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The History and Use of Field Indicators of Hydric Soils in the United States

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1970s

- Soil Taxonomy incorporates wet soils into the classification system
- US FWS asks SCS to create hydric soil lists to assist in the National Wetland Inventory

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1980s

- Hydric soils are one of three parameters identified in protected wetlands for the Food Security Act (1985) and the Clean Water Act's 1987 Wetland Delineation Manual
- National Technical Committee for Hydric Soils is established

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NTCHS Functions

1. Provide technical leadership in the formulation, evaluation, and application of hydric soil definition, hydric soil lists, indicators, technical standard, and glossary.

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NTCHS Functions

2. Annually update and distribute a national list of hydric soils.
3. Refine and maintain the Field Indicators of Hydric Soils in the United States.

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NTCHS Functions

4. Communicate and respond to public comment regarding suggested changes to the hydric soil definition, list, indicators, technical notes, and technical standard.

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NTCHS Functions

5. Determine soil, hydrologic, and climatic data necessary to more accurately define and determine hydric soils.

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History of Hydric Soils Field Indicators

- The first field indicators established for hydric soils were published in the Corps of Engineers 1987 Wetland delineation Manual
- Indicators based on anecdotal knowledge

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Not Hydric Soils

Hydric Soil

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Field Indicator Development

- The NTCHS was formed in the mid-80s to assist in the approval of data supporting Field Indicators of Hydric Soils in the US.
- NRCS funded the "Wet Soil Monitoring Project"

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Regional Committees

- Florida
- New England
- Mid-Atlantic

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1995 Farm Bill

- Formal adoption of the use of *Field Indicators of Hydric Soils in the United States* for use in Farm Bill wetland activities.

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Development of the Field Indicators of Hydric Soils in the United States

- A subcommittee consisting of soil scientists involved in the "Wet Soil Monitoring Project" put together the original list of indicators
- First hard copy (v. 3.2) published 1996

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Hydric Soils Technical Standard

- In the mid-90s a technical standard was developed to standardized data collection requirements for establishing that a soil is a functioning hydric soil

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Addition of Indicators and Test Indicators

- The NTCHS meets once a year to review all proposals for new test or approved indicators or the adoption of test indicators as approved indicators

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-Version 7.0 published in spring 2010

http://soils.usda.gov/use/hydric/

-Hardcopies published last week

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New Criteria for Creating a List of Map Units That Contain Hydric Soils

- **Federal Register 12234** Vol. 77, No. 40 Wednesday, February 29, 2012

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The Hydric Soil Technical Standard

Deliberations of:

National Technical Committee for Hydric Soils (NTCSH)

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NTCHS Recommendation for Application of the HSTS

- The NTCHS recommends that the HSTS be used to:
- a. evaluate the function of wetland restoration, mitigation, creation, and construction,
- b. evaluate onsite the current functional hydric status of a soil, and
- c. with appropriate regional data modify, validate, eliminate, or adopt hydric soil field indicators for the region.

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Standard Requirements

- 1. Anaerobic Conditions
- 2. Saturated Conditions

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1: Anaerobic Conditions

- For a soil to meet the Anaerobic Conditions part of the standard the must meet either
  - Option 1: The requited Redox Potential(Eh) as detailed below, or
  - Option 2: The required IRIS tube reaction as detailed below, or
  - Option 3: The required reaction to alpha-alpha-Dipyridyl as detailed below.

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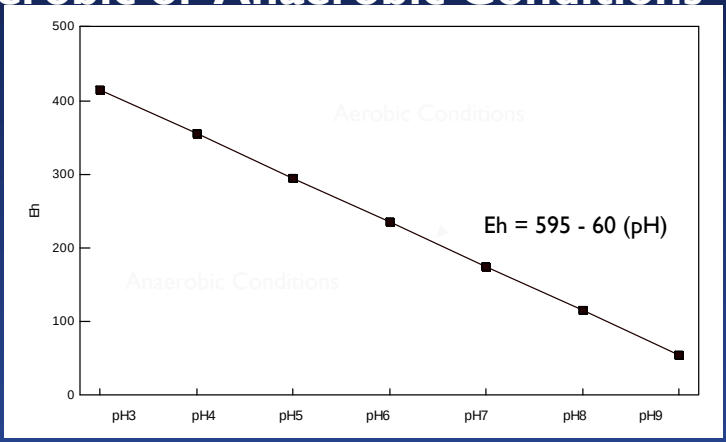
Eh/pH Line for Determining Aerobic or Anaerobic Conditions



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Anaerobic Conditions (Option I)

- 5 Electrodes installed at 12.5 cm in sands (would be at 25 cm or 10 cm for other soil conditions).

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Interpreting for Anaerobic Conditions (Option 2)

- For a soil to meet the Anaerobic Conditions part of the standard at least 3 of 5 IRIS tubes have iron removed from 30% of a zone 15 cm long. Top of zone of iron removal must be within 15 cm of the soil surface for all soils.

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1: Interpreting for Anaerobic Conditions (Option 3)

- A soil meets the Anaerobic Conditions part of the standard if a positive reaction to alpha-alpha-Dipyridyl is the dominant (60% or more) condition of a specific layer (1/2 of 10 cm, 1/2 of 12.5 cm, or at least 10 cm of 30 cm) for at least 2 of the 3 required samples.

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2: Saturated Conditions

- A. Confirmed by piezometer data.
- B. NTCHS recommends that the piezometer data be verified by open well data.
- C. On-site precipitation data are needed.

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2: Saturation Measurements

- For Vertisols in Louisiana and Texas, 3 piezometers at 25 cm and 3 piezometers at 100 cm are installed. All are measured at least weekly.
- For all other soils, one open well to 2 m (preferable auto-recording), 2 piezometers at 25 cm, and 2 piezometers at 100 cm are installed. All are measured at least weekly.

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2: Interpreting for saturated Conditions

- For a soil to meet the Saturated Conditions part of the standard, free water has to exist within the shallowest piezometer (25 cm).

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Measurement Period

- Recommended measurement period is at least one year.
- Minimum measurement period captures a dry (moist)-wet-dry (moist) cycle.

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Duration

- For at least 14 consecutive days, Anaerobic Conditions (confirmed by voltage readings below the Eh/pH line or positive reaction to alpha-alpha-Dipyridyl and Saturation Conditions must exist for a soil to be considered hydric.
- For Vertisols in Louisiana and Texas the minimum time period is 7 consecutive days for a total of 18 annual days.

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Frequency

Frequency must be more than 50% (more than 1 in 2 years).
One method is approved to evaluate precipitation (adapted from Sprecher and Warne, 2000):

Precipitation data for the three months prior to the most saturated and reduced period are evaluated as well as the month during data collection.

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Frequency Evaluation

The frequency requirement is assumed to have been met if precipitation for the three months prior to the most saturated and reduced period is "normal" and the precipitation during the month of data collection is within one standard deviation average precipitation. "Normal" is defined as the 30-70 percentile probability of occurrence.
30-70 percentile probability data are available from the WETS web site at http://www.wcc.nrcs.usda.gov/climate/wets_doc.html On-site precipitation data is compared with the data from the nearest weather station.

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Instrument Installation

- For application of the HSTS, instruments are installed at appropriate depths measured from:
- 1. The O Horizon surface in all soils that meet indicator A1 in all LRRs, or
- 2. The O Horizon surface in all soils that meet indicators A2, and A3 except in LRRs W, X, and Y, or
- 3. The Oa (muck) Horizon surface in soils that have a muck layer of any thickness at the surface except in LRRs R, W, X, and Y, or
- 4. The Oe (mucky peat) or Oi (peat) Horizon surface in soils in which they are directly underlain by sandy soil material in LRRs F, G, H, and M, or
- 5. The surface of the mineral soil in loamy and clayey soil materials that are overlain by Oe (mucky peat) or Oi (peat) Horizons in LRRs F, G, H, and M, or
- 6. The surface of the mineral soil in all LRRs except as noted above.

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Future of Hydric Soils

- IRIS tube use for identifying reduced conditions in soil has accelerated research in the development of new indicators for problematic situations that we currently have no indicators for.

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Use of the Definition, Criteria, Field Indicators and Technical standard

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HYDRIC SOIL IDENTIFICATION

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To be considered a hydric soil the soil must meet_____

1. The hydric soils definition.
2. The characteristics of a map unit component on the hydric soil list
3. A field indicator of hydric soils
4. The technical standard.
5. Any of the above.
6. All the above.

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To be considered a hydric soil the soil must meet_____

1. The hydric soils definition.
2. The characteristics of a map unit component on the hydric soil list
3. A field indicator of hydric soils
4. The technical standard.
5. Any of the above.
6. All the above.

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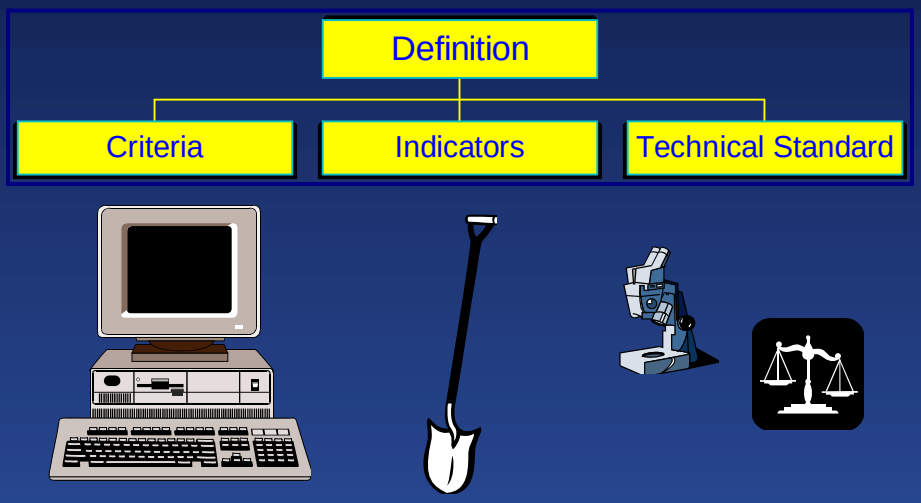
Hydric Soils



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NTCHS Hydric Soils Definitions

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 (Federal Register, 1994)

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HYDRIC SOILS LISTS

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Original Database Selection Criteria for the National List of Hydric Soils

- Originally a list of soil series
- Original criteria required a water table and water table data
- Original list was queried from old SSSD database and not NASIS
- State and Survey Area lists were lists of map units and different than the National List
- Original state and county list had to be significantly hand edited by states

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Current National Hydric Soil

area symbol	area name	map unit sequence	map unit symbol	map unit name	component name and phase	component percent	landforms	hydric rating
IA067	Floyd County, Iowa	3	43	Bremer silty clay loam, 0 to 2 percent slopes	Bremer	100	Stream terraces	Yes
IA067	Floyd County, Iowa	9	84	Clyde silty clay loam, 0 to 3 percent slopes	Clyde	85	Interfluves	Yes
IA067	Floyd County, Iowa	9	84	Clyde silty clay loam, 0 to 3 percent slopes	Maxfield	2	Flats	Yes
IA067	Floyd County, Iowa	9	84	Clyde silty clay loam, 0 to 3 percent slopes	Marshan, 32 to 40 inches to sand and gravel	3	River valleys	Yes
IA067	Floyd County, Iowa	10	88	Nevin silt clay loam, 0 to 2 percent slopes	Bremer	5	Stream terraces	Yes
IA067	Floyd County, Iowa	11	96	Turlin loam, 0 to 2 percent slopes	Coland, occasionally flooded	5	Flood plains	Yes
IA067	Floyd County, Iowa	14	135	Coland clay loam, 0 to 2 percent slopes	Coland, occasionally flooded	95	Flood plains	Yes

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Changes to Criteria for Populating the National List

- **Federal Register 12234** Vol. 77, No. 40 Wednesday, February 29, 2012
- Based on deliberations of the NTCHS
- 30 day public comment period
- Fixed issues related to changes in database and changes to format (list of series vs. list of map units)
- Biggest issue was water table requirement in old criteria but not in definition of hydric soil

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Drained vs. Undrained
Same Soil Series but Possibly Different Map Units

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New Criteria

- (1) All Histels except Folistels and Histosols except Folists; or
- (2) Map unit components in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, or Andic, Cumulic, Pachic, or Vitrandic subgroups that:
  - (a) Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
  - (b) Show evidence that the soil meets the definition of a hydric soil;
- (3) Map unit components that are frequently ponded for long duration or very long duration during the growing season that:
  - (a) Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
  - (b) Show evidence that the soil meets the definition of a hydric soil; or
- (4) Map unit components that are frequently flooded for long duration or very long duration during the growing season that:
  - (a) Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
  - (b) Show evidence that the soils meet the definition of a hydric soil.

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Where to Find Hydric Soils List?

- The National List of Hydric Soils can be found on the NTCHS website (http://soils.usda.gov/use/hydric/)
  - National Coverage
  - Updated yearly
- Local List of Hydric Soils can be found on Soil Data Mart or Web Soil Survey (http://soils.usda.gov/)
  - Soil Data Mart data grouped by Survey Area
  - Web Soil Survey has size limit
  - Updated as official data is updated

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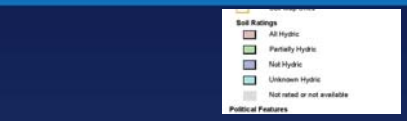
When to use the Hydric Soils Lists?

- General planning
- Preliminary data gathering
- Along with other info for off-site determinations
- Identification of potential WRP sites



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New Report in NASIS

- Hydric
  - 100 % hydric
- Predominantly Hydric
  - < 100% to 66 %
- Partially Hydric
  - 33 % to < 66 %
- Predominantly Non-hydric
  - > 0 % to 33 %
- Non-Hydric
  - 0 %

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FIELD INDICATORS OF HYDRIC SOILS IN THE UNITED STATES

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Field Indicators

- Field indicators are soil morphological features used to identify hydric soils
- The features result from soil genesis in the presence of "anaerobic conditions"
- They are used for on-site verification

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Development of Field Indicators

- Continuous process
  - On-going since mid-80's
- Inter-agency
  - Including universities, private sector, federal, state, and local agencies
- Multi-disciplinary
  - Soil scientists, hydrologists, botanists

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Hydromorphic Processes

- Reduction, translocation, and precipitation of iron and manganese
- Accumulation and differential translocation of organic matter
- Reduction of sulfur

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Hydric Soil Indicators

- Indicators are not intended to replace or relieve the requirements contained in the Hydric Soil Definition
- Indicators are used to identify the hydric soil component of wetlands; however, there are some hydric soils that lack one of the currently listed indicators

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IMPORTANT CONCEPTS

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Proof positive

- If it meets a Field Indicator it is a hydric soil
- If it does not meet a Field Indicator it may still be a hydric soil if it meets the definition of a hydric soil

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Three Major Divisions

- All soils
  - Use regardless of texture
  - Mostly organic based indicators
- Sandy soils
- Loamy soils

- Use sandy indicators in sandy layers, and loamy indicators in loamy layers

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Rules for Field Indicator Use

- A chroma of 2 or less means that the chroma cannot be higher than 2
- Values should be rounded to the nearest color chip
- Except for F8, F12, F19, F20 and F21 all mineral Field Indicators must have less then 15 cm (6 in) of a chroma > 2 above the indicator.

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Soil Surface

- In al LRRs, for Field Indicators A1, A2, and A3 begin measurements at the actual soil surface.
- In LRRs R, W, X, and Y, all other observations begin at the top of the mineral surface.
- In LRRs F, G, H, and M, we begin our observations at the actual soil surface if the soil is sandy and for all other observations at the muck or mineral surface
- For all other LRRs we begin all other observations at the muck or mineral surface.

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Combining Indicators

- It is permissible to combine certain hydric soil indicators if all requirements of the indicators are met except thickness
- The most restrictive requirement for thickness of layers must be met

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Example of a Soil That is Hydric Based

Table 3-4. Example of a soil that is hydric based on a combination of indicators.

Depth (inches)	Matrix Color	Redox Concentrations			Texture
		Color	Abundance	Contrast	
0 – 3	10YR 2/1	--	--	--	Loamy
3 – 6	10YR 3/1	7.5YR 5/6	3 percent	Prominent	Loamy
6 – 10	10YR 5/2	7.5YR 5/6	5 percent	Prominent	Loamy
10 – 14	2.5Y 4/2	--	--	--	Loamy

- 3-6 inches meets F6 Redox Dark Surface, but thickness requirement is 4 inches
- 6 to 10 inches meets F3 Depleted Matrix requirements, but thickness requirement is 6 inches
- Add the 3-6 inch and 6 to 10 inch layer thicknesses together to get 7 inches which is thicker than the most restrictive requirement of 6 inches

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Example of a Soil That is Hydric Based

Table 3-5. Example of a soil that is hydric based on a combination of indicators.

Depth (inches)	Matrix Color	Redox Concentrations			Texture
		Color	Abundance	Contrast	
0 – 3	10YR 3/1	10YR 5/6	3 percent	Prominent	Loamy
3 – 6	10YR 4/1	10YR 5/6	3 percent	Prominent	Sandy
6 – 16	10YR 4/1	--	--	--	Loamy

- 0 to 3 inches meets F6 Redox Dark Surface, but thickness requirement is 4 inches
- 3 to 6 inches meets S5 Sandy Redox, but thickness requirement is also 4 inches
- Combine the thickness of the 2 layers to get 6 inches

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Key to Soils that Lack Field Indicators

- Dig a hole to 6 in.
  - Do organic soil materials or mucky modified layers exist?
  - Does chroma ≤ 2 exist?
  - Are there any distinct or prominent redox concentrations as soft masses or pore linings?
  - Is there a hydrogen sulfide odor?
  - Are you in a sandy soil with stripped zones?
  - Are you in a depression, on a floodplain, in red parent material or within 200 m of an estuarine marsh and 1 m of mean high water?
- If answer is no to all questions, the soil will not meet an indicator.

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Questions???????

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