ATTACHMENT 39
Borrow Study and Soils Inventory
Special Waste Landfill Permit
FGD Disposal Facility
Big Sandy Plant – Ash Pond Closure
Lawrence County, Kentucky

The borrow study report and soils inventory have been included as part of this attachment. The laboratory results summary is included in the ***Borrow Study and Soils Report*** as **Table 1**. The soil volume summary is included as **Table 2**.

ATTACHMENT 39
BORROW STUDY AND SOILS INVENTORY

PROPOSED FLY ASH POND CLOSURE
AMERICAN ELECTRIC POWER
BIG SANDY PLANT – LOUISA, KENTUCKY

Prepared for:

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1 INTRODUCTION

This report provides a description and conclusions of the soil borrow study performed in support of the fly ash pond closure activities at AEP's Big Sandy Fossil Plant. The purpose of the study was to generally characterize the soil at the site and determine if there is sufficient material to recontour the pond and enough low permeability material to construct a soil barrier/liner.

Multiple sources of information were reviewed and compiled for this report. Publicly available regional soils information was researched and summarized in **Section 2** herein. **Section 3** contains a summary of site specific soils data generated from previous investigations performed by Fuller, Mossbarger, Scott, and May Engineers, Inc. (FMSM) and AEP as well as investigations performed by URS as part of this study. Finally, **Section 4** discusses the estimated borrow requirements of the pond closure project compared to the estimated quantity of suitable soils available on site.

Note that this study was originally planned and developed for the Horseford Creek landfill project, which has been suspended indefinitely as of the writing of this report. Given the origins of the study, the identified soil borrow material is mostly on the western half of the site and AEP may want to consider additional exploration on the east side in the future. AEP has already performed a small study in support of the dam construction in 2009. This study also does not account for the material that may be available from the main dam or the saddle dam.

Based on the investigation, an adequate quantity of material is assumed to be present, however; although a large number of test pits have been excavated in the area, additional testing would be required to determine construction specifications (e.g. Proctor density and optimum moisture content). For that, additional test pits should be dug at a greater frequency in the designated area supported by testing designed for the project.

2 REGIONAL SOILS

Regional soils information was obtained from the *Reconnaissance Soil Survey of Fourteen Counties in Eastern Kentucky*, US Department of Agriculture, Soil Conservation Service (SCS), 1965 and *Soil Survey of Lawrence and Martin Counties*, Kentucky, US Department of Agriculture, Natural Resources Conservation Service (NRCS), 2005. Based on this mapping, soils primarily representing the Shelocta, Upshur, and Vandalia soil series are the predominant soils present in the site area. To a lesser extent, the Allegheny, Grigsby, and Cotaco soil series are present in the lowland valleys. A site specific summary of the NRCS report is included in **Appendix A**.

Predominant Soils

The Shelocta series ranges from 4 to 7 feet in thickness and consists of well drained, moderately permeable soils formed in mixed colluvium from shale, siltstone, and sandstone or colluvium and residuum. The fine-loamy soil is typically dark grayish brown to yellowish brown. They are on steep concave mountain sides, foot slopes, and benches. These soils are formed from the in-place chemical and physical weathering of the upland formations and have slopes ranging from 2 to 90 percent.

The Upshur series ranges from 4 to 6 feet in thickness and consists of well drained, slowly permeable soils formed in residuum derived from clay shale and in places interbedded with thin layers of siltstone. The silty clay Upshur soils are reddish brown to yellowish brown and are located on ridgetops, benches, and hillsides. Slope ranges from 0 to 70 percent.

The Vandalia series ranges from 4 to 7 feet in thickness and consists of well drained soils formed in colluvium from shale, siltstone, and some sandstone. The silty clay loam soil is typically brown to reddish brown and permeability is moderate or moderately slow in the A horizon and moderately slow or slow in the subsoil and substratum. They are on foot slopes and colluvial fans. Slope ranges from 3 to 60 percent.

Minor Soils in Lowland Valleys

The Allegheny series consists of well-drained, moderately permeable soils formed in alluvium on stream terraces, foot slopes and alluvial fans. Slopes range from 0 to 25 percent.

The Grigsby series consists of well drained soils formed in mixed alluvium on flood plains. Permeability is moderate or moderately rapid. Slopes range from 0 to 20 percent.

The Cotaco series consists of moderately well or somewhat poorly drained, moderately permeable soils formed in loamy sediments of acid sandstone, siltstone, and shale origin. These soils are on foot slopes, colluvial fans, and low stream terraces. Slopes range from 0 to 20 percent.

3 SITE SPECIFIC SOILS

3.1 Areas of Exploration

The area where field explorations were performed is comprised of three main ranges that fall generally in line with local area drainage features. These are the Horseford Creek area where the AEP ash pond is located, Burke Branch south of the ash pond where a previous landfill was planned but not permitted, and Fullers Branch located south and west of Horseford Creek and Burke Branch, respectively. These areas have all been subject to significant soil

exploration within recent years. For purposes of this study, the borrow area delineated includes portions of the Horseford Creek and Fullers Branch areas. Although the Burke Branch area has had significant soil exploration performed within its boundary, it was not considered as part of the borrow area delineated for the ash pond closure because the other areas are closer in proximity to the pond area. However, due to similarities in soil type to adjacent areas that were delineated as available borrow, laboratory data results and boring logs generated as part of the Burke Branch area have been included within this report to provide a more comprehensive profile of available soil in the area. These areas of exploration are depicted in **Figure 39-1 and Attachment 40**.

3.2 Field Explorations and Laboratory Testing Methodology

Four field subsurface explorations have been undertaken at the site. Explorations were conducted using drilling rigs and excavators.

Generally, a geotechnical engineer, geologist or soils technician was present on-site during the site exploration activities performed by FMSM and URS. They also located the borings and/or test pit excavations, directed the drill crew/operator and logged the subsurface soil, shale and fill materials encountered. The soil, shale and fill materials were logged by observing the cuttings conveyed to the surface during the augering process and from recovered Standard Penetration Test (SPT) samples. The fill materials were further logged by observing the excavated materials from the test pits temporarily stockpiled on the surface. During logging, particular attention was given to the soil's color, texture, consistency and moisture content of the subsurface materials encountered.

The purpose of these excavations was to evaluate the type and consistency of existing potential materials for use in future construction. Soil sampling generally consisted of disturbed samples obtained from materials stockpiled during the excavation process or auger cuttings from the borings. Upon completion of the borings or test pits, they were backfilled with excavated fill materials.

Information presented in **Sections 3.2.1 and 3.2.2** below was obtained from FMSM's special waste permit application developed in 2006. Information presented in **Section 3.2.3** below was obtained from AEP's 2009 borrow study.

3.2.1 FMSM - December 2004 Field Subsurface Exploration

The first field exploration at the site was performed by FMSM. It consisted of advancing a total of 15 borings (B-1 through B-15) and 2 test pit excavations (TP-1 and TP-2). This exploration included the following activities in the vicinity of Burke Branch, a site south of and adjacent to the proposed Horseford Creek Ash Pond Closure:

- One rock core boring (B-1)
- Four soil sample borings (B-3, B-5, B-7 and B-8)

- Three soil profile borings (B-2, B-4 and B-6)
- Two test pit excavations (TP-1 and TP-2 performed within the identified highway refuse fill area)

In addition, this exploration included the following activities at Horseford Creek in the proposed pond closure footprint and proposed borrow area:

- Four soil sample borings (B-9, B-12, B-14 and B-15)
- Three soil profile borings (B-10, B-11 and B-13)

The boring locations were initially staked in the field by FMSM personnel using a consumer grade, 12-channel Global Positioning System (GPS). Boring locations and surface elevations were surveyed by others after the field activities were completed. The borings were advanced using a track-mounted drill rig equipped with 3.25-inch inside diameter (ID) hollow-stem augers and six-inch solid-stem augers following a carbide-tipped tooth bit and NQ-size rock coring equipment. Each of the borings was terminated within bedrock prior to auger refusal.

Field testing consisting of SPTs were performed in soil sample borings at approximate five-foot intervals to provide an indication of the in-situ strength characteristics of the subsurface soil and shale materials. In addition, disturbed samples of the predominant subsurface soil and shale materials observed in the auger cuttings were collected for standard engineering classification purposes. Upon completion of drilling, all borings were checked for the presence of subsurface water and then backfilled with auger cuttings and/or bentonite pellets.

Boring and test pit locations are depicted in **Figure 39-1**. Graphical test pit and boring logs are presented in **Appendix B.1**.

3.2.2 FMSM - September - November 2005 Field Subsurface Exploration

The second field exploration at the site was also performed by FMSM to provide additional geotechnical information in the Burke Branch area and to verify the availability of on-site borrow materials in the Horseford Creek Area. This exploration consisted of advancing a total of 37 borings. Of these, 19 borings (BB-F1 through BB-F4, BB-R1 through BB-R3, BB-S1 through BB-S6 and SP-1 through SP-6) were advanced within Burke Branch. This exploration included the following activities at Burke Branch:

- Seven rock cores with soil sampling (BB-R1 through BB-R3 and BB-F1 through BB-F4)
- Five soil sample borings (BB-S2 through BB-S6)
- Seven soil profile borings (SP-1 through SP-6 and BB-R1)

In addition, the remaining 18 soil profile borings were advanced within the Horseford Creek (HC-S1 through HC-S5) and Fullers Branch (FB-S1 through FB-S13) areas, respectively.

Similar to the previous investigation, the boring locations were initially staked in the field by FMSM personnel using a consumer grade, 12-channel GPS. Boring locations and surface elevations were surveyed by others after the field activities were completed. The borings were advanced using a truck-mounted drill rig equipped with 3.25-inch inside diameter (ID) hollow-stem augers and six-inch solid-stem augers following a carbide-tipped tooth bit and NQ-size rock coring equipment. Each of the borings was terminated within bedrock prior to auger refusal with the exception of HC-S1, HC-S2, HC-S5, FB-S6, FB-S8 and FB-S9.

Field testing consisting of SPTs were performed in soil sample borings at approximate five-foot intervals to provide an indication of the in-situ strength characteristics of the subsurface soil and shale materials. In addition, disturbed samples of the predominant subsurface soil and shale materials observed in the auger cuttings were collected for standard engineering classification purposes. Upon completion of drilling, all borings were checked for the presence of subsurface water and then backfilled with either auger cuttings and bentonite pellets, cement-bentonite grout (BB-1 through BB-R3) or received nested observation well installations (BB-F1 through BB-F4).

Boring locations are depicted in **Figure 39-1**.

3.2.3 AEP – February 2009 Borrow Study

Another borrow study was performed by AEP Civil Engineering (AEP) in February 2009 to provide geotechnical information in support of raising the Horseford Creek Dam.

Borrow Area 1 that had been used for past dam construction and is located approximately 2,500 feet west/southwest of the Main Dam is also within the potential borrow area for the proposed Horseford Creek Ash Pond Closure. This exploration included 9 test pits.

A second area, Borrow Area 2, is situated approximately 750 feet southwest of the Saddle Dam and included 3 test pits.

Test pits were conducted using an excavator for determining the soil profile in the area. Samples were collected during test pit excavation for lab testing.

The above discussed areas are shown in **Attachment 40**. Test pit locations are depicted in **Figure 39-1**. Graphical test pit logs are presented in **Appendix B.2**.

Note that there are other areas to the east of the Ash Pond investigated by AEP as part of this exploration. The areas to the east are outside the limits considered part of this study, thus are not further documented within this report. See the 2009 AEP report for additional information.

3.2.4 URS – May 2012 Field Subsurface Exploration

An additional field exploration at the site was performed by URS Corporation (URS) originally intended to provide additional geotechnical information in support of an application for a Special Waste Landfill Permit in the Horseford Creek area and to verify the availability of on-site borrow materials in the Horseford Creek and surrounding area. This exploration consisted of advancing a total of 10 borings and 21 test pits. All 10 borings (SB-1 through SB-8, HB-1, and HB-5) and test pits (TP-1 through TP-10 and TP-12 through TP-22) were advanced within the Horseford Creek area. This exploration included the following activities at Horseford Creek:

- Five dedicated soil sample and soil profile borings (SB-3, SB-4, and SB-6 through SB-8)
- Three dual purpose hydrogeologic and soil profile borings (HB-2/SB-1, HB-4/SB-5, HB-7/SB-2)
- Two additional hydrogeologic borings (HB-1 and HB-5)
- Twenty-one soil profile test pit excavations (TP-1 through TP-10 and TP-12 though TP-22. TP-11 was not conducted due to limited access)

Similar to previous investigations, the boring and test pit locations were initially staked in the field by URS personnel using a consumer grade, 12-channel GPS. Boring locations and surface elevations were surveyed by URS after the field activities were completed. The hydrogeologic (HB) and dual purpose (HB/SB) borings were advanced using a truck-mounted drill rig equipped with 6.25-inch hollow-stem augers and wireline core barrel assembly with six-inch, solid-stem augers following a carbide-tipped tooth bit and HQ and PQ-size rock coring equipment. The soil sample/profile borings (SB) borings were advanced using a truck-mounted drill rig equipped with 3.25-inch inside diameter (ID) hollow-stem augers and six-inch, solid-stem augers following a carbide-tipped tooth bit and NX-size rock coring equipment. Each of the borings was terminated within bedrock prior to auger refusal.

Field testing consisting of SPTs were performed on soil sample borings at approximate five-foot intervals to provide an indication of the in-situ strength characteristics of the subsurface soil and shale materials. In addition, disturbed samples of the predominant subsurface soil and shale materials observed in the auger cuttings were collected for standard engineering classification purposes. Upon completion of drilling, all borings were checked for the presence of subsurface water and then backfilled with auger cuttings and bentonite pellets or had groundwater monitoring wells constructed as part of the separate field hydrogeologic site investigation.

All test pits were advanced to bedrock/refusal using a small excavator to determine local stratigraphy and soil characteristics. In addition, the borings and test pits were sampled for index property testing and geotechnical characteristics via split spoon and bulk samples.

Boring and test pit locations are depicted in **Figure 39-1**. Graphical test pit and boring logs are presented in **Appendix B.3**.

3.3 Results of the Geotechnical Exploration

3.3.1 Soil Classification and Stratigraphy

Upon completion of the fieldwork performed by URS in May 2012, the recovered soil, shale and fill materials along with the rock core samples were transported to a materials laboratory for further classification testing, engineering testing, and analysis. The recovered samples were then logged by a geologist with particular attention given to color, stratigraphy, structure and features of hydrologic significance such as bedding plane partings, fractures, joints, water stained zones and weathered zones.

The recovered SPT samples were subjected to natural moisture content determinations (ASTM D 2216). In addition, standard engineering classification tests (sieve and hydrometer analyses (ASTM D 422), Atterberg Limits (ASTM D 4318) and specific gravity determinations (ASTM D 854)) were performed on select disturbed samples of the predominant soil, shale and fill materials encountered at the sites. Also, standard Proctor moisture-density tests (ASTM D 698, ASTM D 1557) and remolded one-point permeability tests (ASTM D 5084) were performed on disturbed samples of predominant "clay-like" soils and shale materials in order to assess their suitability for soil barrier and cover soil applications.

In general, the borings and test pit excavations encountered a relatively thin layer of topsoil overlying native soil materials. A total of ten predominant native soils, shale and fill materials were encountered during the preliminary exploration and are designated herein as Soils 1 through 10. These are based on the combined subsurface data from previous and current subsurface investigation programs. Each of these soils is discussed in the subsequent paragraphs. Also, see table **Attachment 38** for a breakdown of unconsolidated soil thickness profiles by area and soil type designation.

Soil 1 - Soil 1 is the predominant soil encountered as the uppermost native soil horizon within the investigated area, including Burke Branch, Fullers Branch and Horseford Creek. This soil consists of clayey sand and is described as light brown to brown in color with occasional beige and gray mottling, moist to wet in moisture content observations, loose to very dense in consistency with occasional manganese concretions and rock remnants. The average thickness of this soil was found to be 8.1 feet, and varied from 1.5 to 29.0 feet thick. Standard engineering classification testing of Soil 1 resulted in designations of SC and A-6(2) according to the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) methods, respectively. Natural

moisture content ranged from 5.5 to 17.8 percent with an average of 14.4 percent. Two Standard Proctor moisture-density tests resulted in a maximum dry density of 114.4 and 120.0 pounds per cubic foot (pcf) at optimum moisture content of 12.8 and 13.6 percent. Two Modified Proctor moisture-density tests resulted in a maximum dry density of 124.6 and 126.7 pounds per cubic foot (pcf) at optimum moisture content of 9.9 and 10.1 percent. In addition, two one-point permeability tests performed on remolded specimens of Soil 1 resulted in values of 5.05×10^{-8} and 3.30×10^{-5} centimeters per second (cm/sec). Note that the significant disparity between the two permeability test results could be attributed to several factors, including that although the two samples were both given a USCS designation of SC, the percentage of fine grained particles in the lower permeability sample was approximately twice that of the higher permeability sample. Also, the lower permeability sample was compacted to 107.1 percent of proctor maximum dry density, indicating a potential lab error.

Soil 2 - Soil 2 was encountered in five borings within Burke Branch. This native soil visually classifies as sandy lean clay and is described as gray in color, moist in moisture content observations, stiff to very stiff in consistency with occasional manganese concretions and rock remnants. The average thickness of this soil was found to be 7.9 feet, and varied from 4.5 to 15.0 feet thick. No laboratory tests of the recovered SPT samples were performed for this soil.

Soil 3 - Soil 3 was encountered within the upper horizon of a single boring in Burke Branch and two borings in Fullers Branch. This native soil consists of silty clayey sand and is described as orange to brown in color, moist in moisture content observations, medium dense in consistency with occasional rock remnants. The average thickness of this soil was found to be 7.0 feet, and varied from 2.3 to 10.0 feet thick. Standard engineering classification testing of Soil 3 resulted in designations of SC-SM and A-4(0) according to the USCS and the AASHTO methods, respectively. Natural moisture content ranged from 12.2 to 13.4 percent with an average of 12.8 percent. Based on its textural classifications, it was judged that Soil 3 will not likely be used in soil barrier applications, thus standard Proctor moisture-density and permeability tests were not performed.

Soil 4 - Soil 4 was encountered within the uppermost portion of the bedrock profile in Burke Branch, Horseford Creek and Fullers Branch. This material consists primarily of shale and to a lesser degree interbedded shale and sandstone. The average thickness of this soil was found to be 7.5 feet, and varied from 0.9 to 27.5 feet thick. Standard engineering classification testing of Soil 4 resulted in designations of SC and A-6(2) according to the USCS and the AASHTO methods, respectively. Natural moisture content was 14.4 percent. A standard Proctor moisture-density test resulted in a maximum dry density of 129.6 pcf at an optimum moisture content of 9.8 percent. In addition, a one-point permeability test performed on a remolded specimen of Soil 4 resulted in a permeability value of 7.67×10^{-8} cm/sec.

Soil 5 - Soil 5 was encountered in two test pit excavations and four borings performed within the identified highway refuse fill area located at Burke Branch. Soil 5 is a heterogeneous fill material consisting of clayey sand with gravel to clayey gravel with sand and is described as gray to brown in color, moist to wet in moisture content observations with occasional rock fragments, boulders and organics (topsoil, roots, tree limbs, etc.). The average thickness of this soil was found to be 67.9 feet, and varied from 46.9 to 95.5 feet thick. USCS and AASHTO classifications of Soil 5 ranged from SC to GC and A-6(3) to A-2-6(0), respectively. Natural moisture content, standard Proctor moisture-density, and permeability tests were not performed for this soil because the heterogeneity of the soil makes it an unlikely candidate for use as borrow material.

Soil 6 - Soil 6 was predominantly encountered in borings located within Fullers Branch and Horseford Creek and to a lesser extent in borings within Burke Branch. Soil 6 consists of lean clay with varying amounts of sand and is described as reddish-brown in color, moist in moisture content observations, dense to very dense in consistency with occasional gravel. The average thickness of this soil was found to be 4.8 feet, and varied from 2.0 to 15.0 feet thick. USCS and AASHTO classifications of Soil 6 are CL and A-7-6(28) to A-7-6(20), respectively. Natural moisture content ranged from 12.2 to 29.5 percent with an average of 18.4 percent. Standard Proctor moisture-density tests resulted in maximum dry densities ranging from 100.1 to 121.0 pcf at optimum moisture contents ranging from 11.2 to 20.3 percent. Modified Proctor moisture-density tests resulted in maximum dry densities ranging from 119.3 to 126.4 pcf at optimum moisture contents ranging from 10.4 to 12.2 percent. In addition, seven one-point permeability tests performed on remolded specimens of Soil 6 resulted in permeability values ranging from 2.94×10^{-9} to 1.30×10^{-6} cm/sec, with an average of 3.50×10^{-7} cm/sec.

Soil 7 - Soil 7 represents an alluvial soil and was encountered within the lower horizons of a single boring in Burke Branch. Soil 7 visually classifies as sandy lean clay to sand with clay and is described as light brown to brown in color, moist in moisture content observations, dense in consistency with occasional organics (topsoil, roots, tree limbs etc.) and numerous gravels. The thickness of soil 7 was found to be 28.5 feet. Natural moisture content ranged from 12.8 to 15.1 percent with an average of 14.0 percent. USCS and AASHTO classifications, standard Proctor moisture-density, and permeability tests were not performed for this soil. Due to the depth at which this soil was found in only a single boring, it is not considered a viable borrow source.

Soil 8 - Soil 8 was encountered in borings located in the Fullers Branch borrow area. Soil 8 consists of sandy lean clay and is described as reddish-brown in color, moist in moisture content observations, medium stiff to stiff in consistency with occasional gravels. The average thickness of this soil was found to be 5.3 feet, and varied from 2.3 to 9.5 feet thick. USCS and AASHTO classifications of Soil 8 are CL and A-7-6(15), respectively. Natural

moisture content was 20.8 percent. A standard Proctor moisture-density test resulted in a maximum dry density of 105.7 pcf at optimum moisture content of 20.3 percent. In addition, a one-point permeability test performed on a remolded specimen of Soil 8 resulted in a permeability value of 3.02×10^{-9} cm/sec.

Soil 9 - Soil 9 represents mine spoil encountered in a single boring in the Fullers Branch borrow area. The mine spoil visually classifies as lean clay and is described as gray to dark gray in color, moist in moisture content observations, soft in consistency with occasional rock remnants. Only the visual description of Soil 9 was located from previous sources (i.e. no lab data or boring logs found) and URS' investigation did not identify any mine spoil on site.

Soil 10 - Soil 10 was encountered in all the test pits in AEP Borrow Area 1 and seven additional test pits/borings within the Horseford Creek area. This native soil visually classifies as sandy fat clay and is described as brown to gray in color, dry, stiff to very stiff in consistency with occasional rock remnants. The average thickness of this soil was found to be approximately 5.1 feet, and varied from 2.0 to 12.5 feet thick. USCS classification of Soil 10 is generally CH with some CL soils which have liquid limits near 50. AASHTO classification of Soil 10 was not performed. Natural moisture content ranged from 17.1 to 29.5 percent with an average of 22.8 percent. Standard Proctor moisture-density tests resulted in maximum dry densities ranging from 98.0 to 111.1 pcf at optimum moisture contents ranging from 16.9 to 24.0 percent. In addition, three one-point permeability tests performed on remolded specimens of Soil 10 resulted in permeability values ranging from 2.14×10^{-8} to 4.00×10^{-8} cm/sec, with an average of 2.79×10^{-8} cm/sec.

3.3.2 Testing

Index testing included testing of select specimens from the disturbed bulk samples of the predominant subsurface soil materials observed in the auger cuttings and test pit soil collected during the previous site explorations. Soil samples collected during the previous explorations that displayed engineering classifications indicative of material suitable for use in low permeability soil layers were selected for Proctor moisture/density, grain size distribution, Atterberg, and permeability testing.

The purpose of these tests was to evaluate the characteristics for developing preliminary construction specifications and to determine the hydraulic conductivity of the subject soils in order to assess their potential to serve as a recompacted soil liner/cap and/or barrier in association with the facility design. The following paragraphs discuss the method and results of these tests.

Proctor Testing - Proctor testing was performed on select samples to determine the relationship between moisture and density for each sample. This information will be used to establish preliminary construction specifications for recompacted soil materials such as test

pads and soil barriers. Both modified and standard Proctor tests were performed in accordance with ASTM D-698 and D-1557 respectively to provide as much information regarding the moisture/density relationship as practical based on typical construction specifications.

A summary of the Proctor tests is provided in **Table 2.1**.

Table 2.1. Summary of Proctor Testing Results

Boring	Soil No.	Standard Proctor		Modified Proctor	
		Optimum Moisture Content (%)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)
B-1	Soil 1	12.8	120.0	-	-
TP-5	Soil 1	-	-	10.1	124.6
TP-14	Soil 1	13.6	114.4	9.9	126.7
BB-R1	Soil 6	15.9	110.5	-	-
FB-S3	Soil 6	16.3	111.4	-	-
TP-2	Soil 6	-	-	11.1	122.8
TP-7	Soil 6	-	-	10.4	126.4
TP-8	Soil 6	20.0	100.1	-	-
TP-17	Soil 6	15.5	109.2	-	-
TP-19	Soil 6	-	-	12.2	119.3
TP-22	Soil 6	11.2	120.6	-	-
TP-4	Soil 6	17.7	109.6	11.9	120.4
HC-S4	Soil 6	16.3	111.4	-	-
TP-0911	Soil 6	16.4	112.7	-	-
TP-0917	Soil 6	12.2	121.0	-	-
FB-S4/FB-S1	Soil 8	20.3	105.7	-	-
TP-0901	Soil 10	15.9	110.3	-	-
TP-0902	Soil 10	16.9	111.1	-	-
TP-0903	Soil 10	19.3	106.8	-	-
TP-0905	Soil 10	17.8	106.8	-	-

Table 2.1. Summary of Proctor Testing Results

Boring	Soil No.	Standard Proctor		Modified Proctor	
		Optimum Moisture Content (%)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)
TP-0906	Soil 10	23.0	99.3	-	-
TP-0907	Soil 10	17.8	110.5	-	-
TP-0908	Soil 10	18.9	107.9	-	-
TP-0909	Soil 10	17.5	108.3	-	-
TP-0910	Soil 10	24.0	98.0	-	-
TP-1	Soil 10	21.0	101.8	-	-

Atterberg Limits - Atterberg limit testing was performed in accordance with ASTM D-4318 on select samples to help determine the characteristics of the residual soil materials. This information will be used to locate and delineate the plastic characteristics of the fine grained material that may be used for barrier materials and structural fill that will be used to establish proper grades within the facility.

A summary of the Atterberg limit tests is provided in **Table 2.2**.

Table 2.2. Summary of Atterberg Limit Testing Results

Boring	Soil No.	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-1	Soil 1	28.0	17.0	11.0
TP-14	Soil 1	25.0	20.0	5.0
HB-7/SB-2	Soil 1	31.0	18.0	13.0
B-8	Soil 3	22.0	16.0	6.0
HB-7/SB-2	Soil 3	20.0	15.0	5.0
BB-R1	Soil 6	48.0	21.0	27.0
HC-S4/FB-S3	Soil 6	46.0	23.0	23.0
TP-0911	Soil 6	40.5	20.9	19.6
TP-0917	Soil 6	33.0	18.6	14.4

Table 2.2. Summary of Atterberg Limit Testing Results

Boring	Soil No.	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
TP-1	Soil 6	33.0	17.0	16.0
TP-6	Soil 6	49.0	22.0	27.0
TP-7	Soil 6	34.0	19.0	15.0
TP-9	Soil 6	36.0	20.0	16.0
TP-17	Soil 6	41.0	23.0	18.0
TP-20	Soil 6	49.0	21.0	28.0
TP-22	Soil 6	26.0	18.0	8.0
HB-1	Soil 6	35.0	17.0	18.0
HB-2/SB-1	Soil 6	45.0	21.0	24.0
HB-5	Soil 6	33.0	17.0	16.0
HB-5	Soil 6	32.0	16.0	16.0
HB-7/SB-2	Soil 6	32.0	17.0	15.0
SB-4	Soil 6	45.0	23.0	22.0
SB-4	Soil 6	46.0	25.0	21.0
SB-5	Soil 6	29.0	15.0	14.0
SB-6	Soil 6	41.0	19.0	22.0
SB-7	Soil 6	41.0	21.0	20.0
TP-4	Soil 6	40.0	21.0	19.0
FB-S4/FB-S1	Soil 8	43.0	20.0	23.0
TP-0901	Soil 10	45.9	20.2	25.7
TP-0902	Soil 10	50.7	21.0	29.7
TP-0903	Soil 10	49.7	24.4	25.3
TP-0905	Soil 10	47.2	24.3	22.9
TP-0906	Soil 10	63.1	24.5	38.6
TP-0907	Soil 10	48.6	19.5	29.1
TP-0908	Soil 10	51.7	24.2	27.5

Table 2.2. Summary of Atterberg Limit Testing Results

Boring	Soil No.	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
TP-0909	Soil 10	45.4	21.9	23.5
TP-0910	Soil 10	56.1	26.2	29.9
TP-1	Soil 10	50.0	24.0	26.0
TP-3	Soil 10	57.0	23.0	34.0
TP-18	Soil 10	56.0	21.0	35.0
SB-6	Soil 10	62.0	25.0	37.0
SB-6	Soil 10	59.0	30.0	29.0

Grain Size Distribution – Grain size distribution testing was performed in accordance with ASTM D-422 on select samples to help determine the characteristics of the residual soil materials. This information will be used to locate and delineate the locations of the fine-grained material that will be used for barrier materials and structural fill that will be used to establish proper grades within the facility.

A summary of the grain size distribution tests is provided in **Table 2.3**.

Table 2.3. Summary of Grain Size Distribution Testing Results

Boring	Soil No.	Sieve/Hydrometer Analysis			
		% Gravel	% Sand	% Silt	% Clay (<0.002 mm)
B-1	Soil 1	5.5	45.5	21.7	27.3
TP-5	Soil 1	0.7	54.8	26.5	18.0
TP-14	Soil 1	10.1	64.4	15.5	10.0
TP-21	Soil 1	14.1	48.1	21.8	16.0
HB-7/SB-2	Soil 1	8.3	44.5	47.2 (silt & clay)	
HB-7/SB-2	Soil 1	19.3	49.8	30.9 (silt & clay)	
B-8	Soil 3	2.7	57.0	16.1	24.2
HB-7/SB-2	Soil 3	16.6	53.6	29.8 (silt & clay)	
BB-R1	Soil 6	0.0	5.0	27.3	67.7

Table 2.3. Summary of Grain Size Distribution Testing Results

Boring	Soil No.	Sieve/Hydrometer Analysis			
		% Gravel	% Sand	% Silt	% Clay (<0.002 mm)
FB-S3	Soil 6	1.1	14.7	28.8	55.4
HC-S4	Soil 6	1.1	14.7	28.8	55.4
TP-0911	Soil 6	0.0	8.1	51.6	40.3
TP-0917	Soil 6	0.0	0.7	72.0	27.3
TP-3	Soil 6	1.8	2.0	23.1	73.0
TP-6	Soil 6	3.9	5.8	45.3	45.0
TP-9	Soil 6	19.5	19.3	41.2	20.0
TP-19	Soil 6	2.2	4.0	43.8	50.0
SB-4	Soil 6	0.0	3.4	46.6	50.0
SB-5	Soil 6	14.1	35.4	33.5	17.0
SB-6	Soil 6	7.1	13.0	33.9	46.0
SB-7	Soil 6	0.0	1.8	47.2	51.0
FB-S4/FB-S1	Soil 8	0.0	30.4	20.4	49.2
TP-0901	Soil 10	0.0	11.4	41.3	47.3
TP-0902	Soil 10	0.0	17.3	32.9	49.8
TP-0903	Soil 10	0.0	1.9	52.1	46.0
TP-0905	Soil 10	0.0	1.3	56.1	42.6
TP-0906	Soil 10	0.6	2.9	35.9	60.6
TP-0907	Soil 10	0.0	7.9	35.9	51.2
TP-0908	Soil 10	1.7	5.7	40.9	43.8
TP-0909	Soil 10	1.9	9.2	48.7	40.9
TP-0910	Soil 10	0.2	9.9	36.1	53.8
TP-1	Soil 10	1.9	10.2	45.9	42.0
TP-3	Soil 10	18.0	9.4	28.6	44.0

Permeability Testing - Permeability testing was performed on select samples and consisted of remolding one specimen per sample. The specimens were generally remolded above 95 percent of standard Proctor or 90 percent of modified Proctor at varying moisture contents mostly above the optimum moisture content, as determined by the associated Proctor test method. A permeability test was then performed on each specimen in accordance with ASTM D-5084.

A summary of the permeability test results showing the compactive effort (percent of standard Proctor maximum dry density), remolded moisture content (in terms of percent above or below the optimum moisture) and resulting permeability value is provided in **Table 2.4**.

Table 2.4. Summary of Remolded Permeability Testing Results

Boring	Soil No.	Proctor Test Method	Dry Density (% of Proctor)	Moisture Content (% Above Optimum)	Permeability (cm/sec)
B-1	Soil 1	Standard	107.1	-2.9	5.1×10^{-8}
TP-14	Soil 1	Standard	96.0	1.1	3.3×10^{-5}
B-2	Soil 4	Standard	95.2	3.0	7.7×10^{-8}
BB-R1	Soil 6	Standard	100.1	1.7	2.9×10^{-9}
HC-S4/FB-S3	Soil 6	Standard	99.7	1.9	1.5×10^{-8}
TP-0911	Soil 6	Standard	96.1	0.6	1.3×10^{-7}
TP-7	Soil 6	Modified	90.3	1.7	8.5×10^{-7}
TP-17	Soil 6	Standard	95.0	1.8	1.3×10^{-6}
TP-19	Soil 6	Modified	89.9	2.5	8.4×10^{-8}
TP-4	Soil 6	Standard	95.3	2.1	6.4×10^{-8}
FB-S4/FB-S1	Soil 8	Standard	99.9	2.0	3.0×10^{-9}
TP-0903	Soil 10	Standard	95.9	2.6	2.2×10^{-8}
TP-0908	Soil 10	Standard	95.9	1.9	2.1×10^{-8}
TP-1	Soil 10	Standard	95.2	1.4	4.0×10^{-8}

These permeability test results indicate that the subject soil materials exhibit relatively low permeabilities with values often well below the recognized maximum allowable permeability of 1.0×10^{-7} cm/sec for low permeability soil liners. Based on these criteria, Soil Numbers 1, 4, 6, 8, and 10 demonstrate capabilities of achieving laboratory permeabilities of 1.0×10^{-7}

cm/sec or less and should be considered suitable for construction of low permeability layers. Note that permeability tests were not performed for Soil Numbers 2 and 9, however further investigation and testing may prove these soils also suitable for construction of low permeability layers.

All the laboratory test data is provided in **Appendix C** and summarized in **Table 39-1**.

3.3.3 Soils Inventory

Soil inventory mapping was prepared to quantify available borrow and to demonstrate that sufficient quantities of borrow are available on site. Soils inventory was approached considering primarily the western Horseford Creek area and portions of the Fullers Branch area. As noted previously, Burke Branch has also been studied and is included as part of this report, but is not anticipated for use as a borrow area for the Horseford Creek Ash Pond Closure at this time; therefore, the following information does not account for the available material in the Burke Branch area.

Six major soil mapping groups were defined and include:

General Soil Description	Soil Types
Coarse-Grained Residual Soils	Soil No. 1 – Clayey Sand Soil No. 3 – Silty Clayey Sand
Fine-Grained Residual Soils	Soil No. 2 – Sandy Lean Clay Soil No. 6 – Lean Clay with varying amounts of sand Soil No. 8 – Sandy Lean Clay Soil No. 10 – Sandy Fat Clay
Shale	Soil No. 4 – Shale
Highway Refuse Fill	Soil No. 5 – heterogeneous fill consisting of clayey sand with gravel to clayey gravel with sand
Alluvial Soil	Soil No. 7 – Sandy Lean Clay
Mine Spoil	Soil No. 9 – Lean Clay

The extents of only the course-grained residual soils and fine-grained residual soils soil mapping groups are shown in **Attachment 40: Soils Inventory Map** because the other materials are unlikely to be used in construction. Lines of delineation between these soil mapping groups were established using straight line interpolation between the borings. The depths used in the volume calculations reflect the depths encountered in the field during the geotechnical explorations. It is assumed that topsoil will be segregated during construction and was considered separately from the other designated soil types. The summary of soil quantities within the URS test pit area / proposed pond closure borrow area is presented in

Table 39-2. It should be noted that Soil 4 (augered shale), encountered within the uppermost portion of the bedrock profile in Burke Branch, Horseford Creek and Fullers Branch was not included on the soils inventory mapping but has the potential to serve as a viable borrow source due to the relative ease of augering and sampling during field explorations and the resultant permeability data. Also, as noted earlier, Soil 9 (mine spoil) could potentially prove suitable as a borrow source with further investigation and testing, however little data is currently available thus it was not included on the soils inventory mapping.

As indicated in **Table 39-2**, the available soil borrow materials represent approximately 3.7 million cubic yards of in-situ soil overburden materials found in Horseford Creek and Fullers Branch.

4 Borrow Requirements

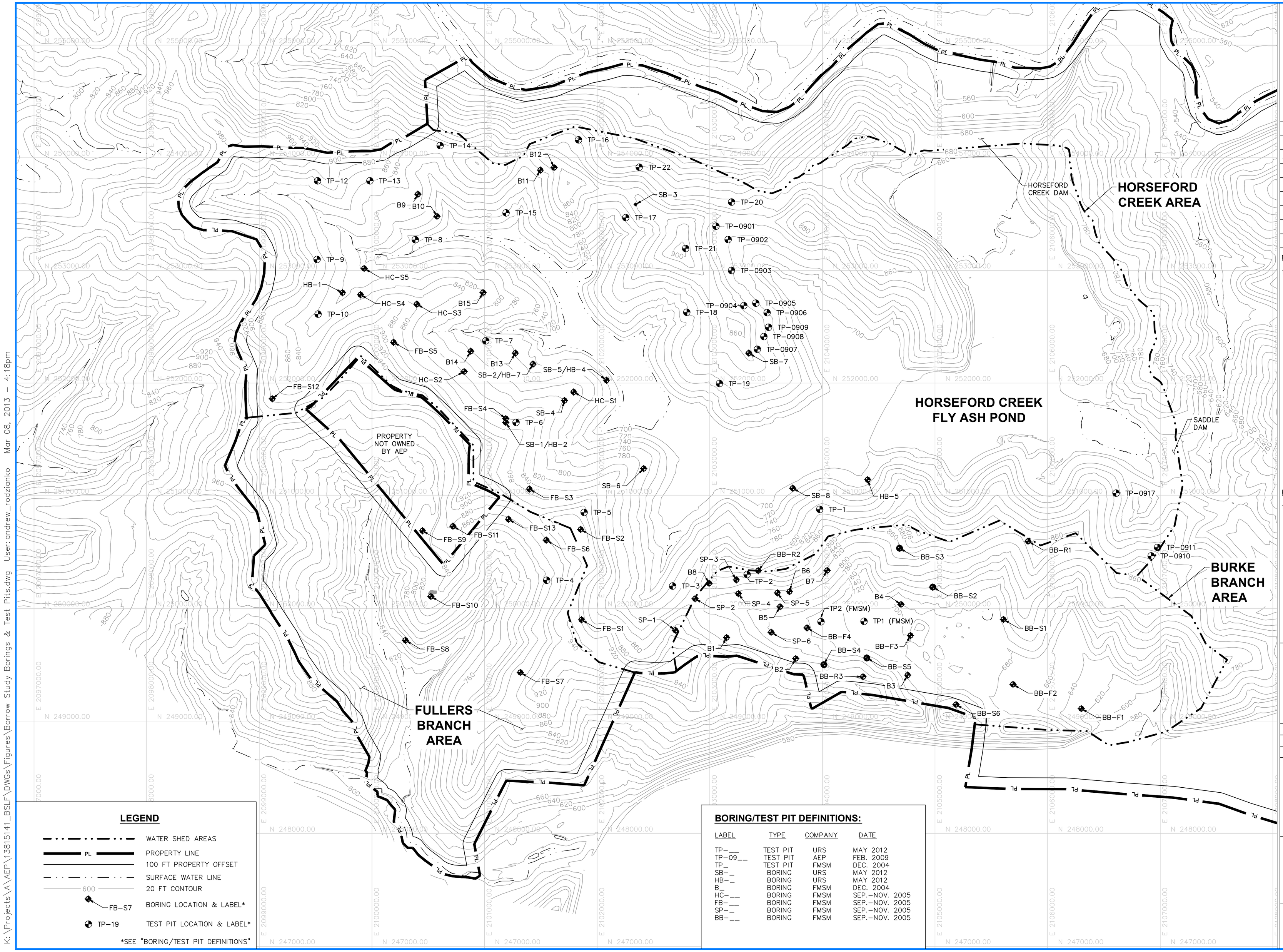
As indicated in **Section 3.3.3** above, approximately 3.7 million cubic yards of soil borrow materials are available within the URS test pit area / proposed pond closure borrow area. Preliminarily, assuming a 150 acre footprint and 5 feet of soil in the cover system, this allows for the use of up to approximately 2.2 million cubic yards for use as structural/contouring fill, 500,000 cubic yards of recompacted soil barrier, and 750,000 cubic yards of frost protection and vegetative material. The preliminary estimated borrow materials required are 2.1 million cubic yards for structural fill and 725,000 cubic yards for cap system cover soil.

It is assumed that the segregated topsoil discussed in **Section 3.3.3** will be re-used for final vegetative cover. Also, it should be noted that the aforementioned limits are those within the areas investigated by both the subsurface exploration and the wetland mapping effort. As shown in **Table 39-2**, the quantities available in Fullers Branch and Horseford Creek are sufficient to provide borrow necessary to construct and close the facility. However, additional areas may be investigated depending on the needs relative to the final cover design, accessibility, and/or proximity. Soil mapping presented in **Attachment 40** illustrates the location of the anticipated borrow materials.

5 References

- Burke Branch Special Waste Landfill Permit Application (Burke Branch Landfill), Fuller, Mossburger, Scott & May (FMSM), July 2006;
- Feasibility Evaluation Technical Memorandum (TM), Geosyntec Consultants, April 4, 2011; and,
- 2009 Borrow Study in Support of Fly Ash Reservoir Dam Raising, AEP Civil Engineering, April 7, 2009.

FIGURES



LEGEND

- WATER SHED AREAS
- PL — PROPERTY LINE
- 100 FT PROPERTY OFFSET
- SURFACE WATER LINE
- 600 — 20 FT CONTOUR
- FB-S7 — BORING LOCATION & LABEL*
- TP-19 — TEST PIT LOCATION & LABEL*

*SEE "BORING/TEST PIT DEFINITIONS"

BORING/TEST PIT DEFINITIONS:

LABEL	TYPE	COMPANY	DATE
TP-___	TEST PIT	URS	MAY 2012
TP-09___	TEST PIT	AEP	FEB. 2009
TP_	TEST PIT	FMSM	DEC. 2004
SB-_	BORING	URS	MAY 2012
HB-_	BORING	URS	MAY 2012
B_	BORING	FMSM	DEC. 2004
HC-__	BORING	FMSM	SEP.-NOV. 2005
FB-__	BORING	FMSM	SEP.-NOV. 2005
SP-_	BORING	FMSM	SEP.-NOV. 2005
BB-__	BORING	FMSM	SEP.-NOV. 2005

400 0 200 400
(IN FEET)

REVISIONS			
NO	DESCRIPTION		
1	-		

RECORD DRAWINGS — DATE — BY

NOTES:

1. FMSM BORING AND TEST PIT LOCATIONS WERE ESTIMATED BASED ON AVAILABLE FIGURES FROM THE BURKE BRANCH PERMIT APPLICATION.

REFERENCES:

1. TOPOGRAPHY FOR THE PLANT AREA PROVIDED BY GEOONE (REYNOLDSBURG, OHIO) VIA AERIAL PHOTOMETRIC SURVEY PERFORMED ON APRIL 13, 2001 WITH CONTOUR INTERVAL OF 2 FT. TOPOGRAPHY. A MAJORITY OF THE PROPERTY PROVIDED BY HENDERSON AERIAL SURVEYS INC. (GROVE CITY, OHIO) VIA AERIAL PHOTOMETRIC SURVEY PERFORMED ON MARCH 9, 2007 WITH CONTOUR INTERVAL OF 2 FT. TOPOGRAPHY WAS SUPPLEMENTED IN PERIPHERAL AREAS WITH USGS TAGGED VECTOR CONTOURS FROM THE FALLSBURG AND PRICHARD USGS 7-1/2 MINUTE TOPOGRAPHIC QUADRANGLE MAPS.

DRAWN	ANR	DATE	9/12
CHECKED	MDR	JOB NO	13814151
SCALE	AS SHOWN		

AEP BIG SANDY BORING/TEST PIT LOCATION MAP

URS
Akron Cleveland Columbus
564 White Pond Drive, Akron, Ohio 44320-1100
PHONE: (330) 836-9111, FAX: 330-836-9115

FIGURE 39-1

K:\Projects\A\AEP\13815141_BSLF\DWGs\Figures\Borrow Study Borings & Test Pits.dwg User: andrew_rodzianko Mar 08, 2013 - 4:18pm

TABLES

Table 39-1: Borrow Soil Characterization Test Results By Soil Type Summary

Soil 4: Shale *(not shown on Figure 2 - Soils Inventory Map)*

Area	Investigation	Source	Sample Depth (ft)	Depth to Top of Layer (ft)	Layer Thickness (ft)	Description	USCS	Sieve/Hydrometer Analysis							Atterberg Limits			Standard Proctor		Permeability
								% Passing 3" Sieve	% Passing #4 Sieve	% Passing No. 200 Sieve	Gravel %	Sand %	Silt %	Clay % (<0.002 mm)	LL	PL	PI	OMC (%)	MDD (pcf)	k (cm/s)
Burke Branch	FMSM	B-1	-	29.7	9.3	Shale (augered)	-	*no lab testing done*												
	FMSM	B-2	15.0 to 20.0	6.0	19.0	Shale (augered)	SC	100.0	83.9	46.9	16.1	37.0	35.7	11.2	31.0	20.0	11.0	9.8	129.6	7.67E-08
	FMSM	B-3	-	6.9	8.1	Shale (augered)	-	*no lab testing done*												
	FMSM	B-4	-	4.0	4.2	Shale (augered)	-	*no lab testing done*												
	FMSM	B-5	-	7.2	2.3	Shale (augered)	-	*no lab testing done*												
	FMSM	B-6	-	12.5	3.0	Shale (augered)	-	*no lab testing done*												
	FMSM	B-7	-	9.5	6.0	Shale (augered)	-	*no lab testing done*												
Horseford Creek	FMSM	B-9	-	3.5	6.5	Shale (augered)	-	*no lab testing done*												
	FMSM	B-10	-	3.9	1.6	Shale (augered)	-	*no lab testing done*												
	FMSM	B-11	-	6.3	6.7	Shale (augered)	-	*no lab testing done*												
	FMSM	B-12	-	6.5	8.5	Shale (augered)	-	*no lab testing done*												
	FMSM	B-13	-	29.1	0.9	Shale (augered)	-	*no lab testing done*												
	FMSM	B-14	-	12.5	1.5	Shale (augered)	-	*no lab testing done*												
	FMSM	B-15	-	2.9	7.6	Shale (augered)	-	*no lab testing done*												
	URS	SB-8	1.0 to 2.0	1.0	27.5	Weathered Shale	-	*no lab testing done*												
	URS	SB-8	2.5 to 4.5	1.0	27.5	Weathered Shale	-	*no lab testing done*												
	URS	SB-8	5.0 to 7.0	1.0	27.5	Weathered Shale	-	*no lab testing done*												
	URS	SB-8	7.5 to 9.5	1.0	27.5	Weathered Shale	-	*no lab testing done*												
	URS	SB-8	10.0 to 11.7	1.0	27.5	Weathered Shale	-	*no lab testing done*												
	URS	SB-8	12.5 to 13.7	1.0	27.5	Weathered Shale	-	*no lab testing done*												
	URS	SB-8	15.0 to 16.3	1.0	27.5	Weathered Shale	-	*no lab testing done*												
	URS	SB-8	17.5 to 18.5	1.0	27.5	Weathered Shale	-	*no lab testing done*												
						Summary:	SC	100.0	83.9	46.9	16.1	37.0	35.7	11.2	31.0	20.0	11.0	9.8	129.6	7.67E-08

Soil 5: Highway refuse fill *(not shown on Figure 2 - Soils Inventory Map)*

Area	Investigation	Source	Sample Depth (ft)	Depth to Top of Layer (ft)	Layer Thickness (ft)	Description	USCS	Sieve/Hydrometer Analysis							Atterberg Limits			Standard Proctor		Permeability
								% Passing 3" Sieve	% Passing #4 Sieve	% Passing No. 200 Sieve	Gravel %	Sand %	Silt %	Clay % (<0.002 mm)	LL	PL	PI	OMC (%)	MDD (pcf)	k (cm/s)
Burke Branch	FMSM	TP-1	3.0 to 8.0	0.0	10.0	Heterogeneous Fill	SC	100.0	76.1	48.8	23.9	27.3	33.5	15.3	33.0	20.0	13.0	-	-	-
	FMSM	TP-2	3.0 to 8.0	0.0	10.0	Heterogeneous Fill	GC	100.0	58.5	35.3	41.5	23.2	26.2	9.1	32.0	20.0	12.0	-	-	-
						Summary:	SC/GC	100.0	58.5 to 76.1	35.3 to 48.8	23.9 to 41.5	23.2 to 27.3	26.2 to 33.5	9.1 to 15.3	32.0 to 33.0	20.0	12.0 to 13.0	-	-	-

Soil 7: Alluvial Soil *(not shown on Figure 2 - Soils Inventory Map)*

Area	Investigation	Source	Sample Depth (ft)	Depth to Top of Layer (ft)	Layer Thickness (ft)	Description	USCS	Sieve Analysis						Atterberg Limits			Standard Proctor		Permeability
								% Passing 3" Sieve	% Passing #4 Sieve	% Passing No. 200 Sieve	Gravel %	Sand %	% Fines (<No. 200 Sieve)	LL	PL	PI	OMC (%)	MDD (pcf)	k (cm/s)
Burke Branch	FMSM	BB-F2	99.0 to 100.5	-	-	-	CL/SC	100.0	62.1	36.1	37.9	26.0	36.1	-	-	-	-	-	-
	FMSM	BB-F2	101.5 to 103.0	-	-	-	CL/SC	100.0	78.8	46.1	21.2	32.7	46.1	-	-	-	-	-	-
	FMSM	BB-F2	104.0 to 105.5	-	-	-	CL/SC	100.0	69.6	44.6	30.4	25.0	44.6	-	-	-	-	-	-
	FMSM	BB-F2	109.0 to 110.5	-	-	-	CL/SC	100.0	70.7	40.2	29.3	30.5	40.2	-	-	-	-	-	-
	FMSM	BB-F2	114.0 to 115.5	-	-	-	CL/SC	100.0	75.1	39.5	24.9	35.6	39.5	-	-	-	-	-	-
	FMSM	BB-F2	119.0 to 120.5	-	-	-	CL/SC	100.0	72.7	38.3	27.3	34.4	38.3	-	-	-	-	-	-
						Summary:	CL/SC	100.0	62.1 to 78.8	36.1 to 46.1	21.2 to 37.9	25.0 to 35.6	36.1 to 46.1	-	-	-	-	-	-

<u>Soil 9: Mine Spoil</u> *(not shown on Figure 2 - Soils Inventory Map)*

Found within Fullers Branch. No lab data available.

Table 39-1: Borrow Soil Characterization Test Results By Soil Type Summary

Soils 2, 6, 8, & 10: Fine-grained residual soils *(color coded as shown on Figure 2 - Soils Inventory Map)*

Area	Investigation	Soil Designation	Source	Sample Depth (ft)	Depth to Top of Layer (ft)	Layer Thickness (ft)	Description	USCS	Natural Moisture Content (%)	Sieve/Hydrometer Analysis							Atterberg Limits			Standard Proctor		Modified Proctor		Permeability
										% Passing 3" Sieve	% Passing #4 Sieve	% Passing No. 200 Sieve	Gravel %	Sand %	Silt %	Clay % (<0.002 mm)	LL	PL	PI	OMC (%)	MDD (pcf)	OMC (%)	MDD (pcf)	k (cm/s)
Horseford Creek	AEP	Soil 10	TP-0901	1.5	1.5	6.5	Lean Clay	CL	22.3	100.0	100.0	88.6	0.0	11.4	41.3	47.3	45.9	20.2	25.7	15.9	110.3	-	-	-
	AEP	Soil 10	TP-0902	4.0	2.0	8.0	Fat Clay with Sand	CH	24.5	100.0	100.0	82.7	0.0	17.3	32.9	49.8	50.7	21.0	29.7	16.9	111.1	-	-	-
	AEP	Soil 10	TP-0903	0.5	0.5	2.9	Fat Clay	CH	23.9	100.0	100.0	98.1	0.0	1.9	52.1	46.0	49.7	24.4	25.3	19.3	106.8	-	-	2.22E-08
	AEP	Soil 10	TP-0905	2.5	0.5	6.5	Lean Clay	CL	20.4	100.0	100.0	98.7	0.0	1.3	56.1	42.6	47.2	24.3	22.9	17.8	106.8	-	-	-
	AEP	Soil 10	TP-0906	1.0	0.0	3.2	Fat Clay	CH	27.6	100.0	99.4	96.5	0.6	2.9	35.9	60.6	63.1	24.5	38.6	23.0	99.3	-	-	-
	AEP	Soil 10	TP-0907	0.5	0.5	5.8	Lean Clay	CL	17.6	100.0	100.0	92.1	0.0	7.9	40.9	51.2	48.6	19.5	29.1	17.8	110.5	-	-	-
	AEP	Soil 10	TP-0908	0.5	0.5	6.0	Fat Clay	CH	22.9	100.0	98.3	92.5	1.7	5.7	48.7	43.8	51.7	24.2	27.5	18.9	107.9	-	-	2.14E-08
	AEP	Soil 10	TP-0909	0.5	0.5	8.3	Lean Clay	CL	20.5	100.0	98.1	88.9	1.9	9.2	48.0	40.9	45.4	21.9	23.5	17.5	108.3	-	-	-
	AEP	Soil 10	TP-0910	0.2	0.2	10.3	Fat Clay	CH	22.5	100.0	99.8	89.9	0.2	9.9	36.1	53.8	56.1	26.2	29.9	24.0	98.0	-	-	-
	AEP	Soil 6	TP-0911	0.3	0.3	8.2	Lean Clay	CL	18.8	100.0	100.0	91.9	0.0	8.1	51.6	40.3	40.5	20.9	19.6	16.4	112.7	-	-	1.32E-07
	AEP	Soil 6	TP-0917	0.0	0.0	10.0	Lean Clay	CL	12.2	100.0	100.0	99.3	0.0	0.7	72.0	27.3	33.0	18.6	14.4	12.2	121.0	-	-	-
	FMSM	Soil 6	HC-S4	6.1 to 10.5	-	-	Lean Clay with Sand	CL	15.2	100.0	98.9	84.2	1.1	14.7	47.8	36.4	46.0	23.0	23.0	16.3	111.4	-	-	1.45E-08
	URS	Soil 6	TP-1	0.5 to 2.5	0.5	5.0	Lean Clay	CL	20.0	-	-	-	-	-	-	-	33.0	17.0	16.0	-	-	-	-	-
	URS	Soil 10	TP-1	3.0 to 6.0	0.5	5.0	Lean Clay	CH	23.5	100.0	98.2	87.9	1.9	10.2	45.9	42.0	50.0	24.0	26.0	21.0	101.8	-	-	4.00E-08
	URS	Soil 6	TP-2	0.3 to 2.5	0.3	2.2	Sandy Lean Clay	CL	17.6	-	-	-	-	-	-	-	-	-	-	-	-	11.1	122.8	-
	URS	Soil 10	TP-3	0.4 to 3.5	0.4	4.6	Lean Clay	CH	26.0	92.9	82.0	72.6	18.0	9.4	28.6	44.0	57.0	23.0	34.0	-	-	-	-	-
	URS	Soil 6	TP-3	3.5 to 5.0	0.4	4.6	Lean Clay	CL	29.5	100.0	98.1	96.1	1.8	2.0	23.1	73.0	-	-	-	-	-	-	-	-
	URS	Soil 6	TP-6	0.4 to 2.0	0.4	5.6	Lean Clay	CL	22.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	TP-6	2.0 to 6.0	0.4	5.6	Lean Clay	CL	16.1	100.0	96.1	90.3	3.9	5.8	45.3	45.0	49.0	22.0	27.0	-	-	-	-	-
	URS	Soil 6	TP-7	0.5 to 5.0	0.5	4.5	Lean Clay	CL	21.2	-	-	-	-	-	-	-	34.0	19.0	15.0	-	-	10.4	126.4	8.50E-07
	URS	Soil 6	TP-8	0.3 to 5.0	0.3	6.7	Lean Clay	CL	24.4	-	-	-	-	-	-	-	-	-	-	20.0	100.1	-	-	-
	URS	Soil 6	TP-8	5.0 to 7.0	0.3	6.7	Lean Clay	CL	14.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	TP-9	0.3 to 4.0	0.3	3.7	Sandy Lean Clay	CL	15.6	100.0	80.5	61.2	19.5	19.3	41.2	20.0	36.0	20.0	16.0	-	-	-	-	-
	URS	Soil 6	TP-10	1.0 to 5.0	1.0	4.0	Sandy Lean Clay	CL	19.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	TP-13	0.5 to 5.0	0.5	4.5	Sandy Lean Clay	CL	14.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	TP-15	0.4 to 3.0	0.4	2.6	Silty Lean Clay	CL	20.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	TP-16	0.6 to 6.0	0.6	5.4	Silty Lean Clay	CL	17.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	TP-17	0.5 to 3.0	0.5	3.0	Silty Lean Clay	CL	19.0	-	-	-	-	-	-	-	41.0	23.0	18.0	15.5	109.2	-	-	1.30E-06
	URS	Soil 10	TP-18	0.5 to 5.0	0.5	4.5	Silty Lean Clay	CH	17.1	-	-	-	-	-	-	-	56.0	21.0	35.0	-	-	-	-	-
	URS	Soil 6	TP-19	2.0 to 4.0	0.5	3.5	Lean Clay	CL	20.2	100.0	97.8	93.8	2.2	4.0	43.8	50.0	-	-	-	-	-	12.2	119.3	8.40E-08
	URS	Soil 6	TP-20	1.0 to 5.0	1.0	4.0	Sandy Lean Clay	CL	14.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	TP-20	5.0 to 7.5	5.0	2.5	Lean Clay	CL	19.4	-	-	-	-	-	-	-	49.0	21.0	28.0	-	-	-	-	-
	URS	Soil 6	TP-22	0.5 to 5.0	0.5	4.5	Silty/Sandy Lean Clay	CL	15.7	-	-	-	-	-	-	-	26.0	18.0	8.0	11.2	120.6	-	-	-
	URS	Soil 6	HB-1	2.0 to 4.0	1.0	5.0	Brown Lean Clay	CL	17.7	-	-	67.9	-	-	-	-	35.0	17.0	18.0	-	-	-	-	-
	URS	Soil 10	HB-1	8.0 to 12.5	8.0	4.5	Fat Clay	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	HB-2/SB-1	8.0 to 10.0	2.0	12.5	Brown Lean Clay	CL	17.7	-	-	91.0	-	-	-	-	45.0	21.0	24.0	-	-	-	-	-
	URS	Soil 6	HB-4/SB-5	0.5 to 2.0	0.5	1.5	Lean Clay	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	HB-5	4.0 to 6.0	3.5	2.5	Brown Lean Clay	CL	-	-	-	47.6	-	-	-	-	33.0	17.0	16.0	-	-	-	-	-
	URS	Soil 6	HB-5	6.0 to 8.0	6.0	2.0	Brown Lean Clay	CL	16.1	-	-	49.5	-	-	-	-	32.0	16.0	16.0	-	-	-	-	-
	URS	Soil 6	HB-7/SB-2	4.0 to 6.0	2.0	4.0	Brown Lean Clay	CL	16.7	-	-	-	-	-	-	-	32.0	17.0	15.0	-	-	-	-	-
	URS	Soil 10	HB-7/SB-2	12.0 to 14.0	12.0	2.0	Fat Clay	CH	17.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	SB-4	0.0 to 2.0	0.0	6.0	Lean Clay	CL	23.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	SB-4	2.5 to 4.5	0.0	6.0	Brown Lean Clay	CL	20.2	-	-	-	-	-	-	-	45.0	23.0	22.0	-	-	-	-	-
	URS	Soil 6	SB-4	3.4 to 3.9	0.0	6.0	Lean Clay	CL	-	100.0	100.0	96.6	0.0	3.4	46.6	50.0	46.0	25.0	21.0	-	-	-	-	-
	URS	Soil 6	SB-5	6.4 to 6.9	5.5	8.0	Sandy Lean Clay	CL	-	100.0	85.9	50.5	14.1	35.4	33.5	17.0	29.0	15.0	14.0	-	-	-	-	-
	URS	Soil 6	SB-6	0.0 to 2.0	0.0	14.0	Lean Clay	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 10	SB-6	2.5 to 4.5	0.0	14.0	Brown Fat Clay	CH	26.3	-	-	89.6	-	-	-	-	62.0	25.0	37.0	-	-	-	-	-
	URS	Soil 6	SB-6	3.9 to 4.4	0.0	14.0	Lean Clay w/Sand	CL	-	100.0	92.9	79.9	7.1	13.0	33.9	46.0	41.0	19.0	22.0	-	-	-	-	-
	URS	Soil 10	SB-6	5.0 to 7.0	0.0	14.0	Brown/Black Fat Clay	CH	29.5	-	-	-	-	-	-	-	59.0	30.0	29.0	-	-	-	-	-
	URS	Soil 6	SB-6	7.5 to 9.5	0.0	14.0	Lean Clay	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	SB-6	10.0 to 12.0	0.0	14.0	Lean Clay	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	SB-6	12.5 to 13.5	0.0	14.0	Lean Clay	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	SB-7	0.0 to 2.0	0.0	7.0	Silty Lean Clay	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 6	SB-7	3.4 to 3.9	0.0	7.0	Lean Clay	CL	-	100.0	100.0	98.2	0.0	1.8	47.2	51.0	41.0	21.0	20.0	-	-	-	-	-
	URS	-	SB-7	5.0 to 7.0	0.0	7.0	Brown Silt	ML	10.4	-	-	71.7	-	-	-	-	39.0	19.0	20.0	-	-	-	-	-
Burke Branch	FMSM	Soil 2	B-1	-	23.5	6.2	Sandy Lean Clay	CL	-	*visual classification, no lab testing done*														
	FMSM	Soil 6	BB-R1	6.0 to 9.5	-	-	Lean Clay	CL	13.6	100.0	100.0	95.0	0.0	5.0	45.8	49.2	48.0	21.0	27.0	15.9	110.5	-	-	2.94E-09
Fullers Branch	FMSM	Soil 6	FB-S3	0.3 to 10.7	-	-	Lean Clay with Sand	CL	15.2	100.0	98.9	84.2	1.1	14.7	47.8	36.4	46.0	23.0	23.0	16.3	111.4	-	-	1.45E-08
	FMSM	Soil 8	FB-S4	0.0 to 6.5	-	-	Sandy Lean Clay	CL	20.8	100.0	100.0	69.6	0.0	30.4	31.7	37.9	43.0	20.0	23.0	20.3	105.7	-	-	3.02E-09
	FMSM	Soil 8	FB-S1	0.2 to 5.5	-	-	Sandy Lean Clay	CL	20.8	100.0	100.0	69.6	0.0	30.4	31.7	37.9	43.0	20.0	23.0	20.3	105.7	-	-	3.02E-09
	URS	Soil 6	TP-4	1.0 to 5.0	1.0	4.0	Lean Clay	CL	21.1	-	-	-	-	-	-	-	40.0	21.0	19.0	17.7	109.6	11.9	120.4	6.40E-08
							Summary:	CL/CH	10.4 to 29.5	92.9 to 100.0	80.5 to 100.0	47.6 to 99.3	0.0 to 19.5	0.7 to 35.4	20.4 to 72.0	17.0 to 73.0	26.0 to 63.1	15.0 to 30.0	8.0 to 38.6	11.2 to 24.0	98.0 to 121.0	10.4 to 12.2	119.3 to 126.4	2.94E-09 to 1.30E-06

Table 39-1: Borrow Soil Characterization Test Results By Soil Type Summary

Soils 1 & 3: Coarse-grained residual soils *(color coded as shown on Figure 2 - Soils Inventory Map)*

Area	Investigation	Soil Designation	Source	Sample Depth (ft)	Depth to Top of Layer (ft)	Layer Thickness (ft)	Description	USCS	Natural Moisture Content (%)	Sieve/Hydrometer Analysis							Atterberg Limits			Standard Proctor		Modified Proctor		Permeability
										% Passing 3" Sieve	% Passing #4 Sieve	% Passing No. 200 Sieve	Gravel %	Sand %	Silt %	Clay % (<0.002 mm)	LL	PL	PI	OMC (%)	MDD (pcf)	OMC (%)	MDD (pcf)	k (cm/s)
Burke Branch	FMSM	Soil 1	B-1	5.0 to 15.0	0.4	23.1	Clayey Sand	SC	5.5	100.0	94.5	49.0	5.5	45.5	29.2	19.8	28.0	17.0	11.0	12.8	120.0	-	-	5.05E-08
	FMSM	Soil 1	B-2	-	0.3	5.7	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-3	-	0.6	6.3	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-4	-	0.4	3.6	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-5	-	0.4	6.8	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-6	-	0.5	12.0	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-7	-	0.5	9.0	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 3	B-8	5.0 to 9.0	0.2	9.0	Silty Clayey Sand	SC-SM	13.4	100.0	97.3	40.3	2.7	57.0	21.0	19.3	22.0	16.0	6.0	-	-	-	-	-
Horseford Creek	FMSM	Soil 1	B-9	-	0.4	3.1	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-10	-	0.3	3.6	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-11	-	0.3	6.0	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-12	-	0.4	6.1	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-13	-	0.1	29.0	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-14	-	0.4	12.1	Clayey Sand	SC	*visual classification, no lab testing done*															
	FMSM	Soil 1	B-15	-	0.2	2.7	Clayey Sand	SC	*visual classification, no lab testing done*															
	URS	Soil 1	TP-5	0.4 to 3.0	0.4	2.6	Sandy Lean Clay	SC	14.6	100.0	99.3	44.5	0.7	54.8	26.5	18.0	-	-	-	-	-	10.1	124.6	-
	URS	Soil 1	TP-12	0.4 to 6.0	0.4	5.6	Lean Clay & Clayey Sand	CL/SC	14.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 1	TP-14	0.3 to 3.0	0.3	2.7	Clayey Sand	SC	17.8	100.0	89.9	25.5	10.1	64.4	15.5	10.0	25.0	20.0	5.0	13.6	114.4	9.9	126.7	3.30E-05
	URS	Soil 1	TP-21	0.5 to 5.5	0.5	5.0	Sandy Lean Clay	SC	14.9	100.0	85.9	37.8	14.1	48.1	21.8	16.0	-	-	-	-	-	-	-	-
	URS	Soil 1	HB-1	6.0 to 8.0	6.0	2.0	Sandy Clay	SC	17.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 1	HB-2/SB-1	0.5 to 2.0	0.5	1.5	Sandy Clay	SC	17.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	Soil 1	HB-7/SB-2	0.0 to 2.0	0.0	2.0	Clayey Sand	SC	16.4	100.0	91.7	47.2	8.3	44.5	47.2 (silt & clay)		31.0	18.0	13.0	-	-	-	-	-
	URS	Soil 1	HB-7/SB-2	8.0 to 10.0	6.0	6.0	Clayey Sand w/Gravel	SC-GC	10.4	100.0	80.7	30.9	19.3	49.8	30.9 (silt & clay)		-	-	-	-	-	-	-	-
	URS	Soil 3	HB-7/SB-2	16.0 to 18.0	16.0	6.0	Silty, Clayey Sand w/Gravel	SC-SM	12.2	100.0	83.4	29.8	16.6	53.6	29.8 (silt & clay)		20.0	15.0	5.0	-	-	-	-	-
	URS	-	SB-3	0.0 to 0.5	0.0	11.0	Sand	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	-	SB-3	2.5 to 3.0	0.0	11.0	Sand	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	URS	-	SB-3	5.0 to 5.5	0.0	11.0	Sand	SP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
							Summary:	SC	5.5 to 17.8	100.0	80.7 to 99.3	25.5 to 49.0	0.7 to 19.3	44.5 to 64.4	15.5 to 26.5	10.0 to 27.3	20.0 to 31.0	15.0 to 20.0	5.0 to 13.0	12.8 to 13.6	114.4 to 120.0	9.9 to 10.1	124.6 to 126.7	5.05E-08 to 3.30E-05

Table 39-2: Borrow Soil Volume Summary

Preliminary Estimated Borrow Required*

Material Type	Applicable Soil Numbers	Required Volume (Cubic Yards)
Structural Fill	Soils 1, 2, 3, 6, 8, & 10	2,100,000
Cap System Cover Soil	Soils 2, 6, 8, & 10	725,000
	Total:	**2,825,000**

Preliminary Estimated Borrow Available

Material Type	Associated Soil Numbers	In-situ Volume (Cubic Yards)
Coarse-Grained Residual Soils	Soils 1 & 3	1,747,000
Fine-Grained Residual Soils	Soils 2, 6, 8, & 10	1,929,000
	Total:	**3,676,000**

*Assumes 150 acre footprint, 5 feet of soil cover.

Notes:

1. Quantities presented herein are preliminary and subject to change.
2. Soil quantities were calculated only within the URS test pit area/proposed pond closure borrow area. The depths used in these volume calculations reflect the depths encountered in the field during the geotechincal explorations.
3. In-situ topsoil was not included in the volume calculations. It is assumed that the topsoil will be segregated during construction and was considered separately from the other designated soil types.

APPENDICES

APPENDIX A

NRCS REGIONAL SOIL REPORT

United States Department of Agriculture

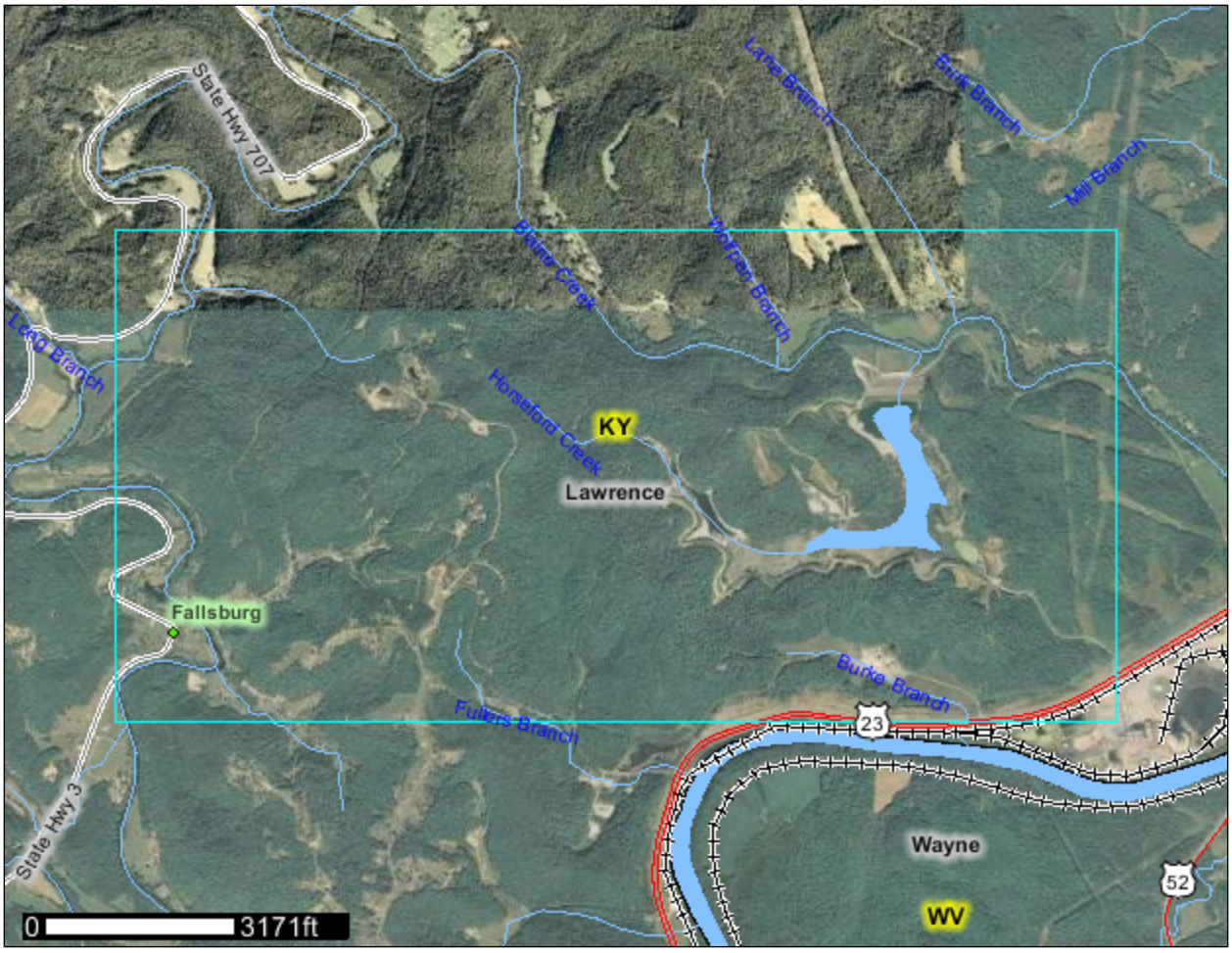
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Lawrence and Martin Counties, Kentucky

Borrow Source Study



May 19, 2012

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

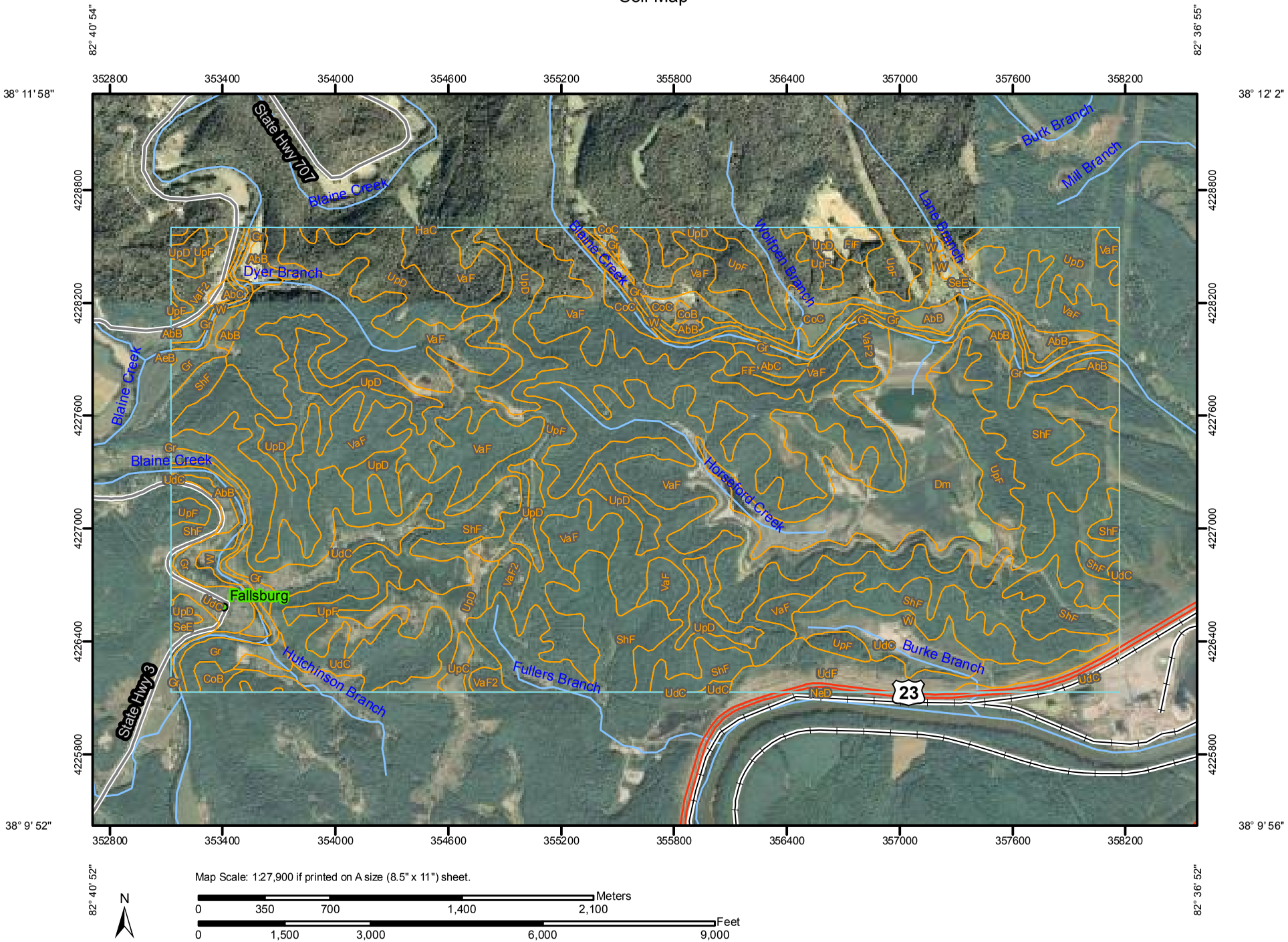
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Lawrence and Martin Counties, Kentucky (KY640)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples	159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes	135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched	70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	61.9	2.0%
W	Water	56.2	1.8%
Totals for Area of Interest		**3,079.6**	**100.0%**

Map Unit Descriptions

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, 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.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Lawrence and Martin Counties, Kentucky

AbB—Allegheny loam, 2 to 6 percent slopes, rarely flooded

Map Unit Setting

Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition

Allegheny and similar soils: 90 percent
Minor components: 10 percent

Description of Allegheny

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from sedimentary rock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: High (about 9.2 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 8 inches: Loam
8 to 52 inches: Silt loam
52 to 89 inches: Sandy loam

Minor Components

Other soils

Percent of map unit: 3 percent

Holly

Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Orrville

Percent of map unit: 1 percent
Landform: Flood plains

Cotaco
Percent of map unit: 1 percent
Landform: Stream terraces

Hayter
Percent of map unit: 1 percent
Landform: Stream terraces, fans

Chagrin
Percent of map unit: 1 percent
Landform: Flood plains

Grigsby
Percent of map unit: 1 percent
Landform: Flood plains

Nelse
Percent of map unit: 1 percent
Landform: Flood plains

AbC—Allegheny loam, 6 to 15 percent slopes, rarely flooded

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Allegheny and similar soils: 85 percent
Minor components: 15 percent

Description of Allegheny

Setting
Landform: Stream terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from sedimentary rock

Properties and qualities
Slope: 6 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: High (about 9.2 inches)

Interpretive groups
Land capability (nonirrigated): 3e

Typical profile
0 to 8 inches: Loam
8 to 52 inches: Silt loam
52 to 89 inches: Sandy loam

Minor Components

Cotaco
Percent of map unit: 3 percent
Landform: Stream terraces

Hayter
Percent of map unit: 3 percent
Landform: Stream terraces, fans

Other soils
Percent of map unit: 3 percent

Chagrin
Percent of map unit: 2 percent
Landform: Flood plains

Holly
Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Orrville
Percent of map unit: 1 percent
Landform: Flood plains

Grigsby
Percent of map unit: 1 percent
Landform: Flood plains

Nelse
Percent of map unit: 1 percent
Landform: Flood plains

AeB—Allegheny loam, 2 to 6 percent slopes, occasionally flooded

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Allegheny and similar soils: 90 percent
Minor components: 10 percent

Description of Allegheny

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from sedimentary rock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water capacity: High (about 9.2 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 8 inches: Loam
8 to 52 inches: Silt loam
52 to 89 inches: Sandy loam

Minor Components

Other soils

Percent of map unit: 3 percent

Holly

Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Orrville

Percent of map unit: 1 percent
Landform: Flood plains

Cotaco

Percent of map unit: 1 percent
Landform: Stream terraces

Hayter

Percent of map unit: 1 percent
Landform: Stream terraces, fans

Chagrin

Percent of map unit: 1 percent
Landform: Flood plains

Grigsby

Percent of map unit: 1 percent
Landform: Flood plains

Nelse
Percent of map unit: 1 percent
Landform: Flood plains

CoB—Cotaco silt loam, 0 to 4 percent slopes, rarely flooded

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Cotaco and similar soils: 90 percent
Minor components: 10 percent

Description of Cotaco

Setting
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty alluvium derived from sedimentary rock

Properties and qualities
Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Moderate (about 7.0 inches)

Interpretive groups
Land capability (nonirrigated): 2w

Typical profile
0 to 9 inches: Silt loam
9 to 55 inches: Silt loam
55 to 85 inches: Silt loam

Minor Components

Other soils
Percent of map unit: 3 percent

Holly
Percent of map unit: 1 percent
Landform: Flood plains

Down-slope shape: Linear
Across-slope shape: Linear

Orrville
Percent of map unit: 1 percent
Landform: Flood plains

Allegheny
Percent of map unit: 1 percent
Landform: Stream terraces

Chagrin
Percent of map unit: 1 percent
Landform: Flood plains

Grigsby
Percent of map unit: 1 percent
Landform: Flood plains

Hayter
Percent of map unit: 1 percent
Landform: Stream terraces, fans

Nelse
Percent of map unit: 1 percent
Landform: Flood plains

CoC—Cotaco silt loam, 4 to 12 percent slopes, rarely flooded

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Cotaco and similar soils: 90 percent
Minor components: 10 percent

Description of Cotaco

Setting
Landform: Stream terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty alluvium derived from sedimentary rock

Properties and qualities
Slope: 4 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 18 to 30 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Moderate (about 7.0 inches)

Interpretive groups
Land capability (nonirrigated): 3e

Typical profile
0 to 9 inches: Silt loam
9 to 55 inches: Silt loam
55 to 85 inches: Silt loam

Minor Components

Other soils
Percent of map unit: 3 percent

Holly
Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Orrville
Percent of map unit: 1 percent
Landform: Flood plains

Allegheny
Percent of map unit: 1 percent
Landform: Stream terraces

Chagrin
Percent of map unit: 1 percent
Landform: Flood plains

Grigsby
Percent of map unit: 1 percent
Landform: Flood plains

Hayter
Percent of map unit: 1 percent
Landform: Stream terraces, fans

Nelse
Percent of map unit: 1 percent
Landform: Flood plains

Dm—Dumps, mine; tailings; and tipples

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Dumps: 90 percent
Minor components: 10 percent

Minor Components

Other soils
Percent of map unit: 5 percent

Fairpoint
Percent of map unit: 1 percent

Fiveblock
Percent of map unit: 1 percent

Kaymine
Percent of map unit: 1 percent

Allegheny
Percent of map unit: 1 percent
Landform: Stream terraces

Cotaco
Percent of map unit: 1 percent
Landform: Stream terraces

FiF—Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Fiveblock, unstable fill, and similar soils: 32 percent
Fairpoint, unstable fill, and similar soils: 30 percent
Kaymine, unstable fill, and similar soils: 28 percent
Minor components: 10 percent

Description of Fiveblock, Unstable Fill

Setting
Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy-skeletal mine spoil or earthy fill derived from sedimentary rock

Properties and qualities
Slope: 30 to 80 percent

Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.4 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 4 inches: Channery sandy loam
4 to 80 inches: Extremely flaggy sandy loam

Description of Fairpoint, Unstable Fill

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy-skeletal mine spoil or earthy fill derived from sedimentary rock

Properties and qualities

Slope: 30 to 80 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 7 inches: Channery silt loam
7 to 80 inches: Extremely flaggy silt loam

Description of Kaymine, Unstable Fill

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy-skeletal mine spoil or earthy fill derived from sedimentary rock

Properties and qualities

Slope: 30 to 80 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.2 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 6 inches: Very channery loam
6 to 80 inches: Extremely flaggy loam

Minor Components

Cloverlick

Percent of map unit: 1 percent

Shelocta

Percent of map unit: 1 percent

Rayne

Percent of map unit: 1 percent

Blairton

Percent of map unit: 1 percent

Cruze

Percent of map unit: 1 percent

Dekalb

Percent of map unit: 1 percent

Marrowbone

Percent of map unit: 1 percent

Fedscreek

Percent of map unit: 1 percent

Hazleton

Percent of map unit: 1 percent

Other soils

Percent of map unit: 1 percent

Gr—Grigsby fine sandy loam, frequently flooded

Map Unit Setting

Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition

Grigsby and similar soils: 90 percent
Minor components: 10 percent

Description of Grigsby

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium derived from sedimentary rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 42 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water capacity: Moderate (about 8.5 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 11 inches: Fine sandy loam
11 to 64 inches: Fine sandy loam
64 to 80 inches: Stratified sandy loam to loam

Minor Components

Other soils

Percent of map unit: 3 percent

Nelse

Percent of map unit: 1 percent
Landform: Flood plains

Holly

Percent of map unit: 1 percent

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Chagrin
Percent of map unit: 1 percent
Landform: Flood plains

Orrville
Percent of map unit: 1 percent
Landform: Flood plains

Allegheny
Percent of map unit: 1 percent
Landform: Stream terraces

Cotaco
Percent of map unit: 1 percent
Landform: Stream terraces

Hayter
Percent of map unit: 1 percent
Landform: Stream terraces, fans

HaC—Hayter-Grigsby complex, 2 to 15 percent slopes

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Hayter and similar soils: 45 percent
Grigsby and similar soils: 35 percent
Minor components: 20 percent

Description of Hayter

Setting
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy colluvium derived from sedimentary rock

Properties and qualities
Slope: 2 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Moderate (about 8.8 inches)

Interpretive groups

Land capability (nonirrigated): 3e

Typical profile

0 to 10 inches: Loam
10 to 70 inches: Loam
70 to 80 inches: Very channery clay loam

Description of Grigsby

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium derived from sedimentary rock

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 42 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water capacity: Moderate (about 8.5 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 11 inches: Fine sandy loam
11 to 64 inches: Fine sandy loam
64 to 80 inches: Stratified sandy loam to loam

Minor Components

Chagrin

Percent of map unit: 4 percent
Landform: Flood plains

Shelocta

Percent of map unit: 4 percent
Landform: Stream terraces

Other soils

Percent of map unit: 4 percent

Orrville

Percent of map unit: 2 percent
Landform: Flood plains

Allegheny

Percent of map unit: 2 percent
Landform: Stream terraces

Cotaco
Percent of map unit: 2 percent
Landform: Stream terraces

Nelse
Percent of map unit: 1 percent
Landform: Flood plains

Holly
Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

NeD—Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Nelse and similar soils: 90 percent
Minor components: 10 percent

Description of Nelse

Setting
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium derived from sedimentary rock

Properties and qualities
Slope: 4 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water capacity: Moderate (about 6.6 inches)

Interpretive groups
Land capability (nonirrigated): 4e

Typical profile
0 to 12 inches: Fine sandy loam
12 to 44 inches: Stratified sand to fine sandy loam
44 to 80 inches: Stratified sand to fine sandy loam

Minor Components

Other soils
Percent of map unit: 3 percent

Holly
Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Orrville
Percent of map unit: 1 percent
Landform: Flood plains

Allegheny
Percent of map unit: 1 percent
Landform: Stream terraces

Cotaco
Percent of map unit: 1 percent
Landform: Stream terraces

Hayter
Percent of map unit: 1 percent
Landform: Stream terraces, fans

Chagrin
Percent of map unit: 1 percent
Landform: Flood plains

Grigsby
Percent of map unit: 1 percent
Landform: Flood plains

SeE—Shelocta silt loam, 12 to 30 percent slopes

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Shelocta and similar soils: 90 percent
Minor components: 10 percent

Description of Shelocta

Setting
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty colluvium derived from shale and siltstone over residuum

Properties and qualities

Slope: 12 to 30 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.4 inches)

Interpretive groups

Land capability (nonirrigated): 6e

Typical profile

0 to 3 inches: Silt loam
3 to 39 inches: Channery silt loam
39 to 51 inches: Very channery silt loam
51 to 61 inches: Weathered bedrock

Minor Components

Other soils

Percent of map unit: 4 percent

Beech

Percent of map unit: 1 percent

Cloverlick

Percent of map unit: 1 percent

Fedscreek

Percent of map unit: 1 percent

Hazleton

Percent of map unit: 1 percent

Rigley

Percent of map unit: 1 percent

Vandalia

Percent of map unit: 1 percent

ShF—Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony

Map Unit Setting

Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition

Shelocta and similar soils: 40 percent
Hazleton and similar soils: 30 percent
Fedscreek and similar soils: 20 percent
Minor components: 10 percent

Description of Shelocta

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty colluvium derived from shale and siltstone over residuum

Properties and qualities

Slope: 30 to 60 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.4 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 3 inches: Silt loam
3 to 39 inches: Channery silt loam
39 to 51 inches: Very channery silt loam
51 to 61 inches: Weathered bedrock

Description of Hazleton

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy-skeletal colluvium derived from sedimentary rock

Properties and qualities

Slope: 30 to 60 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water capacity: Low (about 5.5 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 3 inches: Very channery sandy loam
3 to 80 inches: Extremely channery sandy loam

Description of Fedscreek

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy colluvium derived from sedimentary rock

Properties and qualities

Slope: 30 to 60 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 4 inches: Fine sandy loam
4 to 74 inches: Channery sandy loam
74 to 82 inches: Very channery loam

Minor Components

Other soils

Percent of map unit: 6 percent

Beech

Percent of map unit: 1 percent

Cloverlick

Percent of map unit: 1 percent

Rigley

Percent of map unit: 1 percent

Vandalia

Percent of map unit: 1 percent

UdC—Udorthents-Urban land complex, 0 to 12 percent slopes

Map Unit Setting

Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition

Udorthents and similar soils: 60 percent
Urban land: 30 percent
Minor components: 10 percent

Description of Udorthents

Properties and qualities

Slope: 0 to 12 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Other soils

Percent of map unit: 5 percent

Allegheny

Percent of map unit: 1 percent
Landform: Stream terraces

Cotaco

Percent of map unit: 1 percent
Landform: Stream terraces

Chagrin

Percent of map unit: 1 percent
Landform: Flood plains

Grigsby

Percent of map unit: 1 percent
Landform: Flood plains

Shelocta

Percent of map unit: 1 percent
Landform: Hillsides

UdF—Udorthents-Urban land complex, 0 to 80 percent slopes, benched

Map Unit Setting

Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition

Udorthents and similar soils: 70 percent
Urban land: 20 percent
Minor components: 10 percent

Description of Udorthents

Properties and qualities

Slope: 0 to 80 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Other soils

Percent of map unit: 5 percent

Fairpoint

Percent of map unit: 1 percent

Fiveblock

Percent of map unit: 1 percent

Kaymine

Percent of map unit: 1 percent

Fedscreek

Percent of map unit: 1 percent

Hazleton

Percent of map unit: 1 percent

UpC—Upshur-Rarden complex, 6 to 12 percent slopes

Map Unit Setting

Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F

Frost-free period: 135 to 169 days

Map Unit Composition

Upshur and similar soils: 50 percent
Rarden and similar soils: 30 percent
Minor components: 20 percent

Description of Upshur

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey residuum weathered from shale and siltstone

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.1 inches)

Interpretive groups

Land capability (nonirrigated): 4e

Typical profile

0 to 3 inches: Silty clay loam
3 to 42 inches: Silty clay
42 to 52 inches: Extremely channery silty clay loam
52 to 62 inches: Weathered bedrock

Description of Rarden

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey residuum weathered from shale and siltstone

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.5 inches)

Interpretive groups
Land capability (nonirrigated): 4e

Typical profile
0 to 3 inches: Silt loam
3 to 26 inches: Silty clay
26 to 36 inches: Weathered bedrock

Minor Components

Other soils
Percent of map unit: 8 percent

Blairton
Percent of map unit: 3 percent

Cruze
Percent of map unit: 3 percent

Dekalb
Percent of map unit: 2 percent

Marrowbone
Percent of map unit: 2 percent

Rayne
Percent of map unit: 2 percent

UpD—Upshur-Rarden complex, 12 to 25 percent slopes

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Upshur and similar soils: 50 percent
Rarden and similar soils: 30 percent
Minor components: 20 percent

Description of Upshur

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey residuum weathered from shale and siltstone

Properties and qualities
Slope: 12 to 25 percent

Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.1 inches)

Interpretive groups

Land capability (nonirrigated): 6e

Typical profile

0 to 3 inches: Silty clay loam
3 to 42 inches: Silty clay
42 to 52 inches: Extremely channery silty clay loam
52 to 62 inches: Weathered bedrock

Description of Rarden

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey residuum weathered from shale and siltstone

Properties and qualities

Slope: 12 to 25 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.5 inches)

Interpretive groups

Land capability (nonirrigated): 6e

Typical profile

0 to 3 inches: Silt loam
3 to 26 inches: Silty clay
26 to 36 inches: Weathered bedrock

Minor Components

Other soils

Percent of map unit: 8 percent

Blairton

Percent of map unit: 3 percent

Cruze

Percent of map unit: 3 percent

Dekalb
Percent of map unit: 2 percent

Marrowbone
Percent of map unit: 2 percent

Rayne
Percent of map unit: 2 percent

UpF—Upshur-Rarden complex, 25 to 60 percent slopes, rocky

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Upshur and similar soils: 50 percent
Rarden and similar soils: 30 percent
Minor components: 20 percent

Description of Upshur

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey residuum weathered from shale and siltstone

Properties and qualities
Slope: 25 to 60 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.1 inches)

Interpretive groups
Land capability (nonirrigated): 7e

Typical profile
0 to 3 inches: Silty clay loam
3 to 42 inches: Silty clay
42 to 52 inches: Extremely channery silty clay loam
52 to 62 inches: Weathered bedrock

Description of Rarden

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey residuum weathered from shale and siltstone

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.5 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 3 inches: Silt loam
3 to 26 inches: Silty clay
26 to 36 inches: Weathered bedrock

Minor Components

Other soils

Percent of map unit: 6 percent

Blairton

Percent of map unit: 3 percent

Cruze

Percent of map unit: 3 percent

Rock outcrop

Percent of map unit: 2 percent

Marrowbone

Percent of map unit: 2 percent

Rayne

Percent of map unit: 2 percent

Dekalb

Percent of map unit: 2 percent

VaF—Vandalia-Beech complex, 20 to 60 percent slopes, stony

Map Unit Setting

Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition

Vandalia and similar soils: 60 percent
Beech and similar soils: 30 percent
Minor components: 10 percent

Description of Vandalia

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey colluvium derived from sedimentary rock

Properties and qualities

Slope: 20 to 60 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.9 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 4 inches: Loam
4 to 47 inches: Silty clay
47 to 69 inches: Very channery silty clay loam
69 to 79 inches: Weathered bedrock

Description of Beech

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy colluvium derived from sedimentary rock

Properties and qualities

Slope: 20 to 35 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.5 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 4 inches: Silt loam
4 to 36 inches: Channery clay loam
36 to 80 inches: Extremely channery clay loam

Minor Components

Other soils

Percent of map unit: 4 percent

Fedscreek

Percent of map unit: 2 percent

Hazleton

Percent of map unit: 2 percent

Shelocta

Percent of map unit: 2 percent

VaF2—Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded

Map Unit Setting

Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition

Vandalia and similar soils: 60 percent
Beech and similar soils: 30 percent
Minor components: 10 percent

Description of Vandalia

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey colluvium derived from sedimentary rock

Properties and qualities

Slope: 20 to 60 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.2 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 2 inches: Silt loam
2 to 54 inches: Silty clay
54 to 64 inches: Silty clay
64 to 74 inches: Weathered bedrock

Description of Beech

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy colluvium derived from sedimentary rock

Properties and qualities

Slope: 20 to 35 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.5 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile
0 to 2 inches: Silt loam
2 to 41 inches: Clay loam
41 to 80 inches: Clay loam

Minor Components

Other soils
Percent of map unit: 4 percent

Fedscreek
Percent of map unit: 2 percent

Hazleton
Percent of map unit: 2 percent

Shelocta
Percent of map unit: 2 percent

W—Water

Map Unit Setting
Mean annual precipitation: 37 to 48 inches
Mean annual air temperature: 39 to 67 degrees F
Frost-free period: 135 to 169 days

Map Unit Composition
Water: 100 percent

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Chemical Properties

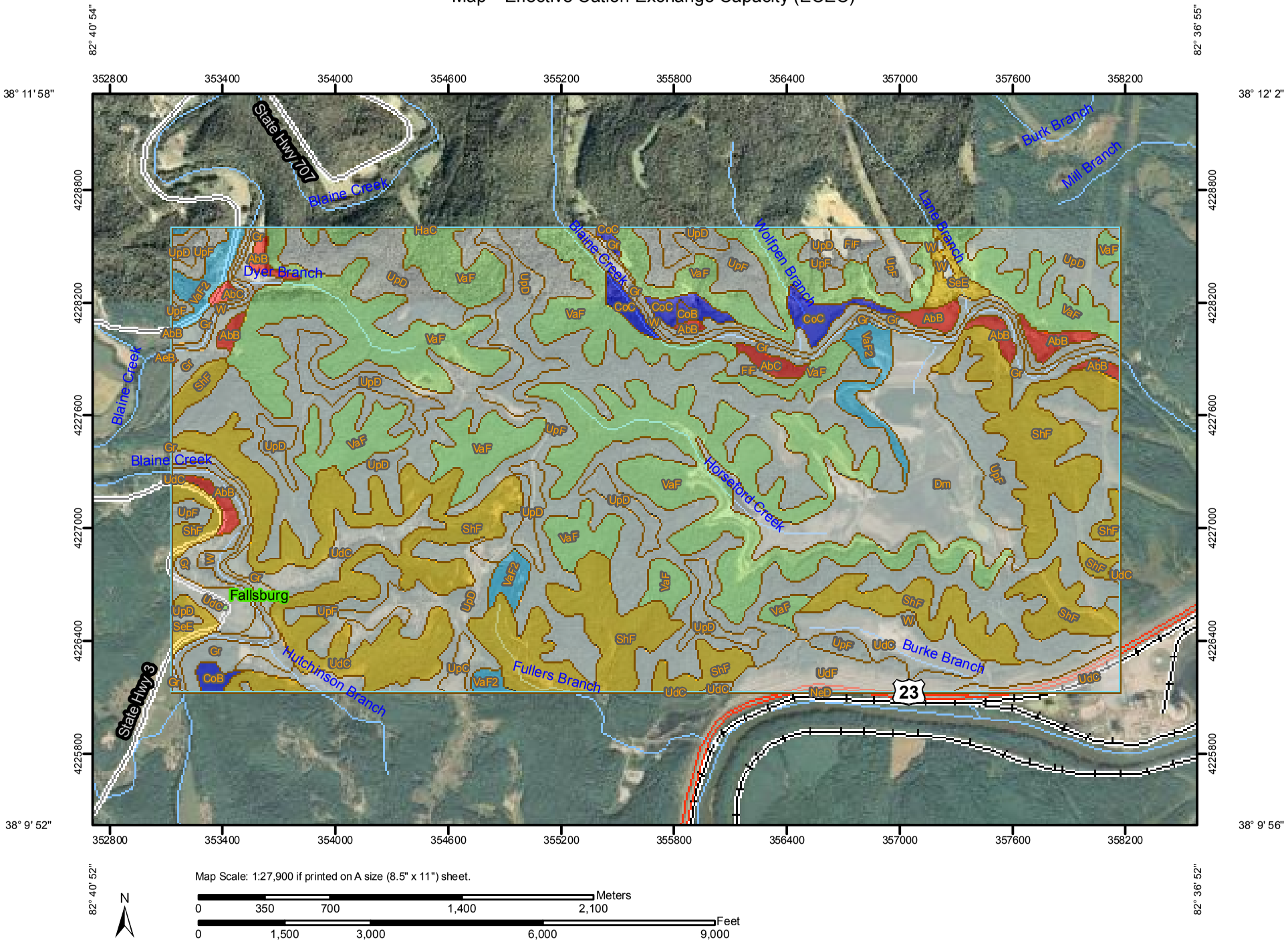
Soil Chemical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil chemical properties include pH, cation exchange capacity, calcium carbonate, gypsum, and electrical conductivity.

Effective Cation-Exchange Capacity (ECEC)

Effective cation-exchange capacity refers to the sum of extractable cations plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5. Soils having a low cation-exchange capacity (CEC) hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution. Effective CEC is a measure of CEC that is particularly useful in areas where the ion-exchange capacity of the soil is largely a result of variable charge components, such as allophane, kaolinite, hydrous iron and aluminum oxides, and organic matter, which result in a CEC that is not a fixed number but a function of pH.

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.

Custom Soil Resource Report
Map—Effective Cation-Exchange Capacity (ECEC)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 5.2
- > 5.2 AND <= 9.9
- > 9.9 AND <= 13.9
- > 13.9 AND <= 14.3
- > 14.3 AND <= 14.4
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Effective Cation-Exchange Capacity (ECEC)

Effective Cation-Exchange Capacity (ECEC)— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (milliequivalents per 100 grams)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	5.2	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	5.2	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	5.2	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	14.4	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	14.4	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony		15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded		133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes		0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded		0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	9.9	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	9.9	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes		7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes		305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky		763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	13.9	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	14.3	61.9	2.0%

Effective Cation-Exchange Capacity (ECEC)— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	Map unit name	Rating (milliequivalents per 100 grams)	Acres in AOI	Percent of AOI
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Effective Cation-Exchange Capacity (ECEC)

Units of Measure: milliequivalents per 100 grams

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options: Depth Range

Top Depth: 0

Bottom Depth: 120

Units of Measure: Inches

Soil Erosion Factors

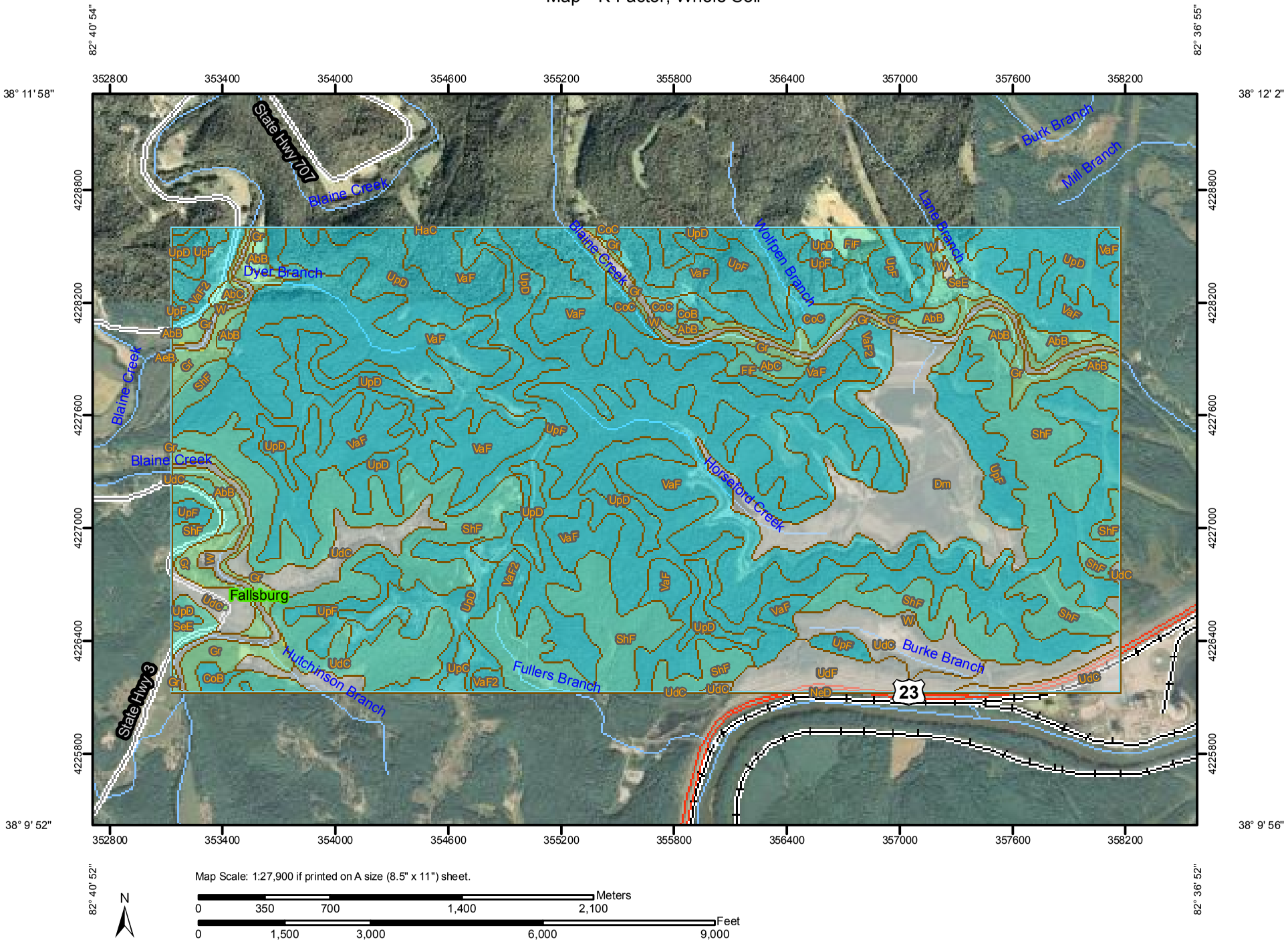
Soil Erosion Factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

K Factor, Whole Soil

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Custom Soil Resource Report
Map—K Factor, Whole Soil



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—K Factor, Whole Soil

K Factor, Whole Soil— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	.32	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	.32	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	.32	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	.37	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	.37	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	.32	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	.28	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	.28	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	.17	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	.32	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	.32	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	.37	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	.37	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	.37	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	.37	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	.37	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—K Factor, Whole Soil

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

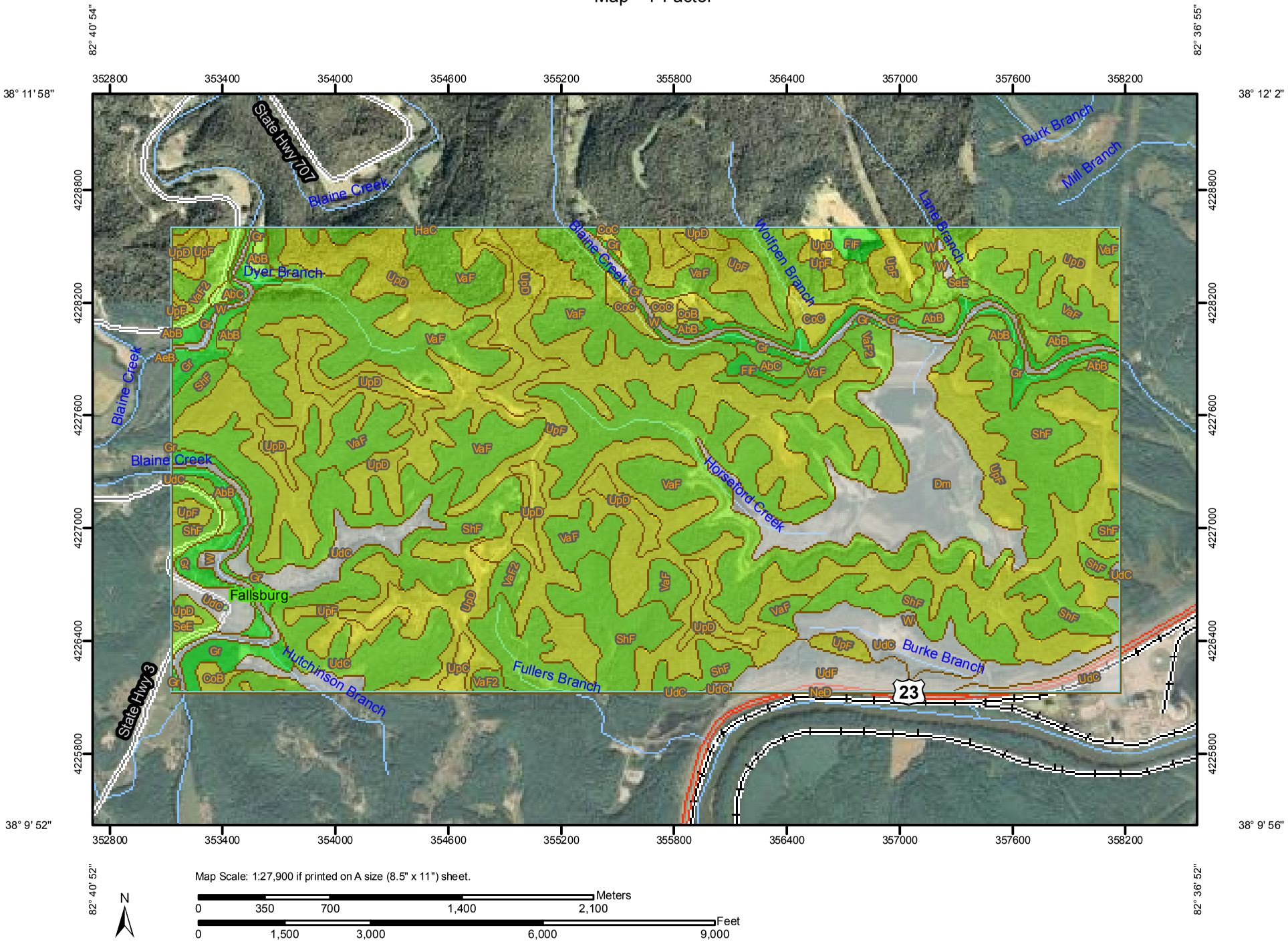
Tie-break Rule: Higher

Layer Options: Surface Layer

T Factor

The T factor is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Custom Soil Resource Report
Map—T Factor



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- 1
- 2
- 3
- 4
- 5
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—T Factor

T Factor— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (tons per acre per year)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	4	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	4	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	4	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	3	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	3	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	5	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	5	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	4	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	5	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	4	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	4	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	3	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	3	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	3	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	4	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	4	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—T Factor

Units of Measure: tons per acre per year

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Soil Physical Properties

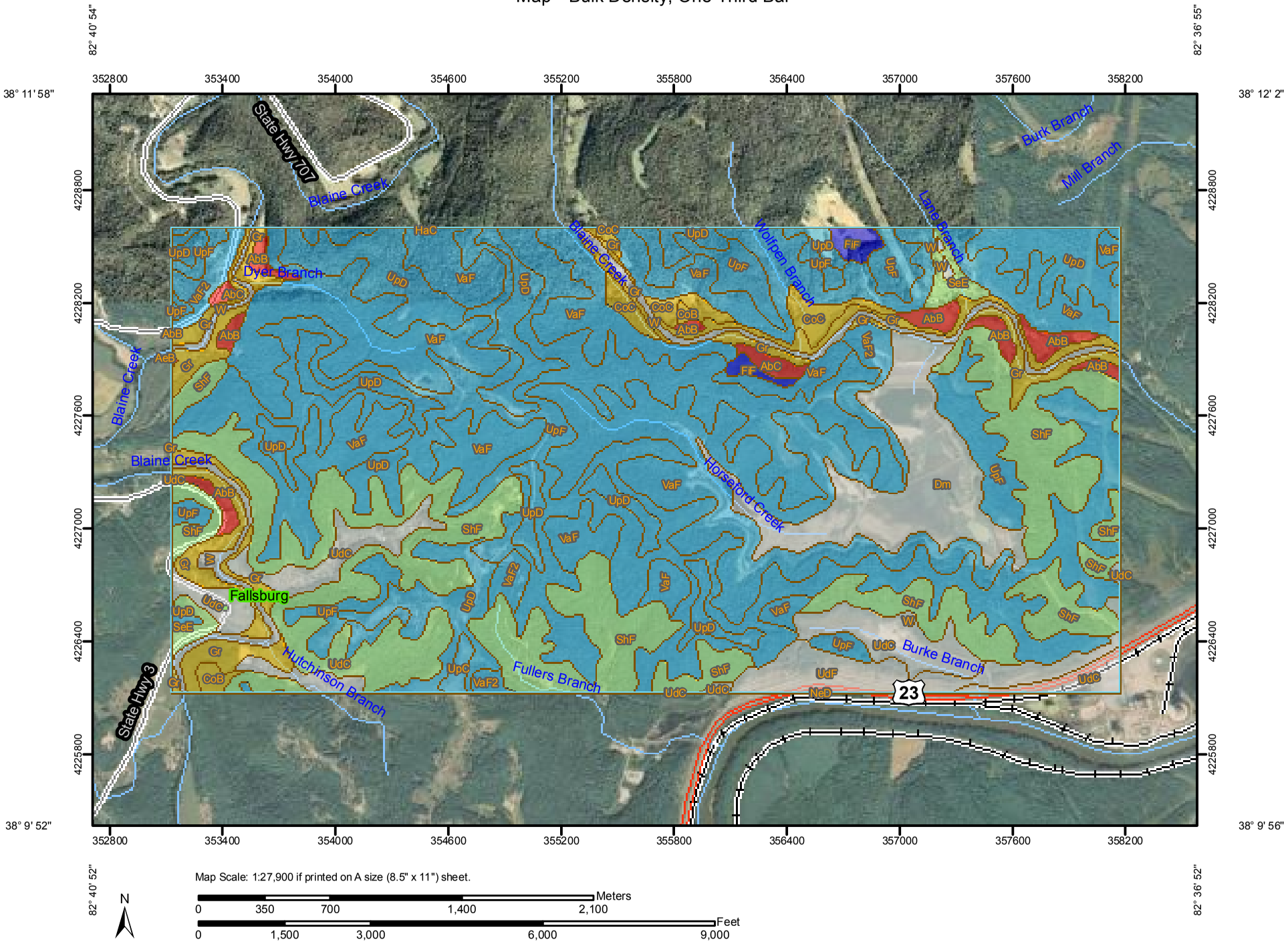
Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Bulk Density, One-Third Bar

Bulk density, one-third bar, is the ovendry weight of the soil material less than 2 millimeters in size per unit volume of soil at water tension of 1/3 bar, expressed in grams per cubic centimeter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

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.

Custom Soil Resource Report
Map—Bulk Density, One-Third Bar



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 1.32
- > 1.32 AND <= 1.35
- > 1.35 AND <= 1.42
- > 1.42 AND <= 1.45
- > 1.45 AND <= 1.57
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Bulk Density, One-Third Bar

Bulk Density, One-Third Bar— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (grams per cubic centimeter)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	1.32	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	1.32	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	1.32	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	1.34	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	1.34	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	1.50	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	1.35	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	1.44	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	1.57	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	1.42	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	1.42	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	1.44	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	1.44	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	1.44	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	1.44	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	1.45	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Bulk Density, One-Third Bar

Units of Measure: grams per cubic centimeter

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options: Depth Range

Top Depth: 0

Bottom Depth: 120

Units of Measure: Inches

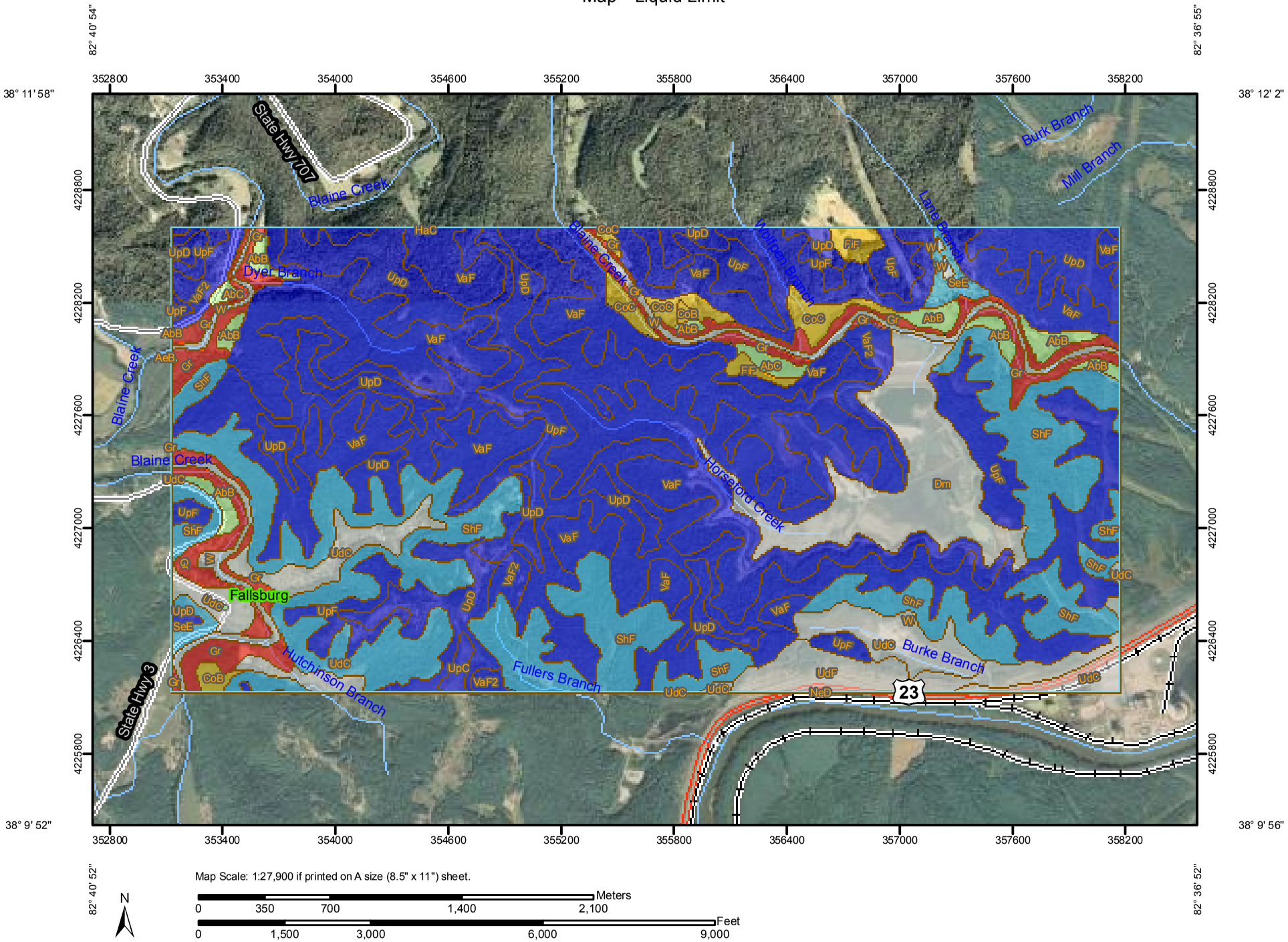
Liquid Limit

Liquid limit (LL) is one of the standard Atterberg limits used to indicate the plasticity characteristics of a soil. It is the water content, on a percent by weight basis, of the soil (passing #40 sieve) at which the soil changes from a plastic to a liquid state. Generally, the amount of clay- and silt-size particles, the organic matter content, and the type of minerals determine the liquid limit. Soils that have a high liquid limit have the capacity to hold a lot of water while maintaining a plastic or semisolid state.

Liquid limit is used in classifying soils in the Unified and AASHTO classification systems.

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.

Custom Soil Resource Report
Map—Liquid Limit



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 11.7
- > 11.7 AND <= 20
- > 20 AND <= 26.1
- > 26.1 AND <= 33.2
- > 33.2 AND <= 54.2
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Liquid Limit

Liquid Limit— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (percent)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	26.1	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	26.1	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	26.1	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	17.2	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	17.2	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	20.0	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	11.7	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	33.2	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	10.4	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	31.0	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	31.5	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	54.2	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	54.2	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	54.2	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	43.6	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	44.3	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Liquid Limit

Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options: Depth Range

Top Depth: 0

Bottom Depth: 120

Units of Measure: Inches

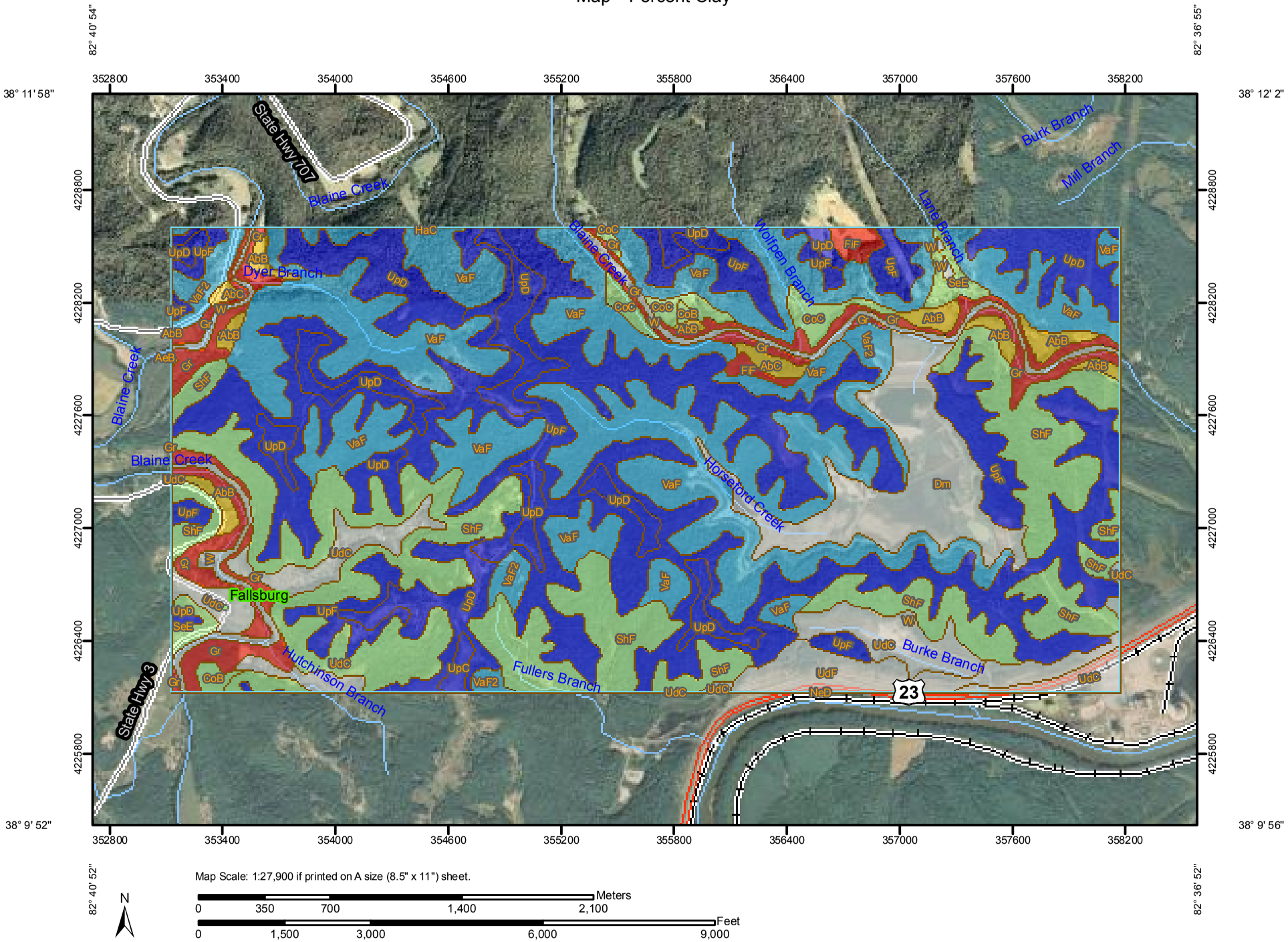
Percent Clay

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.

Custom Soil Resource Report
Map—Percent Clay



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 11.5
- > 11.5 AND <= 21.2
- > 21.2 AND <= 25.5
- > 25.5 AND <= 42.2
- > 42.2 AND <= 44.3
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Percent Clay

Percent Clay— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (percent)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	21.2	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	21.2	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	21.2	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	25.5	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	25.5	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	11.5	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	10.2	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	24.7	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	8.9	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	25.5	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	24.8	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	44.3	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	44.3	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	44.3	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	40.0	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	42.2	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Percent Clay

Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options: Depth Range

Top Depth: 0

Bottom Depth: 120

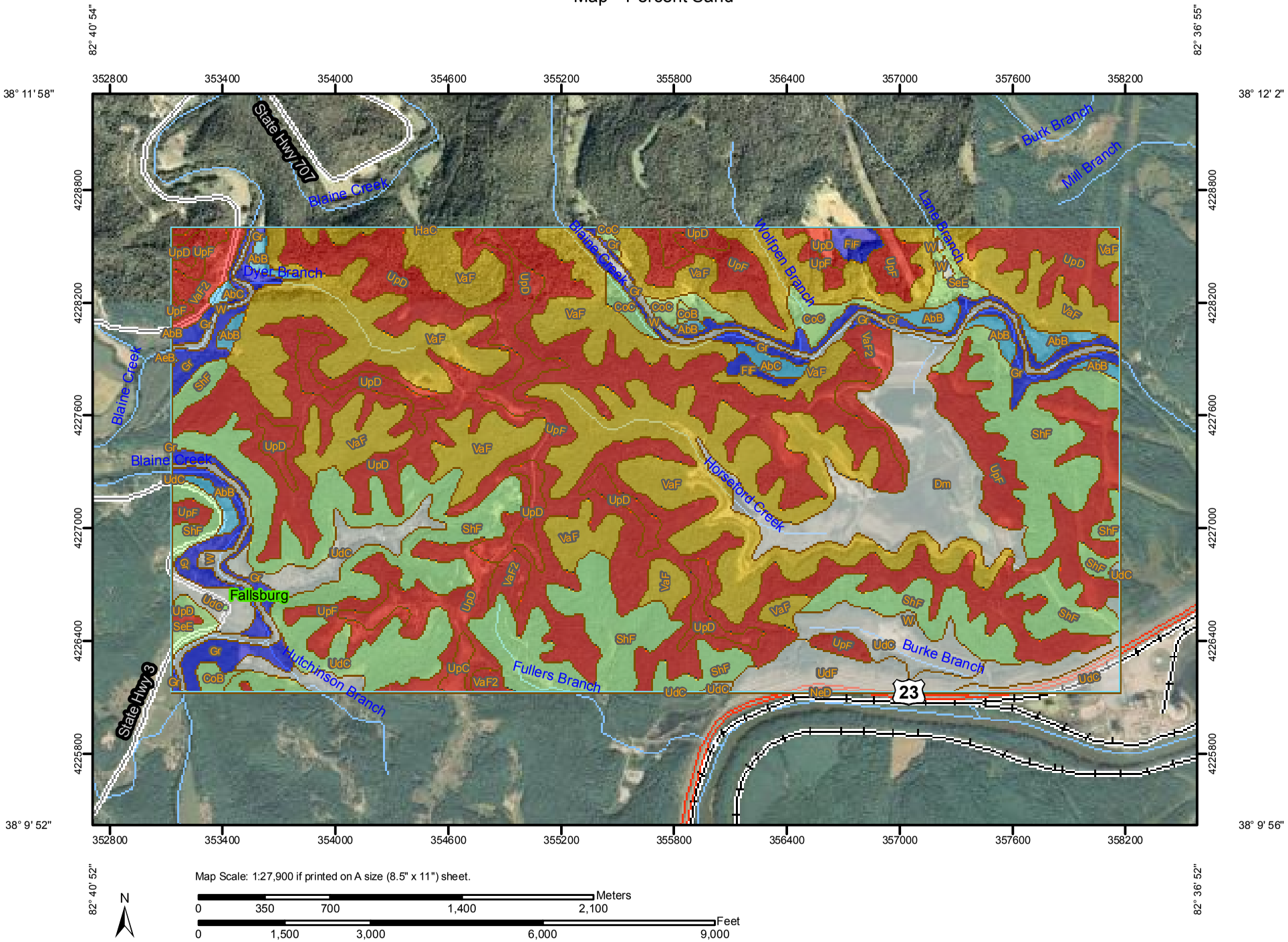
Units of Measure: Inches

Percent Sand

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In the database, the estimated sand 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 content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

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.

Custom Soil Resource Report
Map—Percent Sand



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 8.4
- > 8.4 AND <= 13
- > 13 AND <= 20.3
- > 20.3 AND <= 39.4
- > 39.4 AND <= 68
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Percent Sand

Percent Sand— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (percent)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	39.4	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	39.4	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	39.4	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	20.3	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	20.3	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	65.7	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	68.0	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	39.1	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	67.5	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	19.9	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	20.1	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	6.9	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	6.9	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	6.9	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	13.0	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	8.4	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Percent Sand

Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options: Depth Range

Top Depth: 0

Bottom Depth: 120

Units of Measure: Inches

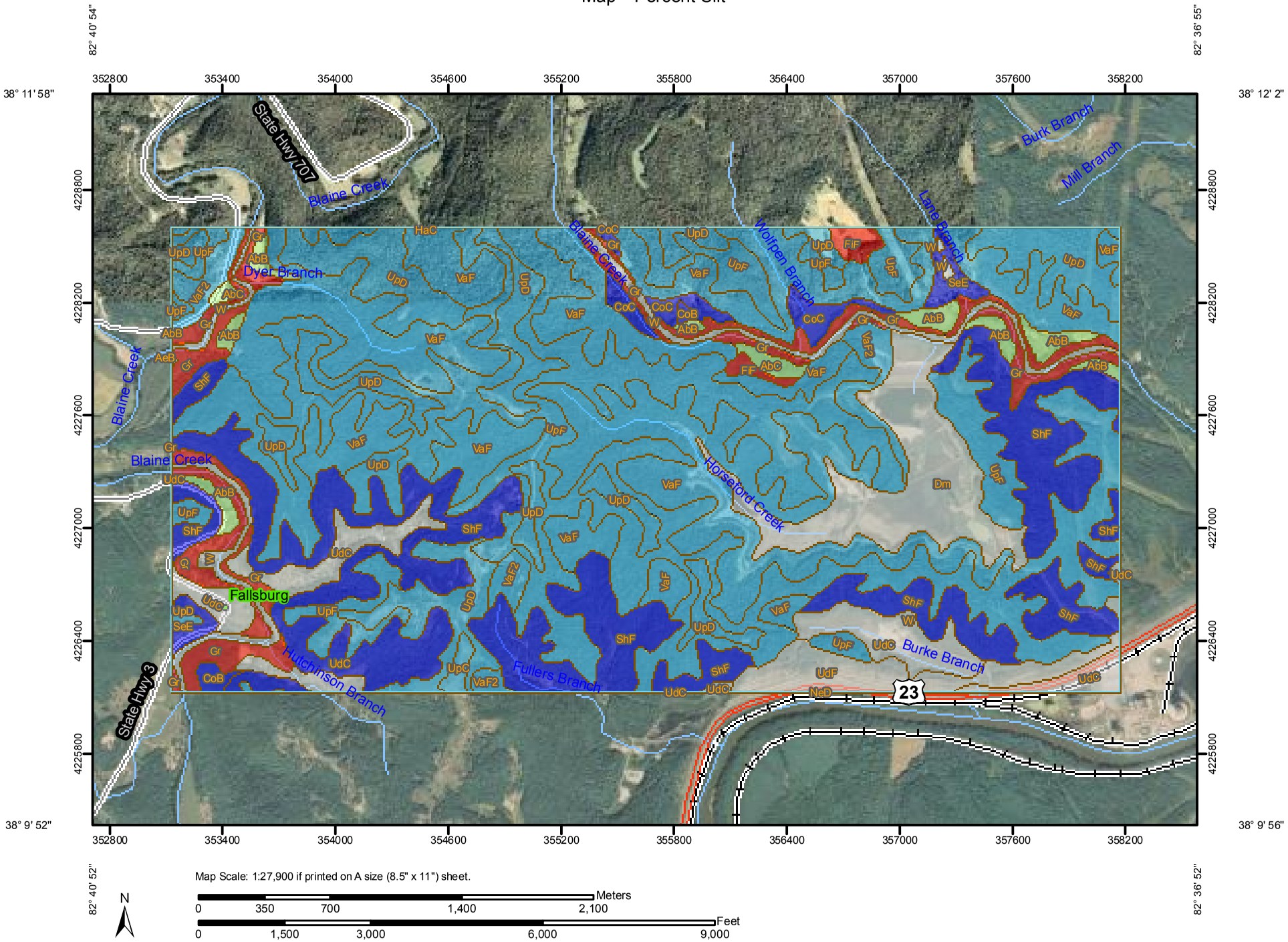
Percent Silt

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In the database, the estimated silt 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 content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification

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.

Custom Soil Resource Report
Map—Percent Silt



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 22.8
- > 22.8 AND <= 36.2
- > 36.2 AND <= 39.3
- > 39.3 AND <= 49.4
- > 49.4 AND <= 55.1
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Percent Silt

Percent Silt— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (percent)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	39.3	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	39.3	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	39.3	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	54.2	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	54.2	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	22.8	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	21.2	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	36.2	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	21.0	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	54.6	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	55.1	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	48.8	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	48.8	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	48.8	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	47.0	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	49.4	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Percent Silt

Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options: Depth Range

Top Depth: 0

Bottom Depth: 120

Units of Measure: Inches

Plasticity Index

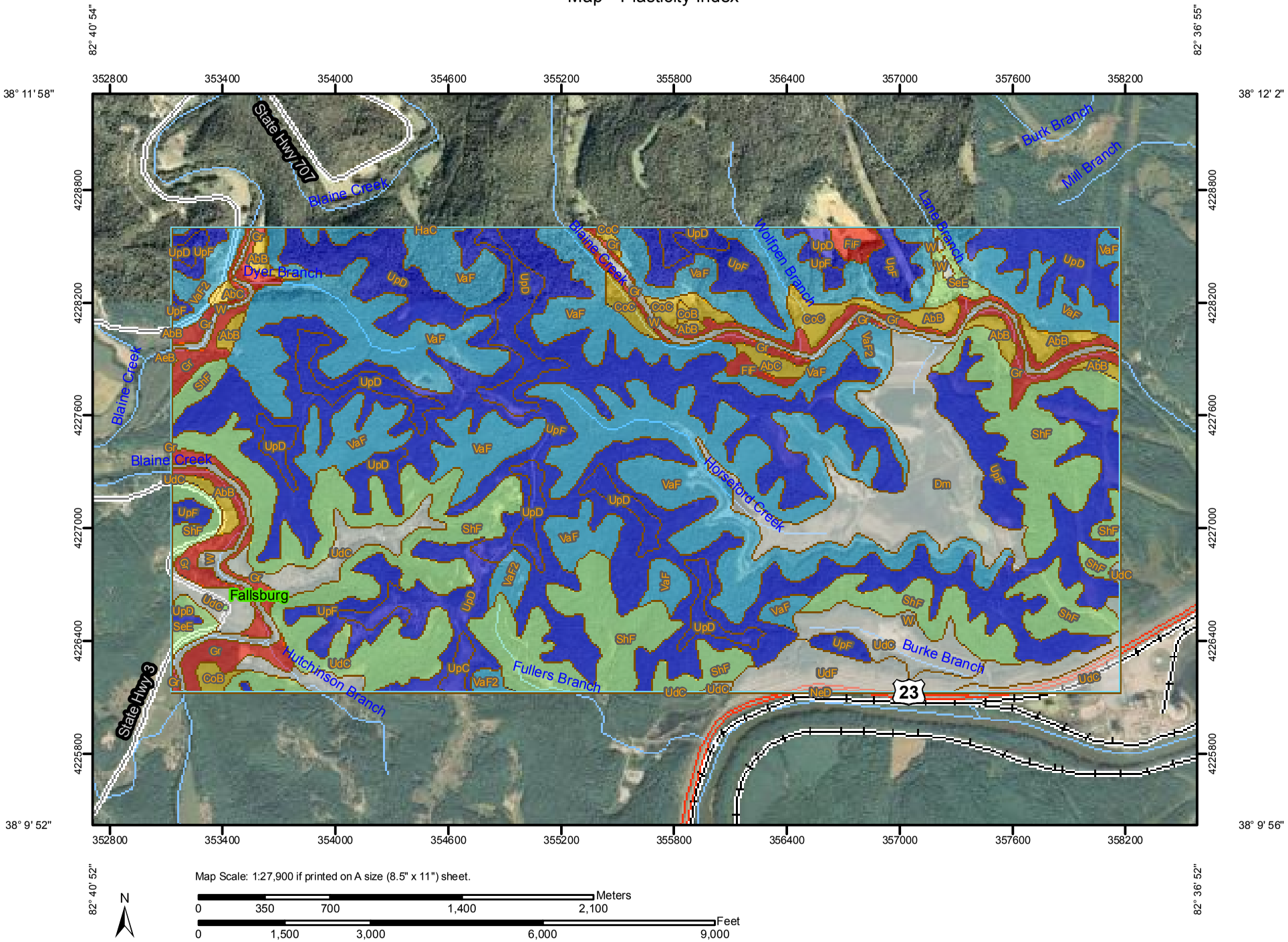
Plasticity index (PI) is one of the standard Atterberg limits used to indicate the plasticity characteristics of a soil. It is defined as the numerical difference between the liquid limit and plastic limit of the soil. It is the range of water content in which a soil exhibits the characteristics of a plastic solid.

The plastic limit is the water content that corresponds to an arbitrary limit between the plastic and semisolid states of a soil. The liquid limit is the water content, on a percent by weight basis, of the soil (passing #40 sieve) at which the soil changes from a plastic to a liquid state.

Soils that have a high plasticity index have a wide range of moisture content in which the soil performs as a plastic material. Highly and moderately plastic clays have large PI values. Plasticity index is used in classifying soils in the Unified and AASHTO classification systems.

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.

Custom Soil Resource Report
Map—Plasticity Index



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 3.5
- > 3.5 AND <= 8.6
- > 8.6 AND <= 13.5
- > 13.5 AND <= 21.8
- > 21.8 AND <= 27
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Plasticity Index

Plasticity Index— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (percent)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	8.6	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	8.6	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	8.6	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	7.1	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	7.1	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	3.5	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	3.2	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	13.5	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	1.4	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	9.7	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	9.7	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	27.0	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	27.0	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	27.0	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	21.1	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	21.8	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Plasticity Index

Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options: Depth Range

Top Depth: 0

Bottom Depth: 120

Units of Measure: Inches

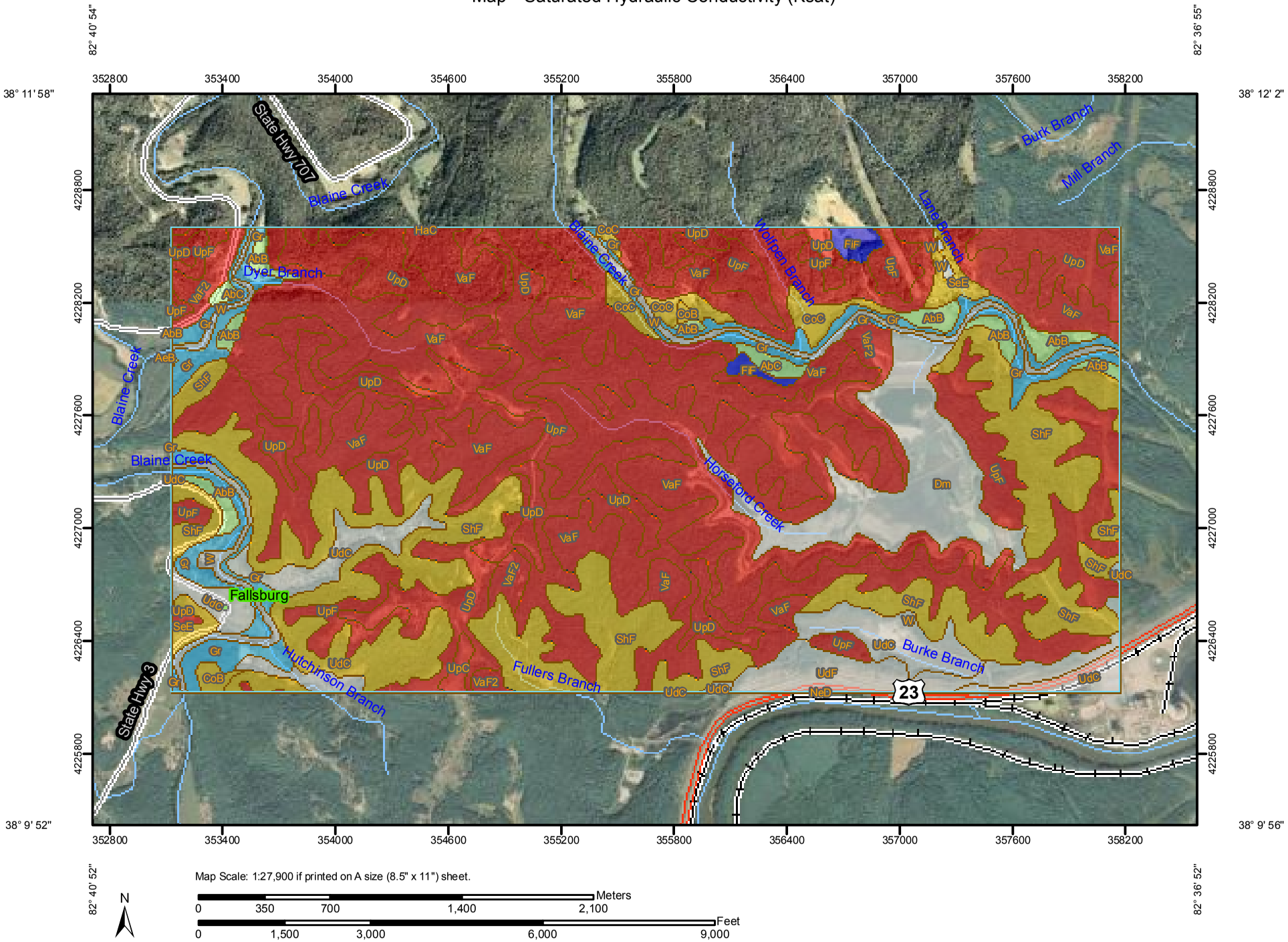
Saturated Hydraulic Conductivity (Ksat)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

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.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Custom Soil Resource Report
Map—Saturated Hydraulic Conductivity (Ksat)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 2.5143
- > 2.5143 AND <= 12.2558
- > 12.2558 AND <= 14.823
- > 14.823 AND <= 28
- > 28 AND <= 78
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Saturated Hydraulic Conductivity (Ksat)

Saturated Hydraulic Conductivity (Ksat)— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (micrometers per second)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	14.8230	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	14.8230	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	14.8230	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	10.4907	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	10.4907	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	78.0000	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	24.6749	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	28.0000	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	70.6108	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	12.2558	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	12.2558	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	1.0091	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	1.0091	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	1.0091	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	2.5143	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	2.3687	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options: Depth Range

Top Depth: 0

Bottom Depth: 120

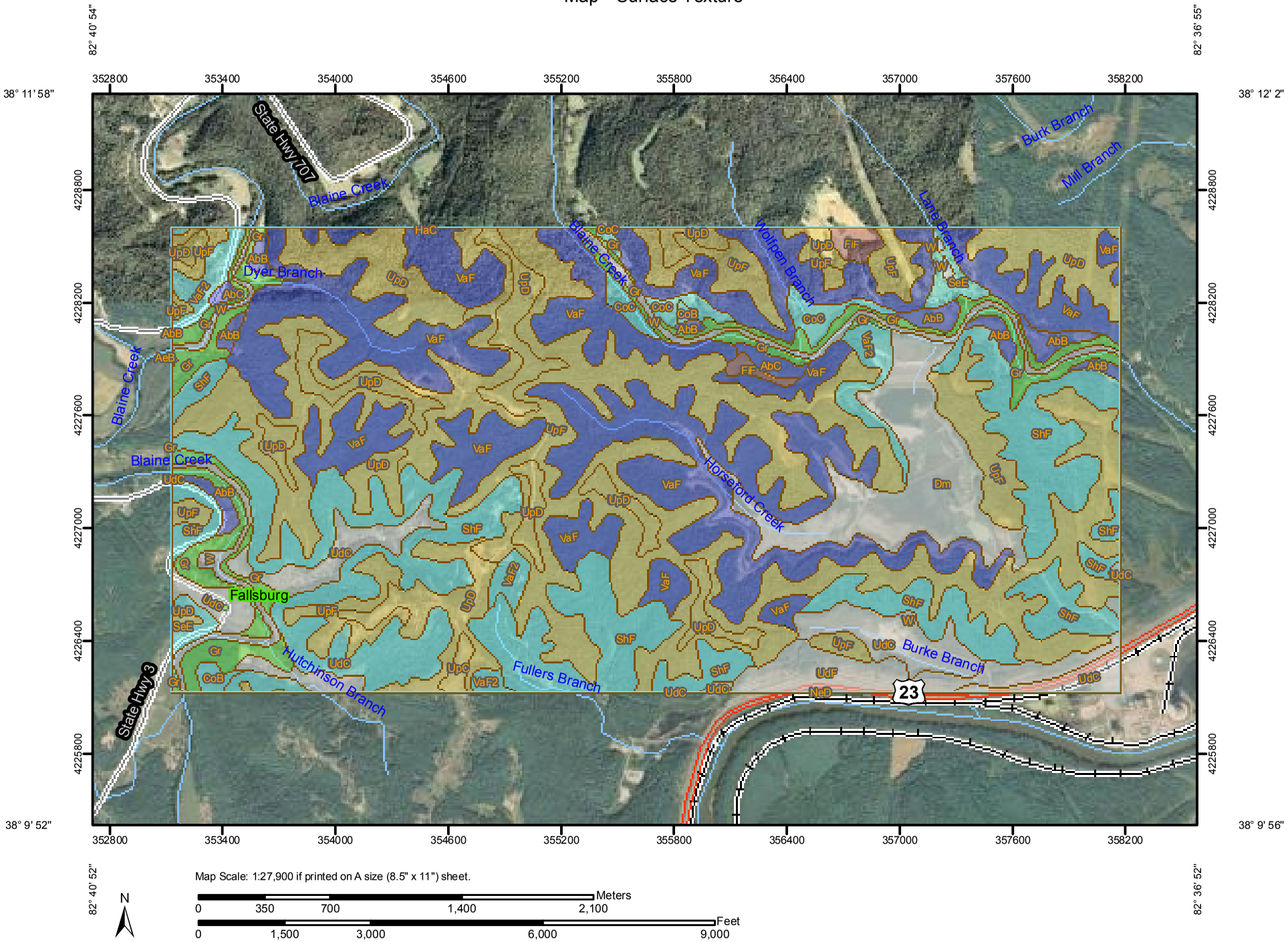
Units of Measure: Inches

Surface Texture

This displays the representative texture class and modifier of the surface horizon.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Custom Soil Resource Report
Map—Surface Texture



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- channery sandy loam
- fine sandy loam
- loam
- silt loam
- silty clay loam
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Surface Texture

Surface Texture— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	loam	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	loam	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	loam	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	silt loam	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	silt loam	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	channery sandy loam	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	fine sandy loam	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	loam	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	fine sandy loam	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	silt loam	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	silt loam	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	silty clay loam	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	silty clay loam	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	silty clay loam	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	loam	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	silt loam	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Surface Texture

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options: Surface Layer

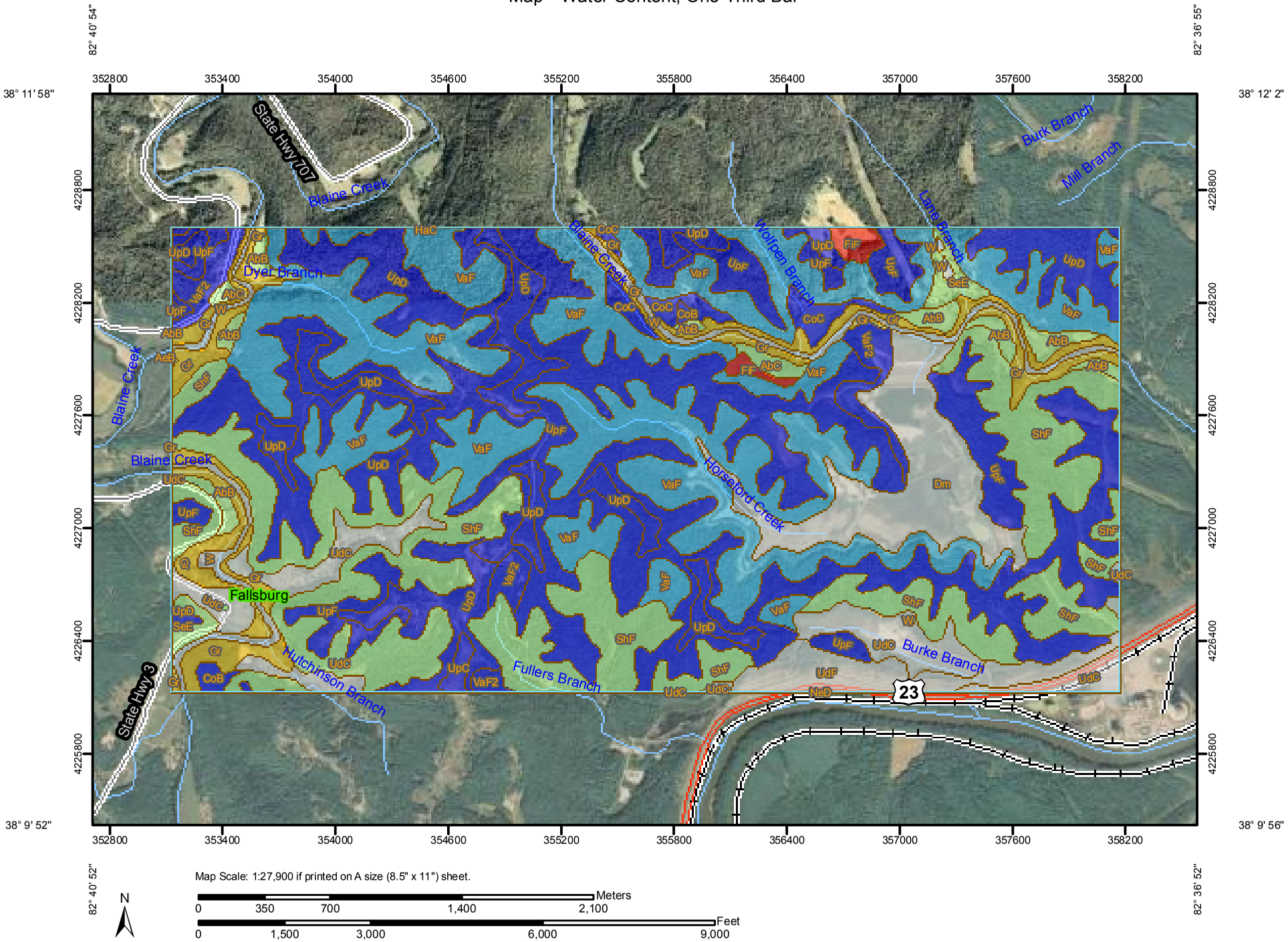
Water Content, One-Third Bar

Water content, one-third bar, is the amount of soil water retained at a tension of 1/3 bar, expressed as a volumetric percentage of the whole soil. Water retained at 1/3 bar is significant in the determination of soil water-retention difference, which is used as the initial estimation of available water capacity for some soils. Water retained at 1/3 bar is the value commonly used to estimate the content of water at field capacity for most soils.

Water content varies between soil types, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure.

For each soil layer, water content is 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.

Custom Soil Resource Report
Map—Water Content, One-Third Bar



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 1.8
- > 1.8 AND <= 16.4
- > 16.4 AND <= 22.9
- > 22.9 AND <= 25.6
- > 25.6 AND <= 27.8
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Water Content, One-Third Bar

Water Content, One-Third Bar— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (percent)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	22.9	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	22.9	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	22.9	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	27.5	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	27.5	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	1.8	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	16.4	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	25.6	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	16.0	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	21.5	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	21.3	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	26.8	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	27.0	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	27.0	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	25.5	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	27.8	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Water Content, One-Third Bar

Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: Yes

Layer Options: Depth Range

Top Depth: 0

Bottom Depth: 120

Units of Measure: Inches

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

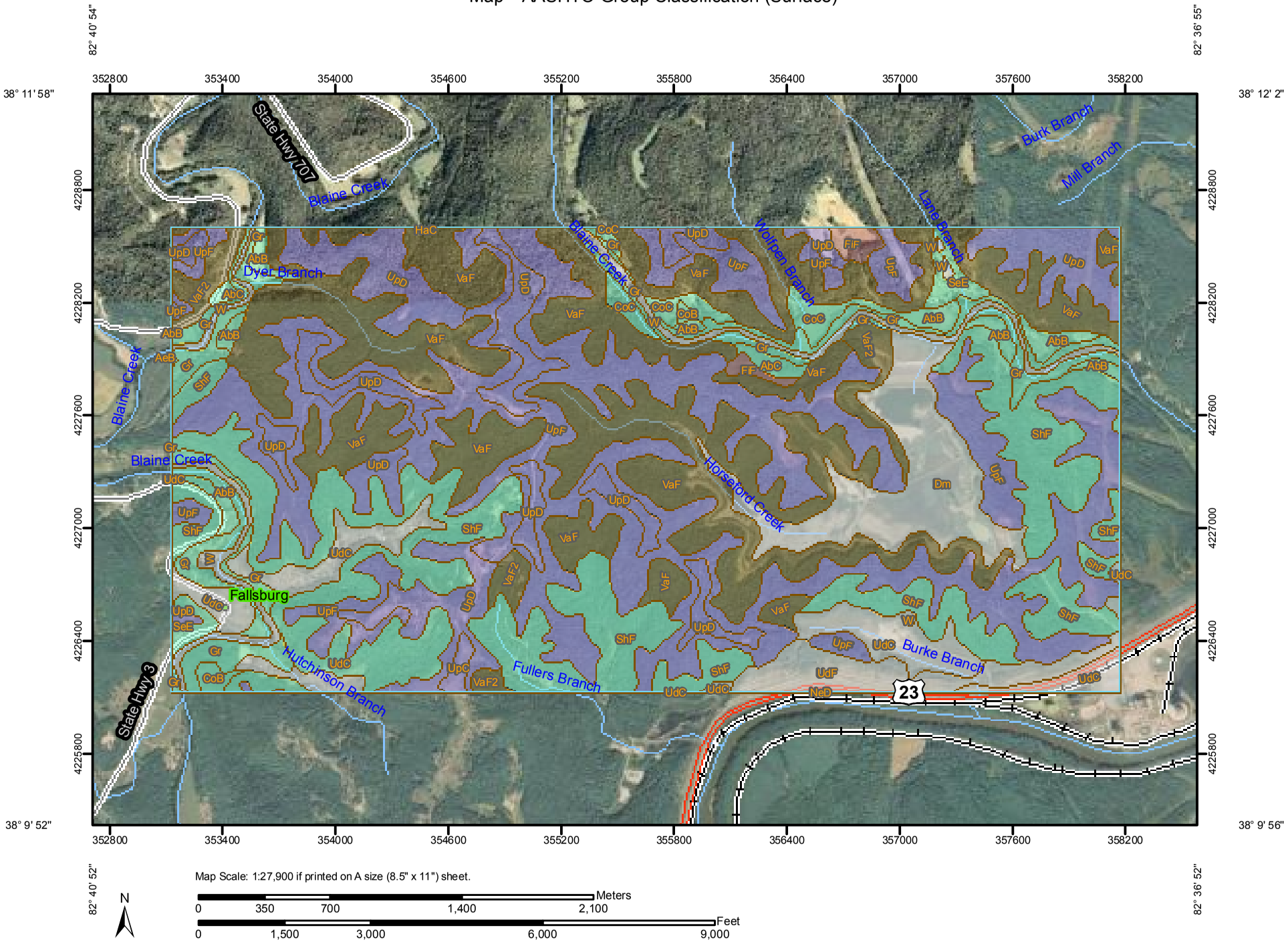
AASHTO Group Classification (Surface)

AASHTO group classification is a system that classifies soils specifically for geotechnical engineering purposes that are related to highway and airfield construction. It is based on particle-size distribution and Atterberg limits, such as liquid limit and plasticity index. This classification system is covered in AASHTO Standard No. M 145-82. The classification is based on that portion of the soil that is smaller than 3 inches in diameter.

The AASHTO classification system has two general classifications: (i) granular materials having 35 percent or less, by weight, particles smaller than 0.074 mm in diameter and (ii) silt-clay materials having more than 35 percent, by weight, particles smaller than 0.074 mm in diameter. These two divisions are further subdivided into seven main group classifications, plus eight subgroups, for a total of fifteen for mineral soils. Another class for organic soils is used.

For each soil horizon in the database one or more AASHTO Group Classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Custom Soil Resource Report
Map—AASHTO Group Classification (Surface)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- A-1
- A-1-a
- A-1-b
- A-2
- A-2-4
- A-2-5
- A-2-6
- A-2-7
- A-3
- A-4
- A-5
- A-6
- A-7
- A-7-5
- A-7-6
- A-8
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—AASHTO Group Classification (Surface)

AASHTO Group Classification (Surface)— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	A-4	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	A-4	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	A-4	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	A-4	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	A-4	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	A-1	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	A-4	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	A-4	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	A-4	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	A-4	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	A-4	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	A-7	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	A-7	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	A-7	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	A-6	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	A-6	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—AASHTO Group Classification (Surface)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options: Surface Layer

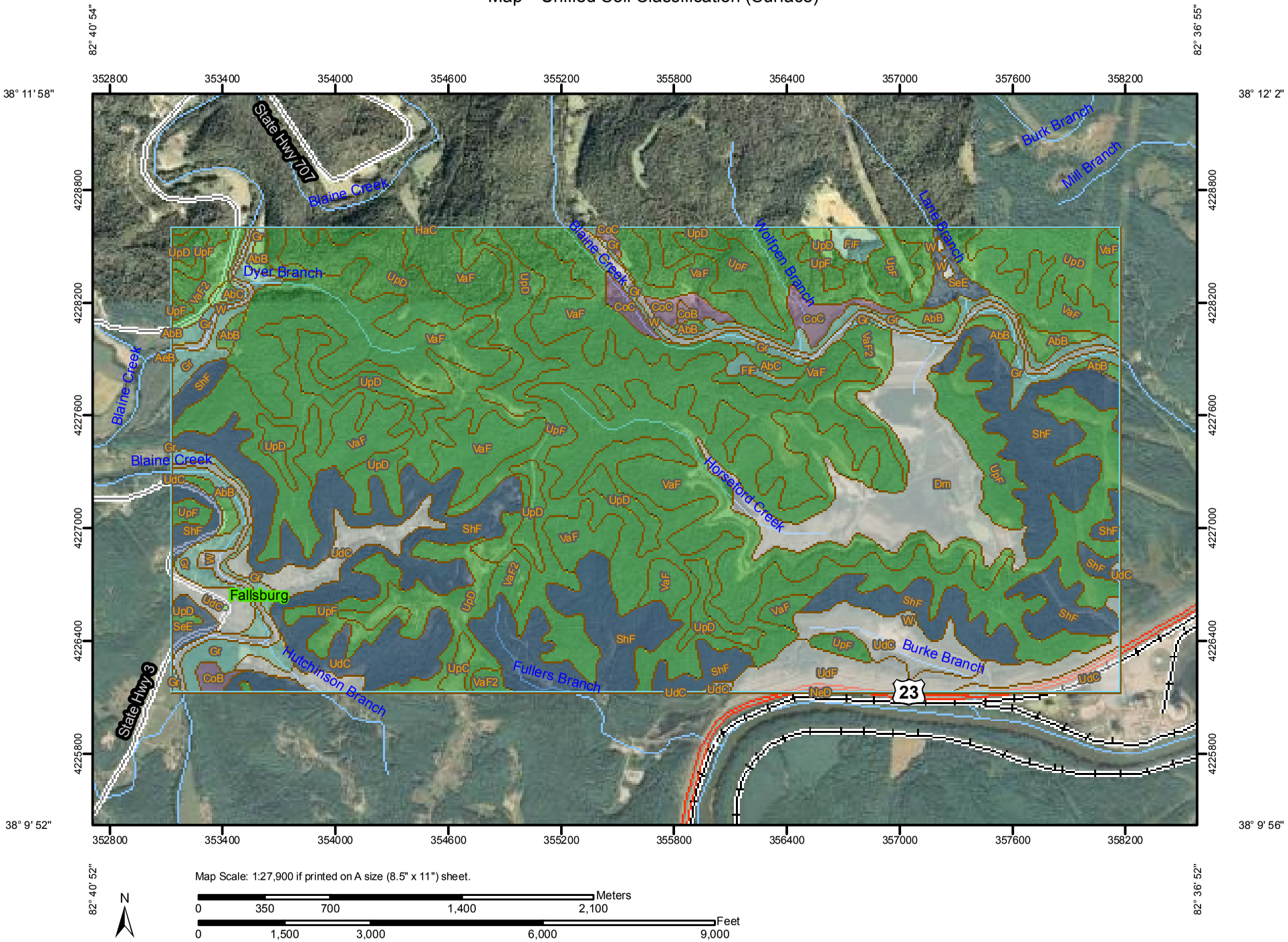
Unified Soil Classification (Surface)

The Unified soil classification system classifies mineral and organic mineral soils for engineering purposes on the basis of particle-size characteristics, liquid limit, and plasticity index. It identifies three major soil divisions: (i) coarse-grained soils having less than 50 percent, by weight, particles smaller than 0.074 mm in diameter; (ii) fine-grained soils having 50 percent or more, by weight, particles smaller than 0.074 mm in diameter; and (iii) highly organic soils that demonstrate certain organic characteristics. These divisions are further subdivided into a total of 15 basic soil groups. The major soil divisions and basic soil groups are determined on the basis of estimated or measured values for grain-size distribution and Atterberg limits. ASTM D 2487 shows the criteria chart used for classifying soil in the Unified system and the 15 basic soil groups of the system and the plasticity chart for the Unified system.

The various groupings of this classification correlate in a general way with the engineering behavior of soils. This correlation provides a useful first step in any field or laboratory investigation for engineering purposes. It can serve to make some general interpretations relating to probable performance of the soil for engineering uses.

For each soil horizon in the database one or more Unified soil classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Custom Soil Resource Report
Map—Unified Soil Classification (Surface)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- CH
- CL
- CL-A (proposed)
- CL-K (proposed)
- CL-ML
- CL-O (proposed)
- CL-T (proposed)
- GC
- GC-GM
- GM
- GP
- GP-GC
- GP-GM
- GW
- GW-GC
- GW-GM
- MH
- MH-A (proposed)
- MH-K (proposed)
- MH-O (proposed)
- MH-T (proposed)
- ML
- ML-A (proposed)
- ML-K (proposed)
- ML-O (proposed)
- ML-T (proposed)
- OH
- OH-T (proposed)
- OL
- PT
- SC
- SC-SM
- SM
- SP
- SP-SC
- SP-SM
- SW
- SW-SC
- SW-SM
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Unified Soil Classification (Surface)

Unified Soil Classification (Surface)— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	CL	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	CL	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	CL	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	ML	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	ML	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	SM	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	SM	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	CL	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	SM	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	CL-ML	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	CL-ML	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	CL	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	CL	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	CL	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	CL	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	CL	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Unified Soil Classification (Surface)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options: Surface Layer

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

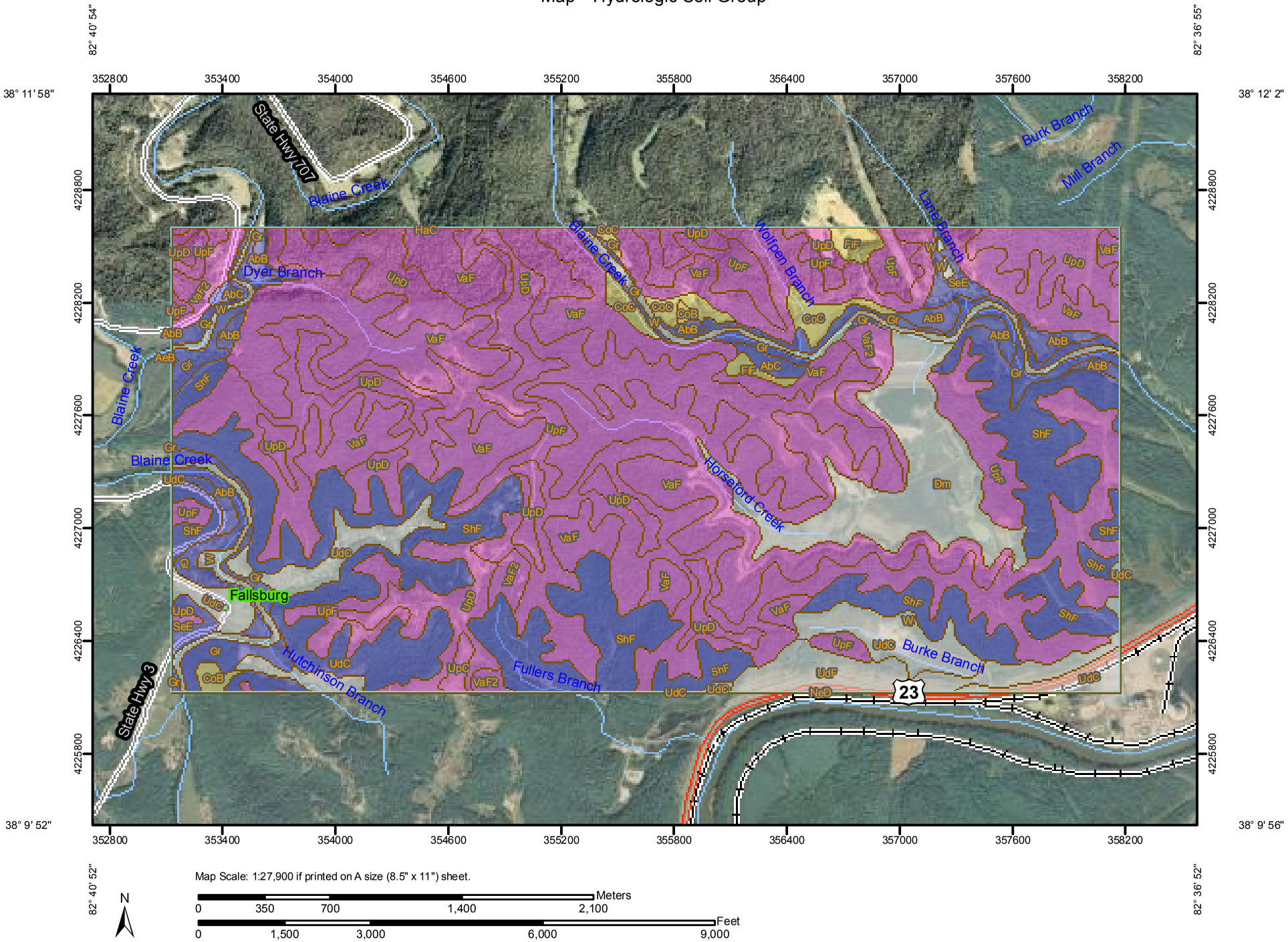
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	B	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	B	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	B	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	C	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	C	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples		159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	C	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	B	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	B	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	B	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	B	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	B	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes		135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched		70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	D	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	D	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	D	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	D	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	D	61.9	2.0%
W	Water		56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Water Features

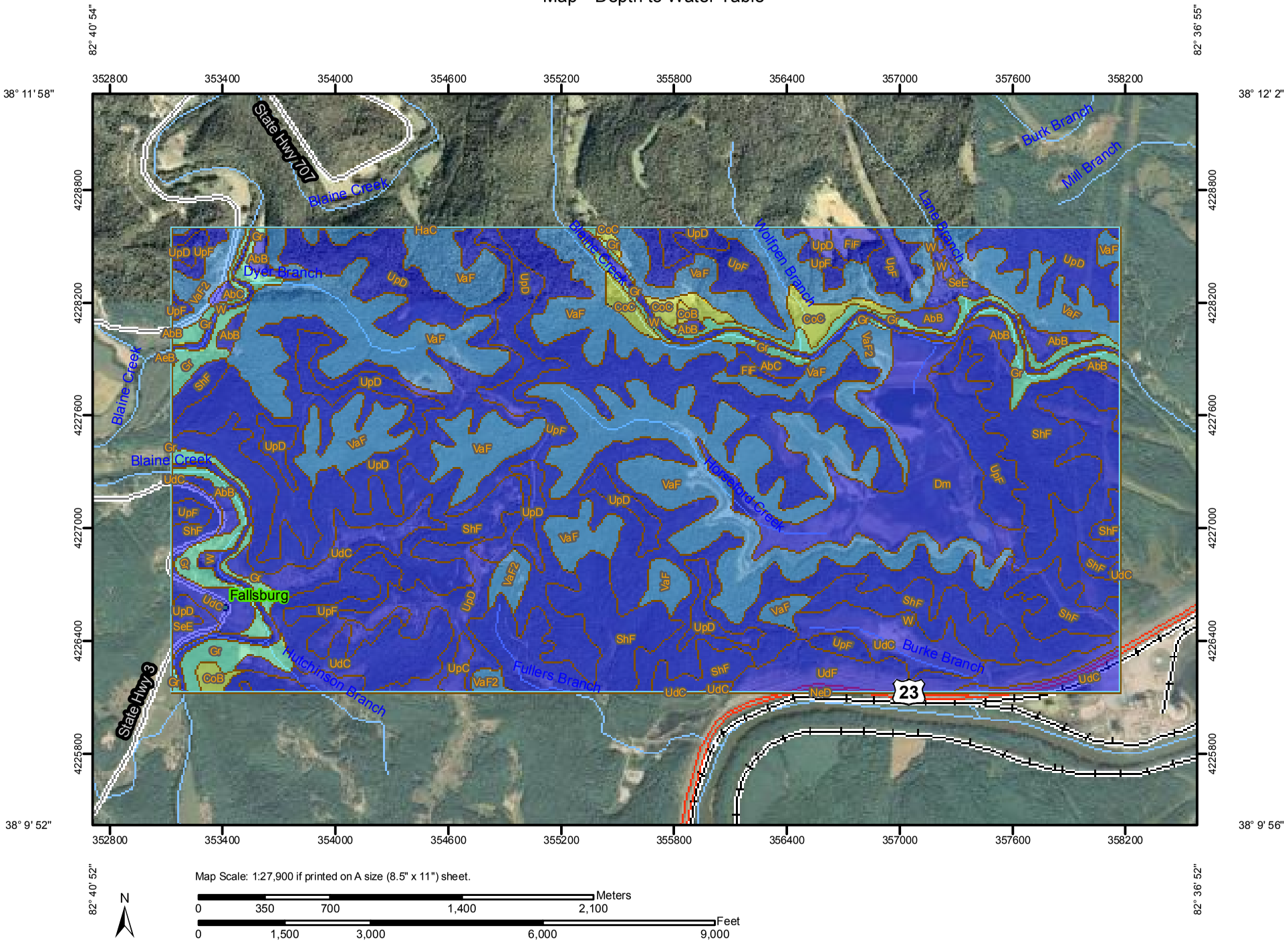
Water Features include ponding frequency, flooding frequency, and depth to water table.

Depth to Water Table

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

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.

Custom Soil Resource Report
Map—Depth to Water Table



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lawrence and Martin Counties, Kentucky
Survey Area Data: Version 7, Oct 22, 2009

Date(s) aerial images were photographed: 8/25/2007; 9/23/2004

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Depth to Water Table

Depth to Water Table— Summary by Map Unit — Lawrence and Martin Counties, Kentucky (KY640)				
Map unit symbol	**Map unit name**	**Rating (centimeters)**	**Acres in AOI**	**Percent of AOI**
AbB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	>200	45.1	1.5%
AbC	Allegheny loam, 6 to 15 percent slopes, rarely flooded	>200	10.9	0.4%
AeB	Allegheny loam, 2 to 6 percent slopes, occasionally flooded	>200	0.2	0.0%
CoB	Cotaco silt loam, 0 to 4 percent slopes, rarely flooded	61	8.4	0.3%
CoC	Cotaco silt loam, 4 to 12 percent slopes, rarely flooded	61	34.8	1.1%
Dm	Dumps, mine; tailings; and tipples	>200	159.9	5.2%
FiF	Fiveblock, Fairpoint, and Kaymine soils, 30 to 80 percent slopes, stony	>200	15.5	0.5%
Gr	Grigsby fine sandy loam, frequently flooded	145	133.4	4.3%
HaC	Hayter-Grigsby complex, 2 to 15 percent slopes	>200	0.0	0.0%
NeD	Nelse fine sandy loam, 4 to 25 percent slopes, frequently flooded	153	0.2	0.0%
SeE	Shelocta silt loam, 12 to 30 percent slopes	>200	23.5	0.8%
ShF	Shelocta-Hazleton-Fedscreek complex, 30 to 60 percent slopes, stony	>200	527.8	17.1%
UdC	Udorthents-Urban land complex, 0 to 12 percent slopes	>200	135.5	4.4%
UdF	Udorthents-Urban land complex, 0 to 80 percent slopes, benched	>200	70.9	2.3%
UpC	Upshur-Rarden complex, 6 to 12 percent slopes	>200	7.2	0.2%
UpD	Upshur-Rarden complex, 12 to 25 percent slopes	>200	305.8	9.9%
UpF	Upshur-Rarden complex, 25 to 60 percent slopes, rocky	>200	763.5	24.8%
VaF	Vandalia-Beech complex, 20 to 60 percent slopes, stony	153	718.8	23.3%
VaF2	Vandalia-Beech complex, 20 to 60 percent slopes, stony, eroded	153	61.9	2.0%
W	Water	>200	56.2	1.8%
Totals for Area of Interest			**3,079.6**	**100.0%**

Rating Options—Depth to Water Table

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://soils.usda.gov/

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://soils.usda.gov/

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://soils.usda.gov/

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.glti.nrcs.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://soils.usda.gov/

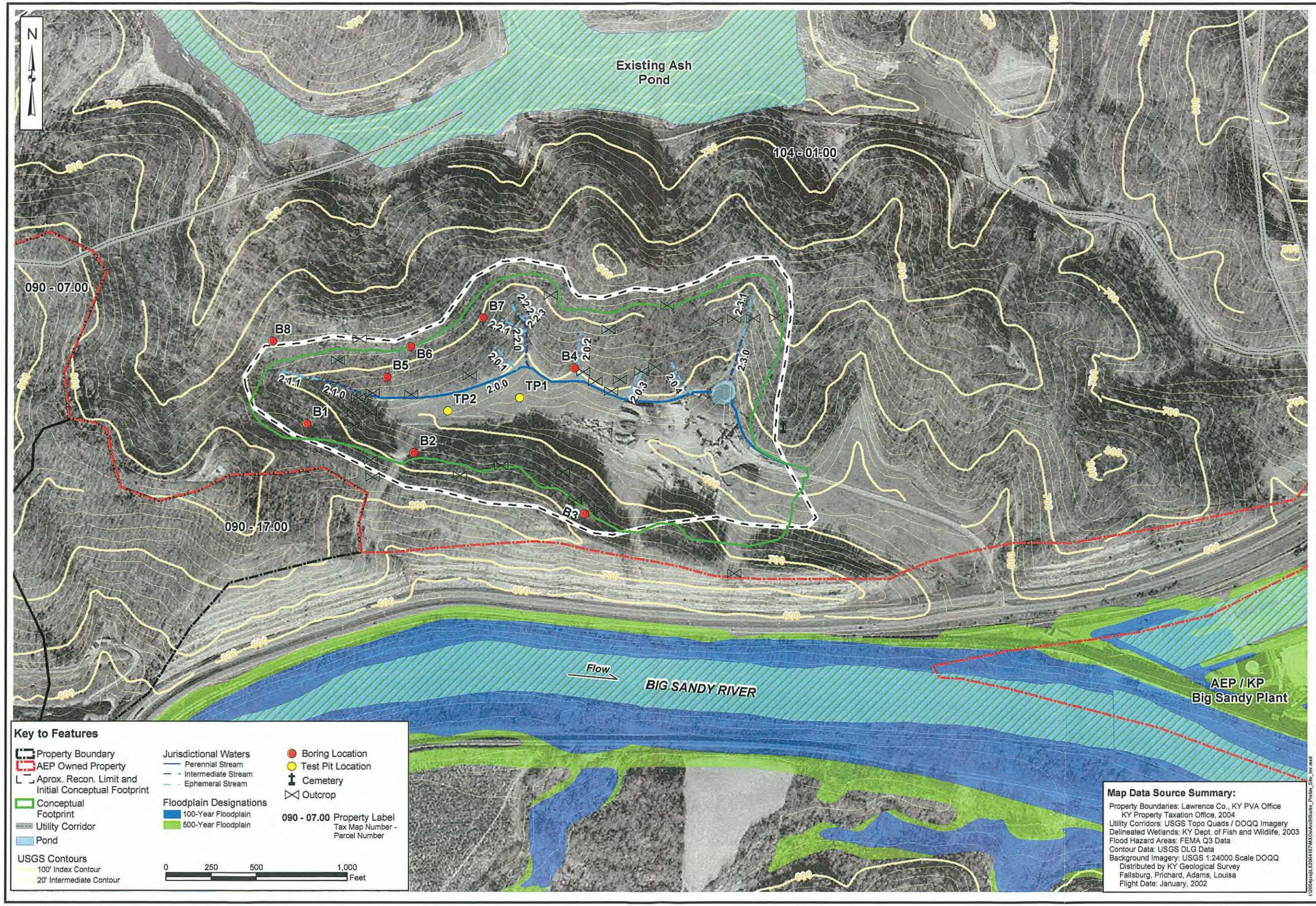
United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://soils.usda.gov/

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

APPENDIX B.1

BORING AND TEST PIT LOGS

FMSM - December 2004 Field Subsurface Exploration



Map Data Source Summary:

Property Boundaries: Lawrence Co., KY PVA Office
KY Property Taxation Office, 2004
Utility Corridors: USGS Topo Quads / DOQQ Imagery
Delineated Wetlands: KY Dept. of Fish and Wildlife, 2003
Flood Hazard Areas: FEMA Q3 Data
Contour Data: USGS DLG Data
Background Imagery: USGS 1:24000 Scale DOQQ
Distributed by KY Geological Survey
Fallsburg, Prichard, Adams, Louisa
Flight Date: January, 2002

I:\2004proj\LX2004107\MXD\ArcGIS\Burke_Prelim_Site_Inv.mxd

FULLER MOSSBARGER SCOTT AND MAY ENGINEERS, INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2250
859-422-3000

Fuller Mossbarger Scott & May

FMSM ENGINEERS
LEXINGTON LOUISVILLE CINCINNATI COLUMBUS ST. LOUIS

Initial Site Exploration
Site 1 - Burke Branch

Final Site Selection
American Electric Power
Big Sandy Plant, Unit 2
Lawrence County, Kentucky

PROJECT NO.	LX2004107
DATE	FEBRUARY, 2005
DRAWN BY	MAA
CHECKED BY	MJS
CHECKED BY	DWF
SCALE	1" = 500'
REVISED	
1.	
2.	
3.	
4.	

SHEET

Exhibit A-1

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Burke Branch
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-1**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/1/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Ashcraft		

Total Depth: 247.0'
Completed: 12/7/04
Depth to Water: Dry
Date/Time: 12/7/04
Depth to Water: N/A
Date/Time: N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
	0.0'	Top of Hole							
	0.4'	Topsoil **Soil 1:** Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants		SPT-1	3.5' - 5.0'		5-6-9	16	Bag Soil 1 @ 5.0'-15.0'
				SPT-2	8.5' - 10.0'		20-13-12	15	
				SPT-3	13.5' - 15.0'		5-7-8	16	
				SPT-4	18.5' - 20.0'		6-14-10	13	

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1/13/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-1** Total Depth 247.0'

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
	23.5'								
	29.7'	**Soil 2:** Sandy Lean Clay, gray, moist, very stiff with occasional manganese concretions and rock remnants (Visual Classification)		SPT-5	23.5' - 25.0'		7-8-8	14	
	32.5'	**Soil 4:** Shale (augered)			Began Core				
	39.0'	Shale, gray, soft, very thin to thin bedded, slightly weathered with occasional clayey and/or silty zones		0	4.5'	4.0'	89	37.0'	
	45.7'	Sandstone, light gray, hard, fine to medium grained, thin bedded, slightly weathered Shale seam from 44.1' to 44.8'							

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/14/05

Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-1** Total Depth 247.0'

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Shale, gray, soft, very thin bedded, silty *(Continued)*		50	10.0'	9.8'	98	47.0'	
	48.3'								
		Sandstone, gray, moderately hard, fine grained, thin bedded, very silty, shaly, micaceous							
	49.9'								
		Shale, brown to dark gray, very soft to moderately hard, laminated to very thin bedded with occasional clayey, silty and/or sandy zones and slightly weathered to weathered zones		74	10.0'	10.0'	100	57.0'	
				45	10.0'	10.0'	100	67.0'	

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FMSM ENGINEERS

SUBSURFACE LOG

Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-1** Total Depth 247.0'

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Shale, brown to dark gray, very soft to moderately hard, laminated to very thin bedded with occasional clayey, silty and/or sandy zones and slightly weathered to weathered zones *(Continued)*		39	10.0'	10.0'	100	77.0'	
	78.5'	Sandstone, light gray, very fine to fine grained, hard, thin bedded, silty, shaly, micaceous							Vertical fracture from 79.2' to 80.3'
	83.2'	Shale, red to dark gray, very soft to moderately hard, very thin to thin bedded with occasional clayey, silty and/or sandy zones, micaceous		88	10.0'	10.0'	100	87.0'	
		Shale becomes slightly weathered with numerous fractures and slickensides from 93.0' to 104.5'							

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SUBSURFACE LOG

Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-1** Total Depth 247.0'

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Shale, red to dark gray, very soft to moderately hard, very thin to thin bedded with occasional clayey, silty and/or sandy zones, micaceous *(Continued)*		64	10.0'	10.0'	100	97.0'	
				75	10.0'	10.0'	100	107.0'	
				89	10.0'	10.0'	100	117.0'	70° Fracture from 119.2' to 119.7'

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/14/05

Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-1** Total Depth 247.0'

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Shale, red to dark gray, very soft to moderately hard, very thin to thin bedded with occasional clayey, silty and/or sandy zones, micaceous *(Continued)*		69	10.0'	10.0'	100	127.0'	
				56	10.0'	10.0'	100	137.0'	Numerous fractures and slickensides from 127.8' to 141.9'
									45° Fracture from 143.8' to 144.0'

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SUBSURFACE LOG

Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-1** Total Depth 247.0'

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		Shale, red to dark gray, very soft to moderately hard, very thin to thin bedded with occasional clayey, silty and/or sandy zones, micaceous *(Continued)*		59	10.0'	10.0'	100	147.0'	
	150.1'								
		Shale (75%) interbedded with Sandstone (25%); Shale, dark gray, soft, very thin bedded. Sandstone, light gray, hard, fine grained, thin bedded.							
	152.9'								
		Sandstone, light gray, hard, medium grained, thick bedded, slightly micaceous		90	10.0'	10.0'	100	157.0'	
	159.6'								
		Shale, dark gray, soft, very thin bedded, silty							
	161.5'								
		Sandstone, light gray, hard, medium grained, thick to very thick bedded		81	10.0'	10.0'	100	167.0'	

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Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-1** Total Depth 247.0'

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		Sandstone, light gray, hard, medium grained, thick to very thick bedded *(Continued)*							
				100	10.0'	10.0'	100	177.0'	
				100	10.0'	10.0'	100	187.0'	
	189.6'								
	190.4'	Carbonaceous Shale, black, soft, laminated with numerous coal partings (boney) and stringers							
		Sandstone, light gray to dark gray, soft to hard, fine to medium grained, thin bedded to cross bedded, shaly with occasional interbedded shale seams, micaceous							

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SUBSURFACE LOG

Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-1** Total Depth 247.0'

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Sandstone, light gray to dark gray, soft to hard, fine to medium grained, thin bedded to cross bedded, shaly with occasional interbedded shale seams, micaceous *(Continued)*		90	10.0'	10.0'	100	197.0'	
				85	10.0'	10.0'	100	207.0'	
				88	10.0'	10.0'	100	217.0'	

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SUBSURFACE LOG

Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-1** Total Depth 247.0'

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Sandstone, light gray to dark gray, soft to hard, fine to medium grained, thin bedded to cross bedded, shaly with occasional interbedded shale seams, micaceous *(Continued)*							
	224.0'	Shale, light gray to dark gray, soft, very thin bedded, silty to sandy with very thin clay-like seams at bedded plane fractures		84	10.0'	10.0'	100	227.0'	
	236.3'	Carbonaceous Shale, black, very soft to soft, very thin bedded with occasional clayey and slightly weathered zones		65	10.0'	10.0'	100	237.0'	
	241.2'	Shale, gray, soft, very thin bedded, silty with occasional slightly weathered zones							

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SUBSURFACE LOG

Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-1** Total Depth 247.0'

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Shale, gray, soft, very thin bedded, silty with occasional slightly weathered zones *(Continued)*							
	247.0'			62	10.0'	10.0'	100	247.0'	

Bottom of Hole

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/14/05

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HYDRAULIC CONDUCTIVITY TEST RESULTS

FGD DISPOSAL FACILITY FINAL SITE SELECTION
BIG SANDY PLANT - UNIT 2
LAWRENCE COUNTY, KENTUCKY

BORING NO.: B-1

$$K = \frac{CQ}{2(pi)LH} \ln(L/r)$$

WHERE: K = HYDRAULIC CONDUCTIVITY (CM/SEC)
Q = FLOW RATE (GAL/MIN)
L = TEST INTERVAL (FT)
H = TOTAL HEAD (FT) (1 PSI = 2.31 FT)
r = HOLE RADIUS (FT)
= 0.125
C = CONVERSION FACTOR (CM-MIN-CU.FT)/(FT-SEC-GAL)
=0.0679

TEST INTERVAL DEPTH (FT)			GAGE PRESSURE (PSI)	FLOW RATE (GAL/MIN)	TOTAL HEAD (FT)	HYDRAULIC CONDUCTIVITY (CM/SEC)	STRATIGRAPHY
35.5	-	47.0	24	0.020	96.6	8.8E-07	Shale / Sandstone / Shale
47.0	-	57.0	28	0.053	116.6	2.2E-06	Shale / Sandstone / Shale
57.0	-	67.0	34	0.013	140.5	4.4E-07	Shale
67.0	-	77.0	38	0.003	159.7	8.9E-08	Shale
77.0	-	87.0	44	0.040	183.5	1.0E-06	Shale / Sandstone / Shale
87.0	-	97.0	48	0.040	202.8	9.3E-07	Shale
97.0	-	107.0	50	0.020	217.4	4.4E-07	Shale
107.0	-	117.0	50	0.080	227.4	1.7E-06	Shale
117.0	-	127.0	50	0.127	237.4	2.5E-06	Shale
127.0	-	137.0	50	0.040	247.4	7.7E-07	Shale
137.0	-	147.0	50	0.040	257.4	7.4E-07	Shale
147.0	-	157.0	50	0.040	267.4	7.1E-07	Shale / Sandstone
157.0	-	167.0	50	0.060	277.4	1.0E-06	Sandstone / Shale / Sandstone
167.0	-	177.0	50	0.060	287.4	9.9E-07	Sandstone
177.0	-	187.0	50	0.060	297.4	9.6E-07	Sandstone
187.0	-	197.0	50	0.147	307.4	2.3E-06	Sandstone / Shale / Sandstone
197.0	-	207.0	50	0.200	317.4	3.0E-06	Sandstone
207.0	-	217.0	50	0.100	327.4	1.4E-06	Sandstone
217.0	-	227.0	50	0.180	337.4	2.5E-06	Sandstone / Shale
227.0	-	237.0	50	0.160	347.4	2.2E-06	Shale
237.0	-	247.0	50	0.060	357.4	8.0E-07	Shale

Note: When no flow occurred during the 15-minute water pressure test, a value of 0.003 gpm (1/2 the smallest division on the water meter divided by 15 minutes) was used to determine the hydraulic conductivity of the test interval.

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SUBSURFACE LOG

Project Number	LX2004107	Location	Burke Branch
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-2**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/7/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele		

Total Depth	25.0'									
Completed	12/7/04									
Depth to Water	Dry	Date/Time	12/7/04							
Depth to Water	N/A	Date/Time	N/A							

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	0.0'	Top of Hole							
	0.3'	Topsoil							
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants							
	6.0'								
		Soil 4: Shale (augered)							
									Bag Soil 4 @ 15.0'-20.0'

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SUBSURFACE LOG

Project Number LX2004107 Location Burke Branch

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-2** Total Depth 25.0'

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 4: Shale (augered) *(Continued)*							
	25.0'								
		Bottom of Hole (No Refusal)							

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/13/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Burke Branch
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-3**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/7/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele		

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth		Remarks
	0.0'	Top of Hole								
	0.6'	Topsoil								
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants		SPT-1	4.0' - 5.5'	1.5'	3-5-7	18		
	6.9'	Top of Rock								
		Soil 4: Shale (augered)		SPT-2	9.0' - 10.5'	1.1'	7-17-43	10		
	15.0'	Bottom of Hole (No Refusal)								

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

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SUBSURFACE LOG

Project Number	LX2004107	Location	Burke Branch
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-4**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/7/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele		

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth		Remarks
	0.0'	Top of Hole								
	0.4'	Topsoil								
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants								
	4.0'	Top of Rock								
		Soil 4: Shale (augered)								
	8.2'	Bottom of Hole (No Refusal)								

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Burke Branch
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-5**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/7/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele		

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth		Remarks
	0.0'	Top of Hole								
	0.4'	Topsoil								
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants		SPT-1	4.5' - 6.0'	1.2'	3-5-9	17		
	7.2'	Top of Rock								
		Soil 4: Shale (augered)								
	9.5'									

Bottom of Hole (No Refusal)

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Burke Branch
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-6**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/8/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele	Depth to Water	Dry
		Depth to Water	N/A

Total Depth	15.5'
Completed	12/8/04
Date/Time	12/8/04
Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
	0.0'	Top of Hole							
	0.5'	Topsoil							
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants							
	12.5'	Top of Rock							
		Soil 4: Shale (augered)							
	15.5'								

Bottom of Hole (No Refusal)

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Burke Branch
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-7**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/8/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele	Depth to Water	Dry
		Depth to Water	N/A

Total Depth	15.5'
Completed	12/8/04
Date/Time	12/8/04
Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
	0.0'	Top of Hole							
	0.5'	Topsoil							
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants		SPT-1	5.0' - 6.5'	1.5'	4-2-4	20	
	9.5'	Top of Rock							
		Soil 4: Shale (augered)		SPT-2	10.0' - 11.5'	1.5'	9-11-18	20	
	15.5'	Bottom of Hole (No Refusal)							

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

FMSM ENGINEERS

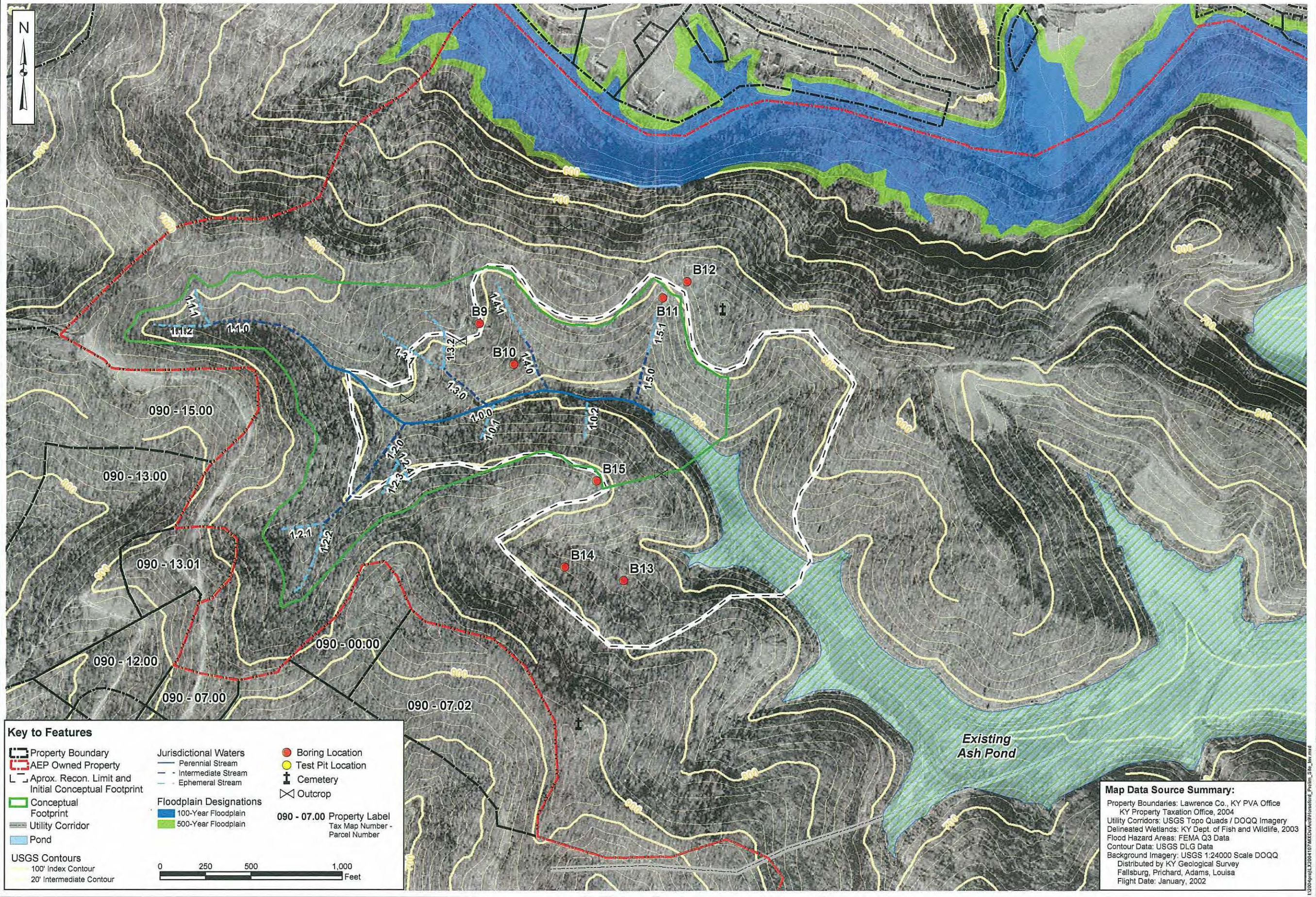
SUBSURFACE LOG

Project Number	LX2004107	Location	Burke Branch
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-8**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/8/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele		

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks	
	0.0'	Top of Hole								
	0.2'	Topsoil								
		Soil 3: Silty Clayey Sand, orange-brown, moist, medium loose, with occasional rock remnants		SPT-1	5.0' - 6.5'	1.5'	8-8-9	17	Bag Soil 3 @ 5.0'- 9.0'	
	9.2'	Top of Rock								
	10.0'	Sandstone (augered)								

Bottom of Hole (No Refusal)

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05



Fuller Mossbarger Scott & May

FMSM ENGINEERS

LEXINGTON LOUISVILLE CINCINNATI COLUMBUS ST. LOUIS

FULLER MOSSBARGER SCOTT AND MAY ENGINEERS, INC.

1409 N. Forbes Rd.
Lexington, Kentucky
40511-2250
859-422-3000

Initial Site Exploration
Site 8 - Horseford Creek
Final Site Selection
American Electric Power
Big Sandy Plant, Unit 2
Lawrence County, Kentucky

PROJECT NO.	LX2004107
DATE	FEBRUARY, 2005
DRAWN BY	MAA
CHECKED BY	MJS
CHECKED BY	DWF
SCALE	1" = 500'
REVISED	
1.	
2.	
3.	
4.	

SHEET

Exhibit A-2

I:\2004proj\LX2004107\MXD\ArcIMS\Horseford_Prelim_Site_Rev.mxd

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Horseford Creek		
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-9**	Total Depth	10.0'
County	Lawrence	Surface Elevation			
Project Type	Preliminary Geotechnical Exploration	Date Started	12/8/04	Completed	12/8/04
Supervisor	Michael Steele Driller Tim Caudill	Depth to Water	Dry	Date/Time	12/8/04
Logged By	Michael Steele	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	0.0'	Top of Hole							
	0.4'	Topsoil							
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants							
	3.5'	Top of Rock		SPT-1	4.0' - 5.5'	1.2'	17-13-16	10	
		Soil 4: Shale (augered)							
	10.0'	Bottom of Hole (No Refusal)							

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Horseford Creek
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-10** Total Depth 5.5'
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/8/04 Completed 12/8/04
Supervisor	Michael Steele Driller Tim Caudill	Depth to Water	Dry Date/Time 12/8/04
Logged By	Michael Steele	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	0.0'	Top of Hole							
	0.3'	Topsoil							
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants							
	3.9'	Top of Rock							
	5.5'	**Soil 4:** Shale (augered)							
		Bottom of Hole (No Refusal)							

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Horseford Creek
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-11**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/8/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele		

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth		Remarks
	0.0'	Top of Hole								
	0.3'	Topsoil								
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants								
	6.3'	Top of Rock								
		Soil 4: Shale (augered)								
	13.0'									
		Bottom of Hole (No Refusal)								

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Horseford Creek
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-12**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/8/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele		

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth		Remarks
	0.0'	Top of Hole								
	0.4'	Topsoil								
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants		SPT-1	4.5' - 6.0'	1.1'	5-7-10	22		
	6.5'	Top of Rock								
		Soil 4: Shale (augered)		SPT-2	9.5' - 11.0'	1.5'	7-11-12	15		
	15.0'	Bottom of Hole (No Refusal)								

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Horseford Creek
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-13**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/8/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele		

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth		Remarks
	0.0'	Top of Hole								
	0.1'	Topsoil								
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants								Steady (artesian) flow from top of augers @ 15.0'

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/13/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number LX2004107 Location Horseford Creek

Project Name Big Sandy Plant - Unit 2 - Final Site Selection Boring No. **B-13** Total Depth 30.0'

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants *(Continued)*							
	29.1'								
	30.0'	**Soil 4:** Shale (augered)							

Bottom of Hole (No Refusal)

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/13/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Horseford Creek
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-14**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/8/04
Supervisor	Michael Steele	Driller	Tim Caudill
Logged By	Michael Steele		

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth		Remarks
	0.0'	Top of Hole								
	0.4'	Topsoil								
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants								
				SPT-1	5.0' - 6.5'	1.5'	5-9-12	16		
				SPT-2	10.0' - 11.5'	1.5'	4-4-7	21		
	12.5'	Top of Rock								
		Soil 4: Shale (augered)								
	14.0'									

Bottom of Hole (No Refusal)

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

1/12/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Horseford Creek
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**B-15** Total Depth 10.5'
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/9/04 Completed 12/9/04
Supervisor	Michael Steele Driller Tim Caudill	Depth to Water	Dry Date/Time 12/9/04
Logged By	Michael Steele	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
	0.0'	Top of Hole							
	0.2'	Topsoil							
		Soil 1: Clayey Sand, light brown to brown with occasional beige and gray mottling, moist to wet, loose to medium loose, with occasional manganese concretions and rock remnants							
	2.9'	Top of Rock							
		Soil 4: Shale (augered)		SPT-1	5.0' - 6.5'	1.5'	9-12-18	12	
	10.5'	Bottom of Hole (No Refusal)							

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/12/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Horseford Creek
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**TP-1**
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/9/04
Supervisor		Driller AEP	
Logged By	Michael Steele		

Total Depth	10.0'									
Completed	12/9/04									
Depth to Water	5.0'	Date/Time	12/9/04							
Depth to Water	N/A	Date/Time	N/A							

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
	0.0'	Top of Hole							
		Soil 5: Heterogeneous Fill: Clayey Sand with Gravel to Clayey Gravel with Sand, with numerous rock fragments, boulders and organics (topsoil, roots, tree limbs, etc.)		GB-1	3.0			17	Test pits performed with a John Deere 4106 Excavator
				GB-2	8.0			19	
	10.0'	Bottom of Hole (No Refusal)							

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/31/05

FMSM ENGINEERS

SUBSURFACE LOG

Project Number	LX2004107	Location	Horseford Creek
Project Name	Big Sandy Plant - Unit 2 - Final Site Selection	Boring No.	**TP-2** Total Depth 10.0'
County	Lawrence	Surface Elevation	
Project Type	Preliminary Geotechnical Exploration	Date Started	12/9/04 Completed 12/9/04
Supervisor	Driller AEP	Depth to Water	Dry Date/Time 12/9/04
Logged By	Michael Steele	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
	0.0'	Top of Hole							
		Soil 5: Heterogeneous Fill: Clayey Sand with Gravel to Clayey Gravel with Sand, with numerous rock fragments, boulders and organics (topsoil, roots, tree limbs, etc.)		GB-1	3.0			9	Test pits performed with a John Deere 4106 Excavator
				GB-2	8.0			13	
	10.0'	Bottom of Hole (No Refusal)							

FMSM_LEGACY LX2004107.GPJ FMSM.GDT 1/31/05

APPENDIX B.2

TEST PIT LOGS

AEP – February 2009 Borrow Study

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF TEST PIT

JOB NUMBER **40743488-08**

COMPANY **KENTUCKY POWER COMPANY**

PROJECT **BIG SANDY FLY ASH DAM**

COORDINATES **N 253,392.9 E 2,103,040.4**

GROUND ELEVATION **807.2** SYSTEM

WATER LEVEL	▽	▼	▼
TIME			
DATE			

TEST PIT NO. **TP-0901** DATE **3/31/09** SHEET **1** OF **1**

START DATE **2/17/09** FINISH DATE **2/17/09**

LOCATION

FIELD PARTY **C McNeil/D Stranahan**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO		TOTAL LENGTH RECOVERY		DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION		Geologists Notes
1		0.0	1.5							**5YR 5/6 MEDIUM BROWN SILTY SAND** w/clay w/grass roots, appears to be fill/graded area, damp, mottled		
2		1.5	8.0				5			**FIRM TO VERY FIRM N8 TO 5YR 5/6 GRAY CLAY** w/minor Fe staining, root traces, minor sand/silt, damp to dry		Sample collected from 1.5' to 8.5' for lab testing.
3		8.0	8.5							**5YR 4/4 CLAYEY SAND** damp **Total Depth = 8.5'**		

RECORDER **K Adkins**

AEP-TRENCH BIG_SANDY_FA_DAM.GPJ AEP.GDT 3/31/09

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF TEST PIT

JOB NUMBER **40743488-08**

COMPANY **KENTUCKY POWER COMPANY**

PROJECT **BIG SANDY FLY ASH DAM**

COORDINATES **N 253,273.6 E 2,103,148.5**

GROUND ELEVATION **786.7** SYSTEM

TEST PIT NO. **TP-0902** DATE **3/31/09** SHEET **1** OF **1**

START DATE **2/17/09** FINISH DATE **2/17/09**

LOCATION

WATER LEVEL	▽	▼	▼
TIME			
DATE			

FIELD PARTY **C McNeil/D Stranahan**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	TOTAL LENGTH RECOVERY	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	Geologists Notes
1		0.0	2.0					**FILL - 5YR 3/4 BROWN SILTY SAND** w/roots	
2		2.0	4.0					**5YR 4/4 BROWN SILTY CLAY** w/Fe stains, root traces, damp	
3		4.0	10.0					**N8 TO 5YR 5/6 MEDIUM GRAY TO BROWN CLAY** w/some sand traces, root traces, dry to damp, w/wet zones	Sample collected from 4.0' to 10.0' for lab testing.
					5				
					10			**Total Depth = 10.0'**	

RECORDER **K Adkins**

AEP-TRENCH BIG_SANDY_FA_DAM.GPJ AEP.GDT 3/31/09

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF TEST PIT

JOB NUMBER **40743488-08**

COMPANY **KENTUCKY POWER COMPANY**

PROJECT **BIG SANDY FLY ASH DAM**

COORDINATES **N 252,999.2 E 2,103,177.5**

GROUND ELEVATION **783.2** SYSTEM

WATER LEVEL	▽	▼	▼
TIME			
DATE			

TEST PIT NO. **TP-0903** DATE **3/31/09** SHEET **1** OF **1**

START DATE **2/17/09** FINISH DATE **2/17/09**

LOCATION

FIELD PARTY **C McNeil/D Stranahan**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	SAMPLE DEPTH IN FEET TO		TOTAL LENGTH RECOVERY		DEPTH IN FEET	GRAPHIC LOG	U S C S	SOIL / ROCK IDENTIFICATION		Geologists Notes
1		0.0	0.5							**SOFT N8 - 5YR 5/6 SILTY CLAY** w/grass roots, gray/brown mottled, damp		
2		0.5	3.4							**FIRM/VERY FIRM N8 - 5YR 4/6 CLAY** mottled, dry		Sample collected from 0.5' to 3.4' for lab testing.
3		3.4	3.5							**10YR 6/2 OLIVE BROWN SANDSTONE** fine grain, micaceous **Total Depth = 3.5'**		

RECORDER **K Adkins**

AEP-TRENCH BIG_SANDY_FA_DAM.GPJ AEP.GDT 3/31/09

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF TEST PIT

JOB NUMBER **40743488-08**

COMPANY **KENTUCKY POWER COMPANY**

PROJECT **BIG SANDY FLY ASH DAM**

COORDINATES **N 252,687.2 E 2,193,287.2**

GROUND ELEVATION **811.2** SYSTEM

WATER LEVEL	▽	▼	▼
TIME			
DATE			

TEST PIT NO. **TP-0904** DATE **3/31/09** SHEET **1** OF **1**

START DATE **2/17/09** FINISH DATE **2/17/09**

LOCATION

FIELD PARTY **C McNeil/D Stranahan**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	TOTAL LENGTH RECOVERY	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	Geologists Notes
1		0.0	0.5					**OVERBURDEN/FILL** from previous borrow area grading	
2		0.5	3.0					**FIRM 5YR 5/6 BROWN MOTTLED GRAY CLAY** dry to damp	No sample collected for lab testing.
3		3.0	6.0		5			**STIFF TO VERY STIFF N8 TO 5YR 5/6 GRAY CLAY** dry	
4		6.0	6.5					**N1 COAL** vitreous streaks, w/carbonaceous shale	
5		6.5	6.7					**N6 GRAY CLAY** dry	
								Total Depth = 6.7'	

RECORDER **K Adkins**

AEP-TRENCH BIG_SANDY_FA_DAM.GPJ AEP.GDT 3/31/09

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF TEST PIT

JOB NUMBER **40743488-08**

COMPANY **KENTUCKY POWER COMPANY**

PROJECT **BIG SANDY FLY ASH DAM**

COORDINATES **N 252,709.5 E 2,103,394.2**

GROUND ELEVATION **789.7** SYSTEM

WATER LEVEL	▽	▼	▼
TIME			
DATE			

TEST PIT NO. **TP-0905** DATE **3/31/09** SHEET **1** OF **1**

START DATE **2/17/09** FINISH DATE **2/17/09**

LOCATION

FIELD PARTY **C McNeil/D Stranahan**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	TOTAL LENGTH RECOVERY	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	Geologists Notes
1		0.0	0.5					**5YR 5/6 MEDIUM BROWN/RED CLAY** minor sand, appears to be graded material from previous borrow operations	Sample collected from 0.5' to 7.0' for lab testing.
2		0.5	3.0					**FIRM 5YR 5/6 REDDISH BROWN CLAY** w/root traces, blocky, dry to moist	
3		3.0	3.3					**5YR 5/2 DARK GRAY CARBONACEOUS CLAY**	
4		3.3	7.0					**FIRM TO STIFF N8 TO 5YR 5/6 MOTTLED REDDISH BROWN TO GRAY CLAY** dry to moist	
					5				
5		7.0	7.1					**10YR 6/2 SANDSTONE** fine grained, micaceous **Total Depth = 7.1'**	

RECORDER **K Adkins**

AEP-TRENCH BIG_SANDY_FA_DAM.GPJ AEP.GDT 3/31/09

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF TEST PIT

JOB NUMBER **40743488-08**

COMPANY **KENTUCKY POWER COMPANY**

PROJECT **BIG SANDY FLY ASH DAM**

COORDINATES **N 252,624.8 E 2,103,493.9**

GROUND ELEVATION **789.0** SYSTEM

WATER LEVEL	▽	▼	▼
TIME			
DATE			

TEST PIT NO. **TP-0906** DATE **3/31/09** SHEET **1** OF **1**

START DATE **2/17/09** FINISH DATE **2/17/09**

LOCATION

FIELD PARTY **C McNeil/D Stranahan**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO		TOTAL LENGTH RECOVERY		DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION		Geologists Notes
1		0.0	1.0							**5YR 5/6 TO 5YR 4/6 REDDISH BROWN CLAY** w/grass roots, moist to damp		
2		1.0	3.2							**FIRM N8 TO 5YR 5/6 MEDIUM GRAY TO OLIVE GRAY CLAY** w/reddish mottling, dry to moist		Sample collected from 1.0' to 3.2' for lab testing.
3		3.2	3.3							**10YR 6/2 SANDSTONE** fine grained, micaceous **Total Depth = 3.3'**		

RECORDER **K Adkins**

AEP-TRENCH BIG_SANDY_FA_DAM.GPJ AEP.GDT 3/31/09

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF TEST PIT

JOB NUMBER **40743488-08**

COMPANY **KENTUCKY POWER COMPANY**

PROJECT **BIG SANDY FLY ASH DAM**

COORDINATES **N 252,299.2 E 2,103,407.6**

GROUND ELEVATION **826.2** SYSTEM

WATER LEVEL	▽	▼	▼
TIME			
DATE			

TEST PIT NO. **TP-0907** DATE **3/31/09** SHEET **1** OF **1**

START DATE **2/17/09** FINISH DATE **2/17/09**

LOCATION

FIELD PARTY **C McNeil/D Stranahan**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO		TOTAL LENGTH RECOVERY		DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION		Geologists Notes
1		0.0	0.5							**10YR 2/2 SILTY/LOAMY TOPSOIL** w/leaves and tree/brush roots, moist/damp		
2		0.5	6.3							**FIRM TO STIFF 5YR 5/6 REDDISH BROWN/MEDIUM BROWN CLAY** dry to slightly moist		Sample collected from 0.5' to 6.3' for lab testing.
							5					
3		6.3	6.5							**DARK RED CLAYSTONE** paleo sol, root traces, dry, (hardpan) **Total Depth = 6.5'**		

RECORDER **K Adkins**

AEP-TRENCH BIG_SANDY_FA_DAM.GPJ AEP.GDT 3/31/09

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF TEST PIT

JOB NUMBER **40743488-08**

COMPANY **KENTUCKY POWER COMPANY**

PROJECT **BIG SANDY FLY ASH DAM**

COORDINATES **N 252,412.8 E 2,103,464.9**

GROUND ELEVATION **811.8** SYSTEM

TEST PIT NO. **TP-0908** DATE **3/31/09** SHEET **1** OF **1**

START DATE **2/17/09** FINISH DATE **2/17/09**

LOCATION

WATER LEVEL	▽	▼	▼
TIME			
DATE			

FIELD PARTY **C McNeil/D Stranahan**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO	TOTAL LENGTH RECOVERY	DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION	Geologists Notes
1		0.0	0.5					**10YR 2/2 LOAMY/SILTY TOPSOIL** w/roots	
2		0.5	4.5					**FIRM TO VERY FIRM 5YR 5/6 REDDISH CLAY** w/roots to 2.5', dry to moist	Sample collected from 0.5' to 11.0' for lab testing.
3		4.5	5.0		5			**N7 TO N8 BLACK CARBONACEOUS SHALE** w/minor coal	
4		5.0	6.5					**FIRM/VERY FIRM N7 TO 5YR 4/6 MEDIUM GRAY TO REDDISH BROWN CLAY** dry to moist	
5		6.5	11.0		10			**N7 TO 5YR 5/6 MEDIUM GRAY TO REDDISH GRAY CLAYSTONE**	
								Total Depth = 11.0'	

RECORDER **K Adkins**

AEP-TRENCH BIG_SANDY_FA_DAM.GPJ AEP.GDT 3/31/09

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AEP CIVIL ENGINEERING LABORATORY

LOG OF TEST PIT

JOB NUMBER **40743488-08**

COMPANY **KENTUCKY POWER COMPANY**

PROJECT **BIG SANDY FLY ASH DAM**

COORDINATES **N 252,495.2 E 2,103,507.5**

GROUND ELEVATION **797.2** SYSTEM

WATER LEVEL	▽	▼	▼
TIME			
DATE			

TEST PIT NO. **TP-0909** DATE **3/31/09** SHEET **1** OF **1**

START DATE **2/17/09** FINISH DATE **2/17/09**

LOCATION

FIELD PARTY **C McNeil/D Stranahan**

SAMPLE NUMBER	SAMPLE	SAMPLE DEPTH IN FEET FROM	TO		TOTAL LENGTH RECOVERY		DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL / ROCK IDENTIFICATION		Geologists Notes
1		0.0	0.5							**10YR 2/2 SILTY/LOAMY TOPSOIL** roots, leaves, dry		
2		0.5	3.5							**FIRM 5YR 4/6 TO 10R 4/6 REDDISH BROWN CLAY** moist		Sample collected from 0.5' to 10.0' for lab testing.
3		3.5	8.8				5			**FIRM TO VERY FIRM MEDIUM/LIGHT GRAY TO ORANGISH BROWN CLAY** Fe staining, dry to slightly moist		
4		8.8	10.0				10			**HARD N8 TO 10Y 6/2 LIGHT TO OLIVE GREEN CLAYSTONE** broken down by hand w/relative ease		
5		10.0	10.1							**10Y 6/2 LIGHT GRAY OLIVE GREEN SANDSTONE** micaceous **Total Depth = 10.1'**		Location: Test Pits 0907-0909 - Base of TP-0907 was ~ same elevation as top of 0908. Base of 0908 was top of 0907. Effectively developed a stratigraphic column.

RECORDER **K Adkins**

AEP-TRENCH BIG_SANDY_FA_DAM.GPJ AEP.GDT 3/31/09

APPENDIX B.3

BORING AND TEST PIT LOGS

URS – May 2012 Field Subsurface Exploration

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-1
Sheet 1 of 1

Date(s) Excavated	5/9/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	8.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 250878 E 2103961				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL) [Topsoil]		
1		Stiff, moist, orange brown, lean CLAY (CL)		Sample @ 0.5-2.5' bgs
2				
3		Weathered coal, soft, friable		
		Very stiff to stiff, moist, gray to yellow gray, lean CLAY (CL) -- grades to bedrock		Sample @ 3-6' bgs
4				
5				
6		Shale, weathered, yellow brown, friable		
7				
8				
9		Base of Excavation @ 8.5 ft bgs.		
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

URS

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-2
Sheet 1 of 1

Date(s) Excavated	5/9/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	2.7 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 250301 E 2103316				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL), roots		Sample @ 0.3-2.5' bgs
1		Soft, moist, dark brown, sandy lean CLAY (CL)		
2				
3		Sandstone, hard, brown Base of Excavation @ 2.7 ft bgs.		
4				
5				
6				
7				
8				
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13				
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19				
20				

URS

Report: TEST PIT; File: AEPTESTPITS-DRAFT.GPJ; 5/31/2012 TP-2

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-3
Sheet 1 of 1

Date(s) Excavated	5/9/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	5.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 250198 E 2102655				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL) [Topsoil]		
1		Stiff to very stiff, moist, orange brown, lean CLAY (CL), some sandstone cobbles (float)		Sample @ 0.4-3.5' bgs
2				
3				
4		Very stiff, moist, gray, lean CLAY (CL)		Sample @ 3.5-5' bgs
5		Shale, buff/yellow		
6		Base of Excavation @ 5.5 ft bgs.		
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation **Project Location: Louisa, KY** **Project Number: 13815141.10000**	**Log of Test Pit TP-4** **Sheet 1 of 1**

Date(s) Excavated	**5/8/12**	Logged By	**J. Ristow**	Checked By	
Length of Excavation		Width of Excavation	**1.5**	Depth of Excavation	**5.5 ft ±**
Excavation Equipment	**Komatsu PC40**	Excavation Contractor	**Utter Construction**	Approximate Surface Elevation	
Water Observations	**No water**				
Location	**N 250249 E 2101536**				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, brown lean CLAY (CL), roots and leaves [Topsoil]		
1		Stiff to very stiff, moist, red with gray mottles, lean CLAY (CL)		Sample @ 1-5' bgs
2				
3				
4				
5		Shale, red, hard		
6		Base of Excavation @ 5.5 ft bgs.		
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation **Project Location: Louisa, KY** **Project Number: 13815141.10000**	**Log of Test Pit TP-5** **Sheet 1 of 1**

Date(s) Excavated	**5/8/12**	Logged By	**J. Ristow**	Checked By	
Length of Excavation		Width of Excavation	**1.5**	Depth of Excavation	**3.5 ft ±**
Excavation Equipment	**Komatsu PC40**	Excavation Contractor	**Utter Construction**	Approximate Surface Elevation	
Water Observations	**No water**				
Location	**N 250852 E 2101869**				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL), with roots		
1		Stiff, moist, orange-brown, sandy lean CLAY (CL), some cobbles of sandstone		Sample @ 0.4-3.0' bgs
2				
3		Sandstone, brown, friable		
4		Base of Excavation @ 3.5 ft bgs.		
5				
6				
7				
8				
9				
10				
11				
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14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation Project Location: Louisa, KY Project Number: 13815141.10000	**Log of Test Pit TP-6** **Sheet 1 of 1**

Date(s) Excavated	**5/8/12**	Logged By	**J. Ristow**	Checked By	
Length of Excavation		Width of Excavation	**1.5**	Depth of Excavation	**6.5 ft ±**
Excavation Equipment	**Komatsu PC40**	Excavation Contractor	**Utter Construction**	Approximate Surface Elevation	
Water Observations	**No water**				
Location	**N 251651 E 2101264**				

Elevation feet	Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
	0		Soft, moist, dark brown, lean CLAY (CL) [Topsoil]		
	1		Stiff, moist, red, lean CLAY (CL), some silt		Sample @ 0.4-2' bgs
	2		Very stiff, moist, gray and yellow mottles, lean CLAY (CL)		Sample @ 2-6' bgs
	3				
	4				
	5				
	6		Shale, red, dry, hard		
	7		Base of Excavation @ 6.5 ft bgs.		
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-7
Sheet 1 of 1

Date(s) Excavated	5/8/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 252375 E 2100996				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL), roots [Topsoil]		
1		Stiff, moist, brown, lean CLAY (CL), some sand and some sandstone cobbles		Sample @ 0.5-5.0' bgs
5		Base of Excavation @ 5 ft bgs.		Light brown shale

Report: TEST PIT; File: AEPTESTPITS-DRAFT.GPJ; 5/31/2012 TP-7

URS

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-8
Sheet 1 of 1

Date(s) Excavated	5/8/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	7.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 253272 E 2100370				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL), roots [Topsoil]		
1		Stiff, moist, brown/orange-brown, lean CLAY (CL), some sand, some sandstone cobbles		Sample @ 0.3-5.0' bgs
5		Hard, moist, gray lean CLAY (CL)		Sample @ 5.0-7.0' bgs
7		Shale, gray, hard		
		Base of Excavation @ 7.5 ft bgs.		
20				

URS

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-9
Sheet 1 of 1

Date(s) Excavated	5/8/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	4.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 253097 E 2099498				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, lean CLAY (CL), with roots and leaves [Topsoil]		
		Stiff, moist, reddish brown, sandy lean CLAY (CL), some sandstone cobbles		Sample @ 0.3-4' bgs
4		Shale, gray, hard		
		Base of Excavation @ 4.5 ft bgs.		
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Report: TEST PIT; File: AEPTESTPITS-DRAFT.GPJ; 5/31/2012 TP-9

URS

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-10
Sheet 1 of 1

Date(s) Excavated	5/8/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 252612 E 2099507				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL), roots and leaf matter [Topsoil]		
1		Stiff, moist, brown, sandy lean CLAY (CL), some sandstone cobbles (float)		Sample @ 1-5' bgs
2				
3				
4				
5		Base of Excavation @ 5 ft bgs.		Brown shale, hard
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-12
Sheet 1 of 1

Date(s) Excavated	5/8/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	6.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 253795 E 2099502				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown lean CLAY (CL), roots [Topsoil]		
1		Stiff, moist, brown/orange-brown, lean CLAY and clayey SAND (CL/SC), sandstone cobbles		Sample @ 0.4-6.0' bgs
6		Weathered sandstone, brown		
7		Base of Excavation @ 6.5 ft bgs.		Shale, sandstone rock

Report: TEST PIT; File: AEPTESTPITS-DRAFT.GPJ; 5/31/2012 TP-12

URS

Project: AEP Big Sandy Landfill Investigation Project Location: Louisa, KY Project Number: 13815141.10000	Log of Test Pit TP-13 Sheet 1 of 1

Date(s) Excavated	5/2/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	5.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 253722 E 2099967				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL) [Topsoil]		
1		Stiff, moist, orange-brown, sandy lean CLAY (CL), some sandstone cobbles		Sample @ 0.5-5.0' bgs
2				
3				
4				
5		Shale, weathered, light brown		
6		Base of Excavation @ 5.5 ft bgs.		
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-14
Sheet 1 of 1

Date(s) Excavated	5/2/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	3.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 254108 E 2100591				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, lean CLAY (CL) [Topsoil]		
1		Stiff, moist, orange-brown, sandy lean CLAY (CL), with some sandstone cobbles		Sample @ 0.3-3.0' bgs
2				
3		Shale, gray, weathered		
4		Base of Excavation @ 3.5 ft bgs.		
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-15
Sheet 1 of 1

Date(s) Excavated	5/7/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	3 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 253511 E 2101176				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL), roots [Topsoil]		
1		Stiff, moist, silty lean CLAY (CL), some sand and few sandstone cobbles		Sample @ 0.4-3.0' bgs
2				
3		Base of Excavation @ 3 ft bgs.		Shale, hard, light brown
4				
5				
6				
7				
8				
9				
10				
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12				
13				
14				
15				
16				
17				
18				
19				
20				

Report: TEST PIT; File: AEPTESTPITS-DRAFT.GPJ; 5/31/2012 TP-15

URS

Project: AEP Big Sandy Landfill Investigation **Project Location: Louisa, KY** **Project Number: 13815141.10000**	**Log of Test Pit TP-16** **Sheet 1 of 1**

Date(s) Excavated	**5/7/12**	Logged By	**J. Ristow**	Checked By	
Length of Excavation		Width of Excavation	**1.5**	Depth of Excavation	**7 ft ±**
Excavation Equipment	**Komatsu PC40**	Excavation Contractor	**Utter Construction**	Approximate Surface Elevation	
Water Observations	**No water**				
Location	**N 254159 E 2101820**				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL), leaves and roots [Topsoil]		
1		Stiff, moist, orange-brown, silty lean CLAY (CL), some sand, some sandstone cobbles (float)		Sample @ 0.6-6' bgs
2				
3				
4				
5				
6		Weathered shale, gray with Fe red and orange stains		
7		Base of Excavation @ 7 ft bgs.		
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-17
Sheet 1 of 1

Date(s) Excavated	5/7/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	3.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 253469 E 2102239				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, silty lean CLAY (CL), with roots and leaves [Topsoil]		
1		Stiff, moist, orange-brown, silty lean CLAY (CL), some sand, cobbles of sandstone		Sample at 0.5-3.0' bgs
2				
3		Shale, gray, hard		
4		Base of Excavation @ 3.5 ft bgs.		
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation Project Location: Louisa, KY Project Number: 13815141.10000	Log of Test Pit TP-18 Sheet 1 of 1

Date(s) Excavated	5/7/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	5.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 252628 E 2102781				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, silty lean CLAY (CL), roots and leaves [Topsoil]		
1		Stiff, moist, orange-brown, silty lean CLAY (CL), some sand		Sample @ 0.5-5.0' bgs
2				
3				
4				
5		Very stiff, moist, gray with orange and red mottles, lean CLAY (CL)		
6		Base of Excavation @ 5.5 ft bgs.		Shale bedrock, yellow/brown
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation Project Location: Louisa, KY Project Number: 13815141.10000	Log of Test Pit TP-19 Sheet 1 of 1

Date(s) Excavated	5/7/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	4.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 251996 E 2103071				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL), with roots and organics [Topsoil]		
1		Stiff, moist, orange-brown, lean CLAY (CL), some sand		
2		becomes very stiff, orange		Sample @ 2.0-4.0' bgs
3				
4		Shale, light brown, soft		
5		Base of Excavation @ 4.5 ft bgs.		
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-20
Sheet 1 of 1

Date(s) Excavated	5/7/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	7.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 253606 E 2103179				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, silty lean CLAY (CL), lots of roots [Topsoil]		
1		Stiff, moist, orange-brown, sandy lean CLAY (CL) with some sandstone cobbles (float)		Sample @ 1-5' bgs
5		Very stiff, moist, gray with orange mottles, lean CLAY (CL), grades to very weathered shale		Sample @ 5-7.5' bgs
8		Base of Excavation @ 7.5 ft bgs.		Shale, gray, hard

Report: TEST PIT; File: AEPTESTPITS-DRAFT.GPJ; 5/31/2012 TP-20

URS

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-21
Sheet 1 of 1

Date(s) Excavated	5/7/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	6 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 253195 E 2102771				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL), lots of roots and leaves [Topsoil]		
1		Stiff, moist, orange-brown, sandy lean CLAY (CL)		Sample @ 0.5-5.5' bgs
2				
3				
4				
5				
6		Stiff, moist, gray, silty lean CLAY (CL), grades to weathered shale		
		Base of Excavation @ 6 ft bgs.		Shale bedrock, gray/brown
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Test Pit TP-22
Sheet 1 of 1

Date(s) Excavated	5/7/12	Logged By	J. Ristow	Checked By	
Length of Excavation		Width of Excavation	1.5	Depth of Excavation	5.5 ft ±
Excavation Equipment	Komatsu PC40	Excavation Contractor	Utter Construction	Approximate Surface Elevation	
Water Observations	No water				
Location	N 253916 E 2102359				

Elevation feet / Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Water content (%)	REMARKS AND OTHER TESTS
0		Soft, moist, dark brown, lean CLAY (CL), roots and leaves [Topsoil]		
1		Stiff, moist, brown, silty/sandy lean CLAY (CL), few sandstone cobbles		Sample @ 0.5-5.0' bgs
2				
3				
4				
5		Stiff, moist, gray, lean CLAY (CL), weathered shale		
6		Base of Excavation @ 5.5 ft bgs.		Shale, light brown, hard
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Key to Log of Boring/Rock Core

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer, tsf	Graphic Log	MATERIAL DESCRIPTION		Well Graphic	REMARKS AND OTHER DETAILS
1	2	3	4	5	6	7	8	9		10	11	12

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows required to advance driven sampler each 6-inch interval, or distance noted, using a 140-lb hammer with a 30-inch drop.

6 **Recovery:** Percentage of driven sample length actually recovered.

7 **Pocket Penetrometer:** Pocket penetrometer field consistency measurement in tons per square foot (tsf).

8 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

9 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density/consistency.

10 **Water Content** Water content of soil sample measured in laboratory, expressed as percent of dry weight of sample.

11 **Well Graphic:** Diagram of well installation

12 **Remarks and Other Details:** Comments and observations regarding drilling or sampling made by driller or field personnel. Also includes well details and laboratory testing results.

TYPICAL MATERIAL GRAPHIC SYMBOLS

BOTTOM ASH
FLY ASH
FILL
SEDIMENTS
TOPSOIL
WATER
PEAT (PT)
Fat Organic CLAY (OH)
Lean Organic CLAY (OL)
Lean CLAY (CL)
Fat CLAY (CH)
SILT (ML)
Clayey SAND (SC)
Silty SAND (SM)
Poorly-graded SAND (SP)
Poorly-graded SAND (SP-SM)
Clayey GRAVEL (GC)
Silty GRAVEL (GM)
Clayey GRAVEL (GC)
COAL
LIMESTONE
SANDSTONE
SHALE

TYPICAL WELL GRAPHIC SYMBOLS

Filter Sand
Natural fill
PVC Pipe in Bentonite Seal
PVC Pipe in Bentonite Grout
Bentonite Plug
PVC Pipe in Filter Sand
Slotted PVC Pipe in Filter Sand

OTHER GRAPHIC SYMBOLS

First water encountered at time of drilling and sampling (ATD)

Water level at time indicated on log

Minor change in material properties within a lithologic stratum

---- Inferred or gradational lithologic contact

ATD At Time of Drilling
NR Not Recorded
NA Not Applicable

TYPICAL SAMPLER GRAPHIC SYMBOLS

Split-spoon
Core Barrel
Shelby-tube
Piston Tube
Core

MINOR SOIL TYPE(s)

"trace" When the soil type's percentage is estimated, using visual/manual procedures, to be between 1 and 15 percent of the total sample.

"with" When the soil type's percentage is estimated, using visual/manual procedures, to be greater than 15 percent and less than 30 percent of the total sample.

"y" When the soil type's percentage is estimated, using visual/manual procedures, to be greater than 30 percent of the total sample.

Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced; they are not warranted to be representative of subsurface conditions at other locations or times.

URS

Project: AEP Big Sandy Landfill Investigation Project Location: Louisa, KY Project Number: 13815141.10000	**Key to Log of Boring** Sheet 2 of 2

KEY TO DESCRIPTIVE TERMS USED ON CORE LOGS

DISCONTINUITY DESCRIPTORS

a Dip of discontinuity, measured relative to a plane normal to the core axis.

b **Discontinuity Type:**

- F - Fault
- J - Joint
- Sh - Shear
- Fo - Foliation
- V - Vein
- B - Bedding

c **Aperture (inches):**

- W - Wide (0.5-2.0)
- MW - Moderately Wide (0.1-0.5)
- N - Narrow (0.05-0.1)
- VN - Very Narrow (<0.05)
- T - Tight (0)

d **Type of Infilling:**

- Cl - Clay
- Ca - Calcite
- Ch - Chlorite
- Fe - Iron Oxide
- Gy - Gypsum
- H - Healed
- Mn - Manganese Oxide
- No - None
- Py - Pyrite
- Qz - Quartz
- Sd - Sand

e **Amount of Infilling:**

- Su - Surface Stain
- Sp - Spotty
- Pa - Partially Filled
- Fi - Filled
- No - None

f **Surface Shape of Joint:**

- Pl - Planar
- Wa - Wavy
- St - Stepped
- Ir - Irregular

g **Roughness of Surface:**

- Slk - Slickensided [surface has smooth, glassy finish with visual evidence of striations]
- S - Smooth [surface appears smooth and feels so to the touch]
- SR - Slightly Rough [asperities on the discontinuity surfaces are distinguishable and can be felt]
- R - Rough [some ridges and side-angle steps are evident; asperities are clearly visible, and discontinuity surface feels very abrasive]
- VR - Very Rough [near-vertical steps and ridges occur on the discontinuity surface]

h **Discontinuity Spacing (feet):**

- EW - Extremely Wide (>6)
- W - Wide (2-6)
- M - Moderate (0.7-2)
- C - Close (0.2-0.7)
- VC - Very Close (<0.2)

ROCK WEATHERING / ALTERATION

Description	Recognition
Residual Soil	Original minerals of rock have been entirely decomposed to secondary minerals, and original rock fabric is not apparent; material can be easily broken by hand
Completely Weathered/Altered	Original minerals of rock have been almost entirely decomposed to secondary minerals, although original fabric may be intact; material can be granulated by hand
Highly Weathered/Altered	More than half of the rock is decomposed; rock is weakened so that a minimum 2-inch-diameter sample can be broken readily by hand across rock fabric
Moderately Weathered/Altered	Rock is discolored and noticeably weakened, but less than half is decomposed; a minimum 2-inch-diameter sample cannot be broken readily by hand across rock fabric
Slightly Weathered/Altered	Rock is slightly discolored, but not noticeably lower in strength than fresh rock
Fresh/Unweathered	Rock shows no discoloration, loss of strength, or other effect of weathering/alteration

ROCK STRENGTH

Description	Recognition	Approximate Uniaxial Compressive Strength (psi)
Extremely Weak Rock	Can be indented by thumbnail	35 - 150
Very Weak Rock	Can be peeled by pocket knife	150 - 700
Weak Rock	Can be peeled with difficulty by pocket knife	700 - 3,500
Medium Strong Rock	Can be indented 5 mm with sharp end of pick	3,500 - 7,200
Strong Rock	Requires one hammer blow to fracture	7,200 - 14,500
Very Strong Rock	Requires many hammer blows to fracture	14,500 - 35,000
Extremely Strong Rock	Can only be chipped with hammer blows	> 35,000

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-1 (MW-1201)

Date(s) Drilled	**4/10/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**HSA, HQ Wireline Core**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**49.5 feet**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**799.4 ft above msl**
Borehole Backfill	**Borehole finished as monitoring well MW-1201**	Sampling Method(s)	**Split-spoon, HQ Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0									Grout
				WOH		1.0		Stiff, moist, brown to reddish brown lean CLAY (CL), trace silt and sand		
	1			2		2.0				
		SS	SS-1	2	50	2.0		Stiff to very stiff, moist, brown to reddish brown, very fine sandy fat CLAY (CH) [RESIDUUM]		SCH 40 PVC 2" diameter riser
				3		3.25				
	2							becomes very stiff to hard		
				5		3.5				
	3			5		4.5				
		SS	SS-2	5	50	3.5				
				7		4.5				
	4									
795				2		1.75		becomes mottled reddish brown and light gray		
				2		3.0				
	5	SS	SS-3	5	63	4.0				
				7		3.0				
	6			7				Medium dense, moist, dark reddish brown fine to medium clayey SAND (SC) with trace oxidized sandstone gravel, with tan and light gray mottling [RESIDUUM]		
				10		3.5				
	7	SS	SS-4	11	100	4.5				
				11		4.25				
	8									
				3		3.5		Very stiff to hard, moist, light gray to light tan, fat CLAY (CH), trace sand [RESIDUUM]		
				6		>4.5				
	9	SS	SS-5	7	92	3.5		1/4" dark red-brown, highly weathered shale seam		
790				9		>4.5				
	10									
				2		3.75				
				5		4.0				
	11	SS	SS-6	9	92	4.25				
				15		4.25				
	12									
		SS	SS-7	50/5"	8	>4.5		becomes gray to light gray		
	13							Quartz sandstone, gray, slight to no weathering, very strong, slight to moderate HCL reaction (4.5"-6"), grading more flaggy and micaceous at 9"		*Auger/spoon refusal at 12.5 ft bgs*
			R1	24%	50			Fracture #1: 0, B, N, None ,None, Ir, SR, M		
	14									
785										
	15									
	16									
								Shale, gray, slight to moderately weathered, very weak		
	17		R2	30%	50			Fracture #2: 0, B, 0, None, None, Pl, SR, VC		
	18									
	19									
780										
	20		R3	27%	77					

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-1 (MW-1201)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20							becomes dark gray and slightly fossiliferous		*Brush creek limestone*
	21							Microcrystalline limestone, gray, slight to no weathering, very strong, fossiliferous		**SCH 40 PVC 2" diameter riser**
	22		R3	27%	77			Shale, dark gray, slight to moderate weathering, very weak, slightly fossiliferous		
	23							Microcrystalline limestone, light gray to gray, slight to moderate weathering, strong		*Brush creek limestone*
								Fracture #3: 0, B, N to MW, None, None, Ir, R, EW		
	24							Shale, dark gray, slight to moderate weathering, very weak becomes gray		
775	25									
	26							becomes green, slight to no weathering, strong with trace brown clay in bedding planes		
	27		R4	13%	30			Coal, black, slight to no weathering, very weak		
	28							Mudstone, black to dark gray, slight to moderate weathering, medium strong		
	29							becomes gray		
770	30									
	31									
	32		R5	68%	87					
	33									
	34									
765	35							becomes with sand, trace mica (muscovite)		**Bentonite seal**
	36							becomes slightly fissile		
	37		R6	45%	100			2-inch gray sandstone seam becomes wavy bedding		
	38							becomes without wavy bedding, without muscovite		**Filter sand**
	39									
760	40							becomes with sand, semi-fissile		**SCH 40 PVC 2" diameter 0.01" slotted screen**
	41									
	42		R7	52%	92			Quartz sandstone with biotite and muscovite, slight weathering, medium strong, ~15° dip, cross bedded		
								Fracture #4: 15%, B, T, Ca, Pa, Pl, SR, VC		
	43									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-1 (MW-1201)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44		R7	52%	92						Filter sand
755	45										
	46										
	47		R8	85%	100						
	48										
	49										
750	50							End of Boring at 49.5´ bgs			
	51										
	52										
	53										
	54										
745	55										
	56										
	57										
	58										
	59										
740	60										
	61										
	62										
	63										
	64										
735	65										
	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-2/SB-1 (MW-1202)

Date(s) Drilled	**4/13/12**	Logged By	**S. Becker**	Checked By	**J. Lach/V. Gautam**
Drilling Method	**HSA, HQ Wireline Core**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**44.5 feet**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**849.6 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1202**	Sampling Method(s)	**Split-spoon, HQ Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Water level @ 28.85 ft bgs**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0									Grout
	1	SS	SS-1	2 3 3 3	100	1.5 3.5 2.0 1.5		Loose, moist, brown, sandy CLAY (SC), trace gravel (topsoil) Loose, moist, brown sandy CLAY (SC), trace gravel [RESIDUUM] becomes mottled brown and gray		SCH 40 PVC 2" diameter riser
	2									
	3	SS	SS-2	3 4 5 5	83	2.5 2.5 2.75 2.5		Stiff to very stiff, moist, tannish brown and gray mottled fat CLAY (CH), trace sand, trace gravel [RESIDUUM] becomes reddish brown and gray mottled		
	4							becomes with weathered brown shale fragments		
845	5	SS	SS-3	2 4 5 6	21					
	6	SS	SS-4	4 6 8 9	13	3.25		becomes without shale fragments, hard		
	8	SS	SS-5	3 6 9 12	58	3.0 4.5 4.5 3.5		becomes gray and tan mottled, without sand, dry to moist, without gravel		
840	10	SS	SS-6	3 5 8 11	79	4.25 3.0 2.5		becomes light gray becomes brownish red		
	12	SS	SS-7	6 10 13 12	63	4.0 4.5 4.5		becomes gray to light gray, without silt		
835	14	SS	SS-8	6 16 16 24	75	>4.5		Shale, greenish gray, highly weathered, very to extremely weak		
	16	SS	SS-9	24 49 50/4"	75			becomes brownish gray, dry becomes greenish gray		
830	18									*18 to 20 ft bgs - No Split Spoon Collected*
	20									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-2/SB-1 (MW-1202)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21	SS	SS-10	9 12 15 16	96					SCH 40 PVC 2" diameter riser
	22	SS	SS-11	50/4"	63					
	23									
	24									*Augered 24-25 ft bgs to begin setup for wireline coring*
825	25							22.4 to 25 ft, bgs - No Recovery - HSA Only becomes with 1-2" weathered limestone 25 ft, bgs - Begin HQ Rock Coring		
	26							becomes with iron-stained lamina, slightly to moderately weathered, strong to very strong		
	27	R	R1	41%	48					*Dry run* *No water*
	28									**Bentonite seal**
	29									
820	30							Quartz sandstone, gray, slightly to moderately weathered, strong, micaceous (muscovite), with iron-staining, thinly bedded		*Dry run* *No water*
	31							becomes with biotite Fracture #1: 0, B, T-N, Fe, Su, Ir, SR, M		**Filter sand**
	32	R	R2	27%	70			Fracture #2: 0, B, T, Fe, Su, Ir, SR, VC		**SCH 40 PVC 2" diameter 0.01" slotted screen**
	33									
	34							becomes wet		
815	35									*Water used*
	36							becomes without iron staining, no weathering, very strong to strong Fracture #3: 0, B, T-VN, --, No, Pl-Wa, SR, VC		
	37	R	R3	98%	103			Fracture #4: 0, B, MW-W, Fe, Su, Pl-Wa, R, M		
	38									
	39									
810	40									
	41									
	42	R	R4	68%	98			Shale, greenish gray, no weathering, very weak		
	43							Fracture #5: 0, B, T, Cl-No, Su -No, Pl, S-SR, VC		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-2/SB-1 (MW-1202)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44	R4	68%	98						Filter sand
805	45						End of Boring at 44.5´ bgs			
	46									
	47									
	48									
	49									
800	50									
	51									
	52									
	53									
	54									
795	55									
	56									
	57									
	58									
	59									
790	60									
	61									
	62									
	63									
	64									
785	65									
	66									

Project: AEP Big Sandy Landfill Investigation	Log of Boring HB-3 (MW-1206)
Project Location: Louisa, KY	
Project Number: 13815141.10000	Sheet 1 of 6

Date(s) Drilled	**4/23/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**Rotosonic (No vibration), Wireline**	Drill Bit Size/Type	**8.0" ID steel casing, 4.0" ID core barrel**	Total Depth of Borehole	**124.5 feet**
Drill Rig Type	**Versa-Sonic**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**695.4 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1206**	Sampling Method(s)	**Rotosonic Core Barrel**	Hammer Data	**Not Applicable**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
695	0						See log for PB-7 from 0-111 ft bgs			**Bentonite chips**
	1									
	2									
	3									**SCH 40 PVC 2" diameter riser**
	4									
690	5									
	6									
	7									
	8									
	9									
685	10									
	11									
	12									
	13									
	14									
680	15									
	16									
	17									
	18									
	19									
	20									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
675	20								
	21								Bentonite chips
	22								
	23								SCH 40 PVC 2" diameter riser
	24								
	25								
670	26								
	27								
	28								
	29								
	30								
665	31								
	32								
	33								
	34								
	35								
660	36								
	37								
	38								
	39								
	40								
655	41								
	42								
	43								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44									
	45									Bentonite chips
650	46									
	47									SCH 40 PVC 2" diameter riser
	48									
	49									
	50									
645	51									
	52									
	53									
	54									
	55									
640	56									
	57									
	58									
	59									
	60									
635	61									
	62									
	63									
	64									
	65									
630	66									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	67									Bentonite chips
	68									
	69									SCH 40 PVC 2" diameter riser
	70									
625	71									
	72									
	73									
	74									
	75									
620	76									
	77									
	78									
	79									
	80									
615	81									
	82									
	83									
	84									
	85									
610	86									
	87									
	88									
	89									
	90									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES Type Number	SAMPLES Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES Recovery, %	SAMPLES Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
605	91								Bentonite chips
	92								
	93								SCH 40 PVC 2" diameter riser
	94								
	95								
600	96								
	97								
	98								
	99								
	100								
595	101								
	102								
	103								
	104								
	105								
590	106								
	107								
	108								
	109								Bentonite seal
	110								
585	111				0.5		Soft, moist to wet, dark gray to dark greenish gray, sandy lean CLAY (CL) [ALLUVIUM]		
	112	CB-1		90	0.5				# 5 filter sand
	113						becomes greenish gray, trace oxidized red and gray		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	114					2.5		becomes very stiff with sand seams		SCH 40 PVC 2" diameter 0.01" slotted screen
						2.5				
	115							becomes with trace gray to dark gray sandstone fragments		
580						2.75				
	116									
						2.25				
	117	CB	CB-1		90					
						3.0				
	118									
						2.5				
	119									# 5 filter sand
						2.5				
	120							becomes greenish brown		
575						4.5				
	121									
						1.5		becomes brownish gray, intermittent sandy clay seams		
	122									
						2.0		becomes with trace sandy shale and sandstone cobbles and gravel		
	123	CB	CB-2		95					*Install MW-1206 at 123.5 ft on 4/24/2012*
						1.25		becomes stiff, grayish brown		*Clay expansion to 123.6 ft overnight*
	124									
								End of Boring at 124.5´ bgs		*Core barrel refusal at 124.5 ft bgs*
	125									
570										
	126									
	127									
	128									
	129									
	130									
565										
	131									
	132									
	133									
	134									
	135									
560										
	136									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-4/SB-5 (MW-1204)

Date(s) Drilled	**4/18/12**	Logged By	**J. Lach**	Checked By	**V. Gautam**
Drilling Method	**HSA, HQ Wireline Coring**	Drill Bit Size/Type	**6 1/4" HSA, 6" OD bit with HQ core**	Total Depth of Borehole	**35.0 feet**
Drill Rig Type	**CME 550 Truck**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**721.3 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1204**	Sampling Method(s)	**Split-spoon, HQ Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0									2.5 ft stickup
				6				Light brown, heavily weathered sandstone (access road)		Grout 20% mix ~30 gallons used
	1			22	86	>4.5		Hard, dry, light brown, lean CLAY (CL) [RESIDUUM OR FILL]		
720				42						
	2			50/3				Light brown, heavily weathered sandstone with some lean clay, dry (Auger Cuttings)		SCH 40 PVC 2" diameter riser
	3									*No recovery - HSA cuttings consist of mixture of lean clay and heavily weathered sandstone fragments - all dry*
	4									
	5							Brown fine to medium grained sandstone, moderately weathered, strong		*Auger refusal at 5.0 ft bgs*
	6							Mudstone, greenish brown, moderately weathered, weak Fracture #1: 0, B, No, W, VN, Pl, SR		
715										
	7							Fracture #2: 0, B, No, W, VN, Pl, SR		
	8		R1	18%	70					
	9							2" brown lean clay seam Fracture #3: 0, B, No, W, VN, Pl, SR		
	10							becomes lightly weathered, extremely weak, micaceous, with iron staining		
	11									
710										
	12		R2	22%	23					*Driller reported constant down pressure. Little to no H20 loss*
	13									
	14							Greenish gray, micaceous sandstone, strong		
								becomes brown, moderately weathered (14.5 to 14.6 ft)		
	15							becomes greenish gray, very strong		
								becomes brown, slightly weathered		Bentonite Hydrated
	16									
705								becomes greenish gray, micaceous, cross-bedded, very weak		
	17							Fracture #4: 0, B, No, W, VN, Pl, SR		
	18		R3	85%	90					#5 filter sand
								becomes mottled with partial brown iron staining and greenish gray, strong in brown stained portions		
	19									
	20							becomes greenish gray, weak, with iron staining		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-4/SB-5 (MW-1204)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20							becomes greenish gray, micaceous, weak		SCH 40 PVC 2" diameter 0.1" slotted screen
	21									
700								Fracture #5: 0, B, No, W, VN, Pl, SR		
	22							becomes brown, coarse, very strong, micaceous		
								becomes greenish gray, strong, very micaceous, wet,		#5 filter sand
	23	R	R4	65%	82			coarse grained		
								becomes brown, coarse, very strong		
	24							becomes dark brown, moderately weathered, strong		
								becomes light gray, coarse, very strong with some		
	25							sections of slight weathering, brown		
	26									
695										
	27							becomes gray, coarse-grained, micaceous, weak with		
		R	R5	80%	100			stained sections (strong where stained)		
	28									
	29							Fracture #6: 90, J, Su, W, VN, Ir, VR		
	30							Fracture #7: 0, B, No, W, VN, Pl, SR		2" diameter sump
	31							Gray shale, fissile, strong		
690								Gray mudstone, very weak, slightly fissile		
	32									
		R	R6	75%	88			becomes with decreasing fissility		
	33							Gray shale, fissile, weak		
								becomes with brown staining		
	34							Gray mudstone, very weak, not fissile		
	35							End of Boring at 35´ bgs		
	36									
685										
	37									
	38									
	39									
	40									
	41									
680										
	42									
	43									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-5 (MW-1205)

Date(s) Drilled	**4/19/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**HSA, HQ Wireline Coring**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**54.5 feet**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**714.3 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1205**	Sampling Method(s)	**Split-spoon, HQ Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0	SS	SS-1	2, 1, 2, 1	100			Very loose, moist, black bottom ash, trace gravel [BOTTOM ASH]		**Bentonite grout**
	1									**SCH 40 PVC 2" diameter riser**
	2	SS	SS-2	2, 1, 3, 4	33	2.0		Medium stiff to very stiff, moist, brown to tan lean CLAY (CL) with sand and trace gravel [RESIDUUM]		
	3									
710	4									
	5	SS	SS-3	9, 5, 8, 8	100	2.75, 1.0, 2.75, 1.5		3" red sand seam		*Shelby tube sample 5-7' bgs Down pressure (psi) = 200-600 psi*
	6							Stiff to very stiff, moist, reddish-brown fat CLAY (CH), trace sand [RESIDUUM]		
	7	SS	SS-4	9, 6, 7, 8	83	2.0, 1.75, 3.5, >4.5		becomes with trace tan-brown shale fragments		
	8							Shale, tan, moderate to highly weathered, weak to extremely weak, dry to moist		
705	9	SS	SS-5	8, 15, 12, 12	75					
	10							becomes dry		
	11	SS	SS-6	4, 17, 23, 19	100					
	12									
	13	SS	SS-7	21, 28, 29, 35	83					
700	14									
	15	SS	SS-8	11, 20, 21, 20	100			becomes white/gray		
	16	SS	SS-9	50/3"	100			becomes greenish gray		*Outside of spoon wet*
	17									
	18									
	19									
695	20	R	R1	17%	37			becomes gray, slight weathering, very weak to extremely weak		*Auger to 19.5 ft to begin coring.*

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-5 (MW-1205)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21									SCH 40 PVC 2" diameter riser
	22		R1	17%	37					
	23									Bentonite grout
	24									
690								becomes red		
	25									
	26							becomes black and red		
	27		R2	47%	70					
	28							becomes gray		
	29									
685										
	30							Fracture #1: 0, B, T, Cl-No, Su-No, Pl, S, M-W		
	31									
	32		R3	35%	57					
	33									
	34									
680										
	35									
	36							becomes sandy		Bentonite chips
	37		R4	0%	100			Sandstone, gray, moderately to highly weathered, weak to medium strong, micaceous, thinly bedded		
	38							Fracture #2: 0, B, T, Cl-No, Su-No, Pl, S, M		Filter sand
	39									
675										
	40									SCH 40 PVC 2" diameter 0.01 slotted screen
	41		R5	42%	100					
	42							becomes slightly-moderately weathered		
	43									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-5 (MW-1205)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44		R5	42%	100					
670	45									
	46									SCH 40 PVC 2" diameter 0.01 slotted screen
	47		R6	55%	93					
	48									
	49									
665	50									Filter sand
	51									
	52		R7		100			Sandy shale, gray, moderately weathered, moderately strong to weak		
	53							becomes less sandy		
	54							coal seam, 2" coal seam, 3"		
660								End of Boring at 54.5´ bgs		
	55									
	56									
	57									
	58									
	59									
655	60									
	61									
	62									
	63									
	64									
650	65									
	66									

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Sheet 1 of 8

Date(s) Drilled	**4/24/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**Rotosonic (No vibration), Wireline HQ**	Drill Bit Size/Type	**8" ID steel casing, 6" OD bit HQ Wireline**	Total Depth of Borehole	**166.0 feet**
Drill Rig Type	**Vibra-Sonic**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**695.0 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1207**	Sampling Method(s)	**HQ Wireline**	Hammer Data	**Not applicable**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
695	0						See log for boring PB-7		**Bentonite grout**
	1								**SCH 40 PVC 2" diameter riser**
	2								*Augered to 126 ft without sampling*
	3								
	4								
690	5								
	6								
	7								
	8								
	9								
685	10								
	11								
	12								
	13								
	14								
680	15								
	16								
	17								
	18								
	19								
675	20								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
675	20									
	21									SCH 40 PVC 2" diameter riser
	22									Bentonite grout
	23									
	24									
670	25									
	26									
	27									
	28									
	29									
665	30									
	31									
	32									
	33									
	34									
660	35									
	36									
	37									
	38									
	39									
655	40									
	41									
	42									
	43									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44								SCH 40 PVC 2" diameter riser
650	45								
	46								Bentonite grout
	47								
	48								
	49								
645	50								
	51								
	52								
	53								
	54								
640	55								
	56								
	57								
	58								
	59								
635	60								
	61								
	62								
	63								
	64								
630	65								
	66								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	67									SCH 40 PVC 2" diameter riser
	68									
	69									Bentonite grout
625	70									
	71									
	72									
	73									
	74									
620	75									
	76									
	77									
	78									
	79									
615	80									
	81									
	82									
	83									
	84									
610	85									
	86									
	87									
	88									
	89									
605	90									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	91									SCH 40 PVC 2" diameter riser
	92									
	93									Bentonite grout
	94									
600	95									
	96									
	97									
	98									
	99									
595	100									
	101									
	102									
	103									
	104									
590	105									
	106									
	107									
	108									
	109									
585	110									
	111									
	112									
	113									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	114									SCH 40 PVC 2" diameter riser
580	115									Bentonite grout
	116									
	117									
	118									
	119									
575	120									
	121									
	122									
	123									
	124									
570	125									
	126	HQ1		0%	0			No recovery 126-131. Driller notes "softer material"		
	127									
	128									
	129									
565	130									
	131	HQ2		0%	0			No recovery 131-136. Shale cuttings		
	132									
	133									
	134									
560	135									
	136	HQ3		18%	80			Shale, light gray to gray, moderately weathered, very to extremely weak		

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	137							Fracture #1: 0, B, N-T, Cl, SP, Pl, S-SR, VC-M		SCH 40 PVC 2" diameter riser
	138									
	139	HQ	3	18%	80					Bentonite grout
555	140							becomes with trace gray sandstone layers (occasional), up to 1/4"		
	141									
	142									
	143	HQ	4	0%	50					
	144									
550	145							becomes dark gray to greenish gray, without sandstone seams		
	146									
	147							becomes dark gray to black		
	148							becomes light gray		
	149	HQ	5	38%	38					
545	150									Bentonite seal
	151							3" layer of light gray, moist clay, with shale fragments		
	152									
	153							becomes interbedded with gray micaceous sandstone layers up to 1/4"		#5 filter sand
	154	HQ	6	37%	83					
540	155									SCH 40 PVC 2" diameter 0.01" slotted screen
	156							6" sandstone, gray, slightly weathered, strong, thinly bedded to shaly		
	157							becomes extremely weak, highly fractured		
	158	HQ	7	25%	73					
	159							interbedded sandstone up to 1/4"		
535	160							becomes dark gray, with thin light gray clay deposits on bedding		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
		HQ	HQ7	25%	73					
	161							Sandstone, gray, moderately weathered medium strong to very strong, flaggy, with thinly interbedded shale, micaceous		SCH 40 PVC 2" diameter 0.01" slotted screen
	162									
	163							Fracture #2: 0, B, T-VN, Cl, SP, Pl, S-SR, VC-M		#5 filter sand
		HQ	HQ8	42%	100					
	164									
530	165									
	166							End of Boring at 166´ bgs		
	167									
	168									
	169									
525	170									
	171									
	172									
	173									
	174									
520	175									
	176									
	177									
	178									
	179									
515	180									
	181									
	182									
	183									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-7/SB-2 (MW-1203)

Date(s) Drilled	**4/16/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**HSA, HQ Wireline Coring**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**54.5 feet**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**728.7 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1203**	Sampling Method(s)	**Split-spoon/Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0			3				Loose, moist, brown clayey SAND (SC), trace sandstone gravel [FILL]		Grout
	1	SS	SS-1	2 2 4	50	0.75 1.5				SCH 40 PVC 2" diameter riser
	2			4				Stiff to very stiff, moist, reddish brown, lean CLAY (CL) [FILL]		
	3	SS	SS-2	4 5 6	71	3.5 3.0 3.0		1" red-brown medium sand seam 2" medium reddish brown sand seam with sandstone fragments		
725	4			3		3.5		becomes with sandstone fragments (gravel) with red-brown sand iron-staining		
	5	SS	SS-3	4 7 7	83	4.5 4.5 3.5				
	6			14		4.5		Dense, dry to moist, red to brown, sandy clayey GRAVEL (GC-SC) [ALLUVIUM]		*Iron staining on sand and gravel*
	7	SS	SS-4	15 17 20	92	4.5 >4.5 >4.5				
	8			7		4.0		becomes mottled brown and orange		
720	9	SS	SS-5	12 13 16	100	4.0 4.5 4.0				
	10			5						
	11	SS	SS-6	13 14 12	100			becomes increasing sand and gravel content		
	12			11		3.5		Very stiff to hard, moist red-brown fat CLAY (CH) trace sand and gravel [ALLUVIUM]		
	13	SS	SS-7	17 27	92	3.25 3.5				
715	14			17		>4.5		4" reddish brown sand layer with trace clay		
	15	SS	SS-8	3 6 10 8	100	1.0 2.0 3.0		Medium stiff to stiff, moist, red-brown sandy lean CLAY (CL) trace weathered sandstone gravel [ALLUVIUM]		
	16			23		1.0				
	17	SS	SS-9	15 13 12	83	3.0 2.5 3.5		2" sandstone fragment in spoon		
	18			4				Loose, moist to wet, red-brown clayey SAND (SC), trace sandstone gravel [ALLUVIUM]		
710	19	SS	SS-10	3 6 6	63					
	20									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-7/SB-2 (MW-1203)

Elevation, feet	Depth, feet	SAMPLES: Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20			9				becomes brown		Grout
	21	SS	SS-11	4 5 24	58					SCH 40 PVC 2" diameter riser
	22			11				becomes medium dense		
	23	SS	SS-12	10 12 9	100					
705	24			4		3.5		Hard, moist, tan and brown mottled lean CLAY (CL), trace sand [RESIDUUM]		
	25	SS	SS-13	8 10 17	83	4.5 >4.5 >4.5				
	26	SS	SS-14	40 50/4"	40			Shale, greenish tan, moderately weathered, extremely weak		
	27									
	28	SS	SS-15	50/4"	50			becomes greenish gray, slightly-moderately weathered		
700	29									
	30							Fracture#1: 0, B, T, Cl-No, Su-No, Ir, S-SR, VC		
	31							becomes brown		
	32	R	R1	44%	78			becomes mottled gray, light brown and red Fracture#2: 38, Sh, T, Cl, Su, Pl, S, VC		
	33							Fracture#3: 30, Sh, N, Cl, Su, Pl, S, VC		Bentonite seal
695	34							becomes greenish gray		
	35									Filter sand
	36									
	37	R	R2	58%	85			Sandstone, gray with very light black banding, slightly weathered, strong, micaceous (muscovite and biotite)		SCH 40 PVC 2" diameter 0.01" slotted screen
	38									
690	39							Fracture#4: 0, B, MW, No, No, St, SR-S, C		
	40							Fracture#5: 0, B, T, No-Sd, Sp, Pl, S-SR, VC		
	41	R	R3		100					
	42							Fracture#6: 25, Sh, T, Fe, Su, Pl-Wa, SR, VC		
	43							7" area Fe staining		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-7/SB-2 (MW-1203)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
685	44		R3		100			Fracture#7: 25, Sh, T, Cl, Pa, Pl, SR, VC 5" Fe staining 12" Fe staining			SCH 40 PVC 2" diameter 0.01" slotted screen
	45										
	46							Fracture#8: 0-15, B, T, Fe, Su, Pl, SR, VC			
	47		R4	70%	100			Fe staining			Filter sand
	48										
680	49										
	50										
	51										
	52		R5	92%	92						
	53										
675	54										
	55							End of Boring at 54.5´ bgs			
	56										
	57										
	58										
670	59										
	60										
	61										
	62										
	63										
665	64										
	65										
	66										

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
PB-1

Sheet 1 of 3

Date(s) Drilled	**4/18/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**Rotary/Water**	Drill Bit Size/Type	**4"**	Total Depth of Borehole	**57.0 feet**
Drill Rig Type	**Acker**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**Top of water el. 685 ft above msl**
Borehole Backfill	**Cement Bentonite Grout**	Sampling Method(s)	**Piston tube/Split-spoon**	Hammer Data	**140#/30" Manual drop**
Boring Location		Groundwater Level(s)	**0' bgs**		

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
685	0						Water ▽			*Barge drilling- water @ 685.*
	1									
	2									
	3									
	4									
680	5									
	6									
	7									
	8									
	9									
675	10									
	11									
	12									
	13									
	14									
670	15									
	16									
	17									
	18									
	19									
665	20									

Project: AEP Big Sandy Landfill Investigation
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Log of Boring PB-1

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
665	20										
	21										
	22										
	23							Soft sediments			*Top of sediment @ 22.5 ft. Casing sank to 27.5 ft.*
	24										
660	25										
	26										
	27							Loose, wet fly ash as silty sand (SM) [FLY ASH]			
	28	SS	SS-1	1 WH 0 0	38						
	29										
655	30										
	31	P	P-1		91						
	32										
	33										
	34										
650	35										
	36	P	P-2		77						
	37										
	38	SS	SS-2	3 6 8 5	100						
	39										
645	40										*Rods sank to 42'*
	41										
	42							12" loose, wet, fly ash as silt (ML), trace fine sand [FLY ASH]			
	43					<0.5					

Project: AEP Big Sandy Landfill Investigation
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Log of Boring PB-1

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44					2.0		Soft, moist, dark gray, lean CLAY (CL) [ALLUVIUM] becomes stiff, yellow, some sand, trace gravel			
640	45			3				becomes very stiff, yellow brown with orange iron staining, with sand, trace gravel			
	46	SS-3		3 4 5	38	2.5					
	47										
	48										
	49										
635	50			6				becomes stiff to very stiff, sandy, trace gravel			
	51	SS-4		7 12 12	33	1.0 2.5					
	52										
	53										
	54							Shale, gray, dry, crushed			*Drilling change encountered @ 53.5 ft bgs*
630	55										
	56	SS-5		45 50/2"	33						
	57							End of Boring at 57´ bgs			
	58										
	59										
625	60										
	61										
	62										
	63										
	64										
620	65										
	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring
PB-2

Date(s) Drilled	**4/17/12-4/18/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**Rotary/Water**	Drill Bit Size/Type	**4"**	Total Depth of Borehole	**77.0 feet**
Drill Rig Type	**Acker**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**Top of water el. 685 ft above msl**
Borehole Backfill	**Bentonite chips**	Sampling Method(s)	**Piston/Split-spoon/Shelby-tube**	Hammer Data	**140#/30" Manual drop**
Boring Location		Groundwater Level(s)	**0 ft bgs**		

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
685	0						Water			*Pond elevation - 685 ft*
	1									
	2									
	3									
	4									
680	5									
	6									
	7									
	8									
	9									
675	10									
	11									
	12									
	13									
	14									
670	15									
	16									
	17									
	18									
	19									
665	20									

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Log of Boring PB-2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
665	20										
	21										
	22										
	23							Soft sediments			*Pond bottom @ 23' bgs*
	24										
660	25										*Casing sank to 25'*
	26		SS-1	2 1 2 3	17			Very loose, wet, gray bottom ash as medium to fine SAND (SP-SM) with some gravel and shale fragments, trace plant fragments [BOTTOM ASH]			
	27										
	28										
	29										
655	30							Loose, wet, fly ash as silty SAND (SM), light and dark laminations [FLY ASH]			
	31		P-1		0						
	32										*1 blow for 24 inches*
	33		SS-2	1 0 0 0	0						
	34										
650	35										
	36										
	37										
	38		P-2		91						
	39										
645	40		SS-3	2 1 1 2	27						
	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
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Log of Boring PB-2

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44										
640	45										*Push to 45' bgs - casing sank to 46' bgs*
	46							becomes gray, with silty sand			
	47	SS	4	1 0 0 0							
	48										
	49										
635	50	P	3		99						
	51							becomes with silt and some fine black sand			
	52	SS	5	WH 0 0 0	100	>1.0		Very soft to stiff, moist, dark gray, lean CLAY (CL) [ALLUVIUM]			
	53										
	54										
630	55							becomes yellow			
	56	P	4								
	57							becomes soft, moist, grey/yellow, some silt, trace gravel, sand at base - root			
	58	SS	6	3 3 6 14	75	0.5 1.0		becomes stiff			
	59										
625	60										
	61	ST	1		50						
	62							becomes stiff, yellow brown with orange mottles, with gravel and trace sand			
	63	SS	7	7 8 9 5	25	1.5 2.0					
	64										
620	65										
	66	SS	8	3 WR WR	33	0.5		Loose, moist, orange brown with gray mottles, sandy CLAY (SC), trace gravel [ALLUVIUM]			

Project: AEP Big Sandy Landfill Investigation
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Log of Boring
PB-2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	67			6							*End at 67' 4/17/12* *Start on 4/18/12* *Begin by drilling to 70'*
	68										
	69							Very stiff, moist, yellow brown with gray mottles, lean CLAY (CL), some sand and gravel [RESIDUUM]			
615	70			5							
	71		SS-9	7 13	38	2.5 3.0					
	72			11							
	73										
	74							Shale, light gray, moderately weathered, dry			
610	75										
	76		SS-10	50/3"	13						
	77							End of Boring at 77´ bgs			
	78										
	79										
605	80										
	81										
	82										
	83										
	84										
600	85										
	86										
	87										
	88										
	89										
595	90										

Project: AEP Big Sandy Landfill Investigation
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Log of Boring PB-3

Sheet 1 of 5

Date(s) Drilled	**4/9/12-4/10/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary with recirculated mud**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricore mud-rotary**	Total Depth of Borehole	**93.0 feet**
Drill Rig Type	**CME 55 Track Mounted and ATV-remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**698.3 ft above msl**
Borehole Backfill	**Finished as 2" PVC riser pipe set w/ grout**	Sampling Method(s)	**Split-spoon/Piston/Shelby-tube**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**4' ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0							Bottom ash access road [BOTTOM ASH]		2.5' stickup; Grout
	1									SCH 40 PVC 2" diameter riser
	2									
	3									*Augered to 6' without sampling*
695	4								▽	
	5									
	6	SS	SS-1	1 2 WOH 1	63			Very loose, wet, fly ash as interbedded light and dark sandy SILT (ML) and silty SAND (SM), trace root fibers [FLY ASH]		
	7									
690	8	SS	SS-2	1 2 1 1						
	9									
	10									
	11									
	12									
	13	SS	SS-3	WOH 0 0 0	79			becomes without root fibers		
685	14									
	15									
	16									
	17									
	18	SS	SS-4	WOR 0 0 1	75					
680	19									
	20									

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Log of Boring PB-3

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21		P-1		71					
	22									
	23									
675	24		SS-5	WOH 0 0 0	0					
	25									
	26									
	27							Medium dense, moist, dark gray trace brown, bottom ash as medium to fine sand (SM), trace coal gravel [BOTTOM ASH]		*Increased drilling resistance @ 27' bgs*
	28		SS-6	7 13 13 14	67					
670	29									
	30							Wet, light to dark gray, fly ash as silty SAND (SM) to silt (ML) [FLY ASH]		
	31									
	32									
	33		P-2		0			Very loose, wet, black, bottom ash and coal fragments as coarse SAND (SP-SM) with gravel [BOTTOM ASH]		
665	34									
	35									
	36									
	37									
	38		P-3		0					
660	39									
	40							becomes black and gray, medium to coarse, with gravel		
	41		SS-7	1 1 1 2	100					
	42							becomes gravelly		*coal gravel up to 7/8"*
	43		SS-8	1	8					
655										

Project: AEP Big Sandy Landfill Investigation
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Log of Boring PB-3

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44	SS	8	0 1 0	8					
	45									
	46									
	47									
650	48	SS	9	1 0 0 0	0					*Sample @ 47.5-49.5' bgs was driven to 50.5' bgs with 1 blow*
	49									
	50									
	51									
	52									
	53	SS	10	WOH 0 1 1	0			becomes coarse to fine		
645	54									
	55									
	56							Very loose, wet, light gray, fly ash as sandy SILT (ML) with interbedded fine sand [FLY ASH]		
	57									
	58	P	4		67					
640	59									
	60									
	61									
	62									
	63	SS	11	1 1 1 3	92			becomes with minor interbedded silty sand-laminations		
635	64									
	65									
	66									

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URS

Project: AEP Big Sandy Landfill Investigation
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Log of Boring PB-3

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									
	68	P	5		83					
630	69									
	70									
	71									
	72									
	73									
625	74							Loose, moist, brown and black, clayey SAND (SC) with decayed plant matter (topsoil)		
	75	SS	12	4 5 5 7	58	1.75 <0.5 1.25		becomes sandy silty clay (CL-ML), trace reddish brown root fibers Soft to stiff, moist, brown with gray mottling sandy lean CLAY (CL) [ALLUVIUM]		
	76									
	77									
	78	ST	1	4 5 5 7	79			Medium dense, moist, variably brown with dark gray and gray mottling, gravelly clayey SAND (SC) [ALLUVIUM]		
620	79									*1 5/8" sandstone on bottom of tube*
	80	SS	13	18 6 6 9	33					
	81									
	82									
	83	SS	14	8 11 17 20	50			Medium dense, moist, variably brown with gray mottling, oxidation staining, clayey GRAVEL (GC), as completely to highly weathered sandstone, horizontal bedding [RESIDUUM]		
615	84									
	85									
	86							Medium dense, moist, variably brown with gray mottling, clayey SAND (SC), with gravel as completely weathered sandstone [RESIDUUM]		
	87									
	88	SS	15	4 6 12 15	100					
610	89									
	90									

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Log of Boring
PB-3

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91							Sandy silty shale, gray with oxidation staining, moderately weathered, weak		
	92									
	93	SS	SS-16	50/4.5"	100					
605	93							End of Boring at 93´ bgs		*Set PVC casing at 93' bgs. Cement-bentonite grout placed using tremie pipe*
	94									
	95									
	96									
	97									
	98									
600	99									
	100									
	101									
	102									
	103									
595	104									
	105									
	106									
	107									
	108									
590	109									
	110									
	111									
	112									
	113									
585										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring PB-4

Sheet 1 of 5

Date(s) Drilled	**4/11/12-4/13/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricone bit**	Total Depth of Borehole	**112.2 feet**
Drill Rig Type	**CME 55 Rubber Track ATV, Remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**700.0 ft above msl**
Borehole Backfill	**2" PVC riser pipe set with grout**	Sampling Method(s)	**Piston/Split-spoon/Shelby-tube**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Encountered at 7.6' bgs ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
700	0									2.5' stickup
										Grout
	1							Very loose, moist, dark gray bottom ash as coarse to fine SAND (SP-SM), trace gravel [BOTTOM ASH]		*Bottom ash access road*
	2									
	3									
	4									
695	5									
	6	SS	SS-1	2 2 2 2	83					
	7								▽	
	8	SS	SS-2	2 2 2 1	33			Very loose, wet, light gray to dark gray fly ash as silty SAND (SM) with minor interbedded sandy silt (ML) trace cat-tail roots [FLY ASH]		
690	9									
	10									
	11									
	12									
	13							becomes without cat-tails		
	14	SS	SS-3	2 1 1 1	75			becomes horizontally bedded		
685	15									
	16									
	17									
	18									*@ 18' bgs begin open hole mud rotary*
	19	P	P-1		98					
680	20									

Project: AEP Big Sandy Landfill Investigation
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Log of Boring PB-4

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
680	20									*sand becoming finer*
	21	SS	4	WOH 2 2 1	46					
	22									
	23									
	24	SS	5	2 1 1 1	50					
675	25									
	26									
	27									
	28	P	2		54					
	29									
670	30	SS	6	1 2 2 1	58					
	31									
	32									
	33	P	3		50					
	34									
665	35	SS	7	WOH 1 0 1	54					
	36									
	37							becomes mostly sand silt (ML) with minor silty sand (SM)		*Split-spoon intended at 37-39 fell to 43' bgs on WOH.*
	38	SS	8	WOH 0 0 0	58					
	39									
660	40									
	41									
	42									
	43									

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Log of Boring PB-4

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44								
655	45								
	46								
	47								
	48	P-4		50					
	49								
	50	SS-9	WOH 0 0 1	67					
650	51								
	52								
	53								
	54								
	55						Loose, wet, variably gray, trace brown bottom ash as medium fine SAND (SP-SM), trace gravel, with interbedded minor fly ash as sandy silt (ML), mostly laminated [BOTTOM ASH]		
645	56								
	57								
	58	SS-10	3 4 4 4	71					
	59								
	60								
640	61						Very loose, wet, gray, fly ash as fine silty SAND (SP-SM), with minor interbedded sandy silt [FLY ASH]		
	62								
	63	P-5		98					
	64								
	65	SS-11	WOH 0 1 0	63					
635	66								

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Log of Boring PB-4

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									
	68									
	69							becomes mostly sandy SILT (ML), with minor interbedded silty sand (SM) [FLY ASH]		
630	70									
	71									
	72			1						
	73		SS-12	0 0 0	75					*1 blow for 6 ft when attempting to sample @ 72-74' bgs. Driven to 78' bgs*
	74									
625	75									
	76									
	77									
	78									
	79									
620	80									
	81							Loose, wet, mostly dark gray with interbedded light gray, bottom ash as medium fine SAND (SP-SM), with interbedded fly ash as fine silty sand to sandy silt [BOTTOM ASH]		*Drilling resistance increases @ 80.5'*
	82			4						
	83		SS-13	4 5 3	58					
	84									
615	85									
	86							Stiff, moist, brown and red sandy lean CLAY (CL), trace gravel as sandstone gravel [ALLUVIUM]		
	87			2		2.0				*Topsoil in slough of sample @ 87-89' bgs.*
	88		SS-14	7 10 11	83	1.5 1.25 2.0		becomes orange-brown		
	89									
610	90		ST-1		100					*400 to 600 psi down pressure*

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Log of Boring PB-4

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91	ST	1		100	2.5		becomes very stiff		
	92							Medium dense, moist, variably orange-brown with trace black and gray mottling, clayey SAND (SC) to sandy lean clay (CL), trace weathered sandstone gravel, trace coal particles [ALLUVIUM]		
	93	SS	15	10 7 7 12	63	2.0 0.75 1.0				
	94									
605	95									
	96									
	97							becomes brownish-gray		
	98	SS	16	WOH 0 14 5	100	0.75 0.75 0.5		Medium stiff, moist, gray with black peat particles, organic CLAY (OH), trace sand seams [ALLUVIUM]		
	99							Medium stiff, moist, dark brownish-gray fibrous PEAT (PT) with interbedded clayey SAND (SC), trace undecayed stems [ALLUVIUM]		
600	100	ST	2		100	0.5				*150 to 300 psi down pressure*
	101									
	102							Medium stiff, moist, brown, organic lean CLAY (OL) with greenish-gray sand seams, trace peat particles [ALLUVIUM]		
	103	SS	17	WOH 0 3 7	83	0.75 0.75 0.75				
	104									
595	105									
	106							Medium dense, moist, greenish-gray with brown oxidation staining, clayey SAND (SC) with horizontally bedded sandstone gravel [Residuum]		*Increased drilling resistance @ 106' bgs.*
	107									
	108	SS	18	11 11 9 11	38					
	109									
590	110									
	111							Sandstone, medium to fine, gray, slightly weathered, medium strong		*Increased drilling resistance @ 111' bgs.*
	112	SS	19	50/1/2"	100			End of Boring at 112.15´ bgs		*Set PVC casing at 112'. Cement-bentonite grout placed using tremie pipe.*
	113									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring PB-5

Sheet 1 of 3

Date(s) Drilled	**4/13/12,4/16/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricone bit**	Total Depth of Borehole	**57.1 feet**
Drill Rig Type	**CME 55 Rubber Track ATV, Remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**700.9 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Encountered 8' bgs ATD, W.L. @ 10.5' bgs on 4/16/12**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0										
700	1							Very loose, moist, dark gray bottom ash as coarse to fine sand (SP-SM to SM), trace gravel [BOTTOM ASH]			Grout
	2										SCH 40 PVC 2" diameter riser
	3										*Bottom ash access road material to 10.5 ft*
	4										*Auger to 7 ft without sampling.*
	5										
695	6										
	7										
	8	SS	SS-1	2 1 1 1	92			becomes wet	▽		
	9										
	10										
690	11							Very loose, wet, light and dark gray fly ash as interbedded fine silty SAND (SM) and sandy SILT (ML) [FLY ASH]			
	12										
	13	SS	SS-2	3 2 1 1	71						
	14										
	15										
685	16										
	17							becomes all fine silty sand, mostly light gray			
	18	SS	SS-3	WOR 0 WOH 0	42						
	19										
	20										

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Log of Boring PB-5

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
680	21									
	22			WOH				becomes interbedded with sandy silt (ML)		*Pushed piston tube in offset borehole 22.5-24.5 ft bgs. 17% recovery*
	23		SS-4	0	17					
	24			0				becomes fine sand in bottom of tube		
	25			1						
675	26									
	27									
	28		P-1		0					
	29			WOH				becomes mostly fine silty sand, with minor interbedded sandy silt		
	30		SS-5	1	79					
670	31			1						
	32			2						
	33									
	34									
	35									
665	36									
	37							Loose, moist, brown with gray mottling, clayey SAND (SC), trace sandstone gravel [Alluvium]		*No fly ash in tube*
	38		P-2		17					
	39			5						
	40		SS-6	3	50					
660	41			3						
	42			3						
	43		SS-7	3	54			Dense, moist, light brown with oxidation staining, medium		

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Log of Boring PB-5

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44	SS	SS-7	5 25 22	54			to fine SAND (SP-SM), with completely weathered sandstone gravel [Alluvium]		
	45									*Lose mud return between 42-47' bgs*
655	46									
	47							Loose, moist, dark brown, clayey SAND (SC) to sandy lean CLAY (CL) with decayed plant matter [Alluvium]		
	48	SS	SS-8	3 4 5 10	75			Loose, moist, light brown, medium to fine SAND (SP-SM) with gravel as completely weathered sandstone [Alluvium]		
	49									
	50									
650	51							Very dense, moist, brown with gray mottling, oxidation staining, gravelly medium fine SAND (SP-SM) as completely to highly weathered sandstone [Residuum]		
	52	SS	SS-9	22 38 46 50/2"	71					
	53									
	54									
	55							Sandstone, fine to medium, gray, slightly weathered to fresh, medium strong		
645	56									
	57	SS	SS-10	50/1/4"	100			End of Boring at 57.1´ bgs		*Set PVC casing at 57' bgs. Cement-bentonite grout placed using tremie pipe*
	58									
	59									
640	60									
	61									
	62									
	63									
	64									
	65									
635	66									

Project: AEP Big Sandy Landfill Investigation
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Log of Boring PB-6

Sheet 1 of 5

Date(s) Drilled	**4/2/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricone bit**	Total Depth of Borehole	**100.0 feet**
Drill Rig Type	**CME 55 Track Mounted Remote-control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**698.6 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon/Shelby-tube**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0						Bottom ash access road [BOTTOM ASH]		2.6' stickup Grout
	1								*Drilled without sampling to 13' bgs.*
	2								
	3								2" SCH 40 PVC riser pipe
695	4								
	5								
	6								
	7								
	8								
690	9								
	10								
	11								
	12								
	13						Very loose, wet, gray with dark gray streaks fly ash as fine silty SAND (SM) [FLY ASH]		
685	14	SS-1	1 2 1 2	25					
	15								
	16								
	17	P-1		75					
	18								
680	19								
	20								

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Project: AEP Big Sandy Landfill Investigation
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Log of Boring PB-6

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21									
	22									
	23							becomes interbedded light and dark gray		*At 23' bgs ~2' heave remove with open end 4" casing*
675	24	SS	SS-2	WOH 1 0 0						
	25									
	26	P	P-2		95					
	27									
	28									
670	29									
	30									
	31									
	32									
	33							becomes mostly gray		
665	34	SS	SS-3	WOH 0 0 1	17					
	35									
	36	P	P-3		0					
	37									
	38									*Drill to 38' to attempt 2nd piston sample ~2' heave @ 36' bgs - no attempt*
660	39									
	40									
	41									
	42									
	43	P	P-4		0					

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Log of Boring PB-6

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
655	44	P-4			0			Very loose, wet, dark gray and black sandy coal as GRAVEL (GM)		
	45									
	46	P-5			88			Loose, wet, light and dark gray fly ash as fine silty SAND (SM) [FLY ASH]		
	47							becomes mostly sandy silt (ML) with interbedded silty clay (CL-ML) [FLY ASH]		
	48	SS-4		3 3 4 3	33					
650	49									
	50									
	51									
	52									
	53									
645	54	P-6			73					
	55									
	56	SS-5		WOH 0 0 0	0			becomes mostly silty SAND (SM), trace decayed root fibers [FLY ASH]		
	57							3/4" brown and gray mottled/layered lean clay (CL)		
	58	SS-6		WOH 1 2 3	92			becoming coarser ash particles		
640	59									
	60									
	61									
	62									
	63							becomes light gray		
635	64	P-7			96					
	65							12" loose, wet, gray fly ash as sandy silt		
	66	SS-7		2 3 5	100			becomes light and dark gray		

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Log of Boring PB-6

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67			6						
	68									
630	69									
	70									
	71									*tube bent*
	72									
	73	P	P-8		100			Wet, brown, silty GRAVEL (GM), as sandstone fragments [ALLUVIUM]		*Fly ash mixed with gravel*
625	74									
	75									
	76									
	77							Stiff, moist, brown with oxidation staining, sandy lean CLAY (CL) to clayey sand (SC), trace gravel, trace root fibers [ALLUVIUM]		*Drilling resistance change @ 76.5' bgs*
	78	S	SS-8	4		1.75				
620	79			7	54	1.5				
	80			7		1.5				
	81			17						
	81	S	ST-1		50			Medium dense, moist, variably brown with oxidation staining, medium to fine SAND (SP-SM), trace gravel as sandstone fragments [ALLUVIUM]		*Shelby tube sample: 250 to 750 psi down pressure*
	82			7						
	83	S	SS-9	6	4					
615	84			9						
	85			9						
	86							Stiff to very stiff, moist, grayish-green, trace oxidation staining, lean CLAY (CL), with sand, trace shale particles [ALLUVIUM]		
	87									
	88							1" clayey sand seam		
610	89	S	SS-10	3	63	1.25				
	90			6		1.5				
				10		2.5				
				10						

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Log of Boring
PB-6

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91									
	92							Loose, moist, greenish-grayish brown to brown with oxidation staining, fine to medium clayey SAND (SC), with interbedded lean clay seams, trace sandstone gravel [ALLUVIUM]		
	93									
605	94	SS	11	5 3 3 5	50	<0.5				
	95									
	96									
	97							Stiff, moist, grayish-brown, sandy lean CLAY (CL), trace peat [ALLUVIUM]		
	98					1.0				
600	99	SS	12	WOR 12 50/3"	100	1.0 1.25		Sandstone, fine, gray with oxidation staining, moderately weathered, very weak to weak		
	100							End of Boring at 100´ bgs		*Set PVC casing @ 100' bgs. Cement-bentonite grout placed using tremie pipe.*
	101									
	102									
	103									
595	104									
	105									
	106									
	107									
	108									
590	109									
	110									
	111									
	112									
	113									

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Log of Boring PB-7

Sheet 1 of 6

Date(s) Drilled	**4/17/12-4/19/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricore mud-rotary**	Total Depth of Borehole	**127.0 feet**
Drill Rig Type	**CME 55 Tracked ATV**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**695.3 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Encountered 8' ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
695	0							Bottom ash access road [BOTTOM ASH]		2.5' stickup; Grout
	1									
	2									*Augered to 8' without sampling.*
	3									
	4									2" SCH 40 PVC riser pipe
690	5									
	6									
	7									
	8								▽	
	9	SS	SS-1	2, 1, 1, 1	58			Very loose, wet, light gray with interbedded dark gray fly ash as mostly fine SAND (SP-SM to SM) with interbedded minor sandy SILT (ML) [FLY ASH]		
685	10									
	11									
	12									
	13							becomes mostly sandy silt (ML)		
	14	SS	SS-2	1, 0, 0, 0	67					
	15									
680	16									
	17									
	18									
	19	SS	SS-3	1, 0, 1, 1	58					
	20									

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Project: AEP Big Sandy Landfill Investigation
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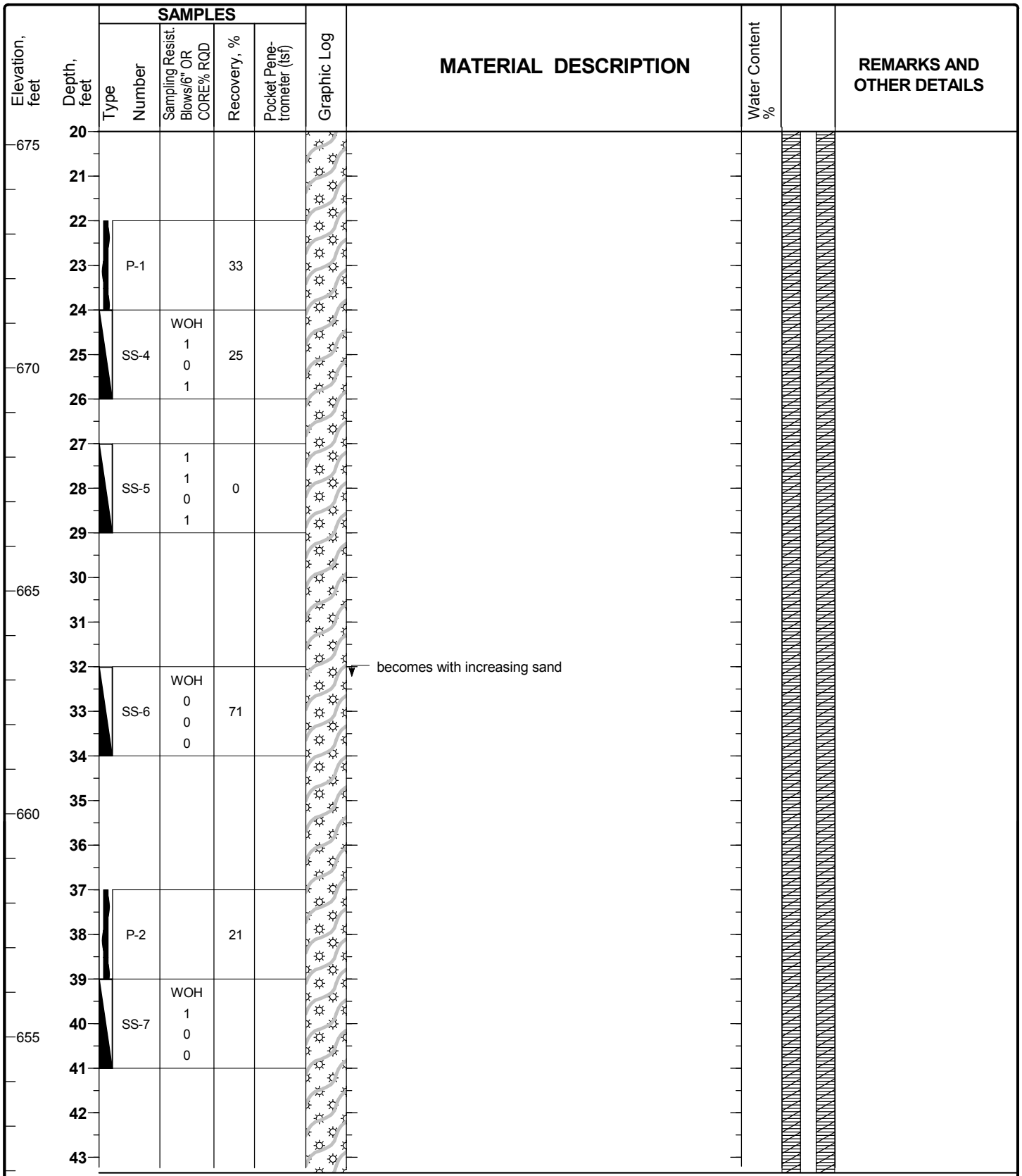
Log of Boring PB-7



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Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44								
	45								
650	46								
	47	P-3		31			becomes with trace root fibers		*Piston tube bent.*
	48								
	49								
	50								
645	51								
	52	P-4		75			becomes without root fibers		
	53								
	54	SS-8	1 2 2 3	67			becomes mostly sand (SP-SM to SM) with minor sandy silt and occasional seams of bottom ash		
640	55								
	56								
	57	P-5		56					
	58								
	59						becomes mostly silt (ML) with interbedded silty sand (SM)		
	60								
635	61								
	62	P-6		96					
	63								
	64	SS-9	1 0 0 0	0					*Split-spoon @ 64-66' bgs driven 4 ft with 1 blow*
630	65								
	66								

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Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									
	68									
	69									
625	70									
	71									
	72									
	73		P-7		92					
	74									
	75		SS-10	2 1 3 6	92			becomes interbedded SM/SP/ML with light brown lean clay laminae		
620	76									
	77									
	78		P-8		75			becomes light brown and gray SILT (ML) with interbedded sand (SP-SM to SM), trace grass		
	79									
	80		SS-11	1 1 1 2	0					
615	81									
	82									
	83		P-9		92					
	84							becomes mostly sandy silt (ML)		
	85		SS-12	2 2 2 4	83			becomes mostly fine silty sand (SM)		
610	86									
	87									
	88		P-10		75					
	89							becomes mostly fine silty sand (SM) with minor interbedded sandy silt (ML)		
	90		SS-13	WOR 0	100					*Sample at 89-91' bgs fell to 96' bgs under weight of rods*

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Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
605	91	SS	13	0 0	100					
	92									
	93									
	94									
	95									
600	96									
	97	SS	14	WOR 0 0 0	0					*Split-spoon @ 97-99' bgs fell to 101.5' bgs*
	98									
	99									
	100									
595	101									
	102	SS	15	4 6 6 10	25			Medium dense, wet to moist, tan to brown with black staining and oxidation staining, clayey GRAVEL (GC), trace root fibers [ALLUVIUM]		*Gravel is sandstone fragments up to 1/2" diameter*
	103									
	104									
	105							Loose, wet, brown with oxidation staining, medium to fine SAND (SP-SM), trace interbedded lean clay [ALLUVIUM]		*Lean clay layers are <1" thick*
590	106									
	107	SS	16	3 4 3 2	71					
	108									
	109									
	110									
585	111							Medium dense, moist, brown with oxidation staining, gray and greenish gray, trace white, clayey SAND (SC) interbedded with silty sand (SM), trace sandstone gravel		
	112	SS	17	10 9 5	25					
	113									

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Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	114	SS-17	4	25					
	115								
580	116								
	117						becomes all clayey sand (SC) with sandstone gravel		
	118	SS-18	12 11 11 11	54			Very stiff, moist, gray to dark brown and greenish gray lean CLAY (CL) with sand, trace sandstone gravel [ALLUVIUM]		
	119								
	120						Very dense, moist, variably brown with gray mottling, with oxidation staining, medium to fine SAND (SP-SM), with gravel as sandstone fragments [RESIDUUM]		
575	121								
	122								
	123	SS-19	10 30 33 50/1½"	71					
	124						Gray and dark gray shale, moderately weathered, weak		*Hard drilling 124-127' bgs*
	125								
570	126								
	127	SS-20	50/½"	100			becomes silty, dark gray, fresh, medium strong End of Boring at 127´ bgs		*Set PVC casing at 127' bgs. Cement-bentonite grout placed using tremie pipe.*
	128								
	129								
565	130								
	131								
	132								
	133								
	134								
	135								
560	136								

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Log of Boring
PB-8

Sheet 1 of 7

Date(s) Drilled	**4/20/12,4/23/12-4/25/12**	Logged By	**T. George**	Checked By	
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricore mud-rotary**	Total Depth of Borehole	**153.0 feet**
Drill Rig Type	**CME 55 Rubber Track ATV, Remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**679.0 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**3.1 ft ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0							Bottom ash splitter dike [BOTTOM ASH]		3.0' stickup Grout
	1									SCH 40 PVC 2" diameter riser
	2									
	3								▽	*Drilled to 13' bgs without sampling*
675	4									
	5									
	6									
	7									
	8									
670	9									
	10									
	11									
	12									
	13									
665	14		SS-1	1 0 0 0	100			Very loose, wet, dark gray, bottom ash as coarse to fine SAND (SP-SM) trace gravel [BOTTOM ASH]		*Split-spoon @ 13' driven with 1 blow to 16'* *Bottom ash splitter dike*
	15									
	16									
	17									
	18									*~6" heave noted*
660	19		SS-2	1 0 1 0	100					
	20									

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Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21									
	22							becomes loose		
	23	SS	3	5 5 3 1	75					
655	24							Very loose, wet, gray fly ash as fine silty SAND (SM) [FLY ASH]		*Bottom of splitter dike @ 23.5' bgs*
	25									
	26									
	27	SS	4	1 0 1 1						*Sample @ 27-29' fell 6" to 29.5' bgs*
650	29									
	30									
	31									
	32	P	1		88					
	33							becomes very loose, wet, gray, SILT (ML) with fine sand		
645	34	SS	5	WOR 0 0 0	0					*Split-spoon @ 34'-36' WOR from 34'-41' bgs*
	35									
	36									
	37									
	38									
640	39									
	40									
	41									
	42	SS	6	1 0 0	8			becomes light gray, interbedded with minor silty sand (SM)		*Split-spoon @ 42-44' 1 blow drives spoon 4 ft to 46' bgs*
	43									

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Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
635	44	SS-6	0	8					
	45								
	46								
	47						becomes mostly silty sand (SM) with interbedded sandy silt (ML)		*At 47-49' bgs rods fell 13' from 47-60' bgs*
	48	SS-7	WOR 0 0 0	100					
630	49								
	50								
	51								
	52								
	53								
625	54								
	55								
	56								
	57								
	58								
620	59								
	60								
	61								
	62								
	63	P-2		92					
615	64								*Split-spoon @ 64-66' fell to 67' bgs*
	65	SS-8	WOR 0 0 0	100					
	66								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									*Roller bit to 67'*
	68	SS	SS-9	WOH 0 0 0	33					
610	69									
	70							Very loose, wet, dark gray bottom ash as coarse to medium SAND (SP-SM), trace gravel [BOTTOM ASH]		
	71									
	72	SS	SS-10	1 1 1 1	33			Very loose, wet, gray fly ash as fine silty SAND (SM) [FLY ASH]		
	73									
605	74									
	75									*Drill rods clogged. Remove and flush.*
	76									
	77	P	P-3		88					*Bottom of piston tube is fly ash as sandy silt (ML)*
	78									
600	79	SS	SS-11	WOR 0 0 0	0					
	80									
	81									
	82									
	83									
595	84									
	85									
	86									
	87	P	P-4		88					
	88									
590	89	SS	SS-12	WOR 0	0					*Split-spoon @ 89-91' fell to 91.5' bgs*
	90									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91	SS	SS-12	0 0	0					
	92									
	93									
585	94									
	95									
	96									
	97	P	P-5		96					*Bottom of piston tube is fly ash as silty sand (SM)*
	98									
580	99							becomes loose, interbedded light and dark gray, medium to fine SAND (SP-SM) to silty SAND (SM), with minor interbedded sandy silt [FLY ASH]		
	100	SS	SS-13	2 2 3 2	63					
	101									
	102									
	103									
575	104							becomes very loose, mostly sandy SILT (ML) to silty SAND (SM) with minor interbedded (SP-SM)		
	105									
	106									
	107									
	108	SS	SS-14	1 0 0 1	79					
570	109									
	110									
	111									
	112							becomes mostly silty sand (SM) with minor interbedded sandy silt (ML)		
	113	SS	SS-15	2 1 0	58					

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
565	114	SS-15	1	58					
	115								
	116								
	117								
	118	P-6		96					
560	119						becomes mostly sandy silt (ML)		
	120	SS-16	WOR 0 0 0	13					
	121								
	122								
	123								
555	124								
	125								
	126						becomes light gray with interbedded grayish brown mostly sandy SILT (ML) with minor interbedded silty sand, trace decayed plant stems		
	127								*Split-spoon at 127-129' fell to 131' bgs*
	128	SS-17	WOR 0 0 0	88					
550	129								
	130								
	131								*Roller bit dropped to 132' when reinserted at 127'*
	132								
	133						Dense, wet, dark gray, medium to fine silty SAND (SM) with brown sandstone gravel [ALLUVIUM]		*Material is possibly a fill*
545	134								
	135								
	136								

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	137									
	138	SS	SS-18	20 17 18 21	79					
540	139									
	140							becomes moist, variably brown with gray mottling, trace greenish-gray, trace brownish-red		
	141									
	142									
	143	SS	SS-19	19 17 26 31	79					
535	144									
	145									
	146									
	147									*Split-spoon at 147'; 6" recovery appears the same as sample @ 142'. Blow counts may not be representative of material.*
	148	SS	SS-20	21 2 1 11	25			No material in sampler representative of blow counts @ 147.5-149		
530	149									
	150									*Drill change at 150'*
	151							becomes with trace decayed vegetation		
	152	SS	SS-21	15 50/1"	100					
	153							Micaceous, silty sandstone, light gray, slightly weathered, weak to medium strong End of Boring at 153´ bgs		*Set PVC casing @ 152.5 ft bgs. Cement-bentonite grout placed using tremie pipe.*
525	154									
	155									
	156									
	157									
	158									
520	159									
	160									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-3

Date(s) Drilled	**4/11/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA/NX Core**	Drill Bit Size/Type	**3 1/4" HSA/2" Core**	Total Depth of Borehole	**54.0 feet**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**845.7 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
845	0		SS-1	50/4"	100			Dense, moist, medium to fine grained SAND (SP) [FILL]			*Road material as weathered sandstone*
	1										
	2										
	3		SS-2	50/5"	100						
	4										
	5		SS-3	50/4"	100						
840	6										
	7										
	8										
	9										
	10										*Shale in cuttings*
835	11										
	12		SS-4	18 31 50/4"	75			Shale, gray brown, highly to completely weathered			
	13										
	14		SS-5	20 50/5"	100						
	15										
830	16										
	17		SS-6	21 36 50/4"	88						
	18										
	19		SS-7	36 50/4"	80			becomes light brown			*Vertical filled fracture noted*
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-3

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20										
825	21										
	22	SS	SS-8	35 50/4"	100						
	23										
	24	SS	SS-9	35 50/5"	91						
	25										
820	26	SS	SS-10	50/3"	100						
	27										
	28	SS	SS-11	50/5"	100						
	29							becomes gray			
	30							Dark grey, fine sandstone			*Auger refusal @ 30' bgs*
815	31										
	32							Sandstone, light green, moderately weathered, weak rock - iron staining on fractures Fracture #1: 0, B, Vn, Fe, None, PL, R			
	33							Shale, light gray, moderately weathered, extremely weak			
	34	R	R1	92.4%	87			Sandstone, light gray with iron staining (red), moderately weathered, strong rock			
	35							Shale, light brown, moderately weathered, extremely weak rock becomes dark gray, weak			
810	36							3" sandstone, pebbly, strong			
	37							becomes light brown			
	38							Fracture #2: 90, J, VN, Fe, Sp, IR, R			
	39							Fracture #2			
	40							becomes sandy, gray Fracture #2 Fracture #3: 60, J, VN, Fe, Sp, IR, R Fracture #3			
805	41	R	R2	88.3%	100						
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring/Rock Core
SB-3

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44										
	45							Sandstone, gray, moderately weathered, weak, medium grained			
800	46		R2	88.3%	100						
	47							← Fracture #4: 45, J, None, None, None, IR, R			
	48										
	49							Light gray shale, extremely weak			
	50							becomes with sandy laminae			
795	51		R3	83.3%	80						
	52										
	53										
	54							End of Boring at 54´ bgs			
	55										
790	56										
	57										
	58										
	59										
	60										
785	61										
	62										
	63										
	64										
	65										
780	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-4

Date(s) Drilled	**4/10/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA**	Drill Bit Size/Type	**3 1/4" HSA/NX Core**	Total Depth of Borehole	**30.0 feet**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**794.0 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0										
	1	SS	SS-1	3 4 5 9	21			Stiff, moist, light brown with gray mottling lean CLAY (CL) [RESIDUUM]			
	2										
	3	SS	SS-2	4 6 10 22	67			becomes very stiff with no mottling			
790	4										
	5	SS	SS-3	5 15 26	89			becomes with gray mottling becomes buff to tan, sandy			
	6			50/1"							
	7							Sandstone, light brown to tan, moderately weathered, strong, mica on split surfaces			
	8	RC	R1	84.7%	100			Fracture #1: 0, B, VN, CL, Sn, Wa, S, C			
785	9							Shale, brown, extremely weak			
	10							Fracture #2: 90, J, VN, Fe, Fi becomes orange-stained			
	11							1" sandstone, strong becomes with iron staining, orange to gray, extremely weak			
	12	RC	R2	50%	60			Sandstone, dark brown, strong, quartz crystal lined, iron stained			
	13							Fracture #1 Fracture #3: 90, B, VN, Fe, Pa, Ir			
780	14										
	15							becomes fine-grained, iron staining			
	16							Fracture #1 Fracture #3			
	17										
	18	RC	R3	56.7%	61			Fracture #3 Shale, gray to black, extremely weak			
775	19										
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-4

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20										
	21										
	22		R3	56.7%	61						
	23										
770	24										
	25							becomes moderately weathered, extremely weak to very weak			
	26										
	27		R4	85%	100			Fracture #4: 90, J, T, None, None, Wa, S			
	28							becomes sandy, weak to very weak, slightly weathered, no fractures			
765	29										
	30							End of Boring at 30´ bgs			
	31										
	32										
	33										
760	34										
	35										
	36										
	37										
	38										
755	39										
	40										
	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-6

Date(s) Drilled	**4/12/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA/NX Core**	Drill Bit Size/Type	**3 1/4" HSA/2" Core**	Total Depth of Borehole	**39.3 feet**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**768.8 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0							1" dark brown topsoil			
	1	SS	SS-1	4 3 7 6	38	2.25		Stiff, moist, light brown with trace dark brown mottling, lean CLAY (CL) [RESIDUUM]			
	2							2" sandstone gravel			
	3	SS	SS-2	2 3 5 11	58	2.25 to 3.25		becomes stiff to very stiff, with brown mottles			
765	4							2" cemented shale with red/orange iron stains			
	5	SS	SS-3	3 5 9 22	83	>4.5		becomes hard			
	6							becomes black			
	7										
	8	SS	SS-4	19 25 21 38	96	>4.5		9" coal seam			
760	9							becomes with coal			
	10										
	11	SS	SS-5	12 21 27 50/3"	100	2.5		5 1/2" coal seam becomes stiff, black and gray 2 1/2" coal seam becomes with black coal			
	12										
	13	SS	SS-6	30 50/5"	100			3" coal seam			
755	14							3" shale, light gray, very weathered 3" coal seam Shale, gray with some black partings			
	15	SS	SS-7	49 50/3"	100						
	16										
	17										*Back of spoon wet* *Auger refusal @ 17.2' bgs*
	18							becomes light gray, moderately weathered, weak			
750	19	R	R1	70.7%	97			Fracture #1: 60, V, N, Cl, Fi, Wa, R			
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring/Rock Core
SB-6

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20							Fracture #2: 90, V, N, Cl, Fi, Wa, R			
	21										
	22	R	1	70.7%	97			becomes sandy shale			*Interbedded sandy shale and shale interbeds with sand are 3" to 1/8"; shale beds are 1/8 to 1 1/2" thick*
	23										
745	24										
	25										
	26							Fracture #3: 30 to 90, J, N, None, None, Ir, Vr Fracture #3			
	27										
	28										
740	29	R	2	61.6%	98			Sandstone, light gray, some lamination, some iron staining, slightly weathered, strong rock			
	30										
	31										
	32										
	33										
735	34										
	35							Shale, gray, moderately weathered, weak rock			
	36										
	37	R	3	100%				Sandy shale, light gray, slightly weathered, strong rock, interbeds of sandy shale and shale			
	38										
730	39										
	40							End of Boring at 39.3´ bgs			
	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-7

Date(s) Drilled	**4/10/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA/Core**	Drill Bit Size/Type	**3 1/4" HSA/3" Core**	Total Depth of Borehole	**29.7 feet**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**850.4 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
850	0							Medium stiff, moist, brown, lean CLAY (CL) (topsoil)			
	1		SS-1	4 3 3 8	38	1 2.0		becomes stiff, trace brown mottles [RESIDUUM]			
	2										
	3		SS-2	3 5 8 15	42	3.5 to 4.5		becomes very stiff to hard, light brown with red mottles			
	4										
845	5		SS-3	10 22 40 50/3"	86	3.5 >4.0		becomes dark red becomes with red mottles			
	6										
	7							Shale, sandy, light brown, moderately weathered, weak			
	8										
	9							becomes very weak			
840	10										
	11		R1	15%	29						
	12										
	13										
	14										
	15							becomes shale fragments, moderately weathered, very weak with iron-staining			
835	16										
	17		R2	0%	18						
	18							8" sandstone fragments, brown with iron staining, strong, but fractured vertically and horizontal			
	19										
	20										

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-7

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
830	20										
	21										*Shale is mechanically broken-- no fractures observable*
	22		R2	0%	18						
	23										
	24										
	25							becomes brown shale, moderately weathered, weak			*25-27' bgs: shale is soft--mechanically broken No fractures observable*
825	26										
	27		R3	20%	20						
	28										
	29										
	30							End of Boring at 29.7´ bgs			
820	31										
	32										
	33										
	34										
	35										
815	36										
	37										
	38										
	39										
	40										
810	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-8

Date(s) Drilled	**4/12/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA**	Drill Bit Size/Type	**3 1/4" HSA/NX Core**	Total Depth of Borehole	**49.3 feet**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**711.3 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location		Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0							3" Bottom ash (road fill)			
		SS	SS-1	4 3 5 15	58	3.25 to 3.5		Very stiff, moist, light yellow/brown, lean CLAY (CL) [RESIDUUM]			
710	1							Shale, light yellow brown, with orange red iron oxidation staining, completely to moderately weathered			
	2										
	3	SS	SS-2	9 6 8 13	13						
	4										
	5										
	6	SS	SS-3	9 19 31 34	96						
705	7										
	8	SS	SS-4	11 21 32 50	58			becomes light gray, without iron oxidation			
	9										
	10							becomes with red mottle staining			
	11	SS	SS-5	10 18 47 50/3"	76			becomes red with gray mottles			
700	12										
	13	SS	SS-6	21 49 50/3"	80			2" crushed chert nodules becomes gray with red mottles to light gray			
	14										
	15							becomes gray with some red mottles			
	16	SS	SS-7	15 18 50/3"	80						
695	17										
	18	SS	SS-8	12 50/5"	100			becomes with some orange mottles			
	19										
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-8

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20							becomes with orange staining			
	21	SS	SS-9	18 31 50/5"	100						
690	22							becomes without orange staining, crushed			
	23	SS	SS-10	50/3"	100						
	24										
	25	SS	SS-11	50/5"	100			1" sandstone, gray, crushed			
685	26										
	27										
	28										
	29							Sandstone, gray with zones of iron staining, moderately weathered, medium strong, fine-grained Fracture #1: 10, J, VN, Fe, Su, PL, SR			*Auger refusal @ 28.4' bgs*
	30							Fracture #1			
680	31	R	R1	85.7%	95			Fracture #1			
	32										
	33										
	34										
	35							becomes with shale fragments			
	36							becomes sandstone massive with orange Fe staining			
675	37							Fracture #1			
	38							shale, orange concretion			
	39	R	R2	93.3%	100			becomes gray, slightly weathered, strong, no fractures			
	40										
	41										
670	42							becomes slightly weathered to fresh, strong, medium-grained			
	43										

Project: AEP Big Sandy Landfill Investigation
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Log of Boring/Rock Core
SB-8

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44		R2	93.3%	100			becomes with orange staining			*No natural fractures*
	45										
	46										
665	47		R3	100%	100						
	48										
	49										
								End of Boring at 49.3´ bgs			
	50										
	51										
660	52										
	53										
	54										
	55										
	56										
655	57										
	58										
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