Designer - Need to Know

I. The Professional will have essential knowledge of wastewater characteristics needed to effectively design septic systems.

A. Wastewater sources
   1. Domestic
   2. Non-Domestic
      a. Commercial
         (1) Definition
         (2) General solutions
      b. Non-sewage wastes
         (1) Definition
         (2) solutions

B. Hydraulics
   1. Determine flows from single family homes up to 9 homes in a cluster
      a. Determine the number of bedrooms
   2. Determine flows for clusters greater then 9 homes
   3. Determine flows from other establishments
      a. Measured
         (1) Peak daily low for tank sizing
         (2) Peak 7 day for drainfield sizing
      b. Estimated
         (1) "A" section of the manual - how to interpret

C. Waste Strength
   1. Demonstrate knowledge of definition, impacts upon system and typical amounts of wastewater characteristics
   2. BOD
      a. Understand measurement and typical values
      b. Calculate BOD loading
      c. Understand how it impacts systems
   3. TSS
      a. Understand measurement and typical values
      b. Understand how it impacts systems
   4. FOG
      a. Understand measurement and typical values
      b. Understand how can impact systems

D. Other components of wastewater
   1. Bacteria and viruses
      a. Definition
      b. Fecal Coliform
   2. Nitrogen
      a. Definition
         (1) Cycle throughout system
   3. Phosphorus
      a. Definition

b. Treatment
4. Chemicals
   a. Pharmaceuticals
   b. Household chemicals
   c. Hazardous waste

II. Understand general design principals, rule limitations and constructability issues.

A. Topography
   1. Upslope conditions - run-on/diversions
   2. Slopes, elevations and benchmarks
   3. System orientation to slope
B. Soils
   1. Coarse sand treatment concerns
   2. Heavy clay acceptance and smearing concerns
      a. Plastic limit
      b. Above ground system required
C. Property boundaries, improvement, obstructions easements and setbacks
D. Special equipment needed
E. Accessibility for installation and maintenance
   1. Equipment limitations
   2. Traffic patterns to minimize compaction
   3. Maximum lift of typical pump trucks
   4. Winter operation and protection from freezing
F. Impact to site

III. Understand and design collection and building sewer from single family homes

A. Basement grinder and injector pump consideration
B. Building sewers
   1. Acceptable pipe materials
   2. Slope
   3. Diameter
   4. Min and max depths
   5. Freezing
   6. Cleanouts
      a. Accessibility
      b. Diameter
      c. Spacing

IV. Demonstrate the treatment achieved and proper sizing of septic tanks size

A. Treatment achieved with domestic sewage
   1. BOD
   2. TSS
   3. FOG

B. Tank sizing for dwellings
    1. With no garbage disposal (GD) or pump in basement (pump)
    2. Sizing with GD
    3. Sizing with pumps in basement
    4. Sizing with both GD and pump
C. Tank sizing for other establishments
D. Flammable waste trap
    1. When required
    2. Proper design
E. Compartmentalized
F. Bury depth
    1. Tank
    2. Risers
    3. Inspection pipes
G. Setbacks, easements
H. Effluent filters
    1. Types
    2. Applications

V. Demonstrate the applications and proper sizing of a lift station

A. Determine capacity
B. Maintenance access location
    1. Determine proper dosing frequency and amount
        a. Dose
        b. Friction loss
        c. Drain back
    2. Wiring – licensed electrician
    3. Control panels
C. Protection from freezing

VI. Understand applications of different types of pumps

A. Sump
B. Ejector
C. Grinder
D. Turbine
E. Centrifugal

VII. Demonstrate ability to size pumps based on the application

A. Block requirement
B. Calculating total dynamic head
C. Calculating gallons per minute
D. Siphons
E. *Uneven pressure distribution*

VIII. Understand how to design a pressure distribution system

A. Identify when required
B. Design to assure even distribution
    1. Acceptable pipe diameter and specifications
    2. Lateral spacing, perforation diameter and perforation spacing
    3. Design for pipes at different elevations

IX. Demonstrate knowledge of applications and design of trench and seepage beds systems

A. Determine loading rates given soil textures, structures and percolation rates
B. Trench
    1. Determine sizing (loading rates given soil textures, structures and percolation rates) and geometry (width, height, depth)
    2. Location
        a. Topography
        b. Setbacks, easements
        c. Unknown buried items (fuel oil tanks, old drainfields)
    3. Inspection pipes
        a. Uses
        b. Size and locations
        c. Securing
    4. Design for different distribution media
        a. Rock, pipe and geotextile
        b. Chambers
        c. Gravelless pipe
        d. Other media not specified in Chapter 7080
    5. Surface water diversion and erosion control
C. Beds
    1. Determine sizing (loading rates given soil textures, structures and percolation rates) and geometry (width, height, depth)
    2. Location
        a. Topography
        b. Setbacks
    3. Inspection pipes
        a. Uses
        b. Size and locations
        c. Securing
    4. Distribution methods
        a. Gravity
        b. Pressure
    5. Surface water diversion and erosion control
D. Design a gravity distribution system for trenches and beds
    1. Pipe diameter and specifications

2. Perforation diameter and spacing
3. Drop Boxes
    a. Use
    b. Specifications
4. Distribution Boxes
    a. Use
    b. Specifications

X. Demonstrate knowledge of applications and design of At-grade systems

A. Determine sizing and linear loading rate (loading rates given soil textures, structures and percolation rates) and geometry (width, height, depth)
B. Location
    1. Topography
    2. Setbacks
    3. Unknown buried items (fuel oil tanks, old drainfields)
C. Inspection pipes
    1. Uses
    2. Size and locations
    3. Securing
D. Pressure distribution system
E. Uneven pressure distribution
F. Split an at-grade into section
G. Surface water diversion and erosion control

XI. Demonstrate knowledge of applications and design of mound systems

A. Determine sizing and linear loading rate (loading rates given soil textures, structures and percolation rates) and geometry (width, height, depth)
    1. Rock bed
    2. Absorption width
B. Location
    1. Topography
    2. Setbacks
    3. Unknown buried items (fuel oil tanks, old drainfields)
C. Inspection pipes
    1. Uses
    2. Size and locations
    3. Securing
D. Pressure distribution system
E. Uneven pressure distribution
F. Split a mound into sections
G. Surface water diversion and erosion control

XII. Understand the design of greywater systems

A. *Determining sizing and linear loading rate (loading rates give4nsoil textures, structures and percolation rates) and geometry (width, height and depth)*
   1. *Rock bed*
   2. *absorption width*
B. *Location*
   1. *Topography, blend mound into landscape*
   2. *setbacks, easements*
   3. *inspection pipes*
C. *Unknown buried items (fuel oil tanks, old drainfields)*
D. *Size reduction for soil treatment area*

XIII. Understand the design of collector systems

A. *Determining sizing and linear loading rate (loading rates give4nsoil textures, structures and percolation rates) and geometry (width, height and depth)*
   1. *Rock bed*
   2. *absorption width*
B. *Location*
   1. *Topography, blend mound into landscape*
   2. *setbacks, easements*
   3. *inspection pipes*
C. *Unknown buried items (fuel oil tanks, old drainfields)*
D. *Calculating wastewater flow.*

XIV.Demonstrate knowledge of applications and design of Alternative Systems

A. Holding Tanks
   1. Use
   2. Capacity
   3. Access
   4. Alarm
   5. Emergency overflow
   6. Maintenance contract
B. Flood plain
   1. Location – flood fringe
   2. No inspection pipes
   3. Pump shut off and backflow prevention
   4. If tank is covered with water sewage generation must stop
   5. Mound design
      a. Rock bed elevation
      b. Inspection pipes
   6. Holding tank sizing
   7. Maintenance after a flood
C. Privies
   1. 3 foot separation requirement or over a vault
   2. Setbacks

3. Must have 25 ft^3 of capacity
4. Venting
5. Maintenance

XV. Demonstrate knowledge of types of systems and regulatory requirements with Other systems

A. *Regulatory requirements*
   1. *3 feet of soil treatment*
   2. *Medium sand or finer*
   3. *Load at a rate of no greater than 1.2 gpd/ft^2*
   4. *Flow measurement, monitoring and mitigation plan*

B. *Types of systems*
   1. *Mounds built on unnatural soil or with less the 12" of unsaturated soil*
   2. *Partially buried systems*
   3. *Tile drainage*
   4. *Soil treatment system downsized but not loaded at greater than 1.2 gpd/ft^2*
   5. *Sand or peat filters with soil treatment systems totaling 3 feet of soil treatment*

XVI. Demonstrate knowledge of types of systems and regulatory requirements with Performance systems

A. *Regulatory requirements*
   1. *Flow measurement, monitoring and mitigation plan*
   2. *Operating Permit*
   3. *Must have "some separation"*
   4. *25' horizontally from the system fecal coliform = 0*
   5. *If lot adjoins a lake the total phosphorus must be <1 mg/l 50 feet from the system*

B. *Types of systems*
   1. *Soil treatment system downsized loaded greater than 1.2 gpd/ft^2*
   2. *Non-soil based pretreatment units followed by less then 3' of separation*
      a. *ATU*
      b. *Gravel filters*
      c. *Textile filters*
      d. *Constructed wetlands*

XVII. Demonstrate general knowledge about system operation, performance and applications drip distribution.

A. *Definition*
B. *Treatment process*
C. *Applications*
D. *Performance*

XVIII. Demonstrate general knowledge about system operation, performance and applications of pretreatment technologies.

A. *Aerobic treatment units*
   1. *Definition*
   2. *Treatment process*
   3. *Applications*
   4. *Performance*
B. *Media Filters*
   1. *Definition and Types*
      a. *Sand*
      b. *Peat*
      c. *Textile*
      d. *Gravel*
      e. *Other*
      f. *Recirculating*
   2. *Treatment process*
   3. *Applications*
   4. *Performance*
C. *Constructed wetlands*
   1. *Definition*
   2. *Treatment process*
   3. *Applications*
   4. *Performance*

XIX. Demonstrate general knowledge of design solutions to difficult lots.

A. Small lots
   1. Water conservation
   2. Small field with holding tank
   3. *Pretreatment to reduced sized drainfield*
   4. Time dosing from large pump tank
B. Lack of unsaturated soil
   1. *Pretreatment technologies*
   2. Reduced linear loading rate
   3. *Recycle system*
C. Gravelly textured soil
   1. Pretreatment units
   2. Mound systems
   3. Liner systems
D. *Damaged soils*
   1. *Excavate out*
   2. *Pretreatment*
   3. *Reduced linear loading rate*

XX. The Professional must have general math skills.

A. Add, subtract, multiply and divide

1. Slope
2. Unit conversion
3. Metric vs. English

B. Basic algebra/geometry
C. Graphing (pump curves)
D. Reading and communication skills

XXI. The professional must have the ability to develop a management plan for the system.

A. Communicate plan to owner when available

Topics Omitted for Advanced/Master Designer

1. *Commercial establishment design*
   a. *flow*
   b. *waste strength*
   c. *pretreatment*
      (1) *septic tank detention*
      (2) *aerobic tanks*
      (3) *sand filters*
   d. *Soil treatment sizing*
2. *Cluster design*
3. *Advanced Treatment Unit and drip design*