

# UNDERSTANDING AND INTERPRETING A SOIL TEST PIT



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# RECORDING THE LAYERS

- ◆ Depth: each layer is recorded in inches
- ◆ Color: using the Munsell color system
- ◆ Texture: using the USDA textures
- ◆ Structure: the shape of the peds as they are removed
- ◆ Consistence: the strength peds to distortion
- ◆ Redoximorphic Features: estimated seasonal high water table



# 2 TYPICAL TEST PITS

**Test Pit No.** 3F  
**ESHWT:** 13"  
**Termination @** 54"  
**Refusal:** NA  
**Obs. Water:** NA

**Lot No.:**  
**WSPCD Group:**  
**Roots to:**  
**SCS Soil:** NA  
**HIS Type:** NA

Depth	Color	Texture	Structure	Consistence	Redox %	Horizon
0-6"	2.5Y 3/2	SIL	GR	FR	NONE	
6-13	2.5Y 5/4	SIL	GR	FR	NONE	
13-21"	2.5Y 5/3	SIL	GR	FR	5%	
21-54"	2.5Y 5/2	SLCL	BLK	FI	30%	

**Test Pit No.** 6A  
**ESHWT:** 22"  
**Termination @** 50"  
**Refusal:** NA  
**Obs. Water:** NA

**Lot No.:**  
**WSPCD Group:**  
**Roots to:**  
**SCS Soil:** NA  
**HIS Type:** NA

Depth	Color	Texture	Structure	Consistence	Redox %	Horizon
0-5"	10YR 3/3	FSL	GR	FR	NONE	
5-15"	10YR 5/6	FSL	GR	FR	NONE	
15-22"	10YR 5/4	FSL	PL	FR	NONE	
22-50"	10YR 5/3	FSL	PL	FI	10%	



0-12 INCHES, 10YR 3/3, FINE SANDY LOAM, GRANULAR, FRIABLE

12-35 INCHES, 10YR 5/6, FINE SANDY LOAM, GRANULAR, FRIABLE

35-89 INCHES, 2.5Y 5/2, FINE SANDY LOAM, PLATY, FIRM, WITH 10% REDOX CONCENTRATIONS

ESHWT:35 INCHES

REFUSAL: 89 INCHES

OBSERVED WATER: N/A

NOTE: FACE OF LEDGE WITHIN THE PIT 40-89 inches





# COLORS

# Hue

Spectral color in relation to red, yellow, blue, etc.



# The Lightness or Darkness of Color

## Value

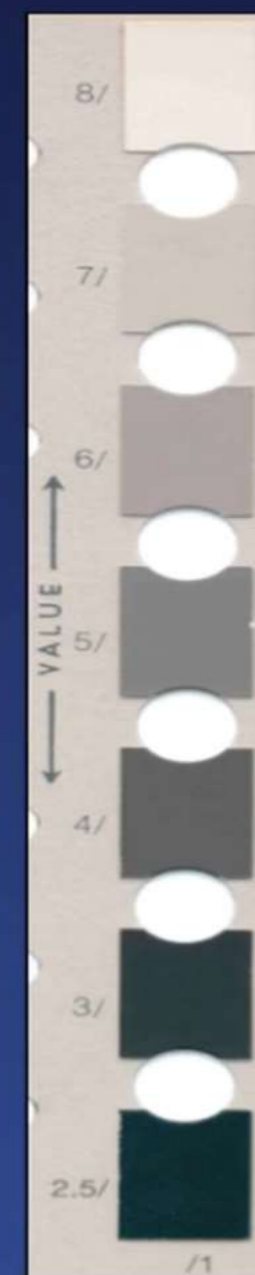
- 10/0 - Pure White



- 5/0 - "Gray"



- 0/0 - Pure Black



# Chroma

“Neutral”  
Gray

“Pure”  
Color

10

12

14

16

18

Increasing strength of color 



 Increasing grayness



## Reading Soil Colors

### Optimum conditions for reading soil colors

- Natural light
- Clear, sunny day
- Midday
- Light at right angles
- Soil moist



TEST PIT#1: ELMRIDGE

Ap: 0-18 INCHES, 10YR 4/4, LOAMY SAND, MASSIVE, FRIABLE (FILL)

Ab: 18-21 INCHES, 10YR 3/2, FINE SANDY LOAM, GRANULAR, FRIABLE

Bwb: 21-36 INCHES, 10YR 4/6, FINE SANDY LOAM, PLATY, FRIABLE

C : 36-97 INCHES, 2.5Y 5/3, SILT LOAM, BLOCKY, FRIABLE, WITH 10% REDOX

CONCENTRATIONS

ESHWT: 36 INCHES

REFUSAL: N/A

OBSERVED WATER: 36 INCHES

TEST PIT #2: ELDRIDGE

Ap: 0-9 INCHES, 10YR 3/3, LOAMY SAND, GRANULAR, FRIABLE

Bw: 9-21 INCHES, 10YR 4/6, LOAMY SAND, GRANULAR, FRIABLE

C: 21-78 INCHES, 2.5Y 4/2, SILT LOAM, PLATY, FIRM, WITH 10% REDOX

CONCENTRATIONS

ESHWT: 21 INCHES

REFUSAL: N/A

OBSERVED WATER: N/A

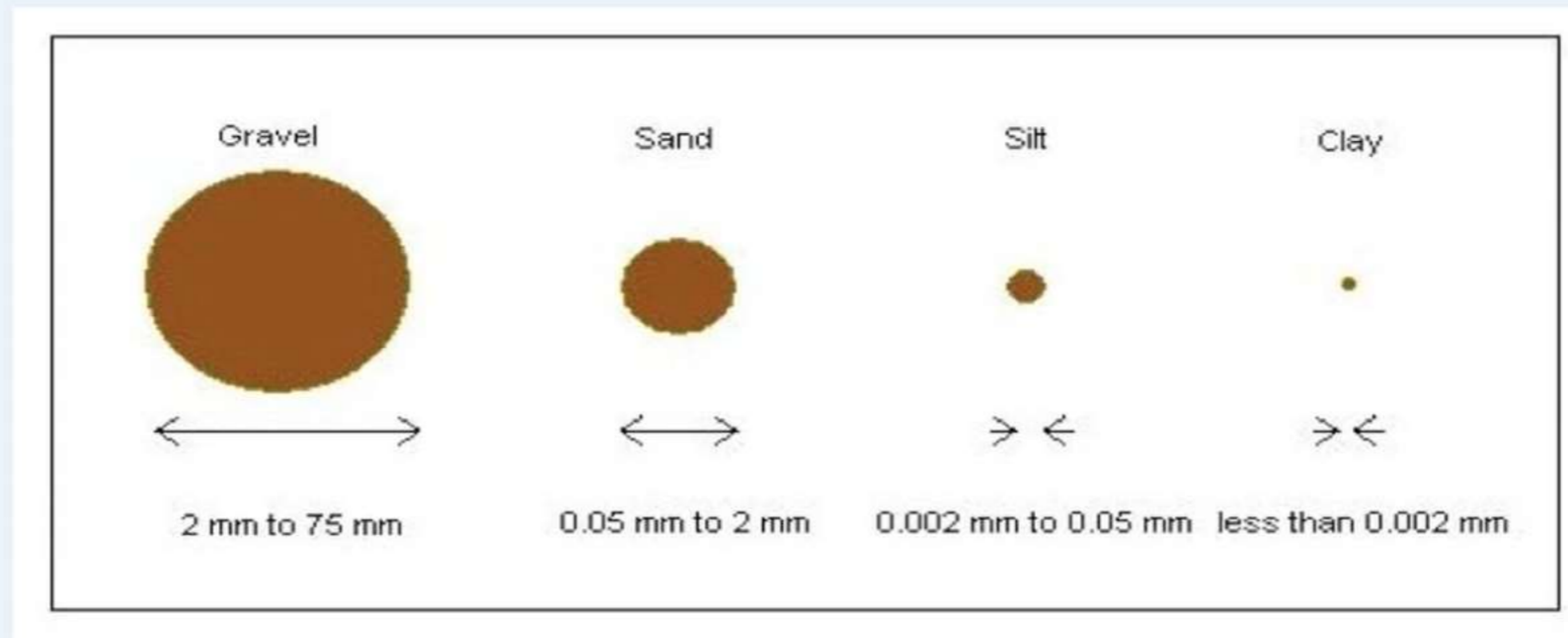
NOTE: SILT LOAM LAYER WAS GRAVELLY/COBBLY



# TEXTURES

# Soil Mineral Particles

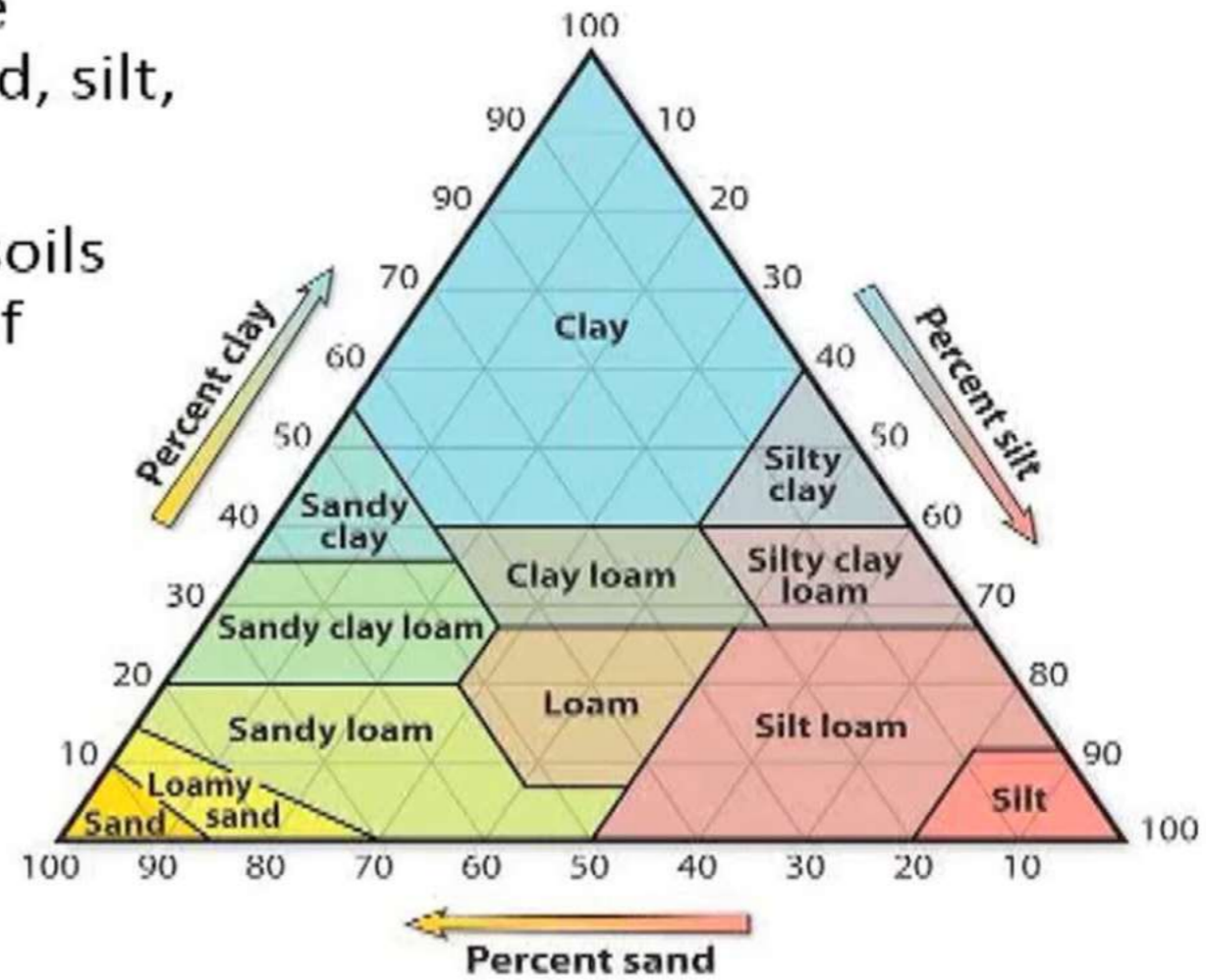
- Mineral Separates
  - Coarse Fraction (Rock Fragments):  $>2.0$  mm diameter
  - Fine Earth Fraction:  $<2.0$  mm diameter
    - Sand: 2.0 – 0.05 mm diameter
    - Silt: 0.5 – 0.002 mm diameter
    - Clay:  $<0.002$  mm diameter

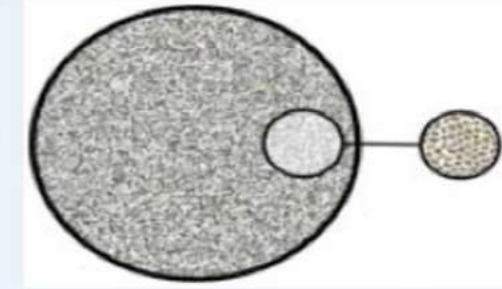
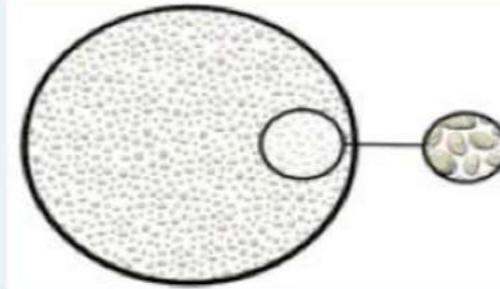
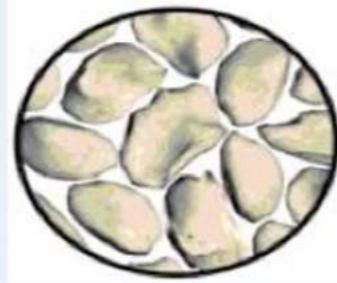




# Soil Texture

- Soil Texture - Describes the relative proportions of sand, silt, and clay
- Soil texture classes group soils with similar distributions of particle sizes





Property	Sand	Silt	Clay
Size range (mm)	2.0 – 0.05	0.05 – 0.002	<0.002
Means of observation	Naked eye	Light microscope	Electron microscope
Attraction of particles for each other (cohesion)	Low	Medium	High
Attraction of particles for water (adhesion)	Low	Medium	High
Water-holding capacity	Low	Medium-High	High
Aeration	Good	Medium	Poor
Resistance to pH change	Low	Medium	High
Nutrient holding capacity	Very Low	Low	Medium-High
Potential to be compacted	Low	Medium	High
Susceptibility to wind erosion	Moderate	High	Low
Susceptibility to water erosion	Low	High	Depends on degree of aggregation



Adapted from Brady and Weil, 2007



# TEXTURE SHORT HAND

# 2 TEST PITS



**Test Pit No.**                    **3F**  
 ESHWT:                            13"  
 Termination @                 54"  
 Refusal:                         NA  
 Obs. Water:                     NA

Lot No.:  
 WSPCD Group:  
 Roots to:  
 SCS Soil:                         NA  
 HIS Type:                         NA

Depth	Color	Texture	Structure	Consistence	Redox %	Horizon
0-6"	2.5Y 3/2	SIL	GR	FR	NONE	
6-13	2.5Y 5/4	SIL	GR	FR	NONE	
13-21"	2.5Y 5/3	SIL	GR	FR	5%	
21-54"	2.5Y 5/2	SLCL	BLK	FI	30%	

**Test Pit No.**                    **6A**  
 ESHWT:                            22"  
 Termination @                 50"  
 Refusal:                         NA  
 Obs. Water:                     NA

Lot No.:  
 WSPCD Group:  
 Roots to:  
 SCS Soil:                         NA  
 HIS Type:                         NA

Depth	Color	Texture	Structure	Consistence	Redox %	Horizon
0-5"	10YR 3/3	FSL	GR	FR	NONE	
5-15"	10YR 5/6	FSL	GR	FR	NONE	
15-22"	10YR 5/4	FSL	PL	FR	NONE	
22-50"	10YR 5/3	FSL	PL	FI	10%	



**Test Pit #D1:**

**0-27 INCHES, 2.5Y 5/3, LOAMY SAND, MASSIVE, FRIABLE**

**27-34 INCHES, 2.5Y 5/4, LOAMY SAND, MASSIVE, FRIABLE**

**34-48 INCHES, 2.5Y 5/3, LOAMY SAND, MASSIVE, FIRM, WITH 30% REDOX CONCENTRATIONS**

**ESHWT: 34 INCHES**

**REFUSAL: N/A**

**OBSERVED WATER: N/A**



# STRUCTURE



# Structureless



Massive



Single Grain





# Granular Soil Structure

- Associated with organic-rich, near-surface mineral horizons
- Roughly spherical, crumb shaped peds, typically 1 – 5 mm in diameter
- High porosity and permeability



Photo Courtesy John Kelley, NRCS



soilquality.org



# Platy Soil Structure

- Thin, plate-like peds, aligned parallel to the soil surface
- If well developed can impede infiltration









# Blocky Soil Structure

- Angular or Sub-Angular
- Common to subsoil horizons
- Held together by coatings of translocation materials, such as clays
- Structure often maintained by root channels between peds



Photo Courtesy John Kelley, NRCS



Photo Courtesy John Kelley, NRCS



Soil Survey Division Staff, 1993



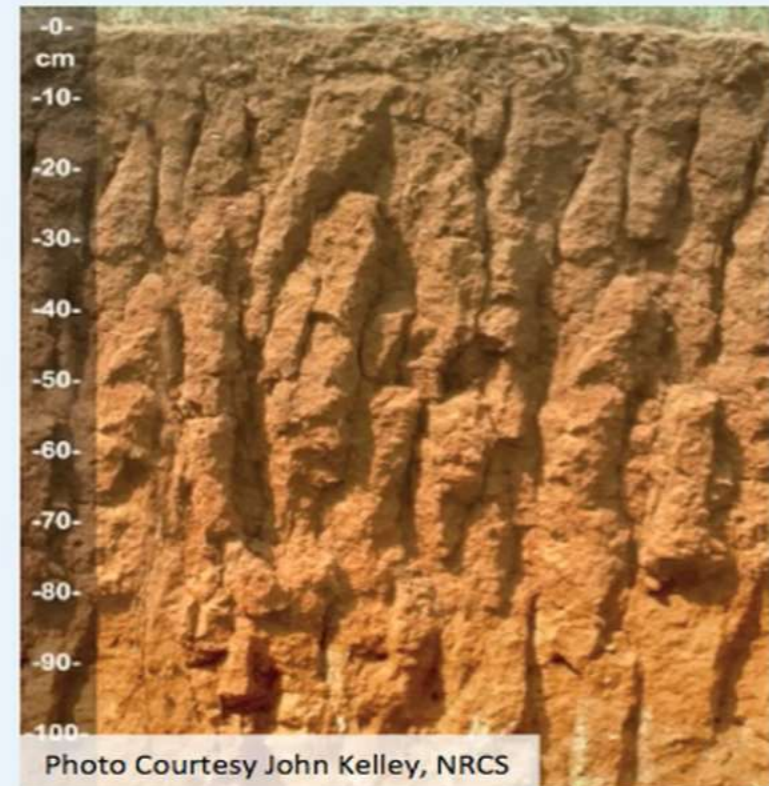






## Prismatic Soil Structure

- Vertically oriented, elongated blocks or prisms



## Columnar Soil Structure

- Similar to prismatic structure, but prism tops are rounded
- Found in soils with high amounts of exchangeable sodium



**CONSISTENCE**



Test Pit #D4:

0-14 INCHES, 10YR 3/2, SILT LOAM, GRANULAR, FRIABLE

14-48 INCHES, 2.5Y 5/3, SILT CLAY LOAM, ANGULAR BLOCKY, FIRM, WITH 20% REDOX  
CONCENTRATIONS

ESHWT: 14 INCHES

REFUSAL: N/A

OBSERVED WATER: N/A





**CONSISTENCE**

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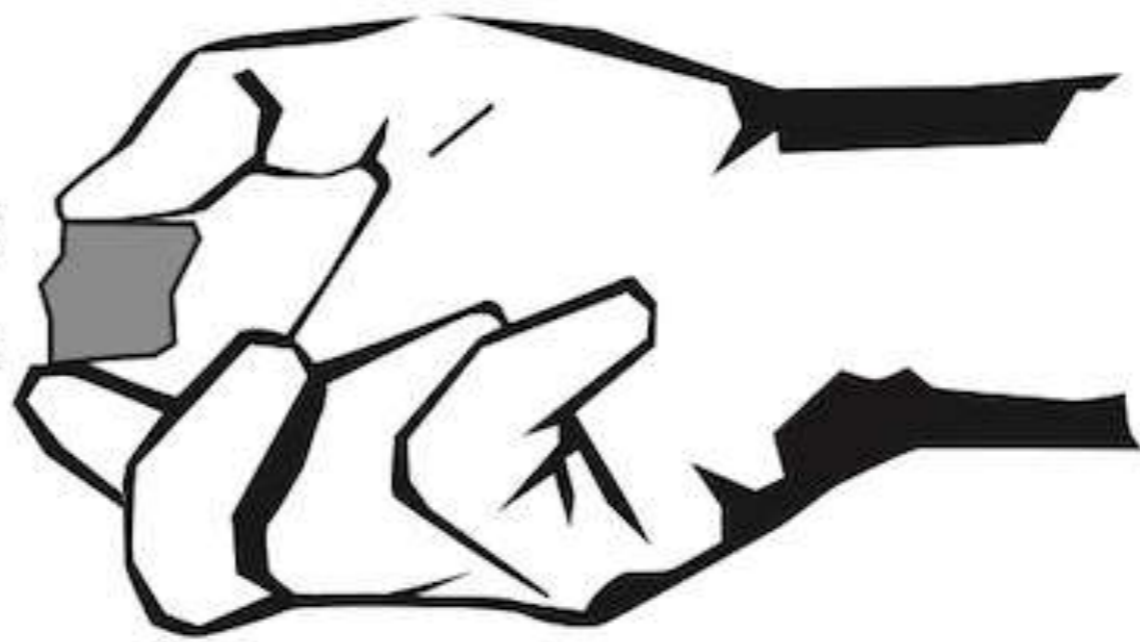
Consistence is the degree and kind of cohesion and adhesion that soil exhibits and/or the resistance of soil to deformation or rupture under an applied stress. Soil-water state strongly influences consistence. Field evaluations of consistence include: **Rupture Resistance** (Blocks, Peds, and Clods; or Surface Crusts and Plates), **Manner of Failure** (Brittleness, Fluidity, Smeariness), **Stickiness, Plasticity,** and **Penetration Resistance**. Historically, consistence applied to dry, moist, or wet soil as observed in the field. Wet consistence evaluated stickiness and plasticity. **Rupture Resistance** now applies to dry soils and to soils in a water state from moist through wet. **Stickiness** and **Plasticity** of soil are independent evaluations.

**RUPTURE RESISTANCE**—A measure of the strength of soil to withstand an applied stress. Separate estimates of **Rupture Resistance** are made for **Blocks/Peds/Clods** and for **Surface Crusts and Plates** of soil. Block-shaped specimens should be approximately 2.8 cm across. If 2.8-cm cubes (e.g.,  $\approx$  2.5-3.1 cm, or 1 inch) are not obtainable, use the following equation and the table below to calculate the stress at failure:  $[(2.8 \text{ cm}/\text{cube length cm})^2 \times \text{estimated stress (N) at failure}]$ ; e.g., *for a 5.6-cm cube*  $[(2.8/5.6)^2 \times 20 \text{ N}] = 5 \text{ N} \Rightarrow \text{Soft Class}$ . Plate-shaped specimens (surface crusts or platy structure) should be approximately 1.0-1.5 cm long by 0.5 cm thick (or the thickness of occurrence, if <0.5 cm thick).



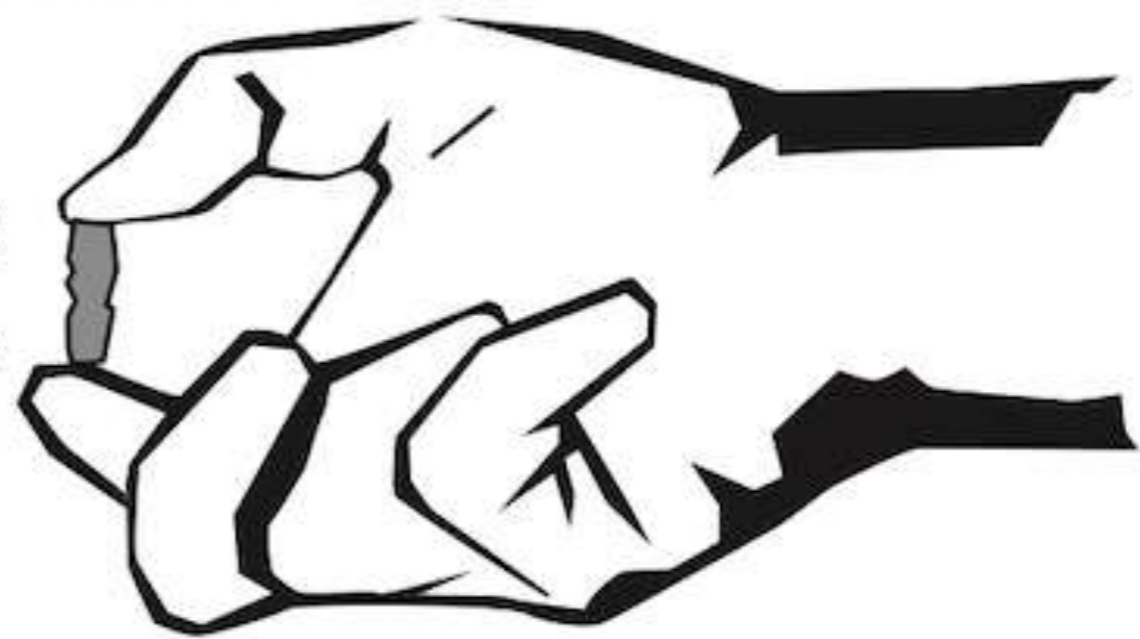
## Blocks/Peds

$\approx 3$  cm



## Crusts/Plates

$\approx 1.0-1.5$  cm





# REDOX FEATURES



**Test Pit #D7:**

**0-10 INCHES, 10YR 3/2, LOAMY SAND, GRANULAR, FRIABLE**

**10-21 INCHES, 2.5Y 5/4, LOAMY SAND, GRANULAR, FRIABLE**

**21-38 INCHES, 2.5Y 5/3, LOAMY SAND, MASSIVE, FRIBALE, WITH 20% REDOX CONCENTRATIONS**

**38-49 INCHES, 2.5Y 5/2, SILT CLAY LOAM, ANGULAR BLOCKY, FIRM, WITH 30% REDOX**

**CONCENTRATIONS**

**ESHWT: 21 INCHES**

**REFUSAL: N/A**

**OBSERVED WATER: 35 INCHES**



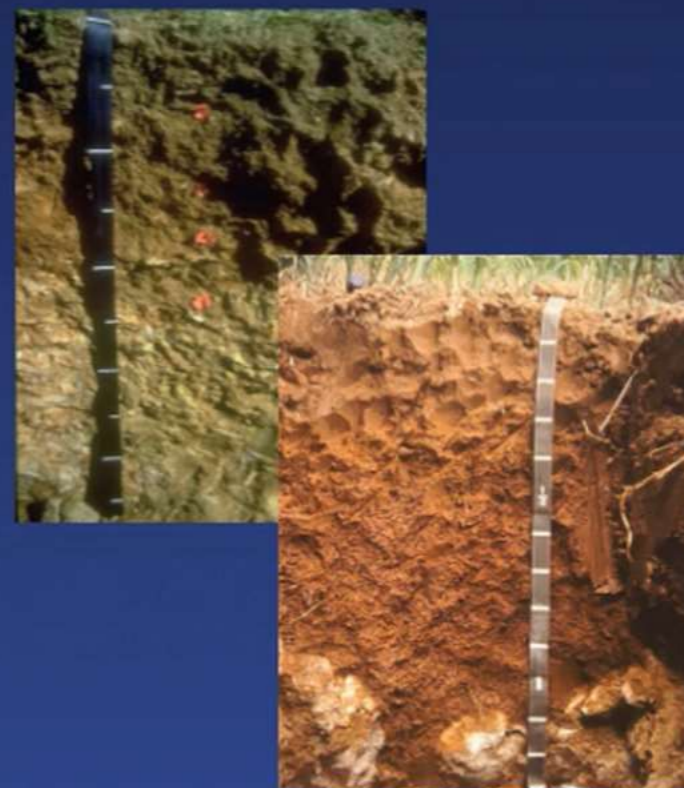


# Redox Features vs. Mottles

Redox Features



Lithochromic Mottles



# 2 TYPICAL TEST PITS

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**Refusal:** NA  
**Obs. Water:** NA

**Lot No.:**  
**WSPCD Group:**  
**Roots to:**  
**SCS Soil:** NA  
**HIS Type:** NA

Depth	Color	Texture	Structure	Consistence	Redox %	Horizon
0-6"	2.5Y 3/2	SIL	GR	FR	NONE	
6-13	2.5Y 5/4	SIL	GR	FR	NONE	
13-21"	2.5Y 5/3	SIL	GR	FR	5%	
21-54"	2.5Y 5/2	SLCL	BLK	FI	30%	

**Test Pit No.** 6A  
**ESHWT:** 22"  
**Termination @** 50"  
**Refusal:** NA  
**Obs. Water:** NA

**Lot No.:**  
**WSPCD Group:**  
**Roots to:**  
**SCS Soil:** NA  
**HIS Type:** NA

Depth	Color	Texture	Structure	Consistence	Redox %	Horizon
0-5"	10YR 3/3	FSL	GR	FR	NONE	
5-15"	10YR 5/6	FSL	GR	FR	NONE	
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# 2 TYPICAL TEST PITS

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**Roots to:**  
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**Test Pit No.** 6A  
**ESHWT:** 22"  
**Termination @** 50"  
**Refusal:** NA  
**Obs. Water:** NA

**Lot No.:**  
**WSPCD Group:**  
**Roots to:**  
**SCS Soil:** NA  
**HIS Type:** NA

Depth	Color	Texture	Structure	Consistence	Redox %	Horizon
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22-50"	10YR 5/3	FSL	PL	FI	10%	



**WHAT IS WRONG WITH  
THIS LOG?**



# 2 TYPICAL TEST PITS

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**Roots to:**  
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22-50"	10YR 5/3	FSL	PL	FI	10%	



# TEST PIT BLOOPERS



**VERY FINE LOAMY  
SAND**















