International Committee for the Classification of Anthropogenic Soils (ICOMANTH)
Circular Letter #6
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Introduction

Circular Letter #6 is a revision of a portion of Circular Letter #5 (issued April, 2004).

- Sections I - V propose changes to the USDA-NRCS system. The USDA-NRCS system is defined here to include Soil Taxonomy (Soil Survey Staff, 1999), Keys to Soil Taxonomy (Soil Survey Staff, 2003), the Soil Survey Manual (SSM) (Soil Survey Division Staff, 1993), the National Soil Survey Handbook (NSSH) (USDA-NRCS, 2003), and the Field Book for Describing and Sampling Soils (Schoeneberger et al., 2002).
- Section VI provides examples of applications of the proposed changes.
- Section VII provides the rationale behind some of the decisions in this Circular Letter.

Future Circular Letters will deal with defining new diagnostic materials, features, or horizons, and proposing new classes in Soil Taxonomy for human-altered and –transported soils. Class separations for human-altered and –transported soils that have been made in the World Reference Base (WRB) (Kosse, 1994; Rossiter and Burghardt, 2003) and other taxonomic systems may be used as a reference. Several of these articles are included on Version 1.0 of the Anthropogenic Soils CD-ROM (Galbraith et al., 2002), available from ICOMANTH at http://clic.cses.vt.edu/icomanth/.

Purpose

The term "anthropogenic soil" has been defined in many different ways (Galbraith et al., 2002, Ch. 2 to 14). An excellent summary of the use of "anthropogenic soil" and the categories that have been devised for these soils was presented at the IUSS meeting in Bangkok in 2002 (Dudal, et al., 2002). The term has been variably used for soils formed in human-transported materials, soils formed in human-manufactured materials, soils that have had all diagnostic horizons destroyed in-situ by singular or periodic human chemical and mechanical disturbance, soils in excavated areas, and soils such as paddy soils whose ongoing genesis is strongly influenced by nearly continuous human activity. ICOMANTH will focus on discussion and description of most of these kinds of soils, regardless of whether they meet all definitions of anthropogenic soils. However, ICOMANTH will not attempt to classify contaminated soils or soils in close proximity to hazardous items such as power or gas lines. The soils that are contaminated and should not be classified include those that contain materials that pose a known health or safety risk to those who attempt to live on, farm, sample, analyze, or map them. Since contaminated soils may be described and their location identified without contact if due precautions are used, ICOMANTH will suggest terms for their description. Published information about health hazards and contaminated soils occur on Version 1.0 of the Anthropogenic Soils CD-ROM (Galbraith et al., 2002, Ch. 19).

Section I. Proposed New Terms for Human-altered and –transported Soils:

Few human-altered and –transported soils can be adequately described with the existing set of terms and materials found in the USDA-NRCS system. ICOMANTH proposes the following terms for addition to the USDA-NRCS system:

A). Definition of terms for human transported materials to be added to the NRCS system:

Human transported materials (HTM) are defined here as any material (artifacts, organic materials, soil, rock, or sediment) moved horizontally into a pedon from a source area outside of that pedon by directed human activity, usually with the aid of machinery. HTM is a kind of parent material. According to NSSH Part 618.40, "Parent material is the unconsolidated material, mineral or organic, from which the soil develops." and "Soil properties and landscape information infer parent material." ICOMANTH proposed that HTM be added as a new term for specific kind of parent material in NSSH Part 629.02 (c) http://soils.usda.gov/technical/handbook/ contents/part629glossary1.html] and defined as: "*human-transported material – Unsorted, unconsolidated artifacts, soil materials, parent materials, or rock deposited by directed human activity without subsequent reworking by wind, gravity, water, or ice; or deposits of artifacts, soil materials, parent materials, or rock deposited by directed human activities that result in sorting of the materials. HTM can be reworked by wind, gravity, water, and ice to become other parent materials.*" If HTM become covered by asphalt, concrete, buildings, etc. then they are considered to be a miscellaneous land type.

Indirectly transported materials such as dust from mining, road traffic, farming, or manufacturing; smokestack and combustion emissions will not be considered HTM. Directly transported materials include earthy and manufactured materials described above. Directly transported and deposited materials results in the creation of a constructional type of landform as defined in the NSSH Part 629.02 (c) as an *"anthropogenic feature" - An artificial feature on the land surface, having a characteristic shape and range in composition, composed of unconsolidated earthy, organic materials, artificial materials, or rock, that is the direct result of human manipulation or activities; can be either constructional (e.g., artificial levee) or destructional (quarry)."* There are 41 terms described presently, but there is a need for additional definition of *"anthropogenic features"* as described in Section I. B. Archaeologists and paleontologists use the term "features" to describe evidence of human activity left in the soil that is not limited to constructional landforms. Additional terms will be added to this section.

Constructional landforms are alluded to in Soil Taxonomy in the description of the epipedons, but are not used as evidence for class placement (Soil Survey Staff, 1999, p. 26-28). Destructional landforms are seldom recognized or classified because of the high amount of spatial and temporal variability. However, after human-transportation and major erosion ceases, soil formation begins and the resulting soil may then be classified. Evidence that leads a field scientist to conclude that soil material has been removed from a soil by directed human activity will be addressed in later circular letters.

The approach taken in this circular letter is to treat HTM as a kind of parent material, (similar to loess or glacial till) rather than a diagnostic material. This allows the individual describing the soil to identify horizons formed in HTM in the same way they identify any other parent material types. That may include reading scientific and historical literature, looking at old aerial, soil, geologic, and topographic maps and surveys and comparing that information with properties observed onsite when describing a pedon. Field soil scientists looking for minimally-disturbed pedons begin their job by inspecting the landforms, and based on their experience and knowledge, they interpret the landscape segments in order to identify the proper place to sample. They avoid what they consider to be lands that show surficial signs of being deeply altered (pits or mounds not caused by treefall, flooding, or mass-wasting) and also exclude soils if they appear to be deeply altered after the sampling begins. In these cases they have concluded that a deposit of HTM exists because they have excluded the sample from being representative of the natural soil.

Evidence of human-transportation and alteration left in the soil:

Because of the range of difficulty in identifying HTM from specific properties observed and described within the soil, the identification of HTM as a parent material will be left to the judgment of soil scientists, based on soil properties, analogous information, and expertise. Often the first clue that HTM occurs at a site is the identification of a constructional anthropogenic landform based on soil and topography maps, soil and rock properties, and direct observation. Identification of HTM is most easily done when the landform does not appear to fit with the surrounding natural topography pattern and recent deglaciation, flooding, and landslides can be reasonably ruled-out. Strong evidence of human-transportation occurs when the suspected transported soil layers are compared to soil horizons described in a soil survey and found on a soil map that pre-dates the suspected human-transportation. Abrupt lateral discontinuities of horizons and irregular or unpredictable discontinuities of properties with depth are indicative of human-transportation of the upper parent material. Unique morphological properties and burial of artifacts, anthropogenic features, or manufactured layers on uplands where landslides can be reasonably ruled-out are also positive indicators of human-transportation of parent material. Evidence in the soil used to indicate human-alteration or –transportation to field scientists will be presented in future circular letters when definitions of epipedons, horizons, features, properties, materials, contacts, and taxa are proposed.

B) Definition of terms for artifacts and anthropogenic features to be added to the NRCS system:

ICOMANTH proposed that the terms “anthropogenic features, manufactured layers, and artifacts” be added to the appropriate places in the Soil Survey Manual, chapter 3, found on-line at: http://soils.usda.gov/technical/manual/), as well as the descriptive information in the sections under “Artifact Categories” described below.

Definitions:

a) Anthropogenic features – Evidence of directed human habitation or soil manipulation found in the soil or rock that is part of a soil (from Greek anthropos human plus *gignesthai* genesis, to be born (formed) and *factura* act of making). Examples include spade marks described for the plaggen epipedon in Soil Taxonomy (p. 26), scrape marks on soil or rock made by machinery during landscaping activities, deep plowing, chiseling, or scraping, mining, mine reclamation, and other constructional evidence of human habitation or manipulation such as trenches, terraces, clay liners, and sand or manure topdressing**.** This conforms more closely to the definition used by archaeologists and paleontologists (Hester et al., 1975). Soil material liners are anthropogenic features formed by compacting soil material to restrict soil, root, and water movement through the subsoil. They limit the depth class and available water holding capacity of the soil and in fact meet the definition of the diagnostic “Densic Materials” and “Densic Contact” of Soil Taxonomy (2^{nd} ed., page 92)..

b) Manufactured layers - Horizontal layers constructed by humans and placed on or in the soil (from Latin *humanus* human (man) plus *factura* act of making and *stratus* bed). Examples include asphalt, concrete, plastic, geotextiles, and rubber. Horizontal manufactured layers occur in urban areas underneath or above a variety of HTM in landfills, buildings, roadbeds, runways, under wetlands, or other special use areas. Surface layers of asphalt, concrete, buildings, etc. are considered to be a miscellaneous land type called urban land or “pavement and buildings.” These manufactured layers, even if only a few millimeters thick, should be described in pedon descriptions. Note that constraints of some computerized pedon description programs may require a minimum horizon thicknesses of at least 1 cm. Manufactured layers may act as liners *(*from Latin *linea*, made of flax and a limit (from Latin *limit* boundary) or a restraint (a device that restricts movement)) if their purpose is to restrict soil, root, and water movement through the subsoil and provided that fine roots cannot penetrate the layer in spacing less than 10 cm apart. Manufactured liners affect the available water holding capacity of the soil and the depth class in the same way that a thin ortstein horizon, placic horizon, or petroferric contact does.

Manufactured Layer Categories:

The following are examples of belowground manufactured layers:

- Asphalt - a dark bituminous substance that is obtained as a residue in petroleum refining and that consists chiefly of hydrocarbons, and an asphaltic composition used for pavements and as a waterproof cement (from Greek *asphaltos*). The degree of density decreases as the asphalt weathers and the byproducts are leached or consumed as a C source by microorganisms.
- Concrete - a hard strong building material made by mixing a cementing material (as “Portland cement”) and a mineral aggregate (as sand and gravel) with sufficient water to cause the cement to set and bind the entire mass (from Latin *concretus*, to grow together). Also “reinforced” concrete**:** concrete in which metal (as steel) is embedded so that the two materials act together in resisting
- Plastic – any of numerous organic synthetic or processed materials that are mostly thermoplastic or thermosetting polymers of high molecular weight and that can be made into objects, films, or filaments (from Greek *plastikos*, from *plassein* to mold, form).
- Geotextile – a woven or knit fabric such as polyethylene used in the earth or underground, typically made of durable artifact materials (from Greek *gE-*, *geO-*, from *gE,* earth and from Latin *texere,* woven).
- Rubber – an elastic substance made from the milky sap of certain tropical plants or made synthetically by chemical processes (India rubber).

c) Artifacts - Something created, modified, or transported from its source by humans usually for a practical purpose in habitation, manufacturing, excavation, or construction processes (from Latin *arte* by skill + *factum* to do). Examples of artifacts include: processed wood products, liquid petroleum products, coal, combustion by-products, asphalt, fibers and fabrics, bricks, cinder blocks, concrete, plastic, glass, rubber, paper cardboard, iron and steel, altered metals and minerals, sanitary and medical waste, garbage and landfill waste. Artifacts are already mentioned in Soil Taxonomy in the description of the epipedons (Soil Survey Staff, 1999, p. 26-28) but are not yet defined.

Artifacts may be added to the soil and occur in or on the soil and should be described if they become part of the soil and are durable enough to persist (resist weathering and leaching) for a few decades or more, to prevent soil descriptions become outdated and soil series concepts become based on transient properties. From a practical purpose, artifacts that become part of the soil should be first split into categories that relate to human safety concerns, and then into categories that relate to their properties and behavior as part of the soil. These categories are defined below and may lend themselves to the creation of new differentiae and new classes in Soil Taxonomy in the future.

Artifact Categories:

1) Human-safety Types:

These categories describe the degree of risk to humans who live on or work with these soils. Soils with a high amount of dangerous or harmful artifacts will not be fully characterized or classified by ICOMANTH, but may need to be described and identified as being harmful using the following terms to be added to the Soil Survey Manual.

a) Innocuous artifacts - Harmless; producing no injury (from Latin *innocuus,* from *in- + nocEre).* These artifacts have not been documented to cause harm to humans unless they have sharp edges. Examples include untreated wood products, iron, bricks and cinder blocks, concrete, plastic, glass, rubber, organic fibers, inorganic fibers, unprinted paper and cardboard, and some mineral and metal products. Any sharp innocuous artifacts (or natural objects) can cause injury, but the materials themselves are still considered innocuous.

b) Noxious artifacts - Potentially harmful or destructive to living beings unless dealt with carefully; dangerous, involving danger; able to or likely to inflict injury or harm regardless of their shape (from Latin *innocuous* and from *noxa* harm). The harm may be immediate or long-term, or through direct or indirect contact. Examples include: toxic metal- or chemical-treated wood products, batteries, waste and garbage, radioactive fallout, liquid petroleum products, asphalt, some types of coal ash, paper printed with metallic ink, and some mineral and metal products. The specific artifact categories that are presumed to be noxious have been underlined in Part 2) above. The potential for risk or harm of chemicals and some particulate artifacts can be determined based on comparison with USEPA standards for maximum contaminant and health advisory levels (http://www.epa.gov/).

2) Size Categories:

These categories describe the size (Table 1 in Section II below) and degree of lateral continuity of the artifacts so that interpretations can be made based on their properties.

a) Very Fine artifacts < 2mm in size are proposed to be considered **part of the fine earth fraction of soils** and are found in or on the soil but not arranged or compacted into a layer to impede soil, roots, or water. Examples include municipal sludge residue, coal ash, and detritus of larger artifacts.

b) Fine, medium, coarse, and very coarse artifacts >2 mm in size are considered to **be fragments found in the soil** but not arranged or compacted into a layer to impede soil, roots, or water. Examples include bricks, concrete, wood products, iron rods, asphalt, and discontinuous or broken pieces of manufactured layers.

3) Types

These specific examples of terms for categories of artifacts can be used in horizon description and database entries, or the exact type of artifact may be described (underlined categories are considered noxious as described in Section I. B. above):

- Treated Wood Products
- Untreated Wood Products (rather than wood fragments)
- Liquid Petroleum Products
- Coal Combustion By-products
- Asphalt
- Organic Fibers
- Inorganic Fibers
- Bricks
- Cinder Blocks
- Concrete
- Plastic
- Glass
- Rubber products
- Printed Paper (such as magazines, advertisements, packaging, and newspapers)
- Unprinted Paper and Cardboard
- Iron and Steel
- Sanitary and Medical Waste
- Garbage and Landfill Waste
- Other Metal Products† (name of the dominant metal/s may be added in the description in parentheses, or the major types estimated separately)
- Other Mineral Products† (the name of the mineral should be added in the description in parentheses, or the major types estimated separately)

† These materials should be identified clearly so they can be correlated to the correct human-safety type above.

4) Degree of cementation may be described using the existing terms (SSM Table 3-14 and NSSH 618.27 (i)) for rupture resistance if that property is determined to be

helpful to understanding the nature or behavior of the artifacts. Consistence, plasticity, toughness, or manner of failure may also be described if needed. Only those terms determined to be appropriate for the artifact being described are recommended for use. The purpose of using these descriptors is to provide information for use in determining the durability of the artifacts so that dangers of subsidence following decomposition may be recognized and interpreted.

5) Buried artifacts made up of rapidly decomposable materials and natural organic materials exposed to decomposition processes should be identified (although not sampled) so that the soil can be properly interpreted for subsidence and methane gas production problems.

6) The excavation difficulty of layers may be described if that is important to soil interpretations (see Table 3-21 of the SSM – Excavation Difficulty Classes).

Section II. Proposed Modification to Existing Definitions of Fragments:

According to the NSSH 618.27 (a):

> "*Fragments are unattached cemented pieces of bedrock, bedrock-like material, durinodes, concretions, and nodules 2 mm or larger in diameter; and woody material 20 mm or larger in organic soils.*
>
> *Fragments are separated into three types: rock fragments~~;~~**,** pararock fragments, and wood fragments.*"

ICOMANTH proposes that the definitions from section NSSH 618.27 (a) be modified to read (changes in bold italics and strikethrough text):

> *"Fragments are unattached cemented pieces of bedrock, bedrock-like material, **artifacts,** durinodes, concretions, and nodules 2 mm or larger in diameter; and woody material 20 mm or larger in organic soils.*
>
> *Fragments are separated into ~~three~~ **five** types: rock fragments~~;~~**,** pararock fragments, artifact fragments, paraartifact fragments, and wood fragments."*
>
> *Pararock **and paraartifact** fragments are unattached, cemented bodies or pieces of material 2 mm in diameter or larger that are extremely weakly cemented to moderately cemented. These fragments are not retained on sieves because of the sample preparation by grinding.*

Section III: Proposed Additions to Existing Texture Terms:

1) ICOMANTH proposes that the term *"artifactual" or "artifactual material"* be used as a "term used in lieu of texture" (NSSH Exhibit 618-15) for layers made up or 90 percent or more artifacts, following the

example for fragmental material.

2) ICOMANTH proposes that the following size classes be added to the Soil Survey Manual (and to NSSH Exhibit 618-15 and part 618.27 (j) (3)) for artifacts and paraartifacts that follows the classes for non-flat fragments:

Table 1. Size class name and size limits for artifacts and paraartifacts.

Size Class	Size (mm)
Very Fine	< 2 mm
Fine	2-20
Medium	20-75
Coarse	75-250
Very Coarse	>250

3) ICOMANTH proposes that the terms "*artifactual*, *v*ery artifactual, extremely artifactual, and artifactual material" be added to the Soil Survey Manual as a Texture Modifier (and also NSSH Exhibit 618-15 and part 618.67 (h) (2) (vi)) in soils that contain a significant amount of artifacts by volume following the example for gravelly or Gypsiferous.

For soil descriptions, rock fragments, parartifacts, and artifacts are each described separately. When appropriate, compound texture modifiers can be used such as "very artifactual gravelly sandy loam" to describe the volume class. This is analogous to current conventions for compound modifier use such as: "channery mucky clay" or "very gravelly ashy loam" (see NSSH 618.67 (h)(2)(iii) for example). ICOMANTH proposes adding the following Table (2) to the Soil Survey Manual to illustrate the use of terms when high volumes of artifacts are found in a horizon or layer.

Table 2. Proposed new texture modifiers.

Percent volume artifacts	Modifier
0 to < 15%	N/A
15 to < 35%	Artifactual †
≥ 35% to < 60%	Very artifactual †
≥ 60% to < 90%	Extremely artifactual †
≥ 90%	Artifactual Material †

† New terms for NSSH exhibit 618-15

4. ICOMANTH proposes the term "manufactured layer" be added as a new "term in lieu of texture" (NSSH Exhibit 618-15). The following terms should be added as new

"compositional modifiers," to identify the most common types of "manufactured layers".

a. Concrete
b. Asphalt
c. Plastic
d. Geotextile
e. Rubber

Section IV: Procedures for Making Detailed Description of Artifacts:

The terms identified in Section I to III may be used in soil horizon and layer descriptions, soil databases, and in official soil series description ranges of properties. ICOMANTH proposes that the following guidelines are followed in making narrative soil horizon and layer descriptions:

1) Very Fine artifacts should be described by the:
   a. % by weight and volume (estimated or measured),
   b. human-safety type, and
   c. category or exact identity (if important for interpreting or classifying the soil).
2) Fine to very coarse artifacts should be described by the:
   a. percent volume (estimated or measured) for each size-class,
   b. human-safety type (for minerals, some metals, and other artifacts where the safety type is not obvious),
   c. rupture-resistance class (if applicable and important), and
   d. category or exact identity.
3) Paraartifacts should be described in a similar manner as other artifacts but should have a separate volume estimate.
4) Manufactured layers should be described by the:
   a. continuity estimated distance between vertical gaps or cracks (if any), and
   b. whether they are behaving as a liner; and
   c. category or exact identity as a "compositional modifier."

Section V: Proposed New Horizon Designations and Changes in Definitions:

ICOMANTH proposes the following additions to the existing horizon designations. These terms will allow full description of most human-transported and -altered soils, entry of those descriptive elements into existing USDA-NRCS databases, and can be used in the establishment of new soil series (NSSH 614.06).

A) Prefix – ICOMANTH proposes the "star" symbol (*) be used to identify horizons and layers of HTM, following the example of the numerical prefixes (Keys to Soil Taxonomy, Ch. 18, SSM Ch. 3, and Field Book for Describing Soils, 2nd. Ed. p. 2-4).
The current terminology in (Keys to Soil Taxonomy, Ch. 18) states that:

- "*Arabic numerals are used as prefixes to horizon designations (preceding the letters A, E, B, C, and R) to indicate discontinuities in mineral soils*."
- "*A discontinuity is a difference in the materials from which the horizons have formed and/or a significant difference in age, unless that difference in age is indicated by the suffix b*."
- "*Where a soil has formed entirely in one kind of material, the whole profile is*

understood to be material 1 and the number prefix is omitted from the symbol."

ICOMANTH proposes a change in the description to read (changes in bold text):

- "*Arabic numerals are used as prefixes to horizon designations (preceding the letters A, E, B, C, and R) to indicate discontinuities in mineral soils.* ***The "star" symbol is used as a prefix to horizon designations (preceding the letters A, E, B, L, C, and R) to indicate human-constructed discontinuities in mineral or organic soils caused by the deposition of HTM. The star in the prefix position is not to be confused with the prime used in the suffix position.***"
- "*A* ***natural*** *discontinuity is a difference in the materials from which the horizons have formed and/or a significant difference in age, unless that difference in age is indicated by the suffix b.* ***A human-constructed discontinuity is one that forms when humans transport and deposit materials on top of an existing pedon or any other base."***
- "*Where a soil has formed entirely in one kind of material, the whole profile is understood to be material 1 and the number prefix is omitted from the symbol.* ***For human-constructed discontinuities, however, all horizons and layers formed in HTM are indicated by the use of the "star" as a prefix.***"

B) Master horizon - ICOMANTH proposes that manufactured layers be added to the NSSH 618.33, SSM (Ch. 3), and the Keys to Soil Taxonomy (Ch. 18) as a new master horizon or layer. The uppercase letter "M" (manufactured layer) would be used to identify physically root-limiting subsoil layers defined as manufactured layers in Section I above. Root-limiting layers are described as being continuous (90 percent or more cemented and has lateral continuity), following the example of the orstein layers in Soil Taxonomy (Soil Survey Staff, 1999, p. 45). Because of this continuity, roots can penetrate only along vertical fractures with a horizontal spacing of 10 cm or more. The M horizon follows the conventions used in the SSM for the O, L, and W horizons that reflect a type of material (Soil Survey Staff, 2003, Ch. 18, p. 314).

The M should not be used in combinations with other master horizon letters for transitional horizons. The specific manufactured layer material is identified in the pedon description as one of several new compositional modifiers used to modify "manufactured layer" (a new "term in lieu of texture") (NSSH Exhibit 618-15) described in Section III above. For example:

***M** -- 23 to 28 in (56 to 70 cm); very dark gray (10YR 3/1) manufactured layer, **asphalt**; massive; extremely firm; no roots; no pores; few cracks about 100 cm apart; 65% crushed sandstone pebbles; neutral; abrupt smooth boundary (5 to 9 inches thick).

C) Suffixes –

a. ICOMANTH proposes that the lowercase letter "u" be used to identify horizons or layers that contain an observable amount of artifacts or fine artifacts as defined in Section I above. Higher amounts of artifacts are also identified by the texture modifiers as described in Section III above.

b. For certain anthropogenic features made by compaction of soil materials, the layer should be signified by the "d" to indicate the anthropogenic densic nature (e.g. *Cd designation for a clay liner from human transported material, or just Cd for non-transported materials compacted in place).

Section VI. Example Use of New Designations and Terms in Descriptions:

A) Demonstrated Use of New Horizon Designations on Hypothetical Profiles

Table 3 compares 5 different hypothetical natural and human-altered or -transported soil profiles, with proposed changes in prefix, master letter, and suffix designations. These profiles compare the conventional USDA-NRCS system to one using new prefix, master horizon, and suffixes (identified by footnotes).

Table 3. Hypothetical human-altered or -transported soil profiles. Assume that each horizon or layer is 25 cm thick unless otherwise stated.

Profile 1	Profile 2	Profile 3	Profile 4	Profile 5
Soil deeply cultivated to 75 cm but not transported	Soil buried by HTM from similar on-site material	Soil buried by HTM from off-site soil material	Soil buried by HTM containing a few artifacts and on-site soil material	Soil with HTM over a geotextile layer over landfill material
0 cm HTM	75 cm HTM	75 cm HTM	75 cm HTM	200 cm HTM
Conventional USDA-NRCS system				
Ap	A	A	A	A
C1	C1	Bw	AC	C
C2	C2	C	Cd	Cd
Cky	Cky	2BAb	Btb1	2C2 (1 cm thick)
Ckyz (> 1m thick)	Ckyz (> 1m thick)	2Btb	Btb2	3C3
		2Cr	BC (> 50 cm thick)	3C4 (> 50 cm thick)
System proposed by ICOMANTH				
Ap	^A	^A	^Au	^A
C1	^C1	^Bw	^ACu	^C
C2	^C2	^C	^Cdu	^Cd
Cky	Cky	2BAb	Btb1	2^M (geotextile)
Ckyz (> 1m thick)	Ckyz (> 1m thick)	2Btb	Btb2	3^Cu1
		2Cr	BC	3^Cu2 (> 50 cm thick)

B) Demonstrated Use of New Horizon Designations, Fragment Types, and Texture Modifiers in a Hypothetical Profile Description

The following soil description is a hypothetical example of the use of the proposals in Sections I to V. New designations occur as **bold italic text**.

Table 4. A hypothetical pedon formed in HTM over a buried natural soil.

^*Ap* -- 0 to 26 cm; reddish brown (2.5YR 4/4) loam; common, fine distinct dusky red (10R 3/4) lithochromic mottles; weak coarse subangular blocky structure; friable; common fine and medium, and few coarse roots; no pores; 5 percent sandstone pebbles; moderately acid; clear wavy boundary.

^*Cu1* -- 26 to 50 cm; reddish brown (2.5YR 4/4) loam; few, medium distinct dusky red (10R 3/4) lithochromic mottles; massive; firm; common fine and medium plus few coarse roots; few very fine pores; 5 percent sandstone pebbles; ***3 percent medium, brick fragments;*** slightly acid; clear wavy boundary.

^*Cu2* -- 50 to 79 cm; reddish brown (2.5YR 4/4) gravelly loam; common, medium distinct dusky red (10R 3/4) lithochromic mottles; massive; firm; common fine and medium plus few coarse roots; no pores; 15 percent sandstone gravel, 5 percent sandstone cobbles; ***8 percent medium brick and concrete fragments;*** neutral; clear wavy boundary.

^*Cu3* -- 79 to 117 cm; reddish brown (2.5YR 4/4) ***artifactual*** gravelly loam; common, medium distinct dusky red (10R 3/4) lithochromic mottles; massive; firm; few fine and medium roots; no pores; 15 percent sandstone gravel, 5 percent sandstone cobbles, and ***15 percent coarse concrete fragments, 5 percent medium brick fragments;*** slightly alkaline; abrupt smooth boundary.

Ab -- 117 to 126 cm; dark brown (2.5YR 3/3) loam; moderate medium granular structure; very friable; common fine and medium roots; few very fine pores; moderately acid; clear wavy boundary.

Btb – 126 to 200 cm; reddish brown (2.5YR 5/4) clay loam; moderate medium subangular blocky structure; friable; common clay films on ped surfaces; few fine and medium roots; common very fine pores; moderately acid.

C) Demonstrated Use of New Horizon Designations, Fragment Types, and Texture Modifiers on Official Series Descriptions (http://soils.usda.gov/technical/classification/osd/)

In June, 2003 the National Cooperative Soil Survey Standing Committee on Standards reviewed a set of four official series descriptions from human-altered and-transported soils to see how they would be affected by the new horizon designation and texture modifications proposed by ICOMANTH circular Letter #4 (posted on the ICOMANTH web site at http://clic.cses.vt.edu/icomanth/circlet.htm). The four example OSDs are listed below in their original and revised versions, with comments by the Committee on Standards at the beginning of each OSD. Modifications proposed by ICOMANTH appear in bold italic text.

1) **Laguardia Series –** This soil is formed in thick deposits (entire 2 meter profile) of fill material with human artifacts throughout. This soil is easily identified as HTM by considering the evidence in the individual horizons themselves.

Original version:

Ap-- 0 to 8 inches; brown (10YR 4/3) gravelly sandy loam; (10YR 6/3) dry; weak very fine subangular blocky structure; friable; few very fine and medium roots; 15 percent brick and concrete fragments, 5 percent asphalt, and 5 percent glass gravel sized fragments, and 5 percent cobble-sized rock fragments; neutral; gradual wavy boundary. (2 to 12 inches thick.)

Bw-- 8 to 26 inches; brown (10YR 4/3) very gravelly coarse sandy loam; weak very fine subangular blocky structure; friable; few very fine roots; 25 percent brick and concrete, 5 percent asphalt, 5 percent metal, and 5 percent plastic gravel sized fragments and 5 percent cobble-sized rock fragments; neutral; gradual wavy boundary. (1 to 20 inches thick.)

C-- 26 to 79 inches; brown (10YR 4/3) very gravelly coarse sandy loam; structureless massive with compaction related plate-like divisions; very friable; few very fine roots; 25 percent brick and concrete, 10 percent asphalt, 5 percent glass, 5 percent metal, and 5 percent plastic gravel sized fragments and 7 percent cobble-sized rock fragments; neutral.

Revised version:

^*Apu* -- 0 to 8 inches; brown (10YR 4/3) ***artifactual*** sandy loam; (10YR 6/3) dry; weak very fine subangular blocky structure; friable; few very fine and medium roots; 5 percent cobbles; ***15 percent fine brick and concrete fragments, 5 percent fine glass fragments, and 5 percent fine asphalt fragments;*** neutral; gradual wavy boundary. (2 to 12 inches thick.)

^*Bwu* -- 8 to 26 inches; brown (10YR 4/3) ***very artifactual*** coarse sandy loam; weak very fine subangular blocky structure; friable; few very fine roots; 5 percent cobbles; ***25 percent fine brick and concrete, 5 percent fine asphalt, 5 percent fine, metal, and 5 percent fine plastic fragments;*** neutral; gradual wavy boundary. (1 to 20 inches thick.)

^*Cu* -- 26 to 79 inches; brown (10YR 4/3) ***very artifactual*** coarse sandy loam; structureless massive with compaction related plate-like divisions; very friable; few very fine roots; 7 percent cobbles; ***25 percent fine brick and concrete, 10 percent fine asphalt, 5 percent fine glass, 5 percent fine metal, and 5 percent fine plastic fragments;*** neutral.

2) **Greatkills Series –** This soil is a landfill. Note that because of the “artifact-free” nature of the cap, no human artifacts are described in the upper 2 horizons. Unlike the Laguardia soil, the 2 uppermost horizons do not have obvious morphology to indicate HTM. In soils like these, the evidence of human influence must be inferred from the relation to the material below.

Original version:

A-- 0 to 2 inches; dark brown (7.5YR 3/2) coarse sandy loam; weak medium granular structure; very friable; many very fine and fine plus common medium and coarse roots; common coarse 3/4 inch thick, hollow Phragmites rhizomes; 10 percent gravel rock fragments; neutral; abrupt smooth boundary. (1 to 7 inches thick)

Bw-- 2 to 7 inches; dark reddish brown (5YR 3/4) gravelly coarse sandy loam; weak medium subangular blocky and platy structure; friable; common fine roots; common coarse rhizomes; 20 percent gravel rock fragments; neutral; clear wavy boundary. (3 to 8 inches thick)

BC-- 7 to 12 inches; dark reddish brown (5YR 3/4) gravelly coarse sandy loam; weak medium platy structure; firm; few very fine roots; common coarse rhizomes; 20 percent gravel rock fragments; 5 percent pieces of broken glass bottles; neutral; clear wavy boundary. (3 to 8 inches thick)

2C-- 12 to 80 inches; dark brown (7.5YR 4/4) extremely cobbly loam; massive; friable; few medium and coarse roots; few coarse rhizomes to a depth of 60 inches; 5 percent cobble rock fragments; 15 percent decomposable cobble-sized coarse fragments such as wood, iron, cardboard, and paper; 40 percent non-decomposable cobble-sized coarse fragments such as bricks, concrete, rugs, plastic bags, glass bottles, plastic toys and objects, and rubber pipes; few stone-sized coarse fragments of concrete and tires; neutral; clear smooth boundary.

Revised version:

^*A*-- 0 to 2 inches; dark brown (7.5YR 3/2) coarse sandy loam; weak medium granular structure; very friable; many very fine and fine plus common medium and coarse roots; common coarse 3/4 inch thick, hollow Phragmites rhizomes; 10 percent gravel; neutral; abrupt smooth boundary. (1 to 7 inches thick)

^*Bw*-- 2 to 7 inches; dark reddish brown (5YR 3/4) gravelly coarse sandy loam; weak medium subangular blocky and platy structure; friable; common fine roots; common coarse rhizomes; 20 percent gravel; neutral; clear wavy boundary. (3 to 8 inches thick)

^*BCu*-- 7 to 12 inches; dark reddish brown (5YR 3/4) gravelly coarse sandy loam; weak medium platy structure; firm; few very fine roots; common coarse rhizomes; 20 percent gravel; ***5 percent fine and medium broken glass bottle fragments***; neutral; clear wavy boundary. (3 to 8 inches thick)

2^Cu-- 12 to 80 inches; dark brown (7.5YR 4/4) ***very artifactual*** loam; massive; friable; few medium and coarse roots; few coarse rhizomes to a depth of 60 inches; 5 percent cobbles; ***15 percent coarse innocuous wood, cardboard, and paper; 40 percent coarse innocuous iron, bricks, concrete, rugs, plastic bags, glass bottles, plastic toys and objects, and rubber pipe fragments; and 2 percent very coarse innocuous concrete fragments and tires;*** neutral; clear smooth boundary.

3) **Bagger Series –** This soil is forming in locally derived fill (due to land leveling) with a buried soil below. Here it is more difficult to discern that this is fill material from evidence in the pedon alone. The buried soil provides a good clue, but with no human artifacts present, you need to consider additional clues outside of the soil itself (like local land leveling practices) to infer the nature of the upper mantle as human transported.

Original version:

Ap--0 to 9 inches; mixed pale brown and yellowish brown (10YR 6/3, 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine, fine and medium roots; many very fine and fine interstitial pores; about 10 percent by volume 2 to 35 mm hardpan fragments which can be broken by hand; hardpan fragments have same color as soil matrix; neutral (pH 7.2); gradual smooth boundary. (4 to 12 inches thick)

2C1--9 to 16 inches; mixed light gray, white and brown (2.5Y 7/2, 8/2; 7.5Y 5/4) light sandy clay loam, grayish brown and brown (2.5Y 5/2; 7.5YR 4/4) moist; massive; hard, friable, sticky and slightly plastic; few very fine roots; common very fine and fine interstitial pores; common thin silica colloids bridging sand grains; about 10 percent by volume 2 to 35 mm hardpan fragments which can be broken by hand; hardpan fragments have same color as matrix; fragments of Bt (argillic) dark brown (7.5YR 4/4) moist clay and clay loam; about 5 percent by volume black (N 4/) Fe-Mn soft concretion ranging up to 5 mm in diameter; slightly calcareous with lime segregated in few fine filaments, moderately alkaline (pH 8.0); clear wavy boundary. (0 to 20 inches thick)

3C2--16 to 30 inches; mixed pale brown and brown (10YR 6/3, 7.5YR 5/4) loamy sand and sandy loam, dark brown (10YR 4/3, 7.5YR 4/4) moist; massive; hard, friable, nonsticky and slightly sticky and nonplastic and slightly plastic; few very fine roots; common very fine interstitial pores; about 3 percent by volume Bt (argillic) fragments having many very fine tubular pores and common thin clay films lining the tubular pores and common thin silica colloids bridging sand grains; in small pockets 20 percent by volume 2 to 5 mm gravels encased by loamy sand fill; about 25 percent by volume 5 to 35 mm hardpan fragments within small pockets in the lower 2/3 of the horizon having the same color as the horizon matrix; few black (N 2/) 2 to 5 mm Fe-Mn flakes; mildly alkaline (pH 7.5); abrupt smooth boundary. (0 to 20 inches thick)

4Ab--30 to 35 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; common fine distinct yellowish red (5YR 5/6) mottles, dark reddish brown (5YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular and interstitial pores; 1/4 inch organic residue at top of horizon, few black (N 2/) 1 to 5 mm Fe-Mn concretions; medium acid (pH 6.0); gradual wavy boundary. (0 to 10 inches thick)

4C3--35 to 49 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine, fine and medium tubular and common very fine and fine interstitial pores; few black (N 2/) 1 to 5 mm Fe-Mn concretions; mildly alkaline (pH 7.5); clear wavy boundary. (0 to 20 inches thick)

4Cq--49 to 60 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; no roots; few very fine interstitial pores; weakly cemented with silica; moderately alkaline (pH 8.0)

Revised version:

^***Ap***--0 to 9 inches; mixed pale brown and yellowish brown (10YR 6/3, 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine, fine and medium roots; many very fine and fine interstitial pores; about 10 percent by volume 2 to 35 mm hardpan fragments which can be broken by hand; hardpan fragments have same color as soil matrix; neutral (pH 7.2); gradual smooth boundary. (4 to 12 inches thick)

2^C1--9 to 16 inches; mixed light gray, white and brown (2.5Y 7/2, 8/2; 7.5Y 5/4) light sandy clay loam, grayish brown and brown (2.5Y 5/2; 7.5YR 4/4) moist; massive; hard, friable, sticky and slightly plastic; few very fine roots; common very fine and fine interstitial pores; common thin silica colloids bridging sand grains; about 10 percent by volume 2 to 35 mm hardpan fragments which can be broken by hand; hardpan fragments have same color as matrix; fragments of Bt (argillic) dark brown (7.5YR 4/4) moist clay and clay loam; about 5 percent by volume black (N 4/) Fe-Mn soft concretion ranging up to 5 mm in diameter; slightly calcareous with lime segregated in few fine filaments, moderately alkaline (pH 8.0); clear wavy boundary. (0 to 20 inches thick)

3^C2--16 to 30 inches; mixed pale brown and brown (10YR 6/3, 7.5YR 5/4) loamy sand and sandy loam, dark brown (10YR 4/3, 7.5YR 4/4) moist; massive; hard, friable, nonsticky and slightly sticky and nonplastic and slightly plastic; few very fine roots; common very fine interstitial pores; about 3 percent by volume Bt (argillic) fragments having many very fine tubular pores and common thin clay films lining the tubular pores and common thin silica colloids bridging sand grains; in small pockets 20 percent by volume 2 to 5 mm gravels encased by loamy sand fill; about 25 percent by volume 5 to 35 mm hardpan fragments within small pockets in the lower 2/3 of the horizon having the same color as the horizon matrix; few black (N 2/) 2 to 5 mm Fe-Mn flakes; mildly alkaline (pH 7.5); abrupt smooth boundary. (0 to 20 inches thick)

4Ab--30 to 35 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; common fine distinct yellowish red (5YR 5/6) mottles, dark reddish brown (5YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular and interstitial pores; 1/4 inch organic residue at top of horizon, few black (N 2/) 1 to 5 mm Fe-Mn concretions; medium acid (pH 6.0); gradual wavy boundary. (0 to 10 inches thick)

4C3--35 to 49 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine, fine and medium tubular and common very fine and fine interstitial pores; few black (N 2/)

1 to 5 mm Fe-Mn concretions; mildly alkaline (pH 7.5); clear wavy boundary. (0 to 20 inches thick)

4Cq--49 to 60 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; no roots; few very fine interstitial pores; weakly cemented with silica; moderately alkaline (pH 8.0)

4) **Quonal Series** - This non-HTM soil illustrates the difficulty of inferring whether a soil contains HTM in the absence of artifacts. This soil has been deeply plowed to break up a duripan, but has little lateral movement of soil material and so it probably does not qualify as HTM as described above. Distinguishing the morphology of a non-transported but deeply plowed soil such as Quonal from a soil formed in thick HTM without artifacts (such as a mined soil like Blocker, Schuline, or Ironbridge, not included here) will encourage recording soil descriptions more detailed than the current OSD's. (NOTE: If the electrical conductivity, sodium adsorption ratio; or pH had been described in horizon 2Bkqmb, or if any scrape-marks had been described across the top of the truncated duripan, there may have been enough morphological evidence of human-transportation of materials. As described, this soil should remain in the Arents suborder).

Original version and revised version are the same:

Ap1--0 to 7 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine, medium and coarse subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; common very fine and fine tubular pores; strongly effervescent, carbonates are disseminated; electrical conductivity is 0.5 decisiemens per meter; sodium adsorption ratio is 2; moderately alkaline (pH 8.3); gradual smooth boundary.

Ap2--7 to 9 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; massive; extremely hard, firm, sticky and plastic; few very fine and fine roots; few very fine and fine tubular pores; few thin clay films in pores of displaced fragments of a natric horizon; strongly effervescent, carbonates are disseminated; electrical conductivity is 3.1 decisiemens per meter; sodium adsorption ratio is 6; very strongly alkaline (pH 9.3); gradual smooth boundary.

Ap3--9 to 16 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; massive; extremely hard, firm, sticky and plastic; few fine and very fine roots; common fine and very fine tubular pores; few thin clay films in pores of displaced fragments of a natric horizon; strongly effervescent, carbonates are disseminated; electrical conductivity is 4.1 decisiemens per meter; sodium adsorption ratio is 12; common fine and medium faint very dark grayish brown (10YR 3/2) moist, relict redox depletions; very strongly alkaline (pH 9.2); gradual smooth boundary.

Ap4--16 to 20 inches; light yellowish brown (10YR 6/4) clay, dark yellowish brown (10YR 4/4) moist; massive; extremely hard, firm, sticky and plastic; few thin clay films on displaced fragments of a natric horizon; strongly effervescent, carbonates are disseminated; electrical conductivity is 7.5 decisiemens per meter; sodium adsorption ratio is 27; very strongly alkaline (pH 9.2); gradual smooth boundary.

Ap5--20 to 32 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; extremely hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; common thin and moderately thick clay films coating faces of and in pores of displaced fragments of a natric horizon; strongly effervescent, carbonates are disseminated; electrical conductivity is 5.9 decisiemens per meter; sodium adsorption ratio is 35; common medium faint dark brown (10YR 3/3) relict redox depletions; very strongly alkaline (pH 9.7); clear wavy boundary.

Ap6--32 to 41 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; strong fine and medium angular blocky structure; extremely hard, firm, sticky and plastic; common very fine tubular pores; few thin clay films in pores of displaced fragments of a natric horizon; 15 percent very fine and fine subangular blocky duripan fragments that are extremely hard and extremely firm; violently effervescent, carbonates are disseminated and segregated as many moderately thick coats on faces of peds and as many fine and medium filaments; electrical conductivity is 7.4 decisiemens per meter; sodium adsorption ratio is 50; very strongly alkaline (pH 9.9); abrupt wavy boundary. (The combined thickness of the Ap horizons is 40 to 60 inches).

2Bkqmb--41 to 44 inches; light yellowish brown (10YR 6/4) strongly silica and lime cemented duripan with 50 percent discontinuous 1/8 inch thick laminar cap, and with fractures 4 to 8 inches apart, dark yellowish brown (10YR 4/4) moist; massive; extremely hard, slightly rigid; strongly effervescent, carbonates are disseminated and segregated as many fine and medium threads and many moderately thick coats in fractures; brittle when wet; clear wavy boundary. (2 to 20 inches thick).

2Bkb1--44 to 50 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine tubular pores; violently effervescent, carbonates are disseminated and segregated as many fine and medium filaments and as many moderately thick coats on faces of peds; electrical conductivity is 0.9 decisiemens per meter; sodium adsorption ratio is 4; moderately alkaline (pH 8.3); gradual wavy boundary. (0 to 16 inches thick).

2Bkb2--50 to 62 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; medium fine angular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine tubular pores; few thin and moderately thick clay films lining pores and on ped faces; strongly effervescent, carbonates are disseminated and segregated as few thin filaments and many moderately thick coats on faces of peds; electrical conductivity is 0.8 decisiemens per meter; sodium adsorption ratio is 2; moderately alkaline (pH 8.0).

Section VII. Rationale Behind Circular Letter #5

1) Why do we define terms for noxious artifacts if we do not intend to sample or classify contaminated soils? Soil scientists must be able to describe these materials in order to communicate their presence and interpret the use of the soil. They can be described and

their volume estimated by remote methods if needed.

2) Why was the term “artifactual” used as a texture modifier? The size and volume categories of the artifacts listed in Section II and III should allow the physical properties of artifacts and paraartifacts to be identified as part of the texture, as is done for natural rock and pararock fragments whenever their volume becomes significant (> 15%).

3) Why are rock, pararock, artifacts and paraartifacts fragments described separately? Reader feedback indicated that preference. From a practical purpose, it is still uncertain how artifacts behave as they weather and if they have none or some limited water-holding and nutrient-supply capacities. Also, paraartifacts are likely to be crushed and passed through a 2 mm sieve during particle-size analysis and may not otherwise be recognized in the soil.

4) Why were the terms “urbic” and “garbic” dropped? After receiving feedback about the use of the terms “urbic” and “garbic” as types of materials with significant artifact content, the terms were set aside until diagnostic materials or horizons are proposed. Garbic material (originally introduced in Fanning and Fanning, 1989) may be reintroduced later, but the present intent of ICOMANTH is to avoid intense study and classification of contaminated soils, and many types of garbage and landfill materials are contaminated or generate methane gas. The discussion on the upper limit of contamination or garbic material is still undetermined. As a reminder, garbic materials are artifacts of refuse such as worthless or useless parts, rubbish, garbage, wasted food, leftovers, scraps, and trash associated with habitation and business waste (from Middle English *offal*, food waste; from Latin *vastus* waste). These artifacts would normally be deposited in landfills. While it may be safe to sample and describe the soil above the garbage, it is probably unsafe to describe the garbage itself without special tools.

5) What is the practical need to define the size of artifacts? The size of the very fine artifacts mean they have much greater surface area and thus behave physically as many fine-earth particles do and are subject to more intense weathering than larger artifacts. The other size classes follow the conventions used for non-flat rock fragments.

6) Why is the anthropogenic landform discussed in Section I as part of the identification of HTM when it cannot be used as a differentiae for identifying the classification of a soil? Identification of a landform and parent materials are interpretive judgments made by the soil scientist in the field and thus belongs as part of the pedon description. The information may be used to identify the presence of HTM as a parent material, just as the occurrence of a stratified layer on a hilltop may be used to identify the parent material as glacial outwash or ancient alluvium.

7) Why were the artifact categories in Section I created? The categories are used to separate artifacts into simple human safety, size, and property groups that can be described and interpreted with some uniformity. Specific examples were listed as suggestions to soil scientists of which artifacts could be grouped in order to shorten descriptions of horizons with a large variety of artifacts and to provide some standardization of terminology for future circular letters.

8) Why are the artifacts now organized differently than proposed in Circular Letter #4?

- Several respondents indicated that the issue of safety for the surveyors and the people living near contaminated soils was a more important concern than other properties of artifacts in the soil.

• Other categories of artifacts were modified or eliminated to fit better into the existing USDA-NRCS system.

• Identifying which artifacts are organic or inorganic was faulty in the case of plastic and rubber, and could not be consistently applied.

• The durability category was dropped because it is very difficult to assess the rate of decomposition of some materials. Artifacts that weather rapidly would not behave as long-term soil properties, nor could the artifacts that are not durable be easily sampled or analyzed as part of standard soil analysis techniques. In addition, the durability is dependent on many microbiological, hydrologic, soil, and regional climate factors. Interpretation tables will need to be developed for various combinations of materials and site conditions.

• The cementation (rupture-resistance class) may provide important interpretive information and thus those properties can be described by the soil scientists if they feel it is an important soil property, reflective of durability or susceptibility for decomposition in the soil. Artifacts and features that are purely transient (such as a manufactured herbicide or fertilizer application) are not described as a part of the soil even though they affect the soil properties temporarily.

9) How can a soil scientist tell if an artifact is noxious or not? The specific examples of artifact categories that are typically noxious have been underlined in Section I. Some metals and minerals may have to be identified as noxious in the description if their human-safety type is not evident. The USEPA regulations may provide some guidelines as well.

10) What can be done to describe noxious material or the material below a manufactured layer or liner? It can be described as in other soil materials that occur within 200 cm if it can be observed. This might include compacted crushed stone or “base material” or might include material in a landfill. In soils placed over buried buildings, the layer would be the last strata described, as is often true for soils over continuous, strongly cemented, unweathered bedrock.

11) How should artifacts be described if they do not fit into one of the specific example categories? Any artifact can be directly identified in the description. However, the example categories could provide some consistency in the terminology used and could eventually be added as a variable in NASIS.

12) Why was the “star” prefix chosen to identify HTM instead of the Master Letter H as previously discussed? Feedback from Circular Letter #4 suggested that the use of a Master Horizon would break from the traditional use of Master Letters in the USDA-NRCS system when naming transitional horizons. Confusion would arise from adding a master letter that had no consistent describable properties or degree of development other than being transported. For example:

a. The master letters O, L, R, W, and some C (Cr) horizons represent a type of material that can be defined and a central concept developed. HTM are too variable in properties to be identified that distinctly.

b. The master letters A, B, E, and some C horizons denote some degree of

pedogenesis that results in an accumulation and/or loss. HTM are too variable to denote a degree of pedogenesis because they can vary from artifacts to redeposited diagnostic horizon materials to dredged sediment or bedrock.
c. The master letters (except for O, L, R, W, and some C (Cr)) are used in combination with other master letters when their properties are combinations of two master letter horizon materials or they are transitional to other genetic master horizons. HTM are a type of parent material and thus they cannot be used in combination with other master letters. Therefore it would be impossible to identify them if a new master letter were used, and it would be impossible to identify their degree of pedogenic development unless you used a completely new set of master letters that were the equivalent of the A, B, E, and C.
d. The use of the star as a prefix avoids these conflicts while identifying of the HTM. It is found on all keyboards and is easily written and not confused with other symbols.
e. The use of any master letter (such as H) as a prefix in front of any other master letter is problematic. For example, how would one identify the properties or degree of development of an HB horizon. The first thought would be that it was transitional between an H and a B horizon. How would one understand an HBC horizon?

13) Why is the Master Letter M not used as part of a transitional horizon? Most commonly there is just one capital letter designation used for a horizon. Current provisions for using multiple designations allow for the recognition of horizons that are dominantly like one form of master horizon, but which have subordinate properties of another. Two types, transitional (e.g. EB,) or combination (e.g. B/E) horizons are recognized. The M layers would be restricted to materials and thus would behave like the O, L, and W master letters. Those letters are also not used in transitional horizons. This follows the precedent of using the O, R, L and W horizons in combination horizons but not with other master letters for transitional horizons.

14) Should humans survey and classify soils that have safety concerns? Some respondents indicated that humans should not describe or classify soils with safety issues. However, if they can describe safely under certain conditions, then some descriptive information about them is better than none at all. Therefore, some designations were defined here so that noxious artifacts could be described. At a later date, ICOMANTH will decide how to apply this information to Soil Taxonomy and at what level it should be recognized. A set of mineralogy classes may be appropriate.

15) Why are HTM not identified as a kind of diagnostic material at this point?
In June, 2003 the National Cooperative Soil Survey Standing Committee on Standards produced a report concerning recommendations in ICOMANTH Circular Letter #4 (posted on the ICOMANTH web site (http://clic.cses.vt.edu/icomanth/circlet.htm). According to the National Cooperative Soil Survey Standing Committee on Standards in June, 2003:

"The experience from our testing of the circular letter proposals with existing Official Series Descriptions revealed a progression from easily identified HTM on one end of a continuum of human-influenced soils to more difficult identification and lack of agreement on the other end of the continuum."

Fill[†] with artifacts throughout	Clean fill[‡] over fill with artifacts	Clean fill[‡] over buried soil horizons	Thick deposits of Clean fill[‡]

→ Increasing Difficulty (decreasing agreement) →

† "Fill" was defined by the committee as human-transported material.
‡ "Clean fill" was assumed by the committee to be human-transported material that did not contain artifacts or anthropogenic features (defined below).

In circular letter 4, an attempt was made to define HTM very rigorously based upon specific properties observed within the soil. (i.e. contains 2 or more of several listed properties). That approach was like those defining other diagnostic "materials" in Soil Taxonomy (eg. spodic materials, fragic materials, paralithic materials, etc). Testing of that concept indicated we simply could not define HTM well enough on field-observable soil properties alone to reliably separate all HTM from similar naturally-occurring materials. In particular, soils recently transported by flooding, deglaciation, or mass-wasting may contain the same properties as those recently by humans. So for now, HTM will not be treated as a diagnostic material that could be used to define taxa.

16) Why are anthropogenic features now identified separately from artifacts? One respondent brought it to our attention that artifacts can be removed from the soil as objects but features such as spade marks cannot. The distinction deserves merit and follows the conventions in place in other anthropological sciences.

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