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

SURFICIAL GEOLOGY OF THE DEFIANCE 30 X 60-MINUTE QUADRANGLE IN OHIO

by
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Map SG-2-DEF
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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 extent of the deposits, indicated by map-unit area boundaries.
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 up to 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 areas 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 Water 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, which were 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

m — **Made land.** Large areas of cut and fill, such as dams, landfills, and urban areas; may include reclaimed or active quarries or pits. 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 extent and thickness are significant.

o — **Organic deposits (Holocene).** Muck and peat, may contain clay at depth. Generally less than 20 feet 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 on moraines, between beach ridges and dunes, and on the lacustrine plain; occurs throughout the map area and is common in areas formerly occupied by intermorainal marshes.

At — **Alluvial terraces (Wisconsinan).** Old floodplain remnants along streams that flowed into high, proglacial lakes. Highly variable textures; commonly present tens of feet above modern floodplains.

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.

LC — **Silt and clay (Wisconsinan).** Laminated to interbedded, may contain thin, fine sand or gravel layers. Present as thick, deltaic deposits; outwash deposits in upland depressions; and intermorainal lake deposits. Associated with deep water and deltaic 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. Associated with moderate-depth water and deltaic deposits of high, proglacial predecessors of Lake Erie.

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, finer-grained ice-contact deposits, and as nearshore dune and beach ridge deposits of proglacial predecessors of Lake Erie.

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 and as beach ridge deposits of proglacial predecessors of Lake Erie. SGg units contain patchy gas (fig. 4).
SGg

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 nonspecified age in buried valleys or where separated by intervening nontill units from an overlying, designated till. Surface may be wave planed or modified by lacustrine erosion and deposition. Tg units contain patchy gas (fig. 4).
Tg

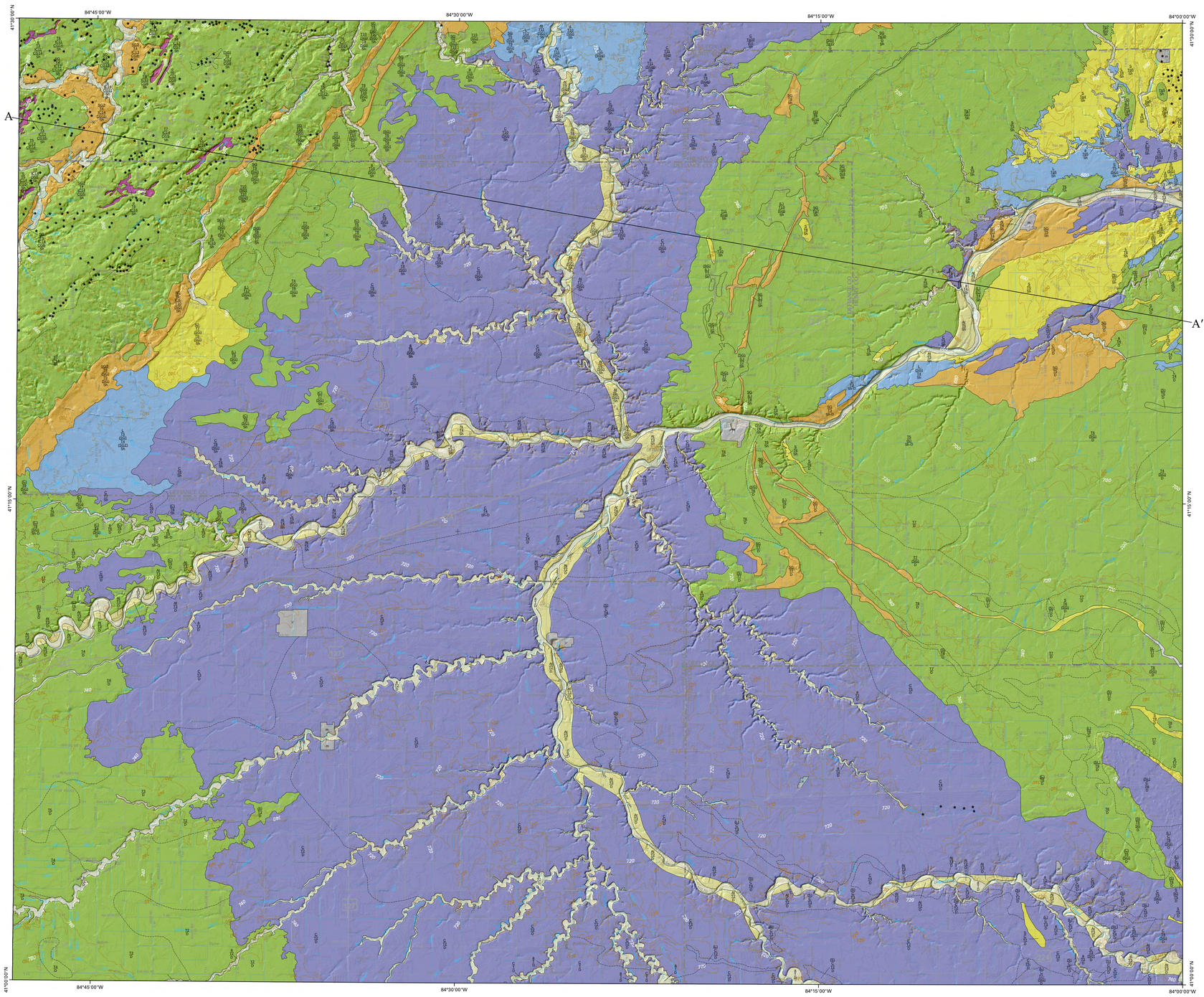
CG — **Clay to Gravel.** Complexly interbedded deposits of clay, silt, sand, gravel, and till in deeper parts of buried valleys; unspecified age. Unit identified from well logs; data insufficient for more detailed differentiation or age assignment.

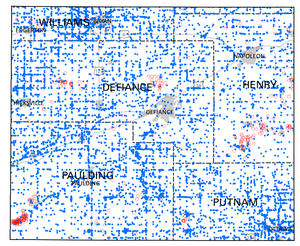
G — **Gravel.** Generally Wisconsinan age. Contains minor amounts of disseminated sand and thin, discontinuous lenses of silt and thicker, more continuous beds of sand; unit well to poorly sorted, angular to well rounded; may be massive, cross bedded, or horizontally bedded. Clasts vary in lithology. In deep buried valleys, may be older than Wisconsinan age. Gg units contain patchy gas (fig. 4).

BEDROCK UNITS

Sh — **Shale.** Coldwater, Sunbury, Bedford, and Antrim Shale. Coldwater Shale (Lower Mississippian), shades of gray to greenish black; clayey; calcareous; carbonate nodules at base. Sunbury and Bedford Shales, undivided (Lower Mississippian and Upper Devonian). Sunbury Shale: brownish black to greenish black; carbonaceous; pyritic. Bedford Shale, shades of gray to olive green; silty to clayey. Antrim Shale (Upper Devonian): brownish black; carbonaceous. Units not exposed, occur beneath undifferentiated Quaternary and Neogene(?) deposits in northwestern Ohio; data from core holes.

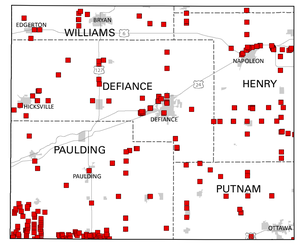
D — **Dolomite.** Stratigraphic names in descending stratigraphic order; predominantly dolomites: Traverse Group, Dundee Limestone, Detroit River Group, and Salina Group undifferentiated. Traverse Group (Middle Devonian): Ten Mile Creek Dolomite and Silica Formation; undivided dolomite, limestone, and shale. Ten Mile Creek Dolomite: gray; contains some nodules of chert. Silica Formation: calcareous clayey shale and limestone; bluish gray; highly fossiliferous. Dundee Limestone (Middle Devonian): blue, gray, and brown; upper is highly fossiliferous; lower contains cherty dolomite. Detroit River Group (Middle and Lower Devonian): dolomite, sandstone, and shale. Unit consists generally of three formations, in descending order: Lucas and Amherstburg Dolomites and Sylvania Sandstone. Lucas and Amherstburg Dolomites: brown to gray; mostly medium to thick beds; carbonaceous laminae. Sylvania Sandstone: white; fine grained; quartzose grains well rounded; locally dolomitic. Salina Group undifferentiated (Upper and Lower Silurian): shades of gray and brown; very finely crystalline; mostly thin to medium beds and laminae; locally includes shale, anhydrite, and/or gypsum beds and laminae.





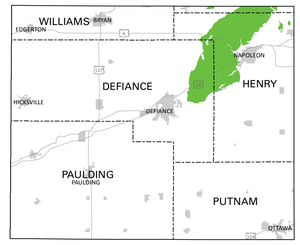
Oil & gas wells Water wells

FIGURE 2.—Plot of oil-and-gas wells and water wells in the Ohio portion of the Defiance 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.



Soil borings

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



Area of occuring natural gas

FIGURE 4.—Natural gas may occur in various units and at depths of 30 feet or greater, sometimes in multiple horizons. The gas is thought to result either from the decay of buried organic deposits (ancient soils or bog deposits), or, in areas underlain by Antrim shale, migration out of the bedrock and into the overlying glacial deposits. Gas may be encountered in tills and gravels just above the bedrock surface, or it may be found well above the bedrock interface.

Location of the Defiance
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.

MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
KILOMETERS 1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
SCALE 1:100 000
5,000 0 5,000 10,000 15,000 20,000 25,000 30,000 35,000 40,000 45,000 50,000 55,000 60,000 65,000 70,000 FEET
1,000 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000 11,000 12,000 13,000 14,000 15,000 16,000 17,000 18,000 19,000 20,000 METERS

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.

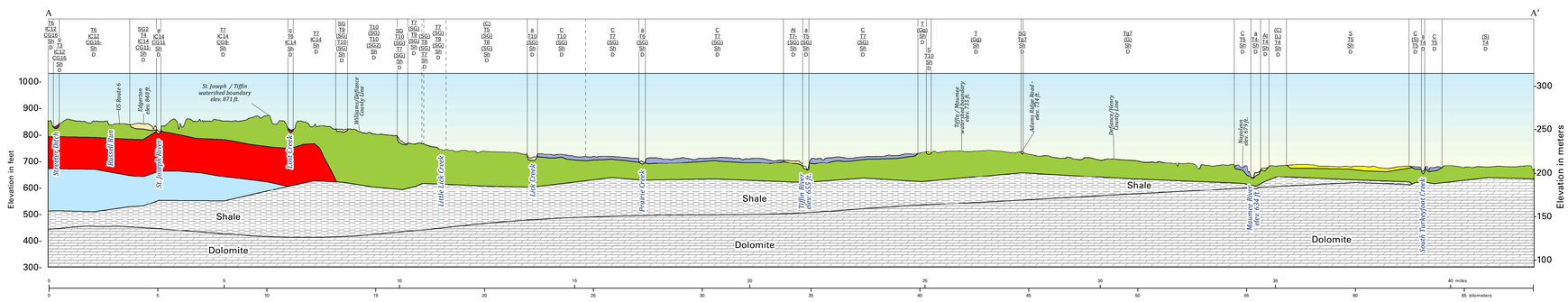
Boundary between map-unit areas having different uppermost, continuous lithologies or significant bedrock lithology change; underlying lithologies may or may not differ.

Boundary between map-unit areas having the same uppermost, continuous lithology but different

KEY TO LITHOLOGIC COLORS*

- Made land, quarries, mines or large pits
- Alluvium (Holocene)
- Organic deposits (Holocene)
- Alluvial terraces (Wisconsinan)
- Clay (Wisconsinan)
- Silt (Wisconsinan)
- Sand (Wisconsinan)
- Sand and gravel (generally Wisconsinan)
- Till (Wisconsinan)

* 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.



KEY TO CROSS SECTION UNITS

- Alluvium (Holocene)
- Organic deposits (Holocene)
- Alluvial terraces (Wisconsinan)
- Clay (Wisconsinan)
- Clay to gravel
- Ice contact
- Sand (Wisconsinan)
- Sand and gravel (generally Wisconsinan
- Till (Wisconsinan)
- Shale
- Dolomite

FIGURE 1.—Cross section of the Surficial Geology of the Defiance 30x60-Minute Quadrangle in Ohio. 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 up to 50 percent, except (1) those 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.

BUTLER EAST	EDGERTON	BRYAN	EVANSPORT	ROGEVILLE CORNERS	NAPOLEON WEST	NAPOLEON EAST
HICKSVILLE	MARK CENTER	SHERWOOD	DEFIANCE WEST	DEFIANCE EAST	FLORIDA	MALINTA
WOODBURN NORTH	ANTWERP	PAULDING	JUNCTION	AVERYVILLE	NEW BAVARIA	HAMLER
WOODBURN SOUTH	PAYNE	LATTY	OAKWOOD	CONTINENTAL	MILLER CITY	OTTAWA

Mapping responsibility and index to the 7.5-minute (1:24,000-scale) quadrangles in the Ohio portion of the Defiance 30 X 60-minute quadrangle. Mapping completed in 2011.

AUTHOR INDEX

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<http://www.dot.state.oh.us/Divisions/Engineering/Geotechnical/Pages/GDocMS.aspx#GRSR>.

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