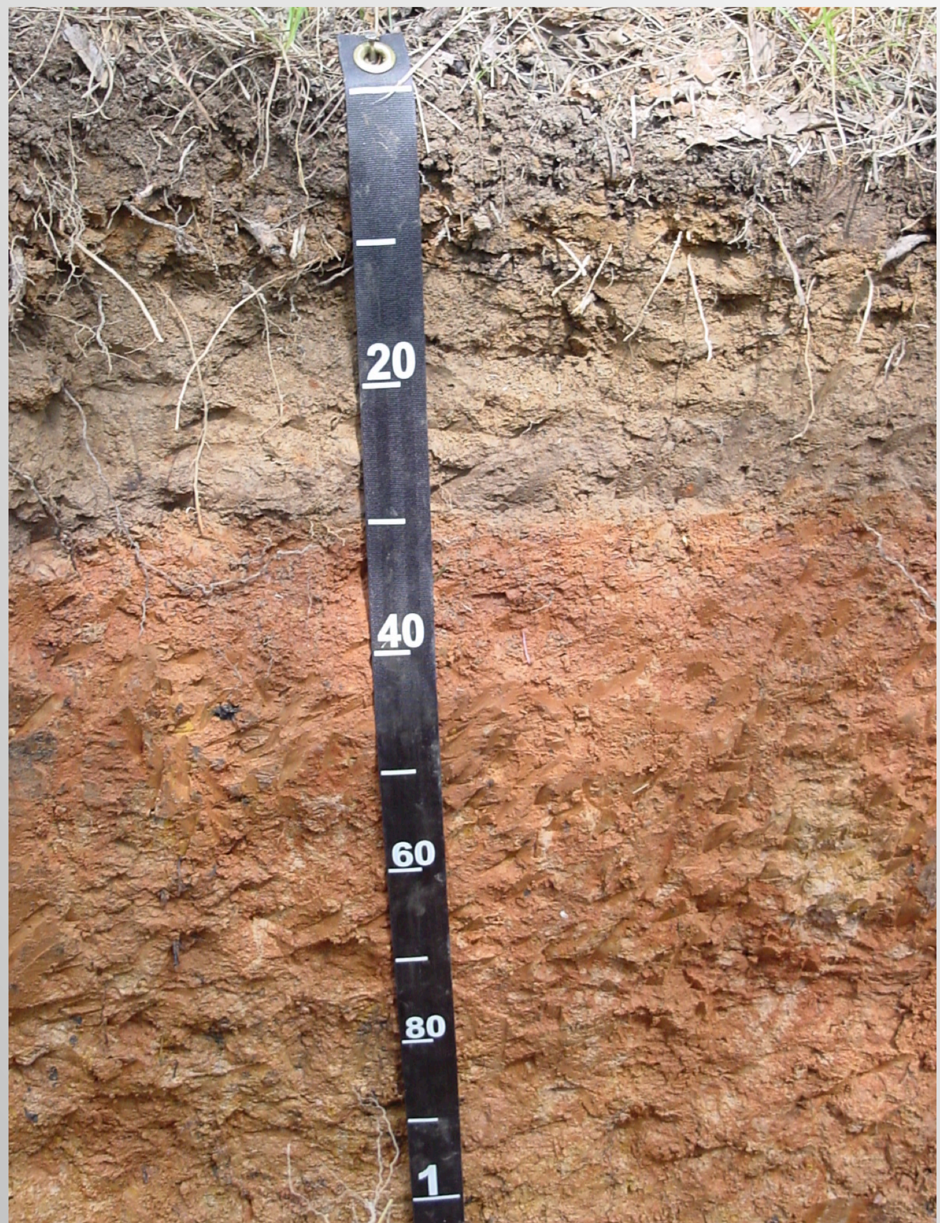
Contest Guidelines

Region IV
Soil Judging Contest
September 25-26, 2014

Kingsville, Texas

Texas A&M University-Kingsville

Department of Agriculture, Agribusiness and Environmental Science



United States Department of Agriculture

Natural Resources Conservation Service

Guidelines

2014 REGION IV SOILS CONTEST

September 25-26, 2014

Kingsville, TX

Hosted by:

Texas A&M University - Kingsville

CONTEST RULES

Acknowledgement

This competition would not have occurred if not for the generous involvement of Soil Scientists Gary Harris, Jim Akin, and Clark Harshbarger of the USDA NRCS. Over the course of 2013-2014 several NRCS Soil Scientists have been Acting State Soil Scientist. They have never failed to be of help in the preparation for this competition.

Fidel Hernandez and Glen Perrigo of TAMU-Kingsville were of generous help in the access to soil profiles on TAMU-Kingsville property. Other anonymous individuals are responsible for other aspects of this contest.

Team Composition

A team is composed of three or four undergraduate students who are enrolled in a full-time, four-year curriculum in the institution they are representing. Each institution may enter only one team in the contest. Additionally, alternate competitors from each team are allowed to compete in the contest activities, but their individual-pit-judged scores will not count towards the sweepstakes (i.e., overall) total. However, alternate competitors are eligible for individual awards. All students must be eligible to represent their institution according to the rules and regulations governing eligibility at their institution. Team and alternate students should be designated by **9:00 pm Wednesday night, September 24, 2014.**

Contest Format

This contest will be an "open book" contest, but only the contest guidelines packet may be used during the contest. Cell phones are prohibited. Students must correctly enter their contestant ID code on their scorecard. Scorecard entries must be made according to the instructions for each specific feature to be judged (see following sections of this guidelines packet). Only one response should be entered in each blank, unless told otherwise.

The contest will consist of three parts: a) four, individually judged pits (Thursday), b) one, team-judged pit (Friday), and c) the sweepstakes (overall) score, a combination of both team and individual results. The sweepstakes placings will be used to select which teams advance to the National Collegiate Soil Judging Contest in Spring 2015.

This regional contest is also meant to expose and prepare students to the additional rigor of the national contest. Therefore, several additional scorecard items have been included for this regional contest that have not previously been included in the Region IV scorecard.

The team scores from the individually judged pits will be the sum of the top three individual scores for each pit. Therefore, the sum of 13 scorecards (3 individuals x 4 individual pits + 1 team-judged pit) will determine the overall sweepstakes score per team. All alternate students from an institution may participate in the one team-judged pit. Students from institutions having less than three team members may compete, but they are only eligible for individual awards.

The clay content of the third horizon will be used to break ties in both the individual and team competitions. In order to break a tie in the overall sweepstakes scores, the mean whole-profile

clay content for individually judged Pit 1 will be calculated from the estimates provided by all members of a given team. The team with the mean estimate closest to the actual value will receive the higher placing. If this does not break the tie, the next pit in order (i.e., Pit 2) will be used in the same manner. For individual score ties, the clay content of the third horizon at Pits 1, 2, and so on, if necessary, will be compared to that estimated by the individual in order to break a tie between individuals. For the team-judged pit, the team estimate of the clay content of the third horizon will be compared to the actual value. The team with the estimate closest to the actual value will receive the higher placing. If this does not break the tie, the next deepest horizon will be used.
Results will be announced Friday afternoon and will be final. Awards will be given to the top three overall sweepstakes teams, the top team in the team-judged-pit portion of the contest, and the top five individuals in the individual-pit-judged portion of the contest.

At each site, a pit will be excavated and a restricted area will be designated on one of the pit walls for the measurement of horizon depth and determination of boundary distinctness. The restricted area will be clearly outlined and a nail will be placed somewhere in the third horizon. A tape measure will also be attached to the restricted area. THE RESTRICTED AREA IS TO BE UNDISTURBED! Picking, taking samples, or other disturbances within the restricted area will not be permitted. The pit ID #, MLRA, number of horizons to describe, depth to be considered, pH, percent base saturation (BS), sodium adsorption ratio (SAR), and percent organic carbon (OC) for each horizon and other relevant information will be displayed on a sign at each pit. Contestants should expect to evaluate between four and six horizons per pit. Slope stakes will be placed along the grade for determination of slope and to facilitate the determination of the landform and hill slope profile.

Fifty (50) minutes will be allowed for the judging of each contest pit. The morning of the individually judged pit portion of the contest, each contestant will be provided an assigned number-letter combination corresponding to team-group designations. This will uniquely identify each contestant and be used to facilitate rotations at the pit according to the schedule provided in Table 1.

Table 1. Contestant rotations at individually judged pits.

	Individual Pits 1 and 3		Individual Pits 2 and 4	
Time	Odd team no.	Even team no.	Odd team no.	Even team no.
First 5 min.	In*	Out	Out	In
Next 5 min.	Out	In	In	Out
Next 10 min.	In	Out	In	Out
Next 10 min.	Out	In	In	Out
Next 20 min.	Free**	Free	Free	Free

*In and Out refer to contestants being allowed in the pit or outside of the pit, respectively.
**During free time, contestants may remain in or out of the pit.

Team-pit Judging

Two teams will be at the team-judged pit at the same time, but start times for each team will be staggered so that only one team has access in the pit at a time. Each team will have two 10-minute intervals in the pit and two 10-minute intervals out of the pit (i.e., 10 minutes in, 10 minutes out, 10 minutes in, 10 minutes out) with the last 10 minutes of the 50-minute total time as free time to be in or out of the pit if desired.

Pit Restricted Area

A restricted area on the pit wall will be outlined with flagging and a tape measure mounted for every practice and contest pit that is NOT to be disturbed, and a nail will be inserted somewhere in the third horizon of each pedon, similar to that pictured in Figure 2. Contestants should provide the following for their personal use: tape measure, clinometers (or Abney level), water bottle or sprayer, acid bottle, knife, pencils, Munsell color charts, hand towel, hand lens, and containers for soil samples. Calculators, 2-mm diameter sieves, and clipboards may also be used. No other materials other than those supplied by the host will be permitted during the contest. Cell phones, pagers, or other communication devices are prohibited during the contest. Talking is NOT permitted between contestants during the 50 minutes of pit judging. Pit monitors will be instructed to collect scorecards from contestants and they will receive a zero for that pit if any of the above rules are broken, especially talking to other contestants. Contestants should show respect for each other and avoid creating distractions during the competition.

Figure 2. Example of restricted area of pit wall.

Scoring and Abbreviations

Grading will be conducted by individuals competent in soil morphology and classification. Each grader will grade only one pit and each scorecard will be re-graded and scores tallied by a second individual for confirmation of accuracy. Point allocations vary among cells and are listed on the scorecard in parentheses. Where an answer is not needed or is inappropriate, a dash (-) may be used or the cell can be left blank.

Contestants may use the official abbreviations (preferred, see Attachment 1) or write out answers. Use of abbreviations other than official abbreviations is strongly discouraged, but graders shall give credit if, in their opinion, the meaning of an unofficial abbreviation is obvious.

For the individually judged portion of the contest, a team is composed of three or four undergraduate students. The team score will be the sum of the top three individual scores at each pit (see example in Table 2). This method maximizes the opportunity for all four team members to contribute to the final team score.

Table 2. Score tabulation example for the individual contest. Shaded scores represent those that are the low score for a pit among the team's contestants and are not included in the team's total score for that pit or overall.

Contestant	**Pit 1**	**Pit 2**	**Pit 3**	**Pit 4**	**Total**
A	132	130	110	144	516
B	146	116	141	138	541
C	130	112	160	158	560

D	125	114	129	145	513
Total score:	**408**	**360**	**430**	**447**	**1645**

The score from the team-judged pit will be added to the individual scores for the overall sweepstakes team totals and final rankings.

SCORECARD INSTRUCTIONS

The scorecard consists of five parts: I. Soil Morphology; II. Soil Profile Characteristics; III. Site Characteristics; IV. Soil Classification; and V. Interpretations (refer to the attached scorecard example at the back of this guidelines packet). The Soil Survey Manual (Chapter 3, 1993), Field Book for Describing and Sampling Soils, version 3.0 (Schoeneberger et al., 2012), and Keys to Soil Taxonomy (12^{th} Edition, 2014) should be used as guides during practice. These publications are available at: http://soils.usda.gov/technical/.

Part I: Soil Morphology

A. Horizonation – (Chpt. 18, pp. 315-321, Keys to Soil Taxonomy, 2010)

Horizon designations will follow standard procedures, including a master, transitional or combination horizon symbol to be recorded in the "Master" column, and when needed, a lower case symbol in the suffix/subordinate distinction column labeled "Sub", and an Arabic numeral in the "No." column. Arabic numerals should be used in the "Prefix" column preceding the "Master" column to indicate lithologic discontinuities. Prime symbols to distinguish otherwise identical designations should be placed in the "Master" column. All B horizons must have a suffix/subordinate distinction. If no designation is necessary for a cell, contestants may leave the cell blank or record a dash (-) to indicate no designation. Only mineral horizons will be described for the contest, and students should be familiar with A, E, B, C and R horizon designations, plus transitional and combination horizons. Suffix symbols that could be used in the contest area are: b, c, d, g, k, kk, m, n, p, r, ss, t, u, w, y, and z. However, denoting a horizon with fragic properties with the suffix "x" will not automatically mean "fragipan" should be marked as an "Other Characteristic" under Part IV. Soil Classification.

B. Lower Depth

The depth of the lower boundary as measured from the soil surface should be recorded in centimeters (cm). Alternately, the depth of both the upper and lower boundary may be given, but only the depth to the lower boundary will be graded. For example, a Bt1 horizon occurring from 30-45 cm may be recorded as "45 cm" (preferred) or "30-45 cm". The last horizon boundary should be the specified judging depth with a "+" added. Thus, if the pit sign states "Describe 5 horizons to a depth of 140 cm", the fifth lower depth designation should be "140+".

However, when the specified depth is at a lithic or paralithic contact, the "+" is dropped from the depth.

Depth measurements should be made between the tapes in the restricted area on the pit wall using the mounted tape measure provided. A range for the lower depth considered correct will be based on the boundary's distinctness according to the following table. Where one horizon grades into another the location of the boundary will be specified at the middle of the transition zone.

Distinctness of boundary	Range for grading
Abrupt (A)	± 1 cm
Clear (C)	± 3 cm
Gradual (G)	± 8 cm
Diffuse (D)	± 15 cm

No horizon less than 8 cm thick will be described. If a horizon less than 8 cm thick occurs, it should be combined with the adjacent horizon that is most similar for the depth measurement purposes. When two horizons combine to a total thickness of 8 cm or more, the properties of the thicker horizon should be described. If lamellae are encountered that are thinner than 8 cm, then the convention is to describe the eluvial and illuvial horizons as a unit (i.e., E&Bt) and the thickest horizon's morphology would be described.

If a lithic contact occurs at the specified depth on the site card, the contact should be considered in evaluating hydraulic conductivity, effective soil depth, and water retention difference. Otherwise, the last horizon should be assumed to extend to 150 cm for making all relevant evaluations. If a paralithic contact occurs within the specified depth, the contact should be considered as one of the horizons to be included in the description, and the appropriate horizon nomenclature should be applied (i.e., Cr).

C. Boundary Distinctness (Chpt. 3, pp. 133 - 134, Soil Survey Manual)

Distinctness refers to the thickness of the zone within which the horizon boundary can be located. The distinctness of a boundary depends partly on the degree of contrast between the adjacent horizons and partly on the thickness of the transitional zone between them. The topography of the boundary will not be described for this contest. The boundary distinctness of the deepest horizon will not be described and should be left blank or with a dash (-) recorded in the cell.

Distinctness classes that will be used for this contest are:

Abrupt (A):	< 2 cm thick
Clear (C):	2-5 cm thick
Gradual (G):	5-15 cm thick
Diffuse (D):	> 15 cm thick

D. Clay Percentage, Coarse Fragments, and Texture (Chpt. 3, pp. 136 - 143, Soil Survey Manual)

Estimates of the clay content as a weight percentage of the soil fines should be recorded in the "Clay%" column. A scaled range for correct answers compared to values estimated by the judges will be used according to the following:

Actual %	Allowed Deviation
< 20	+/- 2
20-40	+/- 3
> 40	+/- 4

The textural class and % clay for each horizon will be determined by the judges and supported by laboratory data. Soil textural classes as defined in Chapter 3 and their official abbreviations (supplied to contestants as part of Attachments 1 and 2) will be used. Deviation from standard nomenclature will be incorrect (i.e., sandy silt or silty loam). Credit for sand, loamy sand, and sandy loam textures will NOT be given if sand modifiers are required (i.e.. very fine, fine, coarse, or very coarse). The textural class should be recorded in the "Class" column.

If clay skins are observed a check mark (√) or the initials "CF" should be placed in the 'clay films' column of the score card.

Coarse fragment modifiers are required as follows:

Coarse fragment (%, v/v)	Modifier
< 15%	none needed
15-34%	gravelly (GR) or cobbly (CB)
35-60%	very gravelly (VGR) or very cobbly (VCB)
> 60%	extremely gravelly (XGR) or extremely cobbly (ECB)

For this purpose the terms "gravel" and "cobble" are defined as below:

"Gravel" – fragments 2-75 mm in diameter of any lithology and shape.
"Cobble" – fragments of any shape and lithology that are > 75 mm diameter by their long axis.

If gravels and cobbles occur in the same horizon, the dominant condition should be described.Coarse fragment modifiers should be recorded in the column labeled "CF Mod." and should not be recorded in the "Class" column for the soil textural class.

E. Color (Chpt. 3, pp. 146 – 157, Soil Survey Manual)

The Munsell color notation to include hue, value, and chroma will be used to describe the moist soil color of each horizon. For <u>surface</u> horizons, the moist color will be determined on briefly rubbed samples as directed in the discussions of a mollic epipedon in the Keys to Soil Taxonomy (Chpt. 1, pp. 7-8, 2010). For all other horizons, the color recorded should be the <u>dominant</u> moist color of the matrix (i.e., the color that occupies the greatest volume of the horizon). Often the most noticeable color may be that of the ped surface, but the ped surface color may not constitute sufficient volume to be designated as the dominant color. The 2009 revised edition of the Munsell color charts will be used for color determinations for all practice and contest pits.

F. Structure (Chpt. 3, pp. 157 – 163, Soil Survey Manual)

Both grade (i.e., structureless, weak, moderate, or strong) and shape of structure should be recorded. Acceptable types of structure are restricted to the following: granular, platy, subangular blocky, angular blocky, wedge, prismatic, and columnar. If two structure types are present in a given horizon, describe the structure with the stronger grade. If the two structures are of equal grade, describe the one with the larger physical size. If there is no structure, indicate "structureless" (SL) in the grade column and either "massive" (MA) or "single-grained" (SG) in the shape column.

G. Effervescence

Material from each horizon should have 10% HCl applied to it so as to observe the effervescence of carbonates. Effervesence categories are: not ("N" or "-" or blank, very slight ("VSl"), slight ("Sl"), strong ("St"), and violent ("V").

H. Redoximorphic Features (Chpt. 1, pp. 24-25, Keys to Soil Taxonomy, 2010).

Redoximorphic features (RMFs) are soil morphological features caused by alternating reduction/oxidation (redox) processes. The reduction/oxidation of iron (Fe), and to a lesser extent manganese (Mn), minerals result in most RMF features. Iron is a major pigment that influences soil color. The loss, accrual, and valence/mineral state of Fe are major determinates of color patterns within or across soil horizons. Iron or Mn reduction occurs when free oxygen is limited or excluded from a soil volume or horizon by water saturation for extended time. Reduced iron (Fe^{2+}) is comparatively much more soluble and mobile than oxidized iron (Fe^{3+}), and moves with water flow and by diffusion gradients. When soil is reduced, Fe and Mn in local zones can be removed, leaving uncoated mineral grains (depletions) of lighter color. Reduced Fe is oxidized and precipitates when water drains from soil (reentry of free oxygen), or where oxygen is present in, or along, soil pores, including root channels, or along roots. The re-oxidized Fe or Mn may form crystals, soft masses, or hard concretions or nodules (concentrations). Oxidized Fe will generally have a redder or yellower color than adjacent soil particles, while Mn often will have a darker color than adjacent soil particles.

Therefore, redox *concentrations* (Con) are defined as zones of Fe-Mn accumulation from:

1. Nodules and concentrations - Concentrations have internal rings and nodules do not.
2. Masses - Masses are non-cemented concentrations.
3. Pore linings - Pore linings may be either coatings on pore surfaces or impregnations from the matrix adjacent to pores.

Redox *depletions* (Dep) are defined as zones with chromas less than, or values higher than those in the matrix where either Fe, or Mn, or both Fe, and Mn, have been removed through reduction and transport processes.

The presence of redox concentrations and/or depletions should be recorded in the column labeled "Con/Dep". If only concentrations exist, record only "Con". If only depletions exist, record only "Dep". If both concentrations and depletions occur, record both "Con" and "Dep". If no RMFs exist, then leave the cell blank or record a dash (-) in the cell. If both concentrations and depletions occur in the same horizon, the abundance for each should be recorded.

Record the abundance of RMFs in the column labeled “Abund” as few (< 2%, F), common (2-20%, C), or many (> 20%, M) of the most abundant RMF present.

Part II: Soil Profile Characteristics

A. Hydraulic Conductivity

The saturated hydraulic conductivity of the surface horizon (Surface) and the most-limiting horizon (Limiting Layer) within the depth specified for judging will be estimated. Should a lithic, paralithic, or densic contact occur at or above the specified judging depth, it should be considered in evaluating hydraulic conductivity.

The three general categories for hydraulic conductivity to be used in this contest are the following:

High - Greater than 3.6 cm/hr. This class includes sands and loamy sands and some highly structured sandy loams. Horizons containing large quantities of coarse fragments with insufficient fines to fill many voids between the fragments are also included in this class.

Moderate - Between 0.036 and 3.6 cm/hr. This class includes materials excluded from the “Low” and “High” classes.

Low - Less than 0.036 cm/hr. Low hydraulic conductivity should be indicated based on the following criteria:

1) Clays, silty clays, or sandy clays that are structureless or have a structure grade of weak or moderate
2) Silty clay loams and clay loams that are structureless or have a structure grade of weak
3) Dense layers (i.e., that use “d” as a horizon suffix)
4) Bedrock layers (i.e., Cr or R horizons) where the horizon directly above contains redoximorphic depletions or a depleted matrix (i.e., color value ≥ 4 with chroma ≤ 2) due to prolonged wetness and indicative of restricted water flow

B. Effective Soil Depth

Effective soil depth classes are defined as the depth from the soil surface to the upper boundary of a root-restricting layer. Root-restricting layers include lithic and paralithic contacts, cemented layers, fragipans, and dense horizons. A sand and/or gravel layer with insufficient fines to fill the voids is also restrictive. If the lower depth of judging is less than 150 cm, and there is no restricting layer within or at the judging depth, the horizon encountered at the bottom of the judged profile may be assumed to continue to at least 150 cm. Effective soil depth classes are:

Very Shallow…………root-restricting layer within 25 cm of soil surface
Shallow………………..root-restricting layer from 25 to 49 cm

Moderately deep……...root-restricting layer from 50 to 99 cm
Deep…………………..root-restricting layer from 100 to 149 cm
Very deep……………..root-restricting layer at 150 cm or deeper

C. Water Retention Difference

The amount of water that a soil can hold between -33 kPa (-1/3 bar) and -1500 kPa (-15 bars) soil-water tension within the zone accessible to roots is the water retention difference of the soil. The water retention difference of the whole soil is calculated by estimating the amount of water each horizon can hold, determining which horizons are sufficiently accessible to plant roots to be significant sources of water, and summing the water retention differences of the accessible layers. Water retention difference is commonly expressed in cm water/cm soil. Classes are based on the amount of water retention difference in the upper 1.5 m of soil, or above a root-limiting layer, such as a lithic or paralithic contact. A number of factors are used to determine the water retention difference of individual horizons. These include texture, clay mineralogy, soil structure, volume of coarse fragments, organic matter content, and bulk density. For the contest, only texture and volume of coarse fragments will be used to estimate the water retention differences of individual horizons above 1.5 m. Estimated water retention in relation to texture is provided in Table 3. If the instructions for a pit require judging a profile that is less than 1.5 m deep, then assume the last horizon extends to a depth of 1.5 m unless it is directly underlain by or contains a lithic or paralithic contact. Contestants are to assume that plant roots are sufficiently restricted by these contacts that no water is available below the contact. Coarse fragments are considered to have negligible (assume zero) moisture retention so estimates must reflect the coarse fragment content (i.e., subtract the percentage of coarse fragment volume from the whole-soil volume). Table 4 is a sample calculation of water retention difference. The five classes for water retention difference recognized are:

Very Low:	< 7.50 cm
Low:	7.50-14.99 cm
Medium:	15.00-22.49 cm
High:	22.50-29.99 cm
Very High:	> 30 cm

Table 3. Estimated relationships among water retention difference coefficients and soil textural class.

Texture Class of Soil Horizon	**cm H2O/cm soil**
silt, silt loam, silty clay loam, loam, clay loam, and very fine sandy loam	0.20
sandy loam, fine sandy loam, sandy clay loam, sandy clay, clay, and silty clay	0.15
coarse sandy loam, loamy fine sand, loamy very fine sand, and loamy sand	0.10
loamy coarse sand and all sands	0.05

Table 4. Example calculation for water retention difference.

Horizon	Depth	Textural Class	Coarse Fragments (%)	Water Retention	
Ap	0-12	ls	0	(12cm)(0.10) =	1.2
Bt1	12-28	sc	0	(16cm)(0.15) =	2.4
Bt2	28-54	scl	0	(26cm)(0.15) =	3.9
2Bt3	54-105	l	5	(51cm)(0.20)(0.95) =	9.69
2Bt4	105-132	grl	20	(27cm)(0.20)(0.80) =	4.32
2R	132+	-	-	0	0.00

Total water retention difference = 21.51 cm
= MEDIUM

D. Soil Wetness Class

Soil wetness class is determined by the depth to specific redoximorphic features (RMF) in the soil indicative of prolonged wetness, specifically depletions with a color chroma of 2 or less and a color value of 4 or more (i.e., gray depletions of at least common abundance as defined by the NRCS). Redox concentrations alone shall not be sufficient evidence for a state of wetness. The wetness classes to be used for this contest are:

Very Shallow:	< 25 cm
Shallow:	25 to 49 cm
Moderately Deep:	50 to 99 cm
Deep:	100 to 149 cm
Very Deep:	>150 cm

If no evidence of wetness exists within the specified depth for characterization and that depth is less than 150 cm, assume the wetness class is “Very deep”. These classes indicate free water and reduction occurs, but do not indicate the duration of occurrence of free water.

Part III: Site Characteristics

A. Parent Material

Parent material refers to unconsolidated organic and mineral material in which soils form. As parent material cannot be observed in its original state, inference from the properties of the soil and from other evidence must be used. Mode of deposition and/or weathering may be implied or implicit. In South Texas parent material may be difficult to infer from the nature of the soil materials themselves. To allow participants to gain insights about the soils that may not be evident from the soils themselves or the surrounding landscape, the major land resource area (MLRA) of the location of the pit will be provided as well as the following MLRA related insights. The following parent materials will be used in this contest:

1. Aeolian Sands – Aeolian sands are sands which were deposited by wind. While recently or long-stabilized dunes are examples, of aeolian materials have also been deposited at relatively uniform depths over large areas. This occurred in MLRA 83E (Sand Sheet Prairie): huge amounts of sand were deposited from

the east when Gulf waters were retreated to the east accompanying cycles of glaciation.

2. Recent Alluvium – Recent Alluvium is material transported and deposited by flowing water in active floodplains. Recent alluvium will occur either in the bed of an open depression, in the bed of an ephemeral stream, within sight of a stream (ephemeral or otherwise), or within reasonable distance to a stream (and would be noted as such). Recent alluvium may occur in any MLRA.

3. Quaternary Alluvium – Quaternary Alluvium is alluvial material found not far from a stream (ephemeral or not; as above) but in a landscape position which no longer experiences flooding (e.g. a terrace position).The deposition of the alluvial material is relatively recent (as old as 1.8 Myr). Such material may be recognized as sufficiently old if the soil being examined is in MLRA 150A (Gulf Coastal Prairies) or MLRA 83E (Sand Sheet Prairie).

4. Tertiary Alluvium – Tertiary Alluvium is alluvial material (as above) but in a landscape position which no longer experiences flooding, and in which the deposition of the alluvial material is older (as old as 30 Myr). Such material may be recognized as sufficiently old if the soil being examined is in MLRA 83C (Central Rio Grande Plain). In this MLRA, the majority of the material is recognized to have been deposited by the Rio Grande River many millions of years earlier (the location of the river is now nearly 100 miles away). Despite this amount of time, soils in upland positions in these areas are considered not to have developed on reworked materials but rather on materials lain down by the Rio Grande that are now being eroded.

5. Residuum - Unconsolidated, weathered, or partly weathered mineral material that accumulates by disintegration of bedrock in place.

6. Marine Sediments – Marine Sediements are unconsolidated materials originally deposited in a marine environment. Marine sediments constitute much of the soils in MLRA 150A (Gulf Coast Prairie) and much of the underlying material in MLRA 83E (Sand Sheet Prairie).

Sometimes two parent materials may be evident in a pedon, for example alluvium over residuum. If evident, indicate the transition with an Arabic numeral in the “Prefix” column beginning with the number 2 for the first transition. It is implied that the overlying parent material is number 1. For example, the following sequence may be found in a profile with two parent materials: A – E – Bt1 – 2Bt2 – 2Bt3 etc.

B. Landform

The landform on which the soil pit is located should be identified. If the pit is in an ambiguous position or the position is obscured by the spoil pile, the slope stakes will be placed in such a position and/or orientation to reinforce the identity of the landform upon which the pit resides.

1. Depression - Positions on the landscape where water and/or sediment accumulate. They may or may not have a free surface water drainage outlet.

2. Floodplain - The lowest geomorphic surface which is adjacent to the stream channel and which floods first when the stream goes into flood stage. It is formed by the deposition of alluvium. Each stream has only one floodplain. Channels of ephemeral streams are considered floodplains.

3. Stream terrace - These are geomorphic surfaces formed by the deposition of alluvium and are higher in elevation than the floodplain. A stream may have one or more terraces. For the purpose of this contest, a landform will be designated as a stream terrace if the parent material is judged to be quaternary or tertiary alluvium.

4. Marine terrace – Marine sediments of quaternary age presently above sea level.

5. Uplands - Areas dominated by residual parent materials and usually occur above floodplains and stream terraces. The bulk of soil material in uplands is produced by physical and chemical weathering of parent material in place.

C. Slope Gradient

Slope classes to be used in the contest are listed on the scorecard. If a site falls on the boundary of two slope classes, mark the <u>steeper</u> class. The slope is to be determined between two stakes at each site designated for this purpose. The student is responsible for checking the heights of the stakes.

D. Hill Slope Profile

The following are the designations for hill slope profile that will be used in this contest with a brief description, which follow the adapted diagram below from Ruhe (1975):

1. Summit (SU) - The topographically highest position of a hill slope profile with a nearly level (planar or only slightly convex) surface. Ridge tops are included under summit since they are topographic highs and are usually planar in one direction.

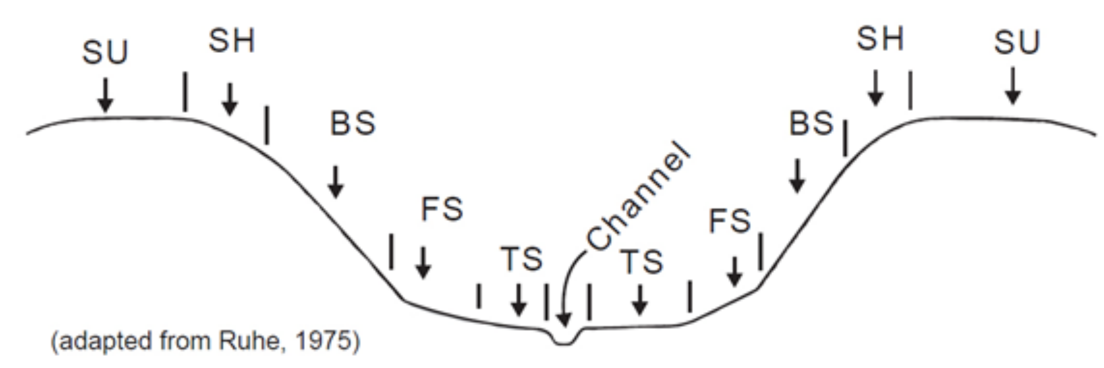
2. Shoulder (SH) - The hill slope profile position that forms the convex, erosional surface near the top of a hill slope. It comprises the transition zone from summit to backslope.

3. Backslope (BS) - This position includes all landscape positions between the shoulder and footslope.

5. Footslope (FS) - The position that forms the concave surface at the base of a hill slope. In some landscapes, the footslope may gradually transition into a toeslope.

5. Toeslope (TS) - The lowest component that extends away from the base of the hill slope. Toeslopes are typically linear in shape. The toeslope may gently transition to a floodplain or depression. If the pit located in a closed depression center that is linear in shape, toeslope should be marked.

6. None – This designation will be used when the slope at the site is < 2% AND the site is not in a well-defined example of one of the hill slope positions given above (e.g., within a nearly level stream terrace or floodplain).



E. Surface Runoff

Surface runoff refers to water that flows away from the soil over the land surface. Surface runoff is controlled by a number of factors including soil properties, climate, and plant cover. Runoff can be significantly altered by management (i.e., natural cover, cultivation, minimum tillage operations, etc.). For the purpose of this contest, only the runoff classes in Table 5 will be used.

Table 5. Surface runoff classes.

	Hydraulic Conductivity of the Surface Horizon		
% Slope	High	Moderate	Low
	------------	surface runoff class	----------------
0-1	Very Slow	Very slow	Very slow
1-3	Very slow	Slow	Slow
3-5	Slow	Medium	Medium
5-8	Medium	Medium	Rapid
8-12	Medium	Rapid	Very rapid
12-20	Rapid	Very rapid	Very rapid
> 20	Very rapid	Very rapid	Very rapid

If a slope falls exactly on a break between slope classes, select the steeper slope category. Should a site be forested or in pasture, the surface runoff may be significantly decreased due to vegetative or residue cover. When surface cover is dense (i.e., less than 10% bare soil), the surface runoff class should be assigned one lower rate class to a minimum of “Very slow”. “Ponded” shall be used to describe surface runoff in depressional areas only.

F. Erosion Potential

Soil erosion potential refers to the likelihood of soil erosion by water. The potential for future erosion losses is influenced mainly by the texture of the surface soil and the amount of surface runoff at a site. For the purpose of this contest, only the erosion potential classes in Table 6 will be used. It is assumed that granular structure or structureless - single grained exists for the surface horizon and that the soil is bare, although in this contest there is no adjustment if that is not the case. A soil profile occurring not in a pit but in a natural cliff-like exposure will be classified with "very high" erosion potential.

Table 6. Erosion potential classes.

	Surface Horizon Texture			
Surface Runoff	S, LS	SCL, SC	SL, CL, C, SiC	L, Si, SiL, SiCL
Ponded	Very low	Very low	Very low	Very low
Very slow	Very low	Very low	Low	Medium
Slow	Very low	Low	Medium	Medium
Medium	Very low	Low	Medium	High
Rapid	Low	Medium	High	Very high
Very Rapid	Medium	High	Very high	Very high

Part IV: Soil Classification

Keys to Soil Taxonomy, 12^{th} Edition (2014) should be used for details on soil classification. Only the diagnostic horizons, features, and orders possible for mineral soils in the area, along with pertinent data displayed on the pit sign (i.e., percent base saturation and organic carbon), are listed on the scorecard.

Note that in this competition particle size control section will be delineated and the particle-size class for the soil family will be calculated as an average across the whole control section, weighted by share of the particle size control section taken by each horizon. The presence of rock fragements in the particle size control section will be ignored both for the purposes of calculating the weighted average of the texture and for the purposes of the use of the word "skeletal" in describing the family class (ignore use of the word skeletal). Strongly contrasting particle size classes in a control section will be ignored and only the weighted average of the whole control section will be determined (as above).

Part V: Interpretations

Soil interpretations involve the determination of the degree of limitation for each soil at a site for a specified use. The most restrictive soil property determines the limitation rating. In cases where the base of the pit does not extend to the depth indicated in the following tables (e.g., 150 cm), one should assume that the lowest horizon in the pit extends to the depth of interest, unless a lithic or paralithic contact occurs within the depth to be judged. The following soil use interpretation tables are partially extracted and modified from the National Soil Survey Handbook (NSSH).

The depth to a seasonally high water table is based on the shallowest observed depth of redoximorphic depletions of color value ≥ 4 with chroma ≤ 2 or a depleted matrix.

The hydraulic conductivity criteria for the septic tank absorption field interpretation excludes the upper 50 cm of the soil profile, thus only the soil between the depths of 50 and 150 cm should be considered.

In addition to indicating the suitability rating for each soil use, contestants will record the number corresponding to the reason in the table used for the suitability rating selected on the scorecard. If all the evaluations are "slight", then record "none" as the reason on the scorecard.

Soil Use Interpretations Tables

Dwellings with Basement

Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
1. Flooding or ponding frequency	None	Not a choice	Rare to Frequent
2. Slope (%)	< 6	6 - 15	> 15
3. Depth to seasonally high water table (cm)	> 100	50 - 100	< 50
4. Depth to soft rock (Cr) (cm)	> 100	50 - 100	< 50
5. Depth to hard rock (R) (cm)	> 150	100 - 150	< 100

Septic Tank Absorption Field

Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
1. Flooding or ponding frequency	None	Not a choice	Rare to Frequent
2. Slope (%)	< 6	6 - 15	> 15
3. Depth to seasonally high water table (cm)	> 150	100 - 150	< 100
4. Depth to High or Low hydraulic conductivity*	> 150	100- 150	< 100
5. Depth to rock (R or Cr) (cm)	> 150	100 - 150	< 100

* Excluding the upper 50 cm of the soil profile. Only evaluate soil horizons between 50 and 150 cm.

Local Roads and Streets

Factors Affecting Use	Degree of Limitation		
	Slight	Moderate	Severe
1. Flooding or ponding frequency	None	Not a choice	Rare to Frequent
2. Slope (%)	< 6	6 - 15	> 15
3. Depth to seasonally high water table (cm)	> 50	25 - 50	< 25
4. Depth to soft rock (Cr) (cm)	> 100	50 - 100	< 50
5. Depth to hard rock (R) (cm)	> 150	100 - 150	< 100

ATTACHMENT 1

Official Abbreviations

Boundary Distinctness

Abrupt - A	Clear - C	Gradual - G	Diffuse - D

Coarse Fragments

Gravelly	- GR	Cobbly	- CB
Very Gravelly	- VGR	Very Cobbly	- VCB
Extremely Gravelly	- XGR	Extremely Cobbly	- XCB

Texture

Coarse sand	- COS	Fine sandy loam	- FSL
Sand	- S	Very fine sandy loam	-VFSL
Fine sand	- FS	Loam	- L
Very fine sandy	- VFS	Clay loam	- CL
Loamy coarse sand	- LCOS	Silt	- SI
Loamy sand	- LS	Silt loam	- SIL
Loamy fine sand	- LFS	Silty clay loam	- SICL
Loamy very fine sand	- LVFS	Silty clay	- SIC
Coarse sandy loam	- COSL	Sandy clay loam	- SCL
Sandy loam	- SL	Sandy clay	- SC
Clay	- C		

Structure, Grade

Weak – 1	Moderate – 2	Strong – 3	Structureless – 0

Structure, Shape

Granular	- GR	Angular blocky	- ABK
Platy	- PL	Subangular blocky	- SBK
Prismatic	- PR	Single-grained	- SG
Columnar	- CO	Massive	- MA
Wedge	- W		

Effervescence

None	- N or '-'	Strong	- ST
Very slight	- VSL	Violent	- V
Slight	- SL		

Redox Features, Type and Abundance

RMF Type:	Concentration – CON		Depletion – DEP
Abundance:	Few - F	Common – C	Many – M

ATTACHMENT 2

Soil Textural Triangle