A Product of The New England Hydric Soil Technical Committee
Disturbed Soils Subcommittee

GUIDELINES FOR DETERMINING WHETHER AN ALTERED SOIL IS HYDRIC - Rev. April 15, 2010

1.0 INTRODUCTION

Soil is defined as *a natural three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.*[1]. In many places the soil has been altered by human activity, and such soils are referred to as *human-influenced*, *anthropogenic*, or *disturbed*.
The following guidelines are intended to aid in the interpretation of altered soils.

Altered soils are typically the result of earth moving activities where: 1) soil material is removed from its natural position; 2) soil material is placed over existing soil; or 3) soil material has been re-graded from on-site sources or transported from other locations. Other sources of disturbance include agricultural and forestry practices, motorized vehicles, and any practice that promotes accelerated erosion or deposition and mass wasting. Changes that affect local water tables and drainage can transform a non-hydric soil into a hydric soil or *visa-versa*.

There are very few sites in New England that have not seen anthropogenic alterations. Much of the region was deforested for agriculture and non-sustainable forestry during the 19th Century, and the effects of those activities can still be observed throughout our landscape. From a practical point of view, the older the disturbance, the harder it is to recognize in the field. Fortunately, soil morphologies develop with time and allow us to use the *Field Indicators for Identifying Hydric Soils in New England*[2] for most soils without regard to whether they have been altered. The guidelines set forth herein are designed to assist in the interpretation of sites where the alteration occurred within the last few decades.

2.0 A WORD OF CAUTION

The purpose of these guidelines is to aid in making a determination of the hydric or non-hydric status of an altered soil. This question is distinctly different than the question of whether there is federal, state, or local regulatory jurisdiction or whether the site is a wetland or not. Most New England regulatory agencies specifically require that wetland scientists follow the methodology outlined in Section F of the 1987 Corps of Engineers Wetland Delineation Manual when delineating wetlands on altered sites[3].

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[1] *Glossary of soil survey reports*, USDA-NRCS.
[2] *Field Indicators for Identifying Hydric Soils in New England, Version 3,* NewEngland Interstate Water Pollution Control Commission (NEIWPCC), Lowell, MA April, 2004.
[3] *U.S. Army Corps of Engineers Wetland Delineation Manual,* Dept. of the Army, Waterways Experiment Station, Vicksburg, VA, January 1987 AND *U.S. Army Corps of Engineers, Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*, U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, October 2009, ERDC/EL TR-09-19

Unauthorized dredging or filling in wetland areas does not necessarily eliminate jurisdiction. Users of these guidelines should be aware of the policies of the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency and state environmental agencies, relative to their jurisdiction at altered sites.

3.0 BEFORE YOU GO INTO THE FIELD:

Learning as much about the history of a site as possible before starting fieldwork can save considerable time, even with a site that has not been altered. Start by interviewing the landowner about his awareness of past land use changes. Often previous owners are also available and willing to provide historical information. Review the most recent USDA, Natural Resources Conservation Service (NRCS) published or interim soil survey reports to put the site in regional perspective and to learn what soils types have been mapped there. USGS maps can provide clues to possible changes in hydrology. A collection of aerial photos taken over the course of several years can often provide a time scale for land use changes. Sometimes specific activities can be observed or interpreted when these aerial photos are carefully examined under magnification or with a stereoscope. And finally, the files of local state and federal agencies may provide valuable clues about the history of a site.

There are a number of private companies that provide historic aerial photography and others that will perform custom flights. The NRCS local field offices are a great first stop. In many locations, aerial imagery from about 1938 through 1985 is available. The UDSA, Farm Service Agency, has been inventorying cropland by aerial photography on a yearly basis since the 1990s and individual copies can be purchased from their national office. Other sources of historic information are old USGS topographic maps and old county soil surveys (1930s-1970s). Also try internet mapping sites like bing.com or earth.google.com.

4.0 PRELIMINARY SITE EVALUATION:

Once in the field, careful observation of general site conditions and landscape features may reveal evidence of unnatural processes. Abrupt changes in topography or vegetative community can often indicate an unnatural landform. Linear features are uncommon in the natural environment.

Early succession plant communities, or domination by invasive species, may be indicators of an altered landscape. When factors influencing plant growth change suddenly, there may be signs of plant stress. Such signs often deserve additional investigation and may help reveal areas where hydrologic regimes have been significantly disturbed. Plant stress should not be used exclusively, but it can be corroborative evidence when considered with other indicators.

Ask the following questions:

Where does water come from, and where does it go? Is this consistent with the USGS map?

Look for evidence of hydrology including:

- Evidence of flooding
- Silt stains and sediment deposits
- Water marks and water-stained leaves
- Drift lines
- Plant rooting characteristics
- Oxide staining (Fe, Mn, etc. on coarse fragments or sand grains at the ground surface)

Where does the vegetative community suggest that hydric soil development is likely?

If the plant community is dominated by facultative wet species (FACW) there is a strong probability that the soil is hydric. Where all dominants in the plant community are obligate species (OBL), the soil is <u>assumed</u> to be hydric and no further analysis is required[4].

Could the site have been altered by filling (HTM) or excavation?

- Both human transported material (HTM), formerly called "fill", and excavated areas are typically characterized by flat surfaces with sudden steep slopes along the perimeter. In some cases, excavated material from one side of the site is used to fill the other side. There may be terracing on the slopes of HTM or the banks of an excavation, and the edges of HTM or an excavation site may coincide with or be parallel to property boundaries. The toe of an HTM slope often ends abruptly at a wetland boundary. Examples of excavation include sand and gravel pits, quarries, ditches, and highway and railroad cuts. Some areas where HTM may be found include construction sites, lawns, parking lots, highway embankments, railroad embankments, and dams.

Do I see other evidence of disturbance?

- Current or historical agricultural practice may have resulted in alterations such as drainage systems, ditches, land leveling, or terracing. If the site has been in agricultural use, you may find a plow layer of up to 20" or more, and there may be accumulations of organic and other materials.

[4] IBID Section 2.0 #3

- Timber harvesting activities may result in areas that have been compacted, plowed up, or filled. Such disturbances are most commonly associated with forest road construction and log landings. Clear cuts sometimes result in the erosion of surface soil horizons, and deposition of the eroded material down slope. Debris piles may obscure wet depressions.

- Structures such as roads, dams or embankments may result in impacts at a significant distance from the structure due to impoundment of water for significant periods. Soil compaction by vehicles may result in small-localized patches of hydric soil. Dug ponds, detention basins, and cellar holes may also impound water.

- Areas down slope from construction, or other activities involving land clearing, may experience accumulation of soil material. Because the receiving area is relatively low lying, this accumulation may be on top of hydric soils.

5.0 ADDITIONAL INFORMATION FROM THE SOIL PROFILES

Soil profiles can provide many additional clues as to whether there have been disruptions to the normal process of soil genesis. Several strategically located soil pits will provide significantly more information than any one pit, and if your first few pits do not make sense, dig a few more. When you think you have an altered site, it is always wise to compare soil profiles of the altered site with soil profiles in adjacent unaltered landscapes.

Most alterations will result in a disruption of the normal sequence of soil horizons. Clues that indicate you are working on an altered site may be:

- The presence of foreign objects (such as trash) within the soil, or “artifacts” (HTM terminology)
- Inverted soil horizons
- Missing or duplicated soil horizons
- Textural discontinuities or other anomalous change within a pit, or between closely spaced pits
- Randomly oriented redoximorphic features
- Soil horizons that do not parallel the ground surface.

5.1 Human Transported Material (HTM) can occur over existing natural soils or excavated surfaces. Formally called “fill”, the principle component HTM is mineral material, but organic material (peat, muck, topsoil) may also occur as layers or masses. In some cases, such as a dredge spoil or deliberately created/restored wetland, organic materials may dominate. Rock fragments and other non-soil components may be mixed into any type of HTM. Human transported material often has slow permeability. Examples include: dredge spoil, or material that has become compacted by heavy equipment. A perched water table can develop in these dense layers and lie above the regional water table or former seasonal high water table. Any disturbance that stratifies unlike materials or textures can result in perched water tables. When describing soil profiles in HTM, the caret prefix (^) is used in front of the master horizon designation, such as ^C, indicating HTM parent material[5].

5.2 Excavation will result in the removal of all or portions of the natural soil horizons. The context of the remaining horizons may be further altered by additions of HTM from local or distant sources. Soils at fresh excavation sites typically lack an A horizon and the B horizon may be absent as well. B horizon material or unweathered material from the C horizon may be exposed at the surface, or be buried immediately below a HTM.

5.3 A Horizons -- When developed at an altered site, the A horizons are often thin and light colored. In some cases "topsoil" may have been added to encourage re-vegetation. It should be noted that the rate at which the topsoil develops is strongly influenced by the frequency and duration of soil saturation.

5.4 B Horizons seldom have time to develop in altered soil. When a B horizon is present in either HTM or newly exposed parent material, it is typically cambic, with colors that do not contrast greatly with the C horizon.

5.5 C Horizons are normally derived from bedrock or parent materials that have been deposited by natural processes. When parent material is the result of an unnatural process, such as land-filling, the C horizon usually lacks the depositional features characteristic of natural sedimentation. For example, sand and gravel HTM will tend to be massive rather than having fine cross-bedding or stratification. There are only a few natural depositional environments that have been responsible for all non-lithic parent materials, and these have distinct features that usually can be recognized. The absence of appropriate features should be viewed with suspicion.

- Flowing water transports materials of varying sizes, and sorts them in accordance with the range of energy levels across the channel and seasonally. Stream (fluvial) deposits typically have bedded, well sorted, layers of alternating textures. Cross-bedding features are common due to the migratory nature of bars, ripples, and other stream bed features. Water flowing through tunnels under a glacier leaves deposits that look like other fluvial deposits except that they form ridges (eskers) across the landscape and raised deltas (kames) where they exited. Extensive outwash materials were deposited in front of the glaciers, as they retreated northward.
- Material deposited directly by melting ice (glacial till) is typically poorly sorted with sizes ranging from clay to boulders. Till tends to be tightly packed due to a content of fine particles and the lack of macro-pores. It is often relatively uniform in color.
- Lake (lacustrine) deposits are stratified, having alternating horizontal layers ranging from fine sand to clay. These materials are brought in by streams and rivers and settle out in the relatively low energy environment. The layers represent seasonal changes in stream flow.
- Marine deposits are similar to lacustrine or fluvial deposits, depending on the energy of the depositional environment. They occur along the lower coastal plain of the Atlantic Ocean, its bays and estuaries.

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[5] ICOMANTH http://clic.cses.vt.edu/icomanth/circlet6_rev.pdf.

- Wind blown deposits (eolian) may have cross-bedding similar to fluvial deposits, but generally on a larger scale. They tend to blanket the landscape, covering a variety of landforms, with a relatively thin mantle of very fine sand and silt.

6.0 DECIPHERING THE REDOXIMORPHIC FEATURES

Some redoximorphic features are more reliable than others and provide considerably more information. This has already been taken into account in keys provided in *Field Indicators for Identifying Hydric Soils in New England.* As you proceed through the keys you are asked to look for either non-specific redoximorphic features or for specific features such as depletions. These features are based on the authors' assessment of the reliability under the circumstances set by each indicator. When working in altered soils, the assessment of reliability falls on the person making the determination.

The following sequence is an attempt to list redoximorphic features in a decreasing order of interpretive reliability[6]. No finite probability has been assigned to their reliability. A hand lens is advised when examining some of these features. Always consider whether the observed redoximorphic features are due to the current hydrologic regime.

1. **Depletions**
2. **20% or more prominent concentrations**
3. **Pore linings**
4. **Oxidized rhizospheres (live roots)**
5. **Soft Masses**

7.0 ADDITIONAL CONSIDERATIONS FOR ANALYZING HTM

In most cases, non-soil information will be required to obtain a reasonable level of confidence that a human transported material (HTM) is hydric when it has not yet developed morphologies necessary to meet one of indicators found in *Field Indicators for Identifying Hydric Soils in New England* or *Field Indicators of Hydric Soils in the United States*[7]. The following situations are considered to have a high probability of being hydric in HTM. Careful observation and analysis of the site should be made to insure that the current soil colors were formed in-place rather than inherent of parent materials imported from another site. These can be interpolated to similar situations with lesser degrees of confidence.

[6] Vepraskas, Michael J., *Redoximorphic Features for Identifying Aquic Conditions*, NC State University, Raleigh, NC, Tech. Bulletin 301, December 1992
[7] USDA, Natural Resources Conservation Service, 2006. *Field Indicators of Hydric Soils in the United States*, Version 6.0, G.W. Hurt and L.M. Vasilas (eds.). USDA, NRCS, in cooperation with the National Technical Committee for Hydric Soils

a. It is highly probable that a soil is hydric if it has a matrix color of chroma 2 or less, more than 2% redoximorphic features (see Section 6.0 above) within 20 inches of the surface, and directly underlies an O or A horizon. If redoximorphic features are not present, the matrix chroma must be 1 or less to remain highly probable [8].

b. It is highly probable that a soil having textures finer than loamy fine sand is hydric if there is a subsurface horizon having a matrix color of chroma 2 or less, within 20 inches of the soil surface, and there are redoximorphic features (see Section 6.0 above) within 8 inches of the soil surface.

c. It is highly probable that a soil with textures of loamy fine sand or coarser in all horizons is hydric if there is a subsurface horizon having a matrix color of chroma 3 or less within 20 inches of the soil surface, and there are redoximorphic features (see Section 6.0 above) within 8 inches of the soil surface.

8.0 ADDITIONAL CONSIDERATIONS FOR ANALYZING EXCAVATED SITES

The principle challenge for hydric soil classification at excavated sites is the lack of a definite reference to the original ground surface elevation. Excavated sites that have been re-graded present additional complexity. As with HTM, non-soil information is necessary to obtain a high level of confidence. Careful observation and analysis of the site should be made to insure that the current soil colors were formed in-place rather than inherent of parent materials imported from another site. The following are some specific circumstances where a soil is likely to be hydric. These can be extrapolated, with lesser degrees of confidence, to similar situations.

8.1 Endosaturation. In cases where there are no restrictive layers, the original parent material (C horizon) remains throughout most of the profile, and the soil is very friable or friable to a depth of 20 inches or more.

a. It is highly probable that a soil with textures <u>finer than loamy fine sand</u> within 20 inches of the soil surface is hydric if there are redoximorphic features (see Section 6. above) directly underlying an A horizon, or to within 12 inches of the soil surface if no A horizon is present.

b. It is highly probable that a soil with textures of <u>loamy fine sand or coarser</u> within 20 inches of the soil surface will be hydric if there are redoximorphic features (see Section 6. above) directly underlying the A horizon or at the soil surface, and extend throughout the profile, to a depth 20 inches or more.

[8] Adapted from *Guidelines For Soil Drainage Class Determination*, U.S. Army Corps of Engineers, New England Division, Operational Draft; 2-27-91.

8.2 Episaturation. In cases where there is a restrictive layer, the original parent material (C horizon) remains, and the slope of the landscape is 5% or less. It is highly probable that a soil is hydric if there are redoximorphic features (see Section 6. above) at a depth of 2 inches or less.

9.0 A PROCESS FOR ASSESSING THE HYDRIC STATUS OF ALTERED SOILS

The following sequential approach is recommended as an initial interpretive guide:

Step 1: Outline an **interpretive history** of the site based on your pre-field research and your examination of the site and the soil profiles.

Step 2: Examine the pedon using the most recent version of *Field Indicators for Identifying Hydric Soils in New England*. If the soil being examined fits a listed indicator, and this does not conflict with your interpreted history, the soil is probably hydric. The site and surrounding area should be reexamined for possible hydrology changes such as diversion or draining that might have occurred since the observed morphological features were formed. Breach of an old dam[9] or abandoned railroad embankment may alter the hydrology for a considerable distance, depending on the slope of the land, but be sure to consider the fact that the area formerly inundated may still be hydric despite the breach.

Step 3: Review the additional considerations in Sections 7 and 8 above.

Step 4: If none of the hydric soils indicators or "additional considerations" fit, but other site characteristics suggest the area may be hydric, you should examine the reasons why specific indicators or considerations were eliminated. The time it takes for diagnostic features to develop is the most common reason for a hydric soil to not key out. If you do not already have a time-frame for the disturbance, look at the trees and other vegetation for clues. Other things to consider are whether excess organic matter has masked soil colors, and whether the material retains relic features from its original position or location.

Step 5: Do a reality check. If you have determined the soil is probably hydric, double check for indications that it might be a relic. If you have determined that the soil is non-hydric make sure that makes sense in regard to the surroundings, vegetation, and apparent hydrology. How sure are you? What is your level of confidence? Your report should fully describe the methods, evidence, and thought process that you have relied upon in reaching your conclusion.

Step 6: If it is not possible to determine the hydric or non-hydric status of a soil, it may be necessary to look at other evidence such as: 1) monitoring wells to determine free water elevations in relation to the root zone, 2) tensiometers to measure saturation or other methods.

[9] This includes a beaver dam, though beaver activity should be considered a natural process.