Final Report

On

Improvements to the External Corrosion Direct Assessment (ECDA) Process (WP # 360)

Severity Ranking of ECDA Indirect Inspection Indications (Project #242)

for

Pipeline and Hazardous Materials Safety Administration (PHMSA)

U.S. Department of Transportation

Contract No. DTPH56-08-T-000012

by

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Executive Summary

On June 28, 2007, PHMSA released a Broad Agency Announcement (BAA), DTPH56-07-BAA-000002, seeking white papers on individual projects and consolidated Research and Development (R&D) programs addressing topics on the pipeline safety program. Although, not specifically suggested by PHMSA, three Direct Assessment projects were proposed by Corrpro based on in-house gap-analysis of the External Corrosion Direct Assessment (ECDA) process. A white paper was submitted for a consolidated Research and Development (R&D) program entitled “Improvements to the External Corrosion Direct Assessment (ECDA) Process”. It was eventually approved for implementation by PHMSA with the following 3 projects:

- Cased pipes
- Severity ranking of ECDA indirect inspection indications
- Potential measurements on paved areas

The ultimate goal of each of the programs was to present the results and recommendations to the applicable Standards Development Organizations (SDOs) to ensure the strengthening of industry consensus standards and the timely implementation of research benefits for improved safety, environmental protection, and operational reliability. It was also to expand DA applicability and increase the knowledge of the DA methodology.

The accomplishments and conclusions of this project,”*Severity ranking of ECDA indirect inspection indications”* are summarized as follows:

- Developed improved ECDA severity classification and prioritization methodologies that
  - Enable operators to efficiently/effectively manage external corrosion threats
  - Provide more consistent assessments of the external corrosion threat
- Methodologies developed represent an enhancement to NACE SP0502-2008
  - Quantification of Indirect Inspection (IDI) data
  - Introduction of soil texture modifier
  - Effective utilization of available soils data
  - Use of soil maps available in the public domain
- The methodologies quantified, qualified, and verified industry knowledge and experience

  - Supported by the data
  - Sound engineering judgment
- The methodologies have significant implications for
  - Public safety
  - Environmental protection
  - Operational reliability
- The methodologies are consistent with other PHMSA's stated goals
  - Collaborative development of technology
  - The strengthening of industry consensus standards
  - Generation and promotion of new knowledge

Improvements to the External Corrosion Direct Assessment (ECDA) Process
Severity Ranking of ECDA Indirect Inspection Indications

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1.0 Introduction

A Government and Industry Pipeline R&D Forum was held in New Orleans, February 7-8, 2007, by the U.S. Department of Transportation (DOT), Pipeline and Hazardous Materials Safety Administration (PHMSA). The 2-day event included approximately 240 representatives from Federal, State and international government agencies, public representatives, research funding organizations, standards developing organizations, and pipeline operators from the U.S., Canada and Europe. The R&D Forum led to a common understanding of current research efforts, key challenges facing government and industry, and potential research areas where exploration can help meet these challenges, and should therefore be considered in developing new research and development applications. On June 28, 2007, PHMSA released a Broad Agency Announcement (BAA), DTPH56-07-BAA-000002, seeking white papers on individual projects and consolidated Research and Development (R&D) programs addressing topics on pipeline safety program areas identified at the R&D Forum, namely:

- Excavation Damage Prevention Technologies
- Direct Assessment Methods for Transmission and or Distribution Pipelines
- Defect Detection/Characterization
- Defect Remediation/Repair/Mitigation
- New Fuels Transportation

Several specific R&D projects were suggested in the BAA. Although, not specifically suggested by PHMSA, three Direct Assessment projects were proposed by Corrpro based on in-house gap-analysis of the External Corrosion Direct Assessment (ECDA) process. Over several years, ECDA has been used to assess the condition of thousands of miles of natural gas pipelines. Corrpro's gap analysis identified three key areas of opportunity to enhance application of the technology. A white paper was submitted for a consolidated Research and Development (R&D) program entitled "Improvements to the External Corrosion Direct Assessment (ECDA) Process". It was eventually approved for implementation by PHMSA. One of the three components of the consolidated R&D program is as follows;

Severity ranking of ECDA indirect inspection indications: Since the development of the ECDA process, the critical parts of the process, namely, severity classification and direct examination (DE) prioritization of indirect inspection (IDI) indications have been difficult to apply consistently and effectively. The existing severity classification and DE prioritization tables are subject to different interpretations, and the outcomes vary from operator to operator, pipeline to pipeline, and sometimes location to location. These tables are vague and very general. As result, these tables provide limited guidance for accurately and effectively classifying and prioritizing IDI indications under widely varying conditions. The tables, as currently defined, limit operators' ability to effectively, economically, efficiently and safely address the external corrosion threat to pipeline integrity.

2.0 Project Objectives

The objectives of the project on severity ranking of ECDA indirect inspection indications are to:

- Conduct literature search and evaluate available operator specifications for severity ranking of ECDA indirect inspection indications
- Analyze and determine the effectiveness, applicability, and inconsistencies of existing severity ranking methodologies and identify industry "best practice"
- Identify possible improvement scenarios
- Develop and implement new and improved severity ranking methodology
- Develop guidelines for severity ranking methodology to be provided to standards organizations for development of recommended practices
- Produce project report, conduct web-based workshop and public presentations

The project is designed such that its outputs primarily parallel PHMSA program elements, namely: pipeline assessment, defect characterization, improved design of data collection systems, human factors and safety.

3.0 NACE SP0502-2008: Severity and Prioritization of Indirect Inspections

The NACE SP0502-2008 severity classification, illustrated in Table 1, is delineated as "Minor", "Moderate", and "Severe". It is based on above grade IDI tools that measure the electrical parameters of pipeline and its environment. The attendant prioritization schedule, illustrated in Table 2, is used in demarcating the remediation regions for "Monitored", "Scheduled", and "Immediate". The classification and prioritization schemes are, by design, very general, because it is the intent of the standard to encourage operators to develop classification and prioritization criteria suited to their particular and unique conditions and requirements based on the methodology outlined within the standard. One of the objectives of this research is to develop guidelines consistent with the methodology of the standard that will assist operators in developing effective and efficient classification and prioritization criteria suited to their particular and unique needs and conditions.

The original classification and prioritization tables are presented as Tables 1 and 2, respectively. The tables are intentionally general and meant to provide initial guidance for continuous development of more refined criteria based on ongoing results. As result, when used without continuous and/or consistent refinement, they provide limited guidance for accurately and effectively classifying and prioritizing IDI indications under widely varying conditions. That is, the tables without continuous and consistent refinement limit the operators' ability to effectively, economically, efficiently and safely address the external corrosion threat to pipeline integrity. As originally intended, both the classification and prioritization criteria as initially defined are imprecise and ambiguous, are subject to different interpretations, and the outcomes vary from operator to operator, pipeline to pipeline, and, sometimes, location to location.

Table 1: NACE SP0502-2008 (Section 4 - Table 3): – Example Severity Classification of Indirect Inspections

Tool/Environment	Minor	Moderate	Severe
CIS, aerated moist soil	Small dips with on and off potentials above CP criteria	Medium dips or off potentials below CP criteria	Large dips or on and off potentials below CP criteria
DCVG survey, similar conditions	Low voltage drop; cathodic conditions at indication when CP is on and off	Medium voltage drop or neutral conditions at indication when CP is off	High voltage drop or anodic conditions when CP is on or off
ACVG or Pearson[7] survey, similar conditions	Low voltage drop	Medium voltage drop	High voltage drop
Electromagnetic	Low signal loss	Medium signal loss	Large signal loss
AC current attenuation surveys	Small increase in attenuation per unit length	Moderate increase in attenuation per unit length	Large increase in attenuation per unit length

Table 2: NACE SP0502-2008 (Section 5 - Table 4): – Example Prioritization of Indirect Inspections

Immediate Action Required	Scheduled Action Required	Suitable for Monitoring
• Severe indications in close proximity regardless of prior corrosion. • Individual severe indications or groups of moderate indications in regions of moderate prior corrosion. • Moderate indications in regions of severe prior corrosion.	• All remaining severe indications. • All remaining moderate indications in regions of moderate prior corrosion. • Groups of minor indications in regions of severe prior corrosion.	• All remaining indications.

The definition of "Minor", "Moderate", "Severe" in the NACE RP 0502-2002 Severity table is not easy to apply and is difficult to explain. This is more so because no two situations/conditions are the same and sometimes it is difficult to determine if a defect falls between two definitions. The usual approach is to err on the side of safety and call a defect worse than it really is (better safe then sorry). Integrating specific types of ECDA indications continues to be challenging under the prioritization criteria recommended by NACE RP0502-2002

Because the schemes are not tested, verified, refined and/or enhanced through a consistent successive and progressive process based on sound engineering judgment, the classification/prioritization scheme frequently results in inconsistencies between above grade IDI and below grade DE. In numerous cases, excavations were performed only to find that they were not necessary based on below grade observations. In certain specific cases, necessary excavations and inspections were not performed because of imprecise and ambiguous classification/prioritization schemes. Such cases only become evident when failure occurs or another route of discovery makes it evident that excavations and inspections should have been performed. Some operators are employing self-defined methodologies for refining the classification/prioritization schemes however such methodologies are not precisely documented, understood and/or consistently implemented and applied.

4.0 An Operator Example: Severity Classification of Indirect Inspections

The intent of the original classification/prioritization scheme is that operators will improve and better define these schemes through successive applications of the ECDA process. Table 3 illustrates an operator example of severity classification and Table 4 illustrates the prioritization scheme for direct examination of indirect indications.

Note that the severity classification table provides specific measurable criteria and definable conditions. It represents an improvement over the previous scheme in that it specifically defines objective measureable numerical values for each IDI tool and also defines some specific conditions under which they apply. Notice, for example, that a "Moderate" CIS indication is explicitly defined on the basis of measured potentials. That is ON potentials are more negative than -850mV and OFF potentials are not more negative than -600mV for "aerated, moist soil". Notice, however, that loosely defined terminologies are used with regard to depressions (Small, Medium and Large) and the somewhat confusing or awkward mathematical terminology ("more negative than" and "not more negative than"). It would appear that this table could be more effective with better defined terminologies and more explicit qualifiers for multiple conditions or mutually exclusive conditions.

Likewise, note that the prioritization shown in Table 4 is specific, objective and is based on measurable criteria and definable conditions. The scheme certainly represents an improvement over the previous scheme in that it explicitly states the prioritization on the basis of either CIS and DCVG or CIS and ACCA. Notice for example that a Moderate CIS indication with a Moderate DCVG indication at the same location is prioritized as a "Scheduled". Also notice that the table assumes or requires that CIS be one of the IDI tools. Although explicitly defined, It would seem that allowance for a wider range of conditions and IDI tool combinations would be an improvement.

Table 3: An Operator Example on Severity Classification of Indirect Inspections

Tool/ Environment	Minor	Moderate	Severe
Close Interval Survey (aerated, moist soil)	• Small depression in potential profile • "On" and "Off" potentials are both more negative than -850 mV	• Medium depression in potential profile • "On" potentials are more negative than -850 mV • "Off" potentials are not more negative than -600 mV	• Large depression in potential profile • "Off" potentials are not more negative than -600 mV
DCVG Survey (aerated, moist soil)	• < 36% IR • Cathodic both "On" and "Off"	• 36% to 60% IR • Cathodic "On" • Anodic or Neutral "Off"	• > 60% IR • Anodic both "On" and "Off"
AC Current Attenuation survey (Pipeline Current Mapper or C-Scan)	• -9 to -30 mdB/ft	• -31 to -60 mdB/ft	• > -60 mdB/ft

Table 4: An Operator Example on Prioritization of Indirect Inspections

		Close Interval Survey			
		Severe	**Moderate**	**Minor**	**No Indication**
DCVG	Severe	Immediate	Scheduled	Scheduled	Monitored
	Moderate	Immediate	Scheduled	Monitored	No Action
	Minor	Immediate	Scheduled	Monitored	No Action
	No Indication	Immediate	Scheduled	Monitored	No Action
ACCA	Severe	Immediate	Scheduled	Scheduled	Monitored
	Moderate	Immediate	Scheduled	Monitored	No Action
	Minor	Immediate	Scheduled	Monitored	No Action
	No Indication	Immediate	Scheduled	Monitored	No Action

5.0 Improved Classification and Prioritization Tables of Indirect Inspections

The challenge of developing improved classification and prioritization tables or guidelines for developing operator specific tables that appropriately integrate specific IDI indications with DE prioritization criteria is daunting. The challenging issues include the following:

- Determining the accuracy of aboveground tools requires that all defects identified are subjected to direct examinations
- There are limited modifications that could be made to better clarify severity classifications except possibly using R-STRENG. GPS locating and/Depth of Cover surveys are an integral part of this process and are included as a standard part of the data alignment process
- Classifications tend to be conservative when compared to actual coating defects/anomalies discovered during excavation inspections
- A minor DCVG indication in conjunction with an AC or DC interference indication is potentially more serious than a severe DCVG in conjunction with an AC or DC interference indication
- The risk of corrosion does not always increase with the size of coating holiday
- Actual corrosion attack occurs only at a coating holiday where, by definition, the metallic surface is exposed to the soil
- The pipeline industry needs technology to assist the understanding of their problems, which in turn must lead to technology-driven tools.
- Mathematical tools are needed for consistent prioritization of integrated data

One of the goals of this research is to develop a consistent, testable, and progressive classification/prioritization methodology such that operators can successfully apply ECDA in the "seemingly rare" case where necessary excavations and inspections are not performed because of imprecise and ambiguous classification/prioritization schemes.

First improved classification and prioritization tables: Using the vast data and analyses included in this research, the enhanced severity classification table presented as Table 5 and the enhanced prioritization table presented as Table 6 were developed. These tables represent a significant improvement over the practice of many operators with effective ECDA programs. They cover more specific conditions and are more explicitly defined. The data used included multiple operator schemes with input from several industry personnel with long-term experience with ECDA.

Notice that a Moderate CIS indication is defined on the basis of four measureable parameters.

OFF potential between -850 and -650 mV or

ON Potential between -950 and -850 mV, and

ON/OFF Convergence between 30 and 10 mV, or

ON or OFF depression between 100 and 200 mV within a 100 feet span

Table 5 Improved IDI Severity Classification Criteria

Measure	Indirect Inspection Severity Classification		
	Minor	**Moderate**	**Severe**
TOOL = Close Interval Potential Survey (CIS)			
A = OFF (Polarized) Potential [mV]	-950 mV < **A** < -850 mV	-850 mV < **A** < -650 mV	-650 mV < **A**
	OR	OR	AND
B = ON Potential [mV]	-1000 mV < **B** < -950 mV	-950 mV < **B** < -850 mV	-850 mV < **B**
	AND	AND	AND
C = ON/OFF Convergence [mV]	50 mV < **C** < 70 mV	30 mV < **C** < 10 mV	10 mV < **C**
	OR	OR	AND
D = ON and/or OFF Profile Depression within 100ft span [mV/span]	50 mV/span < **D** < 100 mV/span	100 mV/span < **D** < 200 mV/span	200 mV/span < **D**
TOOL = AC Current Attenuation Survey (ACCA)			
E = Current 98 Hz Frequency Signal **Loss(-)** [mdB(mA)/ft]	20 mdb(mA)/ft < **E** < 40 mdb(mA)/ft	40 mdb(mA)/ft < **E** < 60 mdb(mA)/ft	60 mdb(mA)/ft < **E**
	AND/OR	AND/OR	AND/OR
F = Current 4 Hz Frequency Signal **Loss(-)** [mdB(mA)/ft]	7 mdb(mA)/ft < **F**< 3 mdb/ft	12 mdb(mA)/ft < **F** < 7 mdb(mA)/ft	12 mdb(mA)/ft < **F**
	AND	AND	OR
CP Level Modifier	Adequate CP Level	Adequate to Marginal CP Level	ALL indications with Inadequate CP Level
TOOL = AC Voltage Gradient Survey (ACVG)			
G = Voltage Signal Loss(-) [dB(mV)]	44 dB(mV) < **G** < 60 dB(mV)	60 dB(mV) < **G** < 78 dB(mV)	78 dB(mV) < **G**
	AND	AND	OR
CP Level Modifier	Adequate CP	Adequate to Marginal CP Level	ALL indications with Inadequate CP
TOOL = DC Voltage Gradient Survey (DCVG)			
H = Coating Defect Size [%IR]	5%IR < **H** < 20%IR	20%IR < **H** < 50%IR	50%IR < **H**
	AND	OR	OR
I = Corrosion State Assessment (Normal Operating Conditions)	**I** = Cathodic/Cathodic or Cathodic/Neutral	All Indications 5%IR < **H** < 50%IR where **I** = Cathodic/Anodic	All indications where **I** = Anodic/Anodic
	AND	AND	OR
CP Level Modifier	Adequate CP	Adequate to Marginal CP Level	ALL indications with Inadequate CP

Table 6 Improved IDI Direct Examination Prioritizations

Direct Examination Prioritization				
Two Tools		1st Indirect Inspection Tool		
		Severe	Moderate	Minor
2nd Indirect Inspection Tool	Severe	Immediate	Immediate	Scheduled
	Moderate	Immediate	Scheduled	Monitored
	Minor	Scheduled	Monitored	Monitored

Other tools (which are primarily coating condition assessment tools) besides CIS contain a modifier regarding the level of cathodic protection. This was added in the event CIS was not one of the two selected IDI tools. A Severe ACCA indication is defined as greater than 60 mdB(mA)/ft loss for a 98 Hz signal and/or greater than 12 mdB(mA)/ft for a 4 Hz signal.

The enhanced prioritization Table 6 represents an improvement over the previous prioritization schemes in that it explicitly defines prioritization on the basis of any two tools over a wide range of specific conditions. A severe indication for one IDI tool and a minor indication from another IDI tool is prioritized as scheduled.

6.0 Use of Soil Survey Data in Classification and Prioritization

During the course of this research some apparent correlation between soils and the occurrence, extent, and severity of external corrosion was identified, which lead to the conclusion that these improved classification and prioritization tables could and should be further improved on the basis of soils data.

The IDI tools commonly used in the EDCA process are well defined and successfully used within the pipeline industry. Although soils data have proved useful in field studies of stress corrosion cracking (SCC) susceptibility[4], the use of soils data as an independent IDI tool has been unsuccessful in two specific cases. Firstly, little independent correlation has been observed between external corrosion and the simpler measures of soil corrosivity such as resistivity and pH. Secondly, there is no independent correlation of soil characteristics, such as soil type, topography, and drainage, with corrosion susceptibility[3,5]. On the other hand, practical experience, including extensive data from the current study, confirms the following:

- The measurements and data produced by each of the IDI tools are affected to differing degrees by the nature of soils
- Cathodic protection effectiveness is affected by the nature of soils
- Coating integrity is affected by the nature of soils
- External corrosion occurrence and associated threat magnitude are influenced by the nature of soils
- Historical pipeline corrosion integrity is affected by the nature of soils

In this project, soils survey data are considered, not as an independent, but a semi-independent IDI "tool". Soils data are embedded in relative terms via the use of soil modifier factors for the electrical-based IDI tools. The procedure adopted complies with the requirements of NACE RP0502 that two IDI techniques are required to be used at grade to identify and define coating faults, other anomalies, and areas at which corrosion activity may have occurred or may be occurring. The soils-data-modified IDI data are used to improve the severity classification table such that the new table provides guidelines to better rank severity of anomalies found by the IDI tools and thereby improve the accuracy of ECDA prioritization process.

7.0 Improved Classification and Prioritization of Indirect Indications with Soil Texture Modifier

The soils survey data utilized in this project are freely available online from the USDA-NRCS (http://websoilsurvey.nrcs.usda.gov). The data is geospatially referenced and covers much of the continental US in great detail. As an example, Figure 1 represents a detailed map of a pipeline passing through various soils defined within the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SURRGO) database[6]. The database contains sufficiently detailed information to assess soil characteristics and their impact on the probability of external corrosion on relatively small pipeline segments. Each of the specific areas identified as soil units are defined by soil texture, slope, physical properties, chemical properties, etc. as illustrated in Table 7.

Table 7 illustrates some of the engineering and chemical properties of soil that prove useful in assessing a particular soil's impact on the occurrence and severity of external corrosion. Useful engineering and chemical properties with possible impact on external corrosion and IDI measurements such as USDA soil texture, Unified/AASHTO classifications, liquid limit, plasticity, cation exchange capacity, pH, and calcium carbonate content of a particular soil unit can be obtained and assessed.

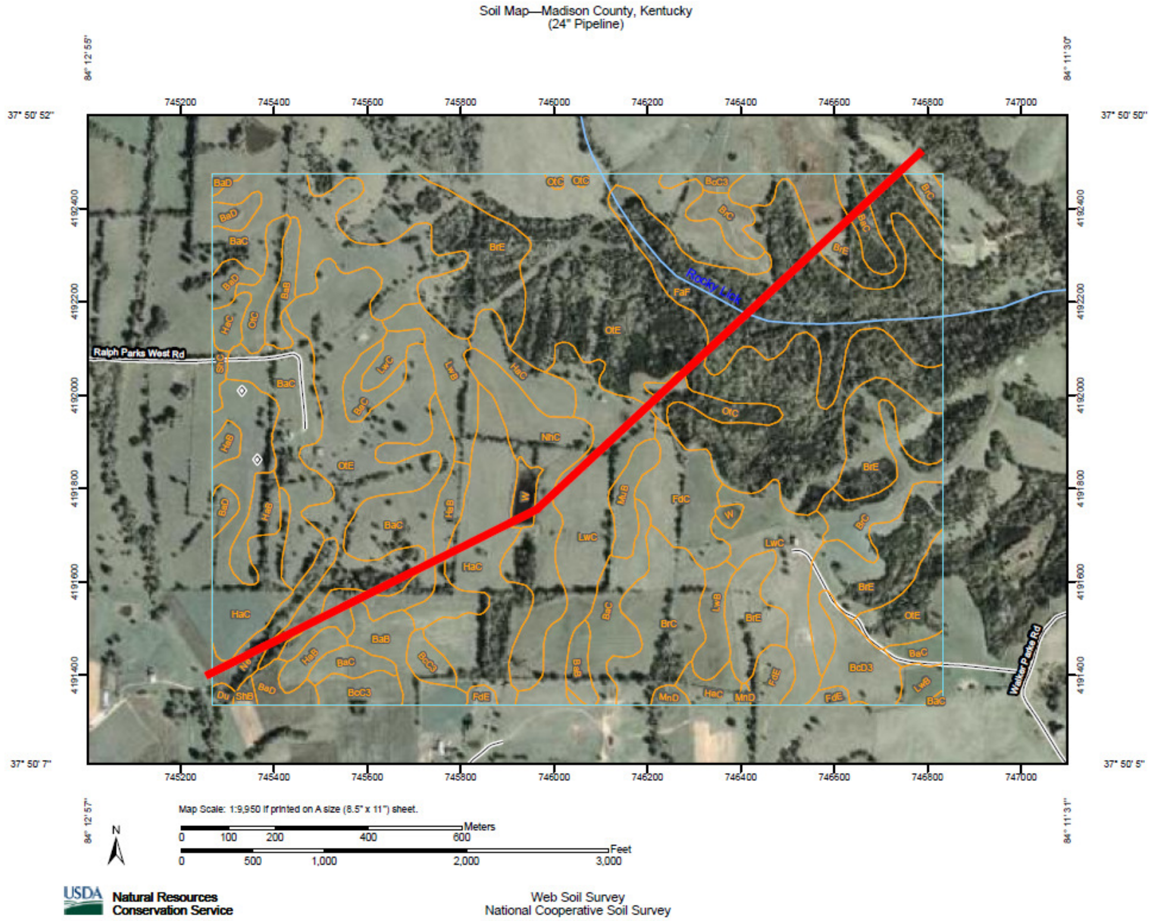
Soils information, coupled with the indirect inspection, direct examination and other external corrosion data, are useful in iteratively assessing the probability of the occurrence, extent and severity of external corrosion. It will be shown that this freely available soil information can be effectively utilized to refine and improve the classification and prioritization of indirect inspection indications. In addition it will also be shown that the soils data can and should be utilized throughout the entire ECDA process.

The influence of soil on indirect inspections and external corrosion data are reflected in Figure 2. There is an apparent correspondence between the presence and severity of external corrosion as indicated by ILI and soils data. It should also be noted that there appears to be a correlation of external corrosion to the transitions between soil types. This profile graph illustrates that soil influences the measurements made during IDIs as well as the extent and severity of external corrosion.

Soils data are indeed a semi-independent "tool" whose sphere of influence may be better reflected by the use of a carefully considered and consistent modifier factor. To illustrate, Figure 3 contains the data for 14,000 joints, 10,000 of which have no external corrosion shown in green and 4,000 which have external corrosion shown in red. Each of the 188 bars represents a particular soil unit. The height of each bar represents the percentage of joints found in that soil unit. The green and red portions represent the relative proportions of joints without and with external corrosion respectively. These soil units are grouped by soil texture classification, namely: clay, silty loam, loam, sandy loam, weathered and un-weathered bedrock, etc. There are fourteen (14) soil textures in all. At first glance, it is apparent that all soils shown are corrosive to varying degrees with the highest probabilities occurring in clay and un-weathered bedrock. This apparent observation is somewhat misleading in that the plot only represents the occurrence of external corrosion and not the severity of external corrosion.

Figure 4 is closer to reality and our understanding changes dramatically when the severity of the external corrosion is taken into account. This figure represents the soil triangle with relative proportions of clay, silt and sand. There are a total of 14,000 data points on this triangle plot. The red points indicate the most severe external corrosion. The orange points indicate moderately severe external corrosion. The yellow points represent moderate external corrosion. The yellow points represent minor external corrosion, the green points represent relatively insignificant external corrosion, and the black points represent no external corrosion.

It should be noted that external corrosion occurs in just about all soil textures; however it is apparent that the severity of the corrosion changes as a function of the relative proportions of clay, sand, and silt, with clay content being the strongest driver. This figure confirms that the greatest external corrosion threat to the integrity of the pipeline occurs in soil textures defined as clay, silty clay, and silty clay loam. This represents a significant finding for classification and prioritization. These relationships are used as a basis for modifying the classification and prioritization schemes in terms of soil texture.



Map Unit Symbol	Map Unit Name
BaB	Beasley silt loam, 2 to 6 percent slopes
BaC	Beasley silt loam, 6 to 12 percent slopes
BaD	Beasley silt loam, 12 to 20 percent slopes
BcC3	Beasley silty clay loam, 6 to 12 percent slopes, severely eroded
BcD3	Beasley silty clay loam, 12 to 20 percent slopes, severely eroded
BrC	Brassfield silt loam, 6 to 12 percent slopes
BrE	Brassfield silt loam, 12 to 30 percent slopes
Du	Dunning silty clay loam
FaF	Fairmount-Rock outcrop complex, 30 to 60 percent slopes
FdC	Faywood silt loam, 6 to 12 percent slopes
FdE	Faywood silt loam, 12 to 30 percent slopes
HaB	Hagerstown silt loam, 2 to 6 percent slopes
HaC	Hagerstown silt loam, 6 to 12 percent slopes
LwB	Lowell silt loam, 2 to 6 percent slopes
LwC	Lowell silt loam, 6 to 12 percent slopes
MnD	McAfee silt loam, 12 to 20 percent slopes
MuB	Mercer silt loam, 2 to 6 percent slopes
Ne	Newark silt loam
NhC	Nicholson silt loam, 6 to 12 percent slopes
OtC	Otway silty clay, 6 to 12 percent slopes (shrouts)
OtE	Otway silty clay, 12 to 30 percent slopes (shrouts)
ShB	Shelbyville silt loam, 2 to 6 percent slopes
ShC	Shelbyville silt loam, 6 to 12 percent slopes
W	Water

Figure 1: Detailed map of a pipeline passing through various soils (USDA Soil Survey)

Table 7: Engineering and Chemical Proprieties of Various soils

Engineering Properties

u

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number–				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
BaB:												
Beasley	0-6	Silt loam	CL-ML, ML	A-4	0	0-5	90-100	85-100	80-100	75-100	25-35	4-10
	6-36	Clay, silty clay	CH, CL	A-7	0	0-5	90-100	85-100	85-100	75-100	45-70	20-40
	36-54	Clay, clay loam, gravelly silty clay, silty clay	CH, CL	A-7	0	0-10	70-100	55-100	50-100	50-95	35-65	15-35
	54-60	Weathered bedrock	---	---	---	---	---	---	---	---	---	---

Chemical Properties

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100 g*	*meq/100 g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
BaB:								
Beasley	0-6	15-30	---	4.5 - 7.3	0-1	0	0.0	0
	6-36	10-30	---	4.5 - 7.3	0-8	0	0.0	0
	36-54	5.0-25	---	6.6 - 8.4	3-21	0	0.0	0
	54-60	---	---	---	---	---	---	---

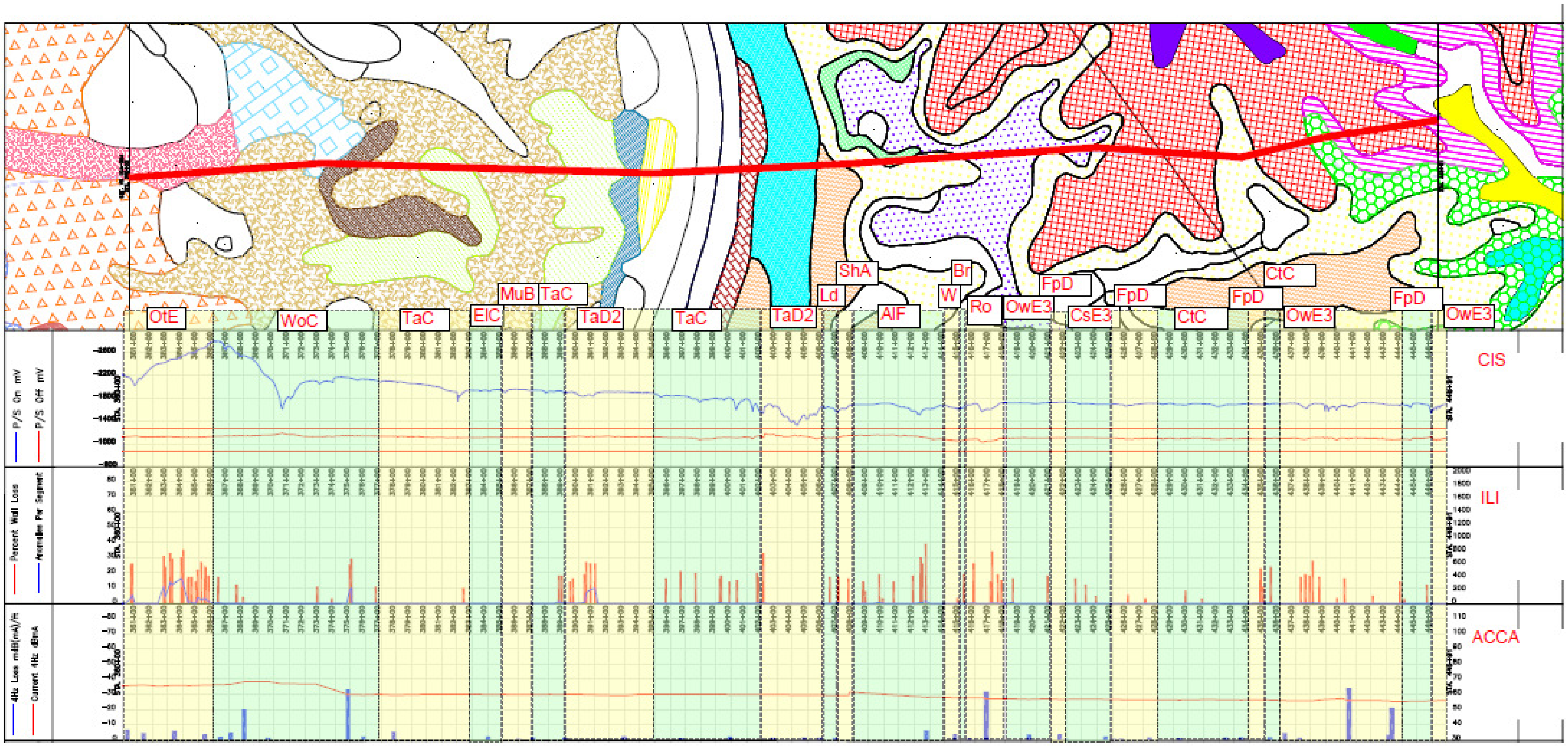


Figure 2: Influence of Soil on Indirect Inspections and Inline Tool Inspection

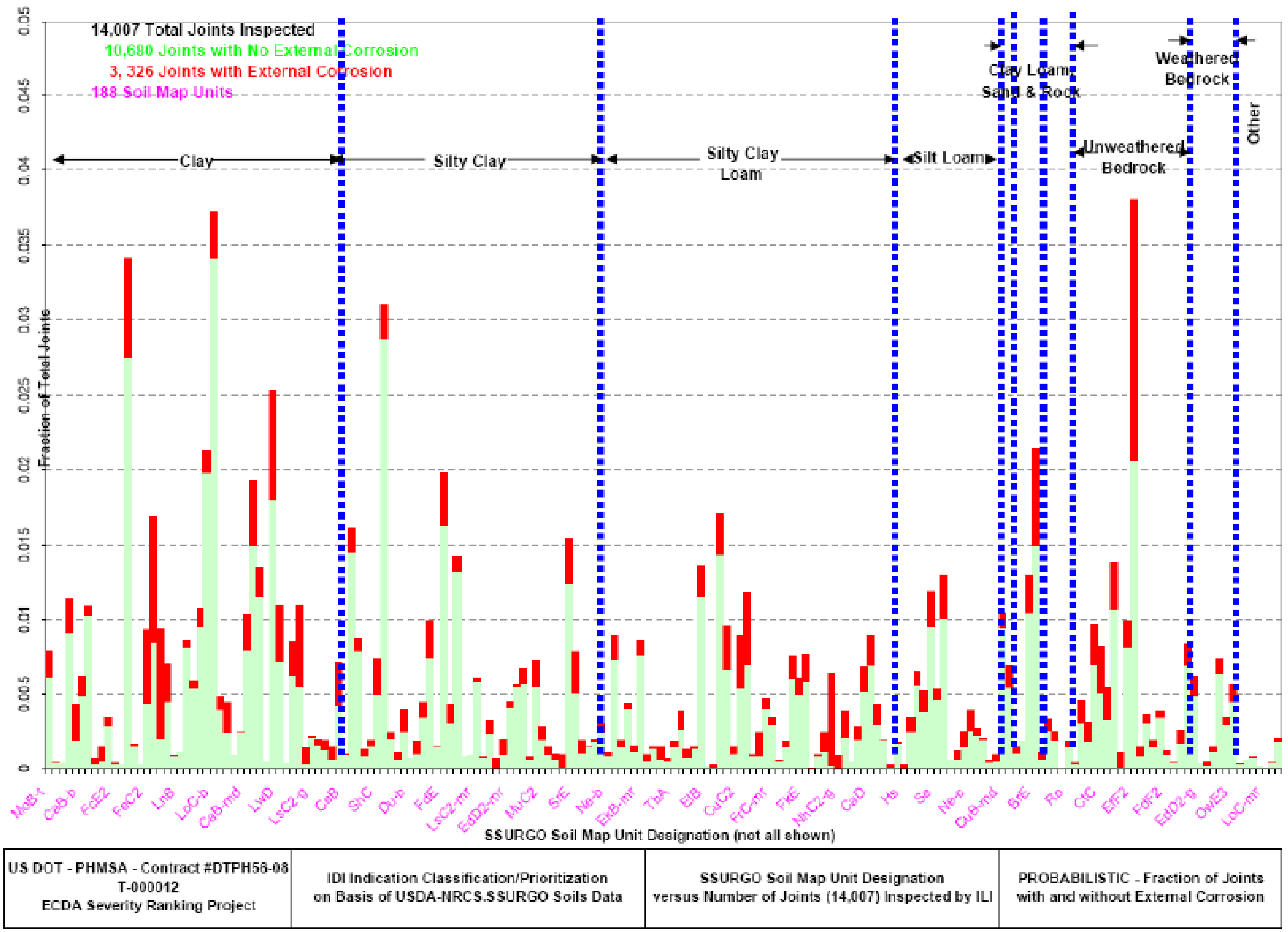


Figure 3: Soils – Joints with and without External Corrosion

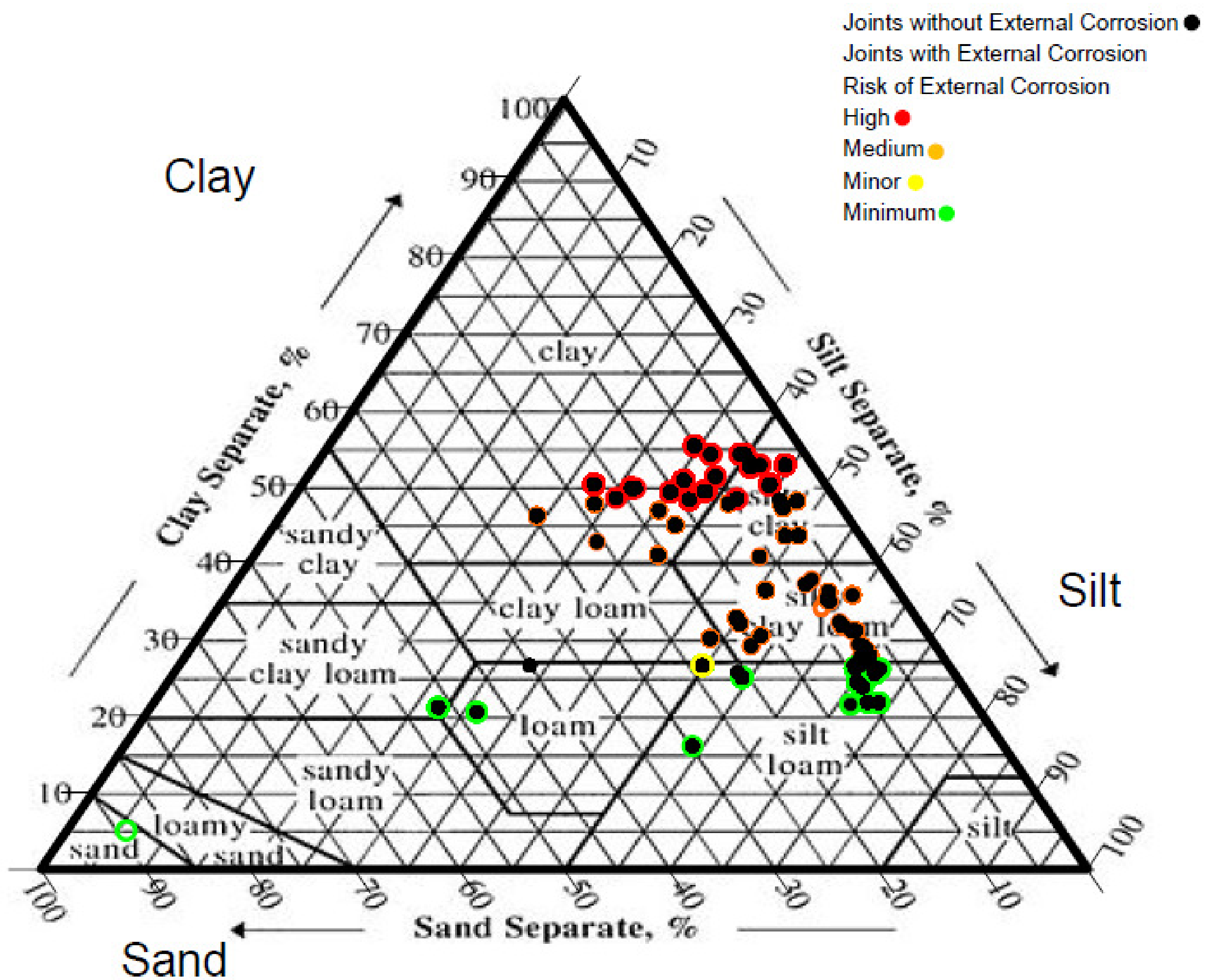


Figure 4: The Impact of Soil Texture on External Corrosion Susceptibility

External corrosion is a threat to the operational integrity of a pipeline. In order to show that the soils impact the severity of external corrosion we define severity of external corrosion in terms of two sub-threats on the basis of possible failure modes, namely: rupture and leak failure modes. Frequently, but not always, the rupture failure mode is the most potentially dangerous but least likely sub-threat and leak failure mode is the most likely but least potentially dangerous sub-threat. On the basis of RPR (Rupture Pressure Ratio) the external corrosion ranges from the greatest threat (RPR=0.8) to the least threat (RPR=1.2). This relationship depends on the stress level and the pipeline operating pressure. Figure 5 illustrates the effect of soil type on the behavior of rupture threat. The graph shows that the greatest rupture threat occurs in silt clay loam, clay, and silty clay. As a result, classification and prioritization can be improved on the basis of the external corrosion rupture threat associated with different soil textures.

On the basis of percent wall loss (%WL) the external corrosion ranges from the greatest threat (%WL=70%) to the least threat (%WL=10%). This relationship is independent of the stress level and the pipeline operating pressure. Figure 6 illustrates the effect of soil type on the behavior of leak threat. This graph represents 4000 joints with external corrosion in terms of leak threat (posed by the severity of the external corrosion) found by ILI. Notice that the greatest external corrosion leak threat to the integrity of the pipeline occur in soil textures defined as clay loam and loam followed by silty clay This is different from the rupture threat which occurs in silt clay loam, clay, and silty clay. Note that where the leak threat is highest the rupture threat is relatively small. Figure 6 also confirms that classification and prioritization can be improved on the basis of the external corrosion leak threat associated with different soil textures.

Further improved classification and prioritization tables: Using the soil survey data and analyses above, an improved classification scheme is presented in Table 8 which incorporates soil data as a modifier to the two tools already being utilized in the first scheme. This table contains specific numerical measurable criteria for a wide range of specific definable conditions that are supported by experience, sound engineering judgment and practice. In addition to the two IDI tools, an indication is classified on the basis of the soil surrounding the indication. For example, an indication that lies in soil with a clay texture would be classified as “Severe”. This, coupled with the two individual IDI tools, enables more effective prioritizations for direct examinations as illustrated by the prioritization table presented as Table 9.

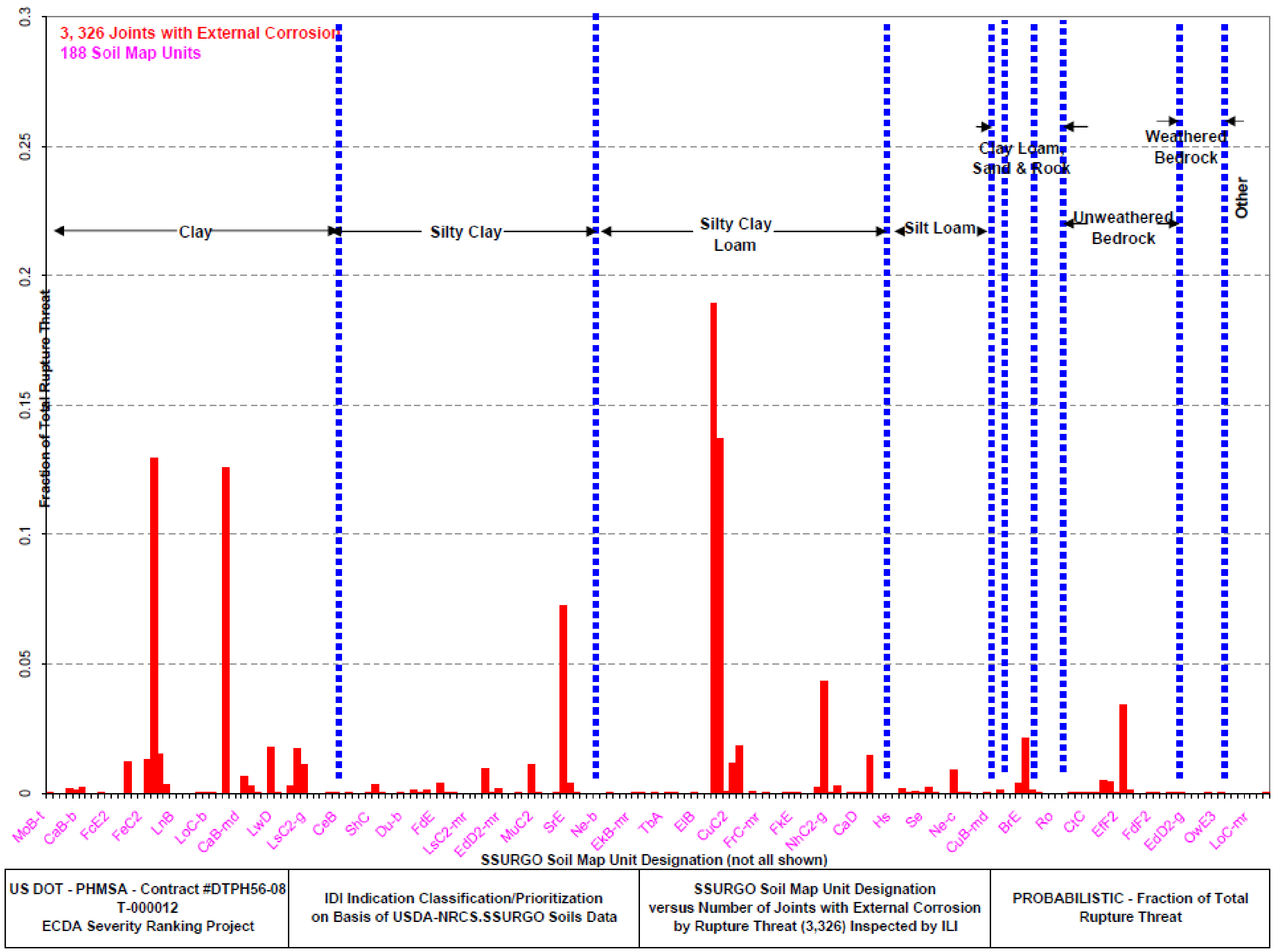


Figure 5 Impact of Soil Texture on External Corrosion Rupture Threat

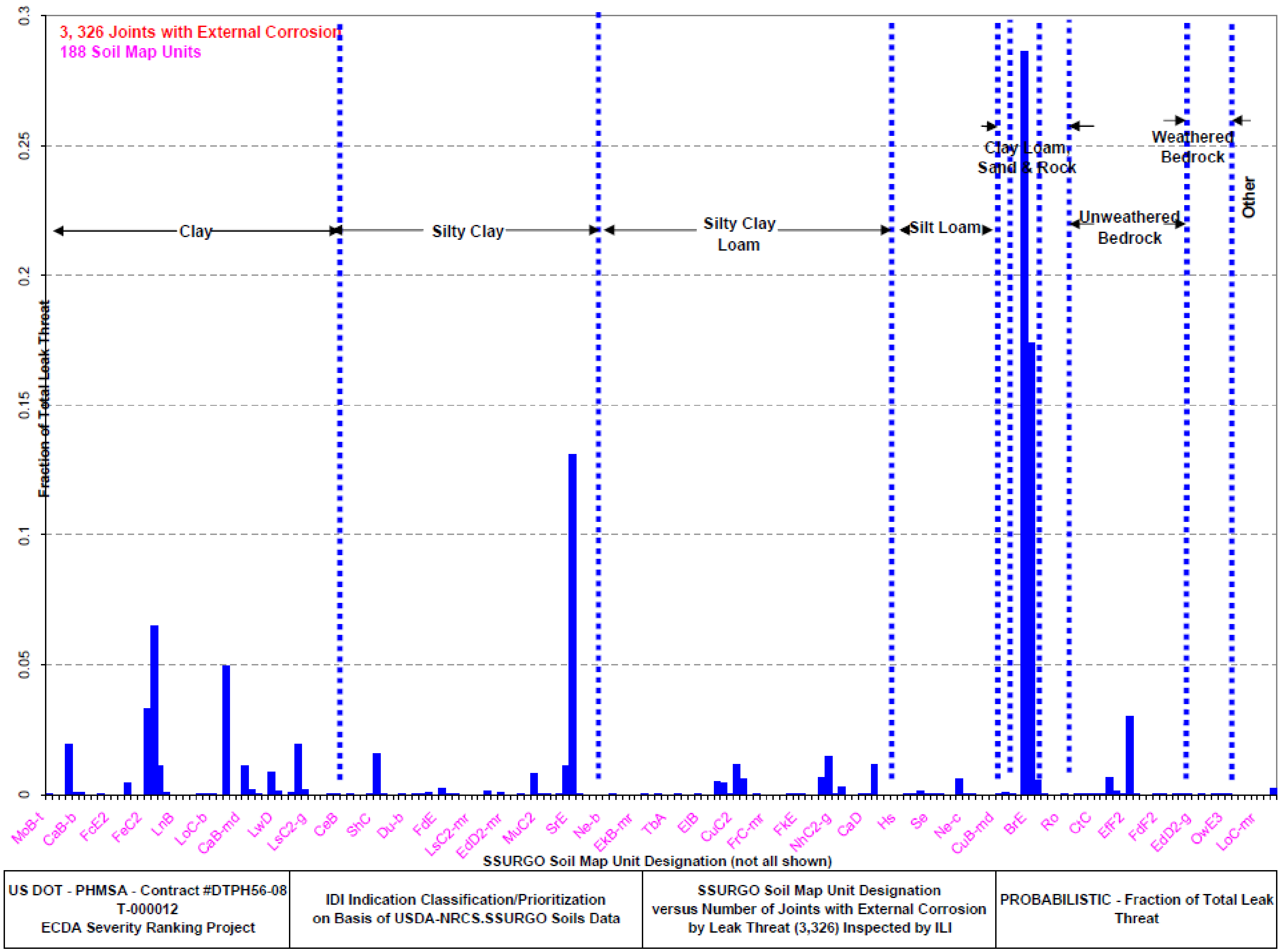


Figure 6: *The Impact of Soil Texture on External Corrosion Leak Threat*

Table 8: Improved Severity Classification of Indirect Inspections with Soil Texture Modifier

Measure	Indirect Inspection Severity Classification		
	Minor	**Moderate**	**Severe**
TOOL = Close Interval Potential Survey (CIS)			
A = OFF (Polarized) Potential [mV]	-950 mV < **A** < -850 mV	-850 mV < **A** < -650 mV	-650 mV < **A**
	OR	OR	AND
B = ON Potential [mV]	-1000 mV < **B** < -950 mV	-950 mV < **B** < -850 mV	-850 mV < **B**
	AND	AND	AND
C = ON/OFF Convergence [mV]	50 mV < **C** < 70 mV	30 mV < **C** < 10 mV	10 mV < **C**
	OR	OR	AND
D = ON and/or OFF Profile Depression within 100ft span [mV/span]	50 mV/span < **D** < 100 mV/span	100 mV/span < **D** < 200 mV/span	200 mV/span < **D**
TOOL = AC Current Attenuation Survey (ACCA)			
E = Current 98 Hz Frequency Signal **Loss(-)** [mdB(mA)/ft]	20 mdb(mA)/ft < **E** < 40 mdb(mA)/ft	40 mdb(mA)/ft < **E** < 60 mdb(mA)/ft	60 mdb(mA)/ft < **E**
	AND/OR	AND/OR	AND/OR
F = Current 4 Hz Frequency Signal **Loss(-)** [mdB(mA)/ft]	7 mdb(mA)/ft < **F**< 3 mdb/ft	12 mdb(mA)/ft < **F** < 7 mdb(mA)/ft	12 mdb(mA)/ft < **F**
	AND	AND	OR
CP Level Modifier	Adequate CP Level	Adequate to Marginal CP Level	ALL indications with Inadequate CP Level
TOOL = AC Voltage Gradient Survey (ACVG)			
G = Voltage Signal Loss(-) [dB(mV)]	44 dB(mV) < **G** < 60 dB(mV)	60 dB(mV) < **G** < 78 dB(mV)	78 dB(mV) < **G**
	AND	AND	OR
CP Level Modifier	Adequate CP	Adequate to Marginal CP Level	ALL indications with Inadequate CP
TOOL = DC Voltage Gradient Survey (DCVG)			
H = Coating Defect Size [%IR]	5%IR < **H** < 20%IR	20%IR < **H** < 50%IR	50%IR < **H**
	AND	OR	OR
I = Corrosion State Assessment (Normal Operating Conditions)	**I** = Cathodic/Cathodic or Cathodic/Neutral	All Indications 5%IR < **H** < 50%IR where **I** = Cathodic/Anodic	All indications where **I** = Anodic/Anodic
	AND	AND	OR
CP Level Modifier	Adequate CP	Adequate to Marginal CP Level	ALL indications with Inadequate CP
TOOL MODIFIER - USDA Soils Data - Soil Texture Designation (Not an independent TOOL)			
J = USDA Soil Texture Designation (12 types)	**J** = Sand, Loamy Sand, Sandy Loam, Loam, Silt Loam or Silt	**J** = Sandy Clay Loam, Sandy Clay, Clay Loam, Silty Clay Loam	**J** = Clay and Silty Clay
	AND	AND	OR
CP Level Modifier	Adequate CP	Adequate to Marginal CP Level	ALL areas with Inadequate CP

Table 9: Improved IDI Indication Direct Examination Prioritizations with Soil Texture Modifier

Direct Examination Prioritization					
USDA Soil Texture Modifier	Two Tools with Soil Modifier		1st Indirect Inspection Tool		
			Severe	Moderate	Minor
Severe	2nd Indirect Inspection Tool	Severe	Immediate	Immediate	Scheduled
		Moderate	Immediate	Scheduled	Scheduled
		Minor	Scheduled	Scheduled	Scheduled
Moderate		Severe	Immediate	Scheduled	Scheduled
		Moderate	Immediate	Scheduled	Monitored
		Minor	Scheduled	Scheduled	Monitored
Minor		Severe	Immediate	Scheduled	Scheduled
		Moderate	Scheduled	Monitored	Monitored
		Minor	Scheduled	Monitored	Monitored

Just like the classification table before it, this prioritization table contains specific measurable criteria and a wide range of specific definable conditions all of which are supported by experience, sound engineering judgment and practice. In addition to the two tools, an indication is prioritized on the basis of the soil surrounding the indication.

8.0 Developing Severity Models Based on Sound Engineering Judgment

Two models are developed based on sound engineering judgment. One deals with external corrosion failure threat and the other deals with an empirical relationship between above-ground and below-grade measurements.

<u>External corrosion threat hazards Vs. clay content</u>

External corrosion is a threat to the operational integrity of a pipeline. The external corrosion threat can be subdivided into two sub-threats on the basis of possible failure modes, namely; rupture and leak failure modes. Frequently, but not always, rupture failure mode is the most potentially dangerous but least likely sub-threat and leak failure mode is the most likely but least potentially dangerous sub-threat. On the basis of RPR the external corrosion ranges from the greatest threat (RPR=0.8) to the least threat (RPR=1.2) and on the basis of %WL the external corrosion ranges from the greatest threat (%WL=70%) to the least threat

(%WL=10%). The following empirical relationships were developed on the assumption that the greatest possible external corrosion is substantially more (orders of magnitude) of a threat to the operational integrity of a pipeline than the least possible external corrosion.

Rupture failure threat: This external corrosion threat, T, is defined on the basis of RPR by

$$T_{RPR} = 3.25^{R} \qquad (1)$$

where,

T_{RPR} = the level of rupture threat represented by a particular external corrosion defect

R = the rate of threat increase as a function of RPR, defined as follows:

$$R = 50(RPR)^2 - 125(RPR) + 68 \qquad (2)$$

Leak failure threat: This external corrosion threat, T, is defined on the basis of %WL

$$T_{\%WL} = 1.85^{L} \qquad (3)$$

where,

T%WL = the level of leak threat represented by a particular external corrosion defect.

L = the rate of threat increase as a function of %WL and is defined as follows:

$$L = 50(\%WL)^2 - 5(\%WL) - 21 \qquad (4)$$

It should be noted that these threat relationships are relative and not absolute. The perception of threat is somewhat subjective and is difficult to quantify or qualify in absolute terms. However in an effort to assess the severity of an external corrosion defect in relation to soil or IDI data it was necessary to quantify and qualify external corrosion defects on the basis of the threat a particular external corrosion defect poses. These relationships were developed based on experience and are utilized to relatively rank the perception of threat represented by a particular external corrosion defect.

Figure 7 illustrates the empirical relationships of rupture and leak relative hazards as functions of percent clay. The T_{RPR} and $T_{\%WL}$ relationships above were used in the hazard computations. This particular plot demonstrates that the USDA soil texture designations can be ordered to effectively determine corrosivity and/or probability of corrosivity based on soil type and/or composition.

Relationship between above-ground and below-grade measurements

With ECDA, IDI techniques are used at grade to identify areas where external corrosion activity may have occurred, may be occurring or may occur on pipelines below grade. One of the goals of this project is to develop empirical relationships of above-grade indirect inspection indications and other operational data with actual occurrence below grade including past, present and/or future external corrosion activity.

The three above-grade IDI tools considered are CIS (Current Off), ACCA (-98Hz) and AC Voltage. In addition to the IDI tools, soil corrosivity is included through the use of weighting factors, W_1, W_2, W_3. Values of the weighting factors are established qualitatively by considering the soil texture, in terms of "clay separate percentage", "sand separate percentage", and "silt separate percentage" illustrated in Figure 4. For example, the lower the sand separate percentage, the lower the corrosion susceptibility.

These three factors affect soil corrosivity and the coating environment. Consequently, the inherent characteristics are qualitatively intertwined in each of the three weighting factors without being decoupled. The geographic based soil survey database SSURGO was utilized in determining the soil properties and characteristics for each joint (of 14,006 joints) of pipeline (~40 foot section). These soil properties and characteristics were used in developing the weighting factors.

Specifically, relationships are developed between IDI and other operational data with actual external corrosion activity below grade discovered by either in-line inspection (ILI) or direct examination. For situations where corrosion activity has occurred or is occurring, the relationship is between IDI data and in-line inspection (ILI) data using the rupture pressure ratio (RPR), as determined by modified B31G. For situations where corrosion activity may occur at a future time, the relationship is between IDI data and coating damage surface area as measured by direct examination (DE). To reduce the various data to usable forms, data integration is required for aligning each data set to alignment sheet and pipeline inventory records using the methodology based on NACE RP 502-2008.

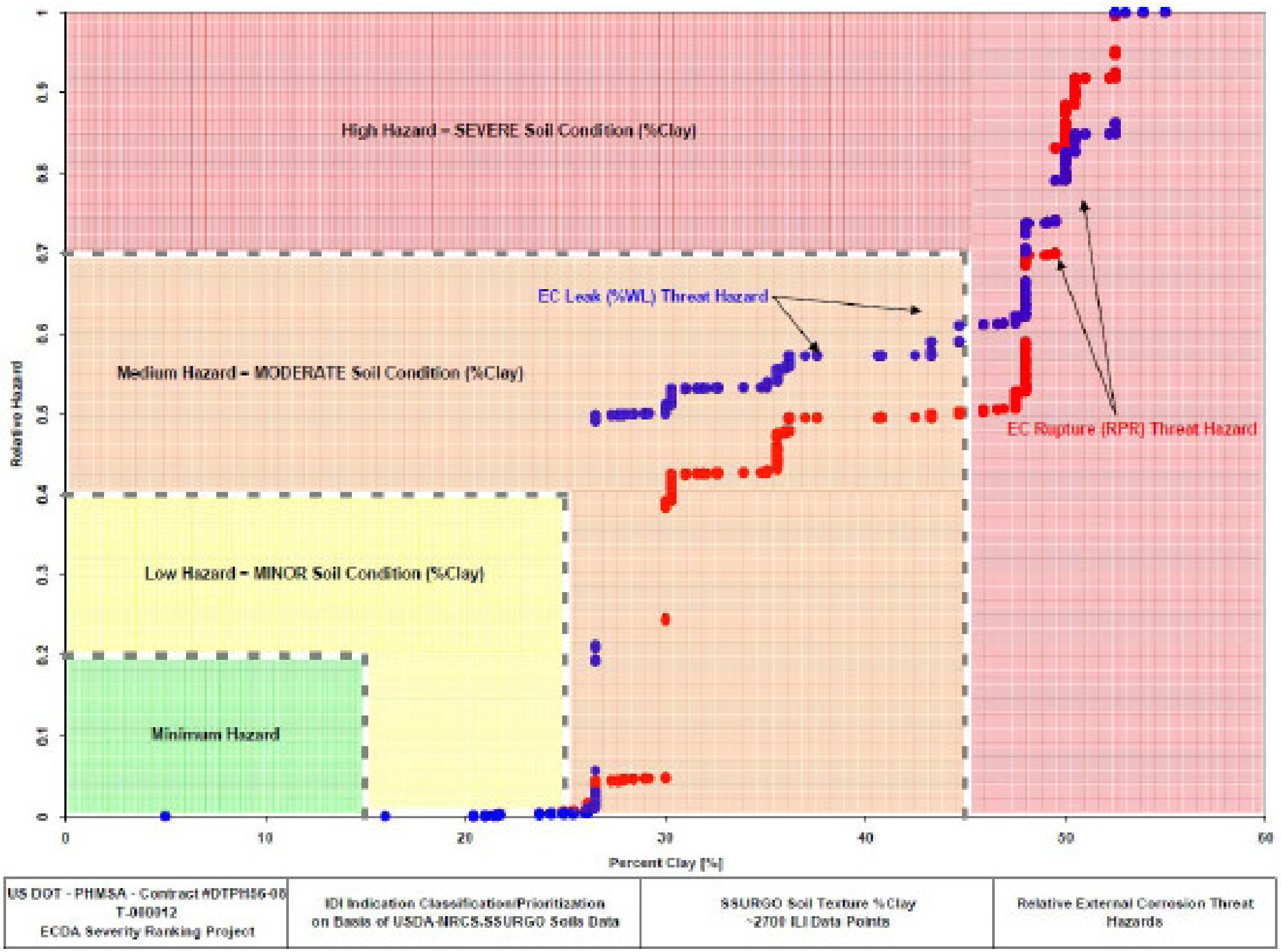


Figure 7: Leak And Rupture Threats as a Function of Percent Clay Content

Data normalization: In order to provide a consistent basis of comparing data for different pipelines, all IDI data are normalized such that the worst case scenario equals 1.0.

$$Y_N = [Y_{(worst\ case)} - Y_{(any\ case)}] \,/\, Y_{(worst\ case)} \qquad (5)$$

That is, the worst case is the largest value and therefore: $0 \leq Y_N \leq 1.0$

For IDI data the normalized value

$$X_N = [X_{(worst\ case)} - X_{(any\ case)}]/X_{(worst\ case)} \qquad (6)$$

That is, the worst case is the largest value and therefore: $0 \leq X \leq 1.0$

Weighted IDI values. The weighted IDI value "G" from three IDI tools (X_1, X_2, and X_3) is given by:

$$G = [W_1X_1 + W_2X_2 + W_3X_3] \,/\, [W_1 + W_3 + W_3] \qquad (7)$$

where X_1 is CIS (Off), X_2 is ACCA (-98Hz), and X_3 is AC Voltage.

That is, the weighted composite values of IDI measurements with 3 weighting factors is depicted as follows:

$$G = [W_1{*}CIS\ (Off) + W_2{*}ACCA\ (-98Hz) + W_3{*}ACV] \,/\, [W_1 + W_2 + W_3] \qquad (8)$$

The resulting value of G has the following boundary values: $0 \leq G \leq 1.0$

Normalized RPR values: The below-grade measurements are composed of ILI data based on the normalized RPR values. For ILI data (RPR), the measured value is normalized such that the worst case is scaled to the value of 1.0:

$$RPR_N = [RPR_{(worst\ case)} - RPR_{(any\ case)}] \,/\, RPR_{(worst\ case)} \qquad (9)$$

The G Values and the corresponding RPR values are plotted in Figure 8.This plot illustrates an empirical relationship between above-ground G measurements and below-grade RPR values for prioritizing indications for subsequent excavation and inspection.

The resulting empirical model provides a predictive scheme for the development of consistent classification and prioritization methodologies that would enable pipeline operators to effectively, economically, and safely address the external corrosion threat to pipeline integrity. It would also enable efficient use of limited resources to address integrity issues on pipelines assessed by ECDA.

9.0 Developing a Severity Model Based on Idealized Simulation

In order to provide a self-consistent basis of comparing data from different IDI tools, the following definition for signal attenuation is used:

$$Q_a = (20*\log(q_{min}/q_{max}) / L) \qquad (10)$$

where,

a = Data from a specific IDI tool or weighted combination of multiple IDI tools

Q_a = Attenuation factor for a segment of pipeline utilizing a particular IDI tool or combination of ID tools used for analytical comparison of severity ranking

q_{min} = The minimum measureable signal (voltage or current) for a given segment, L of pipeline taken from CIS-ON/OFF, ACCA, ACVG, DCVG, other IDI tools and a weighted combination of IDI tools

q_{max} = The maximum measureable signal (voltage or current) for a given segment, L of pipeline taken from CIS-ON/OFF, ACCA, ACVG, DCVG, other IDI tools and/or a weighted combination of IDI tools

L = Length of pipe segment being assessed

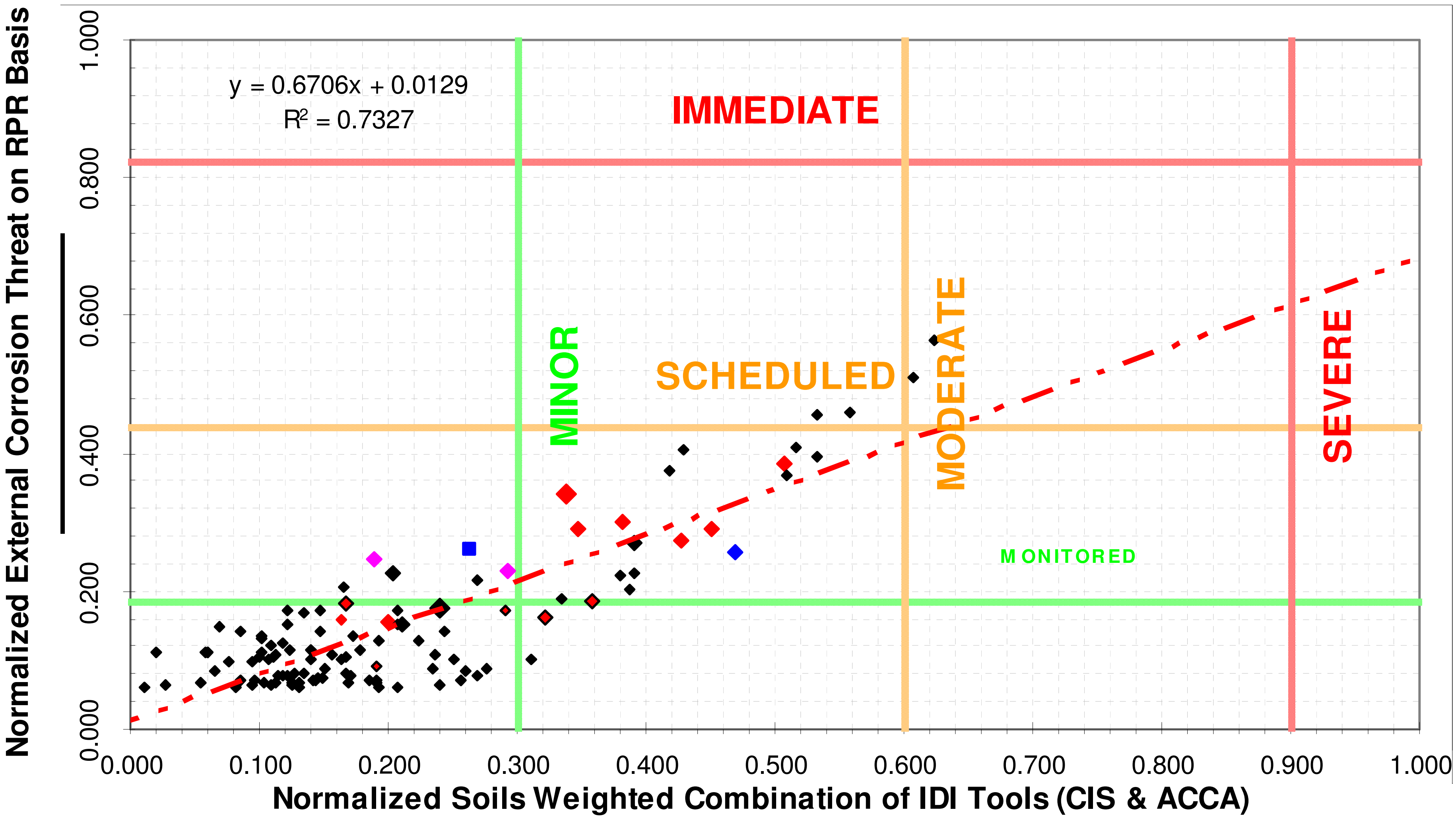


Figure 8: Plot of Normalized RPR versus Weighted IDI Values of G

For example;

a = CIS ON-potential attenuation parameters are defined as follows:

Q_a = CIS ON potential attenuation Factor for section, L of pipe [mdB]

q_{min} = Least negative ON potential for section of pipe of length L [mV]

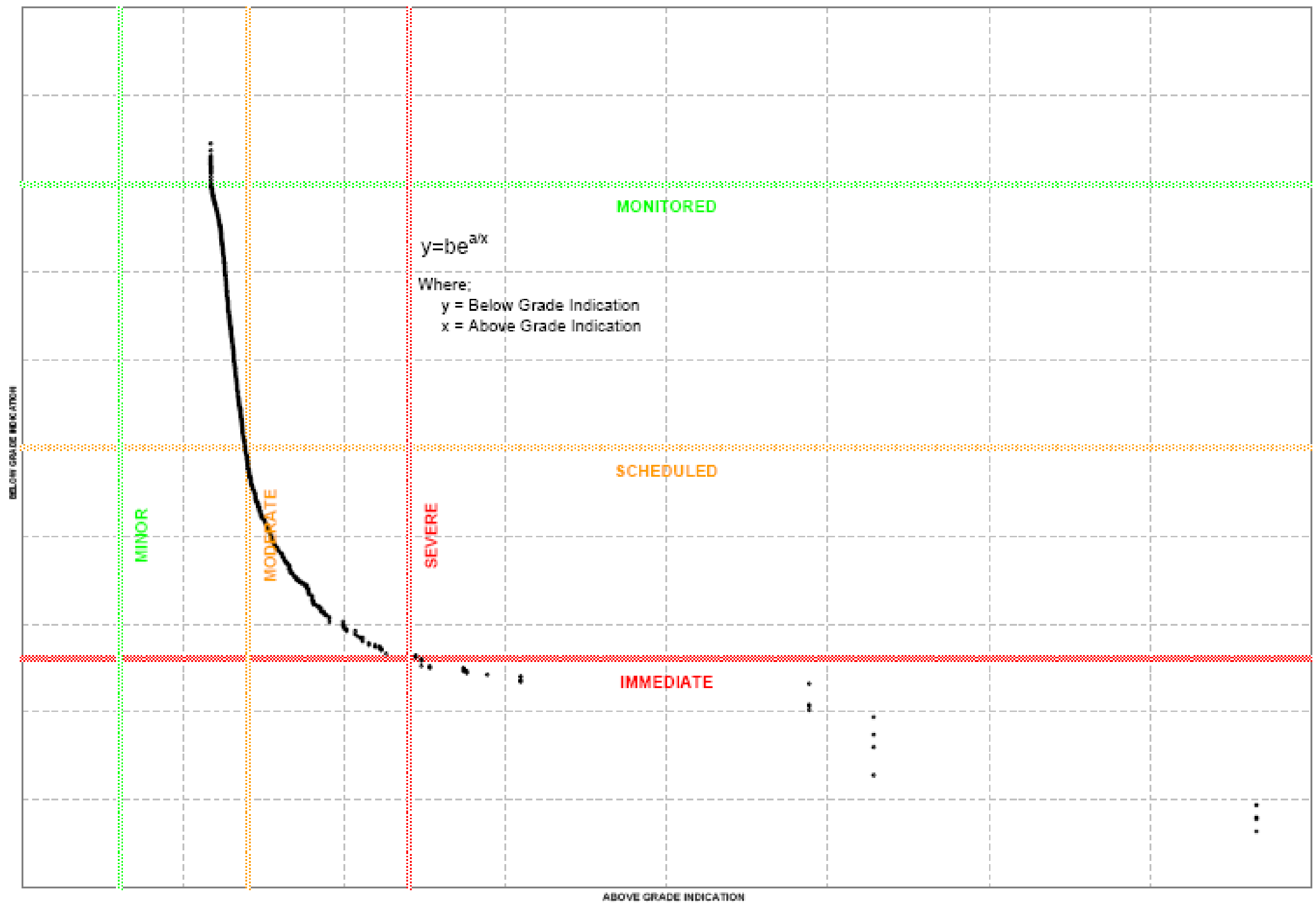
q_{max} = Most negative ON potential for section of pipe of length L [mV]

L = length of pipe section [ft]

For the condition where corrosion activity is occurring or may have occurred, there is a relationship between IDI data with in-line inspection (ILI) data or other below grade data using RPR and %WL. To reduce the various data to usable forms, the required data integration and analysis were performed. The data integration was performed by aligning each data set to alignment sheet and pipeline inventory record using a methodology based on NACE SP0502-2008. Next, some RPR and the corresponding DCVG data set were analyzed. The particular set of RPR data was sorted in ascending order. The corresponding DCVG data was independently sorted in ascending order as well. Each set of data provided an overview of the best and the worst conditions within each independent set. In a perfect world, there should be a correlation between the minimum and maximum of the above ground and below ground data. However, this is not a perfect world. Hence, the following attempt represents a generalized, idealized simulation.

Even though, there is now no correlation between the two ascending data, the above-grade observations are plotted versus the below-grade indications in order to simulate what would happen if we had a "perfect" data set. The result is presented in Figure 9. This graph is therefore a generalized, idealized simulation representing an attempt to illustrate an ultimate goal of a predictive scheme. The resulting empirical relationships could be linear, semi-log, Cartesian, etc., depending on the illustrative effect.

It should be noted that both the x-axis and the y-axis of Figure 9 are dimensionless as per the definition above. In principle, the x-axis can be based on any related above-grade or at-grade measurement; it could be voltage, current, change in current, pH, soil type, probability of these measurements, or some weighted combination. By the same token, the y-axis can be any related below-grade measurement or known data such as steel type, coating type, coating condition, surface area, wall loss, corrosion rate (mpy), RPR, number of occurrences/successes of these data or some weighted combination. The ideal relationship between x and y could be linear, step-wise linear or non-linear depending on what x and y represent.



Job# 380064 ECDA Enhancement Project USDOT PHMSA DTPH 56-08-T-00012	Severity Ranking of ECDA IDI's	Below Ground Indication vs. Above Grade - Indication	IDEAL

Figure 9: An idealized relationship between below grade indications and above grade observation

Note that the chart (Figure 9) is also divided in accordance with severity classification and prioritization schedules. The first, derived from the severity ranking of ECDA indirect inspection indications[4], states as follows:

- Severe – IDI indications considered as having the highest likelihood of external corrosion activity.
- Moderate – IDI indications considered as having possible and probable external corrosion activity.
- Minor – IDI indications considered as inactive or as having the lowest likelihood of external corrosion activity.

The division into a ECDA prioritization schedule[4], is as follows:

- Immediate – IDI indications considered as having an immediate impact on the safe operation of the pipeline under normal conditions. These indications represent ongoing external corrosion activity that when coupled with prior corrosion or other relevant data create an immediate threat.
- Scheduled – IDI indications consider as having no immediate impact on the safe operating condition of the pipeline under normal conditions. These indications represent ongoing external corrosion activity that when coupled with prior corrosion or other relevant data do not create an immediate threat.

Monitored – IDI indications considered inactive or as having a low likelihood of external corrosion activity This empirical "idealized" simulation between above-ground IDI observations and below-grade ILI indications is useful in providing some guidance for prioritizing IDI measurements for DE or other remedial activity.

10.0 Enhanced ECDA Severity Ranking Methodology

The primary objective of this project was to identify improvements to the ECDA severity ranking (classification and prioritization of indirect inspection indications) process. One such identified improvement to the severity ranking process is the incorporation of soils data. However, it became apparent during the course of this project that not only the severity ranking process could be improved but that other processes within the ECDA methodology could be enhanced by the incorporation of soils data. If pre-assessment, indirect inspection, direct examination and post assessment data are coupled with aligned soils data and are utilized iteratively in a continuous improvement process as intended by NACE SP0502-2008, more effective classification and prioritization of indirect indications can be achieved, thereby reducing the external corrosion threat to the operation of pipelines.

The following recommended guidelines for the ECDA severity ranking of onshore segments of buried (externally coated or bare) ferrous pipelines are intended to provide enhanced ECDA severity ranking methodology on typical pipeline systems. The guidelines assume that external corrosion is a pipeline integrity threat that is to be evaluated using the four-step ECDA process.

Pre-Assessment

The pre-assessment step of the ECDA methodology includes the following activities. These activities can be enhanced by incorporating soils data as outlined below.

Data collection

One of the categories of data indentified in NACE SP0502-2008 is Soils/Environmental. As shown in the standard, this data impacts IDI tool selection, ECDA region definition and interpretation of results. By utilizing the soils data from the USDA database and other soils data, areas can be identified where external corrosion is most likely, where certain IDI tools are most effective and/or where different classification/prioritization schemes may be necessary.

Assessment of ECDA feasibility

Soils data can be useful in indentifying areas where ECDA may be difficult to implement or may not be feasible, such as soils with high rock content.

Selection of indirect inspection tools

The results from IDI tools can be impacted to varying degrees by certain soil types. By incorporating soils data, the impact of soils on IDI tool selection can be assessed and the most appropriate IDI tool can be chosen for a particular soil.

Indirect Inspection

The indirect inspection step of the ECDA methodology includes the following activities. These activities can be enhanced by incorporating soils data as outlined below.

Conducting indirect inspections

Having prior knowledge of the soil conditions may enable a more effective performance of IDIs in that specific steps could be taken to determine the impact of particular soil types on the IDI, and additional steps could be taken to aid in the interpretation of results for particular soil types.

In addition, more detailed soils data can be collected concurrently with some IDIs enabling more definitive interpretations and assessments. This could include insitu measurements or soil sample collection.

Aligning and comparing Data

The data from the IDI tools should be spatially aligned with each other as well as detailed soils data and other pertinent pipeline data in order to develop effective and efficient classification schemes.

Direct Examination

The direct examination step of the ECDA methodology includes the following activities. These activities can be enhanced by incorporating soils data as outlined below.

Prioritization of classified IDI indications

The data from the IDI tools should be spatially aligned with each other as well as detailed soils data and other pertinent pipeline data in order to develop effective and efficient prioritization criteria.

Excavation & data collection, measurements of coating damage & corrosion defects and evaluations of remaining strength

Additional soils data, detailed coating damage and external corrosion defect information should be collected such that the classification/prioritization criteria can be effectively and accurately assessed.

Root cause analyses and process evaluation

As iterations of the ECDA process for a particular pipeline or region are performed, soils data as well as other pertinent data should be compiled and evaluated in subsequent iterations of the process. Continuous iterative process analyses should be utilized to determine root cause of external corrosion and coating damage. Such analyses could also be used to evaluate the overall accuracy and effectiveness of the process and the resulting refinement can be used to improve the next iteration of the process.

Post-Assessment

The post assessment step of the ECDA methodology includes the following activities. These activities can be enhanced by incorporating soils data as outlined below.

Remaining life calculations

As stated within the standard, soils data should be used as part of the sound engineering analysis process in estimating corrosion growth rates for remaining life calculations. The incorporation of soils data will enable more accurate estimates of corrosion growth rates to be determined by statistical analyses.

Definition of reassessment intervals, assessment of ECDA effectiveness & feedback/continuous improvement

As iterations of the ECDA process for a particular pipeline or region are performed, detailed soils data; as well as other pertinent data should be compiled and evaluated in subsequent iterations of the process. These iterative process analyses should be utilized to define reassessment intervals, assess effectiveness, and provide feedback for continuous improvement.

11.0 Prospective Future Research Project

There is a need for in-depth research projects in the following specific areas related to severity ranking of ECDA Indirect Inspection Indications:

- The Role of Soil Survey throughout the ECDA Process
- Use of Historical Operational Data in the ECDA Process
- Soil Parameters – Surveying Methods and Techniques
- External Corrosion Threat Prediction and Reduction

12.0 Conclusion

The methodologies developed under this research, represent an advancement in the conventional severity classification and prioritization tables presented in NACE SP0502-2008

1 The improved ECDA severity classification and prioritization methodologies
   - enable operators to efficiently/effectively manage external corrosion threats, and
   - provide more consistent assessments of the external corrosion threat

2 Methodologies developed represent an enhancement of NACE SP0502-2008 in the following order:
   - quantification of IDI data,
   - introduction of soil texture modifier,
   - effective utilization of available soils data, and
   - use of soil maps available in the public domain

3 The methodologies quantified, qualified, and verified industry knowledge and experience as indicated by
   - consistency with data, and
   - sound engineering judgment

4 The methodologies have significant implications for
   - public safety,
   - environmental protection, and
   - operational reliability

5 The methodologies are consistent with other PHMSA's stated goals including
   - collaborative development of technology,

- strengthening of industry consensus standards, and
- generation and promotion of new knowledge

13.0 References

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Appendix A

USDA Soil Survey
Map Unit Description

Map Unit Description

Garrard and Lincoln Counties, Kentucky

[Minor map unit components are excluded from this report]

Map unit: AlB - Allegheny loam, 2 to 6 percent slopes, rarely flooded

Component: Allegheny (90%)

The Allegheny component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on stream terraces on river valleys. The parent material consists of fine-loamy alluvium derived from sandstone and siltstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: AlC2 - Allegheny loam, 6 to 12 percent slopes, eroded

Component: Allegheny (90%)

The Allegheny component makes up 90 percent of the map unit. Slopes are 6 to 12 percent. This component is on stream terraces on river valleys. The parent material consists of fine-loamy alluvium derived from sandstone and siltstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: BaB - Beasley silt loam, 2 to 6 percent slopes

Component: Beasley (85%)

The Beasley component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from shale and siltstone and/or limestone. Depth to a root restrictive layer, bedrock (paralithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 12 percent.

Map unit: BbC2 - Beasley silty clay loam, 6 to 12 percent slopes, eroded

Component: Beasley (85%)

The Beasley component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from shale and siltstone and/or limestone. Depth to a root restrictive layer, bedrock (paralithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 12 percent.

Map unit: BeB - Berea silt loam, 2 to 6 percent slopes

Component: Berea (90%)

The Berea component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over residuum weathered from acid shale. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 20 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: Bo - Boonesboro silt loam, frequently flooded

Component: Boonesboro (85%)

The Boonesboro component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on valleys. The parent material consists of fine-loamy alluvium derived from limestone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: CaE2 - Caneyville silt loam, 12 to 30 percent slopes, eroded, rocky

Component: Caneyville (85%)

The Caneyville component makes up 85 percent of the map unit. Slopes are 12 to 30 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: CeB - Carpenter gravelly silt loam, 2 to 6 percent slopes

Component: Carpenter (85%)

The Carpenter component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-loamy colluvium over clayey residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (paralithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: CeC - Carpenter gravelly silt loam, 6 to 12 percent slopes

Component: Carpenter (85%)

The Carpenter component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-loamy colluvium over clayey residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (paralithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: CgE2 - Carpenter-Lenberg complex, 12 to 30 percent slopes, eroded

Component: Carpenter (50%)

The Carpenter component makes up 50 percent of the map unit. Slopes are 12 to 30 percent. This component is on hills on uplands. The parent material consists of fine-loamy colluvium over clayey residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (paralithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Lenberg (35%)

The Lenberg component makes up 35 percent of the map unit. Slopes are 12 to 30 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from shale. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: CgE2 - Carpenter-Lenberg complex, 12 to 30 percent slopes, eroded

Component: Lenberg (35%)

inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: ChB - Chenault gravelly silt loam, 2 to 6 percent slopes

Component: Chenault (85%)

The Chenault component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of old fine-loamy alluvium over clayey residuum weathered from limestone. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: ChC - Chenault gravelly silt loam, 6 to 12 percent slopes

Component: Chenault (85%)

The Chenault component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of old fine-loamy alluvium over clayey residuum weathered from limestone. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: CkC - Chenault-Lowell complex, phosphatic, 6 to 12 percent slopes

Component: Chenault, (phosphatic) (60%)

The Chenault, phosphatic component makes up 60 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of old fine-loamy alluvium over clayey residuum weathered from limestone. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Lowell, (phosphatic) (30%)

The Lowell, Phosphatic component makes up 30 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: ClD2 - Chenault-Faywood complex, phosphatic, 12 to 25 percent slopes, eroded, rocky

Component: Chenault, (phosphatic) (50%)

The Chenault, phosphatic component makes up 50 percent of the map unit. Slopes are 12 to 20 percent. This component is on hills on uplands. The parent material consists of old fine-loamy alluvium over clayey residuum weathered from limestone. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: ClD2 - Chenault-Faywood complex, phosphatic, 12 to 25 percent slopes, eroded, rocky

Component: Chenault, (phosphatic) (50%)

percent. Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Component: Faywood, (phosphatic) (30%)

The Faywood, Phosphatic component makes up 30 percent of the map unit. Slopes are 12 to 20 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Map unit: CmB - Christian silt loam, 2 to 6 percent slopes

Component: Christian (90%)

The Christian component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone, sandstone, and shale and/or siltstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: CmC2 - Christian silt loam, 6 to 12 percent slopes, eroded

Component: Christian (90%)

The Christian component makes up 90 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone, sandstone, and shale and/or siltstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: CoD2 - Christian silty clay loam, 12 to 25 percent slopes, eroded

Component: Christian (85%)

The Christian component makes up 85 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone, sandstone, and shale and/or siltstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: CpF2 - Colyer-Trappist complex, 25 to 60 percent slopes, eroded, very rocky

Component: Colyer (50%)

The Colyer component makes up 50 percent of the map unit. Slopes are 25 to 60 percent. This component is on hills on uplands. The parent material consists of clayey-skeletal residuum weathered from acid shale. Depth to a root restrictive layer, bedrock (lithic), is 8 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: CpF2 - Colyer-Trappist complex, 25 to 60 percent slopes, eroded, very rocky

Component: Trappist (30%)

The Trappist component makes up 30 percent of the map unit. Slopes are 25 to 60 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map unit: CrB - Crider silt loam, 2 to 6 percent slopes

Component: Crider (90%)

The Crider component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over clayey residuum weathered from limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: CrC - Crider silt loam, 6 to 12 percent slopes

Component: Crider (90%)

The Crider component makes up 90 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over clayey residuum weathered from limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: CuB - Culleoka silt loam, 2 to 6 percent slopes

Component: Culleoka (90%)

The Culleoka component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-loamy colluvium and/or residuum weathered from limestone, sandstone, and shale and/or siltstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: CuC2 - Culleoka silt loam, 6 to 12 percent slopes, eroded

Component: Culleoka (90%)

The Culleoka component makes up 90 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-loamy colluvium and/or residuum weathered from limestone, sandstone, and shale and/or siltstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: CuD2 - Culleoka silt loam, 12 to 25 percent slopes, eroded

Component: Culleoka (85%)

The Culleoka component makes up 85 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of fine-loamy colluvium and/or residuum weathered from limestone, sandstone, and shale and/or siltstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: CyF2 - Cynthiana-Faywood complex, 25 to 50 percent slopes, eroded, very rocky

Component: Cynthiana (50%)

The Cynthiana component makes up 50 percent of the map unit. Slopes are 25 to 50 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Faywood (35%)

The Faywood component makes up 35 percent of the map unit. Slopes are 25 to 50 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: DAM - Dam, large

Component: Dam, large (100%)

The Dam component makes up 100 percent of the map unit. Slopes are Depth to a root restrictive layer is greater than 60 inches. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. This soil does not meet hydric criteria.

Map unit: DoB - Donerail silt loam, 2 to 6 percent slopes

Component: Donerail (90%)

The Donerail component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on depressions on uplands. The parent material consists of clayey alluvium and/or residuum weathered from limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 32 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: EdD2 - Eden flaggy silty clay loam, 8 to 25 percent slopes, eroded

Component: Eden (85%)

The Eden component makes up 85 percent of the map unit. Slopes are 8 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from calcareous shale and/or limestone and siltstone. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2

Map unit: EdD2 - Eden flaggy silty clay loam, 8 to 25 percent slopes, eroded

Component: Eden (85%)

percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 7 percent.

Map unit: EfF2 - Eden-Culleoka association, 25 to 50 percent slopes, eroded, stony

Component: Eden (45%)

The Eden component makes up 45 percent of the map unit. Slopes are 25 to 50 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from calcareous shale and/or limestone and siltstone. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 7 percent.

Component: Culleoka (40%)

The Culleoka component makes up 40 percent of the map unit. Slopes are 25 to 50 percent. This component is on hills on uplands. The parent material consists of fine-loamy colluvium and/or residuum weathered from limestone, sandstone, and shale and/or siltstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map unit: EkB - Elk silt loam, 2 to 6 percent slopes

Component: Elk (85%)

The Elk component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on stream terraces on valleys. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: EkC - Elk silt loam, 6 to 12 percent slopes

Component: Elk (85%)

The Elk component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on stream terraces on valleys. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: EmB - Elk silt loam, 2 to 6 percent slopes, rarely flooded

Component: Elk (85%)

The Elk component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on stream terraces on valleys. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: FaC2 - Fairmount silty clay loam, 6 to 12 percent slopes, eroded, very rocky

Component: Fairmount (85%)

The Fairmount component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: FdF2 - Fairmount-Faywood-Rock outcrop complex, 25 to 50 percent slopes, eroded

Component: Fairmount (45%)

The Fairmount component makes up 45 percent of the map unit. Slopes are 25 to 50 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Faywood (30%)

The Faywood component makes up 30 percent of the map unit. Slopes are 25 to 50 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Rock outcrop (20%)

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Map unit: FeC2 - Faywood-Cynthiana complex, 6 to 12 percent slopes, eroded, rocky

Component: Faywood (60%)

The Faywood component makes up 60 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Component: Cynthiana (30%)

The Cynthiana component makes up 30 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Map unit: FeD2 - Faywood-Cynthiana complex, 12 to 25 percent slopes, eroded, very rocky

Component: Faywood (50%)

The Faywood component makes up 50 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Component: Cynthiana (35%)

The Cynthiana component makes up 35 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: FfC2 - Faywood-Fairmount complex, phosphatic, 6 to 12 percent slopes, eroded, rocky

Component: Faywood, (phosphatic) (50%)

The Faywood, Phosphatic component makes up 50 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Component: Fairmount, (phosphatic) (35%)

The Fairmount, Phosphatic component makes up 35 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Map unit: FfD2 - Faywood-Fairmount complex, phosphatic, 12 to 25 percent slopes, eroded, very rocky

Component: Faywood, (phosphatic) (50%)

The Faywood, Phosphatic component makes up 50 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Component: Fairmount, (phosphatic) (40%)

The Fairmount, Phosphatic component makes up 40 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: FoD2 - Faywood-Shrouts complex, 12 to 25 percent slopes, eroded, rocky

Component: Faywood (45%)

The Faywood component makes up 45 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Component: Shrouts (35%)

The Shrouts component makes up 35 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from calcareous shale. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 13 percent.

Map unit: FoF2 - Faywood-Shrouts complex, 25 to 60 percent slopes, eroded, rocky

Component: Faywood (45%)

The Faywood component makes up 45 percent of the map unit. Slopes are 25 to 60 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Shrouts (35%)

The Shrouts component makes up 35 percent of the map unit. Slopes are 25 to 60 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from calcareous shale. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 13 percent.

Map unit: FrB - Frankstown gravelly silt loam, 2 to 6 percent slopes

Component: Frankstown (85%)

The Frankstown component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-loamy residuum weathered from limestone and siltstone and/or shale. Depth to a root restrictive layer, bedrock (lithic), is 40 to 72 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: FrC - Frankstown gravelly silt loam, 6 to 12 percent slopes

Component: Frankstown (85%)

The Frankstown component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-loamy residuum weathered from limestone and siltstone and/or shale. Depth to a root restrictive

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: FrC - Frankstown gravelly silt loam, 6 to 12 percent slopes

Component: Frankstown (85%)

layer, bedrock (lithic), is 40 to 72 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: FrD2 - Frankstown gravelly silt loam, 12 to 25 percent slopes, eroded

Component: Frankstown (85%)

The Frankstown component makes up 85 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of fine-loamy residuum weathered from limestone and siltstone and/or shale. Depth to a root restrictive layer, bedrock (lithic), is 40 to 72 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: GaC2 - Garlin-Shrouts complex, 6-12 percent slopes, eroded

Component: Garlin (45%)

The Garlin component makes up 45 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-loamy residuum weathered from calcareous sandstone and/or calcareous siltstone and/or limestone and shale. Depth to a root restrictive layer, bedrock (paralithic), is 8 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Shrouts (35%)

The Shrouts component makes up 35 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from calcareous shale. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 13 percent.

Map unit: GaD2 - Garlin-Shrouts complex, 12 to 25 percent slopes, eroded, rocky

Component: Garlin (50%)

The Garlin component makes up 50 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of fine-loamy residuum weathered from calcareous sandstone and/or calcareous siltstone and/or limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 12 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Component: Shrouts (30%)

The Shrouts component makes up 30 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from calcareous shale. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 13 percent.

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: GmF - Garmon channery silt loam, 25 to 80 percent slopes, rocky

Component: Garmon (85%)

The Garmon component makes up 85 percent of the map unit. Slopes are 25 to 80 percent. This component is on hills on uplands. The parent material consists of fine-loamy residuum weathered from limestone and siltstone and/or calcareous shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map unit: GnB - Gilpin silt loam, 2 to 6 percent slopes

Component: Gilpin (90%)

The Gilpin component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-loamy residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: GnC2 - Gilpin silt loam, 6 to 12 percent slopes, eroded

Component: Gilpin (85%)

The Gilpin component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-loamy residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: GrB - Greenbriar silt loam, 2 to 6 percent slopes

Component: Greenbriar (90%)

The Greenbriar component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (lithic), is 40 to 72 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: HgC - Hagerstown silt loam, 6 to 12 percent slopes

Component: Hagerstown (90%)

The Hagerstown component makes up 90 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone. Depth to a root restrictive layer, bedrock (lithic), is 60 to 80 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: JeB - Jessietown silt loam, 2 to 6 percent slopes

Component: Jessietown (85%)

The Jessietown component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over residuum weathered from acid shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: JeC - Jessietown silt loam, 6 to 12 percent slopes

Component: Jessietown (85%)

The Jessietown component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over residuum weathered from acid shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: Jm - Johnsburg-Mullins complex

Component: Johnsburg (45%)

The Johnsburg component makes up 45 percent of the map unit. Slopes are 0 to 4 percent. This component is on flats on uplands. The parent material consists of fine-silty noncalcareous loess over residuum weathered from sandstone and siltstone and/or shale. Depth to a root restrictive layer, fragipan, is 24 to 36 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil does not meet hydric criteria.

Component: Mullins (35%)

The Mullins component makes up 35 percent of the map unit. Slopes are 0 to 3 percent. This component is on depressions on uplands. The parent material consists of fine-silty residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (lithic), is 48 to 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: Jr - Johnsburg-Robertsville complex

Component: Johnsburg (50%)

The Johnsburg component makes up 50 percent of the map unit. Slopes are 0 to 4 percent. This component is on flats on uplands. The parent material consists of fine-silty noncalcareous loess over residuum weathered from sandstone and siltstone and/or shale. Depth to a root restrictive layer, fragipan, is 24 to 36 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil does not meet hydric criteria.

Component: Robertsville (30%)

The Robertsville component makes up 30 percent of the map unit. Slopes are 0 to 3 percent. This component is on depressions on uplands. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer, fragipan, is 15 to 36 inches. The

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: Jr - Johnsburg-Robertsville complex

Component: Robertsville (30%)

natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: La - Lawrence silt loam, terrace, rarely flooded

Component: Lawrence (85%)

The Lawrence component makes up 85 percent of the map unit. Slopes are 0 to 4 percent. This component is on stream terraces on valleys. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer, fragipan, is 18 to 32 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 14 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map unit: Le - Lawrence-Robertsville complex

Component: Lawrence (40%)

The Lawrence component makes up 40 percent of the map unit. Slopes are 0 to 4 percent. This component is on flats on uplands. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer, fragipan, is 18 to 32 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 14 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil does not meet hydric criteria.

Component: Robertsville (30%)

The Robertsville component makes up 30 percent of the map unit. Slopes are 0 to 3 percent. This component is on depressions on uplands. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer, fragipan, is 15 to 36 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: LgC2 - Lenberg silty clay loam, 6 to 12 percent slopes, eroded

Component: Lenberg (85%)

The Lenberg component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from clayey shale. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: LlB - Lily loam, 2 to 6 percent slopes

Component: Lily (85%)

The Lily component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-loamy residuum weathered from sandstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: LlB - Lily loam, 2 to 6 percent slopes

Component: Lily (85%)

classification is 2e. This soil does not meet hydric criteria.

Map unit: LlC - Lily loam, 6 to 12 percent slopes

Component: Lily (85%)

The Lily component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-loamy residuum weathered from sandstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: LoB - Lowell silt loam, 2 to 6 percent slopes

Component: Lowell (85%)

The Lowell component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: LoC2 - Lowell silt loam, 6 to 12 percent slopes, eroded

Component: Lowell (85%)

The Lowell component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: LpD2 - Lowell-Faywood complex, 12 to 25 percent slopes, eroded, rocky

Component: Lowell (55%)

The Lowell component makes up 55 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Faywood (30%)

The Faywood component makes up 30 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: LsB - Lowell silt loam, phosphatic, 2 to 6 percent slopes

Component: Lowell, (phosphatic) (85%)

The Lowell, Phosphatic component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: LsC2 - Lowell silt loam, phosphatic, 6 to 12 percent slopes, eroded

Component: Lowell, (phosphatic) (85%)

The Lowell, Phosphatic component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: LtD2 - Lowell-Faywood complex, phosphatic, rocky, 12 to 25 percent slopes, eroded

Component: Lowell, (phosphatic) (55%)

The Lowell, Phosphatic component makes up 55 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Faywood, (phosphatic) (35%)

The Faywood, Phosphatic component makes up 35 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: Me - Melvin silt loam, frequently flooded

Component: Melvin (90%)

The Melvin component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on river valleys. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is frequently flooded. It is rarely ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: MoB - Monongahela loam, 2 to 6 percent slopes

Component: Monongahela (85%)

The Monongahela component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on stream terraces on river valleys. The parent material consists of mixed fine-loamy alluvium. Depth to a root restrictive layer, fragipan, is 18 to 30 inches. The

Map unit: MoB - Monongahela loam, 2 to 6 percent slopes

Component: Monongahela (85%)

natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 17 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: Ne - Newark silt loam, frequently flooded

Component: Newark (85%)

The Newark component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on valleys. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map unit: NhB - Nicholson silt loam, 2 to 6 percent slopes

Component: Nicholson (85%)

The Nicholson component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over clayey residuum weathered from limestone and siltstone and/or calcareous shale. Depth to a root restrictive layer, bedrock (lithic), is 60 to 80 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 20 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: NhC2 - Nicholson silt loam, 6 to 12 percent slopes, eroded

Component: Nicholson (85%)

The Nicholson component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over clayey residuum weathered from limestone and siltstone and/or calcareous shale. Depth to a root restrictive layer, fragipan, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 20 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: No - Nolin silt loam, frequently flooded

Component: Nolin (85%)

The Nolin component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on valleys. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 54 inches during January, February, March, April. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: OtB - Otwell silt loam, 2 to 6 percent slopes

Component: Otwell (85%)

Map unit: OtB - Otwell silt loam, 2 to 6 percent slopes

Component: Otwell (85%)

The Otwell component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on stream terraces on valleys. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer, fragipan, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 21 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: OwB - Otwell silt loam, 2 to 6 percent slopes, rarely flooded

Component: Otwell (90%)

The Otwell component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on stream terraces on valleys. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer, fragipan, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 21 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: PrB - Pricetown silt loam, 2 to 6 percent slopes

Component: Pricetown (90%)

The Pricetown component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over residuum weathered from limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: PrC - Pricetown silt loam, 6 to 12 percent slopes

Component: Pricetown (85%)

The Pricetown component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over residuum weathered from limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: Rb - Robertsville silt loam, terrace, rarely flooded

Component: Robertsville (90%)

The Robertsville component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on stream terraces on river valleys. The parent material consists of mixed fine-silty alluvium. Depth to a root restrictive layer, fragipan, is 15 to 36 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: RoF - Rock outcrop-Fairmount complex, 50 to 120 percent slopes

Component: Rock outcrop (55%)

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: RoF - Rock outcrop-Fairmount complex, 50 to 120 percent slopes

Component: Rock outcrop (55%)

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Component: Fairmount (30%)

The Fairmount component makes up 30 percent of the map unit. Slopes are 50 to 60 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: SaB - Sandview silt loam, 2 to 6 percent slopes

Component: Sandview (85%)

The Sandview component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over clayey residuum weathered from limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: SaC - Sandview silt loam, 6 to 12 percent slopes

Component: Sandview (85%)

The Sandview component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over clayey residuum weathered from limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: SdB - Sandview silt loam, phosphatic, 2 to 6 percent slopes

Component: Sandview, (phosphatic) (90%)

The Sandview, Phosphatic component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over clayey residuum weathered from limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: SdC - Sandview silt loam, phosphatic, 6 to 12 percent slopes

Component: Sandview, (phosphatic) (85%)

The Sandview, Phosphatic component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-silty noncalcareous loess over clayey residuum weathered from limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: SeC2 - Shrouts silty clay loam, 6 to 12 percent slopes, eroded

Component: Shrouts (85%)

The Shrouts component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from calcareous shale. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 13 percent.

Map unit: SfD3 - Shrouts-Cynthiana complex, 12 to 25 percent slopes, severely eroded, rocky

Component: Shrouts (55%)

The Shrouts component makes up 55 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from calcareous shale. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 13 percent.

Component: Cynthiana (30%)

The Cynthiana component makes up 30 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: SgF3 - Shrouts-Garlin-Cynthiana complex, 25 to 50 percent slopes, severely eroded, very rocky

Component: Shrouts (40%)

The Shrouts component makes up 40 percent of the map unit. Slopes are 25 to 50 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from calcareous shale. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 13 percent.

Component: Garlin (25%)

The Garlin component makes up 25 percent of the map unit. Slopes are 25 to 50 percent. This component is on hills on uplands. The parent material consists of fine-loamy residuum weathered from calcareous sandstone and/or calcareous siltstone and/or limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 12 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Cynthiana (20%)

The Cynthiana component makes up 20 percent of the map unit. Slopes are 25 to 50 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from limestone and shale. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of

Map unit: SgF3 - Shrouts-Garlin-Cynthiana complex, 25 to 50 percent slopes, severely eroded, very rocky

Component: Cynthiana (20%)

water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: Sk - Skidmore very gravelly silt loam, frequently flooded

Component: Skidmore (85%)

The Skidmore component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on valleys. The parent material consists of loamy-skeletal alluvium derived from sandstone and siltstone and/or limestone. Depth to a root restrictive layer, bedrock (lithic), is 40 to 90 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 42 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: TeB - Teddy silt loam, 2 to 6 percent slopes

Component: Teddy (85%)

The Teddy component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-loamy noncalcareous loess over residuum weathered from limestone, sandstone, and shale and/or siltstone. Depth to a root restrictive layer, fragipan, is 18 to 36 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 23 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: TlB - Tilsit silt loam, 2 to 6 percent slopes

Component: Tilsit (90%)

The Tilsit component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of fine-silty residuum weathered from sandstone and siltstone and/or shale. Depth to a root restrictive layer, bedrock (lithic), is 40 to 80 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 19 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: TlC - Tilsit silt loam, 6 to 12 percent slopes

Component: Tilsit (85%)

The Tilsit component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of fine-silty residuum weathered from sandstone and siltstone and/or shale. Depth to a root restrictive layer, bedrock (paralithic), is 40 to 50 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 19 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: TpB - Trappist silt loam, 2 to 6 percent slopes

Component: Trappist (85%)

The Trappist component makes up 85 percent of the map unit. Slopes are 2 to 6 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to

Map Unit Description

Garrard and Lincoln Counties, Kentucky

Map unit: TpB - Trappist silt loam, 2 to 6 percent slopes

Component: Trappist (85%)

a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: TpC2 - Trappist silty clay loam, 6 to 12 percent slopes, eroded

Component: Trappist (85%)

The Trappist component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent material consists of clayey residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: TrD2 - Trappist-Colyer complex, 12 to 25 percent slopes, eroded

Component: Trappist (50%)

The Trappist component makes up 50 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock (lithic), is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Colyer (35%)

The Colyer component makes up 35 percent of the map unit. Slopes are 12 to 25 percent. This component is on hills on uplands. The parent material consists of clayey-skeletal residuum weathered from acid shale. Depth to a root restrictive layer, bedrock (lithic), is 8 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: W - Water

Component: Water (100%)

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Map unit: Yo - Yosemite gravelly silt loam, frequently flooded

Component: Yosemite (85%)

The Yosemite component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on valleys. The parent material consists of loamy-skeletal alluvium derived from limestone and sandstone and/or siltstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Calcium Carbonate (CaCO3)

Layer Option: Depth Range 24 to 72 Inches
Units of Measure: percent
Aggregation Method: Dominant Component
Tie-break Rule: Higher
Interpret Nulls as Zero: Yes

Garrard and Lincoln Counties, Kentucky
Survey Area Version and Date: 4 - 12/18/2008

Map symbol	Map unit name	Rating
AlB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	0
AlC2	Allegheny loam, 6 to 12 percent slopes, eroded	0
BaB	Beasley silt loam, 2 to 6 percent slopes	12
BbC2	Beasley silty clay loam, 6 to 12 percent slopes, eroded	12
BeB	Berea silt loam, 2 to 6 percent slopes	0
Bo	Boonesboro silt loam, frequently flooded	0
CaE2	Caneyville silt loam, 12 to 30 percent slopes, eroded, rocky	0
CeB	Carpenter gravelly silt loam, 2 to 6 percent slopes	0
CeC	Carpenter gravelly silt loam, 6 to 12 percent slopes	0
CgE2	Carpenter-Lenberg complex, 12 to 30 percent slopes, eroded	0
ChB	Chenault gravelly silt loam, 2 to 6 percent slopes	0
ChC	Chenault gravelly silt loam, 6 to 12 percent slopes	0
CkC	Chenault-Lowell complex, phosphatic, 6 to 12 percent slopes	0
ClD2	Chenault-Faywood complex, phosphatic, 12 to 25 percent slopes, eroded, rocky	0
CmB	Christian silt loam, 2 to 6 percent slopes	0
CmC2	Christian silt loam, 6 to 12 percent slopes, eroded	0
CoD2	Christian silty clay loam, 12 to 25 percent slopes, eroded	0
CpF2	Colyer-Trappist complex, 25 to 60 percent slopes, eroded, very rocky	0
CrB	Crider silt loam, 2 to 6 percent slopes	0
CrC	Crider silt loam, 6 to 12 percent slopes	0
CuB	Culleoka silt loam, 2 to 6 percent slopes	0
CuC2	Culleoka silt loam, 6 to 12 percent slopes, eroded	0
CuD2	Culleoka silt loam, 12 to 25 percent slopes, eroded	0
CyF2	Cynthiana-Faywood complex, 25 to 50 percent slopes, eroded, very rocky	0
DAM	Dam, large	
DoB	Donerail silt loam, 2 to 6 percent slopes	0
EdD2	Eden flaggy silty clay loam, 8 to 25 percent slopes, eroded	
EfF2	Eden-Culleoka association, 25 to 50 percent slopes, eroded, stony	
EkB	Elk silt loam, 2 to 6 percent slopes	0
EkC	Elk silt loam, 6 to 12 percent slopes	0
EmB	Elk silt loam, 2 to 6 percent slopes, rarely flooded	0
FaC2	Fairmount silty clay loam, 6 to 12 percent slopes, eroded, very rocky	
FdF2	Fairmount-Faywood-Rock outcrop complex, 25 to 50 percent slopes, eroded	0
FeC2	Faywood-Cynthiana complex, 6 to 12 percent slopes, eroded, rocky	0
FeD2	Faywood-Cynthiana complex, 12 to 25 percent slopes, eroded, very rocky	0
FfC2	Faywood-Fairmount complex, phosphatic, 6 to 12 percent slopes, eroded, rocky	0
FfD2	Faywood-Fairmount complex, phosphatic, 12 to 25 percent slopes, eroded, very rocky	0
FoD2	Faywood-Shrouts complex, 12 to 25 percent slopes, eroded, rocky	0
FoF2	Faywood-Shrouts complex, 25 to 60 percent slopes, eroded, rocky	0
FrB	Frankstown gravelly silt loam, 2 to 6 percent slopes	0
FrC	Frankstown gravelly silt loam, 6 to 12 percent slopes	0
FrD2	Frankstown gravelly silt loam, 12 to 25 percent slopes, eroded	0
GaC2	Garlin-Shrouts complex, 6-12 percent slopes, eroded	0
GaD2	Garlin-Shrouts complex, 12 to 25 percent slopes, eroded, rocky	0
GmF	Garmon channery silt loam, 25 to 80 percent slopes, rocky	0

Calcium Carbonate ($CaCO_3$)

Layer Option: Depth Range 24 to 72 Inches
Units of Measure: percent
Aggregation Method: Dominant Component
Tie-break Rule: Higher
Interpret Nulls as Zero: Yes

Garrard and Lincoln Counties, Kentucky
Survey Area Version and Date: 4 - 12/18/2008

Map symbol	Map unit name	Rating
GnB	Gilpin silt loam, 2 to 6 percent slopes	0
GnC2	Gilpin silt loam, 6 to 12 percent slopes, eroded	0
GrB	Greenbriar silt loam, 2 to 6 percent slopes	0
HgC	Hagerstown silt loam, 6 to 12 percent slopes	0
JeB	Jessietown silt loam, 2 to 6 percent slopes	
JeC	Jessietown silt loam, 6 to 12 percent slopes	
Jm	Johnsburg-Mullins complex	0
Jr	Johnsburg-Robertsville complex	0
La	Lawrence silt loam, terrace, rarely flooded	0
Le	Lawrence-Robertsville complex	0
LgC2	Lenberg silty clay loam, 6 to 12 percent slopes, eroded	0
LIB	Lily loam, 2 to 6 percent slopes	0
LIC	Lily loam, 6 to 12 percent slopes	0
LoB	Lowell silt loam, 2 to 6 percent slopes	1
LoC2	Lowell silt loam, 6 to 12 percent slopes, eroded	1
LpD2	Lowell-Faywood complex, 12 to 25 percent slopes, eroded, rocky	1
LsB	Lowell silt loam, phosphatic, 2 to 6 percent slopes	1
LsC2	Lowell silt loam, phosphatic, 6 to 12 percent slopes, eroded	1
LtD2	Lowell-Faywood complex, phosphatic, rocky, 12 to 25 percent slopes, eroded	1
Me	Melvin silt loam, frequently flooded	0
MoB	Monongahela loam, 2 to 6 percent slopes	0
Ne	Newark silt loam, frequently flooded	0
NhB	Nicholson silt loam, 2 to 6 percent slopes	0
NhC2	Nicholson silt loam, 6 to 12 percent slopes, eroded	0
No	Nolin silt loam, frequently flooded	0
OtB	Otwell silt loam, 2 to 6 percent slopes	0
OwB	Otwell silt loam, 2 to 6 percent slopes, rarely flooded	0
PrB	Pricetown silt loam, 2 to 6 percent slopes	0
PrC	Pricetown silt loam, 6 to 12 percent slopes	0
Rb	Robertsville silt loam, terrace, rarely flooded	0
RoF	Rock outcrop-Fairmount complex, 50 to 120 percent slopes	
SaB	Sandview silt loam, 2 to 6 percent slopes	0
SaC	Sandview silt loam, 6 to 12 percent slopes	0
SdB	Sandview silt loam, phosphatic, 2 to 6 percent slopes	0
SdC	Sandview silt loam, phosphatic, 6 to 12 percent slopes	0
SeC2	Shrouts silty clay loam, 6 to 12 percent slopes, eroded	13
SfD3	Shrouts-Cynthiana complex, 12 to 25 percent slopes, severely eroded, rocky	13
SgF3	Shrouts-Garlin-Cynthiana complex, 25 to 50 percent slopes, severely eroded, very rocky	13
Sk	Skidmore very gravelly silt loam, frequently flooded	0
TeB	Teddy silt loam, 2 to 6 percent slopes	0
TIB	Tilsit silt loam, 2 to 6 percent slopes	0
TIC	Tilsit silt loam, 6 to 12 percent slopes	0
TpB	Trappist silt loam, 2 to 6 percent slopes	0
TpC2	Trappist silty clay loam, 6 to 12 percent slopes, eroded	0
TrD2	Trappist-Colyer complex, 12 to 25 percent slopes, eroded	0

Calcium Carbonate ($CaCO_3$)

Layer Option: Depth Range 24 to 72 Inches
Units of Measure: percent
Aggregation Method: Dominant Component
Tie-break Rule: Higher
Interpret Nulls as Zero: Yes

Garrard and Lincoln Counties, Kentucky
Survey Area Version and Date: 4 - 12/18/2008

Map symbol	Map unit name	Rating
W	Water	
Yo	Yosemite gravelly silt loam, frequently flooded	0

Calcium Carbonate ($CaCO_3$)

Rating Options

Attribute Name: Calcium Carbonate ($CaCO_3$)

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Layer Option: Depth Range 24 to 72 Inches

Units of Measure: percent

Aggregation Method: Dominant Component

Aggregation is the process by which a set of component attribute values is reduced to a single value to represent the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. The components in the map unit name represent the major soils within a map unit delineation. Minor components make up the balance of the map unit. Great differences in soil properties can occur between map unit components and within short distances. Minor components may be very different from the major components. Such differences could significantly affect use and management of the map unit. Minor components may or may not be documented in the database. The results of aggregation do not reflect the presence or absence of limitations of the components which are not listed in the database. An on-site investigation is required to identify the location of individual map unit components.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be generated. Aggregation must be done because, on any soil map, map units are delineated but components are not.The aggregation method "Dominant Component" returns the attribute value associated with the component with the highest percent composition in the map unit. If more than one component shares the highest percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher attribute value should be returned in the case of a percent composition tie.

The result returned by this aggregation method may or may not represent the dominant condition throughout the map unit.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Interpret Nulls as Zero: Yes

This option indicates that a null value for a component should be converted to zero before aggregation occurs. This will be done only if a map unit has at least one component where this value is not null.

pH (1 to 1 Water)

Layer Option: Depth Range 24 to 72 Centimeters
Aggregation Method: Dominant Component
Tie-break Rule: Higher
Interpret Nulls as Zero: No

Garrard and Lincoln Counties, Kentucky
Survey Area Version and Date: 4 - 12/18/2008

Map symbol	Map unit name	Rating
AlB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	4.6
AlC2	Allegheny loam, 6 to 12 percent slopes, eroded	4.6
BaB	Beasley silt loam, 2 to 6 percent slopes	6.9
BbC2	Beasley silty clay loam, 6 to 12 percent slopes, eroded	6.9
BeB	Berea silt loam, 2 to 6 percent slopes	4.6
Bo	Boonesboro silt loam, frequently flooded	7.3
CaE2	Caneyville silt loam, 12 to 30 percent slopes, eroded, rocky	5.9
CeB	Carpenter gravelly silt loam, 2 to 6 percent slopes	5.5
CeC	Carpenter gravelly silt loam, 6 to 12 percent slopes	5.5
CgE2	Carpenter-Lenberg complex, 12 to 30 percent slopes, eroded	5.5
ChB	Chenault gravelly silt loam, 2 to 6 percent slopes	5.8
ChC	Chenault gravelly silt loam, 6 to 12 percent slopes	5.8
CkC	Chenault-Lowell complex, phosphatic, 6 to 12 percent slopes	5.8
ClD2	Chenault-Faywood complex, phosphatic, 12 to 25 percent slopes, eroded, rocky	5.8
CmB	Christian silt loam, 2 to 6 percent slopes	4.6
CmC2	Christian silt loam, 6 to 12 percent slopes, eroded	4.6
CoD2	Christian silty clay loam, 12 to 25 percent slopes, eroded	4.6
CpF2	Colyer-Trappist complex, 25 to 60 percent slopes, eroded, very rocky	4.3
CrB	Crider silt loam, 2 to 6 percent slopes	6.2
CrC	Crider silt loam, 6 to 12 percent slopes	6.2
CuB	Culleoka silt loam, 2 to 6 percent slopes	5.6
CuC2	Culleoka silt loam, 6 to 12 percent slopes, eroded	5.6
CuD2	Culleoka silt loam, 12 to 25 percent slopes, eroded	5.6
CyF2	Cynthiana-Faywood complex, 25 to 50 percent slopes, eroded, very rocky	7.0
DAM	Dam, large	
DoB	Donerail silt loam, 2 to 6 percent slopes	6.0
EdD2	Eden flaggy silty clay loam, 8 to 25 percent slopes, eroded	6.8
EfF2	Eden-Culleoka association, 25 to 50 percent slopes, eroded, stony	6.8
EkB	Elk silt loam, 2 to 6 percent slopes	5.5
EkC	Elk silt loam, 6 to 12 percent slopes	5.5
EmB	Elk silt loam, 2 to 6 percent slopes, rarely flooded	5.5
FaC2	Fairmount silty clay loam, 6 to 12 percent slopes, eroded, very rocky	7.5
FdF2	Fairmount-Faywood-Rock outcrop complex, 25 to 50 percent slopes, eroded	7.5
FeC2	Faywood-Cynthiana complex, 6 to 12 percent slopes, eroded, rocky	6.5
FeD2	Faywood-Cynthiana complex, 12 to 25 percent slopes, eroded, very rocky	6.5
FfC2	Faywood-Fairmount complex, phosphatic, 6 to 12 percent slopes, eroded, rocky	6.5
FfD2	Faywood-Fairmount complex, phosphatic, 12 to 25 percent slopes, eroded, very rocky	6.5
FoD2	Faywood-Shrouts complex, 12 to 25 percent slopes, eroded, rocky	6.5
FoF2	Faywood-Shrouts complex, 25 to 60 percent slopes, eroded, rocky	6.5
FrB	Frankstown gravelly silt loam, 2 to 6 percent slopes	5.3
FrC	Frankstown gravelly silt loam, 6 to 12 percent slopes	5.3
FrD2	Frankstown gravelly silt loam, 12 to 25 percent slopes, eroded	5.3
GaC2	Garlin-Shrouts complex, 6-12 percent slopes, eroded	7.9
GaD2	Garlin-Shrouts complex, 12 to 25 percent slopes, eroded, rocky	7.9
GmF	Garmon channery silt loam, 25 to 80 percent slopes, rocky	5.9
GnB	Gilpin silt loam, 2 to 6 percent slopes	4.6

pH (1 to 1 Water)

Layer Option: Depth Range 24 to 72 Centimeters
Aggregation Method: Dominant Component
Tie-break Rule: Higher
Interpret Nulls as Zero: No

Garrard and Lincoln Counties, Kentucky
Survey Area Version and Date: 4 - 12/18/2008

Map symbol	Map unit name	Rating
GnC2	Gilpin silt loam, 6 to 12 percent slopes, eroded	4.6
GrB	Greenbriar silt loam, 2 to 6 percent slopes	4.6
HgC	Hagerstown silt loam, 6 to 12 percent slopes	6.2
JeB	Jessietown silt loam, 2 to 6 percent slopes	4.6
JeC	Jessietown silt loam, 6 to 12 percent slopes	4.6
Jm	Johnsburg-Mullins complex	4.7
Jr	Johnsburg-Robertsville complex	4.7
La	Lawrence silt loam, terrace, rarely flooded	5.4
Le	Lawrence-Robertsville complex	5.4
LgC2	Lenberg silty clay loam, 6 to 12 percent slopes, eroded	5.0
LlB	Lily loam, 2 to 6 percent slopes	4.6
LlC	Lily loam, 6 to 12 percent slopes	4.6
LoB	Lowell silt loam, 2 to 6 percent slopes	5.5
LoC2	Lowell silt loam, 6 to 12 percent slopes, eroded	5.5
LpD2	Lowell-Faywood complex, 12 to 25 percent slopes, eroded, rocky	5.5
LsB	Lowell silt loam, phosphatic, 2 to 6 percent slopes	5.5
LsC2	Lowell silt loam, phosphatic, 6 to 12 percent slopes, eroded	5.5
LtD2	Lowell-Faywood complex, phosphatic, rocky, 12 to 25 percent slopes, eroded	5.5
Me	Melvin silt loam, frequently flooded	6.7
MoB	Monongahela loam, 2 to 6 percent slopes	5.0
Ne	Newark silt loam, frequently flooded	6.7
NhB	Nicholson silt loam, 2 to 6 percent slopes	5.5
NhC2	Nicholson silt loam, 6 to 12 percent slopes, eroded	5.5
No	Nolin silt loam, frequently flooded	7.0
OtB	Otwell silt loam, 2 to 6 percent slopes	5.0
OwB	Otwell silt loam, 2 to 6 percent slopes, rarely flooded	5.0
PrB	Pricetown silt loam, 2 to 6 percent slopes	5.3
PrC	Pricetown silt loam, 6 to 12 percent slopes	5.3
Rb	Robertsville silt loam, terrace, rarely flooded	4.6
RoF	Rock outcrop-Fairmount complex, 50 to 120 percent slopes	
SaB	Sandview silt loam, 2 to 6 percent slopes	5.9
SaC	Sandview silt loam, 6 to 12 percent slopes	5.9
SdB	Sandview silt loam, phosphatic, 2 to 6 percent slopes	5.9
SdC	Sandview silt loam, phosphatic, 6 to 12 percent slopes	5.9
SeC2	Shrouts silty clay loam, 6 to 12 percent slopes, eroded	6.8
SfD3	Shrouts-Cynthiana complex, 12 to 25 percent slopes, severely eroded, rocky	6.8
SgF3	Shrouts-Garlin-Cynthiana complex, 25 to 50 percent slopes, severely eroded, very rocky	6.8
Sk	Skidmore very gravelly silt loam, frequently flooded	6.7
TeB	Teddy silt loam, 2 to 6 percent slopes	5.5
TlB	Tilsit silt loam, 2 to 6 percent slopes	4.6
TlC	Tilsit silt loam, 6 to 12 percent slopes	4.6
TpB	Trappist silt loam, 2 to 6 percent slopes	4.6
TpC2	Trappist silty clay loam, 6 to 12 percent slopes, eroded	4.6
TrD2	Trappist-Colyer complex, 12 to 25 percent slopes, eroded	4.6
W	Water	
Yo	Yosemite gravelly silt loam, frequently flooded	6.7

pH (1 to 1 Water)

Rating Options

Attribute Name: pH (1 to 1 Water)

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion. In general, soils that are either highly alkaline or highly acid are likely to be very corrosive to steel. The most common soil laboratory measurement of pH is the 1:1 water method. A crushed soil sample is mixed with an equal amount of water, and a measurement is made of the suspension.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Layer Option: Depth Range 24 to 72 Centimeters

Aggregation Method: Dominant Component

Aggregation is the process by which a set of component attribute values is reduced to a single value to represent the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. The components in the map unit name represent the major soils within a map unit delineation. Minor components make up the balance of the map unit. Great differences in soil properties can occur between map unit components and within short distances. Minor components may be very different from the major components. Such differences could significantly affect use and management of the map unit. Minor components may or may not be documented in the database. The results of aggregation do not reflect the presence or absence of limitations of the components which are not listed in the database. An on-site investigation is required to identify the location of individual map unit components.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be generated. Aggregation must be done because, on any soil map, map units are delineated but components are not.The aggregation method "Dominant Component" returns the attribute value associated with the component with the highest percent composition in the map unit. If more than one component shares the highest percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher attribute value should be returned in the case of a percent composition tie.

The result returned by this aggregation method may or may not represent the dominant condition throughout the map unit.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Interpret Nulls as Zero: No

This option indicates that a null value for a component should be converted to zero before aggregation occurs. This will be done only if a map unit has at least one component where this value is not null.

Percent Clay

Layer Option: Depth Range 24 to 72 Centimeters
Units of Measure: percent
Aggregation Method: Dominant Component
Tie-break Rule: Higher
Interpret Nulls as Zero: No

Garrard and Lincoln Counties, Kentucky
Survey Area Version and Date: 4 - 12/18/2008

Map symbol	Map unit name	Rating
AlB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	23.6
AlC2	Allegheny loam, 6 to 12 percent slopes, eroded	23.6
BaB	Beasley silt loam, 2 to 6 percent slopes	50.0
BbC2	Beasley silty clay loam, 6 to 12 percent slopes, eroded	50.0
BeB	Berea silt loam, 2 to 6 percent slopes	22.4
Bo	Boonesboro silt loam, frequently flooded	26.0
CaE2	Caneyville silt loam, 12 to 30 percent slopes, eroded, rocky	48.0
CeB	Carpenter gravelly silt loam, 2 to 6 percent slopes	28.4
CeC	Carpenter gravelly silt loam, 6 to 12 percent slopes	28.4
CgE2	Carpenter-Lenberg complex, 12 to 30 percent slopes, eroded	28.4
ChB	Chenault gravelly silt loam, 2 to 6 percent slopes	29.0
ChC	Chenault gravelly silt loam, 6 to 12 percent slopes	29.0
CkC	Chenault-Lowell complex, phosphatic, 6 to 12 percent slopes	29.0
ClD2	Chenault-Faywood complex, phosphatic, 12 to 25 percent slopes, eroded, rocky	29.0
CmB	Christian silt loam, 2 to 6 percent slopes	44.9
CmC2	Christian silt loam, 6 to 12 percent slopes, eroded	44.9
CoD2	Christian silty clay loam, 12 to 25 percent slopes, eroded	47.2
CpF2	Colyer-Trappist complex, 25 to 60 percent slopes, eroded, very rocky	44.0
CrB	Crider silt loam, 2 to 6 percent slopes	30.0
CrC	Crider silt loam, 6 to 12 percent slopes	30.0
CuB	Culleoka silt loam, 2 to 6 percent slopes	27.8
CuC2	Culleoka silt loam, 6 to 12 percent slopes, eroded	29.0
CuD2	Culleoka silt loam, 12 to 25 percent slopes, eroded	29.0
CyF2	Cynthiana-Faywood complex, 25 to 50 percent slopes, eroded, very rocky	50.0
DAM	Dam, large	
DoB	Donerail silt loam, 2 to 6 percent slopes	33.5
EdD2	Eden flaggy silty clay loam, 8 to 25 percent slopes, eroded	51.0
EfF2	Eden-Culleoka association, 25 to 50 percent slopes, eroded, stony	51.0
EkB	Elk silt loam, 2 to 6 percent slopes	29.0
EkC	Elk silt loam, 6 to 12 percent slopes	29.0
EmB	Elk silt loam, 2 to 6 percent slopes, rarely flooded	29.0
FaC2	Fairmount silty clay loam, 6 to 12 percent slopes, eroded, very rocky	48.0
FdF2	Fairmount-Faywood-Rock outcrop complex, 25 to 50 percent slopes, eroded	48.0
FeC2	Faywood-Cynthiana complex, 6 to 12 percent slopes, eroded, rocky	48.0
FeD2	Faywood-Cynthiana complex, 12 to 25 percent slopes, eroded, very rocky	48.0
FfC2	Faywood-Fairmount complex, phosphatic, 6 to 12 percent slopes, eroded, rocky	48.0
FfD2	Faywood-Fairmount complex, phosphatic, 12 to 25 percent slopes, eroded, very rocky	48.0
FoD2	Faywood-Shrouts complex, 12 to 25 percent slopes, eroded, rocky	48.0
FoF2	Faywood-Shrouts complex, 25 to 60 percent slopes, eroded, rocky	48.0
FrB	Frankstown gravelly silt loam, 2 to 6 percent slopes	28.1
FrC	Frankstown gravelly silt loam, 6 to 12 percent slopes	28.1
FrD2	Frankstown gravelly silt loam, 12 to 25 percent slopes, eroded	26.6
GaC2	Garlin-Shrouts complex, 6-12 percent slopes, eroded	23.5
GaD2	Garlin-Shrouts complex, 12 to 25 percent slopes, eroded, rocky	23.5
GmF	Garmon channery silt loam, 25 to 80 percent slopes, rocky	26.0

Percent Clay

Layer Option: Depth Range 24 to 72 Centimeters
Units of Measure: percent
Aggregation Method: Dominant Component
Tie-break Rule: Higher
Interpret Nulls as Zero: No

Garrard and Lincoln Counties, Kentucky
Survey Area Version and Date: 4 - 12/18/2008

Map symbol	Map unit name	Rating
GnB	Gilpin silt loam, 2 to 6 percent slopes	25.8
GnC2	Gilpin silt loam, 6 to 12 percent slopes, eroded	25.8
GrB	Greenbriar silt loam, 2 to 6 percent slopes	24.7
HgC	Hagerstown silt loam, 6 to 12 percent slopes	54.8
JeB	Jessietown silt loam, 2 to 6 percent slopes	30.9
JeC	Jessietown silt loam, 6 to 12 percent slopes	30.9
Jm	Johnsburg-Mullins complex	28.6
Jr	Johnsburg-Robertsville complex	28.6
La	Lawrence silt loam, terrace, rarely flooded	29.2
Le	Lawrence-Robertsville complex	29.2
LgC2	Lenberg silty clay loam, 6 to 12 percent slopes, eroded	43.6
LlB	Lily loam, 2 to 6 percent slopes	29.0
LlC	Lily loam, 6 to 12 percent slopes	29.0
LoB	Lowell silt loam, 2 to 6 percent slopes	48.0
LoC2	Lowell silt loam, 6 to 12 percent slopes, eroded	48.0
LpD2	Lowell-Faywood complex, 12 to 25 percent slopes, eroded, rocky	48.0
LsB	Lowell silt loam, phosphatic, 2 to 6 percent slopes	48.0
LsC2	Lowell silt loam, phosphatic, 6 to 12 percent slopes, eroded	48.0
LtD2	Lowell-Faywood complex, phosphatic, rocky, 12 to 25 percent slopes, eroded	48.0
Me	Melvin silt loam, frequently flooded	24.0
MoB	Monongahela loam, 2 to 6 percent slopes	26.0
Ne	Newark silt loam, frequently flooded	26.5
NhB	Nicholson silt loam, 2 to 6 percent slopes	26.7
NhC2	Nicholson silt loam, 6 to 12 percent slopes, eroded	26.7
No	Nolin silt loam, frequently flooded	23.0
OtB	Otwell silt loam, 2 to 6 percent slopes	29.7
OwB	Otwell silt loam, 2 to 6 percent slopes, rarely flooded	29.7
PrB	Pricetown silt loam, 2 to 6 percent slopes	31.0
PrC	Pricetown silt loam, 6 to 12 percent slopes	31.0
Rb	Robertsville silt loam, terrace, rarely flooded	25.5
RoF	Rock outcrop-Fairmount complex, 50 to 120 percent slopes	
SaB	Sandview silt loam, 2 to 6 percent slopes	33.7
SaC	Sandview silt loam, 6 to 12 percent slopes	33.7
SdB	Sandview silt loam, phosphatic, 2 to 6 percent slopes	33.7
SdC	Sandview silt loam, phosphatic, 6 to 12 percent slopes	33.7
SeC2	Shrouts silty clay loam, 6 to 12 percent slopes, eroded	59.0
SfD3	Shrouts-Cynthiana complex, 12 to 25 percent slopes, severely eroded, rocky	59.0
SgF3	Shrouts-Garlin-Cynthiana complex, 25 to 50 percent slopes, severely eroded, very rocky	59.0
Sk	Skidmore very gravelly silt loam, frequently flooded	15.0
TeB	Teddy silt loam, 2 to 6 percent slopes	21.7
TlB	Tilsit silt loam, 2 to 6 percent slopes	30.0
TlC	Tilsit silt loam, 6 to 12 percent slopes	30.0
TpB	Trappist silt loam, 2 to 6 percent slopes	47.7
TpC2	Trappist silty clay loam, 6 to 12 percent slopes, eroded	47.7
TrD2	Trappist-Colyer complex, 12 to 25 percent slopes, eroded	47.7

Percent Clay

Layer Option: Depth Range 24 to 72 Centimeters
Units of Measure: percent
Aggregation Method: Dominant Component
Tie-break Rule: Higher
Interpret Nulls as Zero: No

Garrard and Lincoln Counties, Kentucky
Survey Area Version and Date: 4 - 12/18/2008

Map symbol	Map unit name	Rating
W	Water	
Yo	Yosemite gravelly silt loam, frequently flooded	23.8

Percent Clay

Rating Options

Attribute Name: Percent Clay

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Most of the material is in one of three groups of clay minerals or a mixture of these clay minerals. The groups are kaolinite, smectite, and hydrous mica, the best known member of which is illite.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Layer Option: Depth Range 24 to 72 Centimeters

Units of Measure: percent

Aggregation Method: Dominant Component

Aggregation is the process by which a set of component attribute values is reduced to a single value to represent the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. The components in the map unit name represent the major soils within a map unit delineation. Minor components make up the balance of the map unit. Great differences in soil properties can occur between map unit components and within short distances. Minor components may be very different from the major components. Such differences could significantly affect use and management of the map unit. Minor components may or may not be documented in the database. The results of aggregation do not reflect the presence or absence of limitations of the components which are not listed in the database. An on-site investigation is required to identify the location of individual map unit components.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be generated. Aggregation must be done because, on any soil map, map units are delineated but components are not.The aggregation method "Dominant Component" returns the attribute value associated with the component with the highest percent composition in the map unit. If more than one component shares the highest percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher attribute value should be returned in the case of a percent composition tie.

The result returned by this aggregation method may or may not represent the dominant condition throughout the map unit.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Interpret Nulls as Zero: No

This option indicates that a null value for a component should be converted to zero before aggregation occurs. This will be done only if a map unit has at least one component where this value is not null.

Drainage Class

Aggregation Method: Dominant Condition
Tie-break Rule: Higher

Garrard and Lincoln Counties, Kentucky
Survey Area Version and Date: 4 - 12/18/2008

Map symbol	Map unit name	Rating
AlB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	Well drained
AlC2	Allegheny loam, 6 to 12 percent slopes, eroded	Well drained
BaB	Beasley silt loam, 2 to 6 percent slopes	Well drained
BbC2	Beasley silty clay loam, 6 to 12 percent slopes, eroded	Well drained
BeB	Berea silt loam, 2 to 6 percent slopes	Moderately well drained
Bo	Boonesboro silt loam, frequently flooded	Well drained
CaE2	Caneyville silt loam, 12 to 30 percent slopes, eroded, rocky	Well drained
CeB	Carpenter gravelly silt loam, 2 to 6 percent slopes	Well drained
CeC	Carpenter gravelly silt loam, 6 to 12 percent slopes	Well drained
CgE2	Carpenter-Lenberg complex, 12 to 30 percent slopes, eroded	Well drained
ChB	Chenault gravelly silt loam, 2 to 6 percent slopes	Well drained
ChC	Chenault gravelly silt loam, 6 to 12 percent slopes	Well drained
CkC	Chenault-Lowell complex, phosphatic, 6 to 12 percent slopes	Well drained
ClD2	Chenault-Faywood complex, phosphatic, 12 to 25 percent slopes, eroded, rocky	Well drained
CmB	Christian silt loam, 2 to 6 percent slopes	Well drained
CmC2	Christian silt loam, 6 to 12 percent slopes, eroded	Well drained
CoD2	Christian silty clay loam, 12 to 25 percent slopes, eroded	Well drained
CpF2	Colyer-Trappist complex, 25 to 60 percent slopes, eroded, very rocky	Well drained
CrB	Crider silt loam, 2 to 6 percent slopes	Well drained
CrC	Crider silt loam, 6 to 12 percent slopes	Well drained
CuB	Culleoka silt loam, 2 to 6 percent slopes	Well drained
CuC2	Culleoka silt loam, 6 to 12 percent slopes, eroded	Well drained
CuD2	Culleoka silt loam, 12 to 25 percent slopes, eroded	Well drained
CyF2	Cynthiana-Faywood complex, 25 to 50 percent slopes, eroded, very rocky	Well drained
DAM	Dam, large	
DoB	Donerail silt loam, 2 to 6 percent slopes	Moderately well drained
EdD2	Eden flaggy silty clay loam, 8 to 25 percent slopes, eroded	Well drained
EfF2	Eden-Culleoka association, 25 to 50 percent slopes, eroded, stony	Well drained
EkB	Elk silt loam, 2 to 6 percent slopes	Well drained
EkC	Elk silt loam, 6 to 12 percent slopes	Well drained
EmB	Elk silt loam, 2 to 6 percent slopes, rarely flooded	Well drained
FaC2	Fairmount silty clay loam, 6 to 12 percent slopes, eroded, very rocky	Well drained
FdF2	Fairmount-Faywood-Rock outcrop complex, 25 to 50 percent slopes, eroded	Well drained
FeC2	Faywood-Cynthiana complex, 6 to 12 percent slopes, eroded, rocky	Well drained
FeD2	Faywood-Cynthiana complex, 12 to 25 percent slopes, eroded, very rocky	Well drained
FfC2	Faywood-Fairmount complex, phosphatic, 6 to 12 percent slopes, eroded, rocky	Well drained
FfD2	Faywood-Fairmount complex, phosphatic, 12 to 25 percent slopes, eroded, very rocky	Well drained
FoD2	Faywood-Shrouts complex, 12 to 25 percent slopes, eroded, rocky	Well drained
FoF2	Faywood-Shrouts complex, 25 to 60 percent slopes, eroded, rocky	Well drained
FrB	Frankstown gravelly silt loam, 2 to 6 percent slopes	Well drained
FrC	Frankstown gravelly silt loam, 6 to 12 percent slopes	Well drained
FrD2	Frankstown gravelly silt loam, 12 to 25 percent slopes, eroded	Well drained
GaC2	Garlin-Shrouts complex, 6-12 percent slopes, eroded	Well drained
GaD2	Garlin-Shrouts complex, 12 to 25 percent slopes, eroded, rocky	Well drained
GmF	Garmon channery silt loam, 25 to 80 percent slopes, rocky	Well drained
GnB	Gilpin silt loam, 2 to 6 percent slopes	Well drained
GnC2	Gilpin silt loam, 6 to 12 percent slopes, eroded	Well drained

Drainage Class

Aggregation Method: Dominant Condition
Tie-break Rule: Higher

Garrard and Lincoln Counties, Kentucky
Survey Area Version and Date: 4 - 12/18/2008

Map symbol	Map unit name	Rating
GrB	Greenbriar silt loam, 2 to 6 percent slopes	Well drained
HgC	Hagerstown silt loam, 6 to 12 percent slopes	Well drained
JeB	Jessietown silt loam, 2 to 6 percent slopes	Well drained
JeC	Jessietown silt loam, 6 to 12 percent slopes	Well drained
Jm	Johnsburg-Mullins complex	Somewhat poorly drained
Jr	Johnsburg-Robertsville complex	Somewhat poorly drained
La	Lawrence silt loam, terrace, rarely flooded	Somewhat poorly drained
Le	Lawrence-Robertsville complex	Somewhat poorly drained
LgC2	Lenberg silty clay loam, 6 to 12 percent slopes, eroded	Well drained
LlB	Lily loam, 2 to 6 percent slopes	Well drained
LlC	Lily loam, 6 to 12 percent slopes	Well drained
LoB	Lowell silt loam, 2 to 6 percent slopes	Well drained
LoC2	Lowell silt loam, 6 to 12 percent slopes, eroded	Well drained
LpD2	Lowell-Faywood complex, 12 to 25 percent slopes, eroded, rocky	Well drained
LsB	Lowell silt loam, phosphatic, 2 to 6 percent slopes	Well drained
LsC2	Lowell silt loam, phosphatic, 6 to 12 percent slopes, eroded	Well drained
LtD2	Lowell-Faywood complex, phosphatic, rocky, 12 to 25 percent slopes, eroded	Well drained
Me	Melvin silt loam, frequently flooded	Poorly drained
MoB	Monongahela loam, 2 to 6 percent slopes	Moderately well drained
Ne	Newark silt loam, frequently flooded	Somewhat poorly drained
NhB	Nicholson silt loam, 2 to 6 percent slopes	Moderately well drained
NhC2	Nicholson silt loam, 6 to 12 percent slopes, eroded	Moderately well drained
No	Nolin silt loam, frequently flooded	Well drained
OtB	Otwell silt loam, 2 to 6 percent slopes	Moderately well drained
OwB	Otwell silt loam, 2 to 6 percent slopes, rarely flooded	Moderately well drained
PrB	Pricetown silt loam, 2 to 6 percent slopes	Well drained
PrC	Pricetown silt loam, 6 to 12 percent slopes	Well drained
Rb	Robertsville silt loam, terrace, rarely flooded	Poorly drained
RoF	Rock outcrop-Fairmount complex, 50 to 120 percent slopes	
SaB	Sandview silt loam, 2 to 6 percent slopes	Well drained
SaC	Sandview silt loam, 6 to 12 percent slopes	Well drained
SdB	Sandview silt loam, phosphatic, 2 to 6 percent slopes	Well drained
SdC	Sandview silt loam, phosphatic, 6 to 12 percent slopes	Well drained
SeC2	Shrouts silty clay loam, 6 to 12 percent slopes, eroded	Well drained
SfD3	Shrouts-Cynthiana complex, 12 to 25 percent slopes, severely eroded, rocky	Well drained
SgF3	Shrouts-Garlin-Cynthiana complex, 25 to 50 percent slopes, severely eroded, very rocky	Well drained
Sk	Skidmore very gravelly silt loam, frequently flooded	Well drained
TeB	Teddy silt loam, 2 to 6 percent slopes	Moderately well drained
TlB	Tilsit silt loam, 2 to 6 percent slopes	Moderately well drained
TlC	Tilsit silt loam, 6 to 12 percent slopes	Moderately well drained
TpB	Trappist silt loam, 2 to 6 percent slopes	Well drained
TpC2	Trappist silty clay loam, 6 to 12 percent slopes, eroded	Well drained
TrD2	Trappist-Colyer complex, 12 to 25 percent slopes, eroded	Well drained
W	Water	
Yo	Yosemite gravelly silt loam, frequently flooded	Somewhat poorly drained

Drainage Class

Rating Options

Attribute Name: Drainage Class

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value to represent the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. The components in the map unit name represent the major soils within a map unit delineation. Minor components make up the balance of the map unit. Great differences in soil properties can occur between map unit components and within short distances. Minor components may be very different from the major components. Such differences could significantly affect use and management of the map unit. Minor components may or may not be documented in the database. The results of aggregation do not reflect the presence or absence of limitations of the components which are not listed in the database. An on-site investigation is required to identify the location of individual map unit components.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be generated. Aggregation must be done because, on any soil map, map units are delineated but components are not.The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.