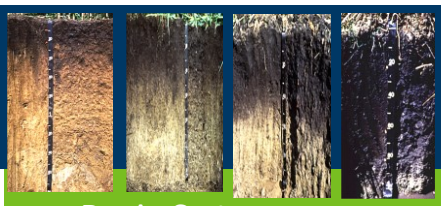

Basic Soil Concepts

BOARD OF WATER AND SOIL RESOURCES

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1

Overview

- Basics of Soil
  - Soil formation
  - Landscape position
- Soil Properties
  - Texture
  - Color
- Hydric soil development
- Web Soil Survey
  - Interpreting soil reports
- Hydric soil indicators
  - All
  - Fine
  - Sandy
- Common soil indicators

2

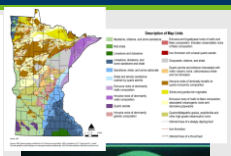
What is Soil?

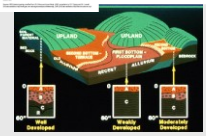
- Natural body that occurs on the land surface, occupies space, and is characterized by one or both of the following:
- Horizons or layers, or
- The ability to support rooted plants in a natural environment
  - Upper limit is air or shallow (>2.5 m) water
  - Lower limit is either bedrock or the limit of biological activity
  - Lower limit for classification set at an arbitrary 2 m

3

Factors That Influence Soil Development

- Climate- weather conditions prevailing over long period of time
- Parent material- geologic material from which soils form
- Topography- landscape position and slope processes
- Organisms- essential role of microbes in the soil, includes humans
- Time- soil doesn't "age", it develops. vegetation, organisms and climate "act on" parent material and topography to develop soil.

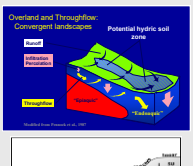


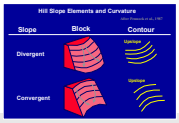


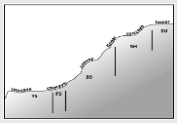
4

Landscape Position

- Location relative to other landforms
- Critically influences water flow and soil formation
- Most wetlands, even groundwater seeps, are on some sort of concave surface







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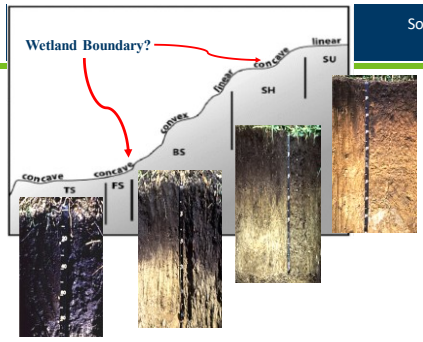
Soil Catena



6

Two Categories of Soil Material - Mineral Soil/Horizons

Mineral horizons

- Primarily sand, silt, and clay, with varying amounts of organic matter

Organic horizon

- consists of mostly decomposed organic material

7

Organic Matter Decomposition

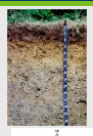
- Fibric (peat)
  - Least decomposed
  - Plant fibers identifiable
  - After rub – >40% of fibers still visible (2/3)
- Hemic (mucky peat)
  - Intermediate decomposition
- Sapric (muck)
  - Most decomposed, <1/3 ID of plant fibers
  - <1/6 of fibers visible after rubbing

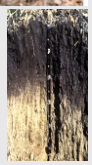
8

Key Soil Properties

Properties that are important to hydric soil development and recognition:

- Horizons- layer of soil with similar physical, chemical, and biologic properties
- Texture- relative proportion of soil particles (sand, silt, clay)
- Structure- arrangement of solid parts and of the pore spaces located between them
- Permeability- ability of water to move through a material
- Color- hue, value, chroma
- Organic matter- percent, thickness, and level of organic decomposition
- Drainage- presence of natural and human drainage on a landscape





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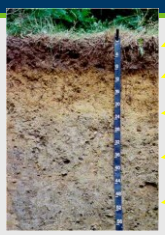
Soil Horizon- layer of soil with similar physical, chemical, and biologic properties



O horizon- Organic horizon, thickness varies

A Horizon- Organic accumulation (typically ~10%), ideally granular structure

E Horizon- Coloring agents (Fe, Organics) removed

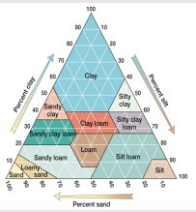
B Horizon- Subsoil accumulation of minerals, organics, and sometimes chemicals, blocky structure

C Horizon - Similar to parent material, often less developed with little structure

R Horizon- Parent material

10

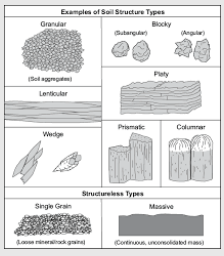
Soil Texture- Relative proportion of soil particles



11

Soil Structure

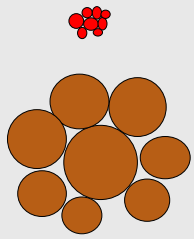
- Soil Structure- arrangement of solid parts and of the pore spaces located between them
- Aggregation- interaction and arrangement of soil particles
- Precipitation of oxides, carbonates and silicates
  - Cementation
- Can decline under cultivation & irrigation



12

Permeability- ability of water or air to move through the soil profile

- Variables in permeability:
  - Structure- arrangement of soil characterized by size, shape (blocky, columnar, platy, etc.) and grade (weak, strong)
  - Texture- pore space of different particle sizes
- Permeability is "measured" in inches per hour
  - Permeability is actually an estimated property
- Larger grain sizes= higher permeability



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Capillary Fringe

- Based upon permeability
- The zone above the free water table that is effectively saturated
  - Water held at tension
  - Theoretical values much higher than "real life"
  - Difficult to measure

14

Coloring Agents in Soil

- Organic matter
  - OM will mask all other coloring agents.
- Iron (Fe)
  - brown colors are the result of Fe oxide stains coating individual particles
- Manganese (Mn)
  - resulting in a very dark black or purplish black color
- Calcium
- Lack of coatings
  - Color of the mineral soil grains (stripped)

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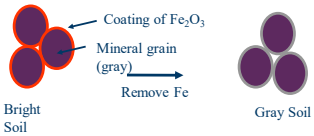
Soil Color



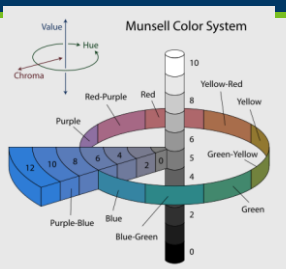
"Bright-colored" soil is bright because the gray-colored mineral grains are coated with a thin layer of "paint" formed by Fe oxides. Stripping the paint off the particles leaves the mineral grains exposed.

16

Color

- Hue- the spectrum color
- Value- lightness or darkness
- Chroma- "purity" or grayness of color

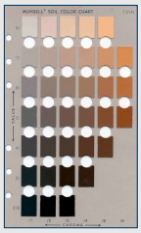
Hue Value Chroma
10YR 2/1



17

Color

- Matrix (predominant) color
- Color of redoximorphic features
  - Contrast, abundance, location, and size of redox features



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Reading Soil Color

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

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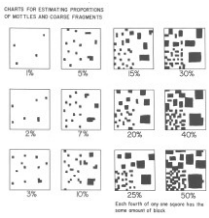
Abundance and Size of Redox

Abundance

- Few -- less than 2%
- Common -- 2 to 20%
- Many -- more than 20%

Size

- Fine -- < 5 mm
- Medium -- 5 to 15 mm
- Coarse -- > 15 mm



Several indicators require at least 2% abundance

20

Contrast

- Contrast refers to the degree of visual distinction between associated colors
  - Faint -- evident only on close examination
  - Distinct -- readily seen at arms length
  - Prominent -- contrast strongly

Contrast Class	Code	Difference in Color Between Matrix and RMF (Δ means "difference between")			
		Hue (h)	Value (v)		*Chroma (c)*
Faint [2]	F	$\Delta h = 0$;	$\Delta v \le 2$	and	$\Delta c \le 1$
		$\Delta h = 1$;	$\Delta v \le 1$	and	$\Delta c \le 1$
		$\Delta h = 2$;	$\Delta v = 0$	and	$\Delta c = 0$
Distinct [2]	D	$\Delta h = 0$;	$\Delta v \le 2$	and	$\Delta c > 1$ to < 4
			or $\Delta v > 2$ to < 4	and	$\Delta c < 4$
		$\Delta h = 1$;	$\Delta v \le 1$	and	$\Delta c > 1$ to < 3
			or $\Delta v > 1$ to < 3	and	$\Delta c < 3$
		$\Delta h = 2$;	$\Delta v = 0$	and	$\Delta c > 0$ to < 2
			or $\Delta v > 0$ to < 2	and	$\Delta c < 2$
Prominent [2]	P	$\Delta h = 0$;	$\Delta v \ge 4$	or	$\Delta c \ge 4$
		$\Delta h = 1$;	$\Delta v \ge 3$	or	$\Delta c \ge 3$
		$\Delta h = 2$;	$\Delta v \ge 2$	or	$\Delta c \ge 2$
		$\Delta h \ge 3$;			

[2] If compared colors have both a value ≤3 and a chroma of ≤2, the contrast is *Faint*, regardless of hue differences.

Several indicators require distinct or prominent contrast!

21

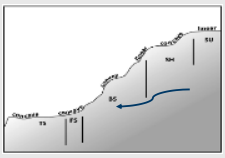
Definition of a Hydric Soil

- A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding **long enough** during the **growing season** to develop anaerobic conditions in the **upper part**.

22

Landscape and formation of hydric soils

- Landscape position
  - Surface shape (linear, concave, convex)
  - Erosional or depositional
- Hydraulics
  - How water moves
- Hydroperiod- seasonal pattern of water table depth in a wetland
  - Long term- organic
  - Seasonal inundation- thick O, dark A
  - Seasonal saturation- thin O
  - Floodplain- thin, stratified layers



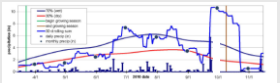


Figure D5. Precipitation analysis for a growing season showing daily precipitation, monthly precipitation, the 30-day rolling sum, and the range of normal conditions.

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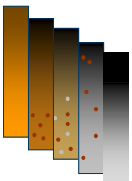
Hydric Soil Development

Hydric soils indicators develop in **anaerobic** conditions by the process of :

1. **Reduction** and Re-oxidation of Iron
2. **Organic Matter** Accumulation

Foundation of the Field Indicator Manual.



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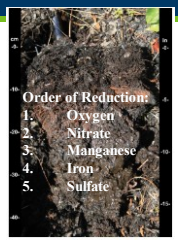
Hydric Soil Development

Soil microbes that drive reduction require:

1. Anaerobic conditions i.e. (saturated soil)
2. Organic matter (energy source)
3. Soil temperature warm enough for microbial respiration (>41F)
4. Duration of conditions (Time)

In anaerobic conditions decomposition slows and leads to organic accumulation



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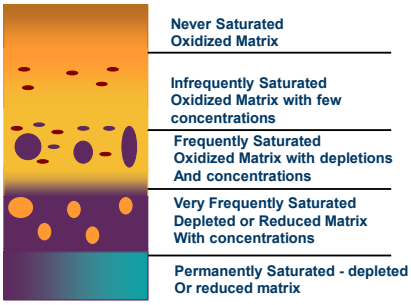

26

Depleted Matrix

Iron removed or re-organized in profile leaving Grey matrix

- **Value 4 or More**
- **Chroma 2 or Less**

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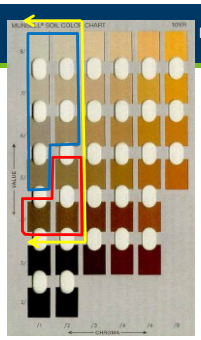
Depleted Matric Requirement

Do Not Need Concentrations

Need Concentrations (2%)



High Value (4 or more)

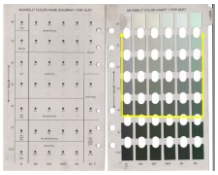
Low Chroma (2 or Less)

28

Gleyed Matrix Requirements

Gleyed Matrix

- **Iron Present, but in reduced state (Fe2+) Gleyed color with value > = 4**



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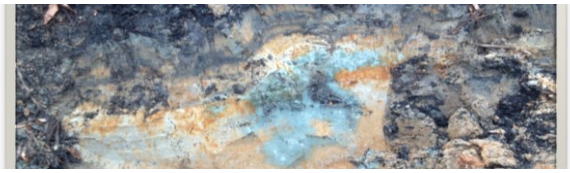

Hydric Soil Indicators

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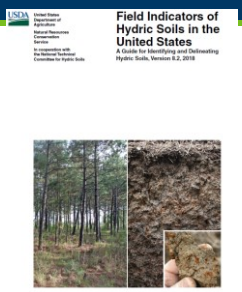
Field Indicators of Hydric Soils

Natural Resources Conservation Service

- National Technical Committee for Hydric Soils

Used for **on-site verification** of hydric soils



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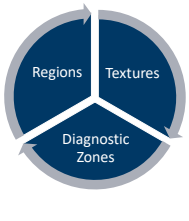
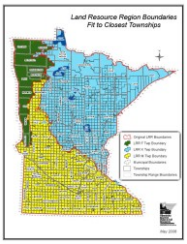
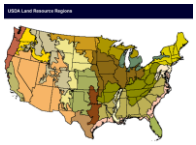
Field Indicator Organization



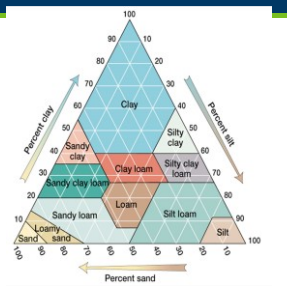




32

All Soils

- Use regardless of texture(s)
  - All Mineral
  - All Organic
- Typically organic matter influences near the surface
- Includes smell
  - Rotten egg

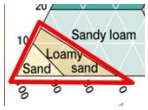


33

Soil Indicator Groups

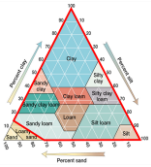
Sandy Soil Indicators (S):

- Use when texture is:
  - Loamy Fine Sand or coarser



Fine Grained Soil Indicators (F):

- Use when texture is:
  - Loamy Very Fine Sand or finer



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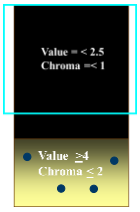
Diagnostic Zones

- Layers with :
  - Certain **Colors**
    - high value and low chroma
    - redoximorphic features
    - organic matter accumulations
  - Specific **Depths** from Surface
  - **Thickness** requirements



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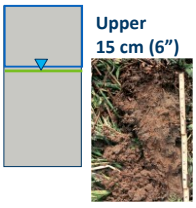
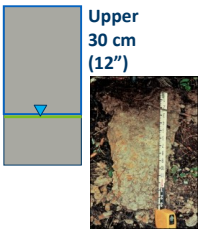
Diagnostic Zones for S and F indicator groups

Sandy (S)



Upper 15 cm (6”)

Loamy / Clayey (F)



Upper 30 cm (12”)

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Couple of key terms to help interpret indicators:

Credit: USDA & NRCS for following pictures

- Aquic- moisture regime, reducing regime virtually free of dissolved oxygen
- Histic- saturated organic horizon
- Epipedon-horizon near the surface
- Depletions- areas of low chroma where oxides have been stripped away
- Concentrations-zones where oxides have accumulated

37

Format of Indicator Descriptions

- Alpha-numeric designation
  - A1
- Short name
  - Histosol
- Applicable land resource regions (LRR)
  - Use in all LRRs
- Description of the indicator
- User notes
  - Additional information, explanation and guidance
- Supplement adds regional likelihood, locations

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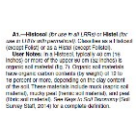
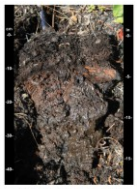
A1- Histosol

- **A1. Histosol:** Classifies as a Histosol. A Histosol has a layer of organic matter accumulation of ≥ 16 inches in the upper 32 inches of soil material.
- Use in all LRRs





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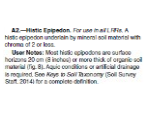
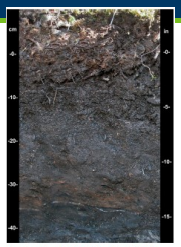
A2- Histic Epipedon

Histic epipedon- saturated, organic horizons 8 inches or more thick in the upper part

- Applicable land resource regions (LRR)
  - Use in all LRRs

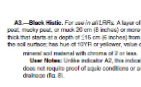


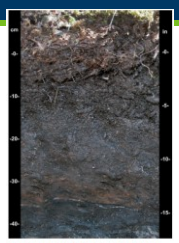


40

A3- Black Histic

- A layer of peat, mucky peat, or muck 8 in or more thick that starts at a depth of ≤ 6 in from the soil surface; has hue of 10YR or yellower, value of 3 or less, and chroma of 1 or less; and is underlain by mineral soil material with chroma of 2 or less.
- Applicable land resource regions (LRR)
  - Use in all LRRs





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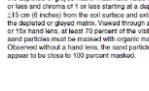
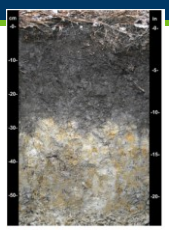
A11- Depleted Below Dark Surface

- Applicable land resource regions (LRR)
  - Use in all MN LRRs





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A12- Thick Dark Surface

- Applicable land resource regions (LRR)
  - Use in all LRRs
- User notes
  - Most often associated with overthickened soils in concave landscape positions.

A12.—Thick Dark Surface. *For use in all LRRs.* A layer at least 15 cm (6 inches) thick with a depleted or gleyed matrix that has 60 percent or more chroma of 2 or less starting below 30 cm (12 inches) of the surface. The layer(s) above the depleted or gleyed matrix and starting at a depth <15 cm (6 inches) from the soil surface must have value of 2.5 or less and chroma of 1 or less to a depth of at least 30 cm (12 inches) and value of 3 or less and chroma of 1 or less in any remaining layers above the depleted or gleyed matrix. In any sandy material above the depleted or gleyed matrix, at least 70 percent of the visible soil particles must be masked with organic material, viewed through a 10x or 15x hand lens. Observed without a hand lens, the particles appear to be close to 100 percent masked.

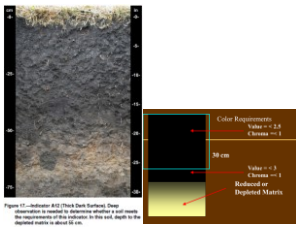

Figure 117.—Indicator A12 (Thick Dark Surface). Deep observation is needed to determine whether a soil meets the requirements of this indicator. In this soil, depth to the depleted matrix is about 55 cm.

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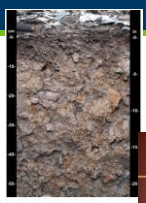
F3- Depleted Matrix

- Applicable land resource regions (LRR)
  - Use in all LRRs

F3.—Depleted Matrix. *For use in all LRRs, except W, X, and Y; for testing in LRRs W, X, and Y.* A layer that has a depleted matrix with 60 percent or more chroma of 2 or less and that has a minimum thickness of either:

a. 5 cm (2 inches) if the 5 cm starts at a depth ≤10 cm (4 inches) from the soil surface, or
b. 15 cm (6 inches), starting at a depth ≤25 cm (10 inches) from the soil surface.



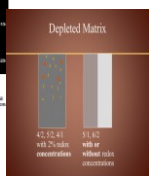


Figure 28.—Indicator F3 (Depleted Matrix). This soil has value of 4 or more and chroma of 3 or less and redox concentrations occurring as soft masses. In this soil, the depleted matrix starts at a depth of 35 cm from the soil surface, the minimum thickness requirement is only 5 cm.

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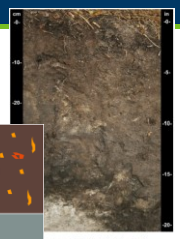
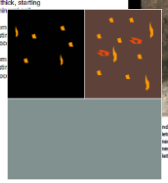
F6- Redox Dark Surface

- Applicable land resource regions (LRR)
  - Use in all LRRs

F6.—Redox Dark Surface. *For use in all LRRs, except W, X, and Y; for testing in LRRs W, X, and Y.* A layer that is at least 10 cm (4 inches) thick, starting at a depth ≤20 cm (8 inches) from the mine surface, and has:

a. Matrix value of 3 or less and chroma or less and 2 percent or more distin prominent redox concentrations so soft masses or pore linings, or
b. Matrix value of 3 or less and chroma or less and 5 percent or more distin prominent redox concentrations so soft masses or pore linings.





ndicators F6 (Redox Dark Surface) and ated Dark Surface). A soil that meets the ents of indicator F7 commonly also meets the ents of indicator F6. If the dark surface layer tations, it most likely also has concentrations.

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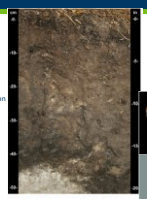
F7- Depleted Dark Surface

- Applicable land resource regions (LRR)
  - Use in all LRRs
- User notes
  - Careful to not mistake an E horizon for depletions!

F7.—Depleted Dark Surface. *For use in all LRRs, except W, X, and Y; for testing in LRRs W, X, and Y.* Redox depletions with value of 5 or more and chroma of 2 or less in a layer that is at least 10 cm (4 inches) thick, starting at a depth ≤20 cm (8 inches) from the mineral soil surface, and has:

a. Matrix value of 3 or less and chroma of 1 or less and 10 percent or more redox depletions, or
b. Matrix value of 3 or less and chroma of 2 or less and 20 percent or more redox depletions.



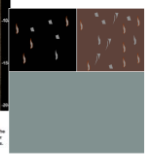


Figure 31.—Indicators F6 (Redox Dark Surface) and F7 (Depleted Dark Surface). A soil that meets the requirements of indicator F7 commonly also meets the requirements of indicator F6. If the dark surface layer has depletions, it most likely also has concentrations.

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S5- Sandy Redox

- Applicable land resource regions (LRR)
  - Use in all LRRs

S5.—Sandy Redox. *For use in all LRRs, except Q, V, W, X, and Y.* A layer starting at a depth ≤15 cm (6 inches) from the soil surface that is at least 10 cm (4 inches) thick and has a matrix with 60 percent or more chroma of 2 or less and 2 percent or more distinct or prominent redox concentrations occurring as soft masses and/or pore linings.

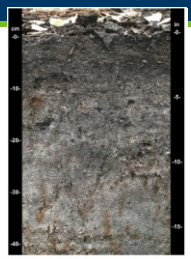

Figure 22.—Indicator S5 (Sandy Redox). This soil meets the requirements of indicator S5, having a matrix chroma of 2 or less and at least 2 percent redox concentrations starting at a depth of about 10 cm.

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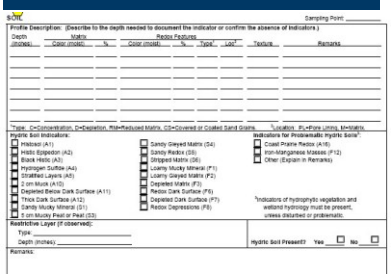
Data Sheet



SOIL

Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:
- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 5 cm Mucky Peat or Peat (S3)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:
- ☐ Coast Prairie Redox (A16)
- ☐ Iron-Manganese Masses (F12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: _____
Depth (inches): _____

Hydric Soil Present? Yes ☐ No ☐

Remarks:

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Problematic Hydric Soils

- Covered in Chapter 5 of the regional supplements
- Problematic hydric soils are the norm in some landscapes
  - **Red** Parent Material *(inhibited, or difficult to see redox features)*
  - Active floodplains *(deposition of new material)*
  - Drained systems *(relict hydric indicators)*
  - **High Value** *(bright)* / **Low Chroma** *(grey)*,
  - Thick prairie soils

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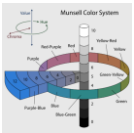
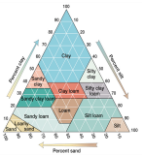
Review

- Soil formation
  - Parent material, landscape position, horizons
- Soil Properties
  - Texture
    - Sand, silt, clay
  - Color
    - Hue, value, chroma
- Hydric soil development
  - Anaerobic conditions, reduction, organic accumulation
- Web Soil Survey
  - Interpreting soil reports
- Hydric soil indicators
  - All, Fine, Sandy
- Common soil indicators
  - Organic Indicators (A1, A2, A3)
  - Depleted Matrix (F3, F7)
  - Redoximorphic features (F6, S3)





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Reviewing Wetland Delineation Reports

BOARD OF WATER AND SOIL RESOURCES

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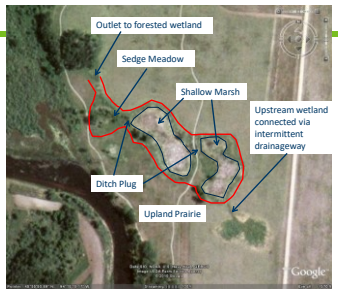

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Wetland Delineation Reports

- Field Notes
- Basic Report Components
- Report Contents
- Field Review
- Non-Routine Wetland Delineations

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Guidance

Delineation Method	Review of offsite mapping resources	Site Visit	Sampling Approach	Complete Field Data Forms	Field Staking of Wetland Boundaries
Routine Level 1	Yes	Sometimes	Offsite	No	No
Routine Level 2	Yes	Yes	Onsite, qualitative	Yes	Yes
Comprehensive	Yes	Yes	Onsite, quantitative	Yes	Yes

WCA Application Type Examples	*Commonly Used* Delineation Method
Temporary impact under No-Loss	Routine Level 1
Banking application: pre-application scoping	Routine Level 1
Banking application: full application	Routine Level 2
Road Program Wetland Impact Documentation—Road project through a large continuous wetland	Routine Level 1
Road Program Wetland Impact Documentation—Scattered wetlands within construction corridor	Routine Level 2
Replacement plan	Routine Level 2
Enforcement actions	Routine Level 2 or Comprehensive
Wetland boundary approval (no project application)	Routine Level 2
Agricultural exemption determination (8420.0420, Subpart 2A)	Routine Level 1

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Take Good Field Notes

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What to Record

- Plant communities
  - Describe and sketch on aerial photograph
- Landscape settings
  - Topographic changes from wetland to upland
    - Gradual, abrupt?
- Vegetation
  - Dominant veg
  - changes from wetland to upland
- Soil
  - Changes from wetland to upland
  - Textures, Colors
- Hydrology indicators
  - Changes from wetland to upland

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What to Record

- Wetland type
  (Circular 39, Cowardin, Eggers & Reed)
- General site description
  - Buildings, ditches, culverts, etc…
- Field conditions
  - Raining, temperature, drought, etc.

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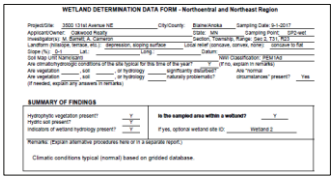
Notes on Field Notes (cont.)

- Note taking skills improve with experience as you figure out what is important and what is not
- Take time to organize, refine, and augment field notes immediately following your field visit.
- Label and organize photos so you know where you took them and what they are intended to show.


WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: 2555 131st Avenue NE City/County: Blaine/Anoka Sampling Date: 5-1-2017
Applicant/Owner: Oakwood Realty State: MN Sampling Point: DP2-wet
Investigator(s): Kathryn Kirchner Section, Township, Range: Sec 2, T31, R23
Landform (hillslope, terrace, etc.): depression, sloping surface Local relief (concave, convex, none): concave to flat
Slope (%): 0-1 Lat: Long: Datum:
Soil Map Unit Name/Series: NWI classification: PEM1Ad
Are climatic/hydrologic conditions of the site typical for this time of the year? Y (If no, explain in remarks)
Are vegetation Y, soil Y, or hydrology Y significantly disturbed? Are "normal circumstances" present? Yes
Are vegetation N, soil N, or hydrology N naturally problematic?
(If needed, explain any answers in remarks)

SUMMARY OF FINDINGS

Hydrophytic vegetation present?	Y	Is the sampled area within a wetland?	Y
Hydric soil present?	Y		
Indicators of wetland hydrology present?	Y	If yes, optional wetland site ID:	Wetland 2

Remarks: (Explain alternative procedures here or in a separate report.)

Climatic conditions typical (normal) based on gridded database.

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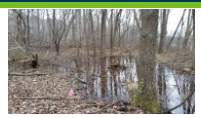
Marking Wetland Boundaries

- Mark with:
  - Flags, lath, whatever works.
  - Will vary depending on situation.
- Locate via GPS or land survey methods (find out local requirements).
- Wetland boundaries must be usable for the regulatory purposes intended (grading plans, plat maps, etc.).



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Guidance


St. Paul District
REGULATORY
US Army Corps of Engineers®

Minnesota Board of Water & Soil Resources

March 4, 2015

Guidance for Submittal of Delineation Reports to the St. Paul District Army Corps of Engineers and Wetland Conservation Act Local Governmental Units in Minnesota, Version 2.0

Introduction – Purpose and Background of 2015 Guidance

This guidance provides specific standards and expectations for conducting wetland delineations and submitting wetland delineation reports for regulatory purposes in Minnesota. It supplements and emphasizes information in the 1987 *Corps of Engineers Wetland Delineation Manual* (Manual) and applicable regional supplements. In 1996, the Corps of Engineers (the Corps), St. Paul District Regulatory Branch issued *Guidelines for Submitting Wetland Delineations to the St. Paul District Corps of Engineers and Local Units of Government in the State of Minnesota* jointly with the Minnesota Board of Water and Soil Resources (BWSR). Significant improvements to the application of the science behind wetland and

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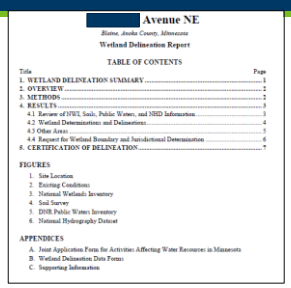
Typical Report Format

- Introduction
- Methods
- Results
- Discussion (optional)
- Figures
- Field Data Forms



[redacted] Avenue NE

Blaine, Anoka County, Minnesota

Wetland Delineation Report

TABLE OF CONTENTS

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Introduction

- Who did you do this for?
  - Developer, public entity
- Where is the project
  - General location and size of project area
  - General description of plant communities: Wooded, meadow, urban etc…
- Why are you doing it?
  - Identify wetlands on potential development site
  - Identify wetlands in road corridor
- When did you do it?

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Methods

- **Level 1 or 2?**
- **Off site aerial review?**
- **Monitoring data?**
- **Reference wetlands?**
- **Problem area or atypical procedures?**

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RESULTS and Discussion

Describe wetlands AND uplands

- Wetland Type – Circular 39, Cowardin, Eggers & Reed
- Dominant Vegetation for each community/type

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Text Examples

Wetland Type &Vegetation:

"Wetland 1 is a Type 3 (PEMC/F) with an interior shallow marsh community surrounded by a fringe of wet meadow.

Dominant vegetation in the shallow marsh includes broadleaf cattail, and water plantain.

The wet meadow fringe include reed canary grass, with a few scattered willow shrubs."

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Text Examples

Soils:

"Soils in the wetland consisted of a deep layer of organic sapric material overlying fine sand consistent with the mapped soil unit. Indicator A1 (histosol) was observed in the wetland.

Adjacent upland soils lacked the organic surface layer and consisted of high chroma loamy fine sand over sand. No hydric soil indicators were observed in the upland."

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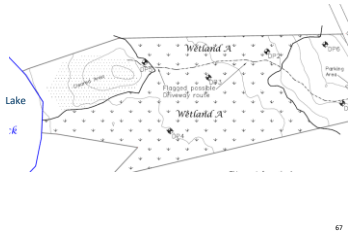
Report Components – Figures

1. Site Location
2. National Wetland Inventory (NWI)*
3. Soils
4. Public Waters Inventory (PWI)*
5. Wetland Boundary Map

*often combined



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Report Components – Maps | Site Location

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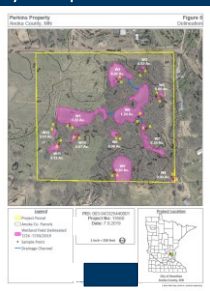
Identify all aquatic resources



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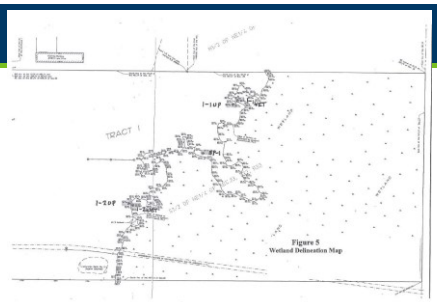

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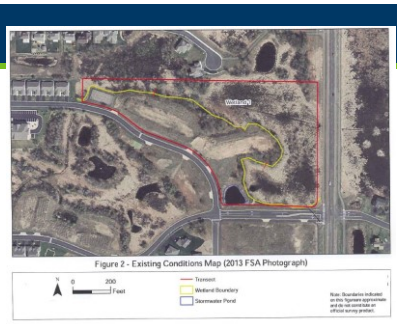

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Reports

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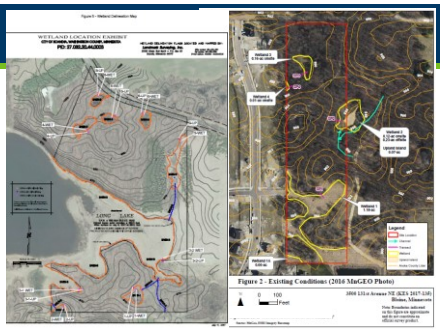

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Data Forms

- Completely filled out
- Correspond to sample locations indicated on a map
- Remember that sample locations should be representative
- Not needed if doing a Routine Level 1
- Do a complete job, but keep in mind that these are field assessments, not a scientific study, spend a reasonable amount of time.

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Field Review

Who should conduct site review?

- At least 1 member of TEP
- LGU may request assistance from TEP (SWCD and BWSR) or other tech. prof.
- Corps invited/coordination
- Delineator invited (but does not need to be present)

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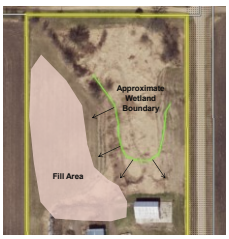
Non-Routine Wetland Delineations

- Informal Delineations
- Landowner wanted to fill an area mapped as non-hydric soil
- Site visit to estimate and stake wetland boundary



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Delineation Class Summary

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Minnesota Wetland Professional Certification Program

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COURSE OVERVIEW

- Critical Definitions
- Classification Systems & Functions
- Wetland Delineation
  - Vegetation – hydrophyte, Dominance
  - Soil – hydric soil indicators
  - Hydrology- inputs/outputs, indicators, monitoring

- Chapter 5
- Delineation Methods
- Offsite Hydrology Methods
- Reviewing Delineations

Minnesota Wetland Professional Certification Program

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What is a Wetland?

Definition: Those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions.

Hydrology + Vegetation + Soil = Wetland

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Wetland Functions & Values

Wetland Functions: in scientific assessments means natural processes

Wetland Value: wetland goods and services providing monetary or social welfare benefit.

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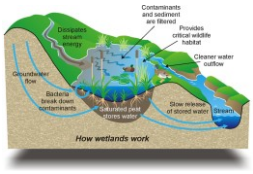
Wetland Functions

- Act as a natural "filter" to maintain water quality
- Facilitates infiltration recharging groundwater
- Stabilize base flow
- Decreases fluid velocity during high flow events which decreases turbidity
- Storm water retention (i.e. storage)
- Provides habitat
- Shoreline protection



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Functional Assessment Methods

- MN Routine Assessment Method (MNRAM)
  - Numeric model for assessing wetland functions and some values

Comprehensive General Guidance

for

Minnesota Routine Assessment Method (MnRAM) Evaluating Wetland Function, Version 3.4 (beta)

9/15/2010

- Floristic Quality Assessment
  - Vegetation based ecological condition assessment method

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Critical Definitions

- Wetlands
- Growing Season
- Atypical Situations
- Problem Areas
- Normal Circumstances

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Chapter 5

- Examples of difficult wetland situations:
  - Land use for agriculture and silviculture
  - Problematic Hydrophytic Vegetation
  - Problematic hydric soils
  - Wetlands that periodically lack hydrology indicators
  - Wetland/Non-wetland mosaic areas
- Reference sites, aerial photography, hydrology data, climatic data

General Procedure:

1) Verify at least one hydric soil indicator and one primary or two secondary hydrology indicators are present
2) Consider landscape position

   concave, floodplain, toe slope, flat, fringes wetland, restrictive soil layers, groundwater discharge

3) Procedures outlined in Chapter 5
4) Long-term monitoring

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3-Parameter/ Indicator Approach

1. **Soils** –Historic conditions, may not reflect current condition.
2. **Hydrology** –Current condition, but heavily influenced by recent climate conditions
3. **Vegetation** – Somewhere between

The 87 Manual requires 3 parameters because no one source typically gives the answer in all situations

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Wetland Delineation Types

ROUTINE

- **Level 1** - Onsite Inspection Unnecessary
- **Level 2** - Onsite Inspection Necessary
- **Level 3** - Combination of Levels 1 and 2

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Land Resource Regions

- **Regions dictate which indicators are used and how they are used**

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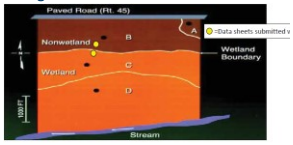
Sampling Location Should Be Representative

- Representative of soil changes (from upland to wetland)
- Representative of vegetation changes
- Representative of hydrology indicator changes
- Representative of landscape changes



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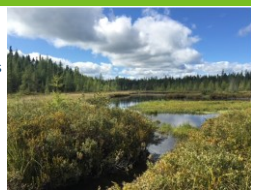
Hydrology

…"inundated or saturated by surface or ground water at a frequency and duration"

- Technical standard of 14 or more consecutive days of flooding or ponding;
- Water table 12 in. or less below soil surface;



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Hydrology Indicators

Evidence that there is continuing hydrology and confirms that an episode of inundation/saturation occurred recently.

Wetland hydrology indicators are divided into two categories:

- Primary – provide stand-alone evidence of a current or recent hydrologic event; and
- Secondary – provide evidence of recent hydrology when supported by one or more other hydrology indicators.

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Hydrology Indicator Groups

Group A – direct observation of *water*

Group B – evidence of *flooding/ponding*

Group C – evidence of *current or recent saturation*.

Group D – *Landscape and veg. characteristics* that indicate contemporary wetland conditions.

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Research Data Sources

- Aerial Photos (current and historic)
- Soil map (Web Soil Survey)
- Topographic\LiDAR
- NWI Map (updated version in MN)
- DNR Protected Waters Map

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Overview of Wetland Vegetation

- Hydrophytic Vegetation Definition
  - Define Hydrophyte
  - What makes a plant a hydrophyte
  - Determine why matters
- Hydrophytic Vegetation Indicators
  - Field indicators
  - Indicator status
  - Dominance
- Determining Hydrophytic Plant Community
  - Rapid Test
  - 50/20 Rule
  - Prevalence Index
  - Morphological Adaptations

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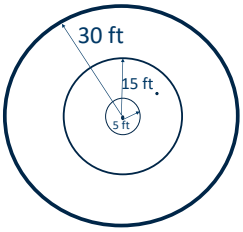
Vegetation Sampling



5 ft Herbaceous; 15 ft Shrub/Sapling; 30 ft Tree

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Determining Hydrophytic Vegetation

The procedure for using hydrophytic vegetation indicators is as follows:

1. Apply Indicator 1 (Rapid Test for Hydrophytic Vegetation).
2. Apply Indicator 2 (Dominance Test).
3. Apply Indicator 3 (Prevalence Index). This and the following step assume that at least one indicator of hydric soil and one primary or two secondary indicators of wetland hydrology are present.
4. Apply Indicator 4 (Morphological Adaptations).

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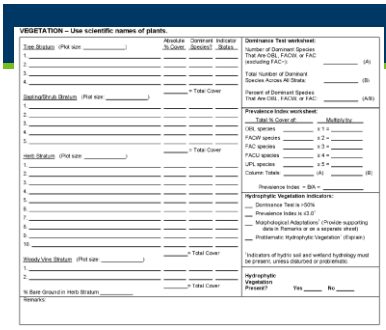
Hydrophytic Veg.



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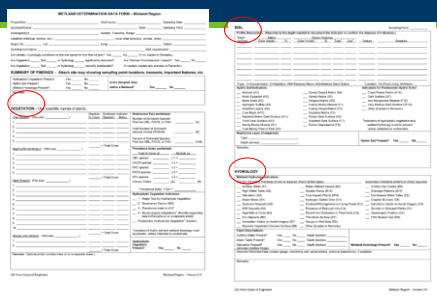
It's all about the documentation!



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Soil Concepts

- Basics of Soil
  - Soil formation
  - Landscape position
- Soil Properties
  - Texture
  - Color
- Hydric soil develop
- Web Soil Survey
  - Interpreting soil reports
- Hydric soil indicators
  - All
  - Fine
  - Sandy
- Common soil indicators

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Field Indicators of Hydric Soils

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Wetland Delineation Reports

- Field Notes
- Basic Report Components
- Report Contents
- Field Review
- Non-Routine Wetland Delineations

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Final Thoughts?

- Questions (last chance!)

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Minnesota Wetland Professional Certification Program

Which of following is a vegetation based ecological condition assessment method for wetlands:

a) MNRAM

b) Cowardin

c) Floristic Quality Assessment

d) Eggers & Reed

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A delineator utilizes air photos, soils map, topographic maps, and local wetland maps to identify and define a wetland boundary. This is an example of what?

a) A comprehensive level 3 delineation
b) An unacceptable methodology under any circumstances
c) A quantitative delineation approach
d) A routine level 1 delineation

A Circular 39 Type 2 wetland, is most similar to what Cowardin Classification?

a) PEMB

b) PUBF

c) PSS1C

d) PFO1B

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A seasonally flooded wetland on agricultural land is normally plowed and planted in most years. For delineation purposes, which of the following conclusions is most likely true?

a) This is not a jurisdictional wetland
b) Normal circumstances are not present
c) Normal circumstances exist
d) A level 1 delineation is required

A wetland good and services which provides monetary or social welfare benefit is known as:

a) wetland value

b) Floristic Quality Assessment

c) wetland function

d) stormwater retention

105

What is the definition of depleted matrix? Describe what it looks like.

Value 4 or More
Chroma 2 or Less

How deep do you need to dig a soil sample pit?

Deep enough to determine if an indicator is present or absent

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Which of the following is the least important when conducting hydrology monitoring with shallow wells for determining if the wetland hydrology technical standard is met for an area?

a) Growing season.

b) Depth to restrictive soil layer.

c) "A" horizon thickness.

d) Well installation methodology.

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Which of the following tests is used for a wetland hydrology indicator?

a)50/20 dominance

b)FAC Neutral

c)Prevalence Index

d)Bulk density

When should the Prevalence Index be calculated?

a) When dominant vegetation (as determined by the 50/20 rule) is determined to be hydrophytic.

b) When non-dominant vegetation (as determined by the 50/20 rule) is determined to be hydrophytic.

c) When hydric soils and wetland hydrology indicators are absent and the wetland determination is made by vegetation alone.

d) When wetland plant communities fail the dominance test, but have indicators of hydric soils and wetland hydrology

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Based on the following vegetation sampling, how many dominant species are present?

Herb Strata	Shrub Strata	Tree Strata
Species A – 45%	Species A – 4%	Species A – 10%
Species B – 35%		Species B – 5%
Species C – 30%		
Species D – 30%		

a) 2
b) 6
c) 7
d) 8

Which of the following does <u>not</u> qualify for a no-loss?

a) Activity that will not impact the wetland.

b) Excavation limited to sediment removal in wetlands that are utilized as a stormwater basin.

c) Excavation in wetlands that removes sediment which alters the original cross section of the wetland.

d) Seasonal water level management activities.

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