DESIGN REGULATIONS

FOR

SUBSURFACE DRIP DISPERSAL SYSTEMS

Boone County Regional Sewer District

Boone County, Missouri

Adopted: March 20, 2018

Chapter 5

Contents

Appendices

5.1. Introduction

Subsurface Drip Dispersal (SDD) is a proven technology for uniformly dispersing wastewater over a large area beneath the soil surface. A small volume of wastewater is dosed at predetermined time intervals throughout the day to the soil through a pressurized piping network that comes close to achieving uniform distribution over the footprint of the dispersal area.

These Regulations are for SDD systems that disperse only domestic wastewater with average day flows of up to 50,000 gallons per day (gpd).

5.2. General Provisions

These Provisions apply to any person(s) who proposes to design and construct a facility that will treat or dispose of domestic wastewater using a SDD system within the jurisdiction of the Boone County Regional Sewer District (District).

The applicant for a permit for a domestic wastewater treatment facility with a SDD system shall submit an engineering report, drawings and specifications (all signed and sealed by a Licensed Engineer in the State of Missouri) to the District that meet the requirements found in these Regulations. Construction shall not begin on a facility until the District approves the engineering report, plans and specifications. The applicant shall also secure all approvals and permits required by the Missouri Department of Natural Resources (MDNR).

The District reserves the right to modify or change any of the criteria in these Regulations. The applicant may submit a variance request from these Regulations with the engineering report. The technical justification for the variance shall be included in the report.

The applicant shall reserve an area equal in size to the drip field area for future construction of a SDD system in the event the original system fails.

Approval of the submitted engineering report, plans, or specifications by the District does not relieve the permittee of any liabilities or responsibilities associated with designing, constructing and operating the SDD system and the associated treatment facility in accordance with applicable MDNR regulations and in a manner that protects human health and the environment.

5.3. Subsurface Drip Dispersal System Alternatives

The designer of the SDD system shall select to design and install one of the systems by the following manufacturers:

1. Geoflow, Inc.
2. Netafim USA

The designer shall use the design spreadsheets and tools developed by the selected manufacturer to design the system, and use the proprietary equipment supplied by that manufacturer to construct the system.

The descriptions of the system components and some of the design parameters were taken from the “Subsurface Drip Dispersal and Reuse - Design, Installation and Maintenance Guidelines” by Geoflow, Inc.

5.4. System Components

A typical SDD system installation will consist of the elements listed below. Minimum standards for each of these elements are included in Appendix A of these Regulations.

5.4.1 Drip Line

Drip line carries the water into the dispersal area. The drip line is connected to the supply and return manifolds with fittings supplied or recommended by the manufacturer.

5.4.2 Controllers

Controllers are used for time dosing and time flushing of the filter and drip fields. Controllers shall include a programmable logic controller to increase flexibility and reliability in the field. All controllers shall include a surge arrestor, elapsed time meter and counter.

5.4.3 Pumps, Pump Tanks and Floats

Drip fields depend on pumps to dose effluent under pressure to the field. These must be sized according to flow and pressure requirements. Two (duplex) pumps shall be used on SDD systems.

Pump tanks are an important part of an onsite system design for small systems and serve to equalize flow, settle solids and even continue oxidation in some instances. Controllers shall be set up for four floats with the lowest one in the tank being the redundant off float. The primary timer on/off float is second from the bottom, followed by the secondary timer float third from the bottom and the high level alarm float on the top.

All SSD systems shall use tanks or piping to store wastewater flow.

5.4.4 Filters

The SDD system shall include filtration to keep any oversized upstream contaminants from entering the drip line. Filtration rating shall be in accordance with manufacturer's recommendation. Filters shall be capable of flushing.

5.4.5 Supply Manifold and Line

This carries the water from the dosing tank to the dispersal area. Rigid PVC pipe shall be used in accordance with the manufacturer's recommendation.

5.4.6 Return Manifold and Line

In order to help clean the system, the ends of the drip lines are connected together into a common return line, most often made of rigid PVC pipe per the manufacturer's recommendation. This line will help equalize pressures in the system. It also allows drip tubing within a zone to collectively flush debris from the tubing and back to the Wastewater Treatment Facility (WWTF).

Flushing should be done frequently during the installation period. Periodic flushing during operation will help to keep the manifolds clean.

5.4.7 Pressure Regulator

Pressure regulators fix the inlet pressure at a given rate. All drip lines shall have a pressure regulator to avoid oversized pumps from damaging fittings and tubing. Regulators shall meet tubing flushing head losses and line losses back to the WWTF.

5.4.8 Air Vacuum Breaker

Air vacuum breakers are installed at the high points, above drip line and below grade to keep soil from being sucked into the emitters due to back siphoning or backpressure. This is an absolute necessity with underground drip systems. They are also used for proper draining of the supply and return manifolds in sloping conditions. One is required on the high end of the supply manifold and one on the high point of the return manifold. Additional air vents shall be required in undulating terrain.

5.4.9 Filter Flush Valves

Filter flush valves shall be used to flush debris from the filter cleanout port back to the pretreatment WWTF. This shall be an electronically activated solenoid valve. Automated electronic flushing is required for all systems.

5.4.10 Field Flush Valves

Field flush valves shall be used to flush out fine particles that have passed through the filter and accumulated on the bottom of the pipe at the end of each lateral. The field flush valve shall be electronically activated by the controller.

5.4.11 Zone Valves

Zone valves are used to divide single dispersal fields into multiple zones. These valves shall be hydraulically activated index valves for SDD systems less than 600 gpd and electrical solenoid valves for SDD systems greater than 600 gpd.

5.4.12 Headworks

The headworks shall include filters, valves, pressure gauge, and pumps, all housed in an insulated shelter.

5.5. Design Parameters

5.5.1 Drip Field Area Selection

The applicant shall develop and submit, with the engineering report, a Site Plan (scale 1 in. = 50 ft.) that incorporates the following items in order to alleviate potential site-specific limitations and ensure suitability for the SDD system. This Site Plan shall include the following:

A. General Site Considerations

1. All of the items contained in the Rules of Department of Health and Senior Services (DHSS) 19 CSR 20-3.060 (2) Site Evaluation (A), excepting percolation testing. Percolation testing is not permitted.
2. A plan to minimize the effects of surface rainfall runoff on the dispersal zones via water diversion berms, curtain drains or other methods.
3. A plan to minimize the effects of dispersal zones on subsurface water tables and perched water tables via curtain drains or other methods.
4. Design criteria to compensate for any restrictive layers within the soil column.
5. Any planned removal of existing vegetation.

B. Protection of Groundwater

1. A SDD system shall not pollute groundwater quality.
2. Groundwater conditions shall be identified in the Site Evaluation. Mitigation of groundwater conditions shall be in accordance with Missouri Department of Natural Resources (MDNR) Regulations or Boone County Code of Health Regulations, which ever apply.

C. Buffer Zone Requirements

1. The SDD system shall maintain minimum set-back distances as specified in Table 1 – Minimum Set-Back Distances specified in DHSS 19 CSR 20-3.060.

5.5.2 Wastewater Quality

The sewage shall be assessed for flow and constituents. The SDD system shall include upstream wastewater treatment facilities capable of achieving the following treatment levels:

1. BOD: Weekly Average < 45 mg/L and Monthly Average < 30 mg/L
2. Total Suspended Solids: Weekly Average < 45 mg/L and Monthly Average < 30 mg/L
3. Oil and Grease: Monthly Average < than 15 mg/L

Wastewater with very high levels of minerals or other abnormal chemical or physical characteristics shall require special consideration and custom design. Iron shall be reduced upstream of the drip system to a level that will ensure the long term operation of all SDD system components. Manufacturer's literature shall be submitted verifying acceptable iron levels in the wastewater.

Wastewater lagoons shall not be used in SDD systems.

5.5.3 Soil Loading Rates

The soil loading rate for all suitable SDD sites shall be 0.05 gallons/day/square feet. A different soil loading rate may be considered by the District, if it is verified by two pre-approved and independent soil scientists. The different soil loading rate shall be derived from soil conditions, properties and permeability as determined by a soil morphology examination as described in DHSS 19 CSR 20-3.060 (2) Site Evaluation (D) 2. Soil Morphology.

This soil morphology examination shall be performed by a soil scientist, professional licensed geotechnical engineer or professional licensed geologist who meets the experience qualifications of DHSS 19 CSR 20-3.080.

The Soil Site Assessment shall state if a site is suitable for SDD.

5.5.4 Depth and Spacing of Drip Line

SDD systems shall have emitter lines placed on 2 foot centers with a 2 foot emitter spacing such that each emitter supplies a 4 square foot area. These lines shall be placed at depths of 10-12 inches below the surface.

Closer line and/or emitter spacing may be used in heavy clay soils or very coarse sands where lateral movement of water is restricted, if justified by the soils report. Using closer spacing shall not reduce the size of the field.

5.5.5 Soil Layers and Types

The soil within the drip line area shall be uniform and homogeneous, non-compacted, and free of construction debris and rocks with volumes greater than 0.25 cubic feet.

5.5.6 Adding Fill to the Dispersal Field

Fill material shall not be added to dispersal fields.

5.5.7 SDD Systems on Sloped or Hilly Sites

A. High Points and Siphoning

A potential problem with buried drip lines is siphoning dirt into the emitters when the pump is switched off. For this reason:

1. Vacuum breakers shall be installed at the high point of the supply manifold and at the high point of the return manifold.
2. Drip lines shall be connected at the end to a common return line with a flush valve.
3. Drip lines shall be installed along a contour. Avoid installing lines along rolling hills where there are high and low points more than 3 feet off contour along the same line. Drip tubing shall not vary more than 3 feet vertically along one lateral. Drip lines shall not be installed over a ridge.

B. Low Head Drainage

At the end of each dosing cycle, wastewater within the system shall flow down to the lowest point within the drip zone when the pumps shut off (low head drainage). The following precautions shall be taken to mitigate low head drainage:

1. Install check valves on multiple zones to isolate the drip laterals. Check valves shall only be used if there is no risk of freezing in the manifolds. They are placed on the supply and return manifolds coupled with an air vent on the downhill side.
2, Install maximum/minimum length of manifolds and number of drip line runs per design to allow for irrigation over 24 hours and pump run time not to exceed 12 hours.
3. Slope the supply and return manifolds down to the pump tank so the effluent drains back down to the tank when the pump is turned off. Open the zone valves fully to drain the lines quickly.

5.5.8 Multiple Zones

Drip dispersal fields can be divided into multiple zones or sections with solenoid valves or index valves for the following reasons:

1. Steep slopes with a risk of low head drainage can be subdivided to distribute the water at system shut-down more uniformly in the field.
2. Smaller zones to reduce the required flow per minute which consequently reduces the size of the pump, valves, filters, supply and return lines.
3. Subdividing the field is a tool used to achieve the optimum ranges required to efficiently operate the pumps, filters and valves and achieve optimum tubing length.

Recommendations of the manufacturer or qualified system integrators shall be followed on multiple zone systems regarding the headworks, valving and flushing. Qualified system integrators are American Manufacturing Company Inc., Geoflow Inc., and JNM Technologies Inc.

5.5.9 Flushing Design

Proper flushing of the drip system is critical for proper long term operation. Fully automatic flushing is required for all SDD systems and shall be designed in accordance with the manufacturer's recommendations and shall be designed considering the following key points:

1. The flush return should be in a visible location.
2. Flush return flows must not adversely impact treatment system performance; minimize disturbance in the return tank and be sure to not overload secondary treatment.
3. Flush frequency shall be once per week for anaerobic systems and once per month for aerobic systems.

5.5.10 Winterization

The product literature shall provide recommendations for protecting the SDD system from the effects of cold weather in Boone County, Missouri. Those recommendations shall be incorporated into the design and installation of the system.

5.5.11 Pumps

Two (duplex) pumps shall be used on SDD systems. The pumps shall be manufactured by Goulds, Berkeley, Sta-Rite or pre-approved equal.

The design and construction of the pumping facility shall be in accordance with the City of Columbia, Missouri's Standard Specifications.

The following pump control equipment shall be used in SDD systems:

1. Multitrode MultiSmart Pump Station Manager
2. Omni-Site Crystal Ball
3. Multitrode Level Sensing Probe

5.5.12 Wastewater Flows and Storage

Flows used for the design SDD system shall be per the manufacturer's recommendation.

The calculation of those flows and required storage shall be as follows:

1. Average Daily Flow: Per MDNR 10 CSR 20-8.020 or historical flow data.
2. Peak Flow: Per MDNR 10 CSR 20-8.110 or historical flow data.
3. Emergency Storage: 8 hours of average daily flow

5.5.13 Lightning Protection

All electrical components in the system shall be grounded in accordance with City of Columbia, Missouri's Standard Specifications.

5.5.14 Operation and Maintenance Manuals

Comprehensive Operation and Maintenance Manuals for equipment and maintenance of the SDD System shall be submitted to the District.

APPENDIX A

Minimum Standards for Key SDD Components

SUBSURFACE DRIP DISPERSAL KEY COMPONENTS MINIMUM STANDARDS

Component	Standard	Notes
Dripline and blank Dripline	Per manufacturer's recommendations	Only wastewater tubing or emitters shall be used.
	Minimum flushing velocity shall be 2 fps	
Dripline installation depth	10″ to 12″ (15-30cm)	~~6" (15cm) standard.~~
Dripline minimum pressure	Flushing pressure shall be in accordance with hydraulic design	
Dripline fittings	Lockslip fittings. Using barb couplings if Lockslip does not fit through installation shank.	Reduces risk of tubing splitting.
Flexible pipe for loops	1/2″ IPS flexible PVC pipe	To avoid kinking
Air valves	2" for any drip area under 2500 emitters.	To assist in rapid pressurization, siphon break and to prevent suction of fines into emitters. Install in valve box with drain rock or pea gravel base. Install with no high or low points between valve and Dripline.
Supply mains	Design at 2-5 fps velocity for dosing flushing	
Pressure test ports	At manifolds, filter outlet, flush valve inlet.	
Check valves (if used)	To prevent back feed of sub areas from flush main, or to prevent drain down of one area to another.	Quality flapper or disc type check valves shall be used
Control valves/flush valve	Contamination resistant solenoid operated hydraulic diaphragm valves	Three way solenoid with external piloting and filtration recommended for larger systems.
	Motorized ball valves	Installed above any water level. Preferred for freezing conditions.
Flush return	Preferred, to septic tank inlet tee with air gap for observation.	Must not cause scouring or disturbance in tank. May be returned to treatment plant inlet if appropriate.
Disc filters	Maximum aperture size shall be per manufacturer's recommendation ~~130 microns~~	
	Screen filters, maximum differential of 2 psi at peak flow rate	For small residential systems with STEP do not use screen filters smaller than 1.5″ to avoid excessive differential

Component	Standard	Notes
Disc filters	Only auto flushing filters shall be used.	
	Differential pressure alarm/gage, set point 5 psi	Optional. May be replaced by pressure test ports.
Pump relief valve	Pressure Sustaining or Relief valve designed to keep pressure within maximum for headworks and achieve pump cooling flow. ~~To be used where pump maximum pressure in excess of 100 psi.~~	
Pump chamber	To meet minimum timed dose standards.	
Control panel	Timed dosing, with main dose at average flow, override at design flow and alarm for high level.	No dosing in excess of the Design flow.
	Alarm, audible and visual	For high level (optionally for filter differential)
	Low level cut off and alarm	To protect pump, with alarm.
	Drain down capability	For freezing conditions.
	Automatic flush capability.	Continuous flush is not recommended.
	Data logging capability High or low flow	Record of events with time, day, date stamp.
Septic tank treatment	Applicable	Applicable
Secondary treatment facility	See Section 5.5.2	Must be provided with outlet barrier filter to 1/16″ prior to pump tank. To be used in aerobic and anaerobic systems
Tanks	Shall meet Missouri Department of Natural Resources standards. Watertight tested, with waterproof risers to grade.	Installed to meet standard practice.
Pipe and plumbing components	Designed and manufactured to resist the corrosive effects of wastewater and common household chemicals, and meet applicable ASTM standards.	
Valve boxes	Provide concrete or equivalent strength valve boxes for all valves and pressure test points with pea gravel or gravel base and positive drainage. Frost protected where necessary. Mark valve box locations.	
Electrical components	Shall comply with appropriate local and national regulatory requirements. The installation of all electrical components must comply with local Electrical Code. Control valves must be wired to manufacturer standards.	