

Chapter Four: Regulations for Pressure Sanitary Sewer and Septic Tank Effluent Pumping Systems (9/16/08)

4.1 Title and Definitions - These regulations including appendixes, tables and drawings shall be known, referred to and cited as the Regulations for Pressure Sanitary Sewer and Septic Tank Effluent Pumping Systems (STEP systems). Unless the context clearly indicates otherwise, the following definitions shall be applicable to this chapter:

(Revised 11/16/99)

4.1.1 Contractor - The term contractor shall mean the person(s) or entities that actually construct, install, or perform other work in connection with a STEP system which causes the system to become operational or functional. For purposes of these regulations, a contractor shall be considered the agent of the Owner which hires or contracts with an Owner for the construction or installation of a STEP system.

4.1.2 District - The term District shall mean the Boone County Regional Sewer District.

4.1.3 District Engineer - The term District Engineer shall mean an engineer licensed by the state of Missouri who is employed or contracted by the District to perform engineering services to the District.

4.1.4 Engineer - The term Engineer shall mean an engineer licensed by the state of Missouri who is employed or contracted by an Owner to perform engineering services in connection with the construction or installation a STEP system.

4.1.5 Owner - The term Owner shall mean the person(s) or entities which own land upon which a STEP system is constructed or installed, and shall include any person(s) or entities which lease, license or otherwise contract for the development of land upon which a STEP system is constructed. The term Owner shall mean the District only when the District has accepted transfer of ownership of a STEP system after any warranties required under these regulations have expired and all warranty obligations have been satisfied.

4.2 Scope and Purpose - The purpose of these regulations is to specify the type and quality of all septic tank effluent pump and pressure sanitary sewer system materials, the method and procedure of construction, the inspection and testing methods, and the terms of acceptance by the District of any new pressure sanitary sewer system work or extensions of existing systems, that are or will be an active part of the sanitary sewer system of the District.

4.3 Authority - These regulations are enacted under the authority vested in the Boone County Regional Sewer District by sections 204.320 and 204.330, Revised Statutes of Missouri. No part thereof may be altered without written approval of the District Board of Trustees.

4.4 General Provisions - STEP systems shall not be permitted in subdivision developments in which the proposed lots are two (2) acres or less in area unless a variance is granted by the Board of Trustees. It is the policy of the District to encourage the installation of gravity collector sanitary sewer systems in subdivision developments in which the lots are two (2) acres or less in area. The District Board of Trustees may grant a variance for the installation of the STEP

sanitary sewer system in subdivision developments in which the proposed lots are two (2) acres or less in area if installation of the STEP system can be justified by citing engineering, environmental, topographical, economic and/or other factors which make the installation of a gravity collector sanitary sewer system impractical or unfeasible. (Revised 4/19/94; 3/16/99; 11/16/99)

4.5 General Responsibilities of Contractor and Owner

4.5.1 Proper Location - The Owner, or an Owner's Engineer, shall be responsible for the proper location of the proposed sanitary sewer or extension work. Property irons, or accurately located and labeled laths, shall be provided at major lot corners, particularly at intersections and curves. The sanitary sewer shall not be located solely from street centerline markers. Possible problems with other utilities and structures must be marked with sizes and depths indicated. Failure of a Owner to provide the above requirements may result in the District declining acceptance of the system. (Revised 11/16/99)

4.5.2 Licenses and Permits - The contractor is responsible for securing all licenses and permits required in connection with this work, except the Department Construction Permit.

4.5.3 Skilled Workers - The contractor shall employ skilled workers under the supervision of a superintendent, experienced in sewer and sewage pump system construction. The inspector may suspend work until, in his or her opinion, skilled personnel are provided.

4.5.4 One Year Guarantee - The owner shall be responsible for any failure of the sewer and sewage pump system that can be attributed to faulty workmanship or defective materials, and for maintenance of backfilled areas for one year after completion of the work. The completion date shall be established in writing by the engineer or the District based on the report of the inspector.

4.5.5 Damaged Property - The contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property or facility, regardless of location or character, which may be caused by moving, hauling, or otherwise transporting equipment, materials, or workers to or from the work or any site thereof, whether by him or her or his or her subcontractors. The contractor shall make, without delay, satisfactory and acceptable arrangements with the Owner or Owners of, or the agency of authority having jurisdiction over the damaged property, surface structure, or facility concerning its repair or replacement or payment of costs incurred in connection with said damage.

4.5.6 Underground Construction and Surface Structures - The contractor shall protect, brace, support, and maintain all underground pipes, conduits, drains and other underground construction uncovered or otherwise affected by the construction work performed by him. All pavement, surfacing driveways, curbs, walks, buildings, utility poles, guy wires, and other surface structures affected by construction operations in connection with the performance of the Contract, crossed by or adjacent to the pipe line, shall be maintained and, if removed or otherwise damaged, shall be restored to the original condition thereof as determined and approved by the Owner of the damaged or removed property. All replacements of such underground construction and surface structures or parts thereof shall be made with new

materials conforming to the requirements of these regulations or, if not specified, as approved by the Owner.

4.5.7 Defective Work - If the District or Engineer determines that the work is defective or endangers the public or local facilities, the contractor shall stop further construction until the defective work is corrected, or the endangered public or facilities, are properly protected. This provision in no way limits the liability of the contractor to construct the project in a safe manner or imposes upon the Engineer or Owner the liability to seek out, discover and adjudge such conditions.

4.5.8 Safe Work Practices - The contractor shall follow safe practices. In public rights-of-way, the contractor shall provide sufficient barricades and warning signs to direct traffic around work in progress. If traffic speed or volume warrant, the contractor shall promptly furnish sufficient flaggers to effectively and safely direct traffic around or through the work area. In railroad, state highway, county highway or municipal street rights-of-way, barricading, lighting and flaggers requirements shall meet standards of the agency having jurisdiction. The contractor shall alone be responsible for the safety, efficiency and adequacy of his or her plant, appliances and methods, and for any damage which may result from their failure or their improper construction, maintenance or operation.

4.5.9 Cleanup - Cleanup shall follow as closely as possible behind the installation. The contractor shall not delay cleanup so that public use of streets is held up needlessly. Surface restoration (including pavement) is considered as a part of the cleanup and general provisions of "cleanup" apply.

4.5.10 Easements - Owner shall provide easements of at least sixteen (16) feet wide to septic tank, pump unit and controls, and pressure sanitary sewer mains for maintenance and repair. After completion of the work, the Owner shall transfer ownership of the pressure sanitary sewer mains to the District. Failure to provide these documents will result in a refusal of the District to make service connections to the mains concerned.

4.5.11 Existing Septic Tanks - When a residence with an existing septic tank connects to a District operated sewer system, the Owner shall replace the existing tank or acquire a variance from the Board of Trustees and verify that the tank is water tight and that no storm water or surface water shall enter the tank. (Revised 11/16/99)

4.5.12 Inspection - The District shall inspect all service connections to the sanitary sewer main, treatment units and effluent pump systems.

4.6 General Responsibilities of the Design Engineer - The Engineer providing engineering services for the design of the septic tank effluent pump system and pressure sanitary sewer system shall be consistent with Department of Natural Resources Design Guide, 10 CSR 20-8.020 DESIGN OF SMALL SEWAGE WORKS, the policies of the District and these Regulations.

4.6.1 Hydraulic Analysis - Hydraulic analysis must confirm design to meet the following conditions:

4.6.1.1 Configuration and Velocity - Pressure sewers shall be laid out in branched tree configuration avoiding flow spitting at branches. The velocity in each line must be adequate to achieve scouring velocity of 2 to 5 fps at least once per day.

4.6.1.2 Peak Hour Flow Rates - Design for peak hour flow rates. Neglect infiltration unless there is a potential for leaky septic tanks or leaky house connections for existing residences. The maximum number of pumps operating simultaneously relative to the total number of potential pumps upstream of any gravity outfall shall be consistent with the table below. For peak hour flows, consider the single pump furthest from the outfall as operating and accumulate downstream pumps along main as appropriate until predicted maximum number of pumps are simultaneously operating.

Number of Pumps Connected on System	Maximum Daily Number Operating Simultaneously
2 - 3	1
4 - 9	2
10 - 18	3
19 - 30	4
31 - 50	5
51 - 80	6
81 - 113	7
114 - 146	8
147 - 179	9
180 - 212	10
213 - 245	11
246 - 278	12
279 - 311	13
312 - 344	14
	15

4.6.1.3 Electrical Requirements Within Subdivisions - Unless otherwise required by hydraulic conditions, all pumps within any subdivision shall have the same electrical requirements (230 volt, single phase, 60 hz, preferred) model and manufacturer and be interchangeable with all other pumps in that subdivision. To simplify the District's inventory and expertise requirements, only those pumps listed herein may be used in pressure sewer systems that will be an active part of the sanitary sewer system of the District without prior written approval by the District. Where hydraulic conditions require more than one pump model, and line size variations still will not allow just one pump usage, design should be made utilizing not more than two models.

4.6.1.4 Pumping Capacity - Pumps shall have a pumping capacity adequate to operate efficiently over the entire range anticipated for the system. The maximum design pumping head should not exceed 85 percent of the maximum obtainable pump pressure. Actual selected pump curves and a Hazen-Williams coefficient of one hundred and twenty ($C = 120$) for pressure sewer lines should be used in the system hydraulic analysis to determine total dynamic head. Evaluate at $C = 150$ for initial startup conditions.

4.6.1.5 Line Size Balance - Sewer service line size and pressure sewer main line sizes must be balanced with authorized pump selection.

4.6.2 Additional Design Consideration Requirements

4.6.2.1 Valve Requirements - Check valves specifically suited for wastewater service shall be provided in the pressure service line before it enters the main. A quarter turn, ball or plug, curb stop valve with valve box shall be provided in the service line between the check valve and the pressure sewer main to allow for service line isolation for maintenance.

4.6.2.2 Cleanout Requirements - Pressure sewer line cleanouts shall be provided at the upstream end of each main branch, at major changes of direction of flow, where one main joins another and at intervals along the main not to exceed 500 feet.

4.6.2.3 Air Relief Requirements - Air relief devices are required at high points in the line, where velocities may be insufficient to purge line. Air/vacuum relief devices may be required in the mains or in association with individual pumps, where necessary. Air relief units may be utilized as cleanouts.

4.6.2.4 On/Off Switches and Alarms - The pump system shall include trouble-free integral on-off level controls, an audible and visual alarm with high water level control and exterior electrical disconnect switch for system maintenance by the operating authority.

4.6.2.5 Location of Septic Tank – Septic Tank shall be conveniently located within fifty (50) feet of a paved or granular driveway on the property to be served by the tank, or within fifty (50) feet of a public road, constructed and maintained in a manner to sustain the load of a truck licensed at 54,000 pounds gross vehicle weight rating, for ease of access and cleaning of the septic tank. In addition, the bottom of the septic tank must be vertically no more than fifteen (15) feet below said driveway or public road and no less than one (1) foot below the lowest floor of any building on the property to be served by the septic tank. Property owner shall not be required to relocate tank to meet this regulation if installed prior to September 16, 2008.

(Revised 11/16/99; 9/16/2008)

4.7 Septic Tank Effluent Pump (STEP) Materials and Equipment - Materials and equipment shall be new and of the highest quality and shall be installed to conform with the Contract Documents, the approved recommendations of the manufacturer, and the applicable codes and standards.

4.7.1 Approved Pumps - Without prior written approval by the District, only those pumps listed herein may be used in pressure sewer systems that will be an active part of the District's system. Pump listings identify pump systems that are of approved quality and function. Engineer is to identify pumps from this listing that meet capacity requirements of system. Caution: Consider the full range of proposed pump curve. Excessive pumping may occur in low head situations and the maximum system total dynamic head should not exceed 85 percent of the maximum obtainable pump pressure.

4.7.1.1 F.E. Myers -

P51-52: hp, 10 gpm @ 72', 20 @ 64', 54 @ 20'.

P102: 1 hp, 10 gpm @ 115', 20 @ 106', 58 @ 20'.

4.7.1.2 Aurora/Hydromatic -

SPD50H: hp, 10 gpm @ 45', 20 @ 40', 80 @ 20'.

..... (Revised 9/16/08)

NOTE: Pump selection shall be consistent within a specific development. Mixing of pump units shall not be permitted unless authorized by the District. (Revised October 18, 1995)

4.7.2 Pump and Wetwell Size - Effluent pump systems serving a single family residence may be a simplex effluent pump unit. Duplex systems are required for units serving multiple family residences with an average daily flow of 1,500 gallons per day or greater. The fiberglass or concrete pump wetwell basin may be separate or integral to treatment unit. Minimum wetwell volume shall be 150 gallons per residence below the alarm level. Minimum storage above the alarm level shall be at least 200 gallons including unused wetwell and septic tank storage. Unit shall include bolt-down steel or 2" reinforced concrete cover, adjustable inlet adapter for 4-inch lines per ASTM (American Society for Testing Materials) D3299, discharge piping and fittings, check valve, ball valve, junction box, level controls and control panel. Minimum wall thickness to be 3\16" fiberglass or 2-1/2" concrete.

4.7.3 Pump Controls - Pump controls in NEMA 3R enclosure for mounting on the side of house or outbuilding at least four (4) feet above grade and no more than six (6) feet above grade. Controls to include a circuit breaker, service disconnect, overload protection, tamper proof door, run light, magnetic contractor, Hand-Off-Auto (HOA) selector switch, reset, liquid level sensors with pump-on, pump-off and high water (high water alarm with red light and audible alarm with silencer). NEMA 4X junction box in wetwell.

4.7.4 Minimum Fittings - Minimum fittings to include quick disconnect of pump from flexible reinforced effluent hose (rated at 100 psi), full flow swing check valve (PVC with Buna-N seal), full flow union type ball valve (PVC with Teflon seats) and other items as normally supplied.

4.7.5 One Year Warranty - The Owner shall provide a one year written warranty, from the date of startup, on the total system, including the septic tanks, pumps, valves, piping, controls and appurtenances, to the District. The Owner and contractor shall be responsible for any failure of the sewer and sewage pump system that can be attributed to faulty workmanship or defective materials, and for maintenance of backfilled areas for one year after completion of the work. The completion date shall be established in writing by the Engineer or the District based on the inspection report of the District.

4.7.6 Residential Treatment Unit - Concrete or fiberglass septic tank or aerated treatment unit as required by the District. Pump wetwell tank may be integral part of treatment unit. Any pump basin volume is in addition to the minimum treatment unit sizes shown below:

1 to 3 bedroom houses	1,000 gallons
4 bedroom houses	1,250 gallons
5 bedroom houses	1,500 gallons (2 compartments)
6 bedroom houses	See DNR design guidelines

4.7.7 Pipe

4.7.7.1 Polyvinyl Chloride (PVC) Pipe - American Society for Testing Materials D1784 and D2241, SDR 21, Class 200. PVC pipe shall have elastomeric push joints ASTM (American Society for Testing Materials) D1794. Schedule 40 ASTM D2466.

4.7.7.2 Polybutylene (PB) Pressure Tubing - Polybutylene pressure pipe, tubing and fittings may be used for 1-inch to 2-inch sanitary sewer service connections, meeting American Water Works Association Specifications C902, pressure class PC 250 PSI with mechanical Flo-Lock fittings.

4.7.7.3 Copper - Type "K" copper tubing, ASTM (American Society for Testing Materials) B-88, may be used for pushes under roads and driveways.

4.7.7.4 Casing Pipe - The casing pipe shall be welded steel pipe, ASTM (American Society for Testing Materials) A139, Grade B with a minimum yield strength of 35,000 psi. Casing pipe bituminous coating shall be applied in conformance with standard coating for metal culverts under highways (Missouri Highway and Transportation Department 1021.5 and AASHTO M190) and shall be a minimum thickness of 0.05 inch on the outside of the pipe.

4.7.8 Fittings - PVC gasket fittings rated at 250 psi

4.7.8.1 Elbows - 45° elbows (slip x slip) for cleanout and turns.

4.7.8.2 Tees - Standard or reducing tee (slip x slip x Fipt) for service connections rather than saddle.

4.7.8.3 Wyes - Wyes for inline cleanouts (slip x slip x slip).

4.7.8.4 Crosses - Crosses (slip) adapt to 2" cleanout by bushing.

4.7.9. Valves - As specified below or Engineer approved equal.

4.7.9.1 Air Relief - Val-Matic 15, 1 to 50 psi, 1" inlet with 1" quarter turn ball valve.

4.7.9.2 Air/Vacuum Relief - Val-Matic 301S with 1" 90° elbow outlet for air release and intake on top and 2" ball valve below this unit to allow this valve to be removed for maintenance.

4.7.9.3 Curb Stop - Mueller 300 Ball Curb Valve.

4.7.9.4 Pit for Valves - Pit for air relief and air/vacuum relief valves should be 24" diameter fiberglass water meter pit with Neenah R-1914 pit cover without lettering.

4.7.9.5 Tapping Saddles - Ford Style FC202 stainless steelband, epoxy coated.

4.7.9.6 Gate Valve - 2" or 3" resilient seat, epoxy coated gate valve. Kennedy or equal with valve box and shut off rod.

4.7.9.7 Ball Valve - 1-1/2" to 3" Watts Series B-6000 ball or Hammond 8201 valve sized as shown on the Plans.

4.7.9.8 Service Connection Check Valve - Bronze check rated at 125 WSP/200 WOG Watts WCV-2 with rubber seat.

4.7.10 Cleanout

4.7.10.1 Piping and Fittings - Schedule 40 PVC per plans.

4.7.10.2 Pit - 24" diameter fiberglass water meter pit with Neenah R-1914 pit cover without lettering.

4.7.11 Valve Boxes - Valve boxes shall be of good quality cast iron or high density reinforced polyethylene. The base section shall be large enough to fit over the valve bonnet. The upper section shall be arranged to screw down on the adjoining lower section and provide a minimum of 4 inches internal diameter throughout. Valve boxes shall be provided with cast iron lids or cover. The overall length of valve boxes shall be sufficient to permit the tops to be set flush with the established pavement or ground surface grade. Tyler, Ametek or approved equal.

4.7.11.1 Curb Stop Valve Box - Mueller telescoping cast iron H-10336 with optional foot piece H-10394 plus shut off rod to just below the cover of the box.

4.7.11.2 Concrete Collar - A concrete collar shall be provided in all paved or traffic areas.

4.8 Excavation and Preparation of the Trench

4.8.1 Size and Alignment - The trench shall be dug such that the pipe can be laid to the proper grade and alignment as shown on the approved plans (30-inch minimum depth. Trenches shall be excavated to a minimum uniform width which will permit satisfactory jointing of pipe and thorough tamping of bedding material. The following trench widths shall be maintained below a plane 12-inches above the top of the pipe:

Pipe Sizes	Trench Width	Minimum/Maximum
1-1/2" to 3"	Pipe O.D. + 3"	Pipe O.D. + 6"
4" to 6"	Pipe O.D. + 6"	Pipe O.D. + 1'8"
8" to 12"	Pipe O.D. + 1'4"	Pipe O.D. + 2'0"

Maximum trench width limitations shall apply beginning 3' from a manhole or other structure.

4.8.2 Pushes Under Hard Surface Street and Driveways - All pressure sewer mains under hard surface streets and driveways, 3-inches or smaller in diameter, shall be installed by

pushing a rod and pulling a mandrel without disturbing the ground or pavement surface above the pipe. The proper line and grade of pipe shall be maintained. Pipe size shown on the plans is a minimum for the pipe being installed therein. The contractor may elect to use a larger pipe. Diameter, thickness and schedule of such alternate pipe must be approved in writing by the Engineer. All pushes shall meet the requirements of the applicable agency involved.

4.8.3 Bracing and Shoring - In the event of any hazardous or unstable trenching conditions, suitable bracing or shoring may be required by the Owner's Engineer or the District.

4.8.4 Open Trench - At no time shall there be more than 400 feet of trench opened in advance of the pipe laying operations and this length of open trench may be shortened by order of the Owner's Engineer or the District.

4.8.5 Rock Excavations - Rock excavation is defined as sandstone, limestone, flint, granite, quartzite, or similar material, in masses measuring more than one cubic yard in volume or in ledges four inches or more in thickness, and which requires blasting or jack hammering for its practical and effective removal.

4.8.5.1 Trench Width and Depth - Any trench of rock excavation shall be at least 6-inches wider than the outside diameter of the pipe and undercut to a 6" greater depth than the trench depth as required by existing topography. In the event of required undercut, the trench subgrade shall be restored to proper grade by filling and compacting, with an approved material to insure a uniform bed along the full length of the pipe and appurtenances.

4.8.5.2 Blasting - Blasting will be permitted only after securing the approval of the District or Owner's Engineer and only when proper precautions are taken for the protection of persons or property. The determination for the use of and the actual use of explosives remains the sole responsibility of the Contractor and the Contractor shall be strictly liable for any and all damages resulting from the use of explosives. Any damage caused by blasting shall be repaired by the contractor at his or her expense. The contractor's method of procedure relative to blasting shall conform to state laws or municipal regulations or the most restrictive of the two. Trench rock will be drilled and blasted without removing the earth above wherein possible. If earth has been removed, the trench will be refilled prior to blasting. Blasting blankets shall be used in the developed areas. In general, blasting will not be allowed for excavation if the site is closer than 80 feet to a home, business or finished building.

4.8.5.3 Protective Devices - All barricades, signs, warning lights, and other protective devices shall be installed and maintained in conformance with applicable statutory requirements and, where within the railroad or highway right-of-way, as required by the authority having jurisdiction there over.

4.8.5.3.1 Open Trenches - All open trenches and other excavations shall be provided with suitable barriers, signs, and lights to the extent that adequate protection is provided to the public against accident by reason of such open construction.

4.8.5.3.2 Obstructions - Obstructions, such as material piles and equipment, shall be provided with warning signs and lights. Materials stored upon or alongside public streets, roads and highways shall be so placed, and the work at all times shall be so conducted as to cause the minimum obstruction and inconvenience to the traveling public.

4.8.5.3.3 Night Lights - All barricades and obstructions shall be illuminated by means of acceptable warning lights at night, and all lights used for this purpose shall be kept burning from sunset to sunrise.

4.8.5.4 Bore and Jacking - Welded bituminous coated steel casing pipe shall be installed under State highways, railroads, or as otherwise required on the approved plans, by dry bore and jacking as per plans and regulations.

4.8.5.4.1 Boring & Jacking Permits - Highway and railroad bore and jacking approval and permit shall be provided by the respective Owner or agency of authority.

4.8.5.4.2 Regulations - Construction shall be in accordance with the respective rules and regulations: MHTD (Missouri Highway and Transportation Department)(7 CSR 10-3.1010) Location and Relocation of Utility Facilities on State Highways Appendix A; or AREA (American Railway Engineering Association) Specifications, Part 5B, Pipelines for Non-flammable Substances, Appendix B.

4.8.5.4.3 Proper Line and Grade - Proper line and grade shall be maintained. Auger shall not be advanced beyond end of the casing.

4.9 Pipe and Appurtenance Installation

4.9.1 General - All pipe shall be cut by use of power or hand saw methods with beveling as required by manufacturer's recommendations. All pipe, fittings, valves, and appurtenances shall be carefully lowered into the trench by means of ropes or mechanical equipment. Trench shall be frost free, dry and bedded per regulations. Ends and interior of all pipe must be thoroughly cleaned.

All joints must be made as per the manufacturer's specifications. All joint deflections must be within the pipe manufacturer's recommendations.

Support in casing pipe must ensure that the carrier pipe is fully supported throughout its length. Wherever a carrier pipe is required within casing pipe, casing spacers shall be used to install the carrier pipe inside the casing pipe. The casing spacers shall be of a projection type and shall fasten tightly onto the carrier pipe so that the spacers do not move during installation. A minimum of three (3) casing spacers shall be equally spaced at intervals along the length of the pipe. Casing spacers shall be installed per the manufacturer's specifications. Spacers must provide sufficient height to permit clearance between the bell joint and the casing wall. Casing spacers shall be of the projection type, totally non-metallic spacers constructed of preformed sections of high density polyethylene. Projection type spacers shall be RACI type projection spacers as marketed by Public Works Marketing, Inc., Dallas, Texas (a local distributor of this product is R. H. Tauser and Associates, Chesterfield, MO, 314-391-1230) or District approved equal. Wooden skids are not acceptable. Casing spacers shall be required in 6-inch, or greater, diameter sanitary sewer lines.

Valves shall be located as designated by the approved plans. All valves shall be protected by an adjustable height valve box as specified above, the top of which shall be to the same grade as the existing terrain.

4.9.2 Air/Vacuum Relief Valves - Set valve box on 6" concrete blocks such that the cover will be at final grade. Install relief unit vertically so that it can be serviced through the opening above. Fill the bottom with 3/4" or 1" clean crushed rock for leaching. Install pit and cover.

4.9.3 Cleanout - Install elbows, riser sections, valve and female adapter. Install pit and cover so that valve is readily accessible. Install reaction backing inside the pit and outside the pit.

4.9.4 Buried Line Identification and Location - All non-metallic pressure sewers must have tracer wire for identification and location purposes.

4.9.4.1 Tracer Wire Specifications - Tracer wire shall be laid along the centerline of all sanitary sewer line construction. The wire shall be 14 gauge AWG-THNN solid copper, with green insulation, and used in minimum 500 foot rolls. It shall be installed with as few splices as possible. Splices shall utilize end to end #16-14 connectors, sealed with silicone sealant, aqua seal or equal and covered with Scotch #33 electrical tape. No bare wire shall be exposed. The two ends of the wire shall be knotted to prevent strain on the splice. Branch connections shall be made without cutting the main wire utilizing a connection clip and sealing the joint the same as splices. Service connections from the pressure sanitary sewer main to the valve box shall be made the same as branch connections where valve boxes are not installed at the main location (eg, street crossings). Service lines shall have a separate tracer wire of the same type laid with the service line from the valve box to the septic tank, but not connected to the pressure main tracer wire.

4.9.4.1.1 Tracer Wire Tape - Tape tracer wire to pipe at intervals sufficient to hold wire in position during backfill.

4.9.4.1.2 Ground Surface Access - Ground surface access to tracer wire shall be provided at each pressure sewer line cleanout or air relief valve. Run wire along outside of cleanout valve box or air relief box and into box through bore hole made within 6-inches of the top of the box, leaving 12-inches of excess tracer wire within box. Service line tracer wire shall enter the valve box in the same manner with 24-inches of excess tracer wire within the box and enough wire to extend 12-inches above final grade at the septic tank. The wire length between surface points shall not exceed 1000 feet. If no valve box is available to surface the wire, a 2-inch curb box shall be used with the wire brought to the surface in the same manner as for valves.

4.9.4.2 Identification Tape Specifications - Shallow depth identification tape shall be laid along the centerline of all sanitary sewer line and service line construction between 6-inches and 12-inches below the finished ground surface. The tape shall be a minimum of 2" in width, of plastic non-corrosive material, intended for direct burial, green in color with the word "SEWER" clearly legible in a contrasting color.

4.9.4.3 Continuity Test - After construction is complete and final backfilling is done, a continuity test must be performed on the wire. Any breaks in the circuit must be repaired by the contractor prior to acceptance of construction. (Revised 10/18/95)

4.9.5 Plugs, Caps, Bends - All plugs, caps, tees, and bends, unless otherwise indicated on approved plans, shall be anchored to prevent movement by providing suitable reaction backing in the form of concrete thrust blocks or metal harness anchored in concrete.

4.9.6 Reaction Backing - Provide reaction backing for all tees and elbows according to the following table of square footage against trench wall in sand:

Elbows Size	Pipe	Tees			
	Plugs	90° Els	45°	22-1/2°	11-1/4°
1-1/2 to 4"	6	2	1	1	1
6"	3	3	2	1	1
8"	4	6	3	2	1

Other Soil Conditions

- Cemented sand or hardpan - Multiply above by 0.5
- Gravel - Multiply above by 0.7
- Hard dry clay - Multiply above by 0.7
- Soft clay - Multiply above by 2.0

Temporary blocking using used grader blades driven into the soil behind valves, DIP caps or other metal fixture.

4.9.7 STEP System Installation - Septic tank, or aerated treatment unit, and effluent pump tank and assembly shall be installed per approved plans and specifications, approved manufacturer recommendations and consistent with the requirements of the District and the Department of Natural Resources.

4.9.8 Location with Respect to Water Mains

4.9.8.1 Horizontal Distance - Sanitary sewer pipe shall be laid no closer than ten feet horizontally from water mains. Should conditions exist whereby the contractor cannot maintain this separation, the sanitary sewer pipe may be laid in a separate trench or on an undisturbed earth shelf located on one side of the sanitary sewer at such elevation that the bottom of water main is at least 18 inches above the top of the sanitary sewer pipe.

4.9.8.2 Vertical Distance - Where PVC sanitary sewer pipe crosses water mains, it must be laid at such elevation that the top of the sanitary sewer is at least 18-inches below the bottom of the water mains and midway between the joints of the water main.

When it is impossible to obtain vertical and horizontal separation on a crossing, a sanitary sewer line constructed with a twenty (20) foot length of Class 200 PVC pipe shall be centered under the water main crossing and must extend on each side of the crossing a minimum distance of ten (10) feet. When these conditions cannot be met, the Engineer shall be notified.

4.9.8.3 Distance from Manhole - No water pipe shall pass through or come into contact with any part of a sewer manhole.

4.10 Backfilling

4.10.1 Adjacent to Top of Pipe - The first eighteen inches (18") of backfill over the top of pipe shall be select backfill material free from debris, organic material, and stones larger than one inch in greatest dimension.

If excavated material is not suitable for backfill, the Engineer may require imported material be used; including clean, finely divided soil or crushed stone aggregate (one inch and smaller). If the material in the banks of the trench is suitable, and granular backfill is not required by approved project plans, it may be used.

If the depth of the trench is over five feet, at least two feet of hand placed fill must be placed over the top of the pipe before a mechanical fill placement is used.

On completion of the specified hand fill, the balance of the trench shall be mechanically filled to at least three inches above the proposed finished grade of the surrounding terrain. In non-paved areas the top six inches backfill shall be topsoil corresponding to that underlying the original sod.

4.10.2 Improved Areas - All streets, driveways, lanes, parking area or other improved areas supporting vehicular traffic shall be backfilled with crushed stone or gravel and shall be restored to original or better condition. Backfill material may be Missouri Highway and Transportation Department Type 1 or Type 2 Grades A or B crushed stone or gravel; Missouri Highway and Transportation Department Type 3 if compacted; or Missouri Highway and Transportation Department Type 4 washed sand and gravel.

4.10.3 Maintenance of Backfilled Areas - Backfilled areas shall be maintained to the grade of the surrounding terrain, by the contractor during construction to the completion date of his or her respective contract. Seeding or sodding shall be done to the satisfaction of the District's inspector.

4.10.4 Cleaning Up - On completion of contract, contractor shall remove all excess materials or supplies and shall clean up the entire working area and dress the land so as to leave a neat, accessible work area. Any ditches, road, or street shoulders shall be restored to their original alignment and grade.

4.11 Hydrostatic Testing

4.11.1 Contractor Responsibilities - The Contractor shall provide all equipment necessary for the pressure test.

4.11.2 Inspection - The District's Inspector shall witness the test.

4.11.3 Procedure

4.11.3.1 Pressure Test - Each valved section of pipe shall be filled with water slowly and the specified test pressure of 2.5 times the maximum working pressure of the section of pipe to be tested (approximately 100 psi), based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gage, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the District's Engineer.

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and appurtenances. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings and appurtenances that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the District's Engineer or inspector.

4.11.3.2 Leakage Test - A leakage test shall be conducted concurrently with the pressure test. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. The minimum duration of the test shall be one hour unless otherwise directed by the District's Engineer or inspector.

Acceptance of installation shall be determined on the basis of allowable leakage. If any test or pipe laid discloses leakage greater than that specified in the following formula, the contractor shall, at his or her own expense, locate and repair the defective material until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of the amount of leakage.

$$L = \frac{S * D * P}{13,200} \quad \text{where,}$$

L = allowable leakage, in gallons per hour.

S = Length of pipe tested, in feet.

D = nominal pipe diameter, in inches.

P = square root of average test pressure in PSI (gauge).

When testing against closed metal-seated valves, an additional leakage per closed valve or 0.0078 gal/hr/in. of nominal valve size shall be allowed.

4.12 Inspection

4.12.1 Inspector - It shall be agreed to by all parties that the District or its representative shall have full authority to inspect the materials and the work performed.

4.12.2 Contractor's Obligations - Inspections shall not relieve the contractor, or Owner, from any obligation to perform his or her work in accordance with these regulations or any approved plans, and work not so constructed shall be removed and made good by the contractor or owner at his or her own expense, whenever ordered by the inspector without reference to any previous oversight or error in inspection.

4.12.3 Contractor Assistance - The contractor shall furnish all reasonable aid and assistance required by the Owner's Engineer or the District for the proper inspection and examination of the work and all parts thereof. Supervising engineers, inspectors, and other properly authorized representatives of the Owner or District shall be free at all times to perform their duties, and intimidation or attempted intimidation of any one of them by the any of the contractor's employees shall be sufficient reason, if the District so desires, for suspension of work.

4.12.4 Inspector's Directions - The contractor shall regard and obey the directions and instructions of the Engineer or inspector so appointed, when the same are consistent to his or her contract or these regulations; however, should the contractor object to any order given by any inspector, he may object by written appeal to the Board of Trustees of the District or its duly appointed representative.

4.13 Maintenance - The Owner shall grant the District easements on forms prescribed by the District to permit access to all pumps, lines and septic tanks for purposes of maintenance, repair and replacement of STEP system components. The District hereby conditions customer service on the right to inspect, maintain, repair and replace STEP system components in accordance with District operation and maintenance procedures and standards enforced by District, the cost of which are included within STEP system rate schedules B or C published and effective January 1, 1998 and amended each year thereafter. The District shall determine the level of maintenance required for customers using STEP systems and assign the appropriate rate schedule as a condition of customer service. District shall not be obligated to maintain, repair or replace STEP system components excluded from its rate schedules such as replacement of septic tanks, or repair, maintenance or replacement of sewer lines or laterals extending from septic tanks to house drains, interior drains, plumbing or fixtures. As a condition of customer sewer service, District shall not be liable for injury or damages caused by STEP system failure, regardless of cause. As a condition of customer service, all District sewer service customers shall be responsible for maintenance, repair and replacement of STEP system components located on the property which receives District service and which is not included within the District rate schedules. District STEP customers shall promptly take all preventative or curative maintenance and repair measures at their own expense which may be prescribed by District; the failure of any District customer included within a STEP system rate schedule to undertake preventative or curative measures for system maintenance, repair or replacement shall be grounds for District to promptly terminate service. (Revised 11/16/99)

4.13.1 Conventional Treatment Systems - STEP system customers whose septic tanks meet the requirements of section 4.6.2.5 and which are connected to conventional wastewater treatment systems shall receive District maintenance prescribed in rate schedule B. STEP system customers who have been granted a variance by the District from compliance with section 4.6.2.5 and which are connected to conventional

wastewater treatment systems shall receive District maintenance prescribed in rate schedule C. (Revised 11/16/99)

4.13.2 Sandfilter Treatment Systems - STEP system customers which are connected to sandfilter wastewater treatment systems shall meet the requirements of section 4.6.2.5 for septic tank location as a condition of District maintenance service and shall receive District maintenance prescribed in rate schedule B. (Revised 11/16/99)

4.14 Drawings - following

4.15 Variances - The Board may grant a variance from the strict application of the regulations adopted in this chapter upon application if it finds after public hearing and upon competent and substantial evidence that the applicant meets the criteria for grant of a variance required by these regulations. No variance from any requirement contained within chapter four of these regulations shall be granted unless the Board finds: (a) the applicant will incur unreasonable and unnecessary hardship if a variance is not granted and the variance is not sought primarily to avoid financial expense in complying with the requirements of these regulations (b) grant of a variance will not endanger the health, safety or welfare of the public, and (c) grant of a variance will not hinder, thwart or circumvent the general intent or any specific purpose of these regulations. All applications for variances shall be filed with the General Manager of the District and after review thereof the General Manager shall make a recommendation to the Board to grant or deny the application and state the reasons for his or her recommendation together with any conditions, if any, which should be imposed in connection with the grant of a variance. The applicant may appeal any decision of the Board as provided by law. (Revised 10/17/2000)