STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
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SURFICIAL GEOLOGY OF LAWRENCE COUNTY, OHIO

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Lawrence
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LAWRENCE COUNTY SURFICIAL GEOLOGY

Lawrence County is in south-central Ohio, within the unglaciated portion of the state. The county is located within the Ironton and Marietta Plateau regions of the Allegheny Plateau Physiographic Province. These plateaus generally have high topographic relief and are composed of Paleozoic-aged siliciclastic rocks with terrestrial origins, including coal-bearing sequences. Lawrence County has a long history of mining coal, clay, and iron ore to support industrial development and trade along the Ohio River (Quarry and Pit). The majority of the population and development within the county is concentrated along the Ohio River and the city of Ironton. The major transportation corridor in the region is made up of U.S. Route 52 and State Route 7, which trace the Ohio River Valley and the southern edge of Lawrence County. Wayne National Forest covers a majority of the less-developed land in the northern half of the county.

The primary surficial deposits of the county, by area, are the colluvium and residuum developed from weathering and erosion of the Paleozoic bedrock. These sediments are the oldest surficial deposits in the county. Pennsylvanian and Permian-aged rocks belong to the Allegheny (P), Pottsville (P), Conemaugh (P), Monongahela (P), and Dunkard (Pd) Groups, which are found at the surface of Lawrence County. Bedrock gently dips eastward towards the middle of the Appalachian Basin, exposing younger rocks to the east and older rocks to the west. The variable nature of lithologies, including sandstone, siltstone, shale, coal, clay, and minor limestone, led to a likewise variable nature of the county's surficial colluvium and residuum. For the purposes of this map, both colluvium and residuum have been generalized into a single unit also consisting of instances of consolidated bedrock exposed by outcrop. In general, residuum is found along stable ridge tops with minimal slope (0–2 degrees), and colluvium forms on hillslopes and accumulates at the base of hills by gravitational forces.

During the Quaternary Period, multiple glacial episodes occurred in Ohio that indirectly led to the deposition of multiple types of water-lain surficial deposits in Lawrence County. Though ice never advanced across the county, it still impacted its surficial geology. Glacial outwash was carried by meltwater through the Ohio River Valley and its tributaries upstream. The high sediment load of this meltwater led to the deposition of as much as 100 feet of sand and gravel (SG) along the southern border of Lawrence County. The deposits are now preserved as flat terraces, which remain elevated at 20–30 feet above the modern floodplain of the Ohio River.

While sediments from outwash were aggrading in the Ohio River Valley, major tributaries within the county had lower sediment loads and could not keep pace with this increased deposition. These streams, like Symmes Creek, Ice Creek, Indian Guyan Creek, and Storms Creek, began to flood as the sediment in Ohio River Valley created dams at their confluences (fig. 1). This process created slackwater lakes in these tributaries and led to the deposition of lake sediment or lacustrine deposits (LC and Lk). These deposits are now preserved on flat terraces about 20 feet above the modern floodplain. These slackwater lakes are also responsible for altering the drainage patterns across the county. A major example of this is the extension of Symmes Creek northward beginning near the intersection of SR-141 and SR-378. The headwaters of Symmes Creek reached as far northward as this modern road intersection. However, the water level from the Quaternary-aged slackwater lake in Symmes Creek eventually rose high enough to overtop the drainage divide and erode the pre-Quaternary ridge. Tributaries north of this paleodivide exhibit a barbed geomorphic shape, indicating that water used to flow north in this watershed. Water flowing over the paleodivide essentially captured the paleowatershed north of Symmes Creek and created a new, larger watershed which feeds directly into the Ohio River.

After glaciers to the north retreated and sediment deposition in the Ohio River Valley returned to preglacial levels, slackwater lakes across the county drained as erosion of unstable sediment dams occurred. The resulting fluvial activity in the Ohio River and its tributaries led to the deposition of alluvium (a) at the lowest elevations of the modern landscape. Alluvium is one of the youngest surficial deposits that can be found in the county. It is a highly variable deposit, and its lithology is dependent on the lithology of the weathered and/or eroded parent material carried by the river and the fluvial depositional environment (bar, channel, or floodplain) in which the alluvium was deposited. Generally, the lithology of the alluvium is dominated by sand and silt eroded from the higher-elevation Paleozoic bedrock hills at the headwaters of the modern valleys.

MAPPING CONVENTIONS

This map provides a three-dimensional framework of the study area's surficial geology and depicts four important aspects of surficial geology:

1. Geologic deposits, indicated by **letters** that represent the major lithologies.
2. Thicknesses of the individual deposits, indicated by **numbers** and **modifiers**.
3. Lateral extents of the deposits, indicated by map-unit area boundaries (solid and dashed lines).
4. Vertical sequence of deposits, by the stack of symbols within each map-unit area.

Letters represent geologic deposits (lithologic units) and are described in detail below. Lithologic units may be a single lithology, such as sand (S) or clay (C), or a combination of related lithologies that are found in specific depositional environments, such as sand-and-gravel (SG) or ice-contact (IC) deposits. The bottom symbol in each stack indicates the bedrock lithologies that underlie the surficial deposits. The detailed lithologic unit descriptions below summarize:

1. Geologic characteristics, such as range of textures, bedding, and age.
2. Engineering properties or concerns attributed to the unit.
3. Depositional environments.
4. Geomorphology or geomorphic locations.
5. Geographic locations within the map area, if pertinent.

Numbers (without modifiers) that follow the lithology designators represent the average thickness of each lithologic unit in tens of feet (for example, 3 represents 30 feet [ft]). If no number is present, the average thickness is implied as 1 (10 ft). Each unmodified number corresponds to a thickness range centered on the specified value but may vary ±50 percent. For example, T4 indicates an average thickness of till in a map-unit area of 40 ft, but overall thickness may vary from 20 to 60 ft.

Modifiers provide additional thickness and distribution information:

1. Parentheses indicate that a unit has a patchy or discontinuous distribution and is missing in portions of that map-unit area. For example, (T) indicates that till with an average thickness of 10 ft is present in only part of that map-unit area.

2. A negative sign (-) following a number indicates the maximum thickness for that unit in an area such as a buried valley or ridge. Thickness decreases from the specified value, commonly near the center of the map-unit area, to the thickness of the same lithologic unit and vertical position specified in an adjacent map-unit area. For example, a *SG3-* map-unit area adjacent to a *SG2-* area indicates sand-and-gravel unit having a maximum thickness of 30 ft that thins to an average of 20 ft at the edge of the map-unit area. If the material is not present in an adjacent area, it decreases to zero at that boundary.

Boundary types reflect the relationships among uppermost continuous lithologies only, not patchy, discontinuous lithologies (in parentheses). The colors on the map correspond to the uppermost continuous map units and serve to assist in visualizing the geology of the area. Discontinuous units (in parentheses) and subsurface only-units are not assigned colors on the map.

The small scale of this reconnaissance map generalizes the great local variability within surficial deposits. That variability is explained in the lithologic unit descriptions and by the use of thickness ranges. Some areas and lithologies are too small to delineate at the 1:24,000 scale and have been included in adjacent areas. This map should serve only as a regional predictive guide to the area's surficial geology and not as a replacement for subsurface borings and geophysical studies required for site-specific characterizations.

UNIT DESCRIPTIONS

m — **Made land.** Large areas of cut and fill, such as dams, landfills, and urban areas.

w — **Water.** Lakes generally larger than 20 acres and not appearing on the base map.

Sand-and-gravel pit. Pit bottom generally underlain by surrounding unconsolidated lithologic units. May contain reclaimed areas.

Quarry. Floored in bedrock; may contain reclaimed areas. Includes strip mine benches.

a — **Alluvium (Holocene).** Includes a wide variety of textures from silt to clay to boulders. Commonly includes organic material; generally, not compact. Occurs in floodplains of modern streams and mapped only where areal extent and thickness are noteworthy. Also includes alluvial terraces, old floodplain remnants that are positioned tens of feet above modern floodplains.

Lk — **Silt and clay; Minford Silt (predominantly pre-Illinoian).** Present on high terraces or as eroded remnants of lacustrine clays and silts. Finely laminated. Often covered with loess and/or colluvium; sometimes underlain by sand and gravel.

LC — **Silt and clay with occasional sand-and-gravel interbeds (unspecified age).** Present as deltaic deposits, outwash, deposits in upland depressions, intermorainal lake deposits, and backwater lake deposits.

SG — **Sand and gravel (predominantly Wisconsinan).** Intermixed and interbedded sand and gravel commonly containing thin, discontinuous layers of silt, clay, and till. Grains well to moderately sorted, moderately to well rounded; finely stratified to massive, may be cross bedded; locally, may contain organic material. Widespread fluvial deposits in terraces and buried valleys. May be older in deep buried valleys.

P — **Sandstone, siltstone, shale, clay, limestone, and coal (predominantly Pennsylvanian).** Sandstone nonbedded to massive, medium to coarse grained with abundant rounded quartz pebbles; quartz pebble conglomerate present. Interbeds of shale, sandstone, siltstone, clay, coal, and limestone common in upper portions of unit. Common horizontal and vertical changes in rock type.

Pd — **Sandstone, Siltstone, shale, and clay (predominantly Permian).** Sandstone fine grained to conglomeratic, thin to massive, crossbedding present. Limestone and coal beds present in lower part of unit.

EXPLANATION OF MAP SYMBOLS

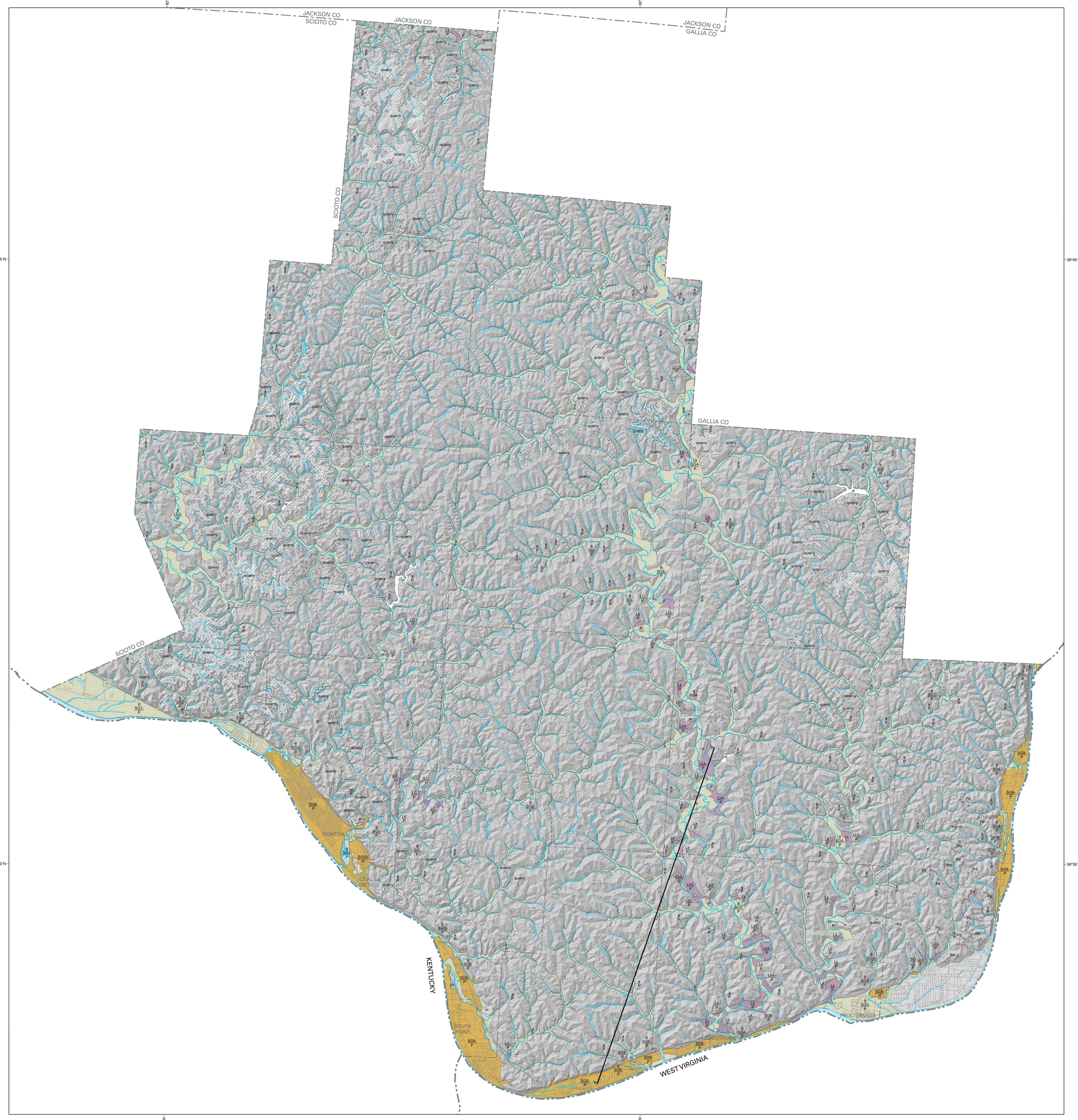
Field data collection locality. Includes soil borings, outcrop observations, and field reconnaissance points.

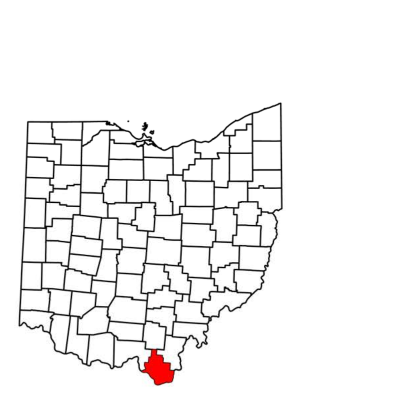
Small sand-and-gravel pit. Pit bottom generally underlain by unconsolidated lithologic units of surrounding polygon(s). May contain reclaimed areas.

Small quarry. Floored in bedrock; may contain reclaimed areas.

Boundary between map-unit areas having different uppermost, continuous lithologies or significant bedrock lithology change; underlying lithologies may or may not differ.

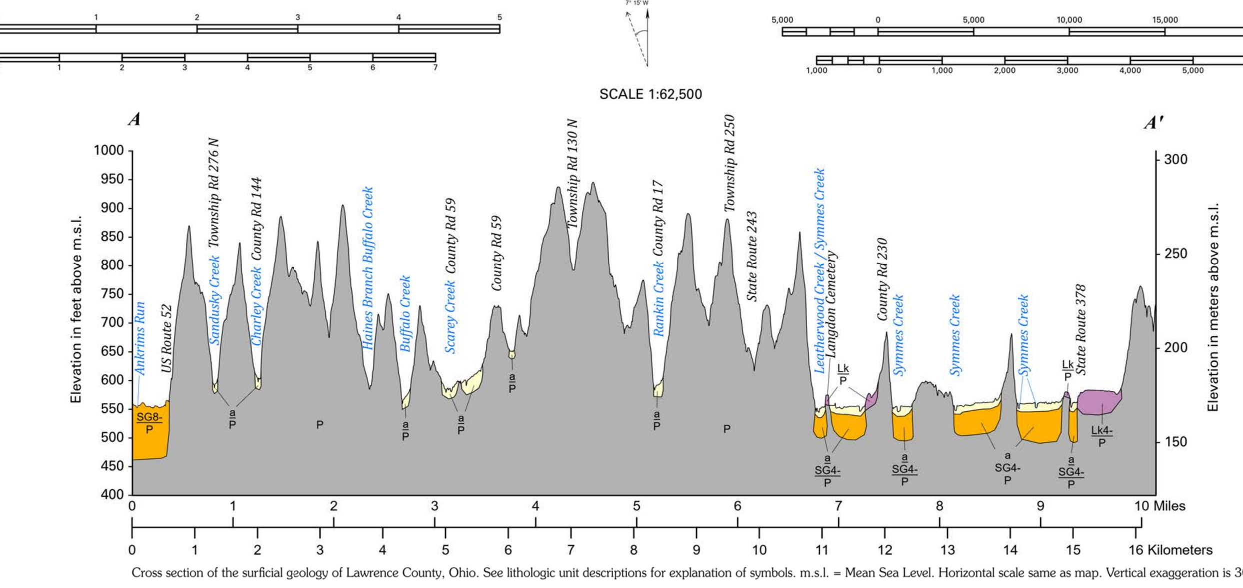
Boundary between map-unit areas having the same uppermost, continuous lithology but different thicknesses or underlying lithologies.





Location of Lawrence County in Ohio

Basemap derived from various State of Ohio datasets
Projection is Ohio coordinate system, south zone
North American Datum 1983



Cross section of the surficial geology of Lawrence County, Ohio. See lithologic unit descriptions for explanation of symbols. m.s.l. = Mean Sea Level. Horizontal scale same as map. Vertical exaggeration is 30x.

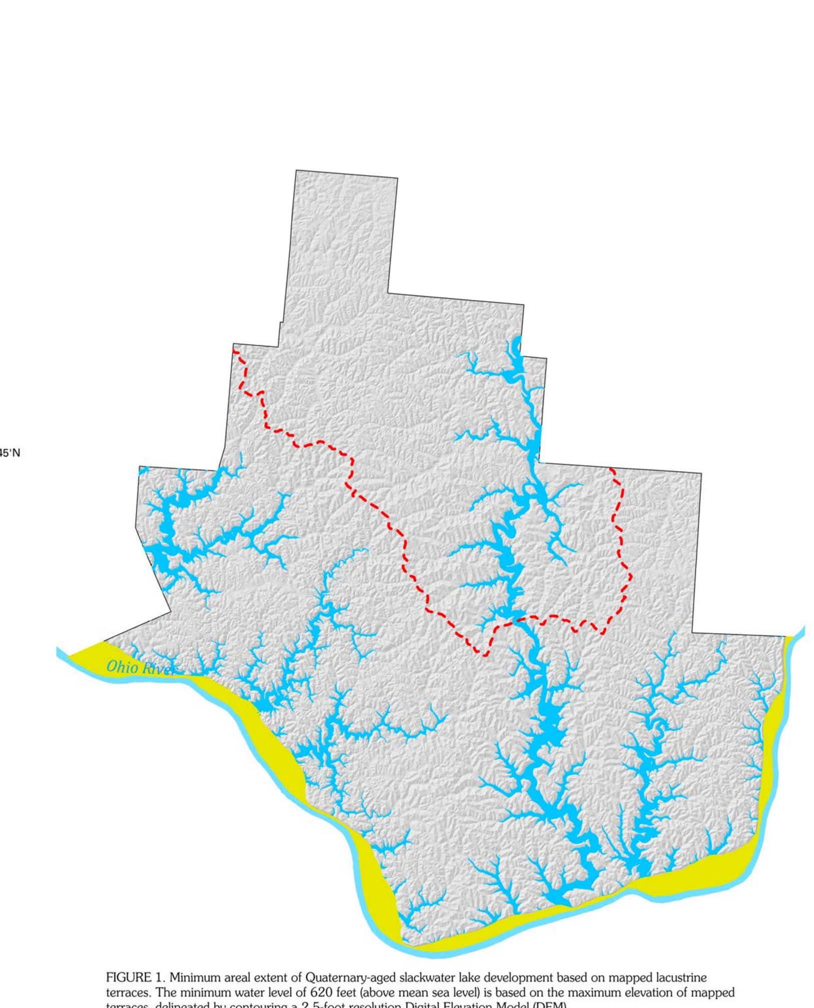


FIGURE 1. Minimum areal extent of Quaternary-aged slackwater lake development based on mapped lacustrine terraces. The minimum water level of 620 feet (above mean sea level) is based on the maximum elevation of mapped terraces, delineated by contouring a 2.5-foot resolution Digital Elevation Model (DEM).

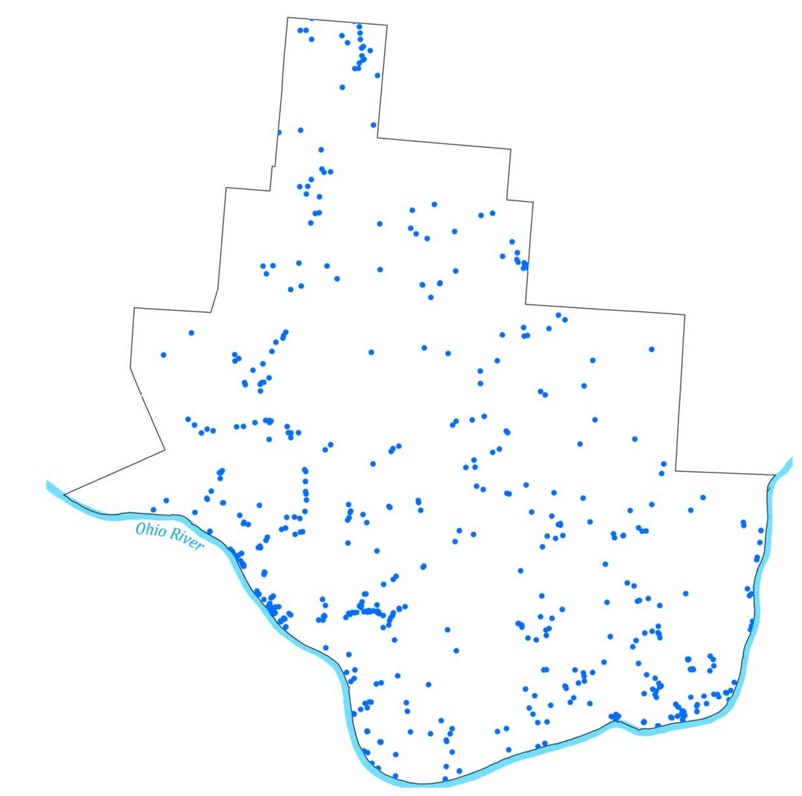


FIGURE 2. Location of water wells (blue dots) in Lawrence County, Ohio.

DATA SOURCES

Data were collected from numerous sources (see "References"). The concentration of data was greatest near the surface and decreased with depth. County soil survey maps, which describe the top 5 ft of surficial materials, provided an initial guide to map-unit areas. These areas were modified through interpretation of local geomorphic settings and other data that indicated changes of deposits at depth, including: water-well logs (fig. 2) from the Ohio Department of Natural Resources (ODNR), Division of Water Resources; test-boring logs provided by the Ohio Department of Transportation, Office of Geotechnical Document Management system, available online at **https://gis.dot.state.oh.us/tims** and at Ohio Environmental Protection Agency and county engineers offices; theses; and published or unpublished geologic reports, maps, and field notes (on file at the ODNR Division of Geological Survey). These data also provided the basis for lithologic unit descriptions that summarize, as accurately as possible, recognized associations of genetically related materials. Total thickness of each surficial deposit was calculated using ODNR Division of Geological Survey open-file bedrock topography maps, and bedrock units were summarized from ODNR Division of Geological Survey bedrock geology maps, all of which are available for each 7.5-minute quadrangle in the map area. The Ohio Statewide Imagery Program collected LiDAR data and converted it into a 2.5 x 2.5-ft-resolution digital elevation model (DEM). Using this DEM, the ODNR Division of Geological Survey generated a shaded relief and a percent slope digital model of the land surface.

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DISCLAIMER

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