Designer - Need to Know

A designer will locate and design the onsite wastewater treatment system using good design judgment and relies on appropriate design methods and calculations.

I. Demonstrate Knowledge of Wastewater Characteristics Needed to Design Onsite Wastewater Treatment 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 residential dwelling
      a. Determine the number of bedrooms
      b. Determine the number of fixtures
   2. Determine flows from non-residential dwelling
      a. Use applicable Arizona Administrative Code provisions
      b. Measured
         (1) Peak daily flow for tank sizing
         (2) Peak 7 day for drainfield sizing
   3. Biomat development
   4. Part-time and vacation use

C. Waste strength
   1. Demonstrate knowledge of definition, impacts upon the onsite wastewater treatment system, and typical amounts of wastewater characteristics
   2. Biochemical oxygen demand (BOD)
      a. Understand measurement and typical values
      b. Calculate BOD loading
      c. Understand how it impacts systems
   3. Total suspended solids (TSS)
      a. Understand measurement and typical values
      b. Understand how it impacts systems
   4. Fats, oils, and grease (FOG)
      a. Understand measurement and typical values
      b. Understand how can impact systems

D. Other pollutants of source water
   1. Bacteria and viruses
      a. Definition
         (1) Fecal Coliform
      b. Impacts on onsite wastewater treatment systems

2. Nitrogen
    a. Definition
        (1) Cycle throughout system
    b. Impacts on onsite wastewater systems
    c. Treatment
3. Phosphorus
    a. Definition
    b. Impacts on onsite wastewater systems
    c. Treatment
4. Dissolved oxygen (DO)
    a. Definition
    b. Impacts on onsite wastewater systems
    c. Treatment
5. Temperature
    a. Definition
    b. Impacts on onsite wastewater systems
    c. Treatment
6. Chemicals
    a. Types
        (1) Pharmaceuticals
        (2) Household chemicals
            (a) Detergents
            (b) Fabric softeners
            (c) Disinfectants
        (3) Hazardous waste
    b. Definitions
    c. Impacts on onsite wastewater treatment systems
    d. Treatment
7. Water treatment devices
    a. Water softeners
    b. Reverse osmosis units
    c. Commercial ice makers
    d. Impacts on onsite wastewater treatment systems
8. Miscellaneous
    a. Sanitary wipes
    b. Gray water
    c. Impacts on onsite wastewater treatment systems

II. Interpret Site Characteristics and Constructability Issues

A designer needs to be able to interpret site characteristics and identify all constructability issues.

A. Topography
    1. Slopes, elevations, and benchmarks
    2. Upslope conditions

        a. Avoiding surface water run-on
        b. Diversions
    3. Downslopes and surfacing
    4. Onsite wastewater treatment 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
    3. Percent rock
C. Property boundaries, improvement, obstructions, easements, and setbacks
    1. Vertical separation
    2. Limiting conditions
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. Demonstrate Design of Collection and Building Sewers

A. 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
B. Basement grinder and injector pump consideration
    1. Consequences for septic tank

IV. Demonstrate Sizing and Installation of Septic Tanks

A. Treatment achieved with domestic sewage
    1. BOD
    2. TSS
    3. FOG
B. Tank sizing for residential dwellings
    1. With no garbage disposal or pump in basement
    2. Sizing with garbage disposals
    3. Sizing with pump in basement

4. Sizing with both garbage disposals and pump in basement

C. Tank sizing for non-residential dwellings
D. Compartmentalization
   1. Double chambers
   2. Single chambers in sequence
E. Bury depth
   1. Tank
   2. Risers
   3. Inspection pipes
F. Buoyancy calculations
G. Setbacks, easements
H. Effluent screens
   1. Types
   2. Applications

V. Demonstrate Knowledge of Applications and Design of Trench and Bed Soil Treatment Systems

A. Determine loading rates
B. Trenches
   1. Determine size (loading rates given soil textures, structures, and percolation rates)
   2. Determine geometry (width, height, depth)
      a. Number of trenches
   3. Location
      a. Topography
      b. Setbacks, easements
      c. Unknown buried items (fuel oil tanks, old drainfields)
   4. Inspection pipes
      a. Uses
      b. Size and locations
      c. Securing
   5. Distribution media
      a. Rock, pipe, and geotextile
      b. Chambers
      c. Gravelless pipe
      d. Other media
   6. Distribution methods
      a. Parallel
      b. Serial
      c. Dropboxes
      d. Distribution boxes (D-boxes)
      e. Distribution valves
      f. Gravity
      g. Pressure
   7. Surface water diversion and erosion control

C. Beds
    1. Determine size (loading rates given soil textures, structures, and percolation rates)
    2. Determine geometry (width, height, depth)
    3. Location
        a. Topography
        b. Setbacks
    4. Inspection pipes
        a. Uses
        b. Size and locations
        c. Securing
    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. Elevations

VI. Demonstrate Knowledge of Applications and Design of Seepage Pit Soil Treatment Systems

A. Determine loading rates
B. Determine size (loading rates given soil textures, structures, and percolation rates)
C. Recognize location limitations based on Arizona soils maps

VII. Demonstrate Knowledge of Applications and Sizing of a Pump Tank

A. Determine capacity
B. Determine proper dosing frequency and amount
    1. Dose
    2. Friction loss
    3. Drain back
C. Buoyancy calculations
D. Wiring
    1. Wiring diagrams
E. Control panels
F. Maintenance access location
G. Protection from freezing
    1. Drain back
    2. Backflow preventer removal
H. Telemetry

VIII. Distinguish When to Use Different Types of Pumps

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

E. Centrifugal
F. Multi-stage?

IX. Demonstrate Ability to Size Pumps Based on the Application

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

X. Demonstrate Knowledge of Applications and Design of Pressure Distribution Systems

A. Identify when required
B. Design hydraulic components
    1. Acceptable pipe diameter and specifications
    2. Lateral spacing, perforation diameter, and perforation spacing
    3. Design for pipes at different elevations
    4. Goal is even distribution

XI. Demonstrate Knowledge of Applications and Design of At-grade Systems

A. Identify types of at-grade systems
B. Determine size and linear loading rate (loading rates given soil textures, structures, and percolation rates)
C. Determine geometry (width, height, depth)
D. Location
    1. Topography
    2. Setbacks
    3. Unknown buried items (fuel oil tanks, old drainfields)
E. Distribution media
    1. Rock, pipe, and geotextile
    2. Chambers
    3. Gravelless pipe
    4. Other media
F. Distribution methods
    1. Parallel
    2. Serial
    3. Dropboxes
    4. Distribution boxes (d-boxes)
    5. Distribution valves
    6. Gravity
    7. Pressure
        a. Even
        b. Uneven
G. Inspection pipes

1. Uses
2. Size and locations
3. Securing

H. More than one at-grade unit in design
I. Surface water diversion and erosion control

XII. 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)
B. Determine geometry (width, height, depth)
   1. Rock bed
   2. Absorption width
C. Location
   1. Topography
   2. Setbacks
   3. Unknown buried items (fuel oil tanks, old drainfields)
D. Inspection pipes
   1. Uses
   2. Size and locations
   3. Securing
E. Pressure distribution system
F. Uneven pressure distribution
G. Multiple mounds in design
H. Surface water diversion and erosion control

XIII. Demonstrate Knowledge of Applications and Design of Greywater Systems

A. Identify types of greywater systems available
B. Compare benefits and drawbacks of available greywater systems
C. Code requirements for a greywater system
D. Code requirements for designing an onsite wastewater treatment system with a greywater system
E. Location
   1. Topography
   2. Setbacks, easements
F. Recognize that there is NO size reduction for soil treatment area

---

XIV. 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.*

XV. 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

XVI. 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*

XVII. 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*

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

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

XIX. 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*

XX. 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*

XXI. Demonstrate General Math Skills

The Professional must be able to demonstrate competency with 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

XXII. Demonstrate the Ability to Develop a Management Plan for the Entire Onsite Wastewater Treatment System

The professional must have the ability to develop a management plan for the entire onsite wastewater treatment system including all sub-systems.

A. Communicate plan to owner when available
B. Include greywater system

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*