MLRA Soil Survey Region 10
Guidelines for Completing and Updating Official Soil Series Descriptions

Updated April 28, 2009

These guidelines are an addition to the guidelines in Part 614.06 in the National Soil Survey Handbook (NSSH) (http://soils.usda.gov/technical/handbook/contents/part614.html#06). These guidelines do not replace the guidelines in the NSSH. These guidelines are intended only for Official Series Descriptions (OSDs) that are the responsibility of MLRA Soil Survey Region 10 (MO10). The guidelines for Official Series Descriptions are as follows:

1. All revisions to existing OSDs and all new OSDs submitted to MO10 should use these guidelines. These guidelines are posted on the MO10 Web site (http://www.mo10.nrcs.usda.gov/references/).

2. All edits/revisions should be made using the MS-Word/Tools "Track Changes." Record/Keep all changes marked on documents.

3. When you submit revised OSDs to MO10, attach the OSDs as files and not in the body of the e-mail. If you send the file with a .txt extension, the file will be in the body of the message and a paragraph mark will occur at the end of each line.

4. If the series description is for a proposed new series or if the revision significantly changes the concept of the existing series, the MLRA Soil Survey Office Leader should submit documentation to the SDQS for the series file. This documentation should include:
   - All of the completed pedon descriptions to determine the range of characteristics. The standard is generally 10 pedon descriptions
   - Summary of field data
   - Laboratory data that are completed in the soil survey office, a university laboratory, or the Soil Survey Laboratory in Lincoln
   - Results of spatial and statistical analysis

5. All official series descriptions submitted to MO10 must have passed a spell check and been run through the OSD Check program; all errors identified in the OSD Check must have been resolved.

6. Upon receiving an OSD, the MO will run the OSD through spell check and the OSD Check Program. Any OSDs not passing spell check and/or the OSD Check Program will be returned to the originating office for correction.

7. There are nineteen (19) sections or headings on an OSD. At the discretion of the reviewer, errors in five (5) sections may result in rejection of the entire OSD revision.

8. All initial and update soil surveys should use the OSD as the Taxonomic Unit Description when possible. Most Taxonomic Unit Descriptions (TUDs) are written in semitabular format. These guidelines for writing OSDs are in both narrative format and semitabular format.

Guidelines for Basic Keying Official Series Descriptions:

- Left margin is in column 1. Right margin is in column 66.
- Tabs, hyphens, automatic centering, bold fonts, and underlines should not be used. The space bar should be used instead of tabs.
    - **If the OSD submitted to the MO has tabs, automatic centering, bold fonts, and underlines, it is clear that the originating office did not follow the MO10 guidelines for obtaining OSDs at** http://www.mo10.nrcs.usda.gov/references/ **and the MO will assume other guidelines have also been ignored. Therefore, unless an alternative option is reached, the OSD will be sent back to the originating office for further work.**
- Everything is left justified except the horizon designations, which are indented at least 1 space using the space bar.
- Section headings are in capital letters.
- Depths and other property data should be expressed in the metric system. Conversion tables and systems can be found at http://www.mo10.nrcs.usda.gov/references/guides.

  Note: Precipitation is stated in millimeters. Depth to saturation and elevation are stated in meters.
- Legal descriptions and locations are in English units of measure.
- Special symbols, subscripts, and superscripts must be expressed as words. (For example: 43° should be expressed as 43 degrees, and 10% should be expressed as 10 percent)
- Generally, abbreviations should be avoided. There are exceptions (for example: pH, g/cc, mmhos/cc).

CRITICAL ITEMS: The first eight lines and the last line of the soil series description are critical to the OSD passing OSD Check and being submitted to the Web site and must be standardized in order to be posted to the OSD Web site.

Line 1--`LOCATION ANTIGO WI`

- This line is entered in capital letters (upper case)
- The first letter of the state where the soil series is located must be in column 33
- When additional states are using the series, the first state should be in column 33 followed by a "+" and then the abbreviation for the next state, then if needed by a space and the abbreviation for the next state, and so on. (Example: `IA+MO NE WI`)
- **This information must agree with the data in the Soil Classification file.** If edits are needed, notify a SDQS

Line 2--Blank

Line 3--`Tentative Series` or `Established Series`.

- All series are "Tentative" until the final correlation document is signed
- **This information must agree with the data in the Soil Classification file.** If edits are needed, notify a SDQS
- Once a series is correlated, the series status will be changed by the SDQS to "Established" in the Soil Classification (SC) file
- See note below in Series Established section regarding manual edit to the OSD

Line 4--`KHJ-RBD-TDT`

- A maximum of three sets of initials should be on the OSD
    - The first set of initials should be those of the original author and should never change
    - The other initials should be those of the two people who most recently edited the series

- The person submitting the revision needs to take responsibility for the action
- The initials indicate who will answer future questions or comments

Line 5--`2/02`

- This should be the month and year that the soil series draft or revision was sent to the SDQS for review
- This date is automatically changed when the OSD is posted to the database

Line 6--Blank Line

Line 7--`SERIES NAME` (All letters are upper case)

Line 8--Blank Line (followed by the introductory paragraph and the rest of the soil series description)

Next to last line--`National Cooperative Soil Survey`

Last line--`U.S.A.`

- All letters are upper case and do not have spaces in between
- Delete any extra paragraph returns after this line

Guidance on Individual Sections of the OSD

Introductory Paragraph:

- Complete the GEOGRAPHIC SETTING section prior to this paragraph
  - The extent of the series will influence the ranges stated in here
- Consider this as an executive summary of data found in the body of the OSD
- The information here should match nearly word-for-word with the information in the body of the OSD. The following format for the introductory paragraph should be used:

```
The Alpha series consists of ? (depth), ? drained soils that formed in ? (parent
material--modifier, kind, and origin).  These soils are on ? (landform(s).  Slope
ranges from ? to ? percent.  Mean annual precipitation is about ? millimeters.
Mean annual air temperature is about ? degrees C.
```

- Depth classes are defined in Table 3-5 of the Soil Survey Manual [SSM]
- Only use parent material and landform terms recognized in part 629 of the NSSH, Glossary of Landform and Geologic Terms **(http://soils.usda.gov/technical/handbook/contents/part629.html#00)**
- Mean annual air temperature is usually about 1 degree C less than mean annual soil temperature
- The values here for MAP and MAAT are arithmetic means, averages of the ranges established in the Geographic Setting section of the OSD

Examples:

```
The Kevilar series consists of very deep, moderately well drained soils that
formed in 50 to 100 centimeters of loamy alluvium over sandy alluvium underlain
by stratified loamy and sandy alluvium at a depth of 100 to 150 centimeters.
These soils are on valley trains. Slope ranges from 0 to 12 percent. Mean annual
precipitation is about 760 millimeters. Mean annual air temperature is about 9
degrees C.
```

The Norden series consists of well drained soils that are moderately deep to sandstone. These upland soils formed in loamy residuum from glauconitic sandstone. Slope ranges from 2 to 65 percent. Mean annual precipitation is about 725 millimeters. Mean annual air temperature is about 8 degrees C.

TAXONOMIC CLASS:

- This statement gives the family classification as per the latest edition of Keys to Soil Taxonomy

TYPICAL PEDON: the following format for the typical pedon should be used:

Alpha ? (surface texture), on a ? (aspect),? (slope shape) slope of ? percent, in ? (land type), at an elevation of about ? meters. (Colors are for moist soil unless otherwise stated.)

Examples:

TYPICAL PEDON: Kevilar sandy loam, on a southwest-facing, convex slope of 4 percent, in a cultivated field, at an elevation of about 248 meters. (Colors are for moist soil unless otherwise stated.)

TYPICAL PEDON: Cublake loamy sand, on a linear slope of 1 percent, in a wooded area, at an elevation of about 393 meters. (Colors are for moist soil unless otherwise stated.)

(Note that no aspect is needed for slopes of 0 to 2 percent)

Typical Pedon Description:

- Refer to Part 614 of the NSSH for more detailed guidance on the content of pedon descriptions
- A few additional guidelines:
  - Surface fragments (rock or pararock) and surface litter are described just above the first horizon. For example:
    About 15 percent of the surface is covered by channers, 30 percent by cobbles, 5 percent by stones, and 3 percent by boulders. The fragments are sandstone.
  - The soil surface is the top of the mineral surface layer, or for soils with an O horizon, the surface is the top of the part of the O horizon that is at least <u>partially</u> decomposed, which <u>excludes</u> live and fresh moss, leaves, and twigs. The top of any surface horizon identified as an O horizon, whether Oi, Oe, or Oa, is considered the soil surface. The proper way to record the thickness of an O horizon is as follows:
    Oi--0 to 5 centimeters; slightly decomposed plant material
- Below is the sequence of features described for a horizon as outlined in Part 614 of the NSSH. All terms are consistent with “Field Book for Describing and Sampling Soils”
  - Color (moist is the most common condition in MO10)
  - Dry color (dry color is usually given for the upper horizons to indicate whether there is an ochric epipedon, mollic epipedon, or albic horizon and also on A and E, E/B, B/E, AB, BA, EB, BE, E and Bt, and Bt and E horizons)
  - Texture
    - Texture of the surface layer must agree with the surface texture phase as stated after the TYPICAL PEDON heading
  - Mottles (dry or moist, not related to wetness)
  - Structure (note that commas are not used to separate terms in the phrase that describes structure. Also, the word "structure" is used only once in describing compound structure, for example, "weak coarse prismatic structure parting to moderate medium subangular blocky")
  - Consistence (dry, moist, stickiness, plasticity)

- Roots
- Pores
- Additional features as follows:
    - Slickensides
    - Durinodes
    - Plinthite
    - Clay films
    - Sand or silt skeletans
    - Concretions
    - Carbonates
    - Salts
    - Sodium
    - Smeariness
    - Redoximorphic features
    - Pebbles, stones, and other rock fragments
    - Brittleness
- Reaction
    - Use measured value or use pH range
        - *Example:* `pH 6.2 or pH 6.1 to 6.5`
    - narrative class with measured value is allowed
        - *Example:* `slightly acid (pH 6.2)`
    - In older descriptions, "medium acid" should be changed to "moderately acid" and "mildly alkaline" should be changed to "slightly alkaline"
- Lower boundary
- Range in thickness - DELETE from Typical Pedon description and ADD to RIC for individual horizons

- If features listed above are not mentioned in the description of a horizon, they are assumed to be absent. (See Exhibit 614-1 of the NSSH for further information)

TYPE LOCATION: The following format should be used:

```
Major Land Resource Area (MLRA) ?-Name of the MLRA; ? County, ? (state), subset;
about ? of ? (general location); located about ? feet ?(north or south) and ?
feet (east or west) of the ? (northeast, southeast, southwest or northwest)
corner of section ?, T. ? N., R. ? W. or E. (Public Land Survey location); USGS ?
topographic quadrangle (7.5-minute series); lat. ? degrees ? minutes ? seconds N.
and long. ? degrees ? minutes ? seconds W., NAD ?. (North American Datum and
year)
```

- Give as complete and comprehensive a location as possible
- When the type location has been revisited and described, the lat/long waypoint should be noted
    - List lat/long to the nearest tenth of a second (ex: `27.3 seconds`)
- Cross check to make sure the PLSS and Lat/Long locations agree with each other; correct errors if they occur
    - In the case of a published survey, use Web Soil Survey
        - Use PLSS locator
        - Use Lat/Long locator
        - Make note of adjacent map units for Geographically Associated Soils section
    - In the case of an initial survey, use the lat/long data collected at the site
- Universal Transverse Mercator (UTM) coordinates are optional
    - The coordinates are measured in meters; be certain to include the word "meters"
    - If listed, these are at the end of the location statement, after the lat., long., and NAD

- Include the UTM Zone
  Example:
  `lat. 41 degrees 55 minutes 11 seconds N. and long. 88 degrees 32 minutes 05 seconds W., NAD 83; UTM Zone 16, 372749 meters easting, 4642017 meters northing, NAD 83.`
- Cross check to make sure the UTM coordinates, PLSS and Lat/Long locations agree with each other; correct errors if they occur

- Cross check to make sure the Type Location is in a map unit that agrees with the initial statement made in the TYPICAL PEDON section above; correct errors if they occur
  - In the case of a published survey, use Web Soil Survey
    - Texture of the surface layer in the Typical Pedon must agree with the surface texture phase as stated after the TYPICAL PEDON heading

Example:
`Major Land Resource Area (MLRA) 3000-Really Neat Glacial Drift; Any County, Any State, subset; about 10 miles southwest of Any Place; located about 1,000 feet south and 300 feet east of the northwest corner of section 6, T. 5 N., R. 8 W.; USGS Someplacespecial topographic quadrangle; lat. 35 degrees 40 minutes 20 seconds N. and long. 108 degrees 30 minutes 20 seconds W., NAD 83.`

RANGE IN CHARACTERISTICS:

- Refer to Part 614.06 of the NSSH for detailed guidelines on this section
- Check NASIS data for typical pedon and query for specific series component data
  - Note and investigate differences between NASIS data and OSD chemical and physical property ranges
  - Make appropriate changes to OSD
  - Note possible changes to NASIS
- First part addresses the **whole soil**
- Second part addresses the **individual horizons**
- Quantitative limits are given for the ranges in properties
- All properties used to differentiate this series from other series in the Competing Series section must be listed in this section
- Range in characteristics must be consistent with the classification of the series
  - Established ranges cannot “cross over” to other taxonomic subgroups or family classification
- It is imperative that only representative pedon descriptions be used to develop the range in characteristics
  - The use of unusual or questionable descriptions when the range in characteristics is developed magnifies the problems involved with competing soil series
- Whenever possible, list only the observed ranges, not "default" ranges
  - For example, if a soil has a fine-loamy particle-size class, do not automatically default to 18 to 35 percent clay when the observed range is only 18 to 25 percent clay
  - Soil property ranges should be limited to occasions when ranges can be supported by lab data
    - For example, **the averaged range of the clay content in the particle-size control section for 30 laboratory-sampled pedons is 35 to 45 percent. This range, 35 to 45 percent clay, should be listed in the range in characteristics and not the default range of 35 to 60 percent clay for the fine family particle-size class.**
- A standard arrangement of information in this section makes comparisons among soil series easier
- Both tabular and narrative formats are acceptable
- In the OSD template, the statement "Depths are measured from the top of the mineral soil surface" is listed after the Range in Characteristics heading

    - This statement applies to soils that have "O" horizons
    - This statement should be deleted for soils that do not have "O" horizons
- It is important that the particle-size control section be clearly defined
    - As a minimum, the clay content must be listed
    - For some soils the sand content and size fraction are important
    - For other soils the amount, lithology, and size of rock fragments are listed
- Be certain to cross check the properties described in the TYPICAL PEDON with property ranges listed in the RANGE IN CHARACTERISTICS

Note: The following examples for the range in characteristics section are not totally inclusive or applicable to every pedon. Some items can be added or deleted as needed to differentiate series and as justified by data.

Whole Soil:

- Mantle kind and thickness
- Thickness of the epipedon
- Depth to (lithic or paralithic contact) bedrock
- Depth to a fragipan
- Depth to a densic contact
- Depth to a lithologic discontinuity or contrasting particle-size
- Depth to carbonates
- Depth to argillic horizon
- Thickness of the argillic horizon
- Content of organic matter in the surface layer
- Range in content of rock fragments (volume of gravel, cobbles, stones, boulders, channers, flags, etc.)
- Reaction (use pH range - *Example:* `pH 6.1 to 6.5)`
- Base saturation
- Soil temperature
- Particle-size control section (weighted average)
    1. Clay content percent
    2. Sand content percent (may use specific sand fractions, such as very fine, fine, medium, coarse, or very coarse sand)
- Depth to redoximorphic features

Example:

```
RANGE IN CHARACTERISTICS:
Thickness of mollic epipedon--18 to 49 centimeters
Depth to lithic contact--100 to 150 centimeters
Depth to carbonates--150 to more than 200 centimeters
Clay content of the particle-size control section (weighted average)--10 to 16
percent
Sand content of the particle-size control section (weighted average)--60 to 80
percent
Rock fragment content--0 to 15 percent, dominantly gravel, mixed lithology
```

Individual Horizons:

- The horizons listed are the major ones described and are of consequence for the definition of the soil series
- All horizons described in the Typical Pedon should have a range in characteristics defined in this section

- The properties in the format below are not totally inclusive or applicable to all pedons. Properties may be added or deleted as needed to differentiate series and as justified by data
- Add Range in thickness for the horizon
    - It is recommended to round the thickness range to the nearest 5 centimeter value. *Example:* `12 to 27 centimeters thick` would be rounded to `10 to 30 centimeters thick`
        - This rounding provides a slightly wider range and thus prevents some immediate revisions to thickness ranges as more descriptions are collected.

```
? horizon:
Hue-- ?
Value-- ?
Chroma-- ?
Texture-- ?
Clay content-- ? to ? percent
Sand content-- ? to ? percent
Rock fragment content-- ? percent
Pararock fragment content-- ? percent
Acid oxalate extractable Al + 1/2 Fe-- ? to ? percent
Base saturation-- ? percent
Calcium carbonate equivalent--
EC (mmhos/cm)-- ? to ?
Gypsum-- ? to ? percent
Reaction--(pH range)
Moist bulk density-- ? g/cc to ? g/cc
Thickness--? to ? centimeters
```

Example:

```
Bt horizon:
Hue--7.5YR or 10YR
Value--2 or 3 moist, 3 or 4 dry
Chroma--1 or 2 moist or dry
Texture--loam or clay loam
Clay content--22 to 33 percent
Sand content--40 to 60 percent, fine sand and coarser
Rock fragment content--2 to 10 percent gravel, 0 to 5 percent cobbles, mixed
lithology
Reaction--pH 4.5 to 6.0
Thickness--25 to 50 centimeters
```

Example:

```
The Bt horizon has hue of 7.5YR or 10YR, value of 2 or 3 moist or 3 or 4 dry, and
chroma of 1 or 2 moist or dry.  It is loam or clay loam.  It averages 22 to 33
percent clay and 40 to 60 percent fine sand or coarser.  The content of rock
fragments ranges from 2 to 10 percent gravel and 0 to 5 percent cobbles of mixed
lithology.  Reaction ranges from pH 4.5 to 6.0. This horizon ranges from 25 to 50
centimeters thick.
```

In cases where some pedons have horizons not in the typical pedon description, either define a set of properties as other horizons, adding (if present) behind the horizon designation, or add a statement between the appropriate horizons

Example:

```
Some pedons have an AB horizon.
```

Hue/Value/Chroma:

- The range for hues should read red to yellow and not yellow to red

- For example, the range for hue should read "5YR or 7.5YR", not "7.5YR or 5YR"
- Use the term "or" when listing a range of two and the term "to" when listing a range of three or more hues, values, or chromas
  - The term "to" is understood to include the end value
- If the range is the same for both dry and moist colors (value and chroma), then this should be stated by adding the phrase "dry or moist"

Example:

```
Hue--7.5YR to 2.5Y
Value--3 to 5 dry, 3 or 4 moist
Chroma--2 or 3 dry or moist
```

Textures:

- Textures should be written out and not abbreviated
- For surface horizons, it is suggested that only the surface texture phases of approved or correlated map units be listed even though other surface textures may have been observed in the field

COMPETING SERIES**:**

- Before competing statements are written, it is critical that the soil series being described has a complete and concise range in characteristics and other properties identified
- Competing series are those with the identical taxonomic classification
  - The most efficient means of determining the competing series is to go to the OSD Web site and click on View OSDs by Query (with FTP option) (http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdquery.cgi) and follow the prompts to view the competing OSDs
- If competing series do not exist, you may select a closely similar soil from the same geographic area to compete against the series described in the OSD

Example:

```
There are no competing series.  A closely similar series is the Alpha series.
```

- Competitors are listed alphabetically
- State abbreviations are not needed
- Competing statements are written individually in the order of listing, except that soils with the same competing characteristics can be grouped together
- The competing statement should clearly identify the "major" difference in **soil properties**
  - Clear separation of series uses numerical soil property comparisons
    - Phrases such as “thicker mollic”, “have less sand”, “redder hues”, “are drier”, etc., are not acceptable
  - Differences in every property need not be described
  - Address only those properties that are distinctly different between the competitors
  - Properties that overlap cannot be used to differentiate series
  - Only properties in the series control section can be used to separate series
    - Differentiating series by parent materials should be defined in soil properties, such as clay content, sand content, rock fragment content, or other property
- Series cannot be differentiated by landform and landscape position in this section
- Do not use different horizonation symbols as a reason to compete series
  - “Alpha soils have a BA horizon" should not be used because the BA horizon is not diagnostic
  - "Alpha soils have a Bt horizon" is not correct
  - Pedogenic process represented by the symbol may be used if it is diagnostic

Examples:

```
Alpha--have an argillic horizon

Alpha--have accumulations of illuviated clay

Alpha--have accumulations of carbonates within a depth of 150 centimeters

Alpha soils have a gleyed horizon
```

- The particular property or feature that is used as the basis for competing must be clearly described in the series being described
  - The inverse differentiating property statement should be added to the competing OSD
  - If necessary, competing OSDs are revised at the same time
    - If competitor is not in the area of responsibility of the editing office, the appropriate office is notified of suggested edits

The following is a list of features used to differentiate soils. It is suggested that this list be used as a key for writing competing statements. For example, if item 1 (soil depth) cannot be used as a differentiating property, then go to item 2 (presence or absence of a diagnostic horizon or feature) and so on until a property is found that can be used as a basis for differentiating the series. This list is not totally inclusive for all pedons but will work for most soils.

1. Soil depth (depth to lithic contact, paralithic contact, densic contact, or fragipan)
   Example:
   ```
   Alpha--have a lithic contact within a depth of 100 centimeters
   ```

2. Presence or absence of a diagnostic horizon or feature
   Examples:
   ```
   Alpha--have an accumulation of carbonates within a depth of 150 centimeters

   Alpha--have an irregular decrease in organic carbon within the series control
   section

   Alpha--have a fine sand content of more than 50 percent in the series control
   section
   ```

3. Particle-size (may or may not be related to soil texture)
   Examples:
   ```
   Alpha--have a sand content that averages more than 90 percent in the particle-
   size control section

   Alpha--have a clay content that averages more than 27 percent in the particle-
   size control section
   ```

4. Soil chemistry (base saturation, pH)
   Examples:
   ```
   Alpha--have carbonates within a depth of 85 centimeters

   Alpha--have base saturation of more than 60 percent in the upper part of the
   argillic horizon

   Alpha--have a pH range of 6.6 to 8.4 throughout the series control section
   ```

5. Content and/or type of rock or pararock fragments
   Examples:

Alpha--have a rock fragment content of less than 15 percent in the series control section

Alpha--do not have rock fragments in the series control section

6. Thickness of the epipedon
   Example:
   Alpha--have a mollic epipedon that is 30 to 46 centimeters thick

7. Thickness of a diagnostic horizon
   Example:
   Alpha--have a spodic horizon 40 to 64 centimeters thick

8. Soil temperature and soil moisture
   Example:
   Alpha--are in areas that have a mean annual air temperature that ranges from 11 to 14 degrees C

- If the series differentiation is unclear, state so and reference remarks for further information
  Example:
  Cresent--differentia are not clear between the Keosauqua and Cresent series; see remarks

GEOGRAPHIC SETTING:

- Complete the DISTRIBUTION AND EXTENT section prior to this section
  - The extent of the series will influence the ranges stated in this section
- The items listed in this section must agree with those listed in the **Introductory Paragraph**
- The following format should be used (Other items can be added as needed to help describe the setting):

  Parent material-- ?
  Landform-- ?
  Geologic formation--optional
  Slope-- ? percent
  Elevation-- ? to ? meters above sea level
  Mean annual air temperature-- ? to ? degrees C
  Mean annual precipitation-- ? to ? millimeters
  Frost-free period-- ? to ? days

- Describe the modifier, kind, and origin of the parent material
  - Use only terms recognized in Part 629, Glossary of Landforms and Geologic Terms, in the NSSH (http://soils.usda.gov/technical/handbook/contents/part629.html#00)
  - The name of the geologic formation can also be identified
    - Naming the geologic formation does not necessarily limit the use of the series to that particular formation
  - Identification of the geologic age of the parent material is optional
- List the landform(s) and positions(s) on the landform(s) (if significant)
  - Use only terms recognized in Part 629, Glossary of Landforms and Geologic Terms, in the NSSH (http://soils.usda.gov/technical/handbook/contents/part629.html#00)
    - If the soil only occurs on toeslopes of hills, then identifying the toeslope position is significant

        - If a soil occurs throughout a flood plain or on dunes, identifying a position is not significant
- In absence of scientifically collected data **for the range of the series** (as described in the DISTRIBUTION AND EXTENT section below), use physiographic and climatic data from AG Handbook 296 to develop Elevation, Mean annual air temperature (MAAT), Mean annual precipitation (MAP), and Frost-free period (FFP) ranges for series
    - http://soils.usda.gov/survey/geography/mlra/index.html or http://www.mo10.nrcs.usda.gov/mlras/
    - Refer to NSSH Exhibit 614-2 (g) (2), which states "Only use indices that have been defined in widely available publications."
    - AG Handbook 296 was developed and published by NCRS, and ranges stated in the OSD should NOT conflict with this published information
    - See Appendix A—MLRA Climate Data (as per AH-296)
    - Values for Elevation, Mean annual air temperature (MAAT), Mean annual precipitation (MAP), and Frost-free period (FFP) should be an aggregation of the ranges for the extent of the series as described in the DISTRIBUTION AND EXTENT section below

Example: The series is in MLRAs 102C and 107B

MLRA	ELEV* (m)	MAAT* (°C)	MAP* (mm)	FFP* (days)
102C	335-610	6-11	585-760	150-190
107B	185-475	8-13	660-1,040	155-220
Aggregated Ranges	185-610	6-13	585-1,040	150-220

* Values from AG Handbook 296

GEOGRAPHICALLY ASSOCIATED SOILS:

- This section applies only to those **soils associated at the original type location** or soil survey area
    - In the case of a published survey, use Web Soil Survey to determine associates
- Either narrative or semitabular format may be used
- As a general guideline, list one soil that occurs in a lower landscape position on the landform, one that occurs in the same landscape position, and one that occurs in a higher landscape position
- Do not list more than four associated soils
- Identify the landform position and how the soils differ from the named series
    - List only the most obvious differences
    - Do not repeat the difference for a soil that has been listed in the competing series section
    - This section should only be updated when the type location has been moved to an area with different associated soils or when the names of the associated soils have changed

Examples:

```
GEOGRAPHICALLY ASSOCIATED SOILS: These are the Alpha, Beta, and Delta soils.
Alpha--are in slightly higher landscape positions on the summits of ridges and
have sandstone bedrock within a depth of 50 centimeters
Beta--are in landscape positions similar to those of the NAMED soils and do not
have calcic horizons
Delta--are in lower landscape positions on toeslopes of moraines and have a
mollic epipedon 50 to 90 centimeters thick

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Alpha, Beta, and Delta soils.
The Alpha soils are in slightly higher landscape positions on the summits of
```

ridges and have sandstone bedrock within a depth of 50 centimeters. The Beta soils are in landscape positions similar to those of the NAMED soils and do not have calcic horizons. The Delta soils are in lower landscape positions on toeslopes of moraines and have a mollic epipedon 50 to 90 centimeters thick.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:

- List drainage class
  - State interpretation; refer to state guides
  - Reference: Soil Survey Manual, Chapter 3 http://soils.usda.gov/technical/manual/contents/chapter3c.html#27
- List depth range in meters to wet saturation (see NASIS Component Soil Moisture Status) and time frame in normal years and kind of saturation
  - A "normal year" is defined as a year that has plus or minus one standard deviation of the long-term mean annual precipitation. (Long-term refers to 30 years or more.)
    - Reference: ftp://ftp-fc.sc.egov.usda.gov/NSSC/Soil_Taxonomy/keys/keys.pdf (page 26)
  - Ensure that saturation statement agrees with morphology of the TYPICAL PEDON
  - Ensure that saturation does not conflict with Taxonomic Classification
- Saturated hydraulic conductivity range
  - Refer to NSSH, Part 618.5 and Exhibits 618-9 and 618.10
  - See Appendix B—Saturated Hydraulic Conductivity & Permeability Conversion Table
  - Use numeric range rather than narrative class
  - Round values to nearest 10-base Ksat value (Ex: 1.41 micrometers per second should be rounded to 1.00 micrometer per second)
- Add a flooding (or ponding) statement if flooded (or ponded) with duration
  - Refer to NASIS Component Soil Moisture Status

Example 1 (from Cumulic Endoaquolls):

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--poorly drained--these soils are frequently saturated from the soil surface to a depth of 0.3 meter during the wettest period of years when precipitation is within one standard deviation of the 30-year mean of annual precipitation; this saturation is considered apparent
Saturated hydraulic conductivity--1.00 to 10.00 micrometers per second
Flooding--rarely flooded to frequently flooded for very brief to long periods

Example 2 (from Lithic Hapludalfs):

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--well drained--frequent saturation does not occur within a depth of 1.8 meters during the wettest period of years when precipitation is within one standard deviation of the 30-year mean of annual precipitation
Saturated hydraulic conductivity--1.00 to 10.00 micrometers per second in the loamy or silty materials, 0.10 to 1.00 micrometer per second in the paleosol, and 0.01 micrometer to 10.00 micrometers per second in the limestone bedrock, depending on the amount of weathered rock

Example 3 (from Mollic Oxyaquic Hapludalfs):

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--moderately well drained--a frequently saturated zone occurs between depths of 0.6 and 1.0 meter during the wettest period of years when precipitation is within one standard deviation of the 30-year mean of annual precipitation, and both perched and apparent saturation can occur in these soils based on the season and intensity of rainfall during a given period of time

```
Saturated hydraulic conductivity--1.00 to 10.00 micrometers per second in the
silty or loamy sediments and 0.01 to 1.00 micrometer per second in the till
```

USE AND VEGETATION:

- List the major use or uses
  - If soils are used for cultivated crops, pasture, or forest or for urban or other uses, the uses are indicated along with the general extent of each, if known
  - List the key species of the native plant community as they appear on the National Plants List
    - Reference: http://plants.usda.gov/index.html
    - List the plants of the present community if the native community is not known

Example (from Cumulic Endoaquolls):

```
USE AND VEGETATION:
Drained areas are cultivated. The principal crops are corn and soybeans. The
native vegetation is big bluestem, western wheatgrass, sedges, blue grama, other
species of the tall grass prairie that are tolerant of excessive wetness, and
scattered deciduous trees.
```

DISTRIBUTION AND EXTENT:

- Check extent in Soil Classification (SC) file (States using and MLRAs using)
  - http://ortho.ftw.nrcs.usda.gov/cgi-bin/sc/scname.cgi
    - Note States using and MLRAs using
- Check extent in NASIS
  - See Appendix C for NASIS screen shots
  - Options/Standard Reports/Local/NASIS Site: MLRA10_Office
    - Run report: Corr-MO10-Series Extent (Permanent Dataset)
      - Type “series name”
      - SSA type = non-mlra*
      - SSA Status = highlight all that apply (ext. revision, initial, published, update, update needed)
      - MU Status = correlated
    - Print report or Save and print report
    - Note in which MLRA(s) the Soil Survey Areas (SSAs) listed in the report are located

    PLEASE NOTE: This NASIS report will have to be rewritten when NASIS 6.0 is implemented.

- Cross check SC file extent to the NASIS Series Extent Report
  - Note and investigate differences
  - Note changes needed to SC file
    - Contact SDQS to make changes to the SC file
  - Ensure that States listed in the NASIS Series Extent Report are listed in **Line 1 (first line of the OSD)**
- Edit Distribution and Extent section of OSD as per MLRAs and SSAs in the NASIS Series Extent Report
  - Edit GEOGRAPHIC SETTING section to include ranges for the MLRAs and SSAs
- Add Physiographic Location as per the Geomorphic Description System
  - ftp://ftp-fc.sc.egov.usda.gov/NSSC/GDS/GDS_v4_11.pdf
  - List the Physiographic Division, Physiographic Province, and Physiographic Sections

    - List the MLRAs by name
- List the Land Resource Region (LRR) and the States using the series
- List the narrative extent of the series as per the following guidelines:
    - Small extent or not extensive--less than 10,000 acres correlated
    - Moderate extent or moderately extensive--10,000 to 100,000 acres correlated
    - Large extent or extensive--more than 100,000 acres correlated
    - Do NOT include acreage figures

Example:

```
DISTRIBUTION AND EXTENT:
Physiographic Division--Interior Plains
Physiographic Province--Central Lowland
Physiographic Sections--Western lake section, Wisconsin driftless section, Till
plains, and Dissected till plains
MLRAs--Rolling Till Prairie (102A),
 Central Iowa and Minnesota Till Prairies (103),
 Eastern Iowa and Minnesota Till Prairies (104),
 Northern Mississippi Valley Loess Hills (105),
 Iowa and Missouri Deep Loess Hills (107B),
 Illinois and Iowa Deep Loess and Drift (108),
 Iowa and Missouri Heavy Till Plain (109),
 Northern Illinois and Indiana Heavy Till Plain (110),
 Central Claypan Areas (113),
 Southern Illinois and Indiana Thin Loess and Till Plain (114), and
 Central Mississippi Valley Wooded Slopes (115)
LRR K and LRR M; Iowa, southern Minnesota, Nebraska, Missouri, Kansas, and
Illinois
Extent--large
```

MLRA OFFICE RESPONSIBLE:

- List the MLRA office (MO) that is responsible for the series
    - Format of the entry is city, state
    - Ensure this matches SC file
- List the MLRA SSO responsible for the series
    - Format of the entry is MLRA SSO 10-? (Cityname, State)

Example:

```
MLRA OFFICE RESPONSIBLE: St. Paul, Minnesota; MLRA SSO 10-5 (Albert Lea,
Minnesota)
```

SERIES PROPOSED OR ESTABLISHED:

- One of these headings is used, depending on the current status of the series
- This must match the heading in line 3 and the status in the SC file
    - The Status will be automatically changed on line 3 when the SC file is updated
    - This section has to be manually changed when the series status changes
- List the year, county, and state where the series was first proposed or established
    - Ensure that this matches SC file
    - The name of the soil survey area is given if it includes more than one county or parts of a county
    - If needed, cross check with appropriate correlation documents
    - For Proposed series, list the source of the name for the series
        - If the name is coined, state so

Examples:
SERIES ESTABLISHED: Warren County, Iowa, 1975.

SERIES PROPOSED: Kandiyohi County Minnesota, 2008. Source of name is a township in Kandiyohi County.

REMARKS:

- There are three parts to this section
  - The first part defines the particle-size control section and the series control section of the typical pedon as per *Soil Taxonomy*
  - The second part identifies the diagnostic horizons and features in the typical pedon
  - The third part is for listing pertinent remarks about the series

- **Defining the particle-size control section and the series control section**

Example (Typic Endoaquolls):
Particle-size control section--the zone from a depth of 25 to 100 centimeters (A1, A2, and BA horizons);
series control section--the zone from the surface of the soil to a depth of 150 centimeters (Ap, A1, A2, A3, BA, Bg, BCg, and Cg horizons).

Example (Typic Argialbolls):
Particle-size control section--the zone from a depth of 43 to 93 centimeters (Btg1, Btg2, and Btg3 horizons);
series control section--the zone from the surface of the soil to a depth of 203 centimeters (A, E, Btg1, Btg2, Btg3, Btg4, and Btg5 horizons).

Example (Lithic Hapludalfs):
Particle-size control section--the zone from a depth of 18 to 41 centimeters (Bt1 and 2Bt2 horizons);
series control section--the zone from the surface of the soil to a depth of 41 centimeters (A, BE, Bt1, and 2Bt2 horizons).

- **Diagnostic horizons and features in this pedon:**
  - List the diagnostic horizons and features that define the series
    - See Appendix D—Diagnostic Horizons and Features for Taxonomic Placement
  - Identify the zones and horizons representing the diagnostic horizons and features in the typical pedon
  - The following format is not inclusive for all pedons and can be modified as needed

? epipedon--the zone from the surface of the soil to a depth of ? centimeters;
albic horizon--the zone from a depth of ? to ? centimeters;
argillic horizon --the zone from a depth of ? to ? centimeters;
calcic horizon --the zone from a depth of ? to ? centimeters;
cambic horizon --the zone from a depth of ? to ? centimeters;
duripan--the zone from a depth of ? to ? centimeters;
fragipan--the zone from a depth of ? to ? centimeters;
glossic horizon --the zone from a depth of ? to ? centimeters;
ortstein--the zone from a depth of ? to ? centimeters;
spodic horizon --the zone from a depth of ? to ? centimeters;
lithic contact--the contact with ? at a depth of ? centimeters;
paralithic contact--the contact with ? at a depth of ? centimeters;
aquic conditions:

- Saturation-- ? to ? centimeters
  - Endosaturation-- ? to ? centimeters
  - Episaturation-- ? to ? centimeters
- Redoximorphic features:
  - Redoximorphic concentrations-- ? to ? centimeters;
    - Nodules and concretions-- ? to ? centimeters
    - Masses-- ? to ? centimeters
    - Pore linings-- ? to ? centimeters
  - Redoximorphic depletions: ? to ? centimeters;
    - Iron-- ? to ? centimeters
    - Clay-- ? to ? centimeters
  - Reduced matrix: ? to ? centimeters

abrupt textural change--at the upper boundary of the ? horizon;
lithologic discontinuity--at the upper boundary of the ? horizon;
soil moisture control section--the zone from a depth of ? to ? centimeters;
udic (or ustic or aquic) moisture regime;
soil temperature control section--the zone from a depth of ? to ? centimeters;
? soil temperature regime.

- **Other pertinent remarks about the series**
  - Any remarks that would help to better define the series or address unresolved problems are recorded here
  - Any unresolved problem with defining the soil series or with differentiating it from others is listed

Examples:

Cation-exchange activity class is supported by lab data from National Soil Survey Laboratory, Lincoln, Nebraska.

Cation-exchange activity class is inferred from lab data for similar soils in the surrounding area.

Oxyaquic subgroup based on a zone of saturation within a depth of 100 centimeters for 20 or more consecutive days or 30 or more cumulative days in normal years.

Some pedons have vertical seams or wedges of sand or loamy sand about 5 to 15 centimeters wide and about 0.9 meter to 1.2 meters deep extending downward from the stone line into the till.

The type location was moved within the same map unit because the original site has been disturbed.

Several property ranges of the Keosauqua and Cresent series overlap. Further study is needed to clearly differentiate these two series.

These soils were previously identified as inclusions in the Delft series in parts of the Granite Falls Till geomorphic landform.

Taxonomy version--Keys to Soil Taxonomy, tenth edition, 2006.

The change to bulk density of 1.75 to 1.90 g/cc and low to moderately low saturated hydraulic conductivity was based on field and lab data and supported by the MLRA 104 steering committee.

ADDITIONAL DATA:

- List any supporting laboratory data or other data collected for this pedon
  - Give the name of the lab and the soil survey sample number
  - If lab tests, such as particle-size analysis, calcium carbonate equivalent, and salinity, were done at the project office, this needs to be stated

Example:

```
ADDITIONAL DATA:
Refer to Minnesota Agricultural Experiment Station Central File Code No. 1276 for
results of some analyses of a representative pedon.
Laboratory data--National Soil Survey Laboratory, Lincoln, Nebraska, user pedonid
70MN039002 (http://ssldata.sc.egov.usda.gov/).
```

APPENDIX A - MLRA Climate Data (as per AH-296)

LRR	MO 10 Letter Code	MLRA	MLRA Name	MAAT (°C)		MAP (mm)		FFP (days)		ELEV (m)	
				Low	High	Low	High	Low	High	Low	High
F	**I**	56	Red River Valley of the North	2	7	455	585	125	170	200	305
K	**A**	57	Northern Minnesota Gray Drift	3	6	585	735	120	175	300	500
H	n/a	76	Bluestem Hills	11	15	785	965	190	225	300	505
K	**B**	88	Northern Minnesota Glacial Lake Basins	2	5	510	735	115	150	275	410
K	**G**	89	Wisconsin Central Sands	6	7	760	840	135	165	270	425
K	**C**	90A	Wisconsin and Minnesota Thin Loess and Till, Northern Part	3	7	660	865	110	180	335	595
K	**V**	90B	Wisconsin and Minnesota Thin Loess and Till, Southern Part	4	8	685	840	135	180	205	470
K	**D**	91A	Central Minnesota Sandy Outwash	4	6	585	735	135	175	250	450
K	**Q**	91B	Wisconsin and Minnesota Sandy Outwash	3	8	635	865	90	180	245	455
K	**E**	92	Superior Lake Plain	4	6	685	940	125	190	185	425
K	**F**	93A	Superior Stony and Rocky Loamy Plains and Hills, Western Part	2	4	635	840	120	175	185	640
K	**U**	93B	Superior Stony and Rocky Loamy Plains and Hills, Eastern Part	3	6	660	965	100	180	185	600
K	**H**	94B	Michigan Eastern Upper Peninsula Sandy Drift	4	7	710	915	120	180	175	425
K	**W**	94D	Northern Highland Sandy Drift	4	5	760	890	125	155	455	565
K	n/a	95B	Southern Wisconsin and Northern Illinois Drift Plain	6	9	760	965	150	190	200	300
M	**J**	102A	Rolling Till Prairie	4	7	485	735	140	175	305	410
M	**K**	102B	Till Plains	6	9	585	660	155	175	350	575
M	**T**	102C	Loess Uplands	6	11	585	760	150	190	335	610
M	**L**	103	Central Iowa and Minnesota Till Prairies	6	10	585	890	155	200	300	400
M	**M**	104	Eastern Iowa and Minnesota Till Prairies	7	10	735	940	160	195	300	400
M	**N**	105	Northern Mississippi Valley Loess Hills	6	10	760	965	145	205	200	400
M	n/a	106	Nebraska and Kansas Loess-Drift Hills	10	13	710	1,015	175	215	300	505
M	**P**	107A	Iowa and Minnesota Loess Hills	7	9	660	790	155	175	340	520
M	**Z**	107B	Iowa and Missouri Deep Loess Hills	8	13	660	1,040	155	220	185	475
M	n/a	108A	Illinois and Iowa Deep Loess and Drift, Eastern Part	8	12	890	1,090	175	210	200	300
M	n/a	108B	Illinois and Iowa Deep Loess and Drift, East-Central Part	8	12	840	990	165	210	200	300
M	**R**	108C	Illinois and Iowa Deep Loess and Drift, West-Central Part	8	11	840	965	170	205	155	340
M	**Y**	108D	Illinois and Iowa Deep Loess and Drift, Western Part	9	11	840	940	175	200	210	460
M	**S**	109	Iowa and Missouri Heavy Till Plain	9	12	865	1,040	175	210	200	300
M	n/a	110	Northern Illinois and Indiana Heavy Till Plain	8	12	840	990	165	210	200	300
M	n/a	111A	Indiana and Ohio Till Plain, Central Part	9	12	915	1,090	175	215	205	380
M	n/a	111B	Indiana and Ohio Till Plain, Northeastern Part	8	11	760	990	165	195	190	470
M	n/a	111C	Indiana and Ohio Till Plain, Northwestern Part	9	11	890	990	170	195	190	285
M	n/a	111D	Indiana and Ohio Till Plain, Western Part	10	12	915	1,090	180	215	160	320

LRR	MO 10 Letter Code	MLRA	MLRA Name	MAAT (°C)		MAP (mm)		FFP (days)		ELEV (m)	
				Low	High	Low	High	Low	High	Low	High
M	n/a	111E	Indiana and Ohio Till Plain, Eastern Part	9	11	890	1,040	165	205	175	425
M	n/a	112	Cherokee Prairies	11	17	865	1,145	185	255	100	400
M	n/a	113	Central Claypan Areas	11	14	915	1,170	190	225	200	300
M	n/a	114A	Southern Illinois and Indiana Thin Loess and Till Plain, Eastern Part	9	14	940	1,170	155	225	100	380
M	n/a	114B	Southern Illinois and Indiana Thin Loess and Till Plain, Western Part	11	14	940	1,170	190	225	105	365
M	n/a	115A	Central Mississippi Valley Wooded Slopes, Eastern Part	11	14	1,015	1,195	200	225	100	310
M	n/a	115B	Central Mississippi Valley Wooded Slopes, Western Part	12	14	965	1,220	185	230	100	310
M	n/a	115C	Central Mississippi Valley Wooded Slopes, Northern Part	9	13	865	1,015	180	215	130	270

APPENDIX B - Saturated Hydraulic Conductivity & Permeability Conversion Table

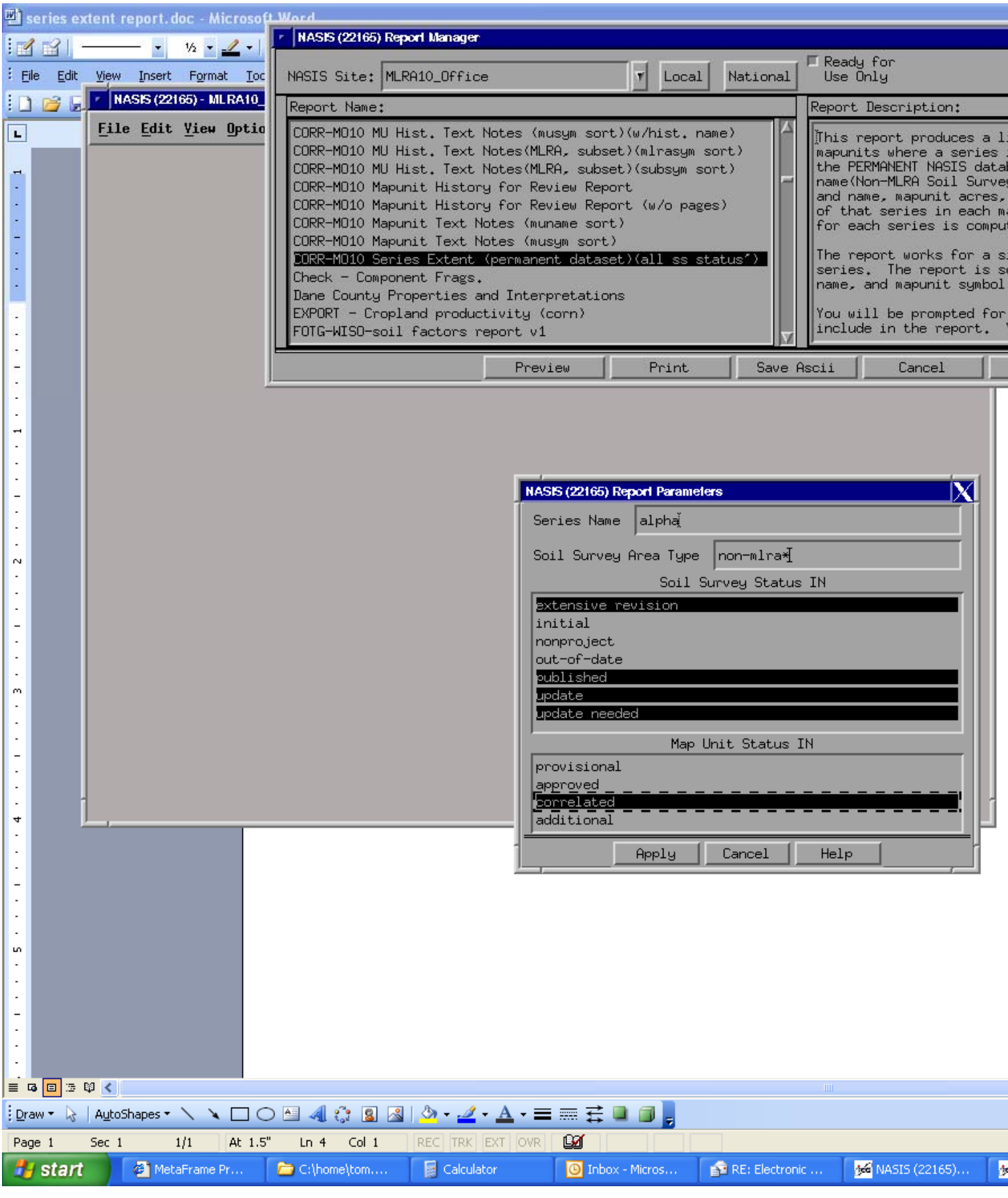
in/hr x 7.0572 = µm/sec

K_{sat} Class			Permeability Class		
µm/sec		**in/hr**	**µm/sec**		**in/hr**
705.00	VERY HIGH	99.90	705.00	VERY RAPID	99.90
			141.14	RAPID	20.00
100.00	HIGH	14.17			
			42.34	MODERATELY RAPID	6.00
			14.11	MODERATE	2.00
10.00	MODERATELY HIGH	1.42			
			4.23	MODERATELY SLOW	0.60
			1.41	SLOW	0.20
1.00	MODERATELY LOW	0.14			
			0.42	VERY SLOW	0.06
0.10	LOW	0.01			
0.01	VERY LOW	0.001	0.01	IMPERMEABLE	0.002
0.00 **µm/sec**		0.00 **in/hr**	0.00 **µm/sec**		0.00 **in/hr**

µm/sec x 0.1417 = in/hr ***in/hr x 7.0572 = µm/sec***

Example of narrative conversion:
Moderate permeability = Moderately high saturated hydraulic conductivity

APPENDIX C - NASIS Series Extent Report



APPENDIX D - Diagnostic Horizons and Features for Taxonomic Placement

(REF: Keys to Soil Taxonomy, Tenth Edition, 2006)

Epipedons (diagnostic surface horizons)

- Anthropic-- 0 to _____ centimeters
- Folistic-- 0 to _____ centimeters
- Histic-- 0 to _____ centimeters
- Melanic-- 0 to _____ centimeters
- Mollic-- 0 to _____ centimeters
- Ochric-- 0 to _____ centimeters
- Plaggen-- 0 to _____ centimeters
- Umbric-- 0 to _____ centimeters

Diagnostic Subsurface Horizons

- Agric-- _____ to _____ centimeters
- Albic-- _____ to _____ centimeters
- Argillic-- _____ to _____ centimeters
- Calcic-- _____ to _____ centimeters
- Cambic-- _____ to _____ centimeters
- Duripan-- _____ to _____ centimeters
- Fragipan-- _____ to _____ centimeters
- Glossic-- _____ to _____ centimeters
- Gypsic-- _____ to _____ centimeters
- Kandic-- _____ to _____ centimeters
- Natric-- _____ to _____ centimeters
- Ortstein-- _____ to _____ centimeters
- Oxic-- _____ to _____ centimeters
- Petrocalcic-- _____ to _____ centimeters
- Petrogypsic-- _____ to _____ centimeters
- Placic-- _____ to _____ centimeters
- Salic-- _____ to _____ centimeters
- Sombric-- _____ to _____ centimeters
- Spodic- _____ to _____ centimeters

Other Diagnostic Soil Characteristics (Mineral Soils)

- Abrupt Textural Change
- Albic Materials
- Andic Soil Properties
- Anhydrous Conditions
- Coefficient of Linear Extensibility (COLE)
- Durinodes
- Fragic Soil Properties
- Identifiable Secondary Carbonates
- Interfingering of Albic Materials
- Lamellae
- Linear Extensibility (LE)
- Lithologic Discontinuities
    - Abrupt textural contacts
    - Contrasting sand sizes
    - Bedrock lithology vs. rock fragment lithology in the soil
    - Stone lines
    - Inverse distribution of rock fragments
    - Rock fragment weathering rinds
    - Shape of rock fragments
    - Soil color
    - Micromorphological features
    - Use of laboratory data
        - Visual scan
        - Data on a clay-free basis
- *n* Value
- Petroferric Contact
- Plinthite
- Resistant Minerals
- Slickensides
- Spodic Materials
- Volcanic Glass
- Weatherable Minerals

Characteristics Diagnostic for Organic Soils

- Kinds of Organic Soil Materials
    - Fibric Soil Materials
    - Hemic Soil Materials
    - Sapric Soil Materials
    - Humilluvic Material
    - Limnic Materials
        - Coprogenous Earth
        - Diatomaceous Earth
        - Marl
- Thickness of Organic Soil Materials (Control Section of Histosols and Histels)
    - Surface Tier-- ____ to ____ centimeters
    - Subsurface Tier-- ____ to ____ centimeters
    - Bottom Tier-- ____ to ____ centimeters

Horizons and Characteristics Diagnostic for Both Mineral and Organic Soils

- Aquic Conditions
    - Saturation
        - Endosaturation
        - Episaturation
        - Anthric saturation
    - Redoximorphic features
        - Redox concentrations
            - Nodules and concretions
            - Masses
            - Pore linings
        - Redox depletions
            - Iron
            - Clay
        - Reduced matrix
        - Alpha,alpha-dipyridyl reaction
- Cryoturbation
- Densic Contact
- Densic Materials
- Gelic Materials
- Glacic Layer
- Lithic Contact
- Paralithic Contact
- Paralithic Materials
- Permafrost

- Soil Moisture Regimes
    - Soil Moisture Control Section
    - Classes of Soil Moisture Regimes
        - Aquic
        - Aridic
        - Torric
        - Udic
        - Ustic
        - Xeric
- Soil Temperature Regimes
    - Cryic
    - Frigid
    - Mesic
    - Thermic
    - Hyperthermic
    - Isofrigid
    - Isomesic
    - Isothermic
    - Isohypothermic
- Sulfidic Materials
- Sulfidic Horizon

Control Sections (Mineral Soils and Mineral Layers of some Organic Soils)

- Soil Moisture-- ____ to ____ centimeters
- Particle-Size Class-- ____ to ____ centimeters
- Mineralogy Class-- ____ to ____ centimeters
- Cation-Exchange Activity Class-- ____ to ____ centimeters
- Calcareous and Reaction Classes-- ____ to ____ centimeters
- Soil Temperature-- ____ centimeters
- Classes of Coats-- ____ to ____ centimeters
- Classes of Permanent Cracks-- ____ to 100 centimeters

Control Sections (Family Differentiae for Histosols and Histels)

- Particle-size class-- ____ to ____ centimeters
- Ferrihumic Mineralogy Class-- ____ to ____ centimeters
- Terric subgroup Mineralogy Class-- ___ to ____ centimeters

Series Control Section

- Series-- ____ to ____ centimeters