

# **Model Decentralized Wastewater Practitioner Curriculum**

## **Soil and Site Evaluation**

### **Needs to Know**

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February 2005

The target audiences for the materials included in this module include a variety of practitioners in the onsite wastewater treatment industry. The purpose of this Needs-to-Know is to provide a list of important concepts related to Soil and Site Evaluation that the combined potential audiences should be familiar with.

Needs to know (Soil Scientist, Designer, EHS, Soil Evaluators, Regulators-field)

1. What is a soil?
  - a. Five parts of a soil
  - b. Variability across landscape
2. How do soils form?
  - a. 5 (6) factors of formation
  - b. Processes that influence soils to onsite wastewater treatment and disposal
3. How to describe soils and site conditions/factors
  - a. Soil Profile Descriptions
    - i. Soil Color
    - ii. Texture
    - iii. Structure
    - iv. Consistence
    - v. Horizons (including restrictive horizons)
    - vi. Features (redoximorphic features)
    - vii. Roots
  - b. Site Conditions/factors
    - i. Slope
      1. Gradient
      2. Position
    - ii. Land surface shape
    - iii. Aspect
    - iv. Soils in Context
      1. Parent Material
        - a. Sink holes
        - b. Depositional features (glacial)
        - c. Erosion surfaces
      2. Topography/Drainage/Hydrology
      3. Vegetation/Microclimate
    - v. Watershed components
      1. Upland (Recharge)
      2. Conveyance (Flow-through)
      3. Collection (Discharge)
    - vi. Other factors
      1. Disturbance
      2. Wells (on and off-site)
      3. Property boundaries

4. Surface waters (type and location)
  5. Current land use
  6. Land use in vicinity
  7. Other cultural influences (utility lines, cemeteries)
4. Understand the role of each of the following soil properties and site conditions relative to wastewater treatment and dispersal:
- a. Physical properties
    - i. Soil permeability (Hydrology/hydraulics) and aeration
      1. Texture
      2. Structure
      3. Mineralogy
      4. Consistence
      5. Restrictive horizons
      6. Other physical properties
    - ii. Aerobic status of the soil (soil saturation)
    - iii. Soil Depth
  - b. Biological and chemical properties
    - i. Distribution of organism in the soil
      1. Anaerobic vs. aerobic organism
      2. Fluctuating water tables
    - ii. Distribution of organic carbon and biological activity
    - iii. Fe, Al, CaCO<sub>3</sub> for P removal
    - iv. CEC, pH
  - c. Site Conditions
    - i. Landscape
      1. Redistribution of water (Where does the water move due to shape)
      2. External Drainage (Slope gradient, location, and position)
      3. Aspect (radiant energy)
    - ii. Watershed components
      1. Upland (Recharge)
      2. Conveyance (Flow-through)
      3. Collection (Discharge)
    - iii. Vegetation
      1. ET
      2. Tree removal
    - iv. Parent Material
      1. Hydrology
      2. Treatment (nutrients and bacteria)
    - v. Other
      1. Off site influences
        - a. "Dueling Fill"

- b. Up slope additions (cumulative influence of systems)
          - 2. Wells
          - 3. Surface Waters
- 5. Matching the system to the site
  - a. Sewage
    - i. Volume
    - ii. Strength
    - iii. Components
    - iv. Flow variability
      - 1. Seasonal
      - 2. Daily
  - b. Assigning loading rate
    - i. Texture
    - ii. Structure
    - iii. Consistence
    - iv. Landscape gradient, position, type, etc.
    - v. Depth
    - vi. Restrictive Horizons (pedogenic features)
    - vii. Limiting layers (geologic features – dense till, bedrock, gravel layers)
  - c. Vertical separation (aerobic zone)
  - d. Landscape parameters
    - i. Effective depth
    - ii. Diversions (hydrology, curtain drains)
  - e. Risk Management
    - i. Environmentally sensitive areas (receiving bodies- wells, water bodies, etc.)
    - ii. Cumulative effects
    - iii. TMDL principles (or what ever is currently in vogue)
    - iv. Watershed components (surface and subsurface)
      - 1. Upland (Recharge)
      - 2. Conveyance (Flow-through)
      - 3. Collection (Discharge)
- 6. Principles of soil and site management
  - a. Preconstruction
    - i. Site/soil evaluation
    - ii. Flagging off drainfield/reserve area
  - b. Installation
    - i. Site disturbance
    - ii. Compaction
    - iii. Wetness during excavation and backfilling

- c. Post-installation
  - i. Vegetative cover
  - ii. Landscaping (turtle back)
  - iii. Traffic
  - iv. Water management
    - 1. Irrigation
    - 2. Roof drainage
    - 3. Surface drainage
    - 4. Sump pumps
    - 5. Etc.

Needs to know (Installer, pumper, inspector, operator, loan evaluator)  
- Lower level of detail than in practitioners sections

7. What is a soil?
  - a. Five parts of a soil
  - b. Variability across landscape
  
8. How do soils form?
  - a. Processes that influence soils to onsite wastewater treatment and disposal
  - b. Wetness and morphology relations
  
9. Critical components of soil and site conditions
  - a. Soil Profile
    - i. Soil Color
    - ii. Texture
    - iii. Structure
    - iv. Consistence
    - v. Horizons (Master Horizons)
  - b. Site Conditions
    - i. Slope
      1. Gradient
      2. Position
    - ii. Land surface shape
    - iii. Hill slope Hydrology
    - iv. Other factors
      1. Disturbance
      2. Wells (on and off-site)
      3. Property boundaries
      4. Other cultural influences (utility lines, cemeteries)
  
10. Understand the role of each of the following soil properties and site conditions relative to wastewater treatment and dispersal:
  - a. Soil properties
    - i. Soil permeability (Hydrology/hydraulics) and aeration
    - ii. Aerobic status of the soil (soil saturation)
    - iii. Soil Depth
    - iv. Biological
    - v. Chemical
  - b. Site Conditions
    - i. Landscape
      1. Redistribution of water (Where does the water move due to shape)
      2. External Drainage (Slope gradient, location, and position)
    - ii. Other

1. Off site influences (“Dueling Fill”)
2. Wells
3. Surface Waters (Flood plains)

11. Understand why the system should be matched to the site
  - a. Sewage
  - b. Assigning loading rate based on soil properties
  - c. Vertical separation (aerobic zone)
  - d. Landscape parameters
  - e. Risk Management (environmentally sensitive areas)
  
12. Understand principles of soil and site management
  - a. Preconstruction
    - i. Site/soil evaluation
    - ii. Flagging off drainfield/reserve area
  - b. Installation
    - i. Site disturbance
    - ii. Compaction
    - iii. Wetness during excavation and backfilling
  - c. Post-installation
    - i. Vegetative cover
    - ii. Landscaping (turtle back)
    - iii. Traffic
    - iv. Water management
      1. Irrigation
      2. Roof drainage
      3. Surface drainage
      4. Sump pumps
      5. Etc.

Needs to know (Realtors, Public Officials, Planners, Developer, Homeowners, Bankers and lenders)

- Lower level of detail than in Installer

13. What is a soil?
  - a. Five parts of a soil
  - b. Variability across landscape
  - c. Variability across the state/region
  
14. How do soils form? (Factors and processes of formation that relate to soil variability)
  
15. Critical components of soil and site conditions
  - a. Soil Characteristics
  - b. Site Conditions
  - c. Hydrology
  - d. Disturbance
  - e. Cultural influences (wells, property boundaries, utility lines)
  
16. Understand the role of each of the following soil properties and site conditions relative to wastewater treatment and dispersal:
  - a. Soil properties
    - i. Soil permeability (Hydrology/hydraulics) and aeration
    - ii. Aerobic status of the soil (soil saturation)
    - iii. Soil Depth
  - b. Site Conditions
    - i. Landscape (hydrology)
    - ii. Surface Waters (FEMA)
    - iii. Wells
  
17. Understand why the system should be matched to the site
  - a. Sewage
  - b. Assigning loading rate based on soil properties
  - c. Vertical separation (aerobic zone)
  - d. Landscape parameters
  - e. Risk Management (environmentally sensitive areas)
  
18. Understand the rationale for soil and site management
  - a. Site/soil evaluation
  - b. Flagging off drainfield/reserve area
  - c. Site disturbance
  - d. Compaction and Traffic
  - e. Wetness during excavation and backfilling
  - f. Vegetative cover



- g. Landscaping (turtle back)
- h. Water management
  - i. Irrigation
  - ii. Roof drainage
  - iii. Surface drainage
  - iv. Sump pumps