November 2, 1992

MEMORANDUM

GMP #9

TO: District Directors
Environmental Health Managers
Environmental Health Supervisors

THROUGH: Donald J. Alexander, Director
Division of OnSite Sewage and Water Services

FROM: David D. Effert, Technical Services Chief
Roger A. Cooley, Assistant Technical Services Chief
Division of OnSite Sewage and Water Services

SUBJECT: Generic Plans for Accessible Intermittent and Accessible Recirculating Sand Filters

Attached are design criteria and "generic" plans for accessible intermittent and accessible recirculating sand filters. These generic plans were prepared to assist the field environmental health specialist with the design and plan review of sand filter systems.

This information was developed as required by the Discharging Systems Regulations Implementation Manual (1992). The design criteria and "generic" plans substantially follow the design standards and recommendations provided in the Environmental Protection Agency's Onsite Wastewater Treatment and Disposal Systems Design Manual (1980). The design criteria were selected, because with proper use and maintenance, filter performance has been shown to achieve levels of treatment which comply with the 30 mg/l BOD_5 and 30 mg/l suspended solids limits of State Water Control Board's General Permit. Note that the "generic" plans are not intended to replace nor should they be used as bid or construction drawings. It may be necessary for bid or construction drawings to be developed for a specific site or project.

Design criteria and "generic" plans have not been prepared for subsurface sand filters because the design and placement of these filters is site specific. Recommended design standards for subsurface sand filters are included in the Office of Water Program's

Sewage Collection and Treatment Regulations (SCAT) and the Environmental Protection Agency's Onsite Wastewater Treatment and Disposal Systems Design Manual (1980). Plans and specifications for subsurface sand filters must be prepared by a Professional Engineer registered in the Commonwealth of Virginia.

Design criteria and "generic" plans have not been developed by the Division of Onsite Sewage and Water Services for sand filters or any other method of wastewater treatment which is required to comply with effluent limits of 10 mg/l BOD_5 and 10 mg/l suspended solids. Due to the high degree of treatment necessary, these systems must be designed by a Professional Engineer registered in the Commonwealth of Virginia.

The attached design criteria and "generic" plans are a first attempt to develop design standards for discharging onsite wastewater treatment systems. Undoubtedly, the design criteria presented here will have to be revised as field experience and new information is obtained. Comments from all environmental health personnel would be appreciated.

rac/dde

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GMP # 9

SEWAGE - ONSITE - GENERIC DESIGN OF SAND FILTERS

DESIGN CRITERIA AND GENERIC PLANS/SPECIFICATIONS
for
ACCESSIBLE INTERMITTENT AND RECIRCULATING SAND FILTERS

BACKGROUND

Section 2.27 of the Alternative Discharging Sewage Treatment Regulations for Single Family dwellings requires that plans and specifications for intermittent and recirculating sand filters be prepared by a professional engineer licensed to practice in Virginia, except for generic systems which have been approved by the Division of Onsite Sewage and Water Services. The Discharging Systems Regulations Implementation Manual directed that "generic" plans be developed by the Division of Onsite Sewage and Water Services. The following "generic" plans have been developed in compliance with the Discharging Systems Regulations Implementation Manual.

These "generic" plans substantially follow the design standards and recommendations provided in the Environmental Protection Agency's Onsite Wastewater Treatment and Disposal Systems Design Manual (1980). These "generic" plans, and additional design criteria, were selected because, with proper use and maintenance, sand filter performance has been shown to achieve levels of treatment which comply with the 30 mg/l BOD_5 and 30 mg/l suspended solids limits of the Virginia Water Control Board's General Permit. Note that the "generic" plans are not intended to replace nor should they be used as bid or construction drawings. It may be necessary for bid or construction drawings to be developed for a specific site or project.

DESIGN CRITERIA

Generic Plans and Design Specifications

Generic plans for a rectangular or circular sand filter configuration are presented in Figures 1 and 2, respectively. These figures can be used for both intermittent and recirculating sand filter designs. Generic design specifications are presented in Table 1.

Number of Filters Needed

A minimum of two filters are to be provided. Recirculating filters are usually operated simultaneously, whereas non-recirculating filters are usually alternated with one filter resting at all times.

Sand Media Containment Structure

The sand media must be contained in a structure that does not allow the wastewater to leak out; is resistant to the deterioration by sewage; and is able to support the sand and gravel media. The container/tank may be constructed of precast concrete, concrete block, steel, or fiberglass. Other material may be acceptable on a case by case basis. In all cases, the owner/contractor will be responsible for the structural integrity of the tank. It is beyond the scope of Technical Services, or the environmental health specialist, to determine the structural integrity of proposed containment structures. It is strongly recommended that the containment structure be approved by a professional engineer registered in Virginia.

Shape of the Sand Filter Bed

The geometric shape of the sand beds is not critical; hydraulic loading rate, dosing volume, depth and type of sand are more important design parameters. Beds may be rectangular, square, or circular.

Depth and Type of Sand in the Filter Bed

The depth of sand should be a minimum of 30-inches. Eventually the sand will clog and some of the sand will need to be removed. Once the sand depth decreases to 24 inches, additional sand should be added to bring the height up to its original design depth.

The effective size, *Se*, and uniformity coefficient, *Cu*, of the sand are very important in the operation of the sand filter. If the grain size of the sand is too small, the filter will require much more maintenance and may clog on a regular basis. If the grain size is too large, treatment efficiency will be reduced. A grain size analysis of the sand (indicating the *Se* and *Cu)* must be made prior to its use. The sand must be approved by the local health department prior to using it.

Effluent Distribution and Collection

The distribution of wastewater on the sand may be by upturned pipe, troughs or any other method which does not erode the sand and cause short circuiting of the wastewater through the sand. PVC schedule 40 pipe is recommended throughout the distribution system, although other corrosion resistant pipe may be suitable. The sizing of the force mains and distribution pipe will depend on the pump capacity and the means of distribution. The underdrain(s) should be constructed of 4 inch diameter perforated corrosion resistant pipe. All underdrain(s) must be vented to the atmosphere.

Effluent Dose Volume

The dosing volume is based on the surface area of the sand filter. Typically, the volume of effluent applied per dose is equal to the volume of effluent which would result in 2 inches of effluent ponding above the sand.

Recirculating Sand Filters

If a recirculating intermittent sand filter is proposed, a minimum of a 3:1 and a maximum of a 5:1 recirculation ratio of treated wastewater to design flow must be provided. A 5:1 recirculation ratio is recommended. Recirculation may be accomplished by using a distribution box, pressure manifold, moveable gate, pump and timer, floating ball, or any other design which will provide for proper recirculation. If a pump or the floating ball bypass is used, the pump must be provided with a timer. The timer must be set based on the capacity of the pump. The pumped volume would equal 3 to 5 times the design flow. For a three bedroom house designed at 450 gpd and a 5:1 recirculation ratio, the volume pumped would equal 2,250 gallons per day. If the pump has a capacity of 20 gpm, the timer should be set to operate 113 minutes per day.

Maintenance:

Both accessible intermittent and accessible recirculating sand filters require routine maintenance. Proper maintenance procedures include checking the dosing chamber equipment and controls, and raking, removing, and adding sand as required.

ADDITIONAL INFORMATION

Additional information on sand filters can be found in the publication entitled "Discharging Wastewater Treatment Technologies - Sand Filters" (1992), prepared by the Division of Onsite Sewage and Water Services, and the Environmental Protection Agency's Onsite Wastewater Treatment and Disposal Systems Design Manual (1980).

Disclaimer

These "generic" sand filter plans and specifications were prepared to assist the field environmental health specialist with the design and plan review of sand filter systems. They are not intended to replace, nor should they be used, as bid or construction drawings. It may be necessary for bid or construction drawings to be developed for a specific site or project.