STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
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DRAFT

SURFICIAL GEOLOGY OF THE BELLEFONTAINE 30 X 60-MINUTE QUADRANGLE

by

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Map SG-2-BEL
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MAPPING CONVENTIONS

This map provides a three-dimensional framework of the 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, shown by the stack of symbols within each map-unit area.

Figure 1 illustrates cross section A–A′ and mapping conventions. Letters, numbers, and modifiers are arranged in stacks that depict the vertical sequence of lithologic units for a given map-unit area. A single stack of symbols occurs in each map-unit area and applies only to the volume of sediments within that particular 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 deposits (IC). 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 environment.
4. Geomorphology or geomorphic location.
5. Geographic location within the map area, if pertinent.

Numbers (without modifiers) that follow the lithology designators represent the average thickness of a lithologic unit in tens of feet (for example, *3* represents 30 ft). If no number is present, the average thickness is implied as *1* (10 ft). These unmodified numbers correspond 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 is 40 ft, but that 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, *(T2)* indicates that till with an average thickness of 20 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 *SG9-* map-unit area adjacent to a *SG3* area indicates a sand-and-gravel unit having a maximum thickness of 90 ft that thins to an average of 30 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.

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 1:100,000 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.

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 feet 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 change of deposits at depth, such as water-well logs from the Ohio Department of Natural Resources (ODNR), Division of Soil and Water Resources and oil-and-gas-well logs on file at the ODNR Division of Geological Survey (fig. 2); test- boring logs provided by the Ohio Department of Transportation and Ohio Environmental Protection Agency (EPA) and county engineers offices (fig. 3); 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 surficial deposits was calculated from 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. Land-surface topography was derived from LiDAR data, collected as part of the Ohio Statewide Imagery Program, and then converted into a 12.5 x 12.5-ft-resolution digital elevation model (DEM) and shaded-relief model by the Ohio EPA. Detailed descriptions of 3-D mapping methods are described in Venteris (2007) and McDonald and others (2007).

LITHOLOGIC UNIT DESCRIPTIONS

SURFICIAL UNITS

w — **Water.** Lakes and reservoirs generally larger than 20 acres.

m — **Made land.** Large areas of cut and fill, such as dams, landfills, and urban areas; may include reclaimed strip mine areas. Underlain by bedrock or other lithologic units.

a — **Alluvium (Holocene).** Includes a wide variety of textures from silt and clay to boulders; commonly includes organic material; generally not compacted. Rarely greater than 20 ft thick; unit considered to thin to zero at contact with adjacent polygons. Present in floodplains of modern streams throughout entire map area or in human-made water retention features. Mapped only where areal extents and thicknesses are significant.

o — **Organic deposits (Holocene).** Muck and peat, may contain clay at depth; generally less than 20 ft thick; considered to thin to zero at contact with adjacent polygons. Formed in undrained depressions. Organic deposits too small to map at 100K-scale indicated by an asterisk (*) and underlain by material shown in surrounding map-unit area. Occupies depressions between beach ridges and dunes and on the lacustrine plain; present throughout the map area; common in marshy areas formerly occupied by intermoraines marshes.

C — **Clay (Wisconsinan).** Massive to laminated; may contain interbedded silt and fine sand; clay content can exceed 80 percent. Laminated clay commonly contains thin silt or sand partings. Carbonate-cemented concretions occur in some areas. Associated with the deep water deposits of high, proglacial predecessors of Lake Erie.

L — **Silt (Wisconsinan).** Massive or laminated; commonly contains thin sand partings. Carbonate-cemented concretions occur in some areas. May contain localized clay, sand, or gravel layers. Present throughout the map area as lowland surface deposits, terraces, and thick, deltaic deposits in intermoraine lakes.

S — **Sand (Wisconsinan).** Contains minor amounts of disseminated gravel or thin lenses of silt or gravel; grains well to moderately sorted, moderately to well rounded; finely stratified to massive, may be cross bedded; locally may contain organics. In deep buried valleys, may be older than Wisconsinan age. Present in association with deltaic deposits or outwash throughout map area.

SG — **Sand and gravel (generally Wisconsinan).** Intermixed and interbedded sand and gravel commonly containing thin, discontinuous layers of silt and clay; grains well to moderately sorted, moderately to well rounded, finely stratified to massive, may be cross bedded; locally may contain organics. In deep buried valleys, may be older than Wisconsinan age. Present as valley wall terraces and in buried valleys throughout the map area.

IC — **Ice-contact deposits (Wisconsinan).** Highly variable deposits of poorly sorted gravel and sand; silt, clay, and till lenses common; may be partially covered or surrounded by till. Deposited directly from stagnant ice as kame or esker landforms. Commonly associated with large, deep buried valleys.

T — **Till (Wisconsinan).** Unsorted mix of silt, clay, sand, gravel, and boulders; variable carbonate content; fractures common. May contain silt, sand, and gravel lenses. Deposited directly from several separate ice advances. Undifferentiated and unspecified age in buried valleys or where separated by intervening nontill units from an overlying till. Surface may be wave-planed or modified by lacustrine erosion and deposition.

CG — **Clay to gravel.** Complexly interbedded deposits of clay, silt, sand, gravel, and till in deeper parts of buried valleys; unspecified age. Unit identified from well logs; data insufficient for more detailed differentiation or age assignment.

CV — **Clay in Teays-age valleys (Early Pleistocene).** Includes the Minford Clay. May contain interbedded silt and fine-sand deltaic deposits where main trunk valley joins tributary valleys. May fill main trunk valley to 800 ft mean sea level, slightly higher in tributary valleys. Unit up to 300 ft thick. Comprised of lacustrine deposits found only in the subsurface in the largest, deeply buried valleys of the classical Teays Valley System.

G — **Gravel (Generally Wisconsinan age).** Contains minor amounts of disseminated sand as well as thin, discontinuous lenses of silt and thicker, more continuous beds of sand; unit well to poorly sorted, angular to well rounded; may be massive, cross bedded, or horizontally bedded. Clasts vary in lithology. In deep buried valleys, may be older than Wisconsinan age.

BEDROCK UNITS

Sh — **Shale.** Interbedded shale, limestone, and dolomite. Cincinnati group (Upper Ordovician) on western portion of the map area. Shale is shades of gray, olive, red, and green; calcareous; dolomitic; locally silty. Limestone is shades of gray and olive; finely to coarsely crystalline; contains thin to medium, irregular, nodular to wavy bedding; argillaceous. Dolomite is shades of olive and yellowish gray; finely to coarsely crystalline; mostly in thin to medium beds; argillaceous. Sparse to abundant fossils. Unit not exposed. Occurs in deep buried valleys. Upper Devonian Ohio Shale is also found in association with the Bellefontaine Outlier and eastern portions of mapping area. Dark brown to black, carbonaceous. Unit is exposed.

Ls — **Limestone.** Devonian-age. Limestone and some dolomite, thin to massive bedded, fossiliferous, may be cherty. Contains areas of well-developed karst topography; buried upper surface may be rubbley and include thick red clay (terra rosa-type paleosol). Source of aggregate. Stratigraphic names: Columbus and overlying Delaware Limestones. Exposed in portions of the map area.

D — **Dolomite.** Dominant bedrock unit present in the map area. Stratigraphic names of the dolomites, in descending stratigraphic order: Salina undifferentiated, Tymochtee and Greenfield Dolomites, and Lockport Dolomite. Salina undifferentiated (Upper and Lower Silurian): shades of gray and brown; very finely crystalline; mostly in thin to medium beds and laminae; locally includes shale, anhydrite, and/or gypsum beds and laminae. Tymochtee and Greenfield Dolomites undivided (Upper and Lower Silurian): dolomite and shale. Tymochtee Dolomite: shades of gray and brown; very finely crystalline; occurs in thin to massive beds with carbonaceous shale laminae and beds. Greenfield Dolomite: shades of gray and brown; very finely to coarsely crystalline; occurs as massive beds to laminae; argillaceous; locally brecciated in lower portion. Lockport Dolomite (Upper and Lower Silurian): variegated white to shades of gray; finely to coarsely crystalline; mostly in medium to massive beds; fossiliferous; vuggy, locally cherty in lower portion of unit.

EXPLANATION OF MAP SYMBOLS

- • Small area of organic deposits.
- × Quarry, mine, or strip mine; floored in bedrock; may contain reclaimed areas.
- × Sand-and-gravel pit. Pit bottom generally underlain by unconsolidated lithologic units of surrounding polygon(s). May contain reclaimed areas.
- —— Boundary between map-unit areas having different uppermost, continuous lithologies or significant bedrock lithology changes underlying lithologies may or may not differ.
- ····· Boundary between map-unit areas having the same uppermost, continuous lithology but different thicknesses or different underlying lithologies.

KEY TO LITHOLOGIC COLORS*

- Water
- Large sand and gravel pits*
- Alluvium (Holocene)
- Organic deposits (Holocene)
- Clay (Wisconsinan)
- Silt (Wisconsinan)
- Sand (Wisconsinan)
- Sand and gravel (generally Wisconsinan)
- Ice contact deposits (Wisconsinan)
- Till (Wisconsinan)
- Shale
- Limestone
- Dolomite
- Clay to gravel†
- Clay in Teays-age valleys (Early Pleistocene)†
- Shale†
- Limestone†
- Dolomite†

* 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.

†Shown only in cross section.

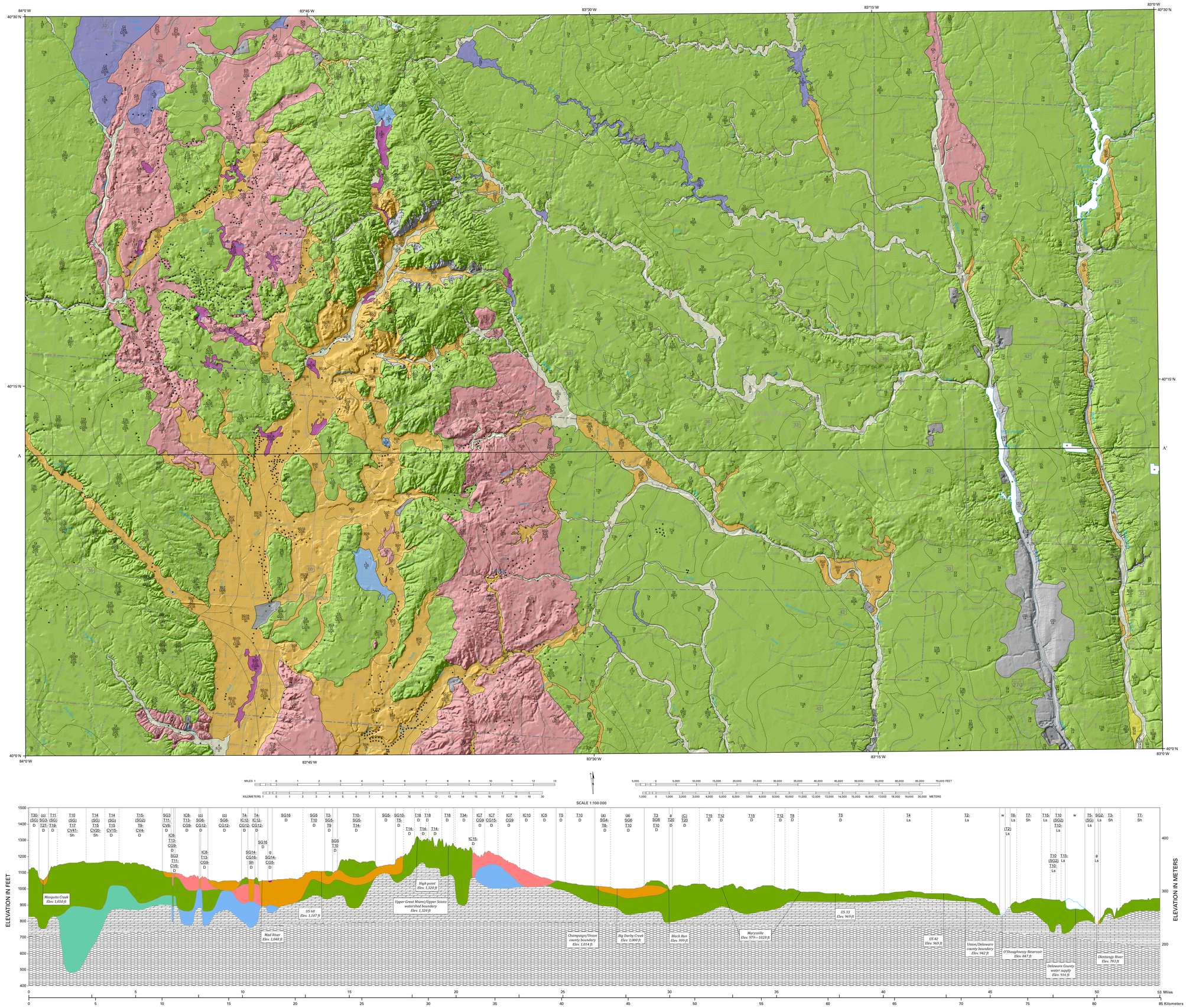
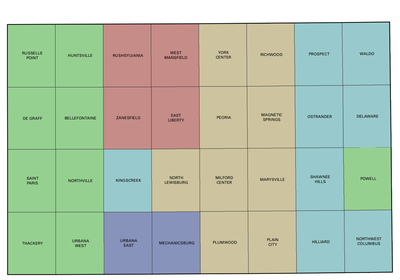


FIGURE 1.—Cross section of the Surficial Geology of the Bellefontaine 30x60-Minute Quadrangle. See key to cross section units for explanation of symbols. Solid-line boundaries separate map-unit areas having different lithologic units at the surface; underlying lithologic units may or may not differ. Dashed-line boundaries separate map-unit areas having the same surface lithologic unit but different thickness or different underlying lithologic units. The cross section illustrates thickness and mapping conventions. Thickness values are in tens of feet. Values are gross averages that can vary ±50 percent, except (I) thicknesses followed by a minus sign (-), which represent the maximum thickness of a thinning trough- or wedge-shaped sediment body, or (2) units in parentheses ( ), which indicate a discontinuous distribution of that unit. Precise surface topography can be determined from topographic maps that are available from the ODNR Division of Geological Survey at several scales; bedrock-surface topography and bedrock geology are available from the ODNR Division of Geological Survey as 1:24,000-scale quadrangle maps. Vertical exaggeration is 40x.

ACKNOWLEDGMENTS

The geologists of the ODNR Division of Geological Survey, Mapping and Industrial Minerals Group used data from records obtained from the Ohio Department of Transportation, Office of Geotechnical Engineering Geotechnical Document Management System, available online at <http://www.dot.state.oh.us/Divisions/Engineering/Geotechnical/Pages/GDocMS.aspx#GRSR>.



Mapping responsibility and index to the 7.5-minute (1:24,000-scale) quadrangles in the Bellefontaine 30 X 60-minute quadrangle. Mapping completed in 2013.

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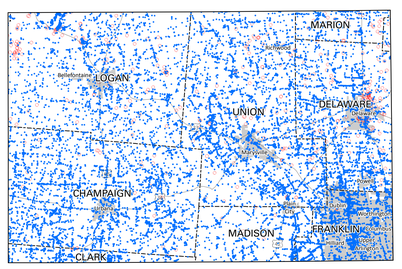

FIGURE 2.—Plot of oil-and-gas wells and water wells in the Bellefontaine 30 X 60-minute quadrangle. Oil-and-gas well logs on file at ODNR Division of Geological Survey. Water-well logs on file at ODNR Division of Soil and Water Resources.

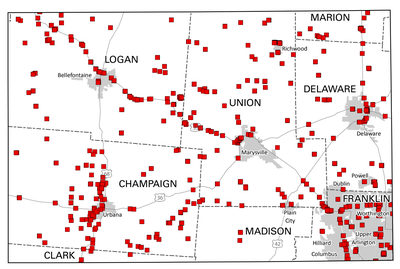

FIGURE 3.—Plot of soil boring locations in the Bellefontaine 30 X 60-minute quadrangle. Test-boring logs provided by Ohio Department of Transportation, Ohio Environmental Protection Agency, and county engineers offices.

Location of the Bellefontaine 30 X 60-minute quadrangle

Base map derived from Ohio Department of Transportation data sets. Projection of data is Ohio coordinate system, south zone, North American Datum, 1983.

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