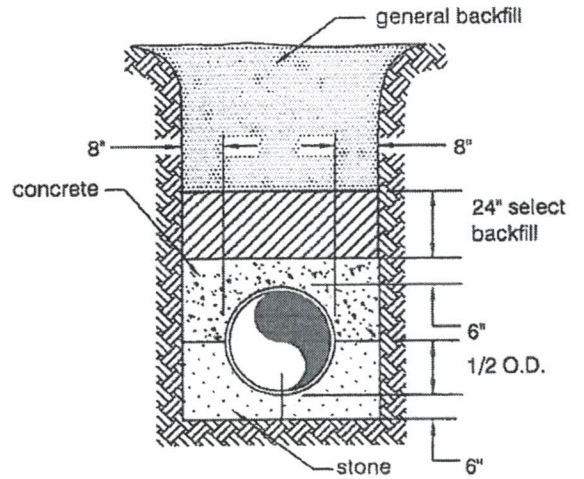


All backfill to be compacted to 95% of ASTM D698 maximum density.

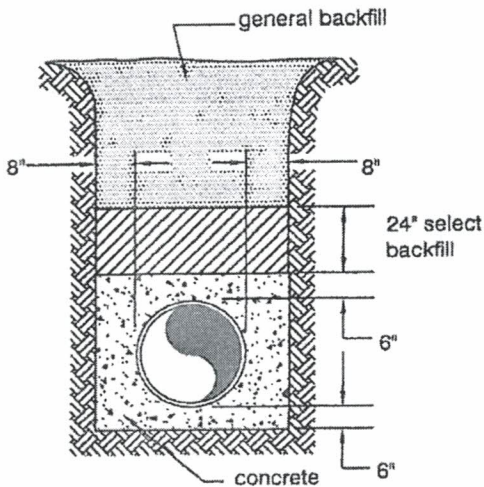
STANDARD



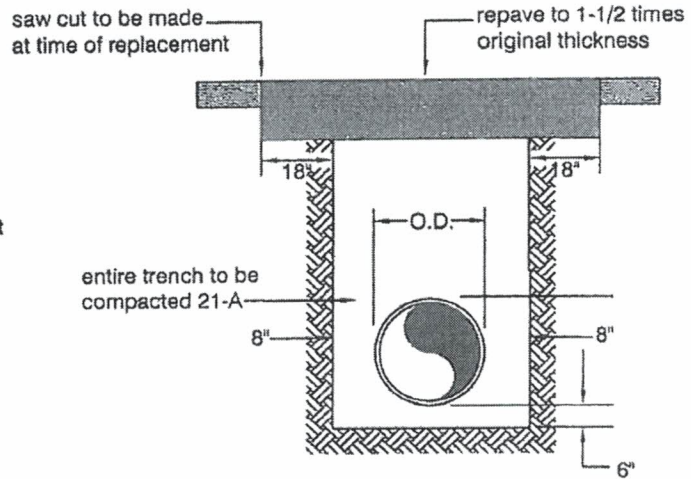
CONCRETE CRADLE



CONCRETE ARCH

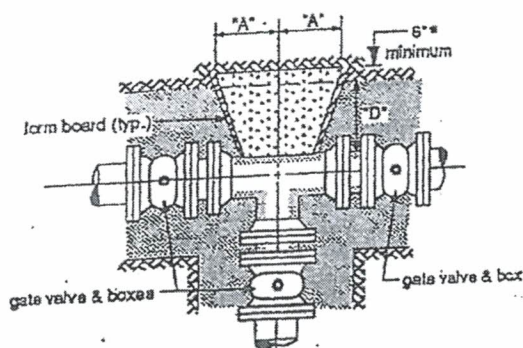


CONCRETE ENCASEMENT



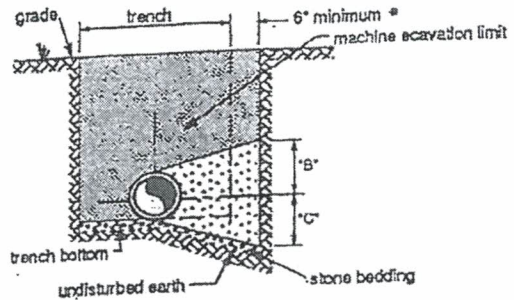
V.D.O.T. PAVEMENT REPLACEMENT

TRENCH & BEDDING



TEE, WYE, OR PLUG

In lieu of wood forming the fitting may be wrapped with polyethylene, and the concrete poured to completely surround the fitting and against undisturbed soil. The bearing dimensions against undisturbed soil shall remain as shown.

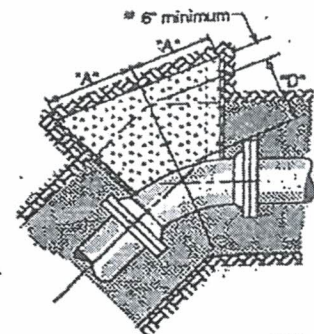


TYPICAL SECTION

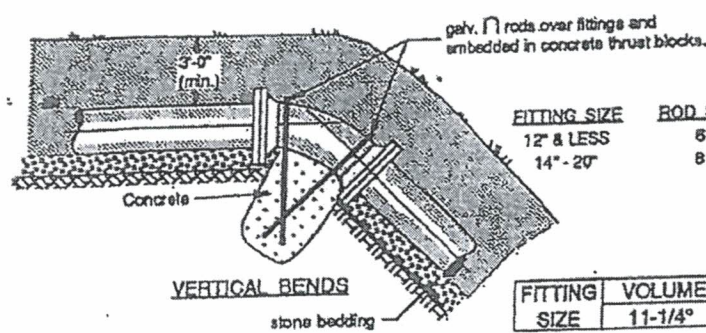
* denotes hand excavation
 "D" = 12" min. for 10" and smaller pipe
 "D" = 18" min. for 12" thru 20" pipe
 see chart below for A, B, C dimensions.

CONCRETE DIMENSIONS FOR HORIZONTAL THRUST BLOCKS

Pipe Dia.	Plugs, Wyes & Tees			11 1/4° and 22 1/2° Bends			45° and 90° Bends		
	A	B	C	A	B	C	A	B	C
6"	1'-0"	0'-9"	1'-3"	0'-9"	0'-9"	0'-9"	1'-3"	0'-9"	1'-9"
8"	1'-3"	0'-9"	1'-9"	0'-9"	0'-9"	0'-9"	1'-5"	0'-9"	2'-3"
10"	1'-5"	0'-9"	2'-3"	1'-0"	0'-9"	1'-3"	1'-9"	0'-9"	2'-6"
12"	1'-9"	1'-0"	2'-6"	1'-3"	1'-0"	1'-6"	2'-0"	1'-0"	3'-0"
14"	2'-0"	1'-0"	3'-0"	1'-3"	1'-0"	1'-6"	2'-6"	1'-0"	4'-0"
16"	2'-3"	1'-0"	3'-5"	1'-5"	1'-0"	2'-0"	2'-9"	1'-0"	4'-6"
18"	2'-6"	1'-3"	3'-9"	1'-6"	1'-3"	2'-0"	3'-0"	1'-3"	4'-9"
20"	2'-9"	1'-6"	4'-0"	1'-9"	1'-6"	2'-0"	3'-3"	1'-6"	5'-0"



11 1/4° THRU 90° BENDS

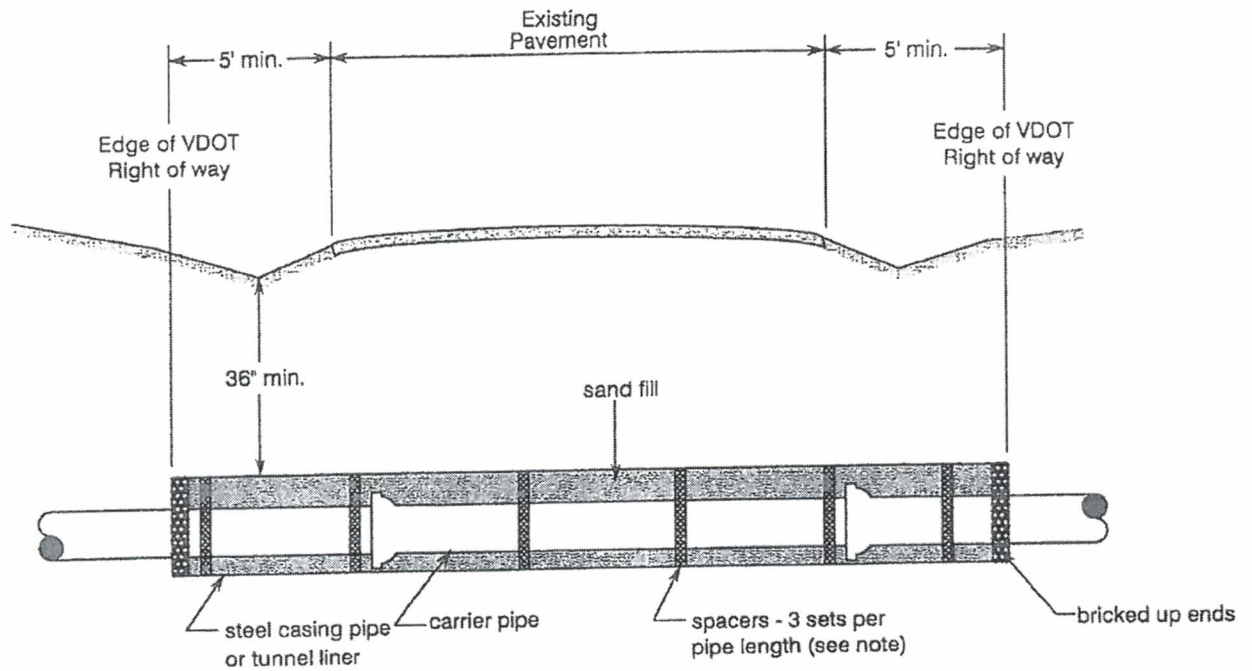


FITTING SIZE	ROD SIZE	NO. RODS	EMBEDMENT
12" & LESS	6	2	30"
14" - 20"	8	2	36"

FITTING SIZE	VOLUME OF THRUST BLOCK IN CU. YD.			
	11-1/4°	22-1/2°	45°	90°
6"	-	-	-	1.3
8"	-	-	1.1	2.3
10"	-	-	1.8	3.7
12"	-	1.2	2.8	5.5
14"	0.5	1.7	3.9	7.6
16"	0.9	2.3	5.1	-
18"	1.4	3.2	6.3	-
20"	2.2	4.5	7.8	-

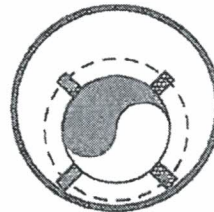
THRUST BLOCKS FOR VERTICAL UP BENDS SHALL BE THE SAME AS FOR HORIZONTAL BENDS.

CONCRETE THRUST BLOCKING
 Figure 2



SIZES REQUIRED

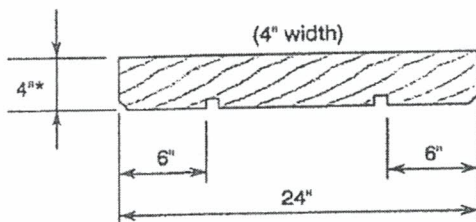
CARRIER PIPE Dia. (")	CASING PIPE Dia. (")	Wall Thickness (")
4 or less	12	.250
6	16	.250
8	18	.375
10	20	.375
12	24	.375
14	24	.375
15	24	.375
16	30	.500
18	30	.500
20	36	.500
21	36	.500
24	36	.500



SECTION

NOTES:

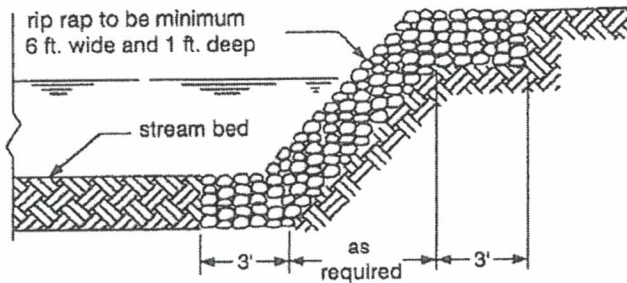
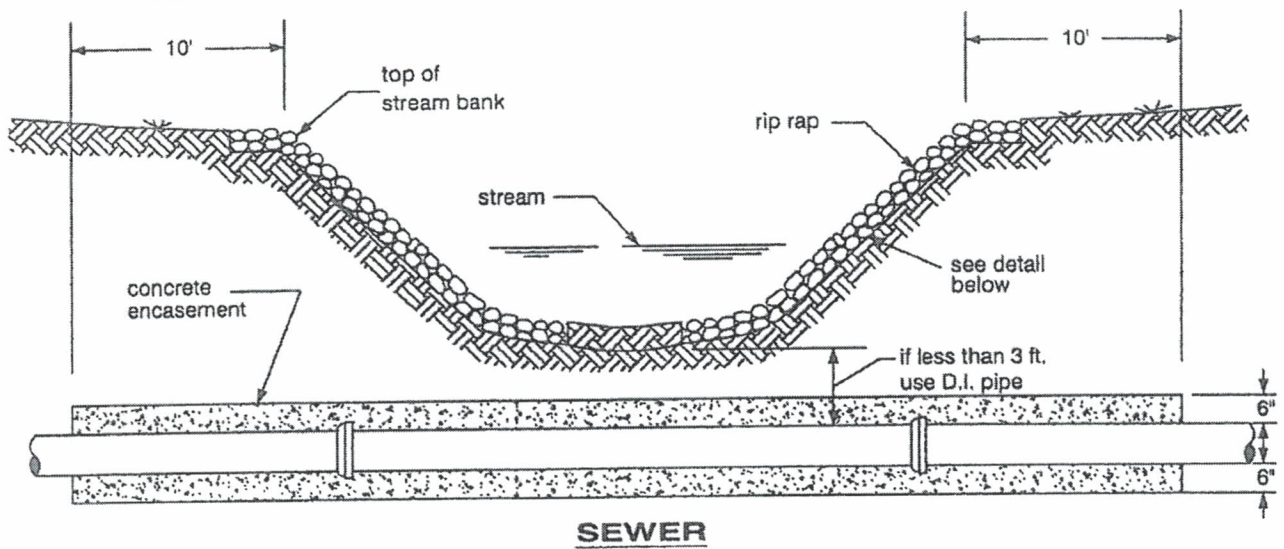
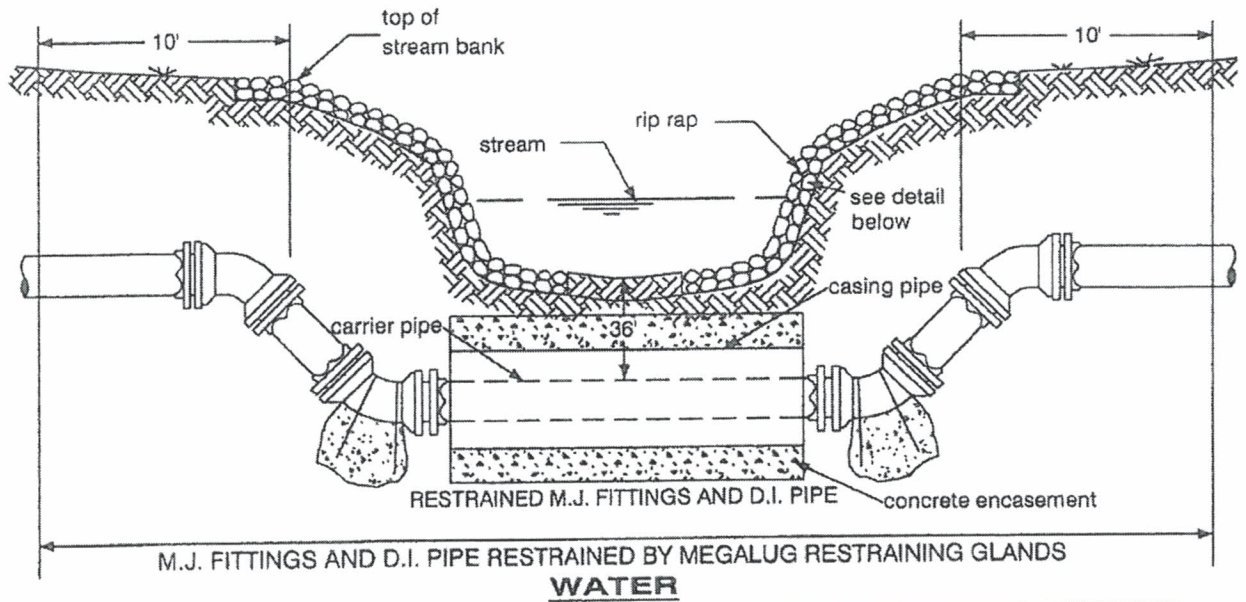
- Separation of carrier pipe from casing pipe shall be by either manufactured steel and/or plastic casing spacers or pressure treated lumber fastened to piping by stainless steel strapping.
- WATER SERVICE LATERALS
 - Casing pipe shall be SCH 40 PVC or SDR 21
 - 3" diameter pipe for 3/4" & 1" service lines
 - 6" diameter pipe for 2" service lines
 - No spacers or sand fill to be installed



TIMBER SKID

* height can be adjusted to obtain correct percent slope

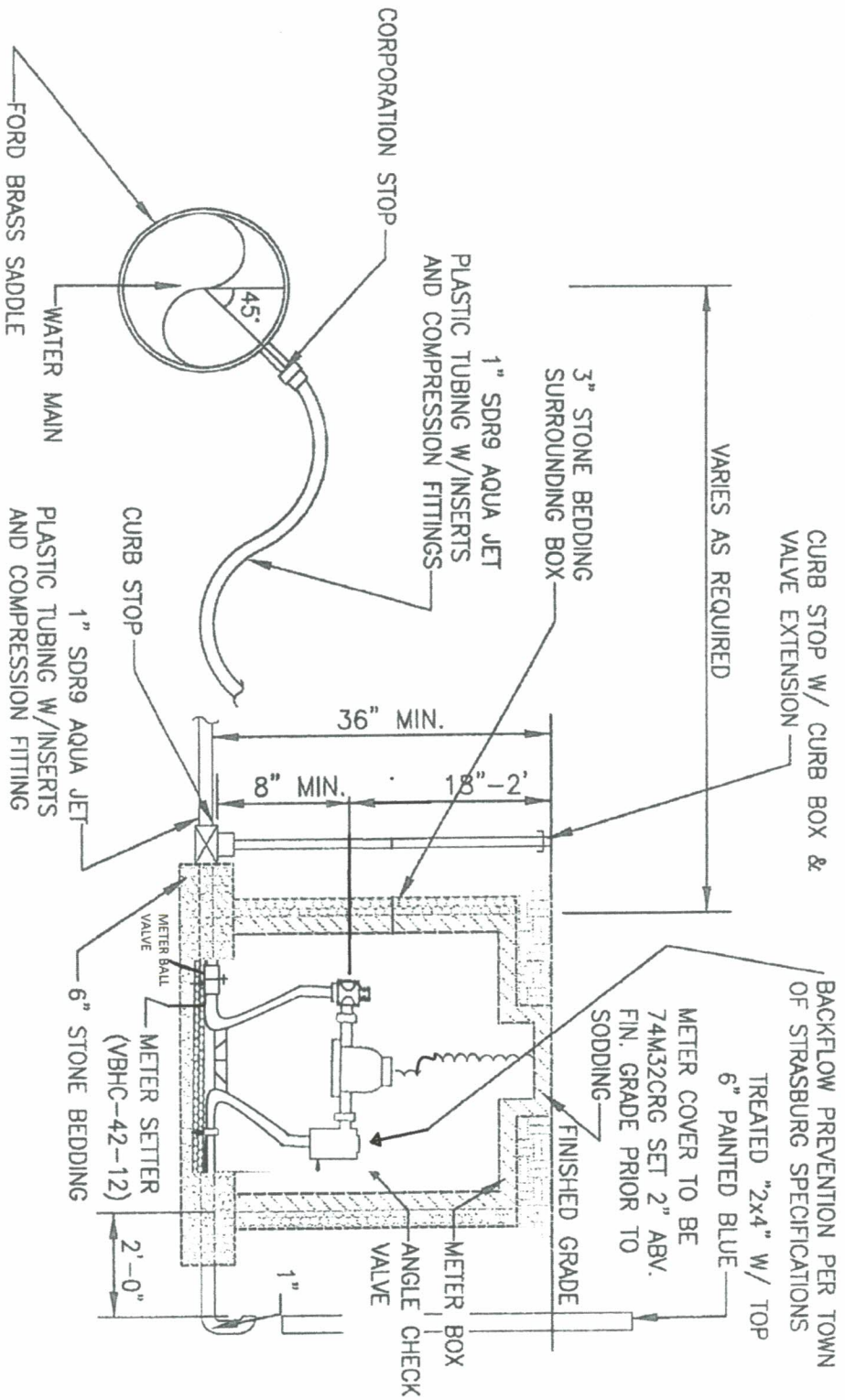
HIGHWAY CROSSING



DETAIL

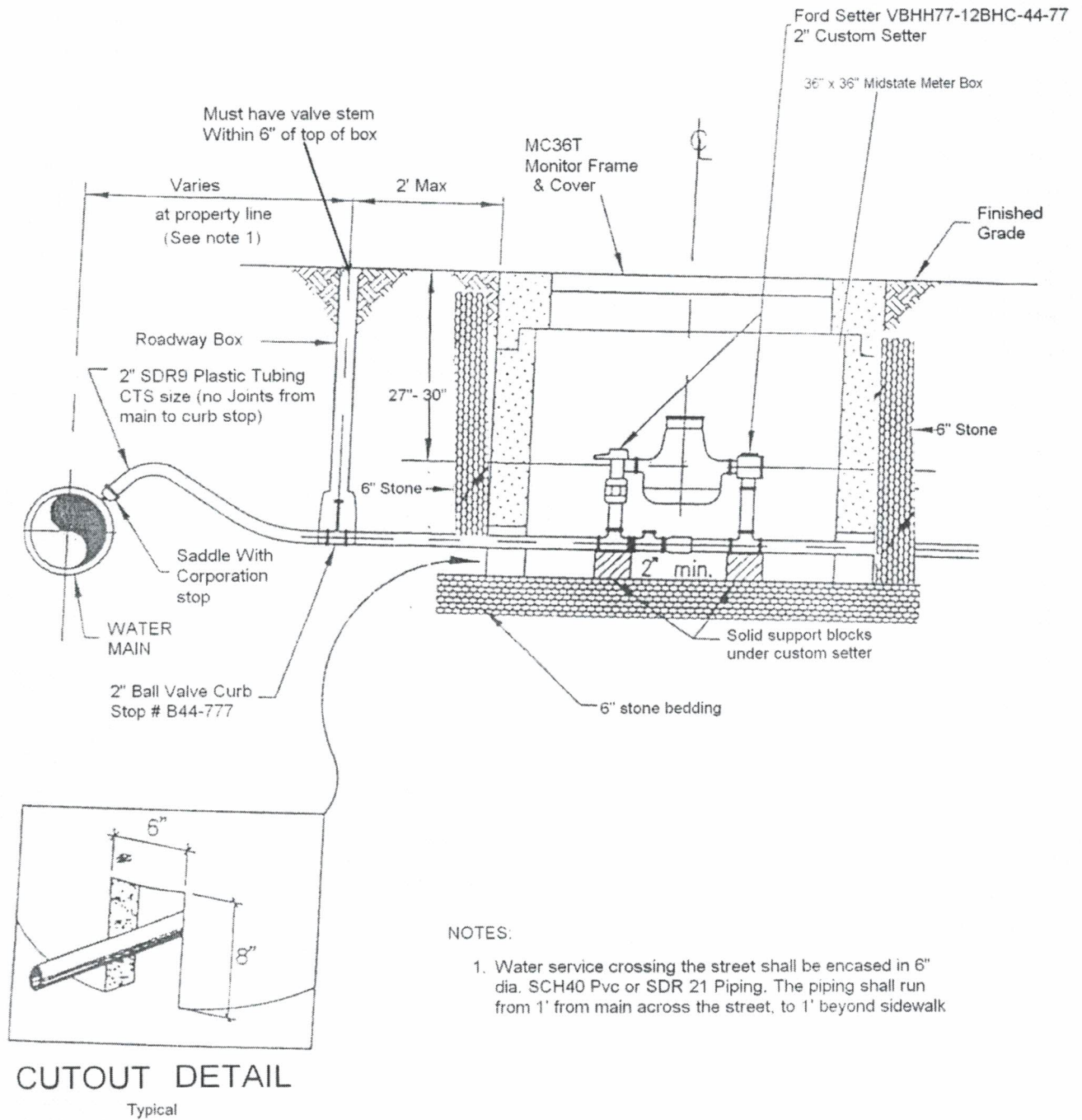
STREAM CROSSING

- INSTALLATION NOTES:
1. EXACT LOCATION OF METER BOX ASSEMBLY TO BE APPROVED PRIOR TO INSTALLATION.
 2. WATER SERVICE CROSSING STREET SHALL BE ENCASED IN SCH40 PVC OR SDR21 PIPING. THE PIPING SHALL RUN FROM ONE FOOT BEYOND SIDEWALK, ACROSS THE STREET TO ONE FOOT BEYOND THE SIDEWALK.



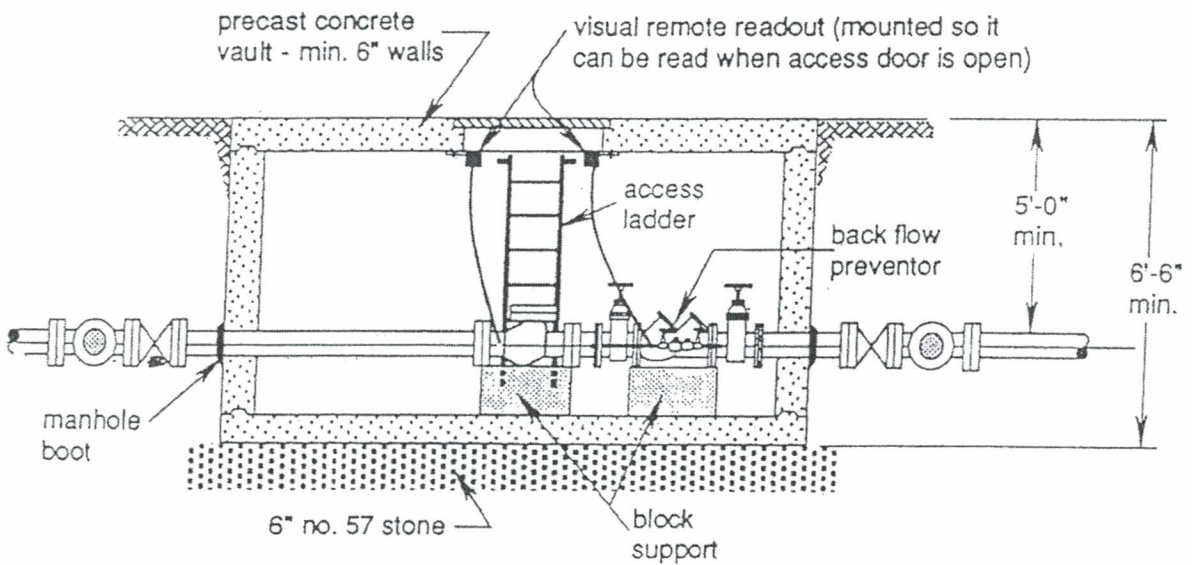
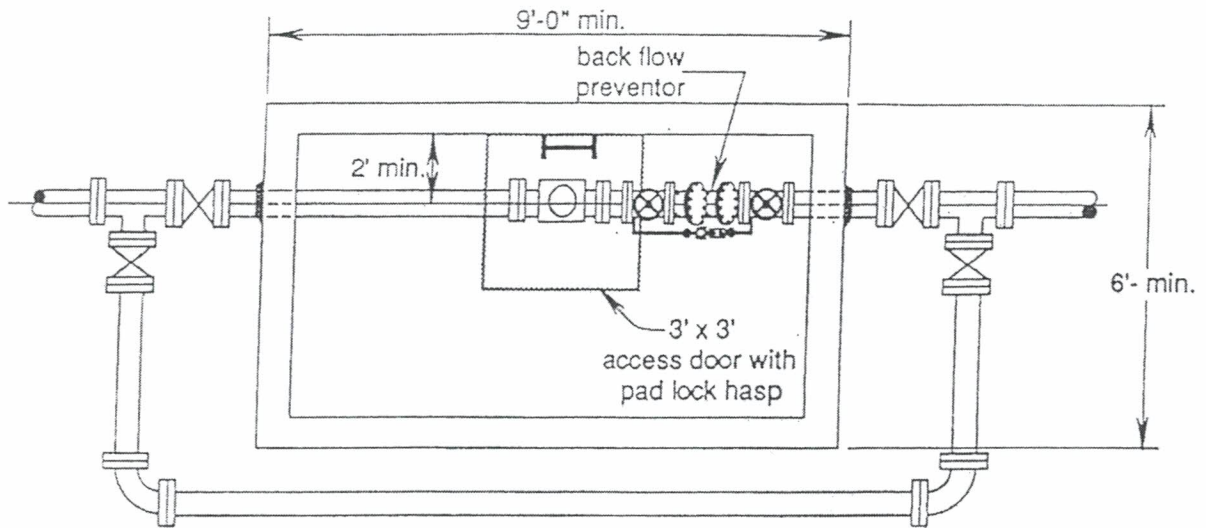
3/4" & 1" METER INSTALLATION

Town of Strasburg



1 1/2 & 2" Meter Installation

Figure 6

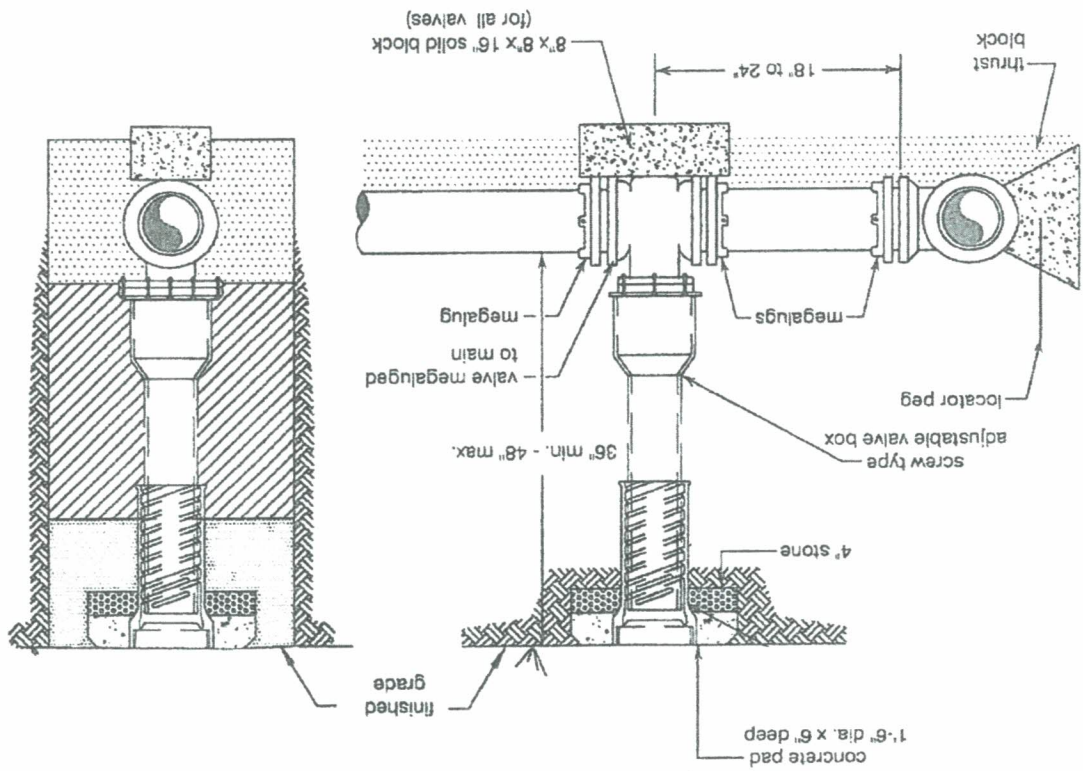


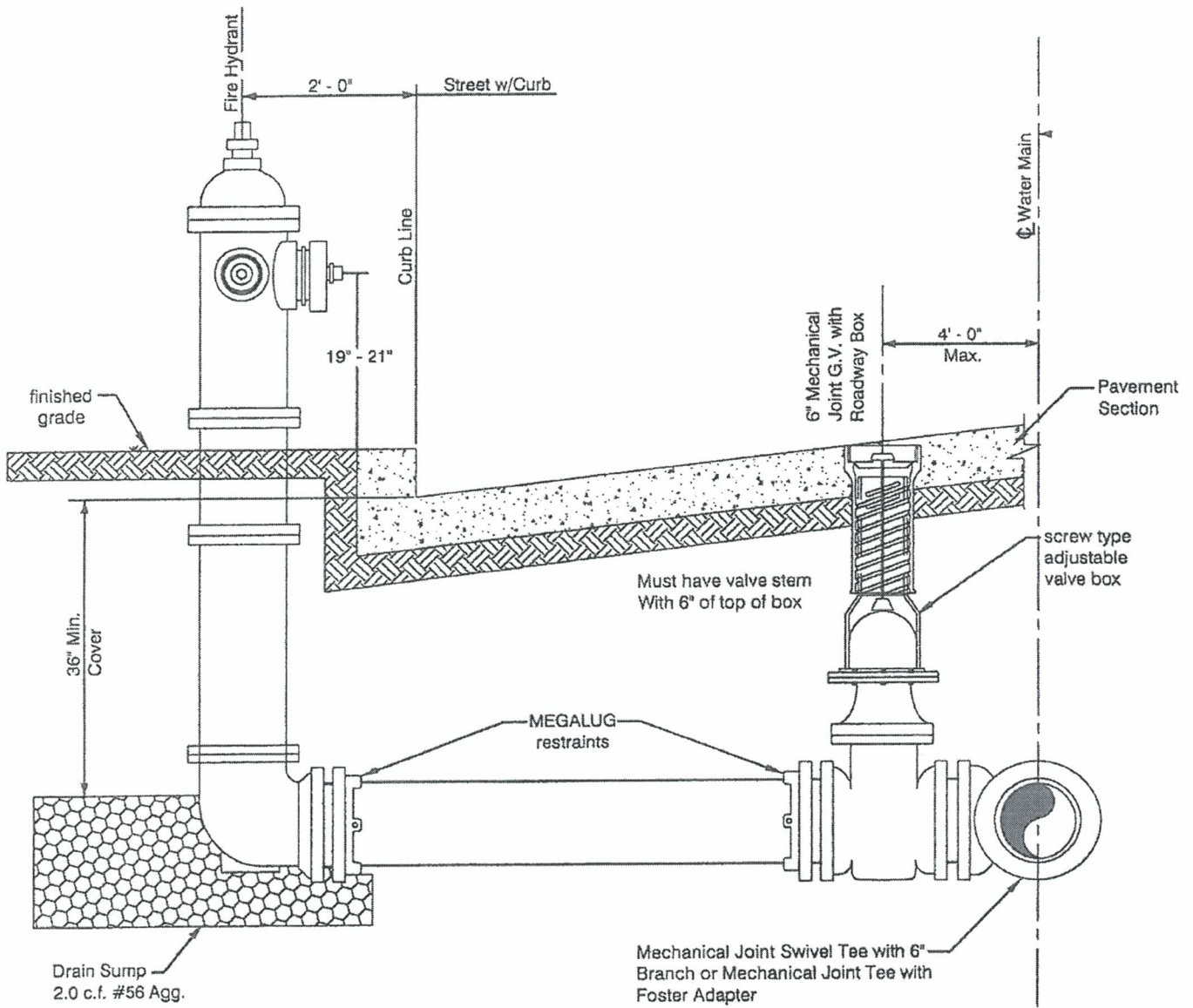
No standing water
In vault must be
drained or pumped.

3" THROUGH 8" METER INSTALLATION

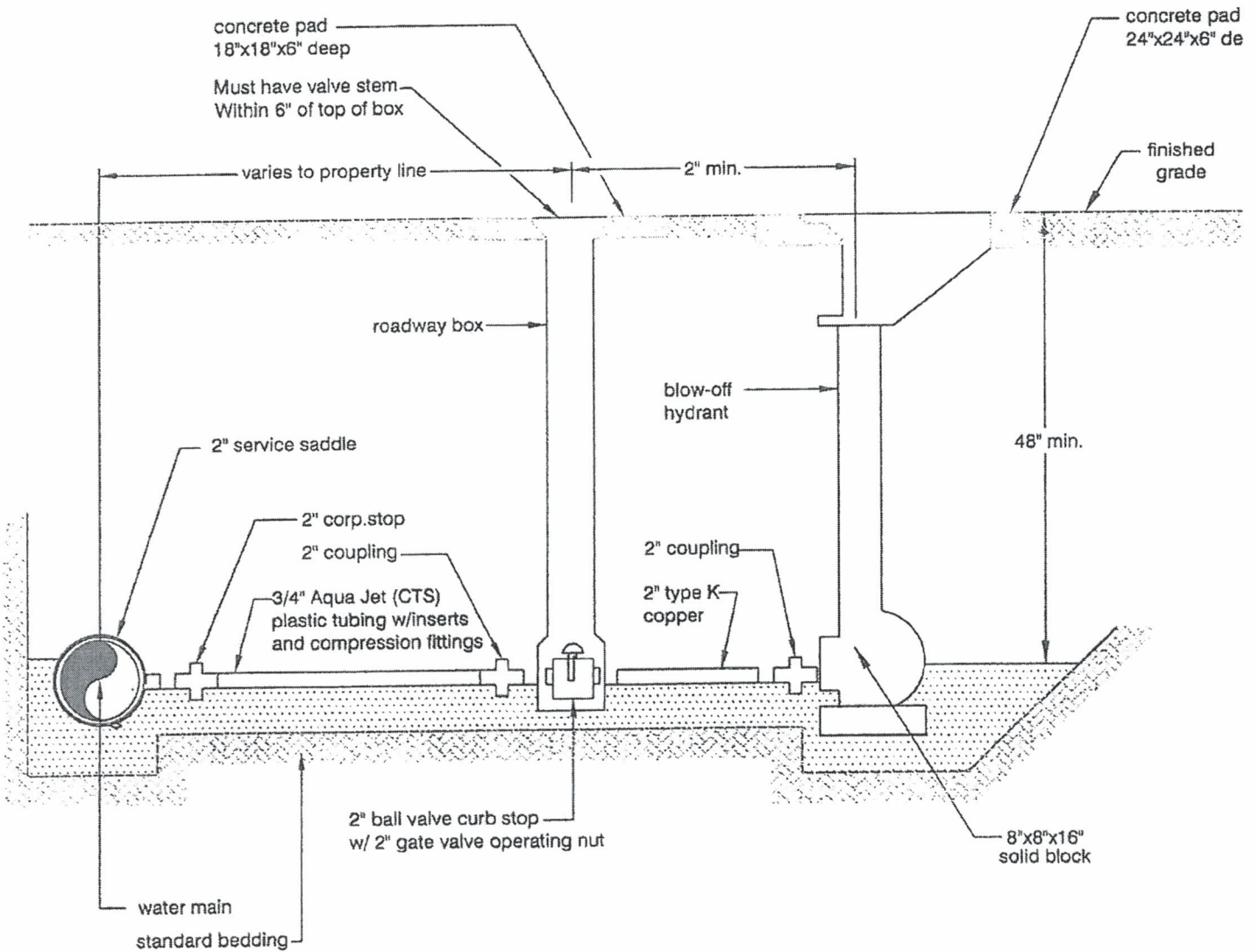
Figure 7

GATE VALVE DETAIL

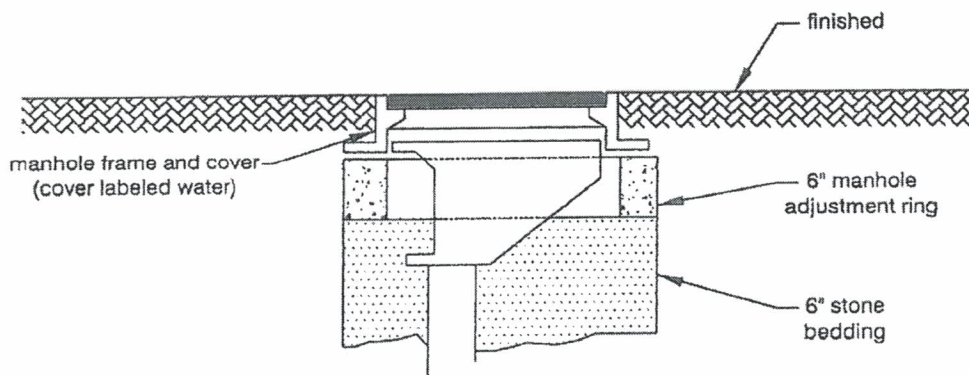




FIRE HYDRANT ASSEMBLY

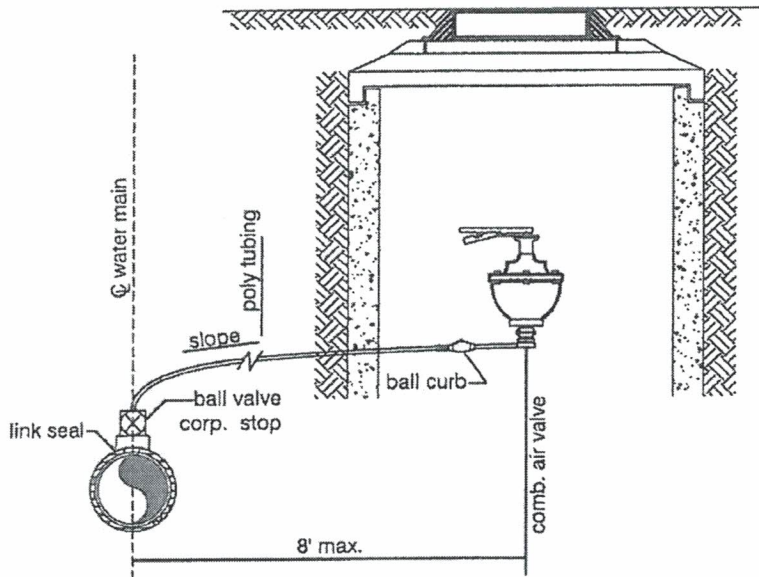


NOTE: IN TRAFFIC AREA BLOW-OFF HYDRANT TO BE SET UNDER MANHOLE FRAME AND COVER.



BLOW-OFF ASSEMBLY

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NOTES:
 METER BOX: 36" X 36" PVC
 LID: MC36T WITH 4 - 3/4" DRILLED HOLES
 COMBINATION AIR VALVE:
 1" VM201C FOR 6" & 8" MAINS
 2" VM202C FOR 10" TO 16" MAINS

CORPORATION STOP: FORD, FB1000 SERIES
 BALL CURB VALVE: FORD, B44 SERIES
 SADDLE:
 FORD, S - 90 SERIES FOR PVC PIPE
 FORD, S - 202 SERIES FOR DIP

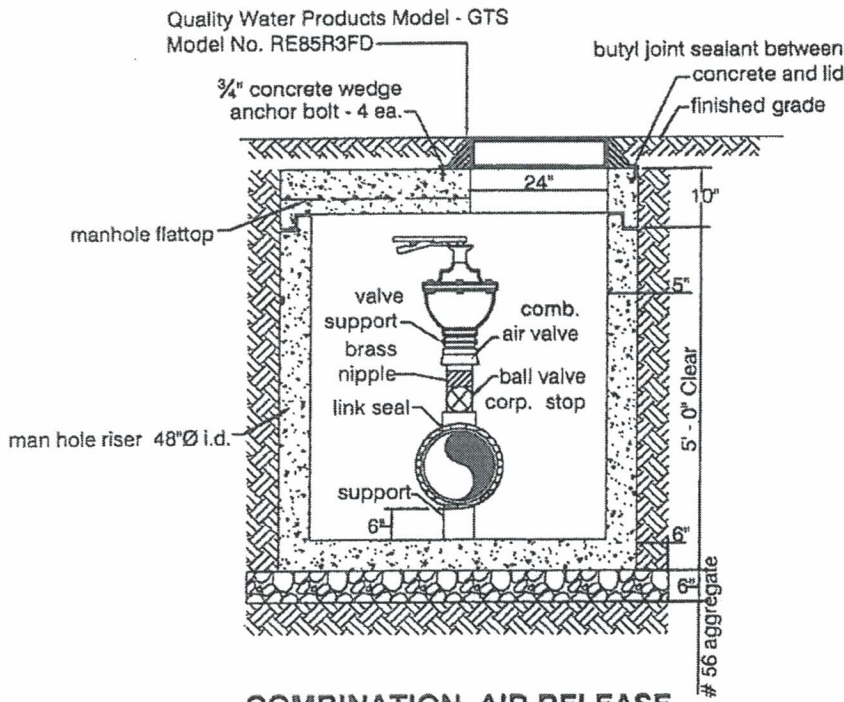
MANHOLE: 4' - 0" I.D., ASTM C - 478, TYPE II CEMENT, PRE-CAST REINF. CONC., T & G JTS., RUBBER RING GASKET AND FLAT TOP. 16" EXTRUDED ALUM. OR 1/2" STL. ENCASED IN RUBBER OR POLYPROPYLENE STEP @ 12" SPG.

FLAT TOO: HAVE EMBEDDED INSERTS (20-GA., 3" ANCHOR, FOR 5/8" BOLT HEAD) TO ANCHOR F & C. #4 @ 6" MIN., REINF. WITH TWO DIAG. BARS AT OPNG.

FRAME & COVER : DESIGN FOR " H-S" NEENAH R1642 MARKED WATER.

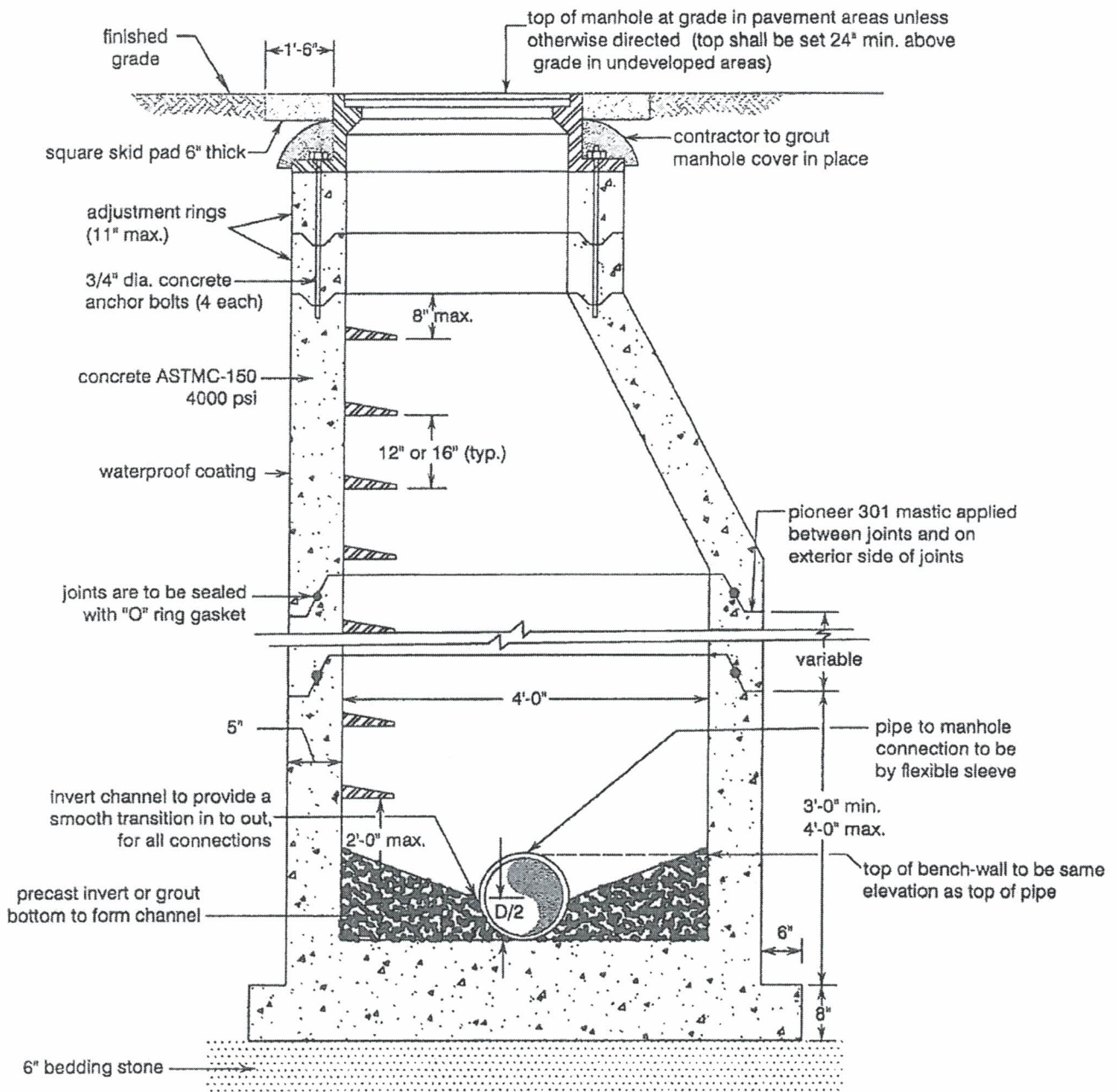
VALVE SUPPORT: L 1 1/2" X 1 1/2" X 1/4" WITH 1/4" U-BOLT ANCHOR ANGLE TO MH WALLS WITH 1/2" CONCRETE ANCHORS

PIPE SUPPORT: CMU



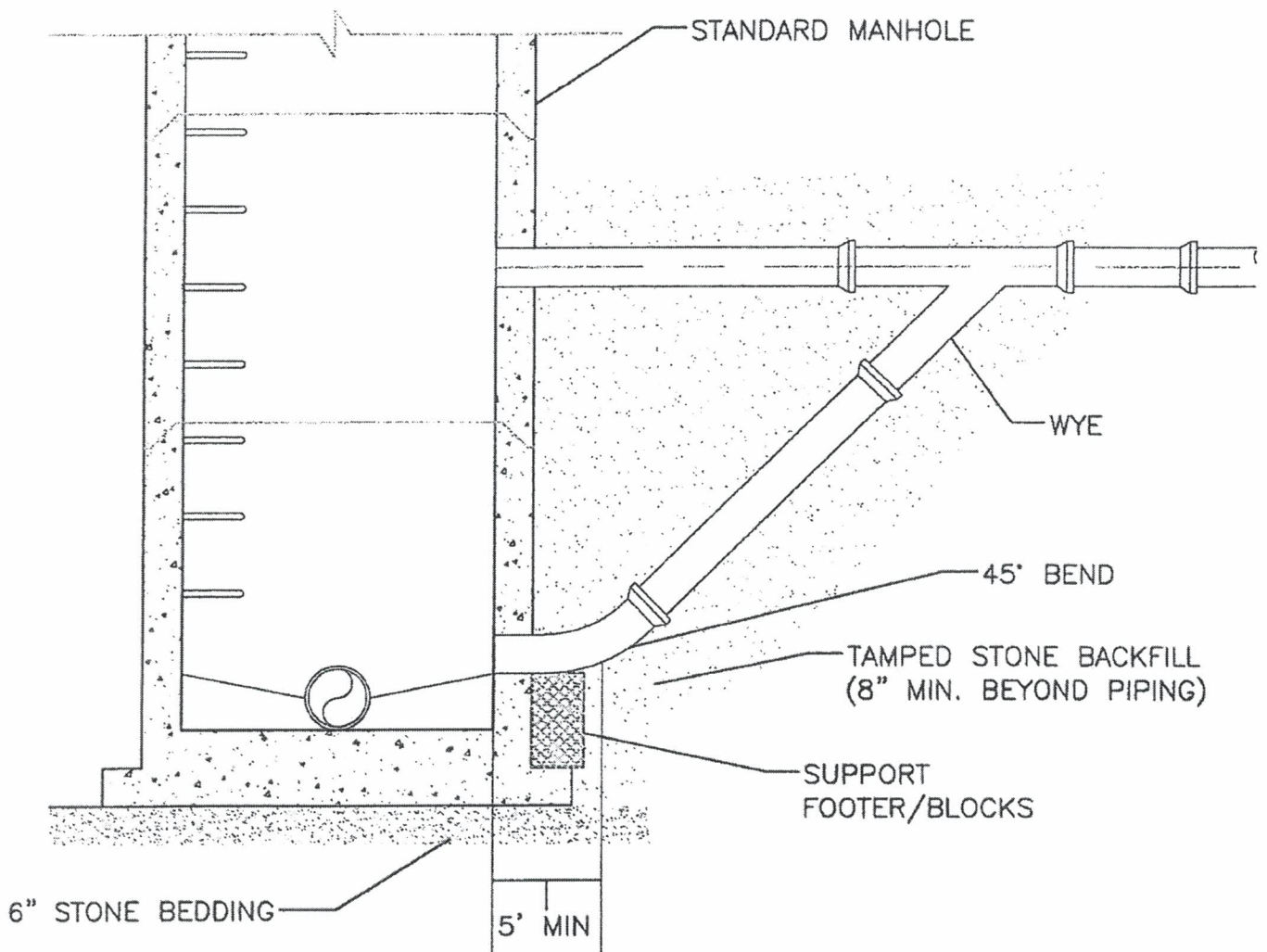
COMBINATION AIR RELEASE AND VACUUM VALVE VAULT

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- NOTES :
1. Manhole sections shall have an external coating of approved polymer film water proofing prior to installation.
 2. If adjustment elevation exceeds two inches use concrete adjustment rings with an exterior coating of bitumastic water proofing.
 3. Final slope adjustment of manhole frame shall be by shims and non-shrink grout.
 4. Skid pad to be placed around manholes located in shoulders of roads.
 5. Flat top casting shall be used on shallow manhole (six feet or less) installations.

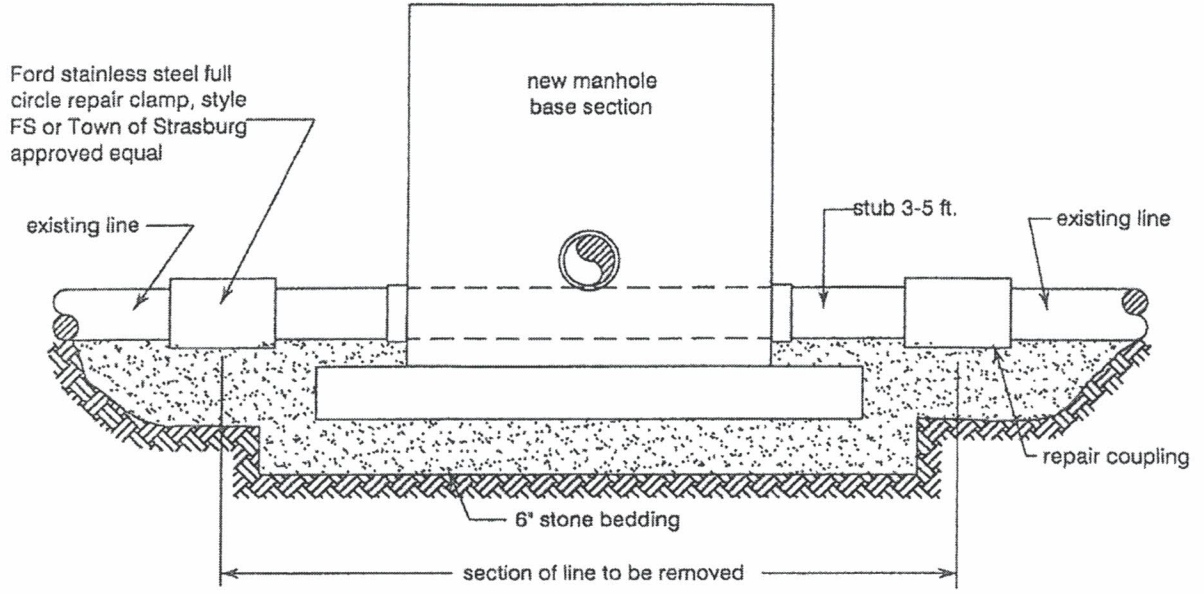
STANDARD MANHOLE



NOTE:

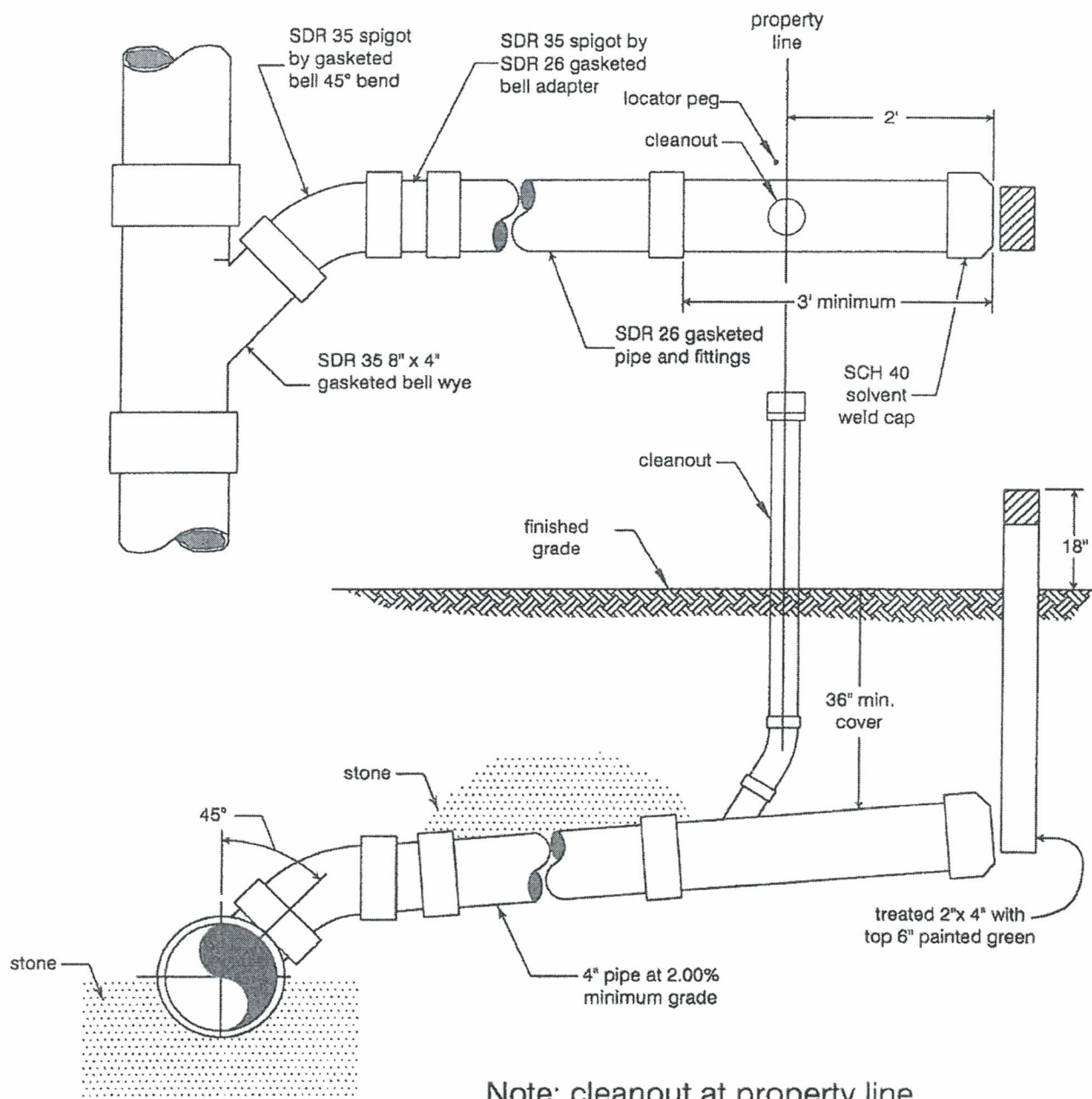
1. Fittings and Pipe for drop to be the same size as incoming sewer
2. Premanufactured inside drops may be used in a minimum 6' diameter manhole at a depth of up to 8' After 8' the manhole shall be 10' diameter.
3. Premanufactured drops shall be installed in accordance to manufacturers specifications.

DROP MANHOLE



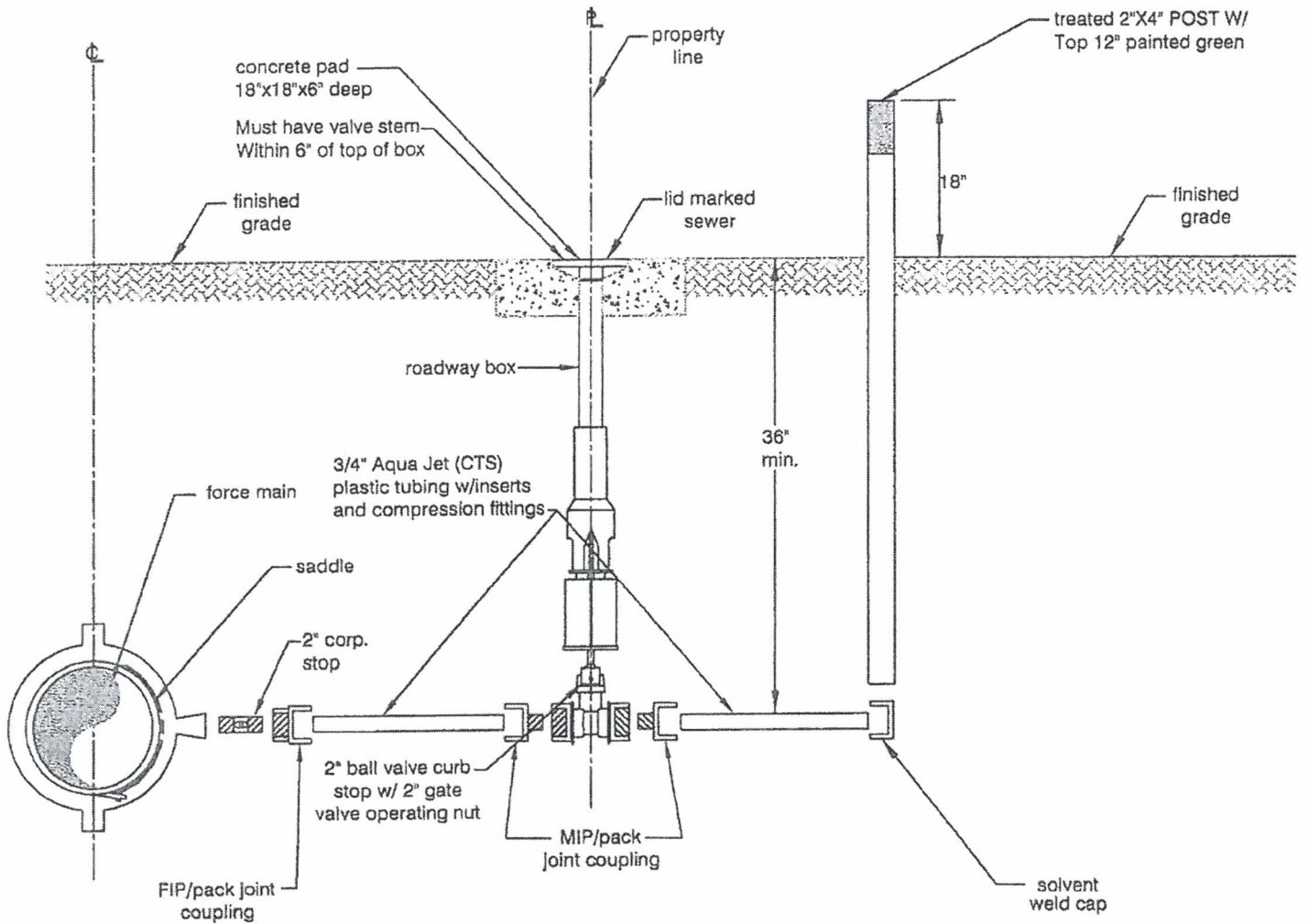
**CUT IN
STANDARD INSTALLATION**

NEW MANHOLE ON EXISTING LINE

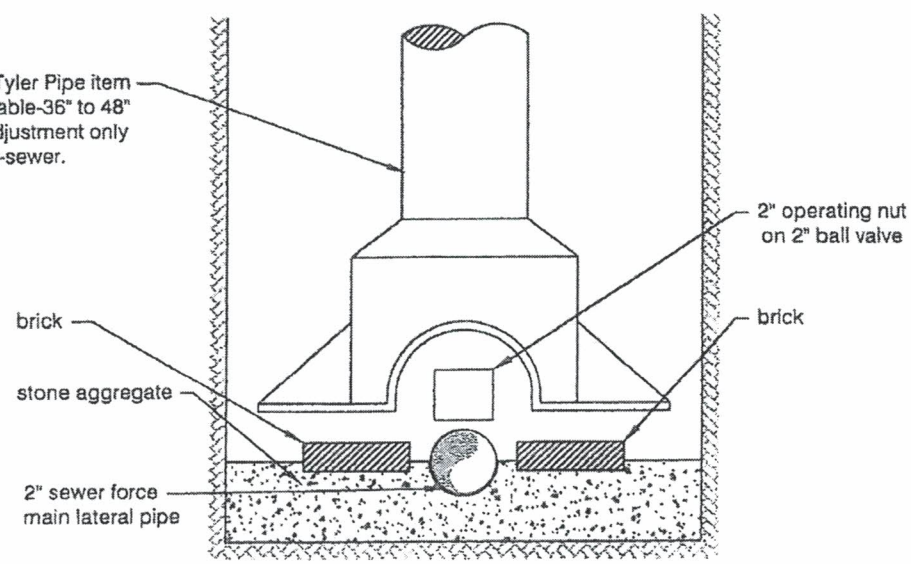


Note: cleanout at property line
(see Figure 17)

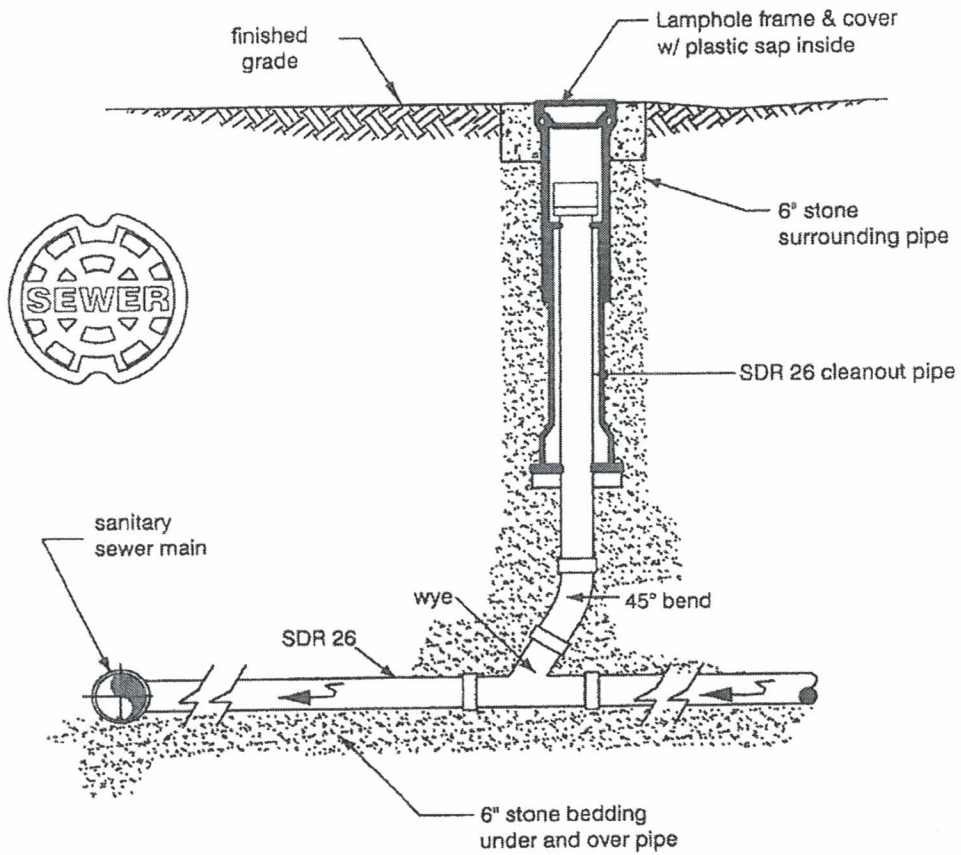
GRAVITY SEWER SERVICE LATERAL



roadway box by Tyler Pipe item
 no. 143- R adjustable-36" to 48"
 threaded shaft adjustment only
 lid marked-sewer.



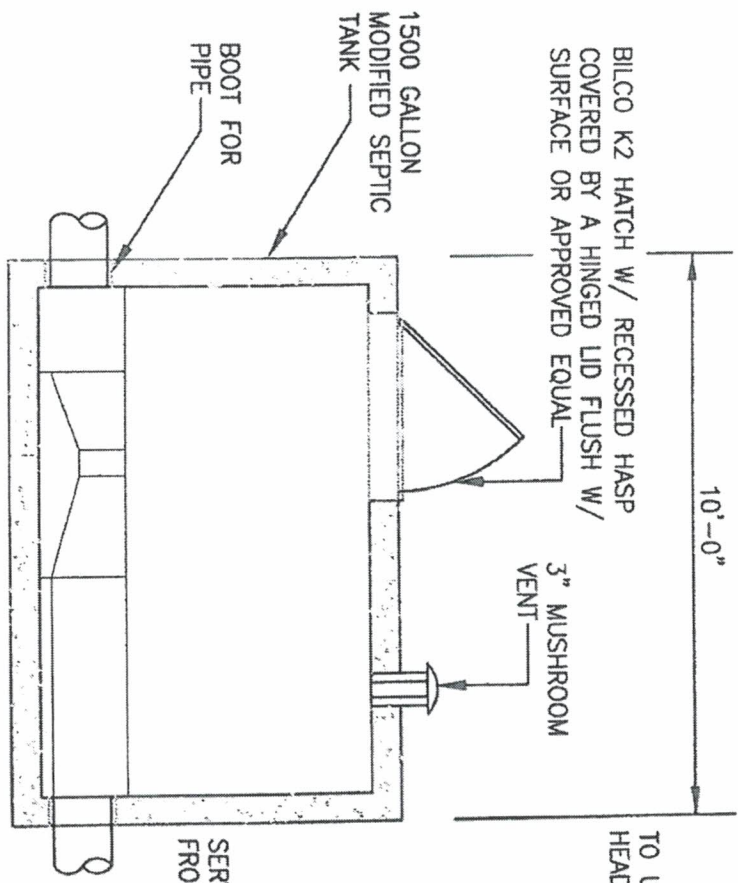
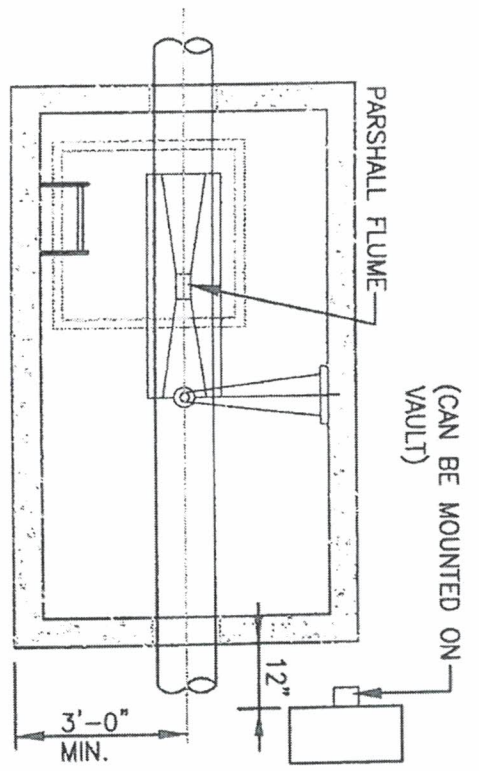
SEWER FORCE MAIN SERVICE LATERAL



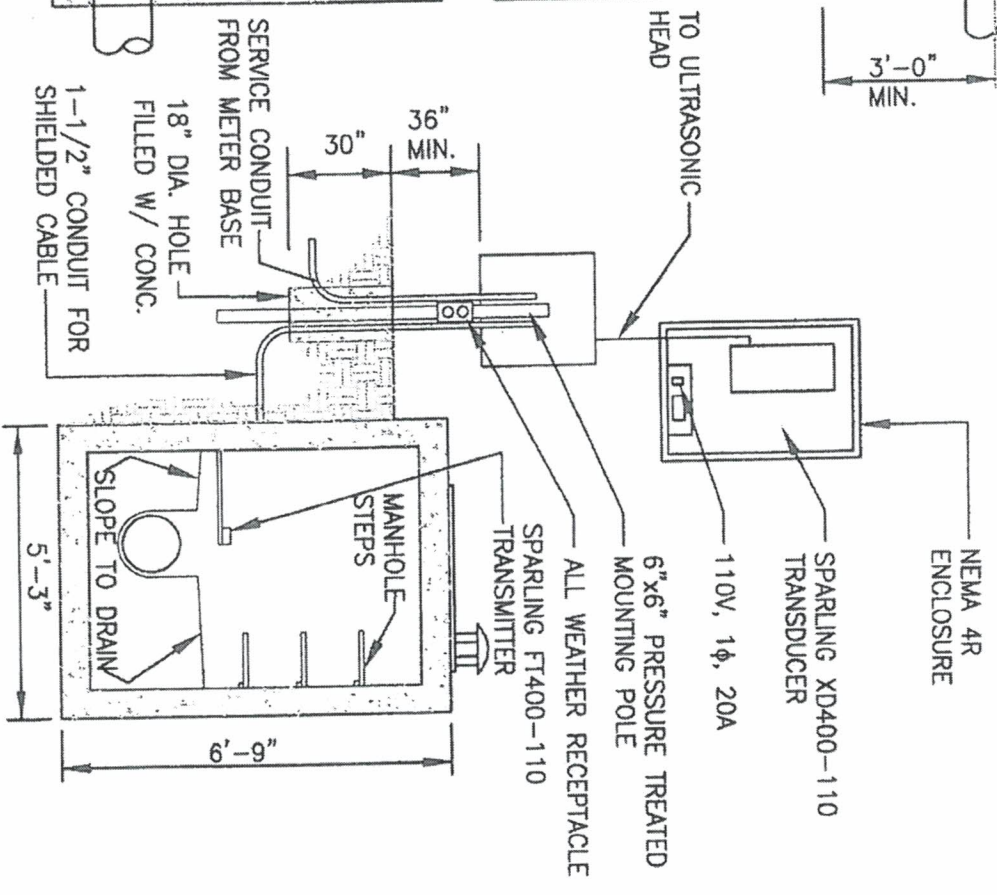
NOTES:

- 1) ALL SERVICE LATERALS MUST HAVE A CLEANOUT ASSEMBLY AT EVERY PROPERTY LINE.

SEWER CLEANOUT



SEWER METERING STATION



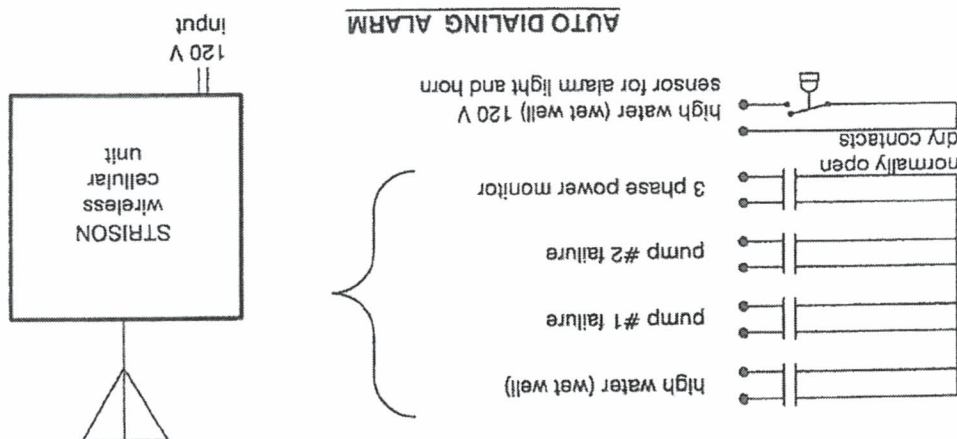
SEWER PUMP STATION DESIGN DATA

phase					
fuse amps	3				
entrance switch amps					
conduit size					
in					
gauge					
wire size (copper)					
voltage	208				
V					
ELECTRICAL DATA:					
working volume provided					gal.
bottom of wet well					ft.
pump off					ft.
1st pump on					ft.
2nd pump on					ft.
high water alarm					ft.
influent invert (lowest)					ft.
existing grade					ft.
top of station					ft.
STATION SCHEDULE:					
tdh actual					ft.
gpm actual					
impeller dia.					in.
motor bhp					
rpm					
model					
PUMPS SHALL BE SMITH & LOVELESS, BARNES, OR ABB					
PUMP MANUFACTURER: ()					
total dynamic head					ft.
total friction head loss					ft.
friction head loss					ft./100 ft.
equivalent length of force main					ft.
fitting loss					ft.
length of force main					ft.
design pumping rate					gpm
force main size (velocity between 2 - 8 fps)					in.
static head					ft.
force main discharge elevation					ft.
low water level (pump off)					ft.
DESIGN ELEMENTS:					
required working depth					ft.
(distance between pump on and pump off)					ft.
wet well diameter (6 ft. or 8 ft.)					ft.
(for one pump, running minimum of one minute)					cu. ft.
wet well volume required					

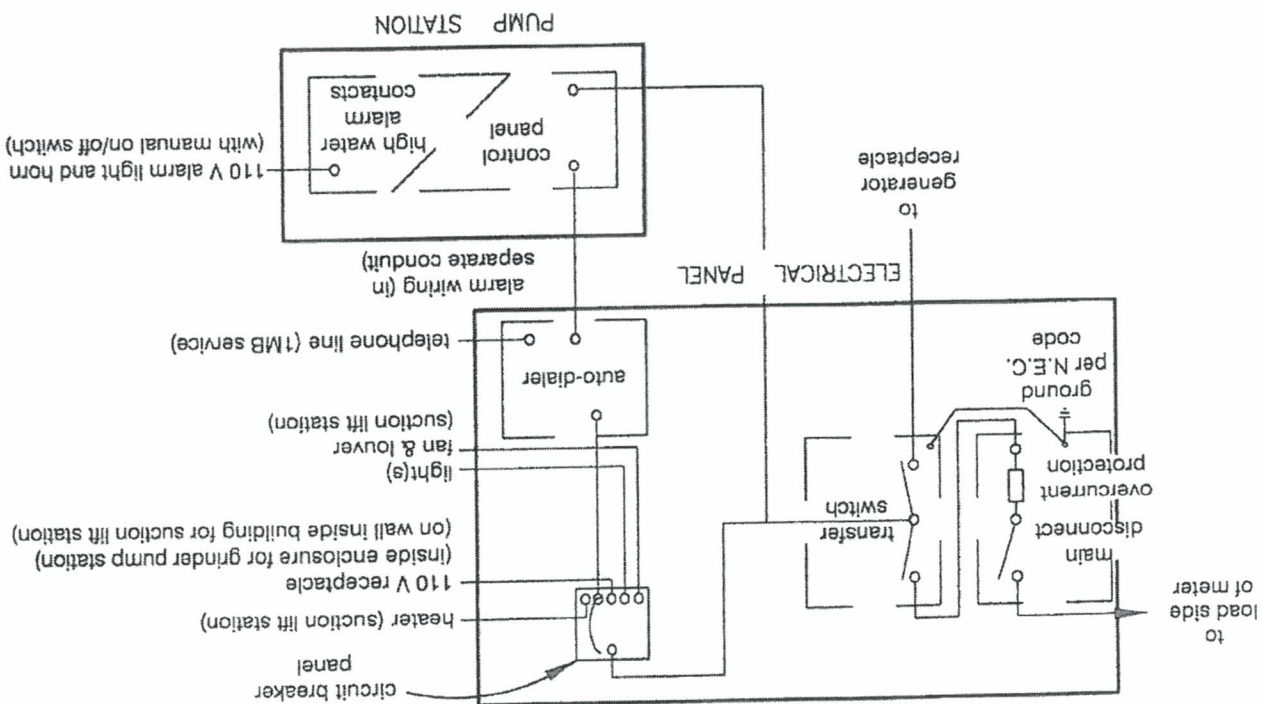
DETERMINATION OF SEWAGE FLOWS:	
total commercial acreage served	ac
estimate GLFA per acre	ea
estimated retail floor area	sq. ft.
water use per 1000 sq. ft.	gpd
total residential acreage served	ac
estimate lots/area	ea
water use per residential lot	gpd per eru
total industrial acreage served	ac
estimate employee per acre	ea
total employees served	ea
total employees served	ea
water use per employee	gal per emp per day
total commercial flow	gpd
total residential flow	gpd
total industrial flow	gpd
total flow	gpd
Average Sewage Use	gpm
Peak Design Flow (at peak factor of 2.5)	gpm

SEWER PUMP STATION TYPICAL WIRING DIAGRAMS

AUTO DIALING ALARM



OVERALL WIRING



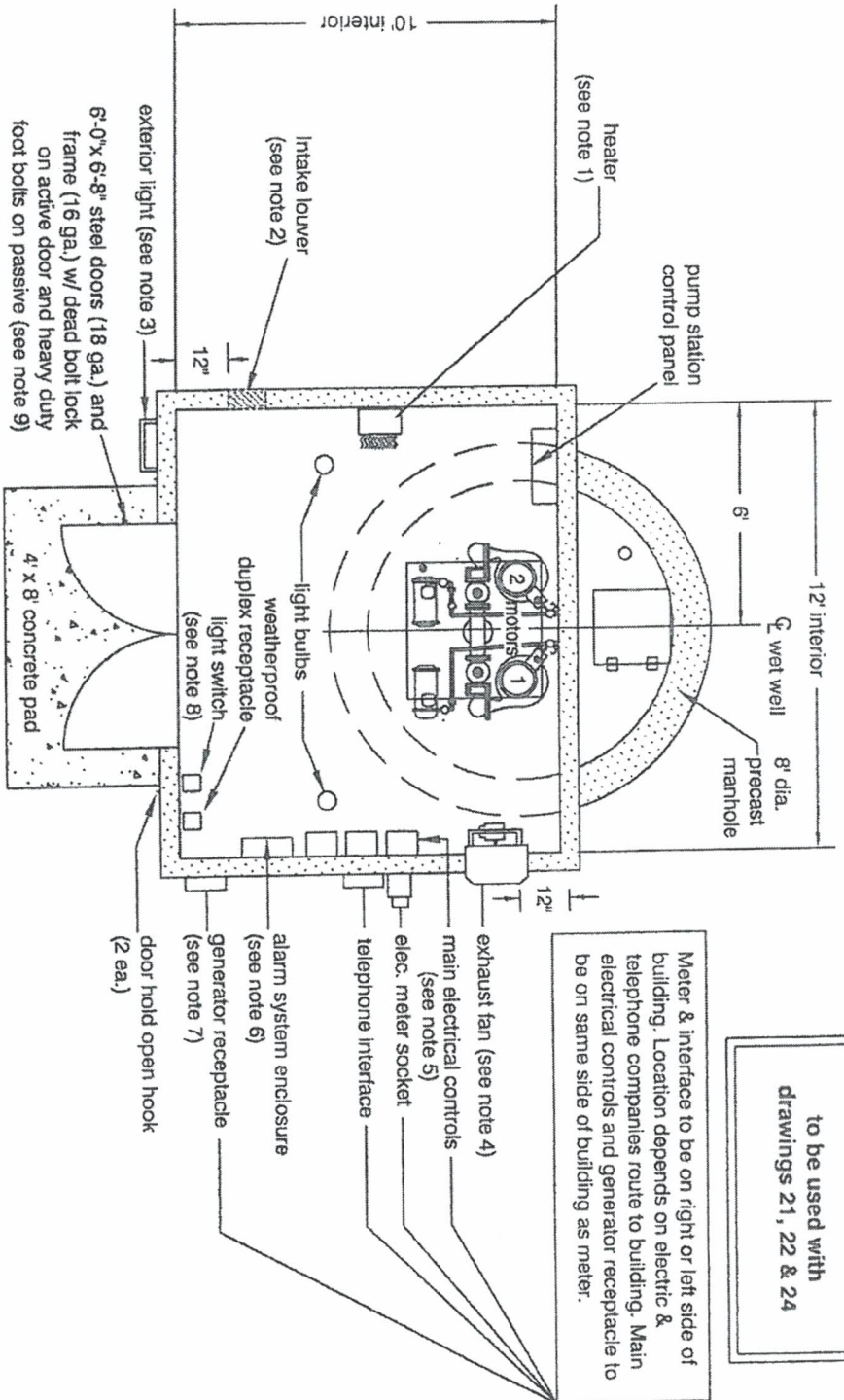
to be used with
drawings 22, 23 & 24 / 25, 26 & 27

SUCTION LIFT SEWER PUMP STATION

PLAN VIEW

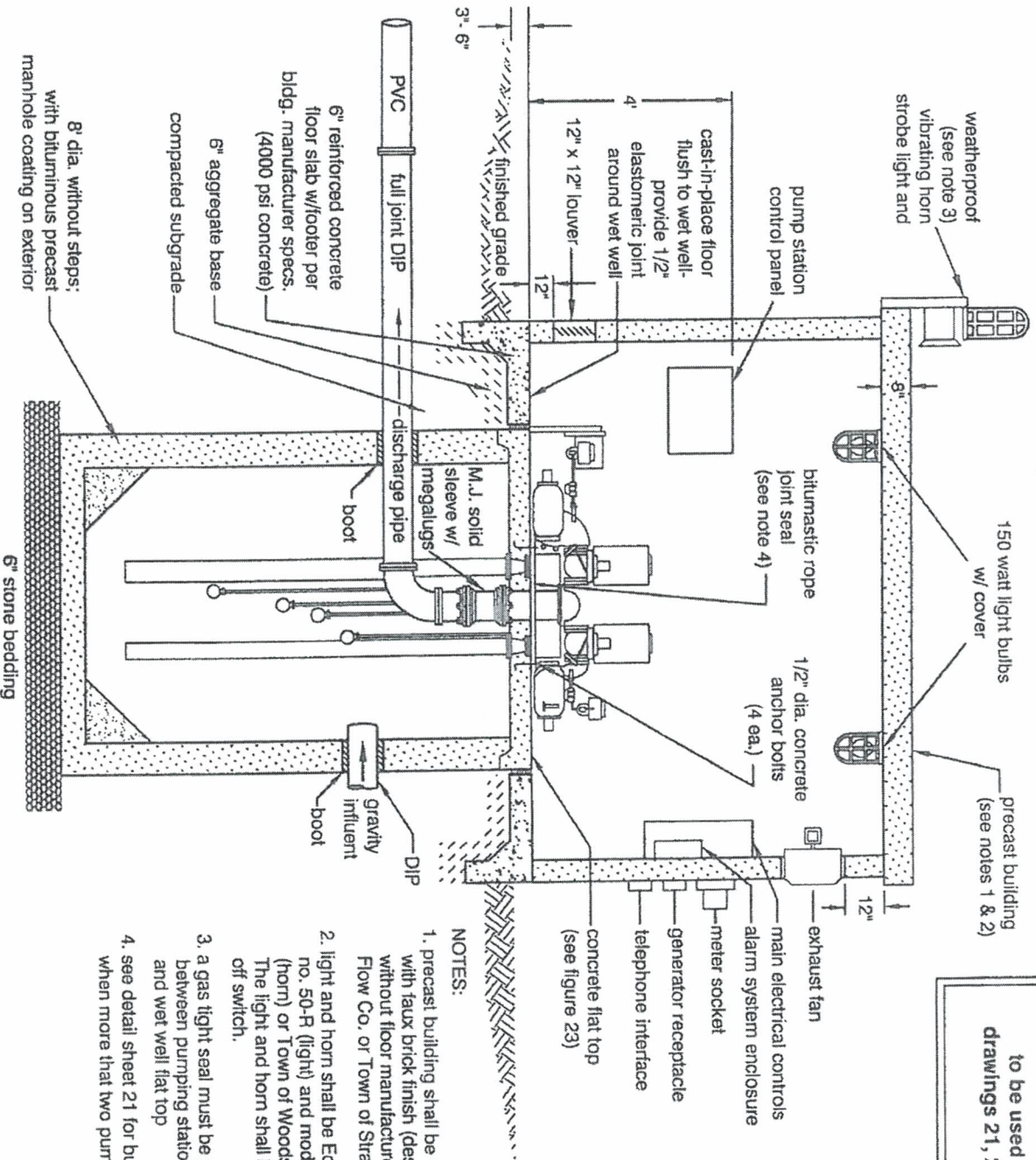
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- NOTES:
1. Heater shall be Market model F3422, or Town approved equal. Provide with integral thermostat and surface mount accessories.
 2. Louver shall be Ruskinn model L745 (18"x18") or Town approved equal. Electric operator for louver shall be interlocked with exhaust fan.
 3. Exterior light shall be American Electric, model E52-70C, or Town of Strasburg approved equal.
 4. Exhaust fan shall be Airmaster shutter fan catalog No. EPRSM12 w/W/R12E (exhaust shutter), or Town of Strasburg approved equal, controlled by remote wall mounted switch. Provide fan with motorized damper in conjunction w/fan operation.
 5. Main disconnect, double throw switch, circuit breaker panel.
 6. Auto dialing alarm system shall be STRIRSON wireless cellular unit.
 7. Generator receptacle shall be Crouse Hinds, cat. # AREA10416-S22.
 8. Switch to operate lights & fan simultaneously.
 9. Lockset to be Kwik Set 980-26D (grade 1) single cylinder w/ thumb latch deadbolt.
 10. For pump motors less than 20 HP, a portable generator will be provided by the Town. For pump motors greater than 20 HP, an on-site generator shall be provided by the contractor, as directed by the Town of Strasburg.

SUCTION LIFT SEWER PUMP STATION SECTION VIEW

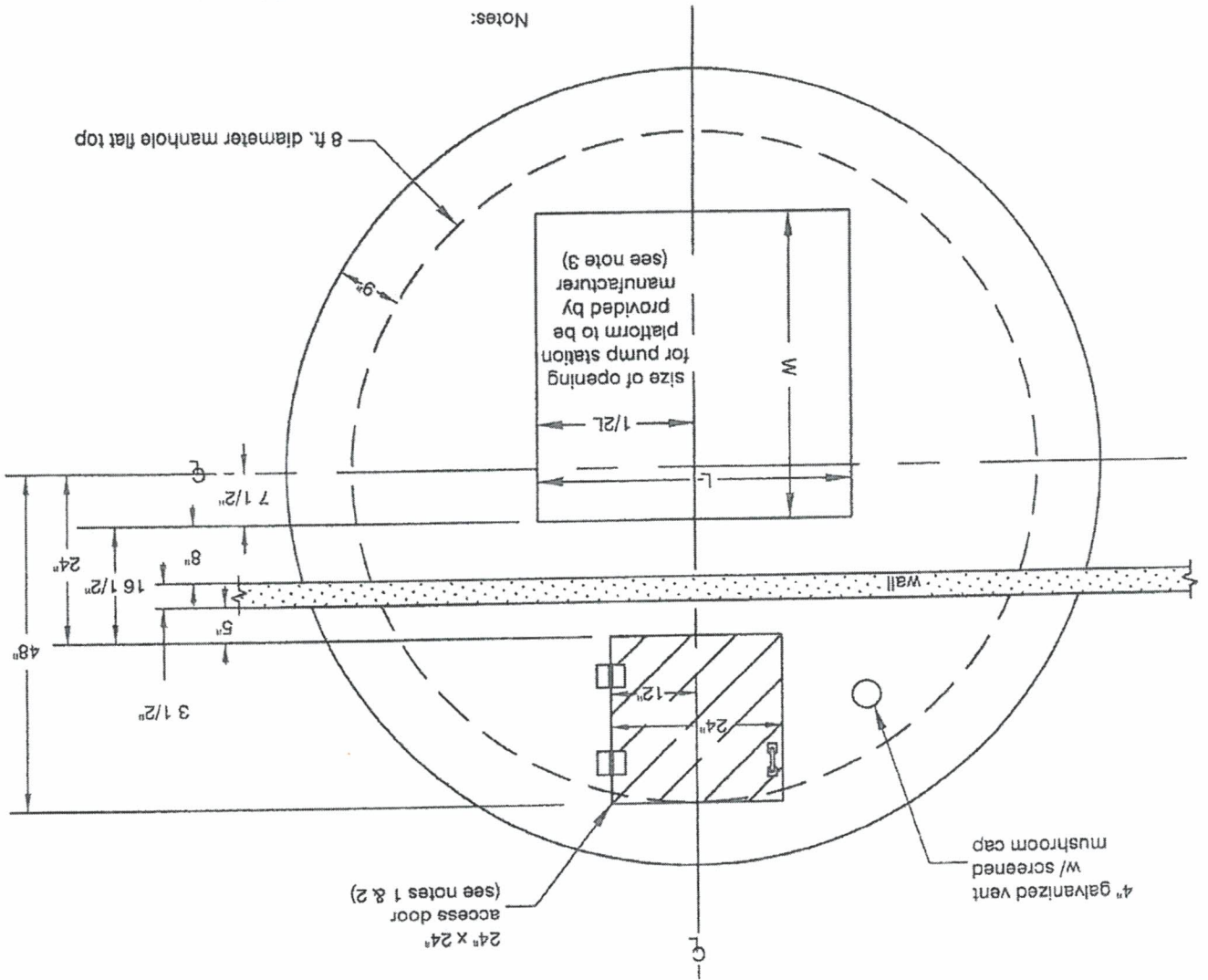


to be used with
drawings 21, 23 & 24

- NOTES:
1. precast building shall be 10'x12'x7'-6", with faux brick finish (desert sand), without floor manufactured by The Clear Flow Co. or Town of Strasburg approved equal
 2. light and horn shall be Edwards model no. 50-R (light) and model no. 876-N5 (horn) or Town of Woodstock approved equal. The light and horn shall have a manual off switch.
 3. a gas tight seal must be provided between pumping station base plate and wet well flat top
 4. see detail sheet 21 for building sizes when more than two pumps are used.

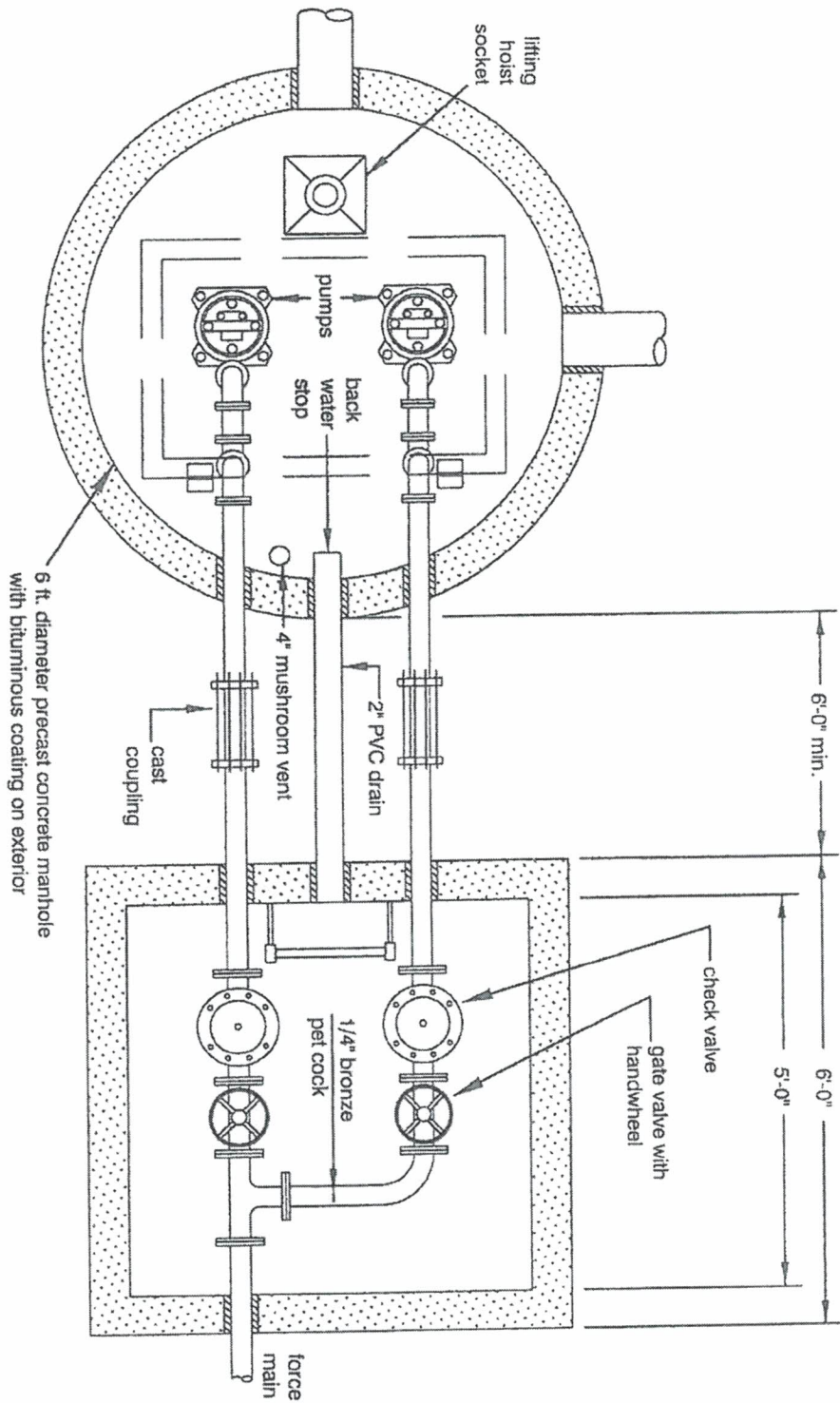
SUCTION LIFT SEWER PUMP STATION WET WELL COVER

- Notes:
1. Access door shall be Halliday Products S1R2424 or Town of Strasburg approved equal.
 2. Access door to open away from vent and when opened be perpendicular to wall.
 3. Manufacturer will need to specify which wall dimension is parallel to wall and which one is perpendicular to wall.



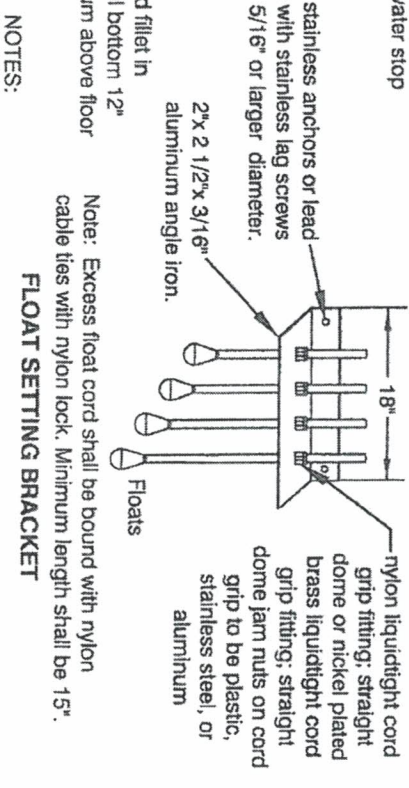
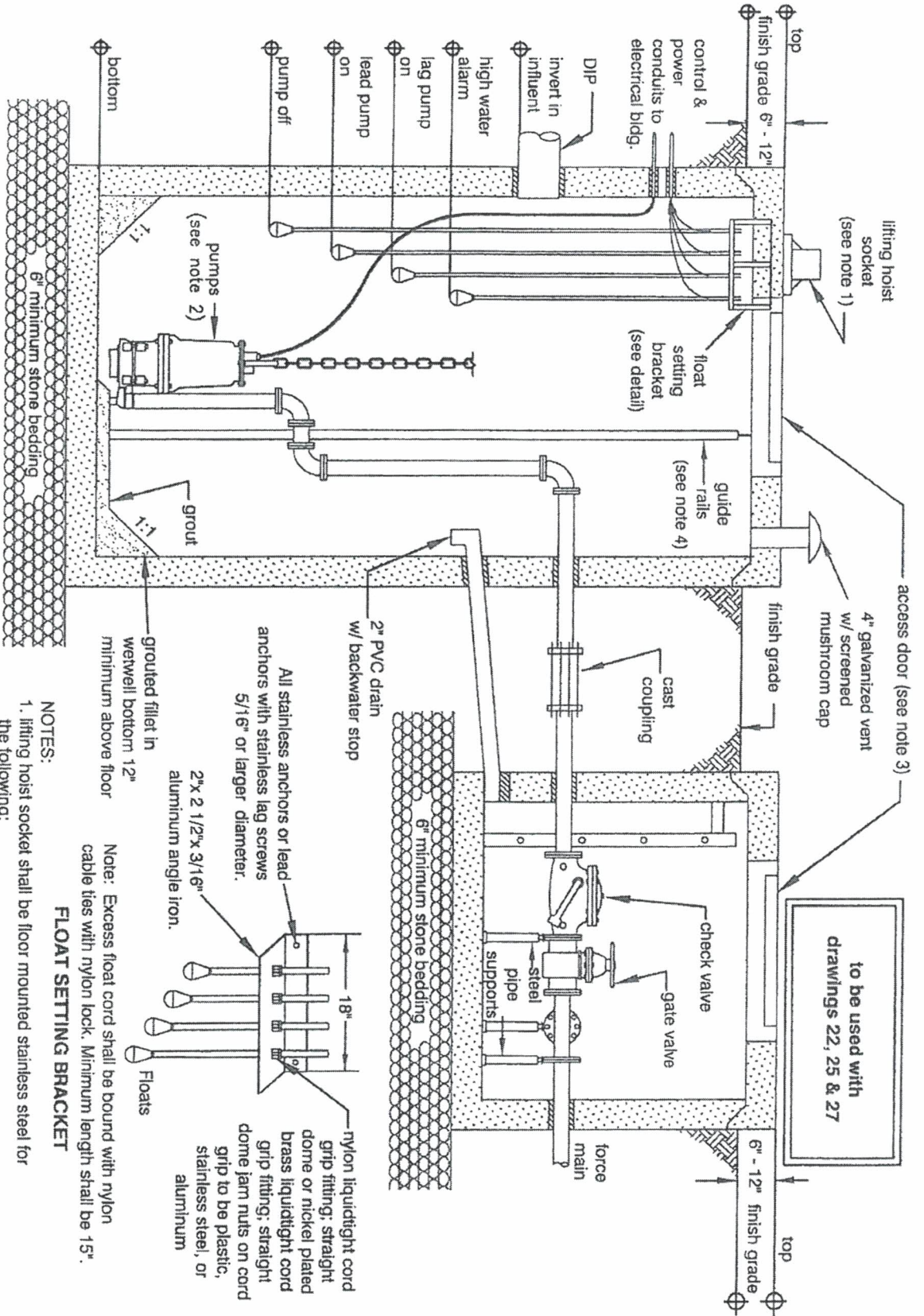
to be used with
drawings 21, 22 & 23

GRINDER SEWER PUMP STATION - PLAN VIEW



to be used with
drawings 21, 26 & 27

GRINDER SEWER PUMP STATION - SECTION VIEW



NOTES:

1. fitting hoist socket shall be floor mounted stainless steel for the following:
 - a Halliday Products hoist model no. D1A24B for motors 10HP or less
 - a Halliday Products hoist model no. D2A24B for motors greater than 10HP

2. pumps shall be Barnes, ABS, or Myers
3. access doors (2 ea.) shall be 30" x 48" aluminum Halliday Products model no. S1R3048 or Town of Strasburg approved equal 4.

ridge rails shall be stainless steel or nitrinrad / fiberlass)

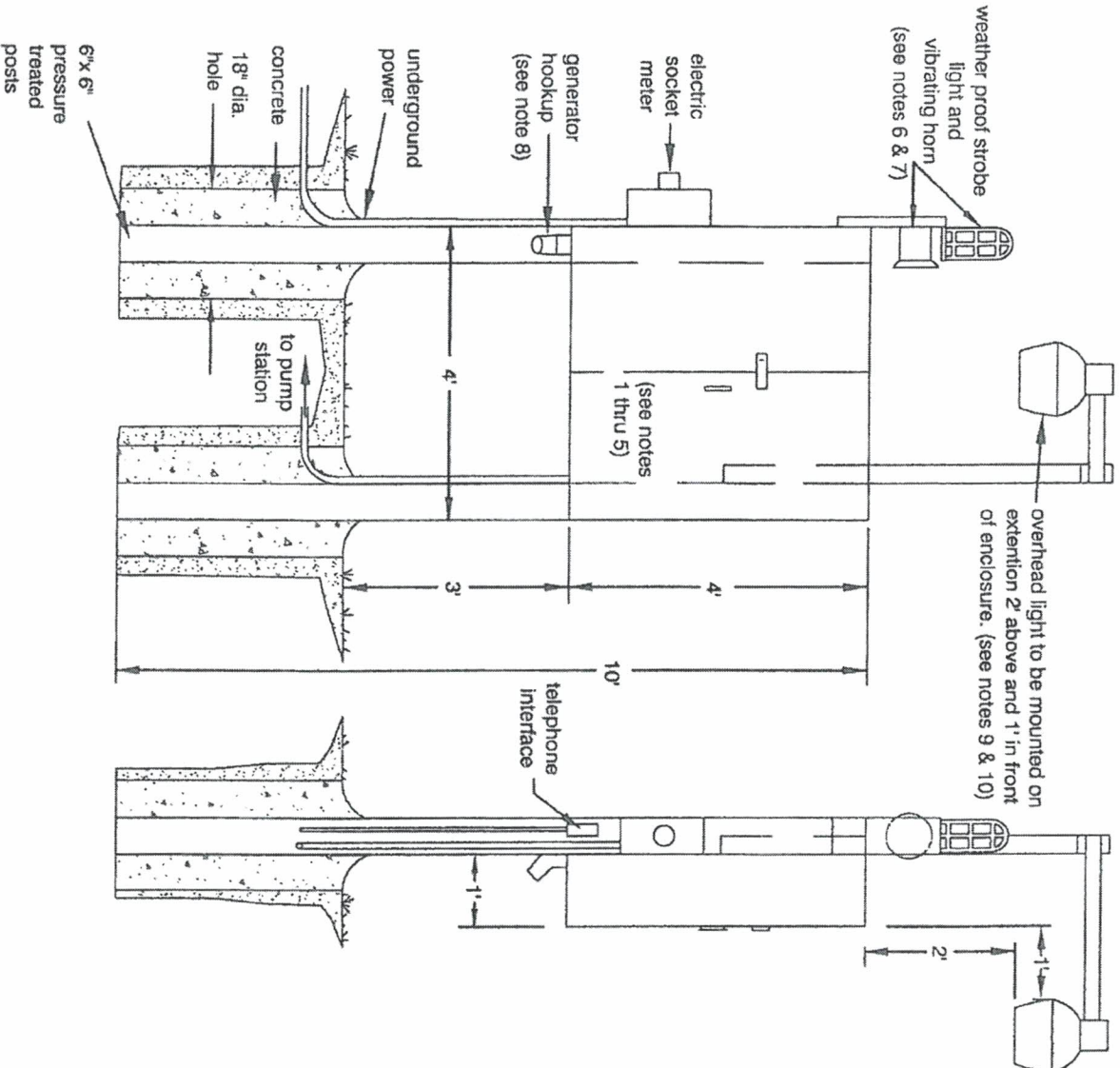
FLOAT SETTING BRACKET

Note: Excess float cord shall be bound with nylon cable ties with nylon lock. Minimum length shall be 15".

to be used with drawings 22, 25 & 27

GRINDER SEWER PUMP STATION ELECTRICAL CONTROLS ENCLOSURE

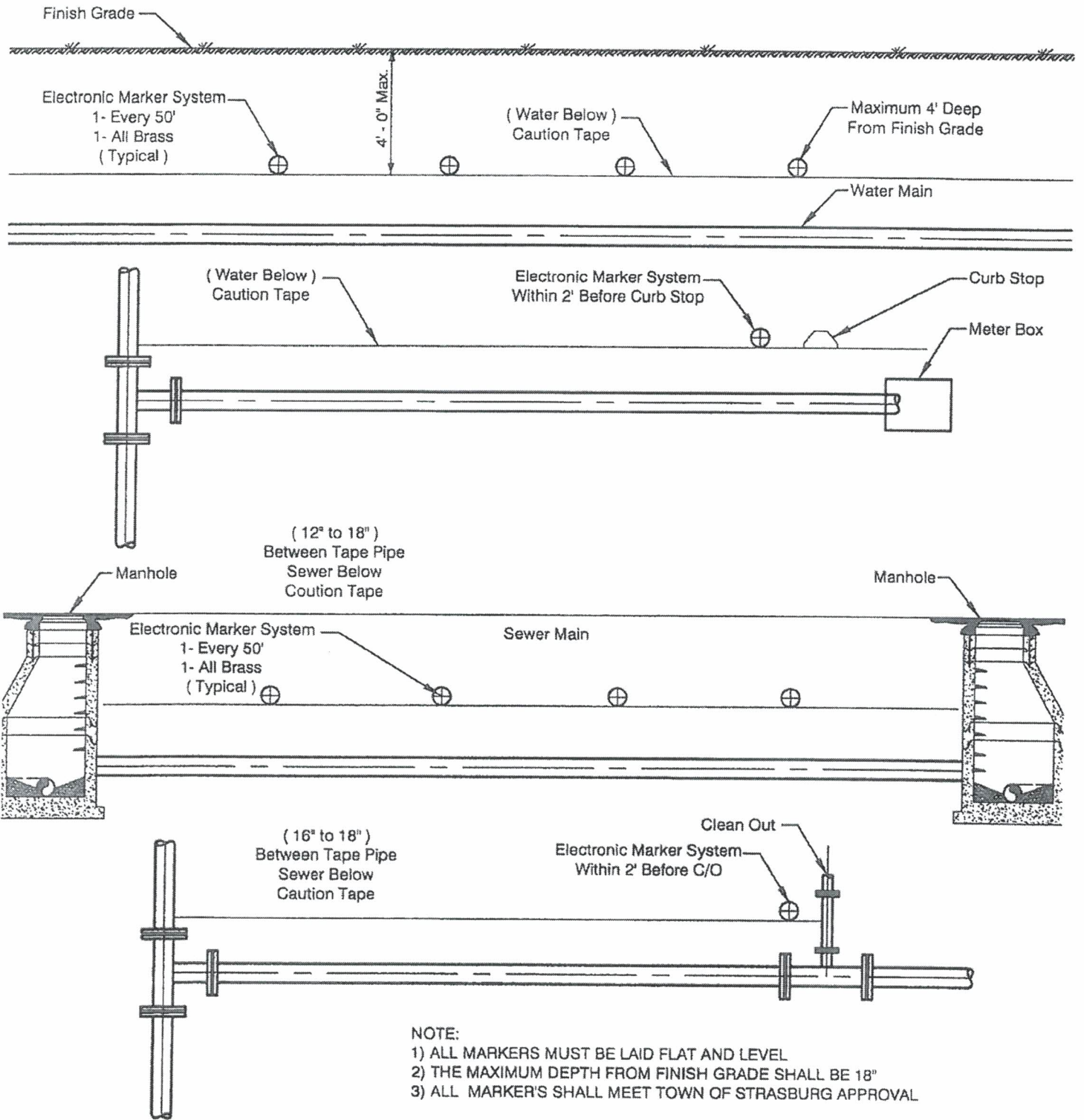
FEBRUARY 07



to be used with
drawings 21, 25 & 26

NOTES:

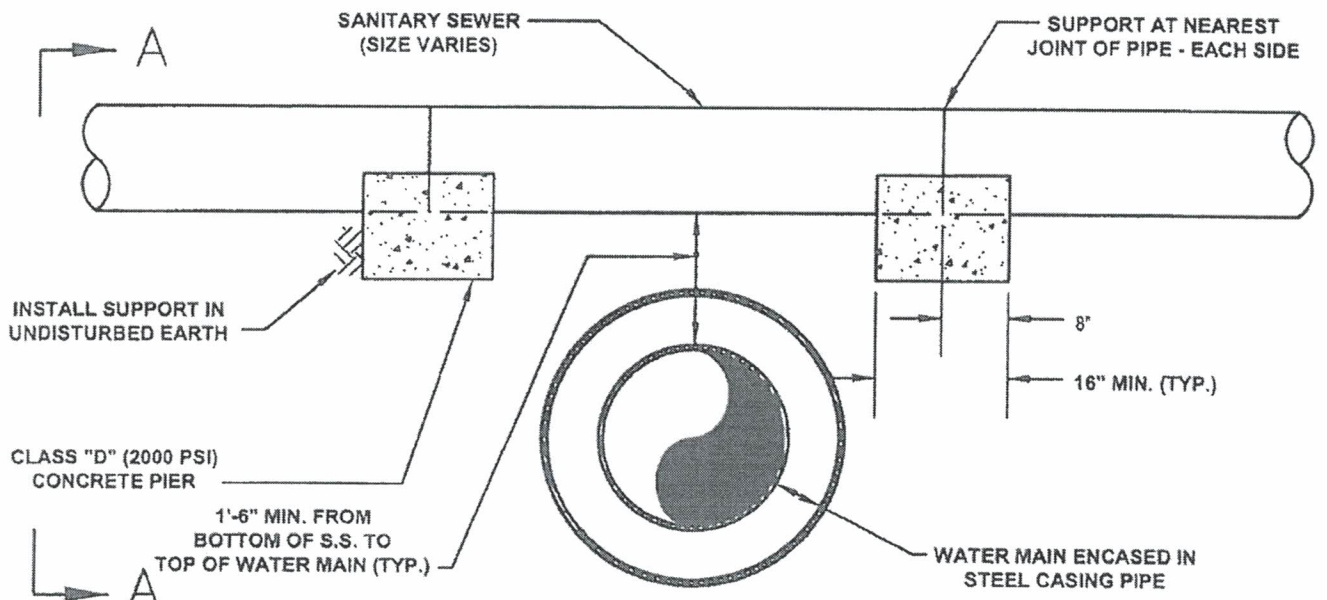
1. Enclosure construction:
 - a) to meet NEMA 3R standards
 - b) 4'-0" (W) x 4'-0" (H) x 1'-0" (D)
 - c) 12 gage galvanized steel
 - d) double doors with:
 - 1) heavy duty hinges
 - 2) heavy duty 3 point latching mechanism
 - 3) heavy duty hasp (for padlock)
 - e) drip shield
 - f) back panel (of 12 gauge steel) to provide a minimum of 5/8" clearance
2. The following items are to be mounted in enclosure:
 - a) double throw transfer switch
 - b) circuit breaker panel
 - c) 110 V outlet
 - d) STRISON wireless cellular unit (with dedicated 110 V outlet, if needed)
 - e) phone jack
 - f) pump control panel
3. Controls to be in their own enclosures and mounted inside panel enclosure.
4. The pump control panel shall be accessible without cutting off power.
5. Inside 110 V outlet to be on separate circuit
6. Light and horn shall be Edwards model no. 50-R (light) and model no. 876-N5 (horn) or Town of Strasburg approved equal.
7. Alarm light and horn to have manual on/off switch inside control enclosure.
8. Generator hookup shall be Russelstoll catalog no. SCB7334-72.
9. Overhead light to be on separate circuit and have on/off switch inside enclosure.
10. Overhead light to be 175 watt 120 V, merc (coated) security light.



MARKER SPECIFICATION'S	PROD. #/COLOR WATER	PROD. #/COLOR SEWER
SCOTCH MARK MIC RANGE	1257/BLUE	1258/GREEN
SCOTCH MARK FULL RANGE	1252/BLUE	1253/GREEN

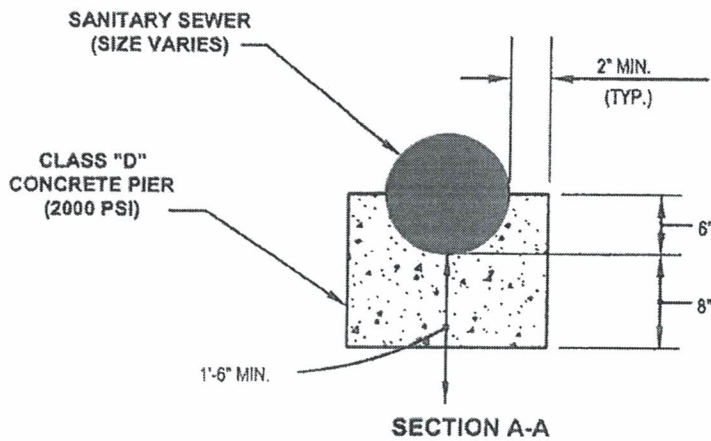
WATER AND SEWER LINE MARKER SYSTEM

FEBRUARY 07



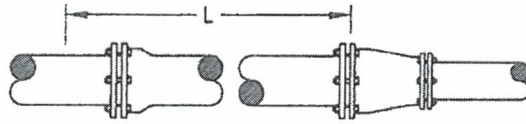
ELEVATION

NOTE: THE LENGTH OF THE PROPOSED WATER LINE SHALL BE CENTERED AT THE POINT OF THE WATER/SEWER CROSSING SUCH THAT JOINTS ARE EQUIDISTANT AND AS FAR AS POSSIBLE FROM THE EXISTING SANITARY SEWER LINE.



CONCRETE PIER AND WATER/SEWER CROSSING DETAIL

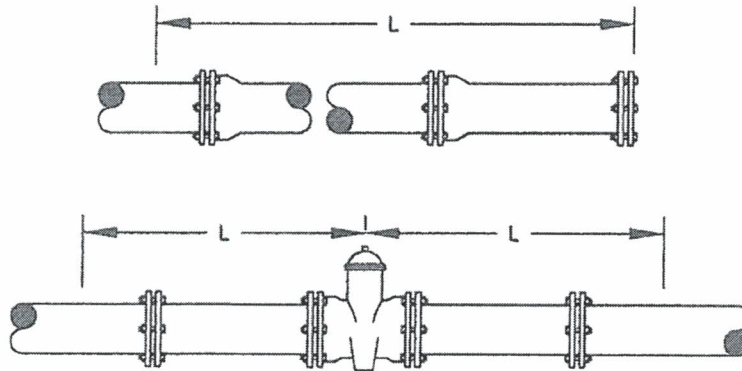
FEBRUARY 07



Both joints of the fitting shall be restrained. In addition, all joints within the recommended length (L) on the large side of the reducer shall be restrained.

SMALL SIDE JOINT	RESTRAINED LENGTH OF PIPE (Ft)							
	LARGE SIDE JOINT							
	PVC				DIP			
	6"	8"	10"	12"	6"	8"	10"	12"
6"	---	40	60	60	---	20	40	40
8"	---	---	40	60	---	---	20	40
10"	---	---	---	40	---	---	---	20

REDUCER

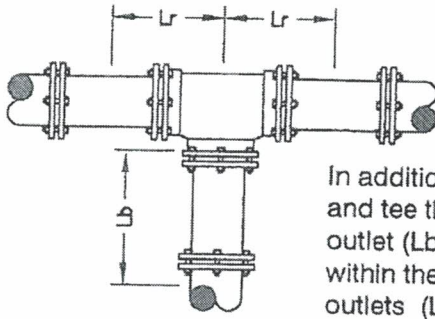


In addition to restraining the connection, any joint that falls within the recommended length (L) shall be restrained.

RESTRAINED LENGTH OF PIPE (Ft)							
PVC				DIP			
6"	8"	10"	12"	6"	8"	10"	12"
60	60	80	100	40	40	60	60

VALVE, DEAD END (PLUG, FIRE HYDRANT)

RESTRAINED JOINTS



In addition to restraining each joint of the tee, (1) any joint and tee that falls within the recommended length on the branch outlet (L_b) piping shall be restrained, (2) any joint that falls within the recommended length of the run (straight through) outlets (L_r) shall be restrained.

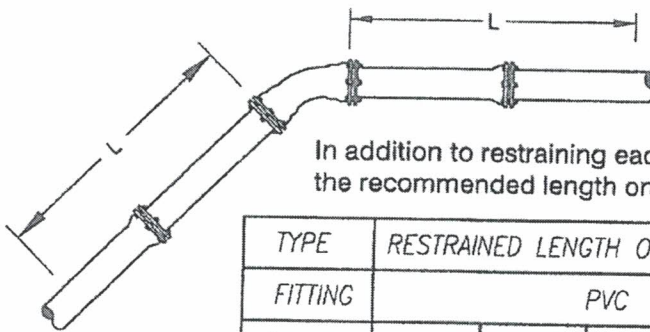
A cross shall be restrained per a tee's requirements for L_b .

A wye shall be restrained per a tee's L_r and a 45° bend's L requirement.

RESTRAINED LENGTH OF PIPE (Ft)				
TEE	PVC		DIP	
	L_r	L_b	L_r	L_b
6 X 6	20	20	20	20
8 X 8	20	20	20	20
8 X 6	20	20	20	20
10 X 10	20	20	20	20
10 X 8	20	20	20	20

RESTRAINED LENGTH OF PIPE (Ft)				
TEE	PVC		DIP	
	L_r	L_b	L_r	L_b
10 X 6	20	20	20	20
12 X 12	20	20	20	20
12 X 10	20	20	20	20
12 X 8	20	20	20	20
12 X 6	20	20	20	20

TEE, CROSS, WYE



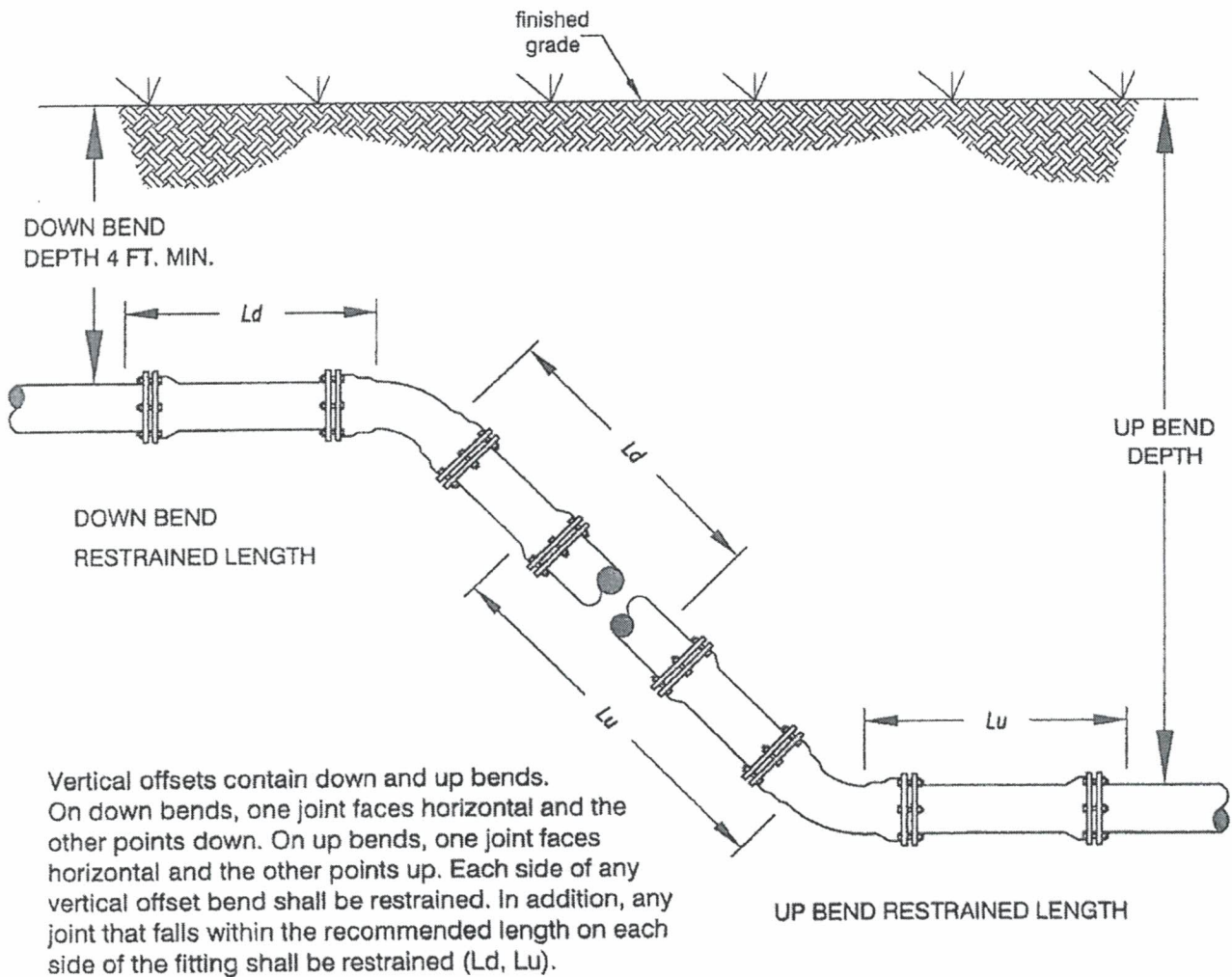
In addition to restraining each side of the bend, any joint that falls within the recommended length on each side of the bend shall be restrained.

TYPE	RESTRAINED LENGTH OF PIPE (Ft)				RESTRAINED LENGTH OF PIPE (Ft)			
	PVC				DIP			
DEGREE	6"	8"	10"	12"	6"	8"	10"	12"
90	20	20	40	40	20	20	20	40
45	20	20	20	20	20	20	20	20
22.5	20	20	20	20	20	20	20	20
11.25	20	20	20	20	20	20	20	20

HORIZONTAL BEND

NOTE: IN ADDITION TO THE ABOVE REQUIREMENTS, ALL BENDS, TEES, AND FITTINGS SHALL BE RESTRAINED WITH THRUST BLOCKING

RESTRAINED JOINTS



RESTRAINED LENGTH OF PIPE (Ft)							
		DEPTH OF BURY				DEPTH OF BURY	
		4 FT. MIN.	5-12 FT.			4 FT. MIN.	5-12 FT.
SIZE/TYPE	DEGREE OF BENDS	L_d (DOWN)	L_u (UP)	SIZE/TYPE	DEGREE OF BENDS	L_d (DOWN)	L_u (UP)
6" PVC/DIP	45, 22.5 & 11.25	20	20	10" PVC	22.5 & 11.25	20	20
8" PVC	45	40	20	10" DIP	45, 22.5 & 11.25	20	20
8" PVC	22.5 & 11.25	20	20	12" PVC/DIP	45	40	20
8" DIP	45, 22.5 & 11.25	20	20	12" PVC	22.5 & 11.25	20	20
10" PVC	45	40	20	12" DIP	22.5 & 11.25	20	20

VERTICAL OFFSET

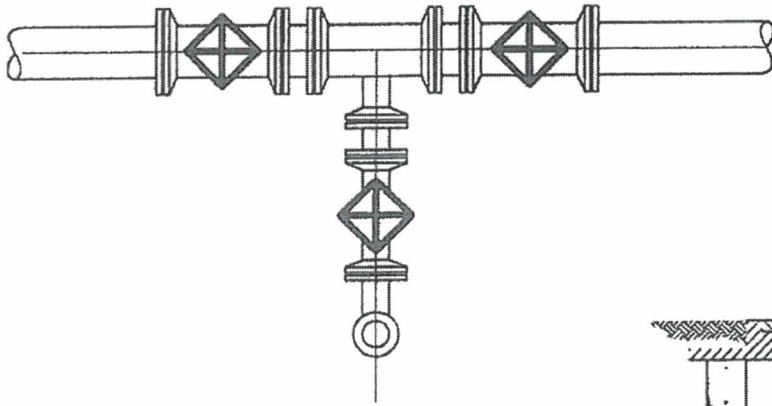
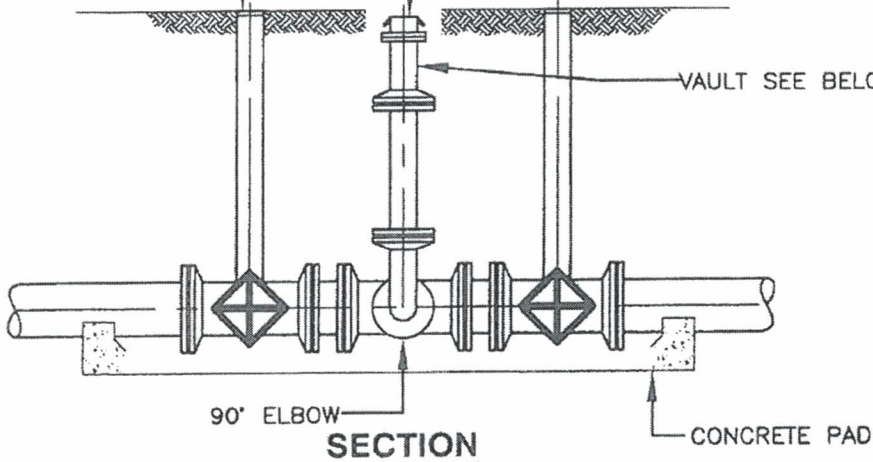
NOTE: IN ADDITION TO THE ABOVE REQUIREMENTS, ALL BENDS, TEES, AND FITTINGS SHALL BE RESTRAINED WITH THRUST BLOCKING

RESTRAINED JOINTS

VALVE EXTENSION AND
STANDARD VALVE BOX

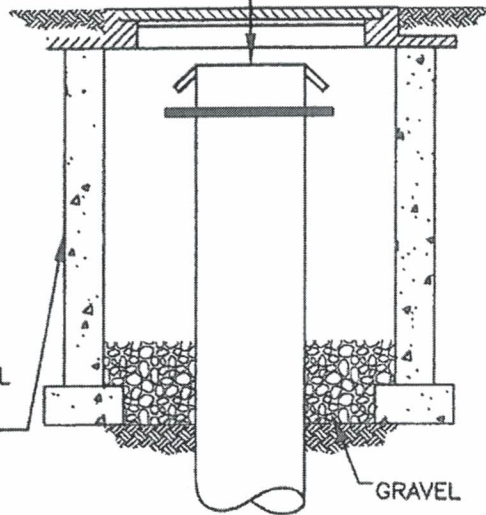
QUICK CONNECT W/ CAP

VAULT SEE BELOW

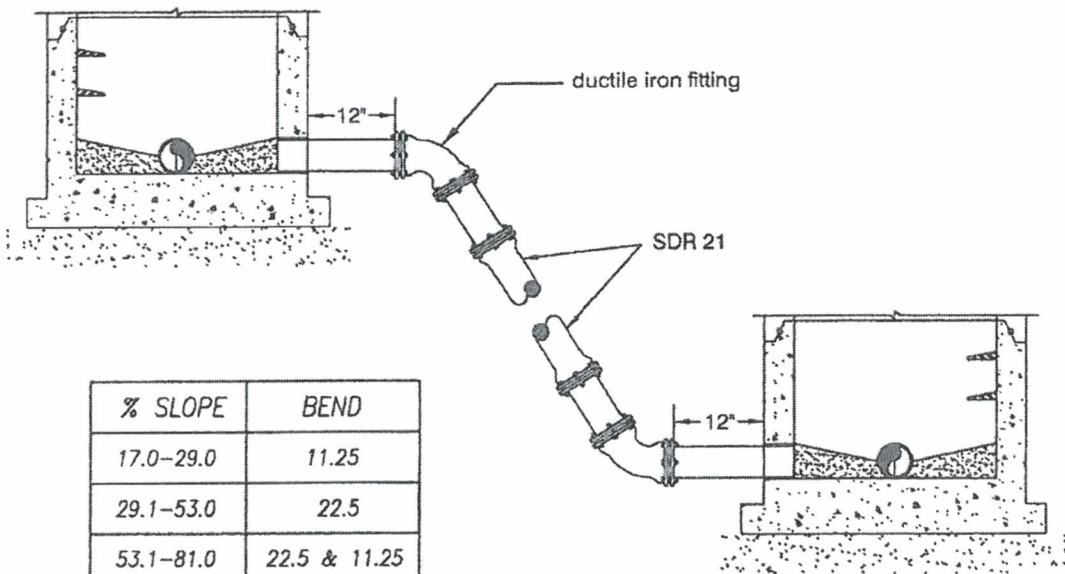


QUICK CONNECT W/PLUG
FLANGED FEMALE TYPE

VAULT TO INCLUDE COVER
& INSTALLATION. DETAILS SHALL
BE IN ACCORDANCE WITH
TOWN STANDARD DETAIL



SEWER PUMP STATION BYPASS



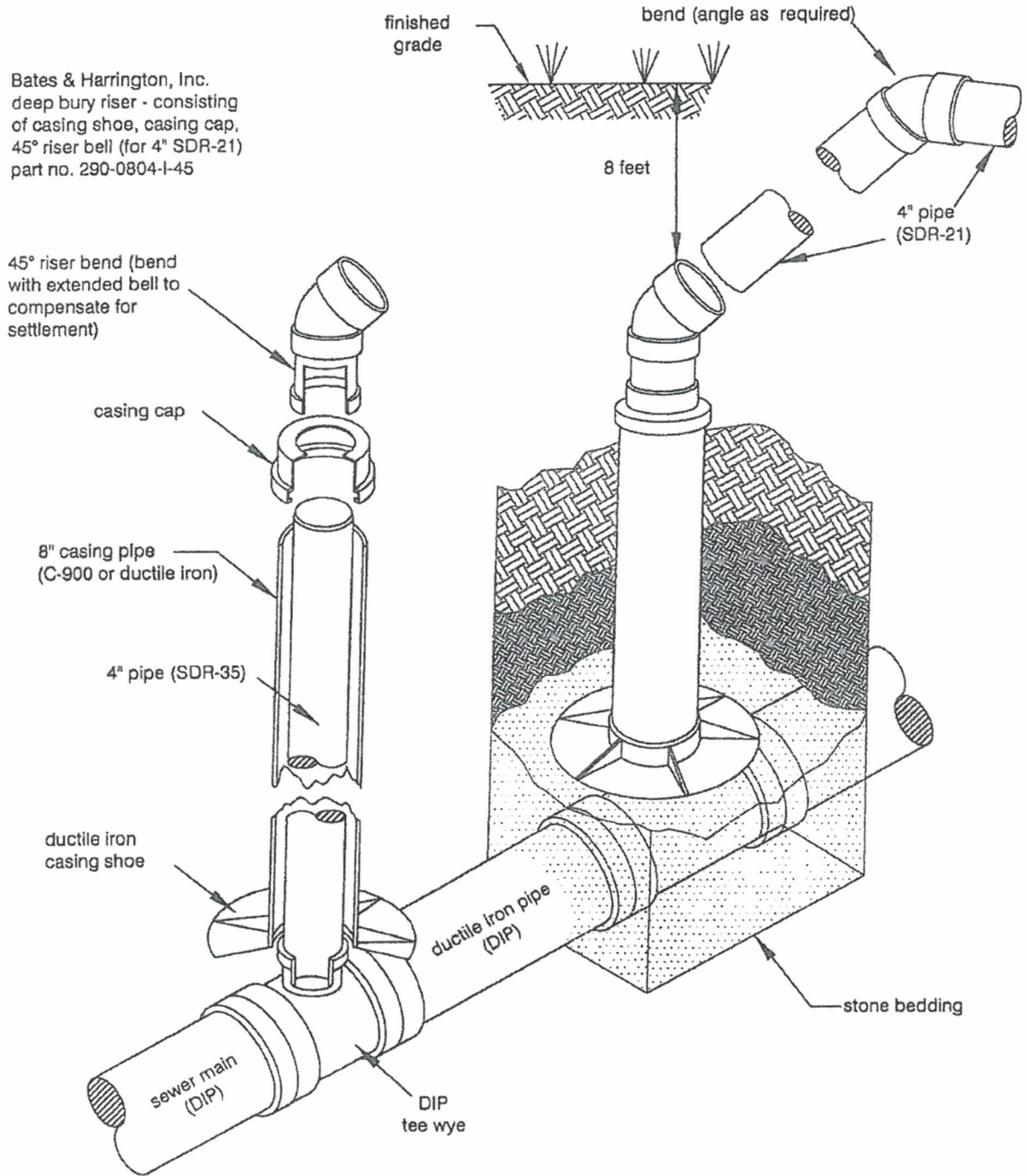
<i>% SLOPE</i>	<i>BEND</i>
17.0-29.0	11.25
29.1-53.0	22.5
53.1-81.0	22.5 & 11.25
81.1-119.0	45
119.0-236.0	45 & 11.25
236.1-308.0	45 & 22.5

Notes:

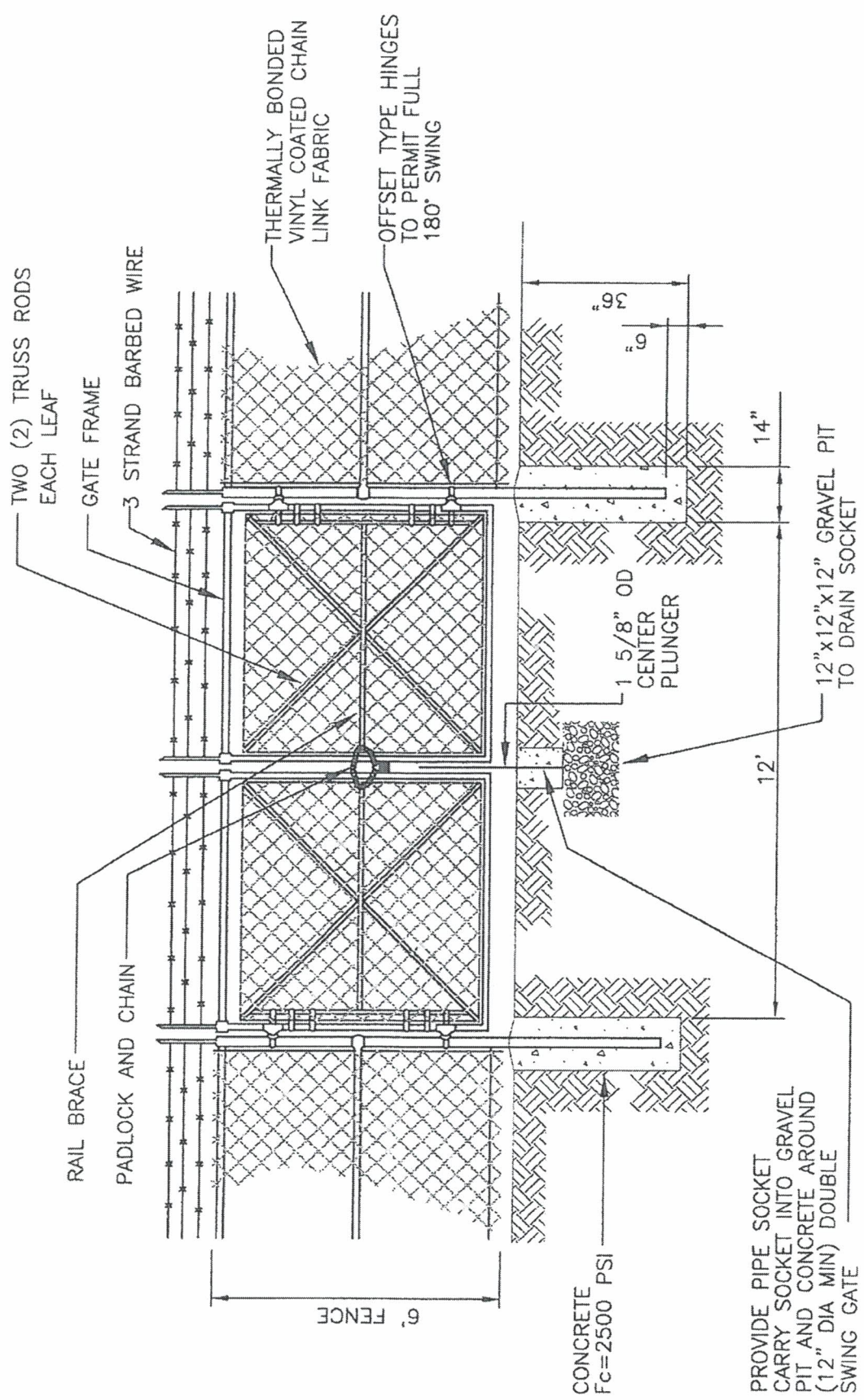
- 1) All joints (pipe & fittings) shall be restrained as stated in the Town standards.
- 2) Multiple bends shall be connected by a foster adapter.

**MANHOLE CONNECTION FOR STEEP PIPE SLOPE
(17% OR GREATER)**

Bates & Harrington, Inc.
 deep bury riser - consisting
 of casing shoe, casing cap,
 45° riser bell (for 4" SDR-21)
 part no. 290-0804-1-45



**SEWER LATERAL
 FOR MAIN WITH COVER GREATER THAN 15 FT**



**DOUBLE GATE FENCING DETAIL
FOR PUMP STATIONS**

1. All post must be 40 wt. Galvanized
2. All Line Post Must be a minimum of 3"
3. Brace & Cross pipes must be a minimum 1 3/4"