Soil Field Guide for Identifying Conservation Tree and Shrub Groups

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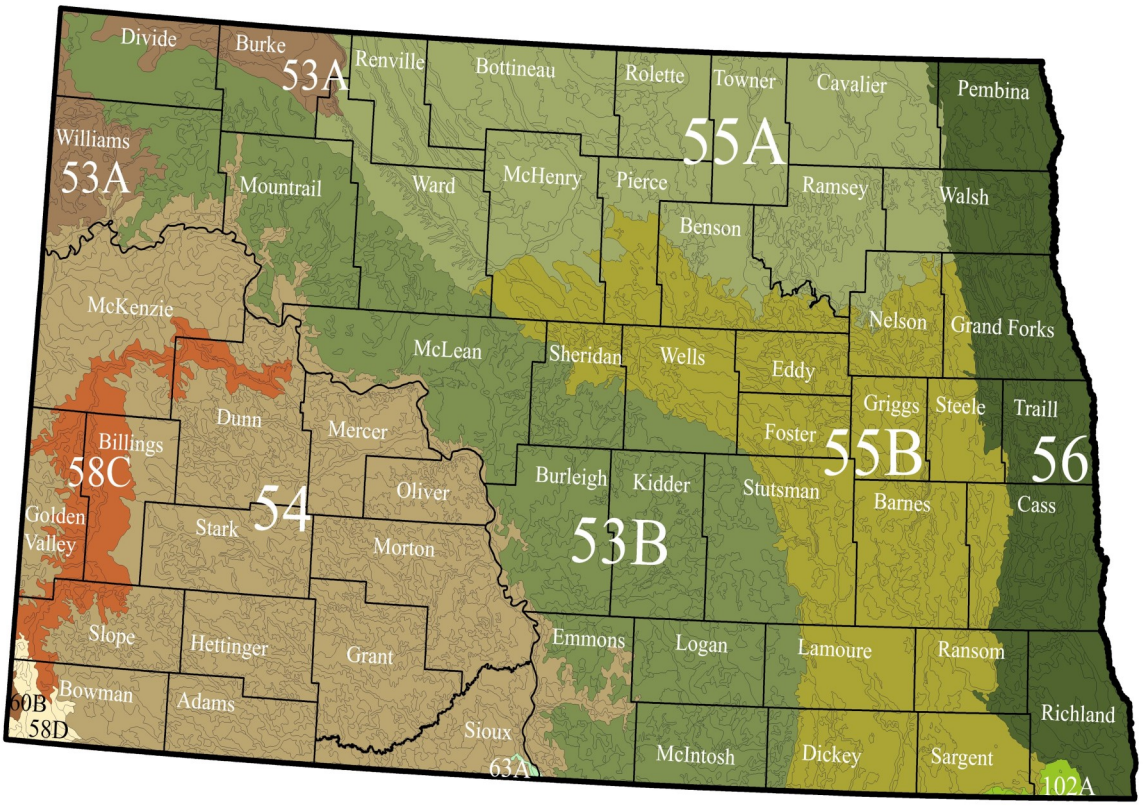
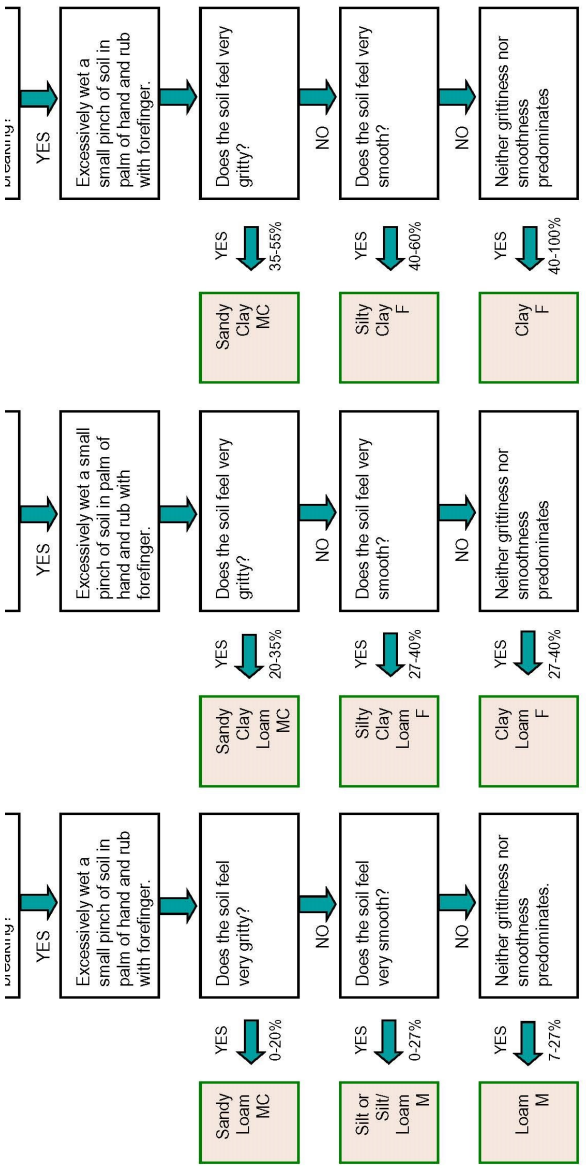


FOREWORD

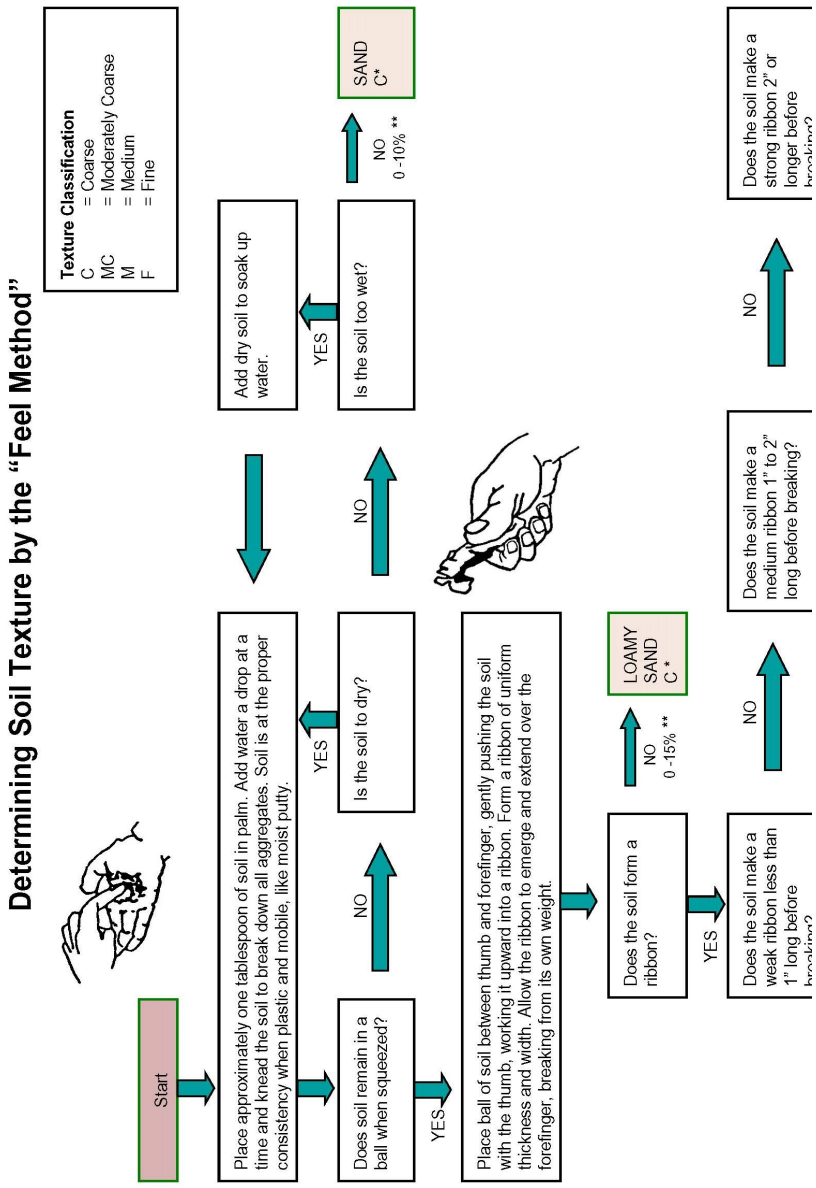
The "Soil Field Guide for Identifying Conservation Tree and Shrub Groups" (CTSG) was designed for field use by individuals with limited soils experience. Knowledge of "Texture by Feel Method" and several key soil features will enable users to assign tree and shrub groups. Soils are defined by a range of characteristics that change gradually over the landscape. Determining where to examine the soil will greatly influence your outcome. Always choose a representative site within the area of investigation.



* Sand Particle size should be estimated (very fine, fine, medium, coarse) for these textures. Individual grains of very fine sand are not visible without magnification and there is a gritty feeling to a very small sample ground between the teeth. Some fine sand particles may be just visible. Medium sand particles are easily visible. Examples of sand size descriptions where one size is predominant are; very fine sand, fine sandy loam, loamy coarse sand.

** Clay percentage range.

Modified from: Thien, Steven J., Kansas state University, 1979 Jour. Agronomy education.



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Using the Field Guide

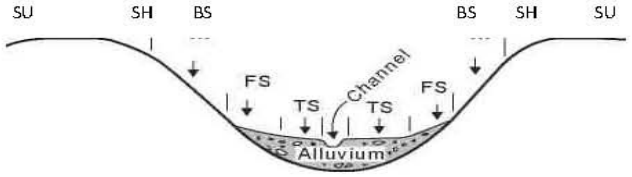
The field guide arranges Conservation Tree and Shrub Groups (CTSG) in a hierarchy. Utilizing the criteria below, **determine the CTSG Set using the first match starting with Set 1**. If a field site does not correspond with sets 1-4, consider the CTSG in the set 5 . CTSGs are determined within each set using National Forestry Manual soil criteria.

Site Criteria	CTSG Set
(1)Poorly drained or wetter (2) claypan ≤ 6 inches from the surface (3) EC ≥8 within 12 inches of the surface. (4) <20 inches to bedrock (5) <14 inches to sand and gravel, (6) very stony or very bouldery surface modifiers, (7) channeled components, slopes >15 percent.	Set #1 Severely Restrictive CTSG 10 Pages 6 and 7
Somewhat poorly drained	Set #2 High Water Table CTSG - 2. 2K, 2KK, H Pages 8 and 9
1. Shallow to Moderately deep to sand/ and/or gravel (< 40 inches). 2. Claypan 6 to 18 inches from the surface. 3. Moderately deep (20 to 40 inches) to bedrock (MLRA 54, 58C, 58D). 4. EC of 4 to 8 in the surface and or subsoil.	Set #3 Root Restrictive CTGSs - 4, 4C, 4CK, 6D, 6DK, 6G, 6GK, 9N, 9W Pages 10, 11, 12
1. Surface and subsoil layers form a <1-inch ribbon and soil feels very gritty when excessively wet . Additionally, the soil has ≤16 inches of mollic color. 2. Surface and subsoil layers do not form a ribbon and may form a ball when squeezed (loamy fine sand to fine sand).	Set #4 Sandy and Sands Textural Family CTSG - 5, 5K, 7 Pages 16 and 17
Soils that do not fit the above criteria.	Set #5 Least Restrictive CTSG - 1, 1K, 3, 8K Pages 18 and 19

GLOSSARY (Cont.)

Position	Code
summit	SU
shoulder	SH
backslope	BS
footslope	FS
toeslope	TS

Hill Slope Position
Two-dimensional descriptors of parts of line segments along a transect that runs up and down the slope. Record sample site of soil.

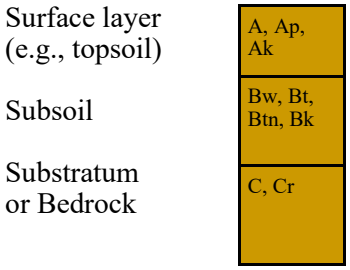


GLOSSARY (Cont.)

Saline Soil – A soil containing sufficient soluble salts to adversely affect vegetative growth and species adaptation. Salts maybe identified in the soil as threads or spherical concentrations that do not react with 1N hydrochloric acid (HCL). Boundaries are sharp and concentrations are white in color. The salinity levels in the surface and subsoil layers must be slightly saline (4 - 8 mmhos/cm) to meet criteria of *CTSG 9W.*

Soil Profile – a vertical section of the soil extending through all its horizons and into the parent material.

Typical Soil Horizonation



CTSG Modifiers

The letter attached to most CTSGs identifies groups of similar soil. Characteristics of each group significantly affect the selection and height growth of trees and shrubs. Letters used represent key soil characteristics for the group:

- C = Clay
- D = Restrictive layer to roots
- K or KK = Carbonates (CaCO3)
- G = Sand and Gravel
- H = Histosols (muck, peat, mucky peat)
- S = Sandy
- W = Wetness

Caution

- **EC ratings contained in this guide are assessed using the saturated paste method. Measurement of salinity using the 1:1 method (i.e., soil:water ratio) must be multiplied by 2 to correlate to saturated paste ratings used in this guide.**

Set #1
Severely Restrictive
CTSG 10

CTGS 10 Criteria

- Landscape – NA
- Bedrock – see Criteria
- Carbonates – NA
- Claypan – See Criteria
- Drainage – See Criteria
- Flooding – See Criteria
- Salinity – See Criteria
- Slope – See Criteria
- Texture – See criteria

If a field site was poorly drained, but now has a surface drain or has subsurface drainage (tile) and does not correspond with the criteria on page 6 or 7, consider Set #2.

GLOSSARY (Cont.)

Redoximorphic Features - In soil horizons, iron and manganese give soils their characteristic brown, red and yellow colors. In saturated soil conditions, iron and manganese are stripped from soil particles and become mobile with water. As the soil dries, iron and manganese are deposited in areas in the soil refered to as *concentrations*. Typically, concentrations are on the surface of soil clods and/or in root channels. They appear as rusty brown colored (iron) or dark purple colored (manganese) thread-like features and/or irregular shaped spots. Areas in the soil where iron and manganese have been removed are referred to as *depletions*. Typically, depletions are on the surface of soil clods and/or in root channels. They appear as gray colored thread-like features and/or irregular shaped spots. These concentrations and depletions of iron and manganese (i.e., redoximorphic features) are a result of prolonged saturation in soil.

The formation of redoximorphic features is a complex process. For more information, reference the publication "Field Indicators of Hydric Soils in the United States" USDA, NRCS.

Sand and Gravel – *Shallow and Very Shallow Ecological Site* uses the term "shallow and very shallow" to describe the depth of sand and gravel. The depth is described
below: The term "gravelly" is used to describe the subsoil material which contains varying percents of sand and gravel.

Depth

- Very Shallow – <14 inches
- Shallow – 14 to 20 inches
- Moderately deep - 20 to 40 inches

GLOSSARY (Cont.)

periodically during the growing season or remains wet for long periods of time.

7. Very poorly drained – water table is 1.0 foot above to 1.0 feet below the soil surface. Water is removed from the soil so slowly that free water remains at or very near the surface.

Flooding – The temporary covering of the soil surface by **flowing water**.

1. Frequently Flooded – flooding is likely to occur often under usual weather conditions: more than a 50 percent chance of flooding in any year.

2. Occasional Flooding – flooding is expected infrequently under usual weather conditions: percent chance of flooding in any year or ground surface during much of the growing season 5 to 50 times in 100 years.

3. Rarely Flooded – flooding is unlikely but possible under unusual weather conditions; 1 to 5 percent chance of flooding in any year or nearly 1 to 5 times in 100 years.

Mollic Colors - The soil has Munsell color values of 3 or less when moist and of 5 or less when dry and chroma of 3 or less.

Ponding – The covering of the soil surface by **stagnant water.**

Porcelanite - Fused shales and clay that occur in the roof and floor of burned coal seams. Commonly referred to as scoria.

CTSG 10 Criteria

One or more of the following must apply:

- Poorly drained or wetter
- Ponded
- Frequent flooding
- Channeled map units
- Claypan < 6 inches of the soil surface
- EC > 8 mmhos within 12 inches of the surface
- < 20 inches to bedrock
- < 14 inches to sand and/or gravel
- Very or extremely stony surfaces
- Very or extremely bouldery surfaces
- Very or extremely channery surfaces
- Soils that do not form a ball in the subsoil and are well to excessively well drained.

Set #2
Hight Water Table - CTSG 2

Criteria

- Landscape – NA
- Bedrock – Very Deep
- Carbonates – Allowed within 16 inches in 2, 2K and 2KK
- Claypan – NA
- Drainage – Somewhat poorly drained or drained poorly drained
- Flooding – Rare, short duration
- Salinity – EC <4
- Slope – <1% for CTSG 2, 2K, 2KK. <15% for CTSG 2H
- Texture – NA

GLOSSARY

Drainage – The field key refers to "High Water Table Ecological Groups" which uses drainage classes to distinguish between several sites influenced by ground water. Water tables are determined by the depth to free water and duration (significant periods during the growing season).

1. Excessively drained – Water table is >5 feet from the soil surface. These soils have very high hydraulic conductivity and low water holding capacity.

2. Somewhat excessively drained – Water table is >5 feet from the soil surface. These soils have high hydraulic conductivity and low water holding capacity.

3. Well drained – Water table is >5 feet from the soil surface. Water is available to plants most of the growing season. Wetness does not inhibit growth of roots.

4. Moderately well drained – Water table is 3.5 to 5 feet below the soil surface. Water is removed somewhat slowly during some periods of the year. Soil are wet for only short time within the rooting depth.

5. Somewhat poorly drained – Water table is 1.5 to 4 feet below the soil surface. Water is removed slowly so that the soil is wet at a shallow depth for significant periods during the growing season.

6. Poorly drained – Water table is 1.0 foot above to 1.5 feet below the soil surface. Water is removed so slowly that the soil is wet at shallow depths

GLOSSARY

Bedrock – Most bedrock in North Dakota is soft and weathered. Common types are sandstone, siltstone, and shale. Weathered bedrock has a platy appearance which fractures horizontally. The depth to bedrock is described below:

Depth

- Very Shallow – <10 inches
- Shallow – 10 to 20 inches
- Moderately deep – 20 to 40 inches
- Deep – 40 to 60 inches
- Very deep – >60 inches

Calcareous (limy) Soil – Soil containing sufficient free $CaCO_3$ (lime) to effervesce (gaseous response seen as bubbles) visibly when treated with 0.1 *N* hydrochloric acid (HCL) (obtain from soil scientist). Site key will address amounts and depth of carbonates.

- Non Effervescent – no bubbles form
- Slight Effervescent – numerous bubbles form
- Strong Effervescent – bubbles form low foam
- Violent Effervescent – bubbles form a thick foam

Claypan – A dense, compact layer in the subsoil having much higher clay content than the overlying material. It is separated by a sharply defined boundary. In undisturbed areas, the soil structure in the subsoil is columnar in shape. They are vertical elongated soil peds with very distinct and normally rounded tops. They usually impede movement of water, air, and the growth of plant roots.

CTSG Site Criteria

Review all CTSG within this set and choose the best match.

CTSG 2 - **None to slight effervescence in the surface and subsoil.** EC ≤ 4 in the surface and subsoil. Slopes are <1%.

CTSG 2K - none to slight effervescence in the surface layer and **slight to violent effervescence in the subsoil**. **EC < 4 in the surface and/or subsoil.** Slopes are <1%.

CTSG 2KK - none to strong effervescence in the surface layer and violent effervescence in the subsoil. **ECs < 4 in the surface and/or subsoil.** Slopes are <1%.

CTSG 2H - **surface layer is organic material 8 to < 16 inches thick** (otherwise known as a "Histic Epipedon." - A surface layer consisting of plant material in varying degrees of decomposition). Slopes are <15%.

Set # 3
Root Restrictive
CTSGs - 4, 4C, 4CK, 6D, 6DK , 6G, 6GK, 9, 9W

Criteria

- Landscape – NA
- Bedrock – Moderately deep to very deep
- Carbonates – See CTSGs
- Claypan – Allowed in CTSG 9N
- Drainage – Moderately well to somewhat excessively drained (unless other wise stated)
- Flooding – None
- Salinity – EC of 4 to 8 in CTSG 9 and 9W. All other CTSG in set 3 have ECs of <4.
- Slope – See site criteria
- Texture – See site criteria

CTSG Site Criteria

Review all CTSG within this set and choose the best match.

CTSG 1 - *surface and subsoil layers* form a <2-inch ribbon (fine sandy loam to silty clay loam). These soils have **≥16 inches of mollic color**. **The surfaced layer and the upper part of the subsoil is none effervescent.** Slopes are ≤ 6 percent. (6 - 15% slopes use CTSG 3.)

CTSG 1K - surface layer form a <2-inch ribbon (silt loam, loam). Subsoil layers form a < 2-inch ribbon (silt loam to clay loam). **These soils are none to strongly effervescent in the surface layer and slightly to strongly effervescent in the subsoil. EC < 4 in the surface and/or subsoil. These sites are on flood plains or low terraces**. Slopes are ≤6 percent.

CTSG 1KK - surface layer form a <2-inch ribbon (silt loam, loam). Subsoil layers form a < 2-inch ribbon (silt loam to clay loam). These soils are none to strong effervescence in the surface layer and **violent effervescence in the subsoil.** ECs < 4 in the surface and/or subsoil**. These soils are moderately will drained.** Slopes are <6%.

CTSG 3 - *surface and subsoil layers* form a <2-inch ribbon (fine sandy loam to silty clay loam). These soils have **≤16 inches of mollic color. The upper part of the subsoil is non effervescent.** Slopes are ≤15 percent.

CTSG 8K- surface layer form a <2-inch ribbon (silt loam, loam). Subsoil layers form a <2-inch ribbon (silt loam to clay loam). **These soils are none to violently effervescent in the surface layer and strongly to violently effervescent in the subsoil. These sites are on upland knolls and ridges**. Slopes are ≤9 percent.

Set #5
Least Restrictive
CTSG 1, 1K, 3, 8K

Criteria

- Landscape – CTSG 1K are on low terraces or flood plains.
- Bedrock – Very Deep
- Carbonates – See Criteria
- Claypan – None
- Drainage – **Well to somewhat poorly drained**
- Flooding – See site criteria
- Salinity – EC < 4
- Slope – See Criteria
- Texture – *surface and subsoil layers* form a <2-inch ribbon (fine sandy loam to silty clay loam).

CTSG Site Criteria

Review all CTSG within this set and choose the best match.

CTSG 4 - Surface layer forms a 1 to 2 inch ribbon (fine sandy loam to silty clay loam). The subsoil forms a 2 inch or longer ribbon (silty clay or clay). Slopes are <15%.

CTSG 4C - Surface and subsoil layers form a 2 inch or longer ribbon (silty clay or clay). Includes somewhat poorly to well drained. Slopes are <9%.

CTSG 4CK - Surface and subsoil layers form a 2 inch or longer ribbon (silty clay or clay). **The surface layer and subsoil are slight to strongly effervescent.** Slopes are <9%.

CTSG 6D - Surface and subsoil layers form a ribbon <2 inches long ribbon (fine sandy loam to silty clay loam). **Soft weather bedrock is moderately deep (20 to 40 inches).** Slopes are <15%.

CTSG 6DK - Surface and subsoil layers form a ribbon <2 inches long (fine sandy loam to silty clay loam). **The surface layer and subsoil are slight to strong effervescent. Soft weather bedrock is moderately deep (20 to 40 inches).** Slopes are <15%.

CTSG 6G - Surface and subsoil layers form a ribbon (fine sandy loam to silty clay). **Soils are shallow (14 to 20 inches) to moderately deep (20 to 40 inches) to sand or sand/gravel.** Slopes are <15%.

Continued:

Set # 3 Root Restrictive
CTSG Site Criteria (Cont.)

Review all CTSG within this set and choose the best match.

CTSG 6GK - The surface a subsoil form a ribbon (sandy loam, to silty clay). **Depth to loamy fine sand or coarser textures (including ≤ 35% gravel) is moderately deep (20 to 40 inches). The surface layer and subsoil are slight to strongly effervescent.** Slopes are <15%.

CTSG 9N/9 - **The subsoil layer exhibits claypan characteristics within 6 to 18 inches of the soil surface. EC is 4 to 8.** Water table is >36 inches from the surface.

CTSG 9W - **ECs ranging from 4 to 8 in the surface and/or subsoil. Water table is 18 to 60 inches from the surface.**

CTSG Site Criteria

Review all CTSG within this set and choose the best match.

CTSG 1S - surface and subsoil may form a ribbon or a ball when squeezed (fine sandy loam to coarse loamy sand.) **These soils are moderately well drained and have depletions or redox features within 30 inches.** (Hecla, Falsen) Slopes are <6 percent.

CTSG 5 - surface layer forms a <1-inch ribbon (fine sandy loam, sandy loam) and feels very gritty when excessively wet). The subsurface layer forms a ribbon from <2 inches. These soils have ≤16 inches of mollic color. **The surface layer and upper part of the subsoil are non-effervescent.** These soils are well, to excessively well drained. Slopes are <15 percent. (Egeland)

CTSG 5K - **s**urface and subsoil layers form a < 1-inch ribbon (fine sandy loam, sandy loam) and feels very gritty when excessively wet). **The surface layer and subsoil are slight to strongly effervescent.** Slopes are <15 percent. (Trembles)

CTSG 7 - **surface and subsoil layers do not form a ribbon but form a ball when squeezed (loamy fine sand, loamy sand).** Slopes are <6 percent. These soils are well, to excessively well drained. (Maddock)

User Notes for CTSG 7

- Rank soils with <20 inches of loamy fine sand or loamy sand over coarser texture material into CTSG 10.
- Rank soils with >10 inches of fine sandy loam or sandy loam in CTSG 5.
- Rank coarse sandy loam like a loamy sand and loamy coarse sand like sand.

Set #4
Sandy and Sands Textural Family
CTSG 5 5K and 7

Criteria

- Landscape – NA
- Bedrock – Moderately Deep to Very Deep
- Carbonates – See criteria
- Claypan – None
- Drainage – Moderately well to excessively drained
- Flooding – None to Frequent
- Salinity – EC <4
- Slope – See criteria
- Texture – See Criteria

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