Designer - Need to Know

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

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

G. Floodplain
1. Consequences of locating in floodplain
2. Designing systems in floodplain

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 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
G. Determine loading rates
H. Determine size (loading rates given soil textures, structures, and percolation rates)
I. Determine geometry (width, height and depth)
    1. Rock bed
    2. absorption width
J. Calculating wastewater flow

XI. Demonstrate Knowledge of Applications and Design of Non-treatment Systems

A. Holding Tanks (Sewage Vaults)
    1. Use
    2. Capacity
    3. Access
    4. Alarm
    5. Emergency overflow
    6. Maintenance contract
B. Floodplain
    1. No inspection pipes
    2. Pump shut off and backflow prevention

3. If tank is covered with water sewage generation must stop
4. Mound design
    a. Rock bed elevation
    b. Inspection pipes
5. Holding tank sizing
6. Maintenance after a flood

C. Pit Toilet (Earth pit Privies), fixed or transportable chemical toilets, incinerator toilet or privy, or pail- or can-type privy; APP 1.08 general permit)
1. Code requirements for these systems
    a. APP: In Arizona currently: IF allowed by a county health or environmental department
    b. Other applicable code
2. Design reference = Bulletin 2
3. Setbacks
4. Venting
5. Maintenance

XII. Demonstrate Knowledge of Applications and Design of Alternative Systems

A. System Types
1. Aerobic treatment units
    a. Identify types
2. Sand filters
3. Peat filters
4. Textile filters
5. Constructed wetlands
6. Engineering pads
7. Pressure distribution
8. At-grade
    a. Identify types of at-grade systems
9. Mounds
10. Drip distribution
11. Other

B. Definitions
C. Treatment processes
D. Applications
E. Locating
1. Setbacks
2. Topography
3. Surface water diversion and erosion control

F. Distribution methods
1. Single pass
2. Recirculating

G. Determine loading rates
H. Determine size (loading rates given soil textures, structures, and percolation rates)
I. Determine geometry (width, height, depth)

J. Performance
    1. Design hydraulic components
        a. Acceptable pipe diameter and specifications
        b. Lateral spacing, perforation diameter, and perforation spacing
        c. Design for pipes at different elevations
    2. Goal is even distribution
K. Inspection points
    1. Types
    2. Size and locations
    3. Securing
    4. Accommodating site conditions

XIII. Demonstrate 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
    4. Karst voids
    5. High groundwater
    6. Presence of bedrock
    7. Caliche
C. Excessively permeable soils
    1. Applicable treatment and dispersal systems
D. Excessively tight soils
    1. Applicable treatment and dispersal systems
E. Damaged soils
    1. Excavate out
    2. Pretreatment
    3. Reduced linear loading rate
F. Applicable treatment and dispersal systems
G. Floodplains
H. Steep slopes
I. Cut banks
    1. Cuts created by construction
    2. Setbacks
J. Earth fissures
K. Proximity to surface waters

XIV. 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

XV. 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 (if present)