Urban Soil Conservation and Management

- Urban Soil include those located in:
  - Cities in park areas
  - Recreation areas
  - Community gardens
  - Green belts
  - Lawns
  - Septic absorption fields
  - Sediment basins
- We need a course devoted to their management

Urban Soil Conservation and Management

- Generally the primary concern is off-site impacts
- As will Ag Soil, Urban Soils are Located in watersheds that provide:
  - Drinking water
  - Wildlife Habitat
  - Recreation
  - Irrigation
  - Etc.

Off-site Impacts

- These are the same as those for Ag, Range and Forested soils
  - Nutrient Pollution
  - Sediment
  - Pesticides
- Additional Concerns:
  - Pharmaceuticals
  - Industrial contamination

Nutrient Pollutions from Urban Soil Management

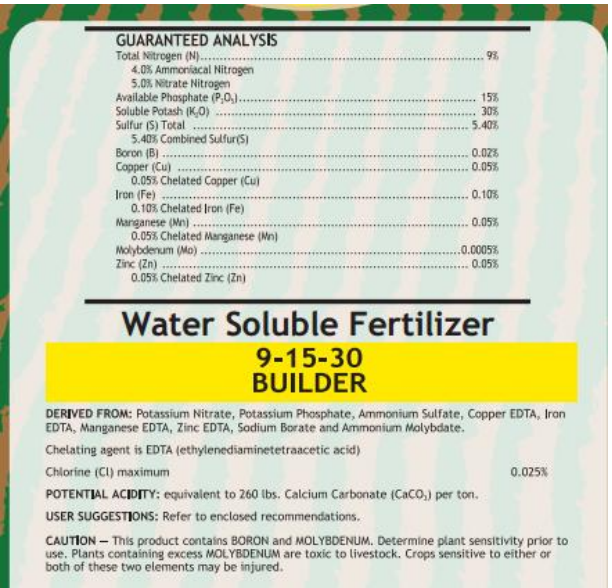
- Results from applications in excess of plant requirement
  - This statement is true regardless of nutrient source
- Slow release and organic fertilizers can release nutrients at a rate that is similar to crop uptake.
  - However, excess application can still result in off-site contamination

Nutrient Pollution from Urban Soils

- Historically “Blended” or “Complete” fertilizers have been used in landscapes and horticulture in general.
  - High value “crops” warranted additional inputs
  - Fewer problems with excess N applications with complete fertilizers
    - Crop damage
    - Water quality

Fertilizer Lab

- $N\text{-}P_2O_5\text{-}K_2O$
- Nutrient ratios found in Bermuda grass
- 9-1-7


GUARANTEED ANALYSIS

Total Nitrogen (N) 9%
4.0% Ammoniacal Nitrogen
5.0% Nitrate Nitrogen
Available Phosphate (P_2O_5) 15%
Soluble Potash (K_2O) 30%
Sulfur (S) Total 5.40%
5.40% Combined Sulfur(S)
Boron (B) 0.02%
Copper (Cu) 0.05%
0.05% Chelated Copper (Cu)
Iron (Fe) 0.10%
0.10% Chelated Iron (Fe)
Manganese (Mn) 0.05%
0.05% Chelated Manganese (Mn)
Molybdenum (Mo) 0.0005%
Zinc (Zn) 0.05%
0.05% Chelated Zinc (Zn)

Water Soluble Fertilizer

9-15-30
BUILDER

DERIVED FROM: Potassium Nitrate, Potassium Phosphate, Ammonium Sulfate, Copper EDTA, Iron EDTA, Manganese EDTA, Zinc EDTA, Sodium Borate and Ammonium Molybdate.

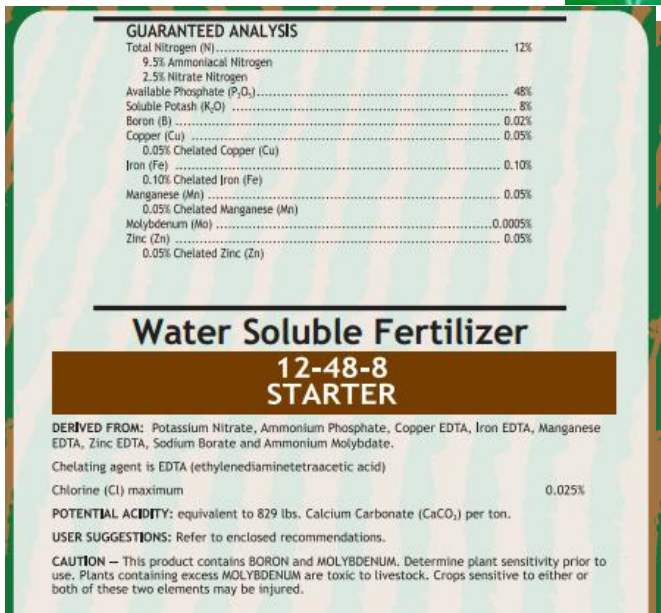
Chelating agent is EDTA (ethylenediaminetetraacetic acid)

Chlorine (Cl) maximum 0.025%

POTENTIAL ACIDITY: equivalent to 260 lbs. Calcium Carbonate ($CaCO_3$) per ton.

USER SUGGESTIONS: Refer to enclosed recommendations.

CAUTION — This product contains BORON and MOLYBDENUM. Determine plant sensitivity prior to use. Plants containing excess MOLYBDENUM are toxic to livestock. Crops sensitive to either or both of these two elements may be injured.


GUARANTEED ANALYSIS

Total Nitrogen (N) 12%
9.5% Ammoniacal Nitrogen
2.5% Nitrate Nitrogen
Available Phosphate (P_2O_5) 48%
Soluble Potash (K_2O) 8%
Boron (B) 0.02%
Copper (Cu) 0.05%
0.05% Chelated Copper (Cu)
Iron (Fe) 0.10%
0.10% Chelated Iron (Fe)
Manganese (Mn) 0.05%
0.05% Chelated Manganese (Mn)
Molybdenum (Mo) 0.0005%
Zinc (Zn) 0.05%
0.05% Chelated Zinc (Zn)

Water Soluble Fertilizer

12-48-8
STARTER

DERIVED FROM: Potassium Nitrate, Ammonium Phosphate, Copper EDTA, Iron EDTA, Manganese EDTA, Zinc EDTA, Sodium Borate and Ammonium Molybdate.

Chelating agent is EDTA (ethylenediaminetetraacetic acid)

Chlorine (Cl) maximum 0.025%

POTENTIAL ACIDITY: equivalent to 829 lbs. Calcium Carbonate ($CaCO_3$) per ton.

USER SUGGESTIONS: Refer to enclosed recommendations.

CAUTION — This product contains BORON and MOLYBDENUM. Determine plant sensitivity prior to use. Plants containing excess MOLYBDENUM are toxic to livestock. Crops sensitive to either or both of these two elements may be injured.


GUARANTEED ANALYSIS

Total Nitrogen (N) 20%
5.4% Ammoniacal Nitrogen
5.5% Nitrate Nitrogen
9.1% Urea Nitrogen
Available Phosphate (P_2O_5) 20%
Soluble Potash (K_2O) 20%
Boron (B) 0.02%
Copper (Cu) 0.05%
0.05% Chelated Copper (Cu)
Iron (Fe) 0.10%
0.10% Chelated Iron (Fe)
Manganese (Mn) 0.05%
0.05% Chelated Manganese (Mn)
Molybdenum (Mo) 0.0005%
Zinc (Zn) 0.05%
0.05% Chelated Zinc (Zn)

Water Soluble Fertilizer

20-20-20
FEED

DERIVED FROM: Potassium Nitrate, Urea, Ammonium Phosphate, Potassium Phosphate, Copper EDTA, Iron EDTA, Manganese EDTA, Zinc EDTA, Sodium Borate and Ammonium Molybdate.

Chelating agent is EDTA (ethylenediaminetetraacetic acid)

Chlorine (Cl) maximum 0.025%

POTENTIAL ACIDITY: equivalent to 555 lbs. Calcium Carbonate ($CaCO_3$) per ton.

USER SUGGESTIONS: Refer to enclosed recommendations.

CAUTION — This product contains BORON and MOLYBDENUM. Determine plant sensitivity prior to use. Plants containing excess MOLYBDENUM are toxic to livestock. Crops sensitive to either or both of these two elements may be injured.

Fertility Management

- After deficiencies (P and K) are remedied nutrient applications should match removal
- Best solution is to “SOIL TEST”
- Link to Oklahoma Fertility Handbook
- Oklahoma Soil Testing Factsheets

A Quick Note on Compost

- Compost is an Excellent soil conditioning amendment
  - Organic matter,
  - Soil Structure
  - Microbial activity
  - Nutrients
- However, Continued applications will result in excess Phosphorus
- “Average” Nutrient Content=10-10-10 lbs/ton

Current Efforts to Reduce Nutrient Pollutions from Urban landscape management

- Many States and Municipalities are restricting phosphorus applications
  - Link to Popular Press article discussing new Maryland Law restricting fertilizer Applications in Urban Systems
- Voluntary reductions in the P content of fertilizers by industry
  - Much less common to find 10-10-10 in the home and garden store!

On-Site Waste Water

- Improper design, maintenance and use of septic systems can result in nutrient and biological contamination of surface and subsurface waters
- Soil treatment of household waste water is preferred treatment option
  - Leaching field
  - Cheap
  - Low maintenance

On-Site Waste Water

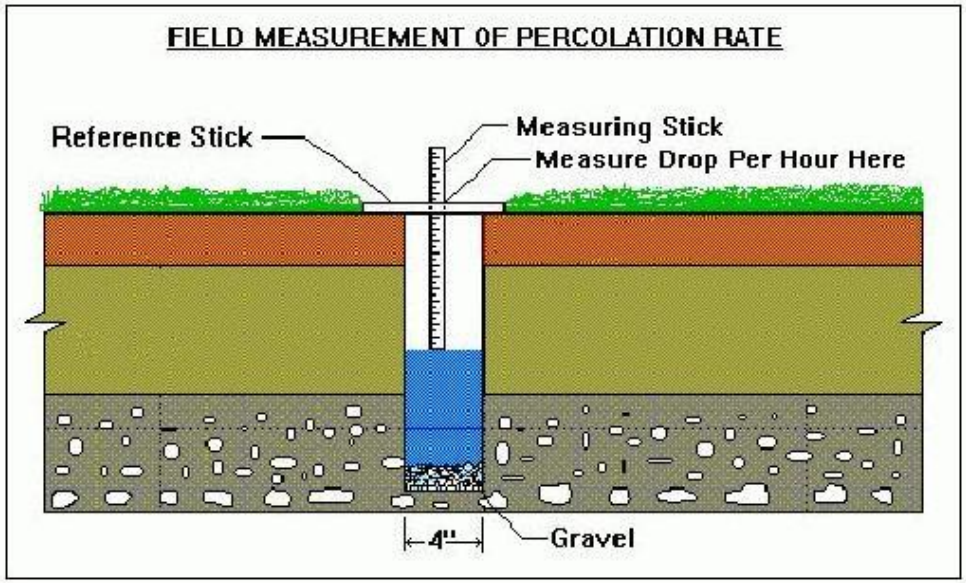
- Soil Characteristics are important when designing a system.
- Must be able to treat water prior to discharge
- Hydraulic conductivity must be slow enough to prevent discharge of untreated water and fast enough to prevent system failure due to anaerobic treatment and blockage .
- Historically a percolation test was used

On-Site Waste Water

- Leaching field should provide for Aerobic treatment of biological waste
- Aerobic treatment is much more rapid that anaerobic treatment.

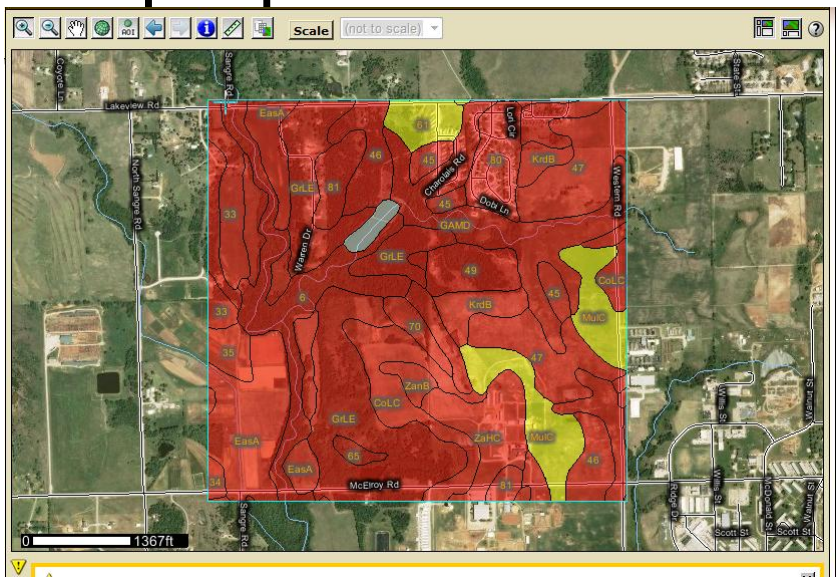
Percolation Test

- Infiltration must be rapid enough to prevent failure
- Problematic because we don't know where the water is going
- Could result in direct discharge through gravel atop shallow rock



Soil Profiles as an Improved Method to Assess Site Suitability

- Soil survey can provide a coarse assessment soil characteristics
- There can be significant variability within mapping units
- Site specific evaluation of soil properties is required

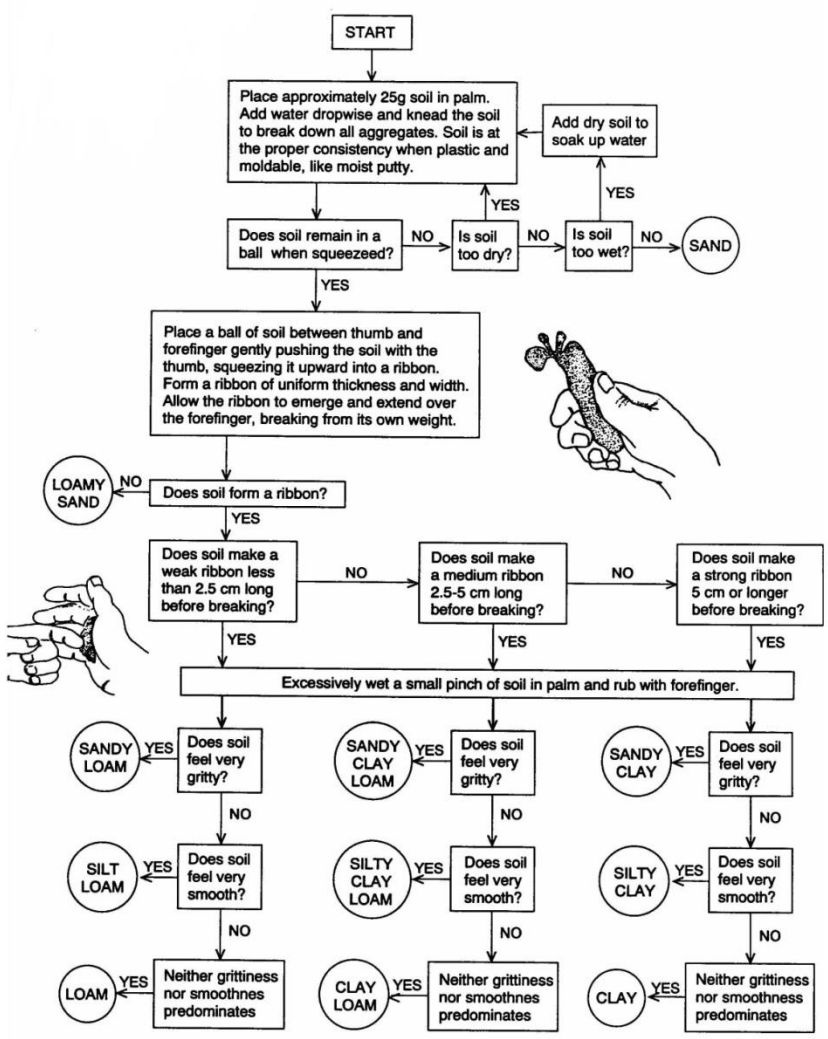


Soil Properties Influencing Water Movement

- Structure, Porosity, Texture
  - These are interrelated and each influence water movement though the soil
- Texture is most commonly used to assess soil suitability because it imposed the greatest influence and can be consistently evaluated
- Structure is used in some States

Soil Texture Evaluation

- Texture by feel method is used to determine texture at 6 inch increments to 4 ft or limiting layer
- 10 to 24 inches of soil between bottom of trench and limiting layer is required depending on texture



Soil Groups

SOIL GROUP	CORRESPONDING SOIL TEXTURE	Application Rate Linear ft/gpd
1	Coarse sand Loamy coarse sand Rocky soils	Prohibited
2	Medium and fine sand Loamy medium and fine sand	0.8
2A	Sandy loam	1.3
3	Sandy clay loam Loam Silt loam with <20% clay Silt	1.7
3A	Sandy clay without slickensides with moderate and strong soil structure Silt loam with >20% clay	2.5
4	Clay loam Silty Clay loam	3.3
5	Sandy clay with slickensides or weak soil structure Clay Silty Clay	Prohibited

Slickensides

- Polished and striated surfaces
- Formed when ped faces slide on each other
- Indicator of high shrink swell capacity in clays
- High shrink swell clays adversely impact water movement

Other Soil Properties Influencing Suitability for waste water Treatment

- Depth to limiting layer
  - Bed rock
  - Water table
  - Impermeable clay

Rock

- Defined Practically as:
  - Impervious to boring

Depth to Water Table

- Water table restricts water flow and provides potential for anaerobic decomposition of organic wastes
- Anaerobic decomposition is slower than aerobic decomposition
  - Anaerobic treatment could be incomplete prior to discharge to surface or subsurface waters.

Depth to Water Table

- Generally not a constant
  - Seasonal water table
  - Perch water table
- Soil Morphology will provide evidence of water table even if water is not present.
  - Redoximorphic Features

Redoximorphic Features

- Redoximorphic features result from microbial activity in the soil
- Microbes **Oxidize** organic matter for energy
  - This oxidation must be coupled with **Reduction** of another molecule
- Oxidation = Losses of electrons
- Reduction = Gain of electrons

Aerobic decomposition of Organic Matter

- When organic matter is Oxidized under aerobic conditions:
- Oxygen serves as the electron accepter

$$O_2 + 4e^- + 4H^+ \longrightarrow 2H_2O$$

Soil Air

Organic Matter decomposition

Anaerobic Decomposition

- Lack of oxygen results in the need for another Electron Accepter
- Fe^{+3} (red mineral in soil) accepts electrons under anaerobic conditions in soils
- Fe^{+2} (grey) is produced

$$FeOOH + 2e^{-} + 2H^{+} \longrightarrow 2FeO + H_2O$$

Fe^{+3} insoluble

Fe^{+3} soluble

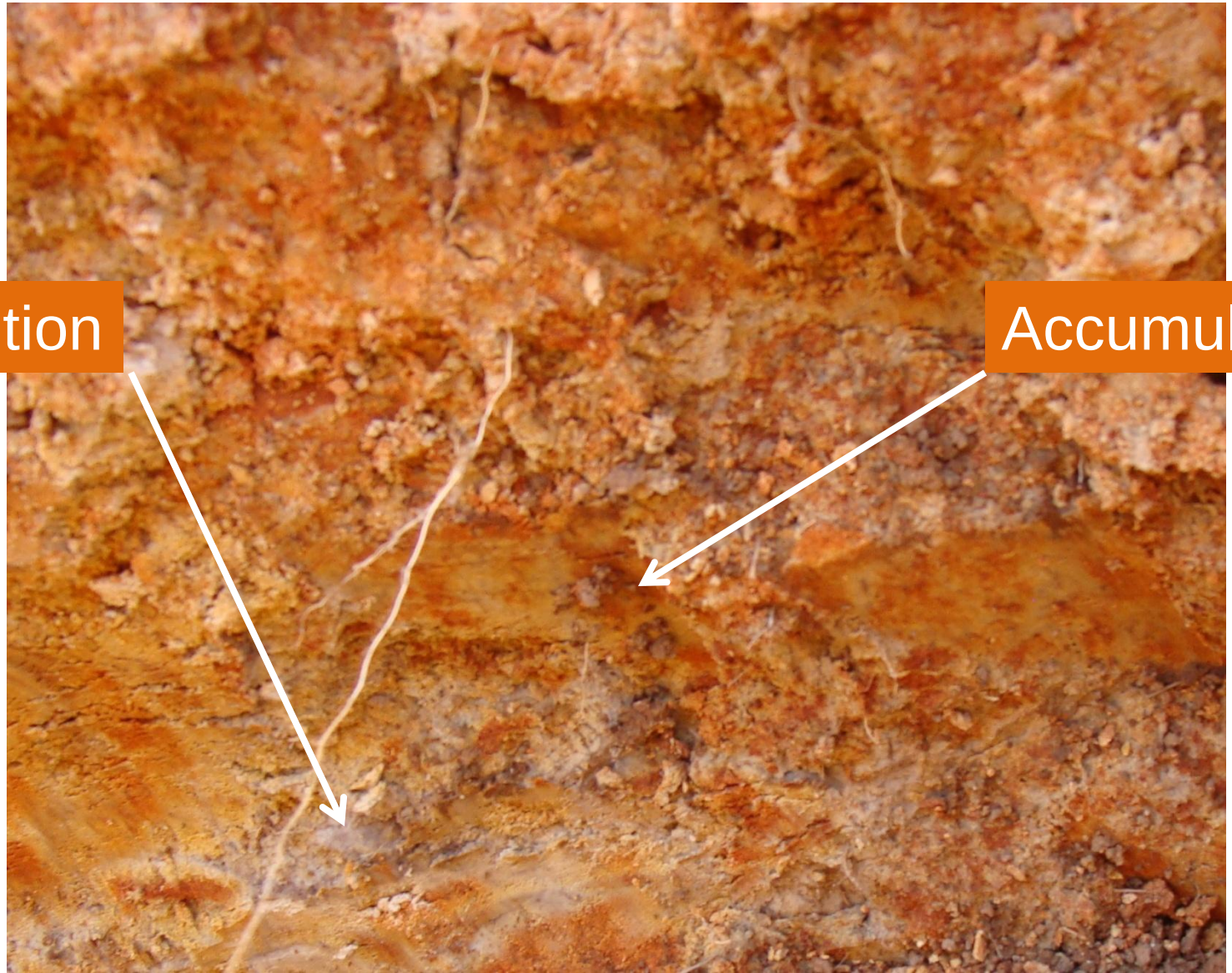
Redoximorphic Features: Accumulations

- Accumulations of Fe-Mn oxides lost from reduced areas
  - Red (Fe+3) or black (Mn+4) in color
  - Nodules and concretions
    - Cemented
  - Masses
    - Non-cemented
  - Pore linings
    - Root channels or worm casts

Redoximorphic Features
Depletions

- Fe-Mn oxides and/or clay have been removed
  - Reduce Fe^{+2} and Mn^{+2} are more soluble
    - Leached out of depletions
  - Grey to white in Color
  - Chroma is less than or equal to 2.
  - Indicates that the soil experiences extended periods of saturation.

Redoximorphic Features



Evaluating Soil Color: Munsell Color Chart

- Hue refers to the dominant wavelength of light (red, yellow, green, etc.).
- Value refers to the lightness and darkness of a color in relation to a neutral gray scale.
- Chroma is the relative purity or strength of the Hue.
- Notation
  - Hue Value/Chroma
  - 10YR 5/6

Limit to Redoximorphic features for On-site

- Depletions of 5% or more in two consecutive layers (6 inch interval)
- Chroma ≤ 2 and
- Value ≥ 4
- Grey to white color

Munsell Soil Color Chart

Excavating for soil profile descriptions

- Small volume soil auger or push probe
  - Can be done by hand
  - More rapid sampling
  - Can be hard on the back
- Large soil pit excavation
  - Ideal for viewing whole soil
  - More detail can be gained
  - Large disturbed volume can reduce soil quality

Oklahoma Soil Classification Manual for On-site

- Link