

## I. SOIL PROPERTIES

### A. PARENT MATERIAL

1A. **Weathered bedrock** (page 8) – has *one or more* of the following:

- > 80% of material in diagnostic zone is so hard that roots will not grow into it (qualifies as bedrock limiting layer)
- < 80% of the material is hard, but sedimentary rock fragments are mainly angular, flat, or both
- Parent material does not meet the definition of another parent material

1B. **Till** (pages 8-9) – has *all* of these characteristics:

- Mixture of sand, silt, clay, and coarser material. There is no stratification/layering.
- Pebbles, if present, are mainly igneous, but in some areas, there is a mixture of underlying sedimentary rocks incorporated.
- Pebbles are usually rounded and randomly distributed.
- Can be weathered (non-calcareous) or unweathered (calcareous).
- Unweathered till may have platy structure; weathered till does not.
- Common texture and color combinations found in unweathered till:
  - Medium texture (loam) and brownish color (10YR 5/4, 5/6, 5/3) *or*
  - Moderately clayey texture (clay loam, silty clay loam) and near the brownish/gray color boundary (10Y 5/3, 5/4, 5/2)

1C. **Outwash/Lacustrine deposits** (page 9) – have *all* of these characteristics:

- Pebbles, if present, are mainly rounded and occur in layers (stratified)
- Material is *either*:
  - In the sandy texture group, and the sands are mainly > 0.5 mm in diameter (qualifies as a coarse sand & gravel limiting layer if it is thick enough), *or*
  - In any texture group and is stratified (consists of layers that are clearly visible)
- If official judges determine the parent material is outwash or lacustrine material, but the profile does not show clear stratification, or the material is not coarse sand & gravel, officials should give the parent material on the site card

1D. **Eolian sand** (pages 9 -10) – has *all* of these characteristics:

- Sandy or moderately sandy texture at the surface
- No gravel or pebbles present in the profile
- Sand grains are mainly fine and medium sand, 0.1 to 0.5 mm in diameter (between 150-grit and 40-grit sandpaper)
- Not stratified, but may have lamellae that are sandy or moderately sandy in the subsoil. Some soils formed in eolian sand may have moderately clayey subsoil texture

1E. **Loess** (page 10) – has ***all*** of these characteristics:

- Silty textures with little or no sand-size particles (silt, silt loam, or silty clay loam) in the topsoil that could extend into the subsoil
- No pebbles or, if present, very few, caused by animal activities or weathering processes
- May or may not be calcareous, but is never dense
- Not stratified, in contrast to water-deposited material

2A. **Alluvium** (page 10) – has ***both*** characteristics:

- The site is low in the landscape (on a flood plain)
- The soil has at least ***one*** of the following:
  - Distinct layers of light- and dark-colored soil material in the parent material zone
  - Calcareous material above 20 inches
  - On the site card, “Weak soil development” is circled “Yes”

2B. **Local overwash** (page 11) – has ***all*** of these characteristics:

- > 20 inches thick (but parent material identification zone may not include all 20”)
- Buries a darker horizon
- Soil horizons in and above the parent material zone have weak development
- Not on a floodplain

**B. SLOPE** (page 11)

- Measure the slope between two stakes near the soil pit
- The stakes are to be set 25 to 100 feet apart whenever possible

**C. LANDFORMS**

*If landform does not meet any of the guidelines below, officials should write name of the landform on site card*

**Upland Landforms** (pages 11-13) – has ***both*** characteristics:

- Parent material is weathered bedrock, till, or loess
- Soil has normal development

5A. **Upland hillslope** – slope is  $\geq 3\%$

5B. **Upland swell** – slope is  $\leq 2\%$  ***and*** surface is convex

5C. **Upland flat** – slope is  $\leq 2\%$  ***and*** surface is flat (“Yes” is circled for “Flat landscape” on the site card)

5D. **Upland depression** – slope is  $\leq 2\%$  ***and*** surface is concave

**Outwash/Lacustrine Landforms** (pages 11-13) – have **both** characteristics:

- “Weak soil development” is circled “No” on the site card
- The soil has **one** of the following:
  - Parent material is outwash or lacustrine deposit, with any slope
  - Parent material qualifies for eolian sand and slope is  $\leq 2\%$

5E. **Outwash/Lacustrine hillslope** – slope is  $\geq 3\%$

6A. **Outwash/Lacustrine swell** – slope is  $\leq 2\%$  **and** surface is convex

6B. **Outwash/Lacustrine flat** – slope is  $\leq 2\%$  **and** surface is flat (“Yes” is circled for “Flat landscape” on the site card)

6C. **Outwash/Lacustrine depression** – slope is  $\leq 2\%$  **and** surface is concave

6D. **Dune** (page 13) – has **both** characteristics:

- Parent material is eolian sand
- Slope is  $\geq 3\%$

6E. **Flood plain** (page 13) – has **all** of these characteristics:

- Parent material is alluvium
- Located low in the landscape
- “Weak soil development” is circled “Yes” on the site card

7A. **Filled depression** (page 13) – has **all** of these characteristics:

- Parent material is local overwash that is  $\geq 20$  inches thick
- Most nearby landforms are uplands or outwash landforms (not flood plains)
- “Weak soil development” is circled “Yes” on site card

**D. SURFACE SOIL COLOR GROUP** (pages 14 -15)

- Determine color from the center of the surface horizon, unless officials write a specific depth on site card
- Crush moist soil material
- Mark GRAY, BROWN or BLACK per chart on pg 14

**E. PREVIOUS EROSION** (pages 15 -16)

Examine the top eight inches of the soil. For soil plowed deeper than eight inches, examine the entire plow layer. Choose one of the following:

9A. **None to slight** if reference horizon:

- contains 76 to 100% topsoil material ***or***
- underlain by an A or E horizon ***or***
- site appears never to have been plowed

9B. **Moderate** –reference horizon contains 26 to 75% topsoil material

9C. **Severe** –reference horizon contains 0 to 25% topsoil material

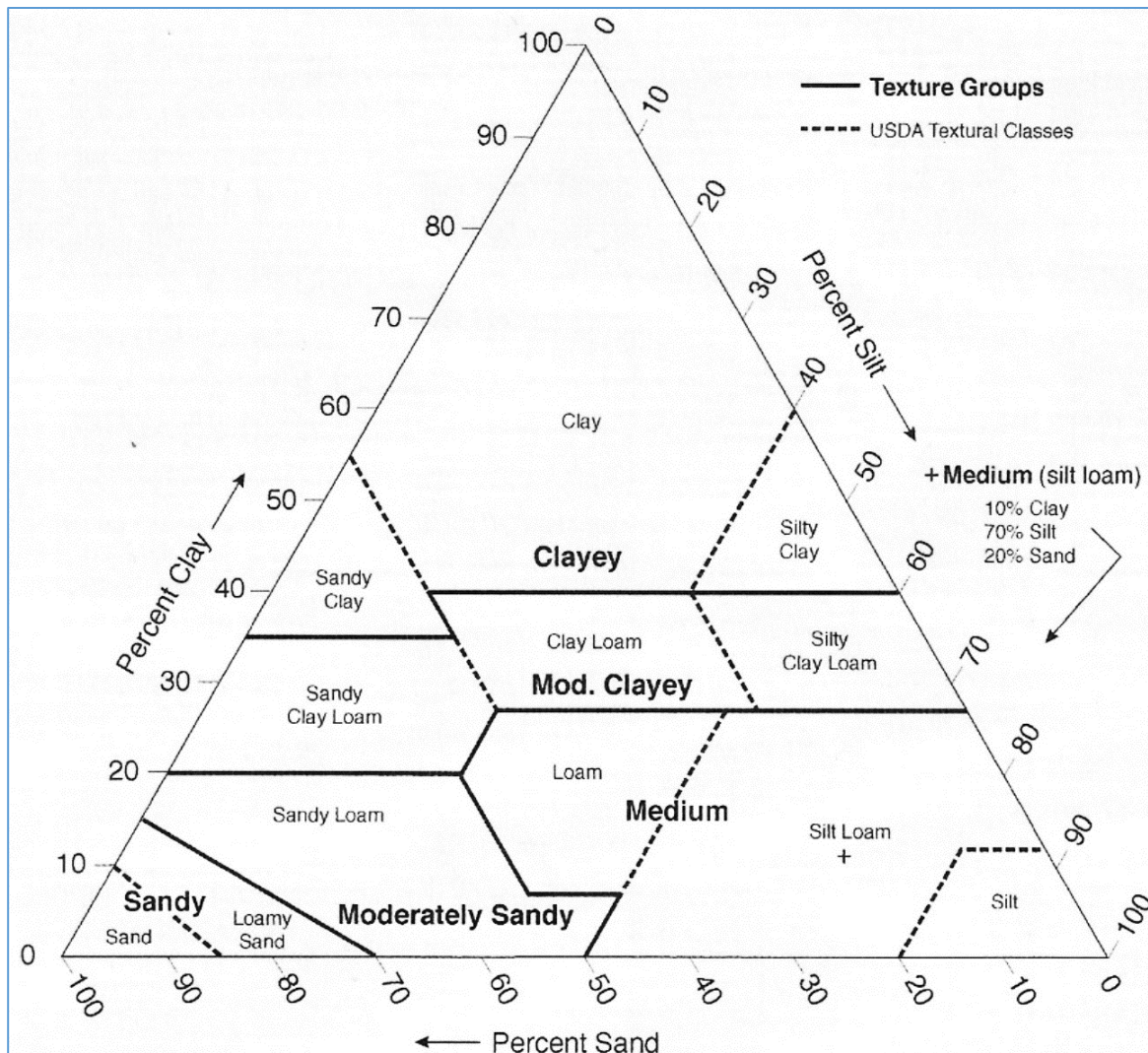
**F. SURFACE TEXTURE** (pages 16 -18)

- Determine the texture group in the Ap horizon *or* the upper 8” of soil if the Ap is < 8” thick
- If conditions warrant, officials may write the depth on the site card at which students should obtain their soil sample, or officials may put samples in a bucket or box outside of the soil pit
- Soil groups contain the following standard texture classes:

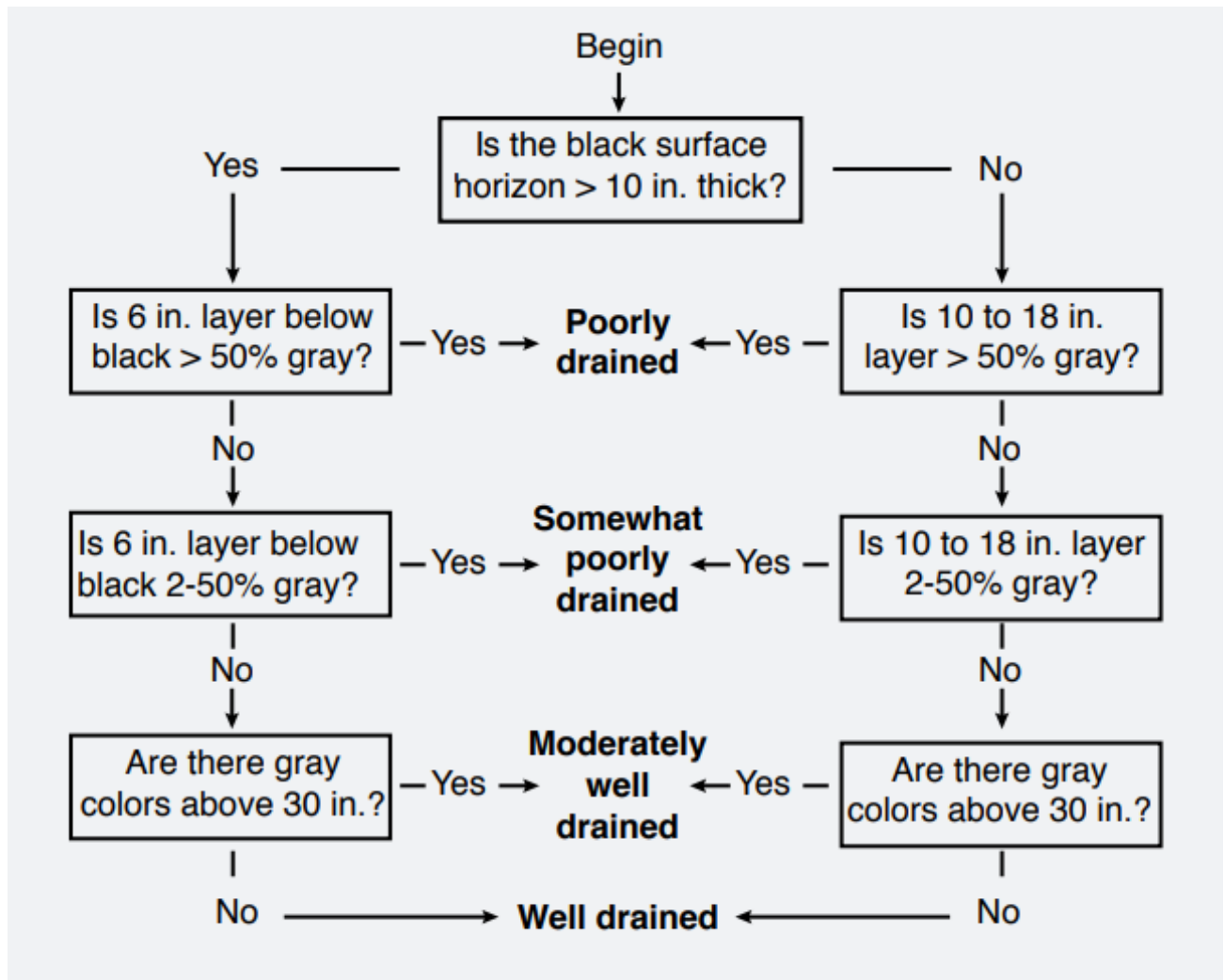
- 10A. **Sandy** – S and LS
- 10B. **Moderately sandy** – SL
- 10C. **Medium** – L, SIL, SI
- 10D. **Moderately clayey** – SCL, CL, SICL
- 10E. **Clayey** – SC, C, SIC

**G. SUBSOIL TEXTURE** (pages 16 -18)

- Determine the texture group in the finest layer (contains the most clay) exposed below the surface horizon
- Soil groups are the same as for Surface Texture



H. NATURAL SOIL DRAINAGE (pages 18 -19)



I. LIMITING LAYER

- A layer must > 10” thick to be considered a limiting layer
- If the layer or material meets the requirements in an individual rule and extends to the bottom of the pit, assume it is > 10” thick, thus a limiting layer

13A & B. **Bedrock** (page 20) > 80% of the layer is rock material that meets one or both of the following:

- It can't be cut with a spade or dug into with a knife *and/or*
- Roots can't grow into it

13C & D. **Dense till** (page 20) – has *all* of these characteristics:

- Not all till is calcareous, but for this contest, all calcareous till is considered to be dense till
- Pebbles, if present, are mainly igneous, but in some areas, there is a mixture of underlying sedimentary rocks incorporated.
- Pebbles are usually rounded and randomly distributed.
- May have platy structure that is characteristic of unweathered till
- Common texture and color combinations found in dense till:
  - Medium texture (loam) and brownish color (10YR 5/4, 5/6, 5/3) *or*
  - Moderately clayey texture (clay loam, silty clay loam) and near the brownish/gray color boundary (10YR 5/3, 5/4, 5/2)

13E & 14A. **Fragipan** (page 21) – has *all* of these characteristics:

- Prisms that on average are  $\geq 4''$
- Material inside the prisms is brittle
- Prisms contain few or no roots

14B & 14C. **Coarse sand & gravel** (page 21) – has *both* characteristics:

- Qualifies for the sandy texture group, and the sands are mainly  $> 0.5$  mm in diameter (the size of 40-grit sandpaper)
- Gravel is usually present, but may be lacking

## II. AGRICULTURE PRACTICES

### A. LAND USE OVERVIEW

15. **Restore original vegetation** (page 23). Choose one:
- A. **Wetland** – if soil is poorly drained
  - B. **Prairie** – has ***both*** characteristics:
    - SWP, MWD, or WD ***and***
    - Black surface horizon > 10” thick
  - C. **Mesic forest** - soil does not qualify for wetland or prairie

16. **Prime farmland** (page 23-24). Mark “YES” if soil has ***all*** of these properties:
- ***Subsoil*** texture is moderately sandy or finer ***and***
  - > 20” to bedrock or coarse sand & gravel limiting layer ***and***
  - Slope  $\leq$  6% ***and***
  - Land form is NOT floodplain

### B. EROSION AND COMPACTION POTENTIALS

17. **High potential for water erosion** (page 24). Mark “YES” if soil has ***one*** of these properties:
- $\leq$  20” to any limiting layer and slope is > 2% ***or***
  - > 20” to any limiting layer and slope is > 6%

18. **High potential for wind erosion** (page 24). Mark “YES” if soil has:
- Sandy or moderately sandy ***surface*** texture

19. **High potential for soil compaction** (page 24). Mark “YES” if soil has ***both*** properties:
- Natural drainage is somewhat poor ***or*** poor ***and***
  - ***Surface*** texture is moderately sandy ***or*** finer

### C. BUFFERS AND COVER CROPS

20. **Grassed waterways** (page 25). Mark “YES” if soil has:
- 3 to 18% slope

21. **Windbreaks** (page 25). Mark “YES” if soil has:
- Sandy or moderately sandy ***surface*** texture

22. **Consider Filter strips** (page 25). Mark “YES” if soil has:
- $\leq$  18% slope

23. **Most significant benefit of cover crops** (page 25 - 26). Mark one of the following:
- A. **Scavenge nitrogen** if soil has either of these properties:
- 0 to 2% slope *or*
  - 3 to 6% slope *and*:
    - Sandy *subsoil* texture *or*
    - Coarse sand & gravel limiting layer
- B. **No need** to consider cover crop if
- > 18% slope (the soil should not be tilled)
- C. **Erosion control** - for all other soils

#### D. CROPPING PRACTICES

24. **Timber stand improvement (TSI)** (page 26). Mark “YES” for:
- All soils

25. **Permanent pasture** (page 26). Mark “YES” for soils with:
- $\leq 25\%$  slope

26. **Crop rotation** (page 26 - 27). Mark “YES” for soils with:
- $\leq 18\%$  slope

#### E. TILLAGE PRACTICES.

27. **No-till** (page 27). Mark “YES” for soils that have both properties:
- $\leq 6\%$  slope *and*
  - *Either*:
    - WD or MWD with any surface texture *or*
    - PD or SWP *with* moderately clayey or coarser surface texture

28. **Moldboard or chisel plowing** (page 27). Mark “YES” for soils that have all these properties:
- $\leq 2\%$  slope *and*
  - Medium or finer surface texture *and*
  - PD or SWD

#### F. WATER MANAGEMENT

29. **Drainage** (page 28). Mark “YES” for soils that have both properties:
- PD or SWP *and*
  - Landform is NOT a floodplain



30. **Irrigation** (page 28 - 29). Mark “YES” for soils that have **both** properties:

- $\leq 6\%$  slope **and**
- **Either:**
  - *Subsoil* texture is sandy or moderately sandy **or**
  - Coarse sand & gravel limiting layer  $< 40$  inches from surface

31. **Terraces** (page 29). Mark “YES” for soils that have **all** these properties:

- WD, MWD, or SWP drained **and**
- $> 40''$  to any limiting layer **and**
- 3 to 12% slope **and**
- *Subsoil* texture is medium or finer

## G. PLANT NUTRIENT APPLICATION

32. **Nitrogen** (page 29 - 30). Choose one:

- **High** – if soil has **all** these properties:
  - $> 40''$  to any limiting layer **and**
  - Subsoil **and** surface soil textures are medium or moderately clayey **and**
  - PD or SWP drained **and**
  - Surface color is black
- **Medium** – if soil has **all** these properties:
  - $> 20''$  to any limiting layer **and**
  - Subsoil **and** surface soil textures are moderately sandy or finer **and**
  - $\leq 12\%$  slope
- **Low** (or no nitrogen) – for soil that do not qualify for high or medium N application

33. **Phosphorus** (page 30). Choose one:

- **Add** – if available P is  $< 15$  ppm
- **None** – if available P is 15 to 100 ppm
- **Deplete** – if available P is  $> 100$  ppm

34. **Potassium** (page 30). Choose one:

- **Add** – if available K is  $< 100$  ppm
- **None** – if available K is 100 to 250 ppm
- **Deplete** – if available K is  $> 250$  ppm

35. **Lime** (page 30). Use pH indicated on site card

- **Add** – if soil pH  $\leq 6.4$
- **None** – if soil pH  $\geq 6.5$

## H. NUTRIENT POLLUTION POTENTIAL

36. **Nitrogen pollution potential** (page 31). Choose one:

- **High for groundwater** – if soil has ***both*** these properties:
  - Sandy *subsoil* ***and/or*** coarse sand & gravel limiting layer ***and***
  - MWD or WD drained
- **High for surface water** – if soil has ***both*** these properties:
  - PD or SWP drained ***and***
  - Any landform BUT floodplain
- **Medium** – for all other soils

37. **Phosphorus pollution potential** (page 31). Choose one:

- **High** – soils with > 12% slope
- **Medium** – for soils with:
  - 7 to 12% slope ***or***
  - 3 to 6% slope with medium or moderately clayey *surface* texture
- **Low** – for all other soils

### III. HOME SITE PRACTICES

#### A. SITE SELECTION AND CONSTRUCTION PRACTICES

15. **Is the soil suitable for a homesite?** (page 33). Choose one:

A. **YES** – if the landform IS NOT a floodplain or a filled depression

B. **NO** – if the landform is a flood plain or a filled depression

*NOTE: if you mark “NO” to this question, then questions 16 - 38 should also be marked NO.*

16. **Preserve existing trees and plant new ones?** (page 33). Mark “YES” for

- All sites

17. **Maintain soil cover during construction?** (page 34). Mark “YES” if

- > 2% slope *or*
- Any slope if surface texture is sandy or moderately sandy

18. **Improve surface drainage?** (page 34). Mark “YES” for soils that have both properties:

- PD or SWP drained *and*
- 0 to 2% slope

19. **Is the soil suitable for a basement?** (page 34). Mark “YES” for soils that have all these properties:

- Well drained *and*
- Bedrock > 40” from soil surface *and*
- ≤ 12% slope

20. **Design for high-clay subsoils?** (page 34 - 35). Mark “YES” if

- Subsoil texture is clayey

21. **Potential construction hazards on slopes?** (page 35). Mark “YES” if

- > 12% slope

22. **Install diversion structures and drains?** (page 35). Mark “YES” for soils that have both properties:

- > 2% slope *and*
- *Either:*
  - Bedrock, dense till, or fragipan limiting layer < 40” from soil surface *or*
  - Subsoil texture is moderately clayey or clayey

23. **Provide foundation drainage?** (page 35-36). Mark “YES” for soils with these properties:

- MWD, SWP, or PD, regardless of other properties *or*
- WD soils that do NOT have:
  - Sandy subsoil texture *and/or*
  - Coarse sand and gravel limiting layer < 40” from the soil surface

24. **High risk for cave-in during construction?** (page 36). Mark “YES” for soils that have *one or both* properties:

- Landform is Dune, Outwash/Lacustrine, or Floodplain, *and/or*
- Any PD soil, regardless of landform

## B. LANDSCAPE AND LAWN PRACTICES

25. **Manage soil reaction for acid-loving shrubs** (page 36). Choose one:

- A. **No application** – if soil pH is  $\leq 5.6$
- B. **Apply sulphur** – if soil pH is 5.7 to 7.9
- C. **Plant other species** - if soil pH is  $\geq 8.0$

26. **Manage soil reaction for lawns** (page 36). Choose one:

- A. **Apply lime** – if soil pH is  $\leq 5.9$
- B. **No application** – if soil pH is 6.0 to 7.5
- C. **Plant other species** - if soil pH is  $\geq 7.6$

27. **Apply phosphorus to lawn** (page 36 - 37). Mark “YES” if

- available P is < 25 ppm

28. **Apply potassium to lawn** (page 36 - 37). Mark “YES” if

- available K is < 75 ppm

### C. ON-SITE SEWAGE DISPOSAL SUITABILITY

29. **Is the soil suitable for an absorption field?** (page 37). Mark “YES” for all soils **EXCEPT** those with one or more of these properties:

- Bedrock, fragipan, sand and gravel, or dense till limiting layer < 20” from the soil surface
- Slope > 25%
- Upland depression or outwash depression landform

**NOTE:**

- *If you mark “NO” to this question, then questions 30-38 should also be marked “NO” or “N/A”*

### D. SEPTIC TANK CARE PRACTICES

30. **Septic tank outlet filter cleaning interval** (page 38). Choose one:

- A. **6 months** – if 4 or more people live in the home
- B. **1 year** – if 1 to 3 people live in the home
- C. N/A - if #29 was marked NO

31. **Septic tank pumping interval** (page 38).

- A. **1 to 2 years**
- B. **3 years**
- C. **4 years**
- D. **≥ 5 years**
- E. N/A – if # 29 was marked NO

$$PI = \frac{(10 \text{ or } 7)^* \times (\text{tank capacity in gallons})}{\text{\# residents living in home} \times 1000}$$

\* If NO garbage disposer use 10  
If YES garbage disposer use 7

**Round 0.5 DOWN to nearest whole number!**

### E. SOIL ABSORPTION FIELD PRACTICES

32. **Subsurface trench, gravity flow system** (page 39-40). Mark “YES” if soil has **all** these properties:

- No bedrock, fragipan, coarse sand & gravel, or dense till limiting layer < 40” from soil surface ***and***
- WD ***and***
- Subsoil texture is medium or moderately sandy ***and***
- ≤ 12% slope

33. **Subsurface trench, flood dose system** (page 40). Mark “YES” if soil has all these properties:
- No bedrock, fragipan, coarse sand & gravel, or dense till limiting layer < 40” from soil surface *and*
  - WD *and*
  - *Subsoil* texture is moderately clayey or clayey *and*
  - ≤ 12% slope

34. **Subsurface trench, pressure distribution system** (page 40). Mark “YES” if soil has all these properties:
- No bedrock, fragipan, coarse sand & gravel, or dense till limiting layer < 40” from soil surface *and*
  - WD *and*
  - *Subsoil* texture is sandy *and*
  - ≤ 12% slope

35. **Elevated sand mound system** (page 40 - 41). Mark “YES” if soil has all these properties:
- No bedrock, fragipan, coarse sand & gravel, or dense till limiting layer < 20” from surface *and*
  - WD or MWD *and*
  - ≤ 6% slope

36. **Elevated sand mound system & perimeter drainage** (page 41 - 42). Mark “YES” if soil has all these properties:
- No bedrock, fragipan, coarse sand & gravel, or dense till limiting layer < 20” from soil surface *and*
  - SWP or PD *and*
  - ≤ 6% slope

37. **Drip distribution system and secondary treatment** (page 42). Mark “YES” if soil has all these properties:
- No bedrock limiting layer < 20” from soil surface *and*
  - WD or MWD if a perimeter drainage is installed *or*
  - ≤ 25% slope

38. **Secondary treatment** (page 42). Mark “YES” if:
- At least one soil absorption field practice is marked “YES”