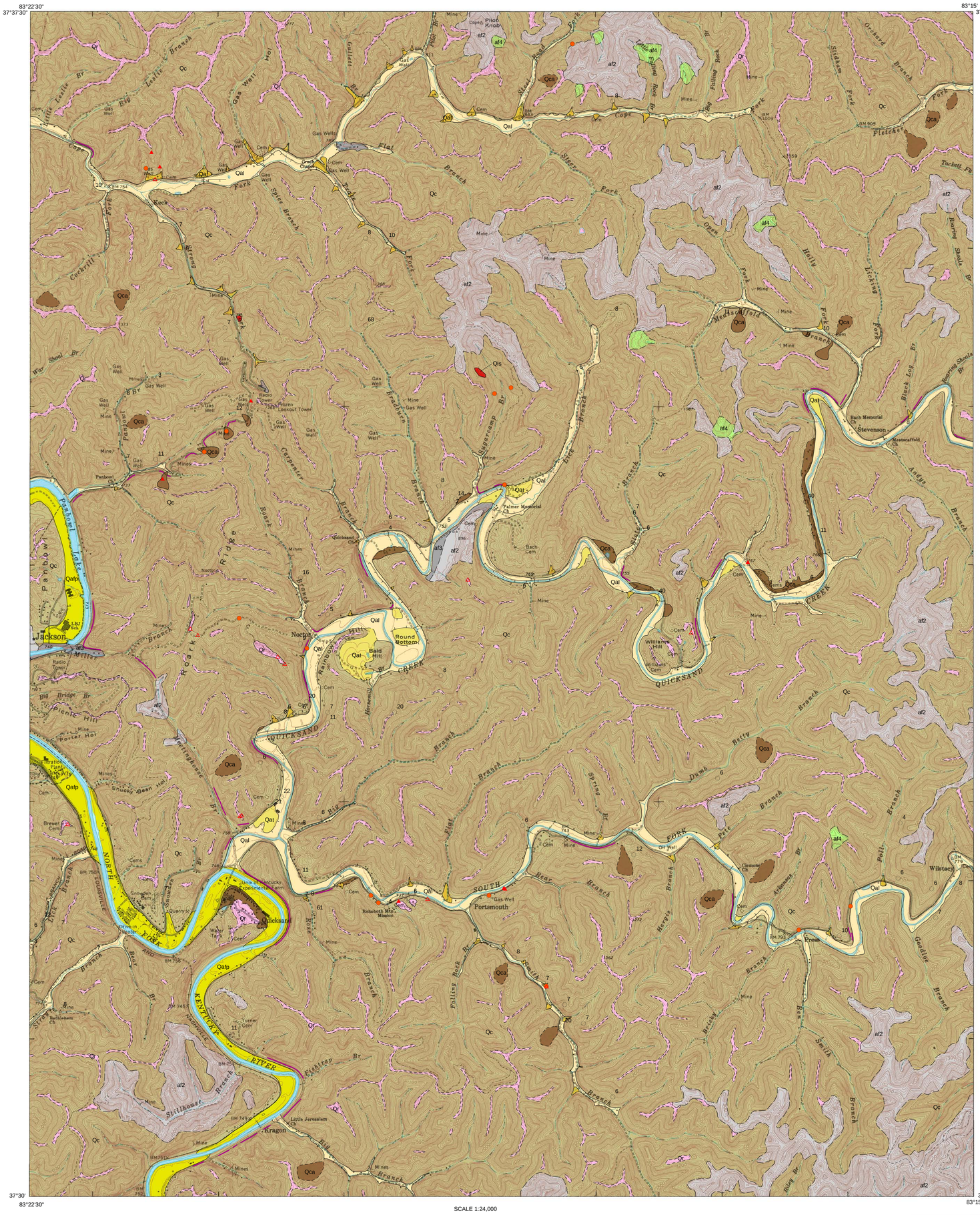
KENTUCKY GEOLOGICAL SURVEY
James C. Cobb, State Geologist and Director
University of Kentucky, Lexington



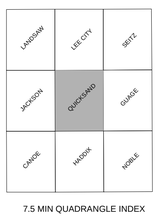
SCALE 1:24,000

Kentucky Single Zone State Plane projection

Topographic base and cultural features are from Kentucky Raster Graphics from Kymartian.ky.gov/krgmaps/KRG of QUICKSAND

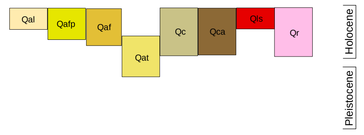
5,000 2,500 0 5,000 10,000 Feet
0.5 0.25 0 0.5 1 Miles
0.5 0.25 0 0.5 1 Kilometers

CONTOUR INTERVAL 20 FEET



7.5 MIN QUADRANGLE INDEX

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qal — **Alluvium modern (Holocene)**
Unconsolidated sand, silt, gravel, and clay. Mainly occupies modern river channels, narrow stream valley bottoms, and floodplains. Local sand and gravel bars containing cobbles and boulders present. Unit typically generated from weathered colluvium and debris flows near valley bottoms and often flooded, eroded, and re-deposited. Contact between adjacent colluvium and alluvial fans vary from sharp to poorly defined. Thickness ranges from 0 to 10 feet.

Qaf — **Alluvium, alluvial fans (Holocene)**
Broad, fan-shaped deposits of unconsolidated material at the mouths of small valleys and ravines. Confined to coalescing tributary valleys, unit probably contains a mixture of flood-plain alluvium and hill slope colluvium. Fluvial origin varies from recent to older.

Qat — **Alluvium, low terrace (Holocene)**
Silt, sand, and clay deposited by rivers; forms terrace above adjacent floodplain; contact with adjacent units varies from sharp to poorly defined; locally inferred on the basis of topographic expression; distinguished by topographic expression from lower floodplain.

Qafp — **Alluvium, river floodplain (Holocene)**
Sand, silt, fine gravel, and clay; surface mantled by silty clay and sandy silt; surface forms the lowest well-developed terrace along major rivers; up to 60 feet thick along North Fork Kentucky; overlies older unconsolidated deposits or bedrock; contact is sharp, drawn at scarp of next higher terrace (Qat) or colluvial slope.

Qc — **Colluvium undifferentiated, modern (Holocene)**
Unconsolidated sand, gravel, silt, clay, cobbles, and boulders; gravity driven material mantling steep slopes, generated from weathering of underlying bedrock. Thickness ranges from 0 to 40(?) feet and varies depending on landscape position and underlying bedrock lithology. Typically colluvial deposits are thickest at the base of slopes (toe slopes) and thin and discontinuous toward the shoulder (higher side slopes). Thick colluvium troughs or wedges often surround bedrock outcrops or ledges on steep slopes.

Qca — **Colluvial accumulation zones (Holocene)**
Thick accumulation deposits of colluvial material generally deposited on gently sloping toe slopes. Unit also may be small, fan-shaped deposits near base of steep slopes or occur downslope of gaps in bedrock ledges, on concave slopes, and in toe slopes. Inferred areas derived from digital elevation models (hillshade) and geomorphic similarities with observed areas.

Qr — **Residuum (Holocene)**
Highly weathered bedrock regolith found along ridge tops, gently sloping hills, and convex upward slopes. Unit is typically mixed fine-grained rock and silty soil, few large angular rock pieces; typically maintains sedimentary rock structure. Underlain by interbedded sandstone, shale, siltstone, and coal lithology which determines weathering and residual soil development rates.

Qls — **Landslide deposits, modern (Holocene)**
Complex accumulations of slumps, earthflows, debris flows, and hummocky ground within colluvial slopes. Unit derived from thick to thin colluvial slopes. Commonly consists of cobbles with sand, silt, and clay matrix. Slides range from active to historic non-active slides. Commonly associated with colluvial accumulation zones (Qca). Generally small in size, most too small to map at this scale, and difficult to delineate contacts with other units.

af2 — **Artificial fill, mine spoil (Modern)**
Unconsolidated overburden and fill material generated from surface and underground coal mining processes. This includes material mined and restored from contour mining, excess mine spoil placed in hollow fills, dry refuse, slurry ponds, and mountain top removal sites. Unit delineated by soil map analysis, modern aerial photography, current mine maps, and historical topographic maps.

af3 — **Artificial fill, other fill (Modern)**
Chaotic, unconsolidated fill material; includes materials cleared during maintenance of roads and water ways and graded recreational areas.

af4 — **Artificial fill, hollow fill (Modern)**
Excess overburden replaced in narrow valleys after coal removal. Volume of material swells by approximately 20%-25% as unconsolidated spoil after bedrock is broken up. Material is typically graded and benched.

*Map units **Qc**, **Qr**, and **Qal** are primarily derived from the parent materials of the USDA soil series units. Delineation of these units was completed by field observations, slope percentage analysis, and mining data.

*Map units **Qaf**, **Qat**, **Qca**, and **Qls** are derived from field observation.

*Map units **af2** and **af4** were derived from soil series maps, known mined areas, mine permit maps, and aerial photography.

EXPLANATION

- Contact
- Approximate contact
- Inferred contact
- Terrace scarp
- Bedrock outrop
- 33 KGS database, number indicates depth to bedrock in feet
- Landform observation and soil probe
- Landform observation
- Mapped landslide

DRAFT GEOLOGIC QUADRANGLE

QUICKSAND QUADRANGLE, KY.

Series XII, 2009
GQ-240
Version 1.0
Contract Report 33

GEOLOGIC SUMMARY

GEOLOGIC SETTING AND ECONOMIC GEOLOGY

The Quicksand 7.5-minute quadrangle is located in Breathitt County, Ky., and lies on the western margin of the Eastern Kentucky Coal Field of the Appalachian Basin. The bedrock geology consists of gently dipping sedimentary rocks of Pennsylvanian age and unconsolidated sediments of Quaternary age. These rocks are dominantly sandstone, siltstone, shale, coal, and limestone of the Breathitt Group.

Coal, oil, and natural gas are the principal mineral resources of the Quicksand 7.5-minute quadrangle. Coal mining has a history of more than 100 years. Breathitt County alone has produced approximately 212 million tons from a variety of surface and underground mining methods. According to the Kentucky Geological Survey web site (www.uky.edu/KGS), in 2006 Breathitt County produced approximately 3 million tons of coal which ranks 10th out of 25 Eastern Kentucky Coal Field counties for which production data are available. In 2007, Breathitt County produced 8,561 barrels of oil and 467,248 cubic feet of gas.

The distribution of surficial materials is related to specific bedrock lithology, weathering rates, and the influence of mining and other types of development. The units described on this map reflect natural processes collectively operating as a dynamic geomorphic system (Newell, 1978). They are the result of the relationship between processes and landforms. Chemical and mechanical weathering, mass wasting, and streamflow are the main agents creating and transporting the surficial materials that become the alluvial, colluvial, and residual units.

GEOTECHNICAL BEHAVIOR

The Quaternary deposits identified in the map area exhibit a wide range of grain size and geotechnical behavios. Grain-size distribution, soil thickness, plasticity index, clay content, and soil wetness are the primary factors affecting the behavior of soils for geotechnical, hydrogeologic, and agricultural applications. The grain-size distributions of unconsolidated sediments are dominantly controlled by the conditions under which the materials were deposited. Fluvial processes produce moderately sorted deposits and colluvial processes produce poorly sorted deposits. Low-energy environments allow the deposition of fine-grained materials. High-energy deposits limit deposition to only coarser-grained materials.

Major properties of surficial materials recorded during mapping include (1) texture, using standard U.S. Department of Agriculture terms defined by percentages of sand, silt, and clay and (2) classification, determined by the Unified Soil Classification System, which classifies soil properties that affect construction development.

HAZARDS

The highly dissected topography in the Quicksand area has a history of mass wasting and has the potential to cause engineering and maintenance problems. The thick sequences of interbedded sandstone, siltstone, and shale in the Breathitt Group, covered by varying thicknesses of surficial materials, have the potential of slope failure by landslide, creep, slumps, and debris flows. Heavy precipitation, stream erosion, new roads, logging, and removal of vegetation for construction can destabilize slopes. Small landslides are particularly abundant after large storms. These are mainly in the form of road embankment slumps with streams below, or thin translational slides composed of soil. Coal-mining activities can also activate landslides. Landslides of colluvium from hillsides pose engineering hazards and have damaged roads, railroads, and housing developments. Within the colluvial units, many of the housing developments are benched into the toe of slopes along narrow valleys, tiered commonly as much as a few hundred feet up the slope. A sandy matrix of colluvium (sandstone makes up greater than 50 percent of the bedrock) typically has higher porosity and is well drained, making it more stable than colluvium derived from clay-rich rocks (Newell, 1978). A colluvium whose matrix is rich in clay and silt (sandstone is less than 33 percent of the bedrock) is poorly drained and easily saturated and mobilized (Newell, 1978).

Flooding is a common occurrence in areas underlain by alluvium, particularly in late winter or early spring,. Both modern channel deposits and floodplain alluvium occupying narrow stream valleys between steep slopes have flood potential. Floodplain alluvium will vary from sandy, well-drained sediment to predominantly silt and clay that may drain poorly following floods. Low terraces correspond to high-magnitude, low-frequency flood stages.

LAND USE

The topography in the Quicksand area severely limits developable sites. Housing developments and transportation corridors are most often located on relatively flat alluvium and colluvium deposits near valley bottoms. These deposits are marginally stable materials that were moved into place by variable mass wasting or floods. Though these landforms appear stable, loading a deposit with structures, truncating the toe of a deposit, or saturating the materials with septic systems or excess drainage may destabilize and activate mass movement events. Other possible sites for development and transportation corridors are former mining benches, hollow-fill deposits, and mined-out areas. Care must be taken to understand the distribution and compaction of the mine spoil and location of buried highwalls and undisturbed bedrock relative to planned construction.

DISCLAIMER

Although these data have been processed successfully on a computer system at the Kentucky Geological Survey (KGS), no warranty, expressed or implied, is made by KGS regarding the utility of the data on any other system, nor shall the act of distribution constitute any such warranty.

KGS does not guarantee this map or digital data to be free of errors or inaccuracies. Some cultural features originate from data sources other than KGS, and may not align with geologic features on this map. KGS disclaims any responsibility or liability for interpretations from this map or digital data, or decisions based thereon.

The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

ACKNOWLEDGMENTS

This map was generated using new field mapping and compilation of unpublished and previously published data and was funded in part by the U.S. Geological Survey National Cooperative Mapping Program under the STATEMAP Program authorized by the National Geologic Mapping Act of 1992, Grant No. 08HQPA0003, and by the Kentucky Geological Survey.

Field mapping was completed by Matthew M. Crawford and Michael L. Murphy from May 2008 to May 2009, with assistance from William M. Andrews, Jr.

Subsurface information was compiled from data on file at the Kentucky Geological Survey as well as data contributed by the Kentucky Transportation Cabinet.

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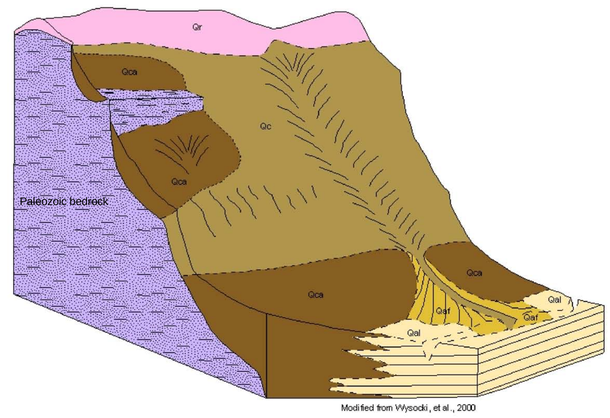

Figure 1. Diagram showing common landforms and distribution of surficial geologic units in the Quicksand quadrangle.

QUATERNARY GEOLOGIC MAP OF THE QUICKSAND 7.5-MINUTE QUADRANGLE, KENTUCKY

By Matthew M. Crawford and Michael L. Murphy

2009