

## How does a wastewater facility use land as the final treatment component?

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## Clarification

- Land Application
- Water recycling/reuse
  - Defined in Chapter 90.46 RCW
  - use of reclaimed water as permitted under this chapter for the purpose of irrigation or watering of landscape vegetation
  - Disposal not treatment

## Definition of Land Treatment

Land treatment – the application of appropriately pre-treated municipal and/or industrial wastewater to the land at a controlled rate in a designed and engineered setting.

### Benefits:

- Obtain beneficial use of the wastewater
- Improve environmental quality
- Achieve treatment goals
- Cost effective

## Regulations

- Groundwater Standards - Chapter 173.200 WAC
- Guidelines for Preparation of Engineering Report for Industrial Wastewater Land Application Systems
- Criteria for Sewage Works Design (Orange Book)

TABLE 1  
GROUNDWATER QUALITY CRITERIA

CONTAMINANT	CRITERION
<b>I. PRIMARY AND SECONDARY CONTAMINANTS AND RADIONUCLIDES</b>	
<b>A. PRIMARY CONTAMINANTS</b>	
Barium*	1.0 milligrams/liter (mg/l)
Calcium**	0.01 mg/l
Chromium*	0.05 mg/l
Lead*	0.05 mg/l
Mercury*	0.002 mg/l
Selenium*	0.01 mg/l
Silver*	0.05 mg/l
Fluoride	4 mg/l
Nitrate (as N)	10 mg/l
Endrin	0.0002 mg/l
Methoxychlor	0.1 mg/l
1,1,1-Trichloroethane	0.20 mg/l
2,4-D	0.10 mg/l
2,4,5-TP Silyox	0.01 mg/l
Total Coliform Bacteria	1/100 ml
<b>B. SECONDARY CONTAMINANTS</b>	
Copper**	1.0 mg/l
Iron*	0.30 mg/l

## Criteria for Land Treatment Facilities (Green Book)

### Limiting Design Parameter Concept

- Define the design criteria
- Define site management on a daily and yearly basis
- Provide an annual report template

## How to design a land treatment system

### Site Assessment

- Depth to groundwater
- Type of crop
- Type of soil
- Wastewater constituents





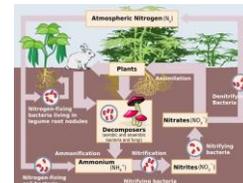
### BOD<sub>5</sub>

$$\text{load (lbs)} = \text{flow (MGD)} \times \text{concentration (mg/l)} \times 8.34$$

- Most of the biological activity occurs near the surface where organics are filtered by the soil and oxygen (aerobic conditions) is present to support biological oxidation.
- Excess organic loading
  - Odorous anaerobic conditions
  - Untreated organic passing through the soil profile
  - Mobilizing oxidized forms of iron and manganese

### Nitrogen

- Nitrogen exceeds agronomic rate of the plants then nitrate can be transported into the groundwater.
- Designs usually say 25% of the nitrogen will be lost to denitrification, and volatilization.
- Need to check the carbon to nitrogen ratio.



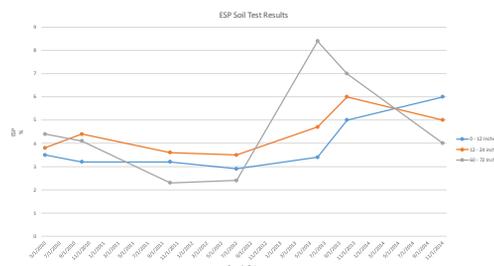
### Total Dissolved Solids (TDS)

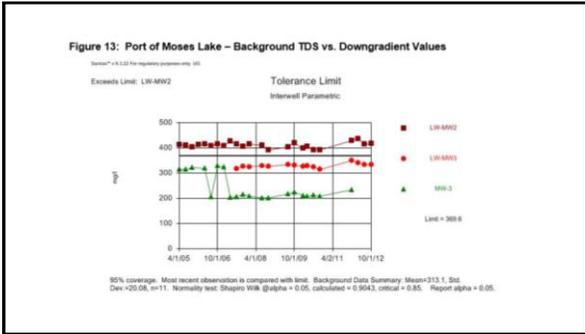
- A percentage consists of volatile dissolved solids.
- The other percentage is the fixed dissolved solids (FDS).
- The organic portion of the FDS is used by the plants.
- The inorganic portion (salts) needs to be leached from the soil profile.

Month	Wastewater BOD	Precip	Evapotranspiration	Balance	Soil Holding Capacity	Percolate Load	Leaching Fraction
Jan	0	1.5	0.4	1.1	0.5	0	0
Feb	0	2.54	0.52	2.02	0.12	0	0
Mar	0	3.41	1.99	1.42	0.54	0	0
Apr	0	1.47	1.62	-0.15	0.39	0	0
May	1.55	0.99	0.85	4.83	2.99	0.4	0
Jun	3.6	2.31	1.57	5.25	3.37	1.09	0
Jul	3.1	1.99	0.25	7.77	0.53	0.5	0
Aug	2.79	1.79	0.67	5.77	0.31	0.81	0
Sep	0	0.37	1.67	-1.3	0.11	0	0
Oct	0	2.02	2.17	-0.15	0.26	0	0
Nov	0	1.7	0.66	1.04	0.22	0	0
Dec	0	2.35	0.31	2.02	0.2	0	0

### Permit Monitoring

- Wastewater applied to each field
- Crop
- Soil
- Groundwater





Questions