

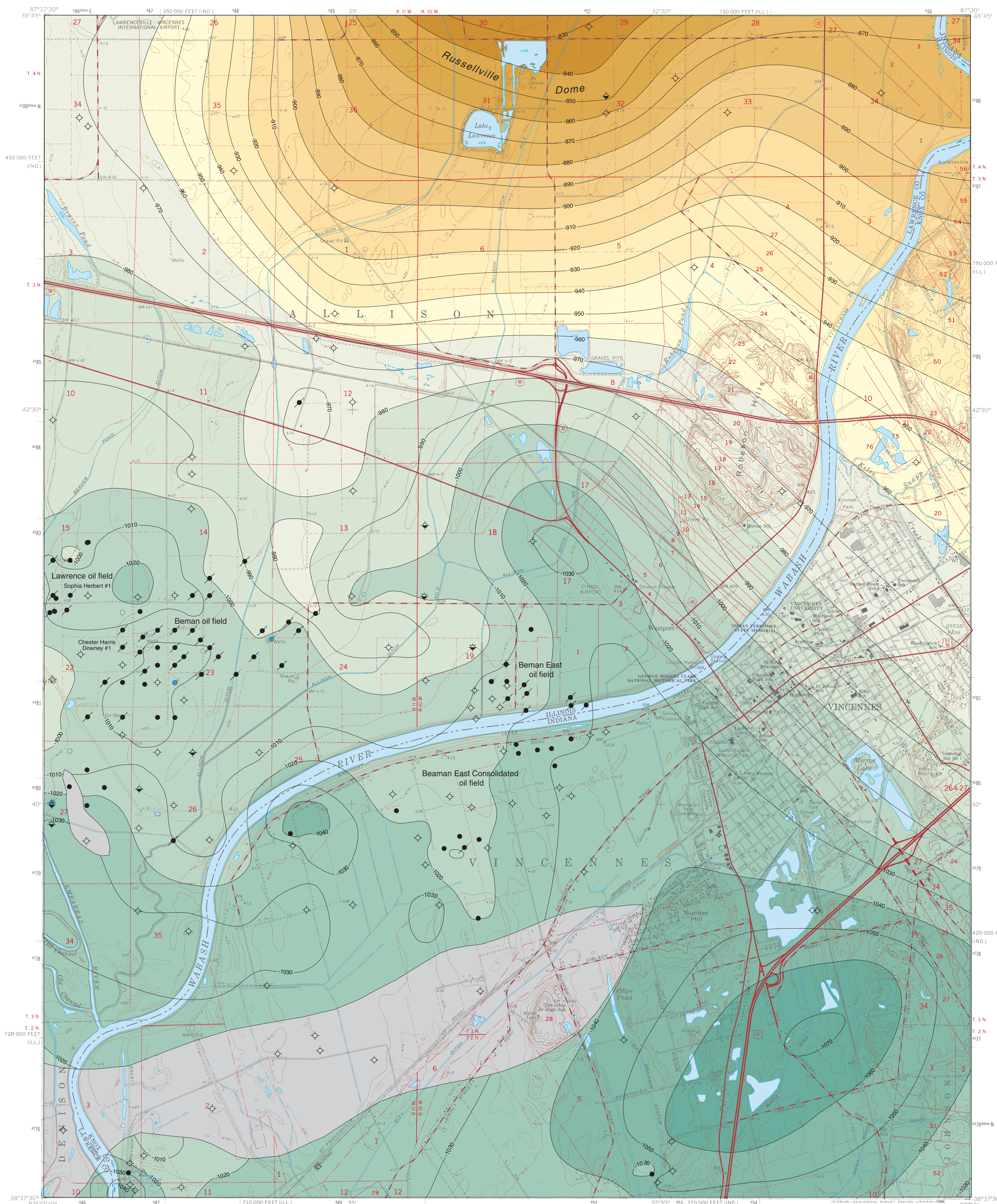
SUBSURFACE STRUCTURE AND PETROLEUM DRILLING IN THE VINCENNES

QUADRANGLE: MAP 1—GLEN DEAN FORMATION LAWRENCE COUNTY, ILLINOIS AND KNOX COUNTY, INDIANA

Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

Illinois Geologic Quadrangle Map
IGQ Vincennes-SP

Bryan G. Huff, Beverly Seyler, Russell J. Jacobson, Alison B. Lecouris, and Paul N. Irwin
2016



Introduction

As part of the 1:24,000 mapping project of the Illinois State Geological Survey conducted in cooperation with the Indiana Geological Survey, structure maps were constructed on three Mississippian horizons in the Vincennes Quadrangle by using geophysical and drillers' logs. The Vincennes Quadrangle is an area of oil production, and in addition to structure, these maps show the locations of oil accumulations. They can be used as a predictive tool to locate possible new discoveries as well as to identify areas of poor potential.

Stratigraphy

Pre-Pennsylvanian rocks in the Vincennes area are overlain by approximately 1,400 feet (427 meters) of Pennsylvanian rocks, which, in turn, are overlain by up to 160 feet (49 meters) of Quaternary sediments. The base of the Pennsylvanian is unconformable with the Mississippian and occurs at depths of between 1,200 and 1,500 feet (366 and 457 meters). Below this surface are approximately 1,600 feet (488 meters) of Mississippian strata. The Devonian has been only partially penetrated and its total thickness in the quadrangle is unknown. Over most of the area, the Tar Springs Sandstone and Glen Dean Limestone are observed beneath the base of the Pennsylvanian, although locally, erosion into strata as old as the Hardinsburg Sandstone is observed beneath a Pennsylvanian channel in the southwestern part of the quadrangle. In a few areas, the Vienna Limestone appears to be present and would be the youngest Mississippian stratum in the area.

Subsurface Mapping and Structure

Structure maps for the Vincennes area were constructed on the top of the Glen Dean Limestone (Map 1), the top of the Beech Creek ("Barlow") Limestone (Map 2), and the top of the Ste. Genevieve Limestone (Map 3). The southern end of the only named structure in the mapping area, the Russellville Dome (Nelson 1995, p. 106), is visible in the north portion of the map and shows approximately 200 feet (61 meters) of structural relief. Other structural features in the area consist primarily of northeast-southwest- and northwest-southeast-trending sinuous anticlines and synclines with axes from one to several miles long. Dips on the flanks are generally less than one half a degree. Two closed depressions, one in the southeast and one in the central portion of the map, are visible, as is a small dome on the Ste. Genevieve and Barlow surfaces on the east side of the map just north of Vincennes. The structures are reflected in the different mapping horizons, although the axes only approximately and sometimes discontinuously overlie each other.

Mapping was attempted on the sub-Pennsylvanian unconformity, but the difficulties in distinguishing this surface on electric logs (Atherton et al. 1960; Bristol and Howard 1971, p. 6) precluded construction of an accurate map. The lack of Devonian penetrations made mapping on Devonian horizons impractical.

Oil Production

Oil was first discovered in the Vincennes Quadrangle in July of 1913 when the Ohio Oil Company completed its Sophia Herbert #1 well in the Lawrence field. The well had an initial production of 40 barrels of oil per day from the Fredonia ("McClosky") Limestone and a plugged-back total depth of 1,904 feet (580 meters).

A total of 77 oil-producing wells assigned to four oil fields are located within the Vincennes Quadrangle. In Illinois, the wells are assigned to Beman (discovered in 1942), Beman East (discovered in 1947) and a small portion of the giant Lawrence field. The wells in Indiana are assigned to the Beman East Consolidated field, which was formed when Beman East (discovered in 1949) and Beman South were consolidated in 1960. As of the beginning of 2005, only the Beman field was still active and produced about 100 barrels of oil per month.

Oil production in the area is from the Mississippian Aux Vases Sandstone and the Spar Mountain (Rosiclare) Sandstone and Fredonia ("McClosky") Limestone Members of the Ste. Genevieve Formation at depths of approximately 1,800 to 1,870 feet (549 to 570 meters). Traps are primarily stratigraphic; changes in rock thickness and type coupled with axis changes in subtle anticlines and structural noses allowed oil to accumulate. A total of 780,396 barrels of oil were produced in the quadrangle through 2015.

Table 1 Oil production in the Vincennes Quadrangle through 2015, in barrels of oil

Production	Field	Barrels
Illinois	Beman	488,100
	Beman East	130,200
	Lawrence	7,096 ¹
Indiana	Beman East Consolidated	152,053
	Total	780,396 ²

¹Includes only wells in the Vincennes Quadrangle.
²Figure is incomplete; production began in the Lawrence field before records were kept.

The deepest oil test in the quadrangle is the Chester Harris Downey #1 in Section 22, T 3 N, R 11 W. This well was drilled to a total depth of 3,376 feet (1,090 meters) and tested Devonian and younger strata. It was completed in August of 1939 and was dry and subsequently abandoned.

Future Oil Possibilities

Several infill and development locations have yet to be drilled in the existing fields. Although no undrilled locations can be dismissed as potentially oil productive, two areas show a higher probability of containing undiscovered oil. The first is the Pennsylvanian channel visible in the southwest part of the Glen Dean Limestone structure map (Map 1). Several types of reservoirs (e.g., basal sands) are found within such channels (Howard and Whitaker 1988). The second area is the high most notable on the eastern section of the Ste. Genevieve structure map (Map 3). This high was defined using data from a drillers' log and should be viewed with some suspicion.

References

Atherton, E., G.E. Emrich, H.D. Glass, P.E. Potter, and D.H. Swann, 1960, Differentiation of Caseyville (Pennsylvanian) and Chester (Mississippian) sediments in the Illinois Basin: Illinois State Geological Survey, Circular 306, 36 p.
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Howard, R.H., and S.T. Whitaker, 1988, Hydrocarbon accumulation in a paleovalley at Mississippian-Pennsylvanian unconformity near Hardinville, Crawford County, Illinois: A model paleogeomorphic trap: Illinois State Geological Survey, Illinois Petroleum 129, 26 p.
Nelson, J.W., 1995, Structural features in Illinois: Illinois State Geological Survey, Bulletin 100, 144 p.

Base map compiled by the Illinois State Geological Survey from the United States Geological Survey topographic map dated 1998. Topography compiled from imagery dated 1958 and 1962 and plane-table surveys in 1961 and 1965. Planimetry derived from imagery taken in 1987 and other sources. Photosynthesized using imagery dated 1998.

North American Datum of 1927 (NAD 27)
Projection: Transverse Mercator
10,000-foot ticks: Illinois State Plane Coordinate System, east zone, and Indiana State Plane Coordinate System, west zone (Transverse Mercator)
1,000-meter ticks: Universal Transverse Mercator grid system, zone 16

Recommended citation:
Huff, B.G., B. Seyler, R.J. Jacobson, A.B. Lecouris, and P.N. Irwin, 2016, Map 1—Glen Dean Formation, in Subsurface structure and petroleum drilling in the Vincennes Quadrangle, Lawrence County, Illinois and Knox County, Indiana: Illinois State Geological Survey, Illinois Geologic Quadrangle Map, IGQ Vincennes-SP, 3 sheets, 1:24,000.



ADJOINING QUADRANGLES

1	2	3
4	5	6
7	8	9

1 Birds
2 Russellville
3 Oakton
4 Lawrenceville
5 Frickton
6 Saint Francisville
7 Decker
8 Iona, IN

APPROXIMATE MEAN DECLINATION, 2016

Geology based on subsurface geophysical log interpretation by Bryan G. Huff, Beverly Seyler, Russell J. Jacobson, and Alison B. Lecouris, Illinois State Geological Survey, and Paul N. Irwin, Indiana Geological Survey, 1996-1998.

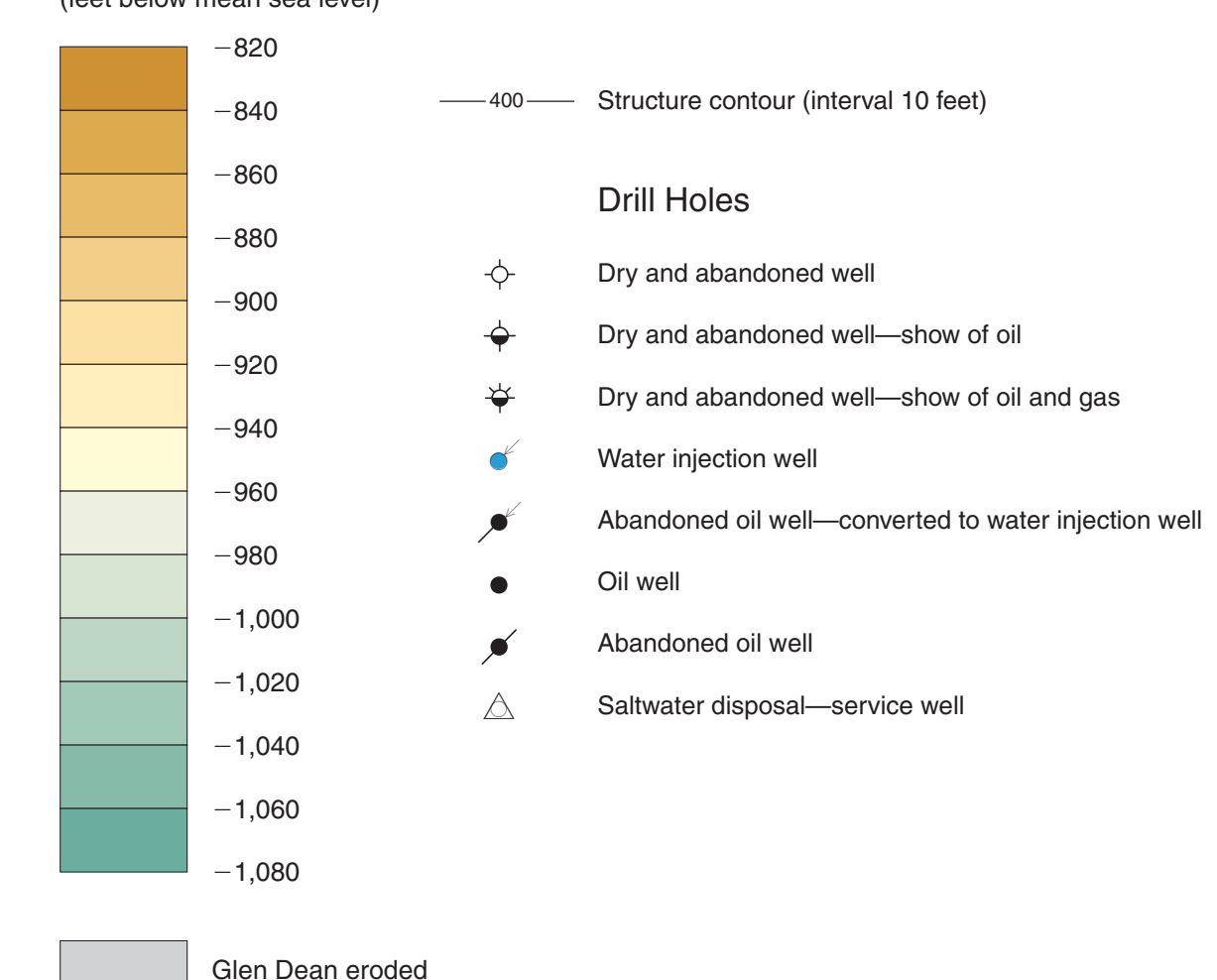
Digital cartography by Jane Johnson-Dornier, Michael Widener, and Jennifer E. Carrell, Illinois State Geological Survey.

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ROAD CLASSIFICATION

Primary highway, hard surface	Light-duty road, hard or improved surface
Secondary highway, hard surface	Unimproved road
U.S. Route	State Route

Elevation of Top of Glen Dean Formation (feet below mean sea level)



SUBSURFACE STRUCTURE AND PETROLEUM DRILLING IN THE VINCENNES QUADRANGLE: MAP 2—BEECH CREEK MEMBER OF THE GOLCONDA FORMATION

LAWRENCE COUNTY, ILLINOIS AND KNOX COUNTY, INDIANA

Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

Illinois Geologic Quadrangle Map
IGQ Vincennes-SP

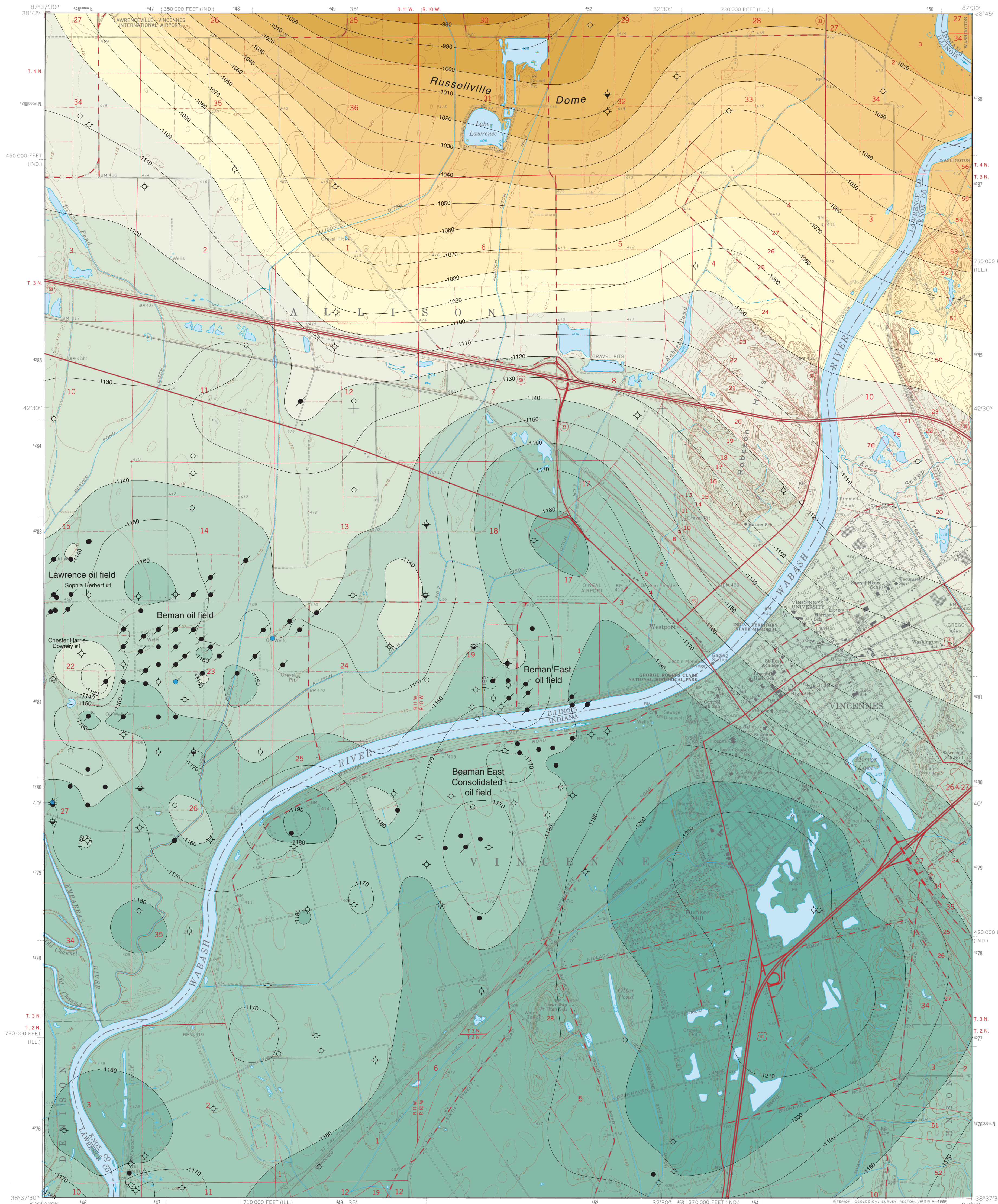
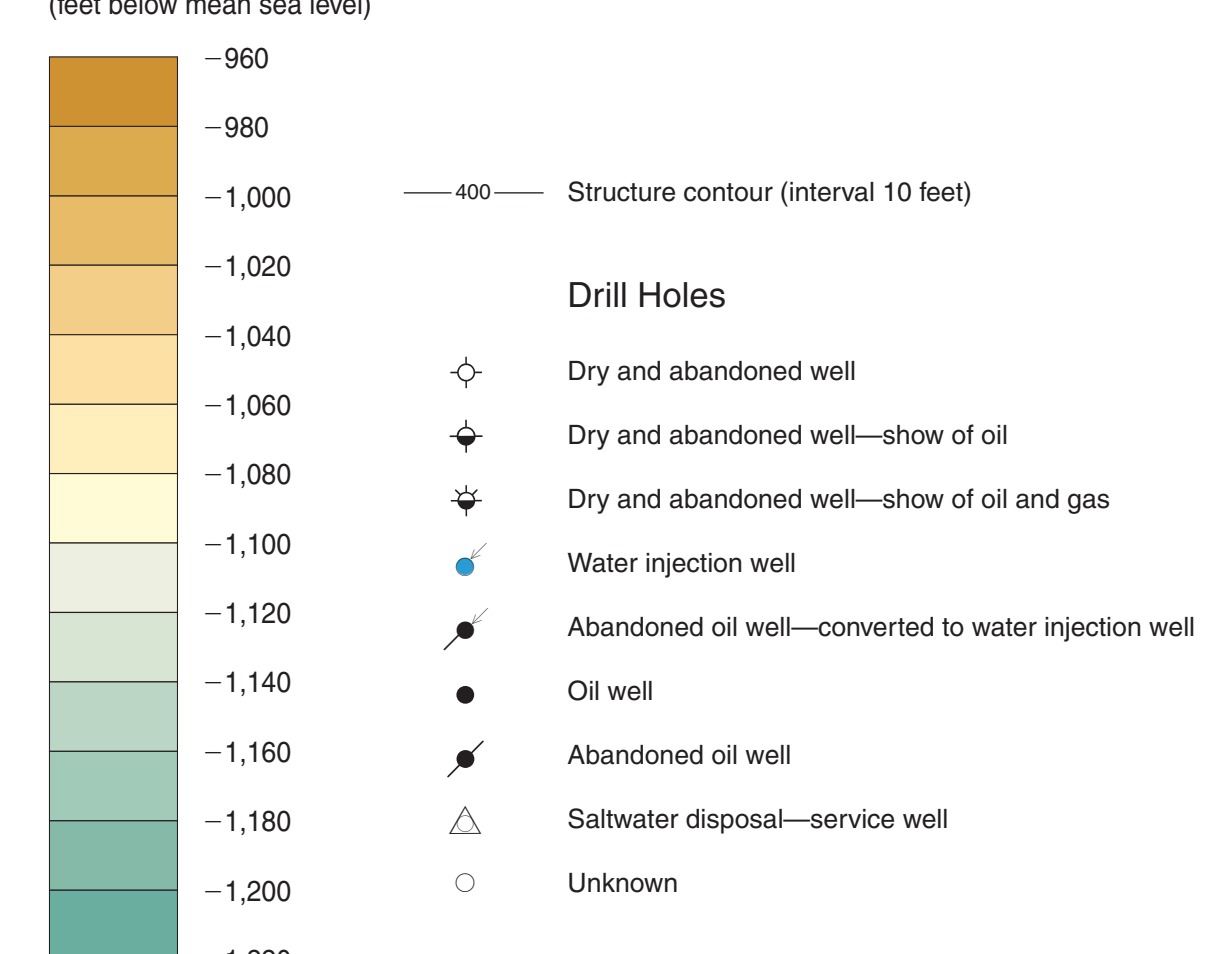
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STRATIGRAPHIC AND LITHOLOGIC COLUMN OF ROCKS IN THE VINCENNES AREA

SYSTEM	SERIES	FORMATION	MEMBER	GRAPHIC COLUMN	APPROX. THICKNESS (FEET)	
PENNSYLVANIAN	Undifferentiated, only lower part shown	Vienna Ls.			to 1,400	
		Tar Springs Sandstone			0-50	
		Glen Dean Ls.			0-20	
		Hardinsburg Ss.			5-15	
		Golconda	Haney Limestone			80
			Fraileys Shale			85
		CHESTERIAN	Cypress Sandstone			105
				Ridenhower		27
			Bethel Ss.		20	
			Yankeetown Sandstone	Downey's Bluff Limestone		30
Aux Vases Sandstone			30			
Ste. Genevieve Limestone	Karnak Limestone			20		
	Spar Mountain ("Rosclaw") Sandstone		Fredonia ("McClosky") Limestone		100	
MISSISSIPPIAN	St. Louis Limestone				230	
			Salem Limestone		220	
				Ullin Limestone		120
VALMIEYERAN	Fort Payne			400		
		Borden Siltstone		35		
DEVONIAN	UPPER	New Albany Shale	Grassy Creek Shale		90	
			Sweetland Creek Shale		40	
			Blocher Shale		20	
	LOWER	Lingle Limestone		80		
		Grand Tower Limestone		Unknown Bottom Contact Not Penetrated		
	KINDERHOOKIAN	Saverton Shale			10	
			Cibola Ls.		14	

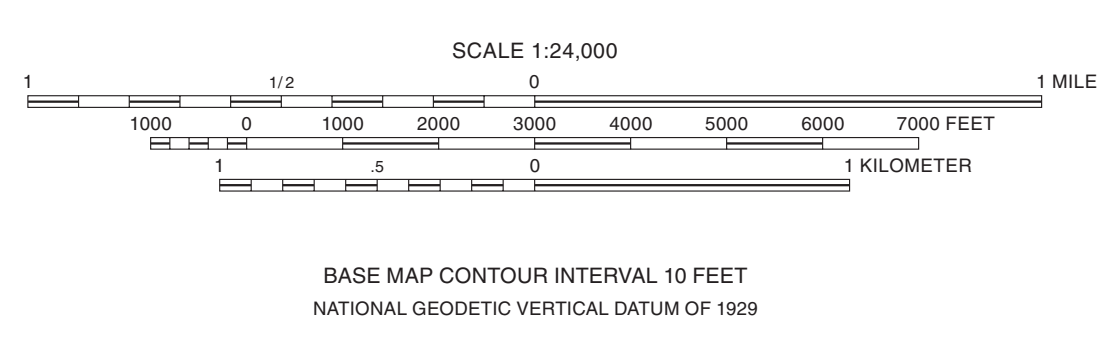
Lithologic Symbols

Elevation of Top of Beech Creek ("Barlow") Member of Golconda Formation (feet below mean sea level)



Base map compiled by the Illinois State Geological Survey from the United States Geological Survey topographic map dated 1996. Topography compiled from imagery dated 1958 and 1962 and plane-table surveys in 1961 and 1965. Planimetry derived from imagery taken in 1987 and other sources. Photosynthesized using imagery dated 1998.

North American Datum of 1927 (NAD 27)
Projection: Transverse Mercator
10,000-foot ticks: Illinois State Plane Coordinate System, east zone, and Indiana State Plane Coordinate System, west zone (Transverse Mercator)
1,000-meter ticks: Universal Transverse Mercator grid system, zone 16



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Recommended citation:
Huff, B.G., B. Seyler, R.J. Jacobson, A.B. Lecouris, and P.N. Irwin, 2016, Map 2—Beech Creek Member of the Golconda Formation, in Subsurface structure and petroleum drilling in the Vincennes Quadrangle, Lawrence County, Illinois and Knox County, Indiana: Illinois State Geological Survey, Illinois Geologic Quadrangle Map, IGQ Vincennes-SP, 3 sheets, 1:24,000.



ADJOINING QUADRANGLES

1	2	3
4	5	
6	7	8

1 Birds
2 Russellville
3 Oakton
4 Lawrenceville
5 Friction
6 Saint Francisville
7 Decker
8 Iona, IN



ROAD CLASSIFICATION

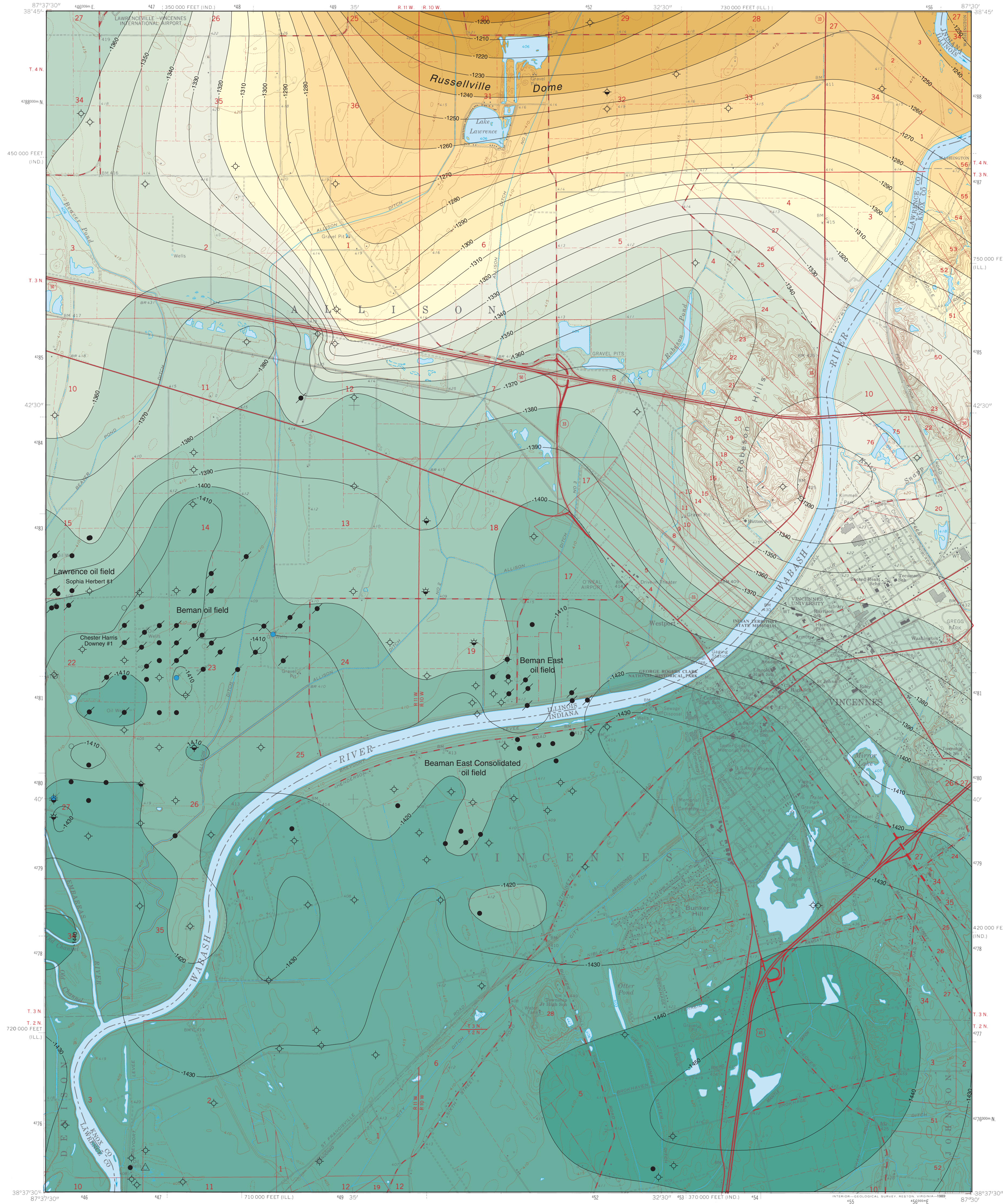
SUBSURFACE STRUCTURE AND PETROLEUM DRILLING IN THE VINCENNES

QUADRANGLE: MAP 3—STE. GENEVIEVE FORMATION LAWRENCE COUNTY, ILLINOIS AND KNOX COUNTY, INDIANA

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Illinois Geologic Quadrangle Map
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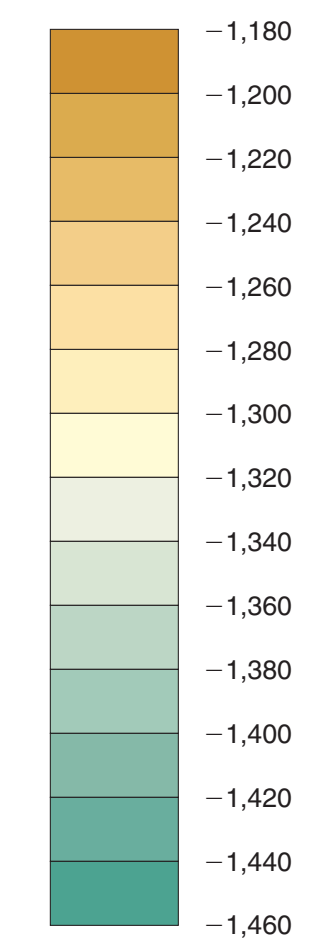


— 400 — Structure contour (interval 10 feet)

Drill Holes

- ◊ Dry and abandoned well
- ◆ Dry and abandoned well—show of oil
- ◆ Dry and abandoned well—show of oil and gas
- Water injection well
- Abandoned oil well—converted to water injection well
- Oil well
- Abandoned oil well
- △ Saltwater disposal—service well
- Unknown

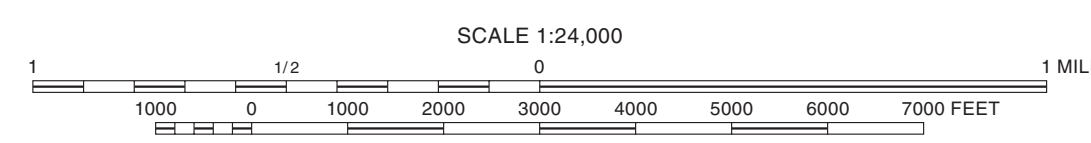
Elevation of Top of Ste. Genevieve Formation (feet below mean sea level)



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BASE MAP CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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7	8	

ADJOINING QUADRANGLES
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31° 5' 30" N
APPROXIMATE MEAN DECLINATION, 2016

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- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- U.S. Route
- State Route