United States Department of Agriculture

Natural Resources Conservation Service

Connecticut Department of
Energy and Environmental Protection

CLARIFICATION OF WETLAND SOIL CRITERIA FOR HUMAN-ALTERED AND HUMAN-TRANSPORTED SOILS IN CONNECTICUT

The Statute

The Connecticut General Statutes Section 22a-38 defines inland wetlands as:

> *"land, including submerged land, not regulated pursuant to sections 22a-28 to 22a-35, inclusive, which consists of any of the soil types designated as poorly drained, very poorly drained, alluvial, and floodplain by the National Cooperative Soil Survey, as may be amended from time to time, of the Natural Resources Conservation Service of the United States Department of Agriculture"*

The National Cooperative Soil Survey (NCSS) is a nationwide partnership of Federal, regional, State, and local agencies and private entities and institutions (USDA-NRCS 2014). The Natural Resources Conservation Service (NRCS, formerly Soil Conservation Service or SCS) is responsible for the leadership of soil survey activities of the U.S. Department of Agriculture and for the leadership and coordination of NCSS activities.

The Soil Survey of the State of Connecticut is the official NCSS soil survey for Connecticut (Soil Survey Staff). The soil survey is a collection of map units which are areas defined and named in terms of their soil components. The survey contains a detailed description of the properties and qualities of each soil component including drainage class, parent material, and geomorphic component (i.e. soil properties and interpretations referenced in the statute above). Based on these properties, NRCS provides an interpretive list of map units dominated by soil types that meet the wetland soil criteria defined in the statute. This report is referred to as the Connecticut Inland Wetland Soils list (available as a Web Soil Survey report[1] and on Connecticut eFOTG[2]). Attention should be given to the appropriate use of soil survey maps in regard to map scale. A relevant excerpt from the 'Use Constraints' section of the Soil Survey of the State of Connecticut metadata is reprinted in Appendix A.

Hydrologic alteration

Alteration of hydrology in the form of lowered water tables (e.g. ditching, tiling, stream alteration/channelization, etc.)

[1] Web Soil Survey: Soil Data Explorer tab, Soil Reports sub-tab, AOI Inventory, Selected Soil Interpretations, Inland Wetlands (CT); also available on the USDA-NRCS CT Soils page under "Connecticut Soil Survey Interpretations"

[2] NRCS-CT eFOTG: Section II, Soils Information, 2. Soil Tables and Interpretations, Statewide CT, c. CT Inland Wetland Soils

are recognized as artificial drainage in the Keys to Soil Taxonomy. By definition[3], poorly drained and very poorly drained soils that are ditched, tiled, or otherwise drained are still recognized as poorly drained and very poorly drained soils.

Human-altered and human-transported soils

Human-altered and human-transported (HAHT) soils is the term used by NRCS that describes soils commonly referred to as (but not limited to) fill or filled, excavated, or anthropogenic[4]. The Soil Survey of the State of Connecticut does not contain detailed descriptions of HAHT soil types. Consequently, the Connecticut Inland Wetland Soils list does not contain map units with wetland HAHT soils. In lieu of NCSS published wetland HAHT soil types, the assignment of drainage class for HAHT soils should be based on the same criteria used to assign soil types in the Soil Survey for the State of Connecticut and on the Connecticut Inland Wetland Soils list. Those criteria are defined by the presence of specific diagnostic horizons and properties in the latest edition of the *Keys to Soil Taxonomy*[5].

Drainage class for unmapped soil types

Drainage class identifies the natural drainage condition of the soil (USDA-NRCS 2014). It refers to the frequency and duration of wet periods under conditions similar to those under which the soil developed. Drainage class is inferred from observation of landscape position and soil morphology. In some instances direct observations and/or measurements of hydrology and reduced conditions may be used to aid in drainage class determination.

For the Soil Survey of the State of Connecticut, moisture regime was used to assign drainage class to soils. Soil types with aquic or peraquic moisture regimes are correlated to poorly or very poorly drained drainage class. Appendix B has more information regarding criteria used to diagnose moisture regime.

HAHT soils with aquic moisture regimes meet the wetland soils definition in the Connecticut General Statute section 22a-38 as relates to drainage class. Areas of these soils are therefore wetlands and regulated under the Connecticut Inland Wetlands and Watercourses Act.

Problematic morphologic features in HAHT soils

Human transported materials (i.e. fill) may be sourced from a wide variety of areas, including those with wetland hydrology. Such fill material may exhibit redoximorphic features (i.e. wetland soil morphologic features) associated with the prior moisture regime before the material was excavated, transported, and redeposited. Such features are termed *relict* and should not be used as diagnostic criteria for classification as they may indicate a *false positive* diagnosis of aquic moisture regime. Conversely, recent fill material subject to wetland hydrology may not have had enough time under aquic conditions to develop redoximorphic features. Such material may indicate a *false negative* diagnosis of aquic moisture regime. This is not to suggest that all morphologic features in fill material should be disregarded, however they should receive extra scrutiny from the describer[6].

---

[3] "Artificial drainage is defined here as the removal of free water from soils having aquic conditions by surface mounding, ditches, or subsurface tiles or the prevention of surface or ground water from reaching the soils by dams, levees, surface pumps, or other means. In these soils water table levels and/or their duration are changed significantly in connection with specific types of land use. Upon removal of the drainage practices, aquic conditions would return. In the keys, artificially drained soils are included with soils that have aquic conditions." (Soil Survey Staff 2014, page 26).

[4] HAHT soils do not, as defined in the Keys to Soil Taxonomy, include soils that are altered solely in regard to hydrology (Soil Survey Staff 2014). For information regarding hydrologic alteration, see the section titled **Hydrologic Alteration**.

[5] Soil Taxonomy is the system of soil classification used by USDA-NRCS to order, name, organize, understand, remember, transfer, and use information about soils (USDA-NRCS 2014). Soil Taxonomy can be applied to all soils, including HAHT soils, regardless of the amount or type of disturbance.

[6] The National Technical Committee for Hydric Soils published a technical note regarding altered hydric soils that discusses morphologic

In cases where the morphologic features of fill material are thought to not accurately reflect the current soil moisture regime (based on best professional judgment), other methods in lieu of morphologic features may be used to identify the actual depth to aquic conditions[7].

Floodplains and alluvial soils

In Connecticut, all soil types (regardless of soil moisture regime) formed on floodplains from alluvial parent materials are recognized as wetlands as defined in Connecticut General Statute section 22a-38. HAHT soils found in these landscape positions with underlying alluvial parent materials may still correlate to alluvial soils[8]. Further, filled/buried alluvial soils should be scrutinized as to whether they are still subject to a flooding regime that characterizes flood plains and deposits alluvial soils.

Levees and other alteration of flooding regime

Alluvial and floodplain soils in areas that are protected by levees or otherwise altered to remove or lessen the natural flooding regime are still considered alluvial and/or floodplain soils[9] and are considered wetland areas per Connecticut General Statute section 22a-38.

Generalizations concerning depths of fill and how it affects identification of wetland soils

Due to the variability of HAHT soils, generalizations about specific depth of fill should not be used to assign soil moisture regime and drainage class. Only accurate on-site observation, description, and classification using USDA-NRCS standards[10] will provide a defensible technical determination of whether a HAHT soil meets wetland soil criteria defined in Connecticut General Statutes Section 22a-38.

Buried soils, surface mantles, and their effect on drainage class

Soil moisture (including aquic conditions) for the purpose of classification is ***always*** evaluated from the actual soil surface in all soils (HAHT soils, buried soils, or otherwise; Soil Survey Staff 2014). Supplemental information regarding the effect of buried soils and surface mantles on the classification using Soil Taxonomy is given in Appendix C. Examples with illustrations are provided in Appendix D.

---

characteristics that can suggest relict features (NTCHS).

[7] The Hydric Soil Technical Standard identifies methods to identify anaerobic and saturated conditions in lieu of field indicators based on soil morphology (NTCSH 2007). Anaerobic and/or saturated conditions may correspond to aquic conditions, as defined in the Keys to Soil Taxonomy. Aquic conditions within specified depths are diagnostic criteria for all of the taxonomic suborders mentioned in Appendix B, and hence aquic moisture regime.

[8] Soils that classify as *fluvents* suborder typify alluvial or floodplain soils. In other soil orders the recognition of alluvial soils taxa is often determined at the sub group level with a prefix of *Fluv-*. A brief discussion of the nature of floodplain soils as relates to classification is on page 406 of Soil Taxonomy (Soil Survey Staff 1999).

[9] These areas may be phased according to their altered flooding regime (e.g. *Rippowam fine sandy loam, flood protected*) and may be dealt with especially according to the degree of flooding regime alteration, as determined by the appropriate local or state officials.

[10] A discussion and list of USDA-NRCS standards is available in the National Soil Survey Handbook Part 600. Of particular note to field professionals making Connecticut Inland Wetlands determinations are:

- Field Book for Describing and Sampling Soils, Version 3.0. (2012)
- Keys to Soil Taxonomy (current edition)

Appendix A:

Excerpt from the Soil Survey of the State of Connecticut (version 13) spatial metadata section titled 'Use Constraints':

> This data set is not designed for use as a primary regulatory tool in permitting or citing decisions, but may be used as a reference source. This is public information and may be interpreted by organizations, agencies, units of government, or others based on needs; however, they are responsible for the appropriate application. Federal, State, or local regulatory bodies are not to reassign to the Natural Resources Conservation Service any authority for the decisions that they make. The Natural Resources Conservation Service will not perform any evaluations of these maps for purposes related solely to State or local regulatory programs.
>
> Photographic or digital enlargement of these maps to scales greater than at which they were originally mapped can cause misinterpretation of the data. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale. The depicted soil boundaries, interpretations, and analysis derived from them do not eliminate the need for onsite sampling, testing, and detailed study of specific sites for intensive uses. Thus, these data and their interpretations are intended for planning purposes only. Digital data files are periodically updated. Files are dated, and users are responsible for obtaining the latest version of the data.

Appendix B:

Each soil order has its own set of diagnostic criteria (found in the Key to Suborders section of the *Keys to Soil Taxonomy*) related to whether a soil has an aquic or peraquic moisture regime. Soils in Connecticut (including HAHT soils) with an aquic or peraquic moisture regime would classify as one of the following suborders:

- Aquents (Entisols)
- Aquepts (Inceptisols)
- Aquolls (Mollisols)
- Aquods (Spodosols)
- Fibrists, Hemists, or Saprists (Histosols)
- Aqualfs

The *Keys to Soil Taxonomy* reference specific morphologic features that would classify a soil to one of these (or other) orders and suborders. There is no single accurate rule-of-thumb in regard to morphologic properties to diagnose moisture regime; the *Keys* should always be used as they are the most significant standard used by USDA-NRCS in the correlation of soils to drainage class and soil types (i.e. series).

The *Field Indicators of Hydric Soils in the United States* is a standard used to identify and delineate hydric soils in the field for federal wetland delineations. Other state, and/or local laws may specifically reference hydric soils in their definition of wetlands or in the regulations and/or policy that outlines how wetlands should be identified and delineated.

Professionals engaged in the myriad jurisdictions of wetland-related field work will likely be familiar with hydric soil indicators. The Connecticut Inland Wetlands and Watercourses Act does not specifically reference hydric soils in its definition of wetlands and therefore there is no direct statutory link to hydric soil field indicators. Further, hydric soil field indicators were not exclusively used in assigning drainage class to soil types. However, hydric soil field indicators are based on extensive research and field testing and the *Field Indicators of Hydric Soils in the United States* is an excellent resource for professionals engaged in wetland delineation. While hydric soil field indicators do not serve as direct or indirect evidence of wetlands per Connecticut statute, their presence (including indicators approved for problematic materials) would suggest either aquic or peraquic moisture regime. There may, however, be soils that meet the Connecticut Inland wetland definition criteria and do not meet a hydric soil field indicator. Field indicators should not be used in lieu of the specific criteria in the Connecticut statue.

Appendix C

Buried soils and their effect on taxonomic classification

Page 37 of Chapter 4 of the Keys to Soil Taxonomy explain the effect of buried soils and surface mantles on the depths used to identify diagnostic soil horizons and characteristics (Soil Survey Staff 2014). Additionally, the USDA-NRCS has published a Technical Note title "Buried soils and their effect on taxonomic classification" (Soil Survey Staff 2013) to provide clarification regarding the proper recognition and assignment of control sections and diagnostic horizons and characteristics in soils with surface mantles (e.g. human transported fill or natural deposits). A major issue addressed in this Technical Note relevant to Connecticut General Statutes Section 22a-38 is how to classify soils with thin surface mantle deposits (e.g. thin deposits of fill). Depending on characteristics of the surface mantle, either the whole soil (mantle and underlying soil materials) or only the soil materials under the mantle will be used for identification of diagnostic criteria for classification. Again, soil moisture (including aquic conditions) is *always* evaluated from the actual soil surface.

Appendix D

Illustrations of evaluating aquic conditions in HAHT soils

Figure 1 illustrates a case where an original mineral soil, an *Aquepts* suborder (poorly drained), with aquic conditions at 5 inches is filled with 10 inches of human-transported material. The filled soil is reexamined in regard to aquic conditions, which are found at 15 inches. Though the depth to aquic conditions has increased, in this example the soil would still classify as an *Aquepts*, with aquic conditions within 20 inches, and meet the definition of a poorly drained soil.

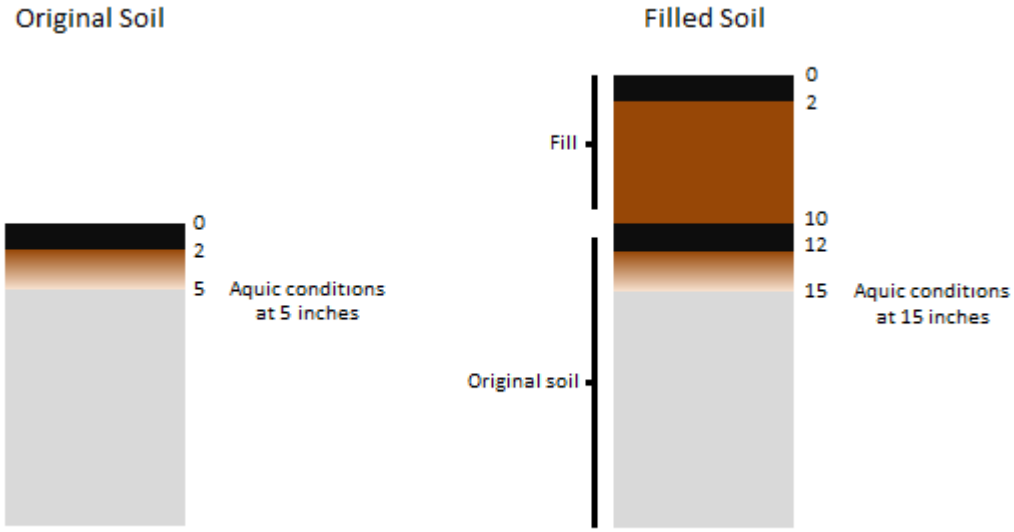

Figure 1. Example of change in depth to aquic conditions after place of fill

Figure 2 illustrates a case where an original mineral soil, an *Aquepts* suborder (very poorly drained), with morphology indicating aquic conditions at the surface and with seasonal ponding (5 inch depth over soil surface), is filled with 21 inches of human-transported material. The filled soil is reexamined in regard to aquic conditions, which are found at 16 inches (based on redoximorphic features in the overlying human-transported material). In this example, the filled soil would classify as an *Aquepts* or *Aquents* with aquic conditions within 20 inches, and meet the definition of a poorly drained soil.

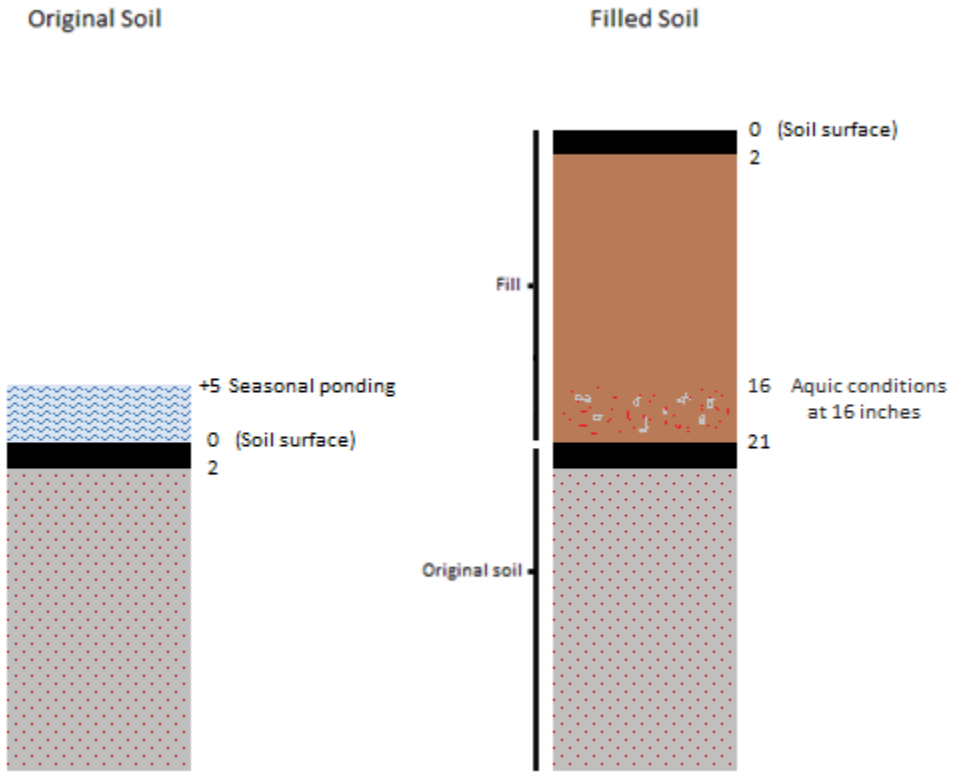

Figure 2. Example of change in depth to aquic conditions after place of 21-inches of fill

Figure 3 shows the same original condition as Figure 2, however in this scenario a greater depth, 30 inches, of human transported material have been deposited. The filled soil is reexamined in regard to aquic conditions, which are found at 25 inches. In this example, the soil would classify as an *Udorthents* (not an *Aquents* or *Aquepts*), failing to meet the definition of a poorly drained soil and therefore failing the definition of an inland wetland area.

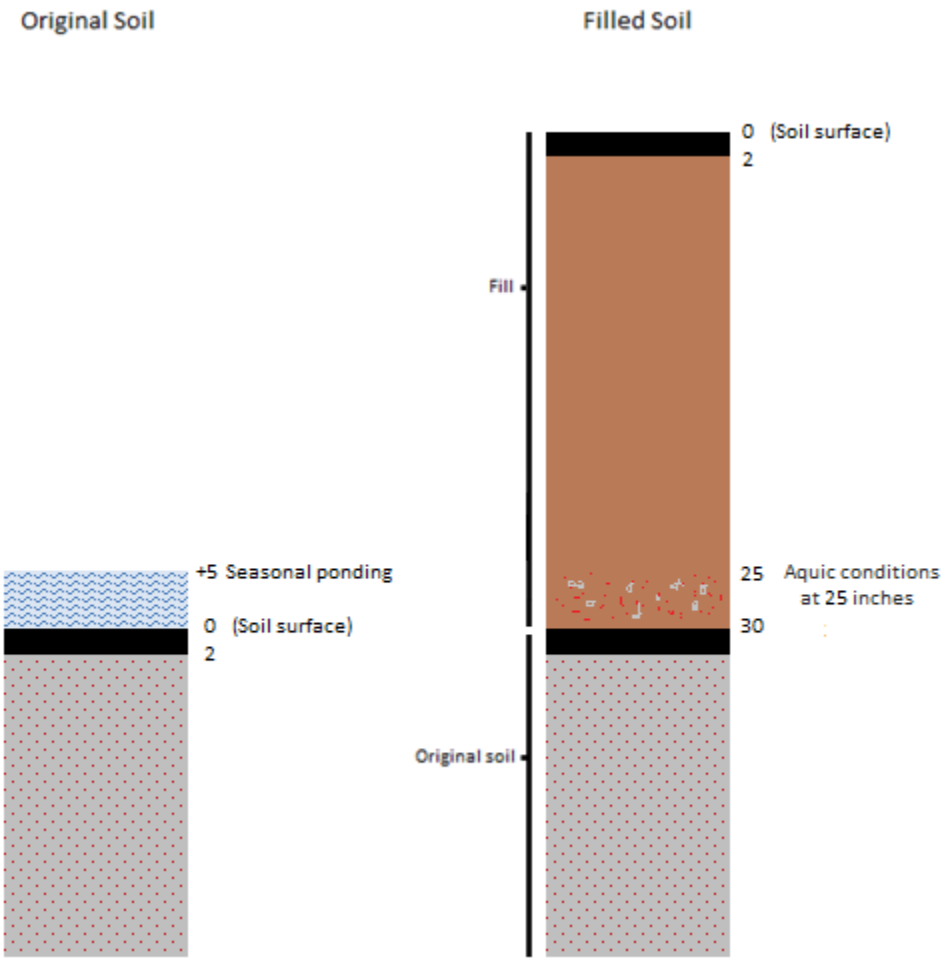

Figure 3. Example of change in depth to aquic conditions after place of 30-inches of fill

Appendix E

Glossary

Disclaimer: The following abridged definitions and notes are provided for clarity and quick reference while using this guidance document. They are not intended to, and should not, replace full definitions for these terms found in official USDA-NRCS standards listed in the National Soil Survey Handbook Part 600.

alluvial – Pertaining to material or processes associated with transportation and/or subaerial deposition by concentrated running water. (U.S. Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. Available online. Accessed 05/01/2015).

aquic conditions – continuous or periodic saturation and reduction (Soil Survey Staff. 2014. Keys to Soil Taxonomy, 12th ed.). *Note: aquic conditions are not specific to any range of depths in a soil. For example, a soil may have aquic conditions starting at a depth of 50 centimeters from the soil surface. Aquic conditions are **not** synonymous with aquic moisture regime.*

aquic [soil] moisture regime – a reducing regime that is virtually free of dissolved oxygen because it is saturated by water (Soil Survey Staff. 2014. Keys to Soil Taxonomy, 12th ed.). *Note: aquic moisture regime implies the presence of aquic conditions at or near the soil surface. There is not one set of diagnostic criteria or depths to determine aquic moisture regime. Aquic moisture regime is **not** synonymous with aquic conditions.*

flood plain – The nearly level plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the streams. (U.S. Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. Available online. Accessed 05/01/2015).

Human-altered material – parent material for soil that has undergone soil mixing or disturbance by humans (Soil Survey Staff. 2014. Keys to Soil Taxonomy, 12th ed.). *Note: this material is a formal diagnostic characteristic in soil taxonomy and is defined by specific criteria described in the Keys to Soil Taxonomy.*

Human-transported material – parent material for soils that has been transported onto a pedon from a source area outside of that pedon by purposeful human activity (Soil Survey Staff. 2014. Keys to Soil Taxonomy, 12th ed.). *Note: this material is a formal diagnostic characteristic in soil taxonomy and is defined by specific criteria described in the Keys to Soil Taxonomy.*

hydric soil – 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 (U. S. Department of Agriculture, Natural Resources Conservation Service. 2010. Field Indicators of Hydric Soils in the United States, Version 7.0.). *Note: 'hydric soil' is not a term directly reference by Connecticut General Statutes Section 22a-38 or by USDA-NRCS for the purpose of assigning drainage class to soil components in the official soil survey. This term is defined here and referenced in this guidance document for the purpose of differentiating hydric soils from inland wetland soil types as defined in CT General Statues.*

peraquic moisture regime – a regime where ground water is always at or very close to the soil surface (Soil Survey Staff. 2014. Keys to Soil Taxonomy, 12th ed.).

poorly drained – water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. *Note: alteration of the water regime by man, either through drainage or irrigation, is not a consideration in assigning drainage class.*

very poorly drained – water is removed from the soil so slowly that free water remains at or very near the ground surface during much of the growing season (Soil Survey Division Staff. 1993. Soil survey manual.). *Note: alteration of the water regime by man, either through drainage or irrigation, is not a consideration in assigning drainage class.*

References:

National Technical Committee for Hydric Soils (NTCHS). 2007. Technical Note 13: Altered Hydric Soils. Available online at: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051928.pdf. Accessed 5/12/2015.

National Technical Committee for Hydric Soils (NTCHS). 2007. Technical Note 11: The Hydric Soil Technical Standard. Available online at: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051608.pdf. Accessed 5/12/2015.

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff. 2012. Field book for describing and sampling soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. United States Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2014. Keys to Soil Taxonomy, 12th ed. USDA-Natural Resources Conservation Service, Washington, DC.

Soil Survey Staff. 2013, revised. . Soil Survey Technical Note 10, Buried soils and their effect on taxonomic classification, U.S. Department of Agriculture, Natural Resources Conservation

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed 5/12/2015.

U.S. Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. Available online at http://www.soils.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054242. Accessed 5/12/2015.

U. S. Department of Agriculture, Natural Resources Conservation Service. 2010. Field Indicators of Hydric Soils in the United States, Version 7.0. L.M. Vasilas, G.W. Hurt, and C.V. Noble (eds.). USDA, NRCS, in cooperation with the National Technical Committee for Hydric Soils.