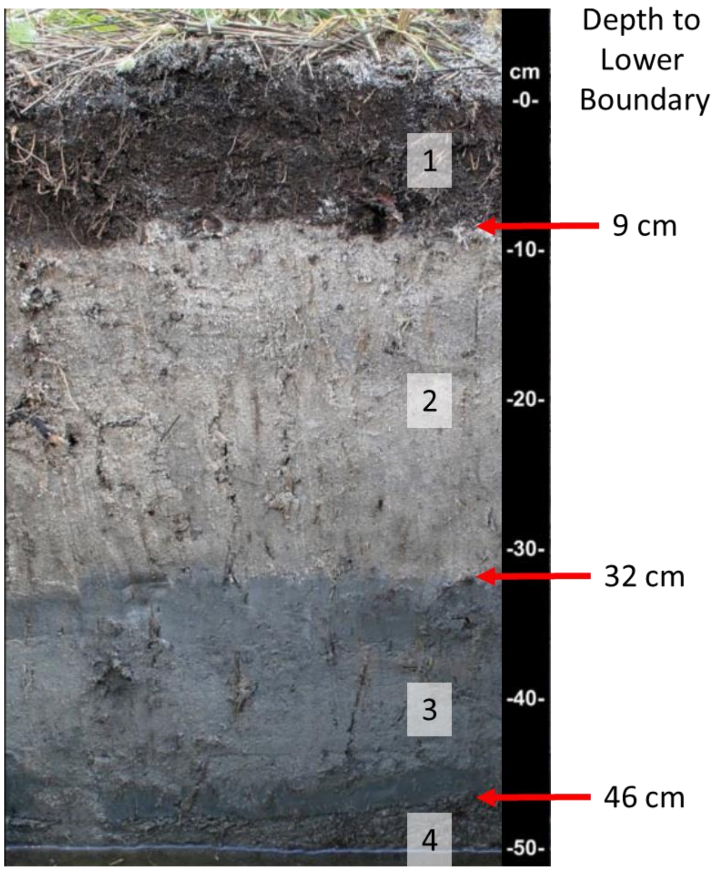
Reference Card S-2, Side A: Delineating Horizon Boundaries



Profile Photo: USDA NRCS (2010)

Distinguishing Soil Horizons

Soil horizons are delineated based on differences in:

- Texture
- Color
- Structure and Consistence
- Redoximorphic Features
- Other features, including mottles (colors/features not related to wetness), organic features, rocks or coarse fragments, roots

Identify each horizon from 0-100 cm and place markers (e.g., golf tee, nail) at the bottom of each horizon. Number horizons in order from the top of the profile to the bottom (100 cm).

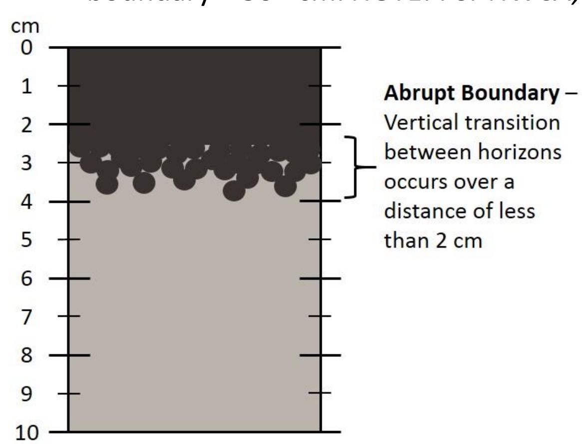
Measure the depth **from the soil surface to the lower boundary** of each horizon. Record the depths in the *Depth from surface to lower boundary* column in the Soil Profile Description section of **Form S-1 (Front)**.

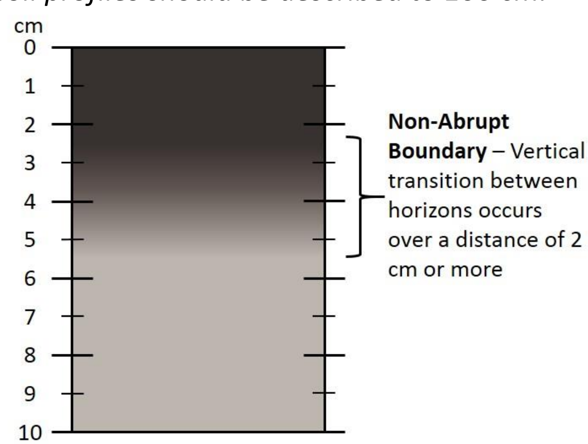
Using the example soil profile (left):

- **Horizon 1** is 9 cm thick with the upper boundary at 0 cm and the lower boundary at 9 cm. Depth from surface to lower boundary = 9 cm.
- **Horizon 2** is 23 cm thick with the upper boundary at 9 cm and the lower boundary at 32 cm. Depth from surface to lower boundary = 32 cm.
- **Horizon 3** is 14 cm thick with the upper boundary at 32 cm and the lower boundary at 46 cm. Depth from surface to lower boundary = 46 cm.
- **Horizon 4** continues beyond the bottom of the soil pit (lower boundary is not visible). The final depth of the soil pit is 50 cm. Depth from surface to lower boundary = 50+ cm. *NOTE: For NWCA, soil profiles should be described to 100 cm.*

Describing Horizon Boundaries

If the transition between two horizons occurs over a distance of less than 2 cm, fill in the bubble in the *Abrupt lower boundary present* column in the Soil Profile Description section of **Form S-1 (Front)**.

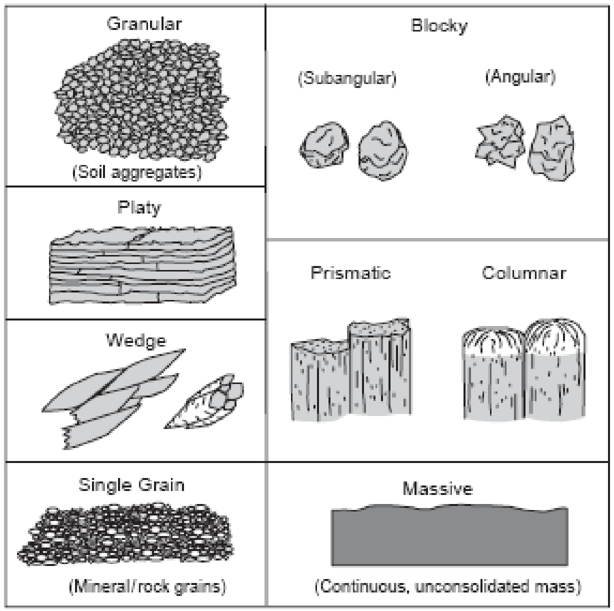




Reference Card S-2, Side B: Soil Structure, Consistence, and Estimating Surface Cover

Soil Structure describes the arrangement of mineral soil separates (sand, silt, and clay) in to secondary units or peds.

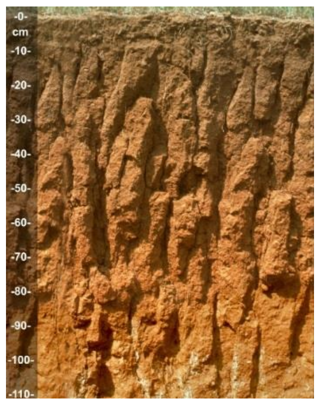
Horizons can be differentiated by changes in the dominant size, shape, or distinctness of peds.



Granular structure. Photo by John Kelley, USDA NRCS

Blocky structure. Photo by John Kelley, USDA NRCS

Platy structure. (Soil Survey Division Staff, 1993)



Prismatic structure. Photo by John Kelley, USDA NRCS

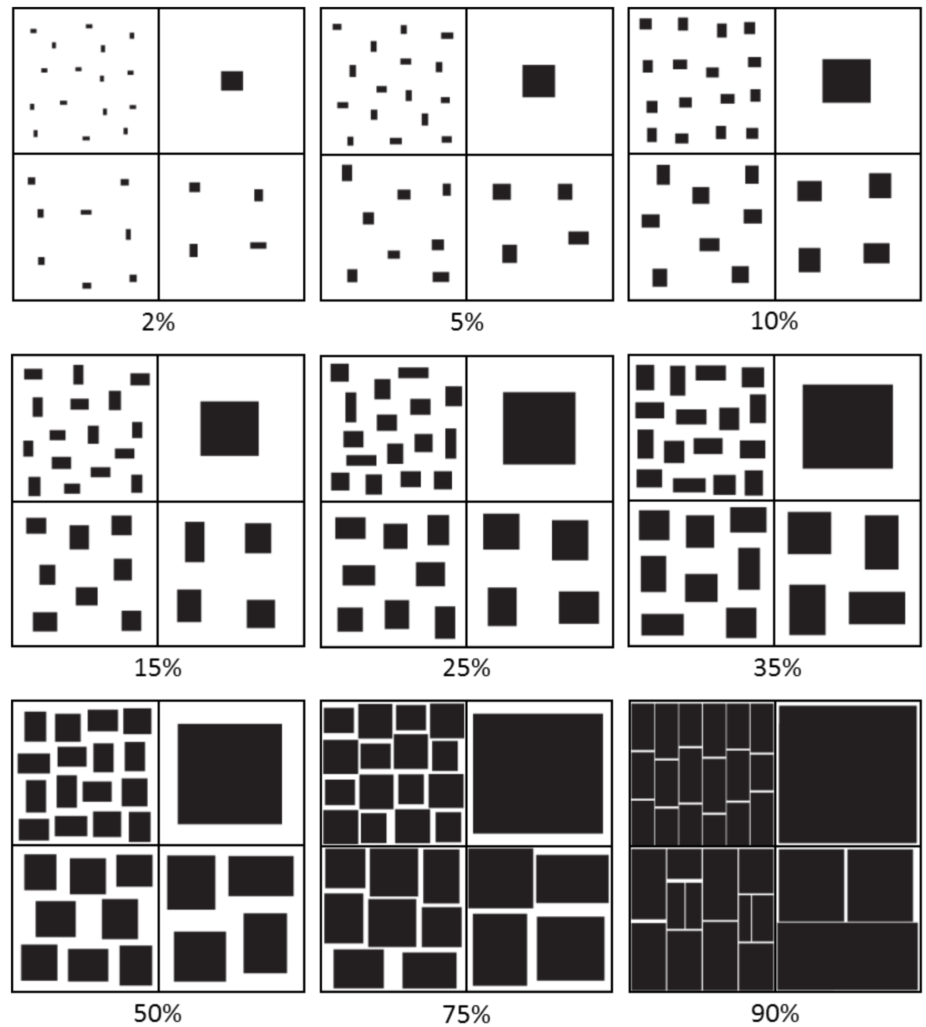
Consistence is the degree and kind of cohesion and adhesion the soil exhibits and/or the resistance of the soil to deformation or rupture under an applied stress.

Differences in consistence between horizons can be identified by changes in the ease of digging into the soil using a shovel, trowel, or soil knife, how easily a ped can be crushed, or the nature of peds as they are crushed (brittle or fluid).

Note: Soil structure and consistence do not need to be recorded on Form S-1. However, these properties may be useful in identifying horizon boundaries.

Estimation of Surface Area Cover

Use the reference charts to estimate percent surface area of the soil matrix occupied by other components (e.g., redoximorphic features, rocks, roots, or masked sand grains).



Reference Card S-3, Side A: Soil Texture

Step 1: Determine if the soil is Organic, Mucky Mineral or Mineral.

Collect a quarter sized moist soil sample and gently rub it between the forefingers and thumb several times.

- If the soil feels greasy and has a low density (feels light), the soil is organic or mucky mineral; **go to Step 2**.
- If the soil does not feel greasy, the soil is a mineral soil; go to **Step 3**.

Step 2: Texturing High Organic Matter Content Soils

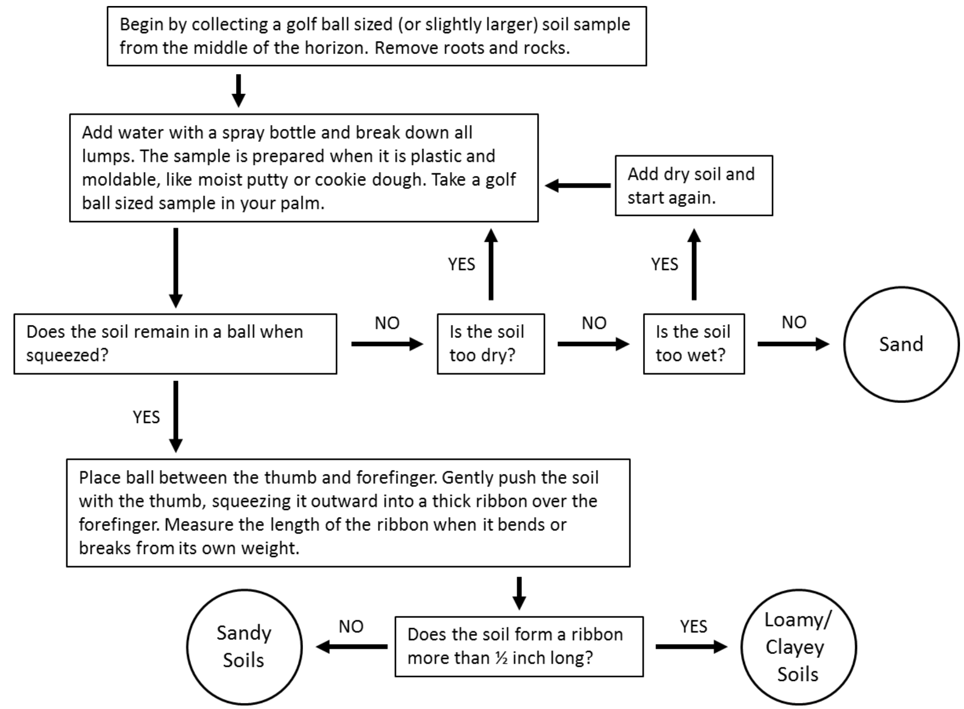
a. Determine if the soil is mucky mineral or organic. Both have a greasy feel. Squeeze a golf ball sized chunk of moist soil.

- **Mucky Mineral** – Soil will feel gritty or stick to the hand when squeezed and rubbed. Identifiable plant fragments are rare to nonexistent.
- **Organic** – Mineral grains are not visible and cannot be felt when the sample is rubbed. Sample will have a low bulk density and feel light. When squeezed, the soil will extrude liquid or much of the soil material and the remaining soil material will stick to the hand. Identifiable plant fragments may be common. Distinguish the type of organic material; go to **Step b**.

b. Distinguish the type of organic material. Take a fresh sample of moist soil and rub the sample between the thumb and fingers 10 times. Visually estimate the percent volume of plant fibers and dead roots. Use the chart below to determine the type of organic material.

Organic Soil Material	Volume of Fibers Visible after Rubbing
Peat	> 40%
Mucky Peat	20% - 40%
Muck	< 20%

Step 3: Texturing Mineral Soils



Modified from Thien (1979).

Reference Card S-3, Side B: Soil Color

To Measure Soil Color:

1) If the soil is dry, use a spray bottle to moisten the ped. Spray until moist, but not saturated.

2) Observe the soil color in direct sunlight with the sun over the shoulder (whenever possible). Match the color of the soil with the closest color chip in the Munsell Soil Color Book.
   - Start at the 10YR page. Hues will be progressively redder moving towards the front of the book, and will get yellower and greyer towards the back of the book

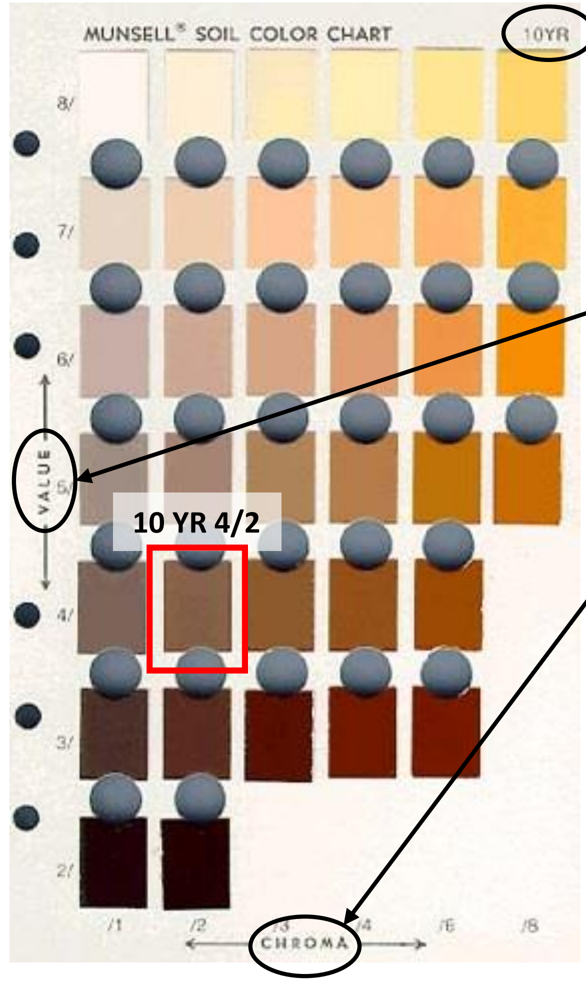
10R 2.5YR 5YR 7.5YR 10YR 2.5Y 5Y

   - The color chips in the Munsell Soil Color Book have holes so that the soil can be placed behind the page and viewed through the hole next to the chip of interest.
   - Take care to keep the color chips clean and dry. When not using the book, keep it closed and out of the sun, which will cause chips to fade.

3) For each horizon, record the hue, value, and color for the soil matrix (dominant color in the horizon of interest) and the dominant concentration and depletion colors (if present).
   - For red and yellow hues, each hue is on a separate page. Value is shown on the left side of the page, and chroma is shown at the bottom. Color descriptions are given on the page opposite the color chips.

     example: 10YR 4/2 = grayish yellow brown
   - On the gleyed pages, hues are organized in columns and listed at the bottom of the page. Gleyed hues include N (neutral), 10Y, 5GY, 10GY, 5G, 5BG, 10BG, 5B, 10B, and 5PB. Value is shown at the left side of the page. If the soil has a neutral hue (N), the chroma is 0. For all other gleyed hues, the chroma is 1 for the first column of the hue, and 2 for the second column of the hue. Color descriptions are given on the page opposite the color chips.

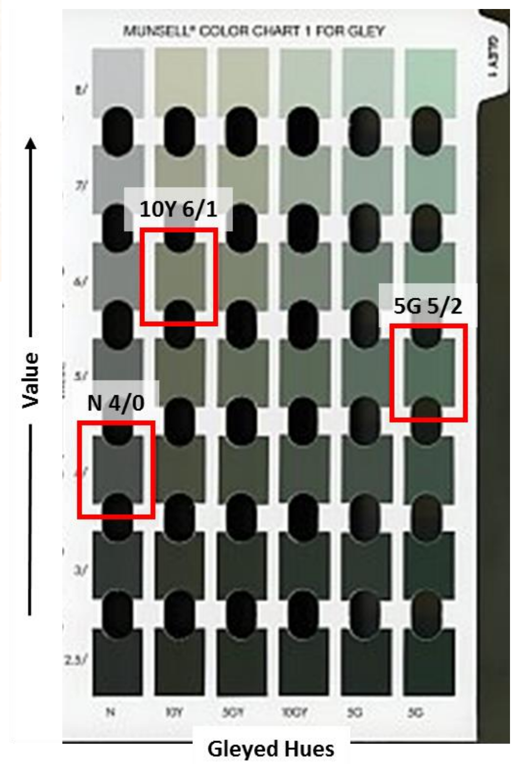
     examples: N 4/0 = gray; 10Y 6/1 = greenish gray; 5G 5/2 = grayish green



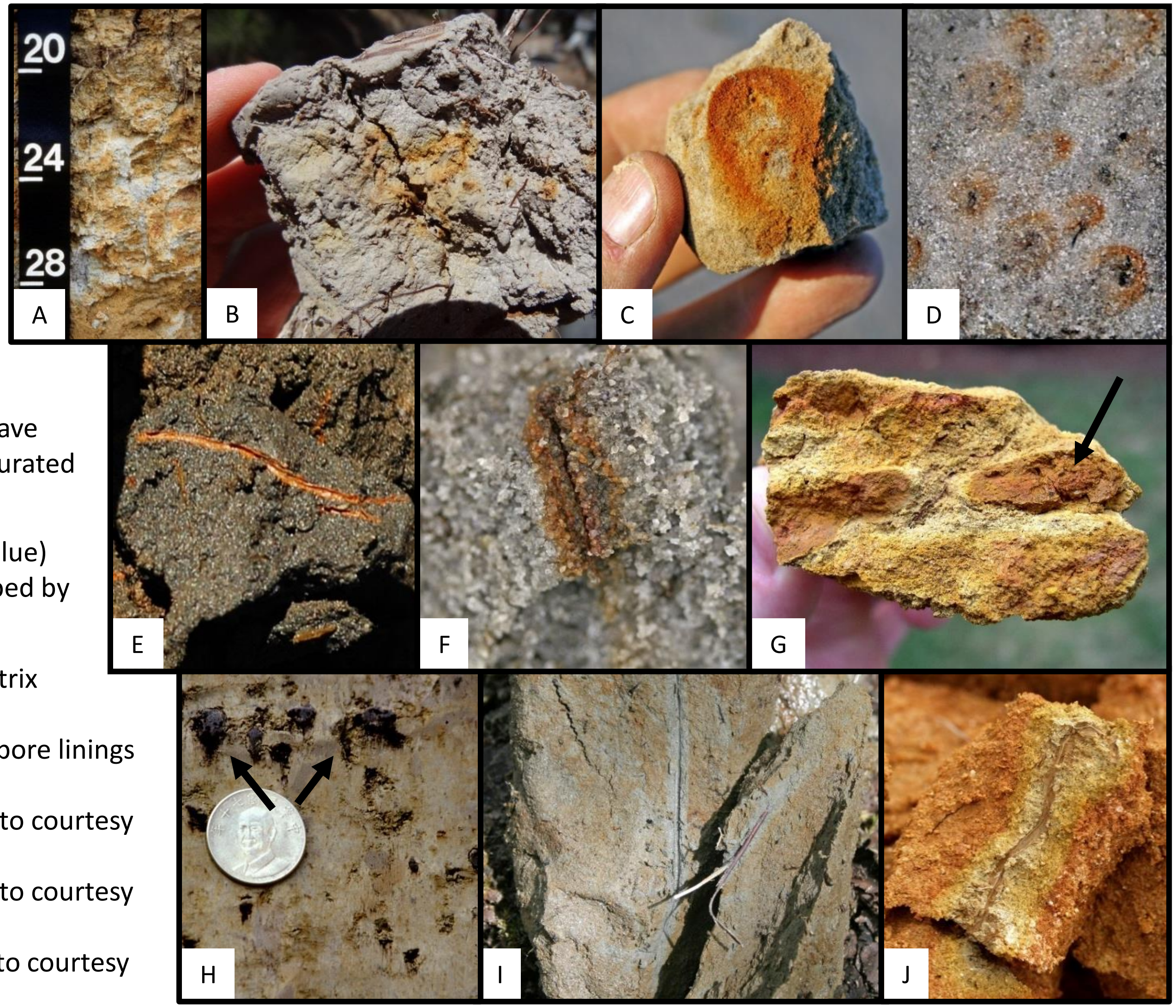
Hue: Measure of chromatic composition – red, yellow, green, blue, purple

Value: Degree of lightness or darkness of color. Value decreases with darkness.

Chroma: Relative purity or strength of color (brightness). Low chroma colors are dull or gray, higher chroma colors are brighter.



Reference Card S-4, Side A: Soil Redoximorphic Features



Redox Concentrations

Accumulations of Fe or Mn oxides that form as the soil is oxidized (becomes aerobic).

Fe concentrations have redder hues and higher (brighter) chromas relative to the soil matrix. Mn concentrations tend to be black in color. Redox concentrations are described by the type (soft masses, pore linings, nodules/concretions), color, and percent surface area cover.

Redox Depletions

Localized zones where Fe or Mn oxide minerals have been reduced, solubilized, and leached under saturated soil conditions.

Depletions are greyer and lighter in color (high value) than the soil matrix. Redox depletions are described by the color and percent surface area cover.

A. Depletions (grey zones) in an ozidized soil matrix (red areas) (Photo courtesy of USDA NRCS)
B. Concentrations occurring as soft masses and pore linings (Photo by Ann Rossi)
C. Concentrations occurring as soft masses (Photo courtesy of USDA NRCS)
D. Concentrations occurring as soft masses (Photo courtesy of USDA NRCS)
E. Concentration occurring as a pore lining (Photo courtesy of USDA NRCS)
F. Concentration occurring as a pore lining (Photo courtesy of USDA NRCS)
G. Iron nodules (Photo by John Kelley, USDA NRCS)
H. Manganese concretions (Photo courtesy of USDA NRCS)
I. Depletion along root channel (Photo courtesy of USDA NRCS)
J. Depletion along root channel (Photo by John Kelley, USDA NRCS)

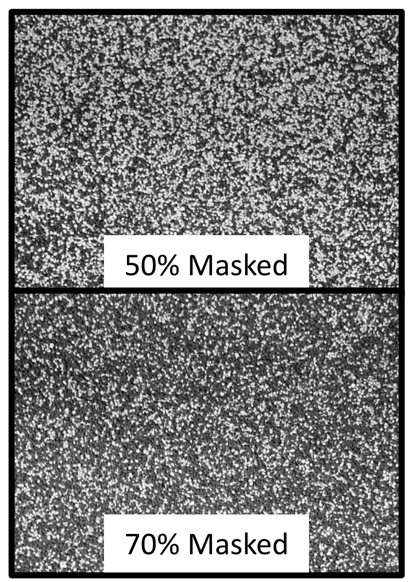
Reference Card S-4, Side B: Organic Features, Masked Sand Grains, and Mottles

Organic Bodies – Aggregates of organic matter with mineral or mucky mineral textures. They typically occur at the tips of roots and are commonly 1 to 3 cm in diameter. The presence of organic bodies is a Hydric Soil Field Indicator in some regions (A6. Organic Bodies). Photos courtesy of USDA NRCS.

Stripped Matrix – Zone where iron and manganese oxides are stripped from the matrix and the primary base color of the soil material is exposed. A stripped matrix in a sandy soil is a Hydric Soil Field Indicator in some regions (S6. Stripped Matrix). Photo courtesy of USDA NRCS.

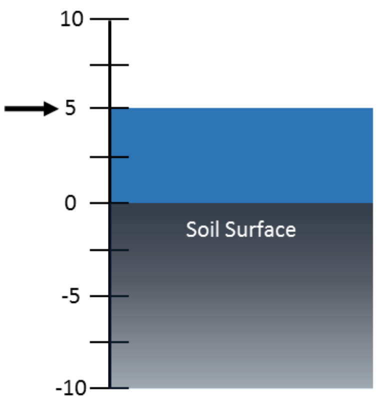
Mottles – Mottles are areas or splotches of color that differ from the soil matrix color. Mottles are unrelated to saturated or reducing conditions, and typically have a geologic origin (reflect the soil parent material). Photo by Ann Rossi.

Organic Infillings – Accumulations of organic matter in pores, root channels, or soil cracks. This can occur when dead roots decompose in a root channel, or when organic material from the soil surface fills in an animal burrow. Photos courtesy of USDA NRCS.

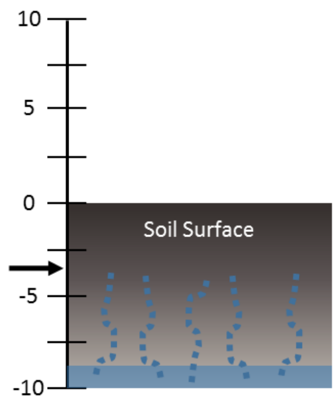


Masked Sand Grains – In sandy soils, organic material can coat or mask mineral grains. Depending on the degree of masking soils can have a salt and pepper appearance to looking almost completely black. The degree of masking is a criteria for many Hydric Soil Field Indicators when the soil is sandy. Degree of masking is reported as the percentage of sand grains that are coated by organic matter (dark in color). Photos by Martin Rabenhorst.

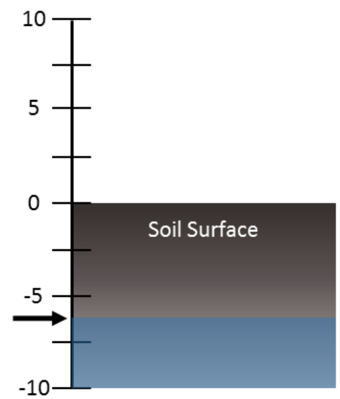
Reference Card S-5: Measuring Water Table Depth



Surface Water
Water level is 5 cm above the soil surface.
Record Water Level as +5 cm



Evidence of Saturation in Soil Pit – Water Seepage
Water seepage starts 4 cm below the soil surface.
Record Water Level as -4 cm

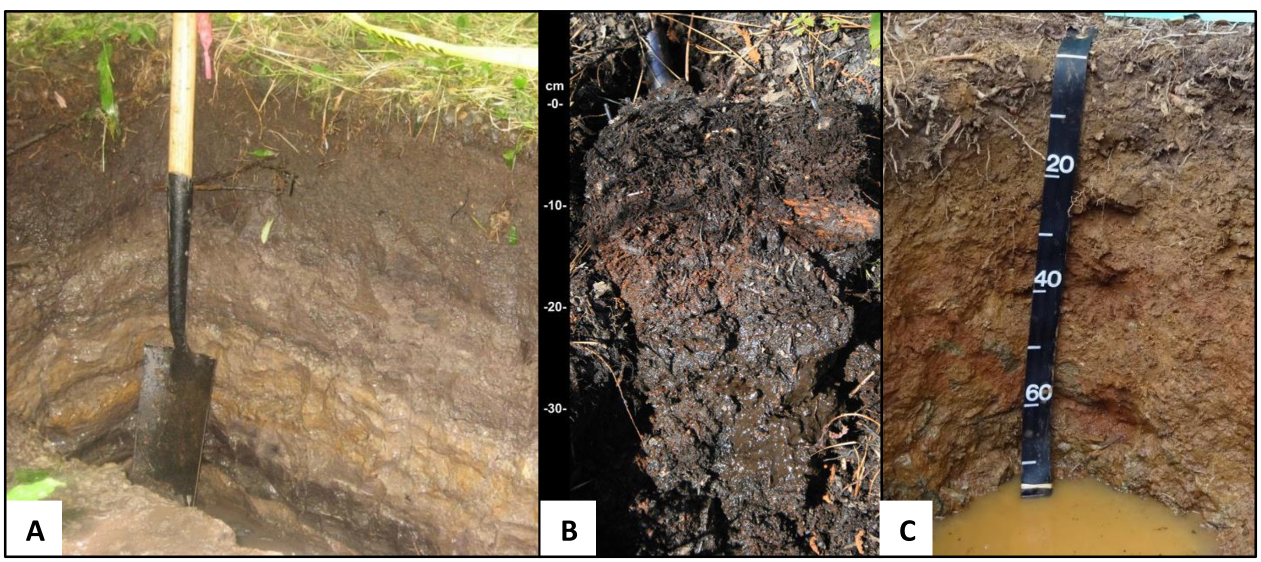


Standing Water in Soil Pit
Water level is 6 cm below the soil surface.
Record Water Level as -6 cm

Estimate the depth of the water table based on surface water at the Soil Pit, evidence of saturation in the Soil Pit, or standing water in the Soil Pit.

Surface Water – Measure the height or depth of the water above the soil surface. Record as a positive (+) value.

Water Table below the Soil Surface – Measure the water table depth as the distance from the soil surface to the saturated zone in the Soil Pit. Record depth as a negative (-) value.



Soil Saturation can be indicated by:

(A) Pit surfaces with a sheen of moisture or appear to be glistening. Photo by Ann Rossi.
(B) Water seepage from the pit walls. This includes water running down the Soil Profile Face, along ped faces, or oozing from macropores. Photo courtesy of USDA NRCS.
(C) Standing water in the Soil Pit. Photo by Ann Rossi.