COMMONWEALTH of VIRGINIA

C.M.G. BUTTERY, M.D.
COMMISSIONER

Department of Health
Richmond, Virginia 23219

May 12, 1988

MEMORANDUM

TO: Regional Managers X
District Sanitarians

FROM: David D. Effert D.D.E.
Technical Services Chief
Bureau of Sewage and Water

SUBJECT: Mass drainfield criteria

Enclosed is the formula which can be used to estimate the nitrate concentration of groundwater near a mass drainfield. It is fairly self-explanatory. Also enclosed is information which can be used to predict water mounding under mass drainfields. Sample calculations are provided. The three formulas used to predict water mounding have been written into a basic computer program which is available from Charles Swanson of this department. He can be contacted at 786-5568.

If you have any additional questions, I can be reached at 786-1750.

/der
Enclosure

5 inches
K. T.

VDH

Draft

Proposed
Mass Drainfield
Regulations
May 13, 1988

Article 2. Definitions

"Drainfield Acre" - A drainfield acre shall typically be a four sided area, 43,560 square feet in extent, with the length of the shortest side being not less than 75% of the length of the longest side.

"Mass Sewage Disposal System" - a mass sewage disposal system is a sewage disposal system which will discharge effluent to a single absorption area, or multiple absorption areas, with or without combined flows, such that the loading rate exceeds 1,200 gallons per any drainfield acre per day. Detached single family residences with individual sewage disposal systems are exempt from this definition.

§ 4.32 Special Requirements for Mass Sewage Disposal Systems. The criteria in this section apply to mass sewage disposal systems and shall supersede any other conflicting criteria contained elsewhere in these Regulations. Design criteria not specifically covered in this section shall be taken from the appropriate sections of these Regulations.

A. Ownership of a mass sewage disposal system shall be the same as described in section 3.13.05.

B. Mass sewage disposal systems shall be considered Type II Systems requiring formal plans and specifications.

C. Mass subsurface sewage disposal system shall be designed using low pressure distribution.

D. Separate reserve areas(s), meeting the requirements of the original absorption area(s), and equaling 100% of the required area, shall be provided adjacent to the proposed system.

E. The prevention of groundwater contamination shall be addressed by the applicant. Documentation shall include but not be limited to how nitrate-nitrogen concentrations in the groundwater will be reduced to 5 mg/l or less at the perimeter of the project.

F. The potential for effluent mounding below the absorption area shall be addressed by the applicant. Data shall be submitted which will demonstrate how a minimum of two feet of unsaturated soil will be maintained below the trench bottom.

G. In addition to the subsurface absorption system protection provided for in sections 8.05 and 8.05.06, a dedication document duly recorded with the Clerk of the Court shall be furnished to the Department stating that the sewage disposal system area(s) and reserve area(s) will be used only for sewage renovation and may not be used for excavation or permanent structures, while the mass sewage disposal system is utilized.

H. Groundwater, soil, and effluent sampling may be required on a case-by-case basis. Whenever a water supply or supplies are located down gradient from a mass sewage disposal system(s), at least one monitoring well shall be required between the water supply and the mass sewage disposal system.

Sampling parameters and frequency shall be established by the Department on a case-by-case basis.

Note the correction to the first equation.

The following outlines the calculations necessary to determine the impact of a mass drainfield on the nitrate concentration of groundwater. It is based on the concept of mass balance. The following assumptions are made:

1. The ammonia concentration of the wastewater is 65 mg/l. This value is based on an average ammonia concentration for domestic wastewater as reported in the EPA manual "Design of Onsite Wastewater Treatment Systems."

2. Of the 65 mg/l of ammonia, 50 percent is volatilized or otherwise lost. According to EPA, 99 percent of the rest is converted to nitrate under aerobic conditions. For calculation purposes, it is assumed that 30 mg/l of nitrate is available in domestic wastewater.

3. The average rainfall in the state is 43 inches per year. Of this, 20 inches per year infiltrates into the ground and is added to the groundwater. This assumes normal vegetation. Slope is not taken into account. If there are buildings or a paved parking lot, these areas are subtracted from the dilution area. Gravel parking lots have an estimated 5 inches of infiltration per year as estimated by the Soil Conservation Service. The system owner must own or control by legal easement the dilution area.

The following variables are needed to calculate the concentration of nitrate in the groundwater.

Dilution area (in acres) = D

Absorbed rainfall (in inches) = R (typically 20 inches)

The calculation of the groundwater nitrate concentration is a two step process. The first step involves determining what the dilution rate from rain water will be. This can be calculated with the following formula: $\times 10^6$

$$R \frac{\text{inches}}{\text{year}} \times \frac{1\text{ft.}}{12\text{ inches}} \times 3.259 \frac{\text{gal}}{\text{Ac ft.}} \times D \text{ acres} \times 1 \frac{\text{year}}{365\text{ days}} = \text{dilution (gal)}$$

Knowing the number of gallons of wastewater produced per day, the nitrate concentration of the groundwater leaving the property can be calculated as follows:

$$\frac{\text{No. of gallons of wastewater}}{\text{No. of gallons of ww + dilution}} \times \frac{30 \text{ mg}}{1} = \text{concentration, mg/l}$$