DRAFT MANUAL FOR LAND TREATMENT OF WASTEWATER
COMMENTS REQUESTED FROM
WATER RESOURCES ADVISORY COMMITTEE

August 30, 2006

The current *Manual for Land Application of Treated Sewage and Industrial Waste*, DEP ID: 362-2000-009, is being revised to reorganize and update various sections including guidance on determining hydraulic loading rates. The manual limits application rates for slow rate infiltration systems (spray irrigation) to a maximum of 2 inches per week, and for large volume community onlot systems the hydraulic loading rate is to be based on 4-10% of the saturated vertical hydraulic conductivity.

According to information in EPA's 2002 *Onsite Wastewater Treatment Systems Manual,* "Morphologic features of the soil, particularly structure, texture, and consistence, are better predictors of the soil's hydraulic capacity than percolation tests." Jerry Tyler, professor of soil science at the University of Wisconsin, has developed a table of hydraulic loading rates based on soil texture and structure, and numerous states have adopted this table for use in sizing onlot systems.

Department staff charged with revising the current manual has considered a number of alternatives for determining the hydraulic loading rate for a large volume onlot system. Most agree that a soil morphological loading rate table should be utilized for this purpose, and a number of options have been presented. A loading rate table could be developed based on the efforts of Jerry Tyler, or the loading rates could be closely associated with the percolation table in Chapter 73.16. The suggested loading rate table developed by Department staff, and the table developed by Jerry Tyler are presented on the following pages.

The Department requests comments and recommendations on the following:

- Should any changes be made to the process for determining the hydraulic loading rate for large volume onlot systems as described in DEP's current *Manual for Land Application of Treated Sewage and Industrial Waste?* If yes, what changes are recommended and why?

- If determining hydraulic loading rates based on soil morphology is recommended, how should loading rate tables be developed – following the process developed by DEP staff, table adopted from work of Jerry Tyler, or some other process?

Hydraulic Loading Rate Table Developed by DEP Staff

The percolation table, without the 1/3 reduction for ATU units was utilized, since the Manual proposes to use flows from the Domestic Wastewater Flow Manual, not Chapter 73. Therefore, the flows are already reduced, and an additional increase in loading rates would not be justifiable. The higher loading rates for coarser textured soils in the following table match closely to our percolation test ranges, and the slower rates for finer textured soils are in line with the manufacturers recommendations for large community systems.

The recommended changes for the Manual are as follows:

USDA Soil Textural Class	Soil Structure	Infiltrative Loading Rate (gal/ft2/day)
Coarse and Fine sand	To be considered	.25-.84
Loamy sands	Moderate to strong Weak to weak platy	.15-.6
Sandy loam	Moderate to strong Weak to weak platy Massive	 .15-.3 .1-.15
Loam, Silt loam	Moderate to strong Weak to weak platy Massive	 .15-.22 <.1
Sandy clay loam, Clay loam, Silty clay loam	Moderate to strong Weak to weak platy Massive	 .04-.1 0
Sandy Clay, Clay, Silty Clay	Moderate to strong Weak to weak platy Massive	<.075 0 0

Loading rates should not be assigned based on soil texture classes alone. Characterization of a soil based receiver site involves a systematic evaluation by trained soil scientists. Assignment of loading rates within the above table ranges shall be determined by site and soil conditions such as:

- *topographic and soil conditions such as regional hydrology and landscape position*
- *slope*
- *soil depth*
- *soil texture*
- *soil structure*

- *depth to restriction or limiting zone*
- *soil consistence*
- *clay mineralogy*
- *soil compaction*
- *soil density*
- *site uniformity*

Generally, deep soils with sandy and loamy textures should not be loaded at any greater than 2 inches per week or .18 gal/ft/day. The clay loams or shallow to limitation sites should not be loaded at any greater than 1 inch per week or .09 gal/ft2/day. Loading rates of ½ inches per week or .05 gal/ft2/day are indicated in the most severe sites.

An effort should be made to avoid concentration of the dispersal field in one area. Extending the system along contour as much as possible to reduce landscape linear loading as well as placement of the drip zones in differing landforms will enhance the hydraulic dispersal of the effluent on the landscape.

Hydraulic Loading Rate Table from EPA's 2002 *Onsite Wastewater Treatment Systems Manual* (adopted from Jerry Tyler)

Infiltration surface hydraulic loading design rates are a function of soil morphology, wastewater strength, and SWIS design configuration. Hydraulic loadings are traditionally used to size infiltration surfaces for domestic septic tank effluent. In the past, soil percolation tests determined acceptable hydraulic loading rates. Codes provided tables that correlated percolation test results to the necessary infiltration surface areas for different classes of soils. Most states have supplemented this approach with soil morphologic descriptions. Morphologic features of the soil, particularly structure, texture, and consistence, are better predictors of the soil's hydraulic capacity than percolation tests (Brown et al., 1994; Gross et al., 1998; Kleiss and Hoover, 1986; Simon and Reneau, 1987; Tyler et al., 1991; Tyler and Converse, 1994). Although soil texture analysis supplemented the percolation test in most states by the mid-1990s, soil structure has only recently been included in infiltrative surface sizing tables (table 4-3). Consistence, a measure of how well soils form shapes and stick to other objects, is an important consideration for many slowly permeable soil horizons. Expansive clay soils that become extremely firm when moist and very sticky or plastic when wet (exhibiting firm or extremely firm consistence) are not well suited for SWISs.

Table 4-3. Suggested hydraulic and organic loading rates for sizing infiltration surfaces

Texture	Structure		Hydraulic loading (gal/ft^2-day)		Organic loading (lb BOD/1000ft^2-day)	
	Shape	Grade	BOD=150	BOD=30	BOD=150	BOD=30
Coarse sand, sand, loamy coarse sand, loamy sand	Single grain	Structureless	0.8	1.8	1.00	0.40
Fine sand, very find sand, loamy fine sand, loamy very fine sand	Single grain	Structureless	0.4	1.0	0.50	0.25
Coarse sandy loam,	Massive	Structureless	0.2	0.6	0.25	0.15
	Platy	Weak	0.2	0.5	0.25	0.13

sandy loam		Moderate, Strong				
	Prismatic, blocky, granular	Weak	0.4	0.7	0.50	0.18
		Moderate, strong	0.6	1.0	0.75	0.25
Fine sandy loam, very fine sandy loam	Massive	Structureless	0.2	0.5	0.25	0.13
	Platy	Weak, mod., strong				
	Prismatic, blocky, granular	Weak	0.2	0.6	0.25	0.15
		Moderate, strong	04.	0.8	0.50	0.20
Loam	Massive	Structureless	0.2	0.5	0.25	0.13
	Platy	Weak, mod., strong				
	Prismatic, blocky, granular	Weak	0.4	0.6	0.50	0.15
		Moderate, strong	0.6	0.8	0.75	0.20
Silt loam	Massive	Structureless		0.2	0.00	0.05
	Platy	Weak, mod., strong				
	Prismatic, blocky, granular	Weak	0.4	0.6	0.50	0.15
		Moderate, strong	0.6	0.8	0.75	0.20
Sandy clay loam, clay loam, silty clay loam	Massive	Structureless				
	Platy	Weak, mod., strong				
	Prismatic, blocky, granular	Weak				
		Moderate, strong	0.2	0.3	0.25	0.08

Source: Adapted from Tyler, 2000.