INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI

University Microfilms International
A Bell & Howell Information Company
300 North Zeeb Road. Ann Arbor, MI 48106-1346 USA
313/761-4700 800/521-0600

Order Number 9411959

Geologic and fluid-density controls on the hydrodynamics of the Mt. Simon Sandstone and overlying geologic units in Ohio and surrounding states

Gupta, Neeraj, Ph.D.

The Ohio State University, 1993

U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

GEOLOGIC AND FLUID-DENSITY CONTROLS ON THE HYDRODYNAMICS OF THE MT. SIMON SANDSTONE AND OVERLYING GEOLOGIC UNITS IN OHIO AND SURROUNDING STATES

DISSERTATION

Presented in Partial Fulfillment of the Requirements for

the Degree Doctor of Philosophy in the Graduate

School of The Ohio State University

By

Neeraj Gupta, B.Sc., M.Sc., M.S.

* * * * *

The Ohio State University

1993

Dissertation Committee:

Dr. E. Scott Bair

Dr. Gunter Faure

Dr. Thomas G. Naymik

Dr. Franklin W. Schwartz

Approved by

Adviser
Department of Geological Sciences

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to Dr. Scott Bair for his scientific guidance, financial support, friendship, and most of all for his patience during this long process. I would like to thank Drs. F. W. Schwartz, G. Faure, and T. G. Naymik for serving as research committee members. Special thanks are due to Dr. Schwartz for his thoughtful advice throughout this project and for providing unlimited access to the computer systems on which the simulations were run. This study would not have been possible without generous help from a large number of people. Foremost among them is Larry H. Wickstrom at the Ohio Geological Survey who provided unlimited access to all the geological survey files and records, his own library and his personal insight into the study area. Thanks are due to the staff of the Ohio Geological Survey, especially to the Chief Geologist Thomas Berg, Ron Rea, and Ron Riley for their assistance at various stages of data compilation. I also thank Rodney Sheets of the U.S. Geological Survey for permission to use and modify his original computer code for vector plots, to George Casey for providing the Digital Elevation Model data, and to my colleagues Abe Springer and Yuping Xu for help at various stage of the project. Finally, I am forever indebted to my wife Rashmi for her love and to my family in India for their patience and support during all these years of being away from home.

VITA

June 19, 1962	Born - New Delhi, India
1984	B.Sc., Geology, Panjab University, Chandigarh, India
1985	M.Sc., Geology, Panjab University, Chandigarh, India
1989	M.S. Geochemistry, George Washington University, Washington D.C.
1987-1993	Graduate Teaching Associate and Graduate Fellow, Department of Geolgical Sciences, The Ohio State University
1989-1991, 1993	Research Intern, Hydrogeologic Transport and Assessment, Battelle, Columbus, Ohio
1993	Research Scientist, Hydrogeologic Transport and Assessment, Battelle, Columbus, Ohio

PUBLICATIONS

Gupta, N., and E.S. Bair, 1992, Influence of variable fluid density on regional flow patterns in the Mt. Simon Sandstone waste-injection reservoir, USA, 29th Int. Geol. Cong., Kyoto, Japan, p. 227.

Gupta, N., and E.S. Bair, 1992, Regional variable-density flow in the Mt. Simon Sandstone waste-injection reservoir, Proc. of 5th Int. Conf. on Solving Ground Water Problems with Models, National Ground Water Association, Dallas, TX. p. 497-510.

Gupta, Neeraj, and E.S. Bair, 1992, Structural and fluid-density controls on the flow system in the Paleozoic arches and basins of the midwest. Geol. Soc. Amer., abstracts with programs, p. 282.

Wickramnayake, G.B., N. Gupta, R.E. Hinchee, and B.J. Nielsen, 1991, Free petroleum hydrocarbon volume estimates from monitoring well data, Journal of Environmental Engineering, ASCE, volume 117(5), p. 686-691.

Beard, Thomas C. and Gupta, N., 1990, Geology and hydrogeology of West Jefferson North site, Corporate report prepared by Battelle Memorial Institute, Columbus, OH, for the U. S. Department of Energy, 47 p.+appendices.

Siegel, F.R., C.D. Gerber, N. Gupta, and D.J. Stanley, 1988, Geochemical relations in cores from Nile Delta, Egypt, AAPG Bulletin, volume 72(2), p. 247.

Siegel, F.R., C.D. Gerber, N. Gupta, and D.J. Stanley, 1988, Factors and geochemical barriers controlling clay fraction chemistry in Nile Delta sediments, Egypt, Chemical Geology volume 70(1/2), p.16.

FIELDS OF STUDY

Major Field: Geological Sciences

Specialization: Hydrogeology, Geochemistry

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

This dissertation presents the regional hydrodynamics of the groundwater flow system in the midwestern United States and an analysis of the geologic and hydrologic factors that control regional flow directions and velocities. The geologic units of interest are the Mt. Simon Sandstone and overlying strata encompassing the sedimentary basins and arches in Ohio and the surrounding states (fig. 1).

Regional groundwater flow patterns in large sedimentary basins are controlled by topography-related gravitational forces, lateral and vertical variations in hydraulic conductivity, and (formation fluid) density-driven forces. Several conceptual, field, and numerical studies have been published describing the roles of topography and hydraulic conductivity on regional flow patterns. These include the classic papers of Toth (1963, 1978) on the generation of local, intermediate, and regional flow cells and cross-formational flow through low-permeability layers; Hitchon (1969a, 1969b) on topographic and geologic controls on flow patterns in the western Canada sedimentary basin; and Freeze and Witherspoon's (1966, 1967) numerical solution and extension of the analytically-based solution by Toth (1963).

A significant assumption in many previous studies (Hitchon, 1969a, 1969b; Toth, 1978) is that effects of variations in formation-fluid density can be adequately

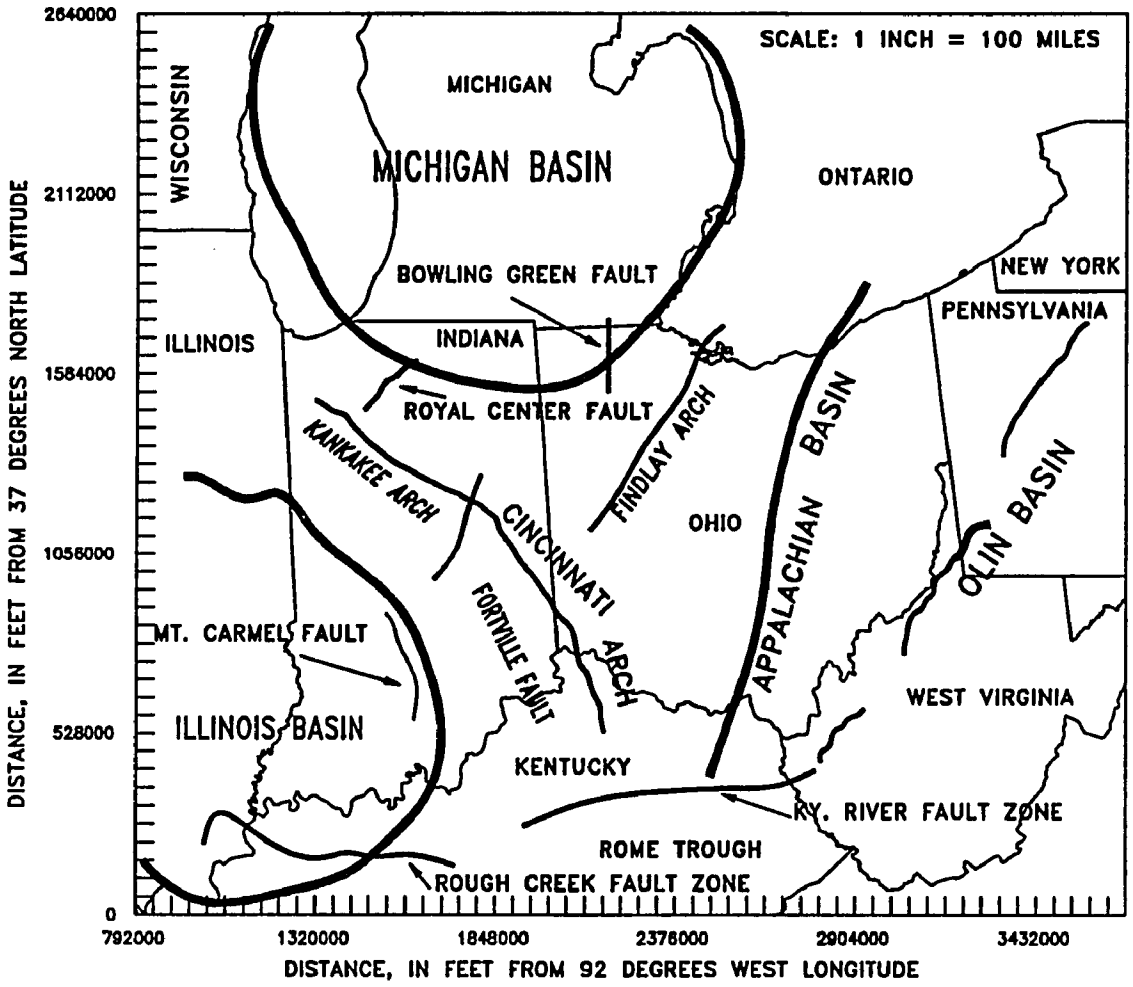

Figure 1. Geologic reference map showing structural features

represented by converting hydraulic head to an equivalent column of freshwater and assuming all formation fluids have a density equal to that of freshwater (ρ = 1.00 gm/cc). Use of equivalent freshwater heads appears to work well in systems where flow directions are predominantly horizontal and fluid-density gradients are small. However, in regions of appreciable vertical gradients due to a complicated geologic framework or in regions of large fluid-density differences, use of equivalent freshwater heads can lead to significant errors in interpretations of flow directions and flow velocities. Davies (1989) and Kelly and Bair (1988) showed that simulated flow directions using equivalent freshwater heads can differ by as much as 170 degrees compared to those computed using actual fluid densities. Other studies of regional variable-density flow including those for the Palo Duro Basin of Texas (Bair, 1987; Kelly, 1989; Senger and Fogg, 1990), Gulf coastal aquifers (Williamson et al, 1990), and Illinois Basin (Bond, 1972; Mandle and Kontis, in press), also show that fluid-density variations in large sedimentary basins are common and can have a pronounced effect on the interpretation of flow directions and flow velocities. The primary objective of this study is to evaluate the factors that control the velocity and patterns of variable-density fluid movement in the complex geologic framework of the large sedimentary basins and intervening arches in the midwestern United States.

The practical application of this research is to the increased use of deep sedimentary formations for injection of hazardous-liquid wastes and to problems related to high-level radioactive waste storage, which necessitate an understanding of the principles governing regional flow patterns of variable-density fluids and the

incorporation of these principles into predictions of flow patterns and traveltimes of wastes away from their source locations. In the midwestern United States, the Cambrian Mt. Simon Sandstone is predominantly used as a reservoir for the subsurface disposal of hazardous-liquid wastes. Between 1968 and 1989, over 6 billion gallons of hazardous liquids from industrial manufacturing processes were injected into the Mt. Simon Sandstone in Ohio alone (Ohio Environmental Council, 1992). At present, there are seven hazardous-waste injection facilities in Ohio that operate 16 disposal wells. Despite its heavy use as a waste reservoir in Ohio and in adjoining states, regional flow patterns in the Mt. Simon Sandstone and in the overlying geologic units are poorly understood.

Previous studies depicting water levels and flow directions in the Mt. Simon Sandstone have used potentiometric-surface maps based on equivalent freshwater heads (Clifford, 1972; Warner, 1988, see Appendix A). This approach (fig. 2) shows regional flow converging towards a potentiometric low region in northwest Ohio. A potentiometric-surface map of the Mt. Simon Sandstone based on variable-density heads (fig. 3) shows regional flow diverging away from a potentiometric high region in the same area. Thus, two opposite flow patterns are depicted depending upon the method of analysis used. One of the goals of this study is to evaluate the use of these two approaches to define flow patterns and velocities in the Mt. Simon Sandstone.

The general hypothesis of this work is that regional hydrodynamics are influenced by a combination of factors including topography, geologic structure, hydraulic conductivity, and fluid density, and that all of these factors need to be

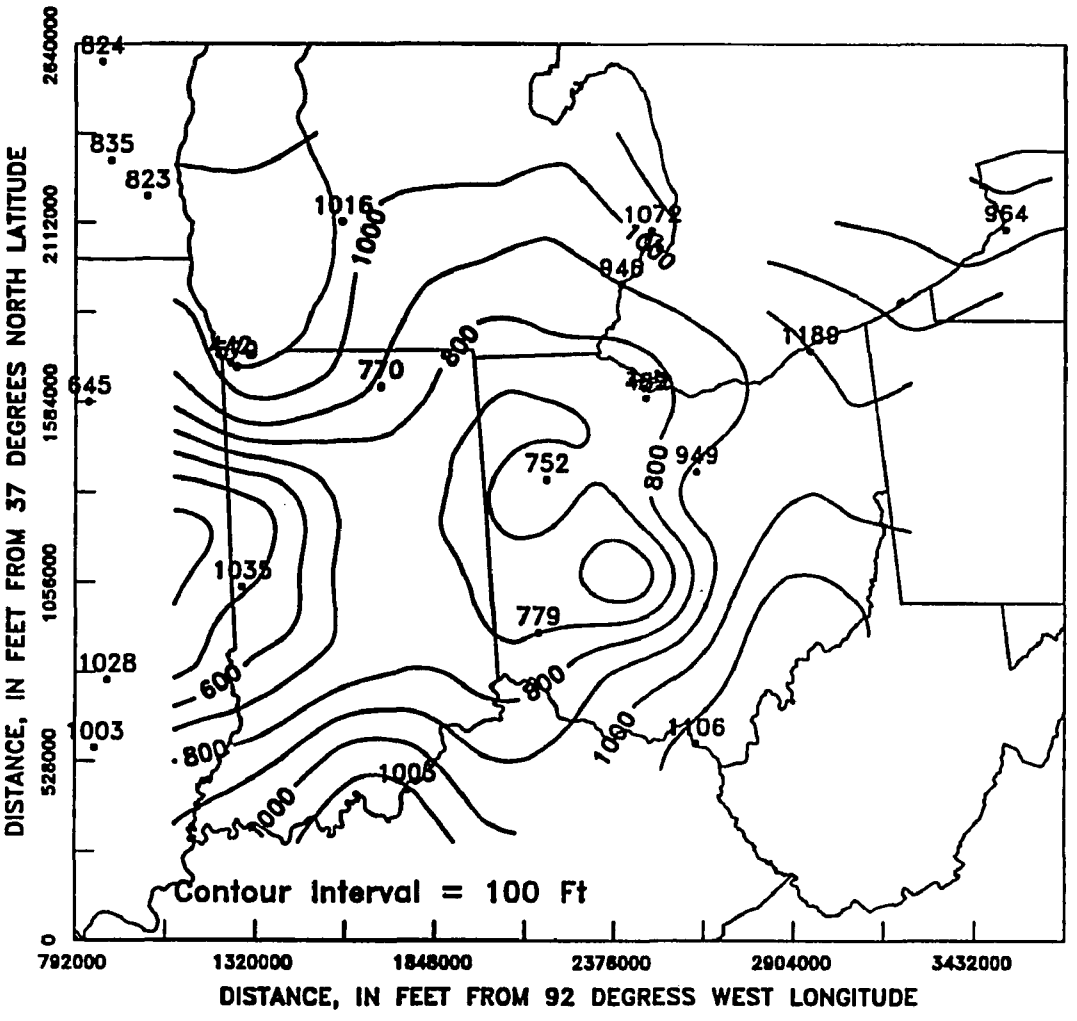

Figure 2. Observed equivalent freshwater head map for Mt. Simon Sandstone

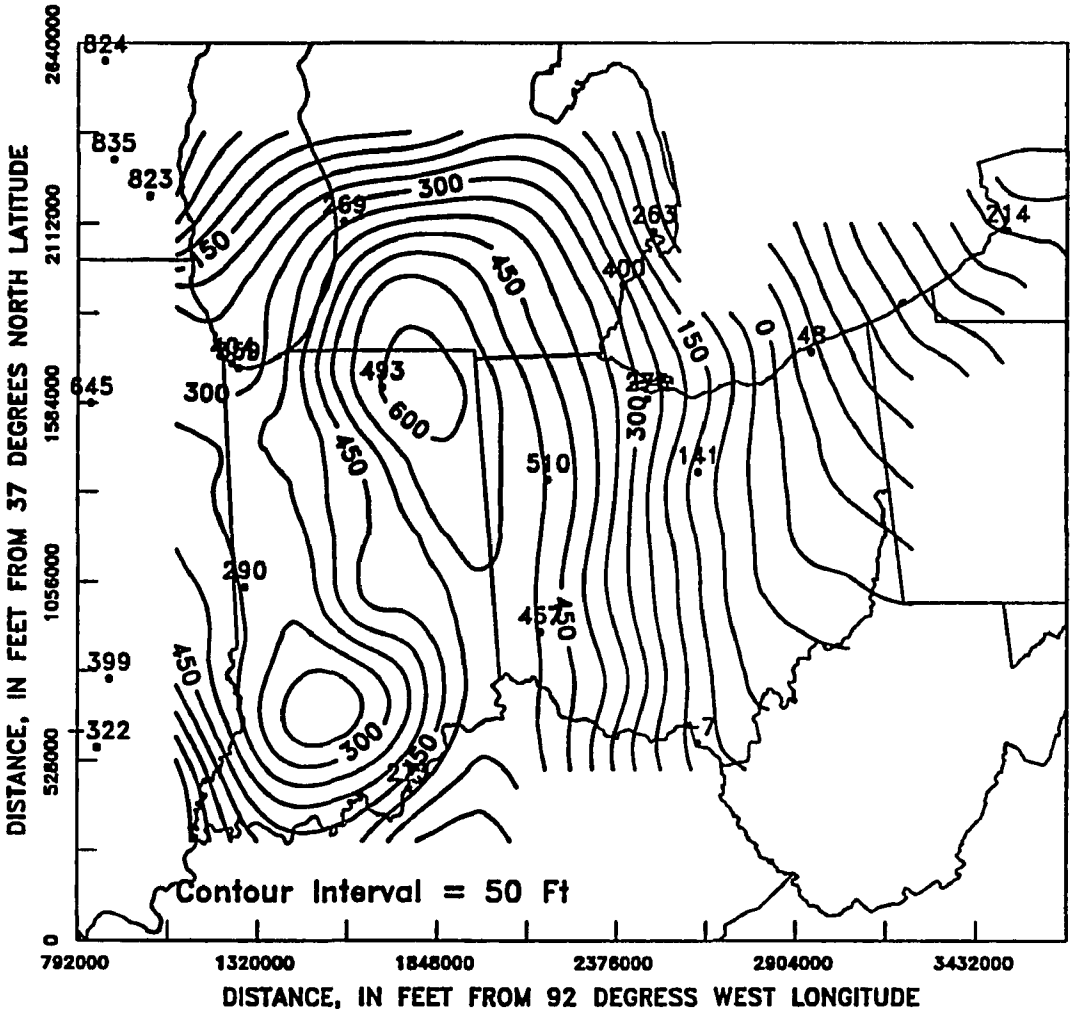

Figure 3. Observed variable-density head map for Mt. Simon Sandstone

considered in an integrated manner to understand regional flow patterns. This is achieved through a detailed compilation and analysis of available data, construction of a conceptual model, and simulation of the flow system using a three-dimensional, steady-state, numerical flow model of the area covering the Cincinnati Arch and surrounding sedimentary basins.

It should be mentioned here that the primary focus of this study is on the definition of regional-scale flow patterns in the Mt. Simon Sandstone and overlying geologic units and the factors controlling these flow patterns. Therefore, this research is not performed at the same scale or with the same context as work performed under the Regional Aquifer-System Analysis at the U.S. Geological Survey, or by various contractors performing srudies for the federal "No Migration" program on behalf of operators of Class I waste injection wells.

CHAPTER II

HYDROGEOLOGIC SETTING

Structural Setting

Although the focus of this research is in Ohio, the modeled area includes nearly 275,000 square miles in eight states. The major structural features in the region are shown in Figure 1. The central part of the study area, the Ohio-Indiana Platform, is an uplifted, stable platform surrounded by the Appalachian Basin to the east, the Illinois Basin to the southwest, and the Michigan Basin to the north. The uplifted nature of the Precambrian basement is shown by the Cincinnati Arch, Findlay Arch, and the Kankakee Arch (fig. 1). Although most of the area is considered relatively stable tectonically, several major and minor fault systems have been identified. These include the Kentucky River Fault Zone and the Rough Creek Fault Zone in Kentucky and Illinois (fig. 1). In the study area these fault systems separate the Lower Paleozoic Sauk Sequence from the much thicker sedimentary sequence in the Rome Trough to south (Webb, 1980) and form the southern boundary for this study. The Olin Basin and related growth faults in the Paleozoic strata in West Virginia, western Pennsylvania, and southwestern New York (Wagner, 1976) form the eastern boundary of the study area in the Appalachian Basin.

Within the study area there is evidence of localized fault systems in the Paleozoic strata. Several groups of faults appear to be clustered along the uplifted Ohio-Indiana Platform in northwestern Ohio (Wickstrom, 1990). The most famous of these is the Anna Fault Zone that has been linked to anomalously high seismic activity in the region. Other mapped or inferred faults in the area include the Bowling Green, Outlet, Auglaize, and the Logan-Hardin faults (Wickstrom, 1990). Onasch and Kahle (1991) present evidence that the region surrounding the Bowling Green fault zone in northwest Ohio has been the site of many episodes of tectonic activity. This tectonic activity has led to the development of joint systems in the Paleozoic sequence in the region (Hauwert et al, 1991). Similarly, disturbances related to the uplift of the Cincinnati Arch have led to the development of extensional joint systems in the Paleozoic sequence in the region (Dean et al, 1986). In Indiana, the significant faults are the Royal Center Fault in the north, the Fortville Fault in the center, and the Mt. Carmel Fault in the south. These and other smaller structural features and associated fracturing and jointing may provide pathways for vertical flow between aquifers that are otherwise separated by low permeability layers. Recently, drilling and seismic studies have indicated the presence of extensive rift basins beneath the Mt. Simon Sandstone in southwestern Ohio (Shrake et al., 1991).

Stratigraphic Relations

The sedimentary rocks in the study area range in age from Cambrian to Permian and small subcrops of Jurassic deposits in central Michigan. These strata

commonly are overlain by a thin, irregular sequence of glacial and alluvial deposits. In this study the stratigraphic units overlying Precambrian basement were grouped into 11 generalized hydrostratigraphic units (HSUs) based on lithologic similarity and regional continuity (fig. 4). The geologic data used to define these HSUs were compiled from a variety of available sources. These include state geological survey files and reports in Ohio, Indiana, Michigan, Illinois, and Kentucky; published geologic maps; well-log data; and information in petitions submitted for hazardous-waste injection operations as part of the federal "No Migration" program. The geologic data compiled for the various states are listed in Appendix B. It should be noted here that the location coordinates for many of the wells in the database were determined from township, range, and section information that may only be accurate to within a mile of the actual well location. The compiled structure and isopach data for various units were gridded and contoured by the author using SURFER (Golden Software, 1989). A brief description of these units is presented here. For more detailed discussion and some original data the reader is referred to Janssens (1973), Becker et al (1978), Rupp (1989), Lillienthal (1978), and Willman et al (1975).

The Upper Cambrian Mt. Simon Sandstone commonly is the basal sedimentary unit throughout the Midwest. Precambrian basement consisting of igneous, metamorphic, and metasedimentary rocks of very low permeability underlie the Mt. Simon Sandstone and generally serve as a lower confining boundary to regional groundwater flow. The recently discovered rift basins underlying the Mt. Simon Sandstone in southwestern Ohio consist of highly compacted quartzites called the

E. ILLINOIS	INDIANA	S. MICHIGAN	W. OHIO E. OHIO	LAYER #
Quaternary Pennsylvanian and Mississippian strata	Quaternary Pennsylvanian and Mississippian strata	Quaternary Pennsylvanian and Mississippian strata	Quaternary Pennsylvanian and Mississippian strata	13
New Albany Sh.	New Albany Sh.	Berea Ss. Ellsworth Sh. Antrim Sh.	Berea Ss. Ohio Shale Olentangy Sh.	12 11
Silurian and Devonian carbonates	Silurian and Devonian carbonates	Silurian and Devonian carbonates	Silurian and Devonian carbonates	10
Maquoketa Sh.	Maquoketa Sh.	Undifferentiated Cincinnatian sh.	Undifferentiated Cincinnatian sh.	9
Galena Gp. Platteville Gp. Jaochim Dol.	Trenton Fm. Black River Fm. Wells Creek Fm.	Trenton Fm. Black River Fm. Glenwood Fm.	Trenton Fm. Black River Fm. Wells Creek Fm. Beekmantown Fm.	8
Knox Dol.	Knox Dol.	Prairie Du Chien Gp. Trempealeau Fm.	Knox Dol. Rose Run Ss. Copper Ridge Fm.	7 6
Ironton Ss. Galesville Ss.	Ironton Ss. Galesville Ss.	Dresbach Ss.	Kerbel Fm.	5
Eau Claire Fm.	Eau Claire Fm.	Eau Claire Fm.	Conasauga Fm. Rome Fm. Eau Claire Fm.	4
Mount Simon Ss.	Mount Simon Ss.	Mount Simon Ss.	Mount Simon Ss.	3
Precambrian	Precambrian	Precambrian	Precambrian	2

Figure 4. Schematic hydrostratigraphic framework

Middle Run Formation (Shrake et al, 1991). These quartzites appear to have much lower porosity and permeability (Larry Wickstrom, Ohio Geological Survey, personal communication, 1991) than the overlying Mt. Simon Sandstone and are considered for hydrologic purposes to be part of the impermeable Precambrian basement. Thus, the base of the Mt. Simon Sandstone is considered to be the top of the Precambrian rocks throughout the study area. The structure-contour map of the bottom of the Mt. Simon Sandstone surface shows a basement high in western Ohio, which is referred to as the Indiana-Ohio platform (fig. 5). To the east, north, and southwest of the platform, the Precambrian surface dips gently into the Appalachian, Michigan, and Illinois basins. The elevation of the top of the Precambrian surface varies from 2000 feet (ft) below mean sea level on the Cincinnati Arch to more than 13,000 ft below mean sea level in the basins (fig. 5). It should be noted that despite the apparent sharp drop in the elevation of the Precambrian surface in the basins, the overall dip on this surface is generally less than two degrees.

The Mt. Simon Sandstone unconformably overlies Precambrian rocks throughout the study area. The Mt. Simon Sandstone crops out in Wisconsin and appears to be stratigraphically continuous across Illinois into northern Kentucky and eastward into the Appalachian Basin. Vertically it generally grades from conglomerate and arkose at the base to fine-grained sandstone at the top. The maximum thickness of the Mt. Simon Sandstone, 2500 ft, is observed in northern Illinois with a gradual thinning in all directions away from this area (fig. 6). There is a gradual decrease in thickness to the east into Indiana and western Ohio to about 300 ft. In central and

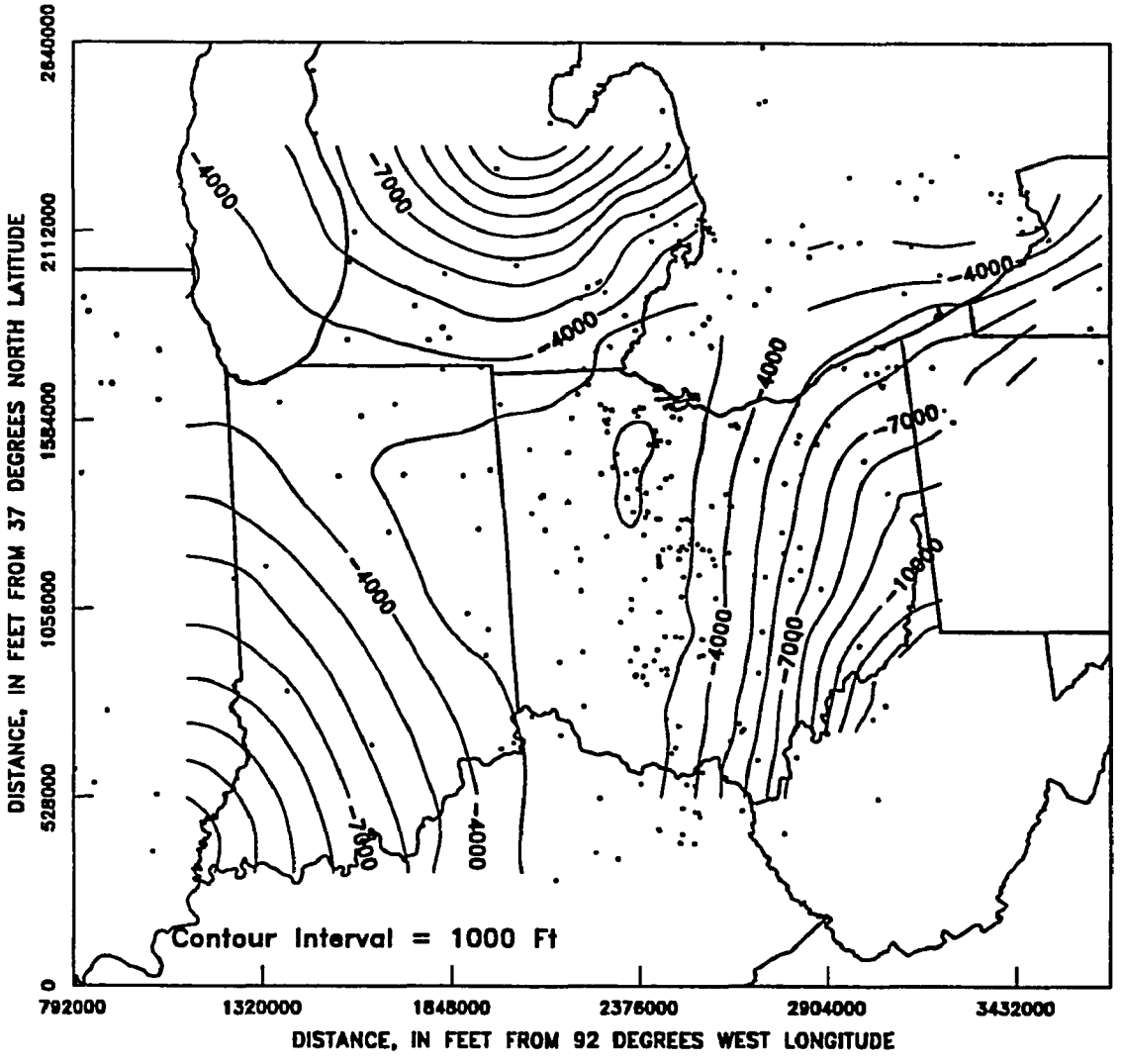

Figure 5. Structure contour map of base of Mt. Simon Sandstone. (elevation in feet, relative to sea level)

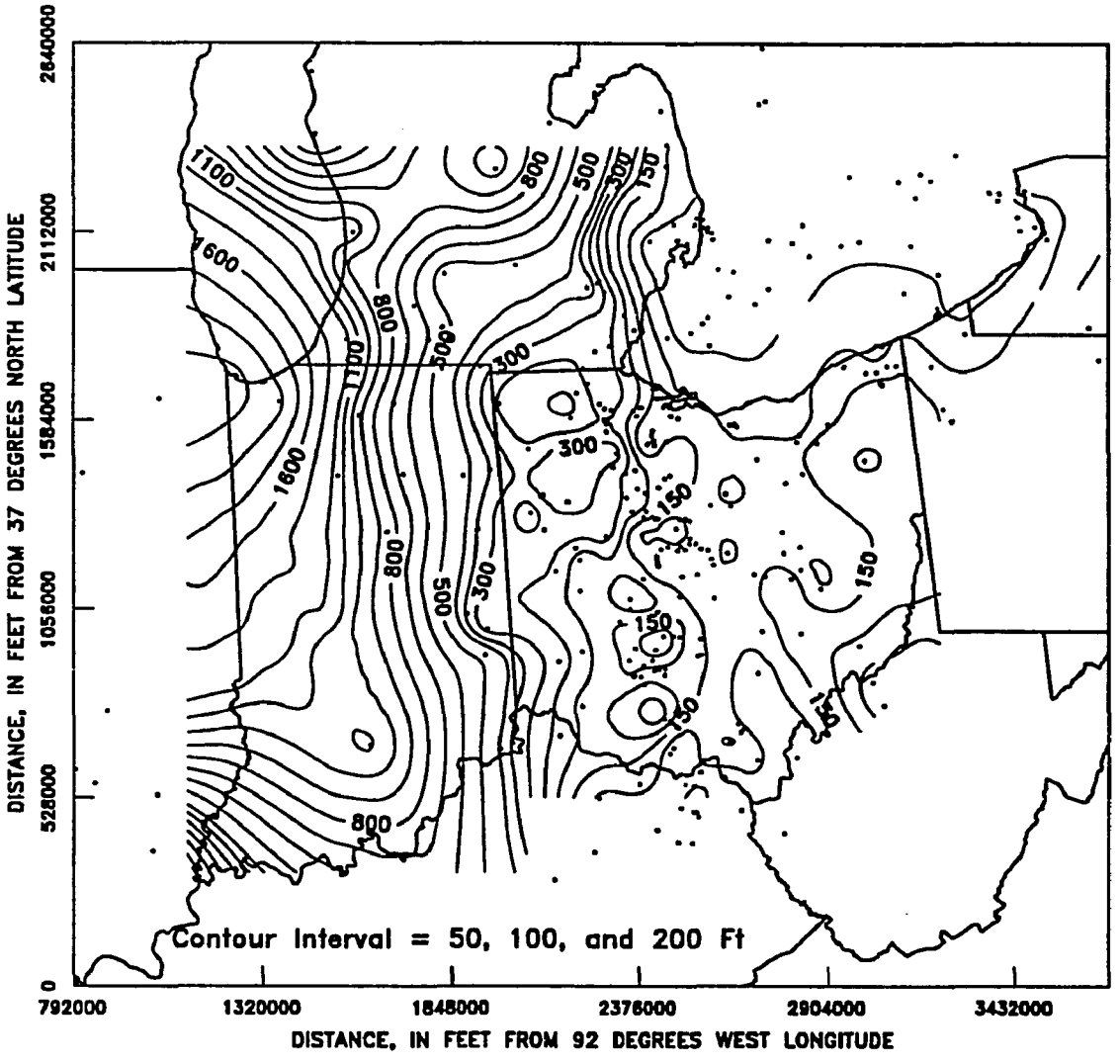

Figure 6. Isopach map of Mt. Simon Sandstone

eastern Ohio, the thickness varies between 100 to 300 ft depending on the shape of underlying Precambrian surface (fig. 6). North of Lake Erie and east of Lake Huron the Mt. Simon Sandstone gradually thins and is absent in most of southeastern Ontario (Sanford and Quinlan, 1959).

In the western part of the study area, the Mt. Simon Sandstone is overlain by the Eau Claire Formation, which consists of glauconitic siltstone, very fine-grained sandstone, and interbedded shale. In Ohio, the Eau Claire shows a gradual facies change from fine-grained glauconitic sandstone in the west, to dolomitic sandstone in central Ohio, and to crystalline dolostone overlain by shale in eastern Ohio (fig. 7) (Janssens, 1973). The dolostone facies is known as the Rome Formation, whereas the shale facies is known as the Conasauga Formation (fig. 7). The Eau Claire, Rome, and Conasauga formations are combined in this study as the HSU overlying the Mt. Simon Sandstone throughout the study area. The combined thickness of these units varies between 0 to 1000 ft with the thickest areas in the Illinois and Appalachian basins (fig. 8).

In most of Ohio the Kerbel Sandstone overlies the Rome, Conasauga, and Eau Claire formations (fig. 7). The Kerbel Sandstone is about 100 to 150 ft thick in north-central Ohio but gradually thins to the south and is absent in southeastern and southwestern Ohio (fig. 9). Hydrostratigraphic equivalents of the Kerbel Sandstone include the Ironton and Galesville sandstones in northern Indiana and Illinois and the Dresbach Formation in Michigan. Above these sandstones the lower and middle Paleozoic strata are dominated by sequences of carbonates and shales. These deposits

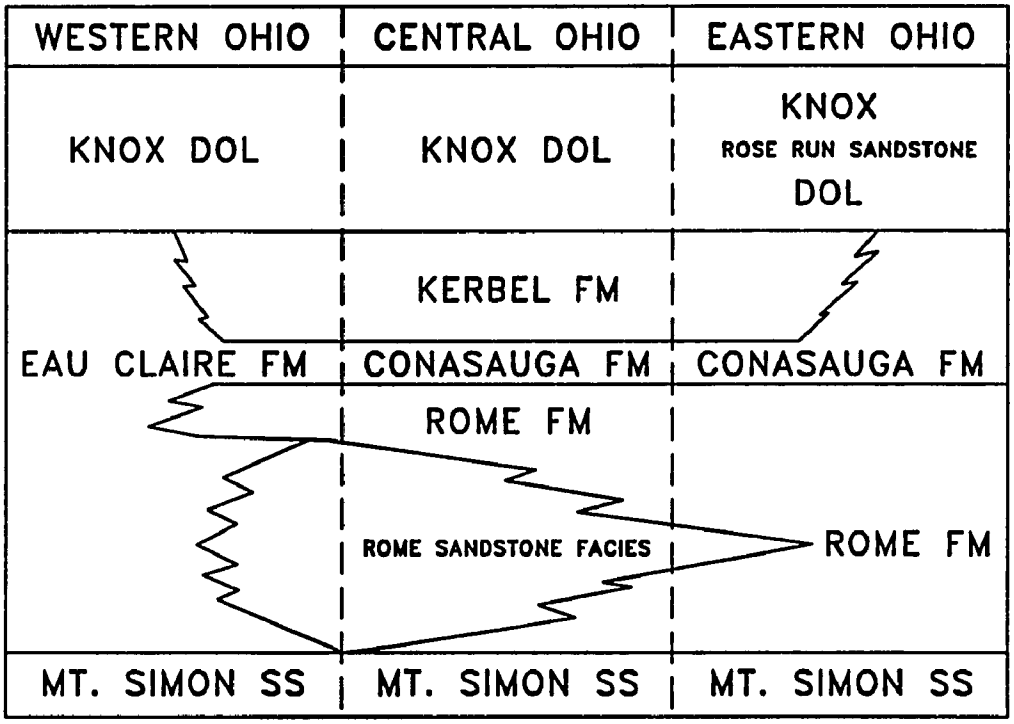

Figure 7. Stratigraphic column of Cambrian sequence in Ohio (from Janssens, 1973)

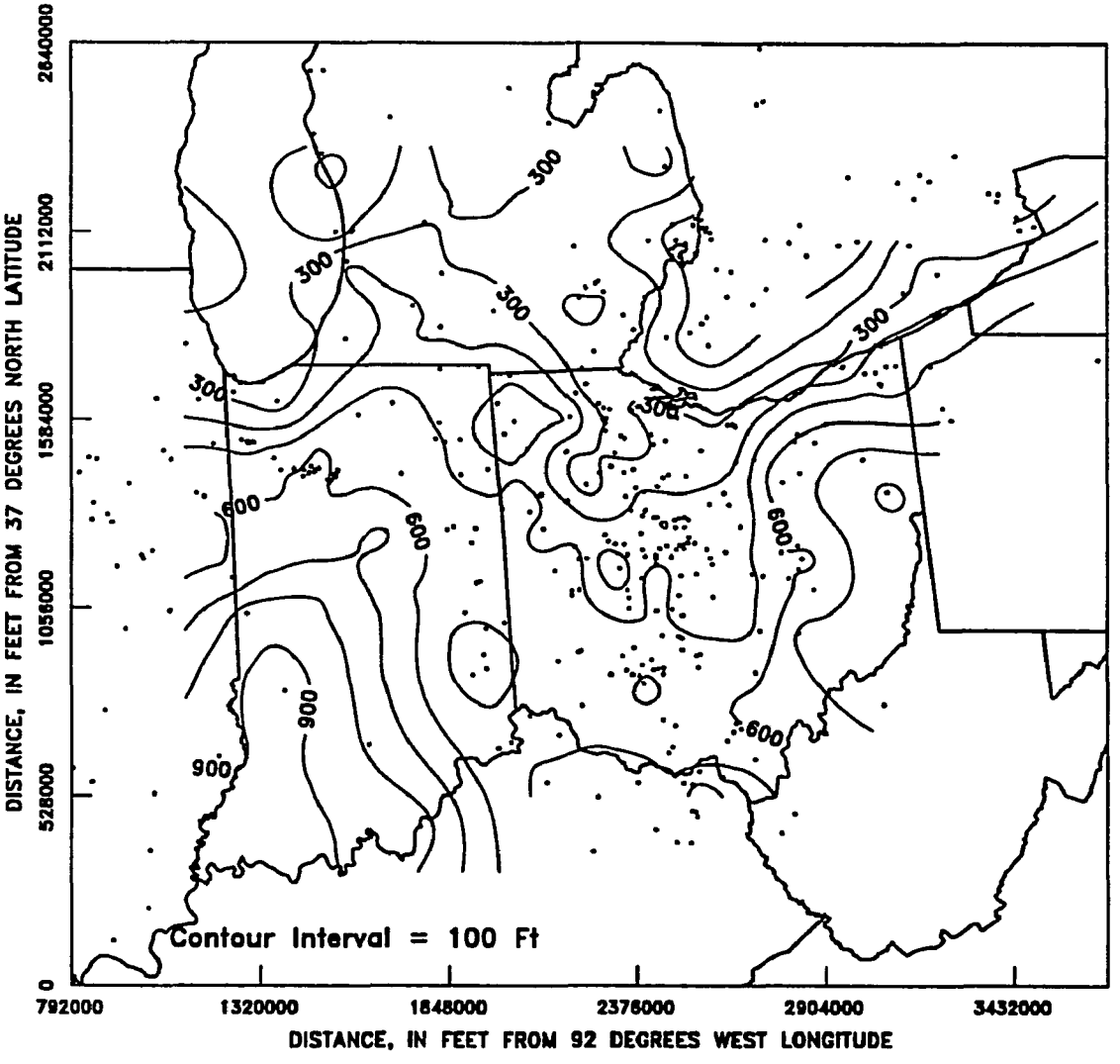

Figure 8. Isopach map of Eau Claire/Rome/Conasauga formations

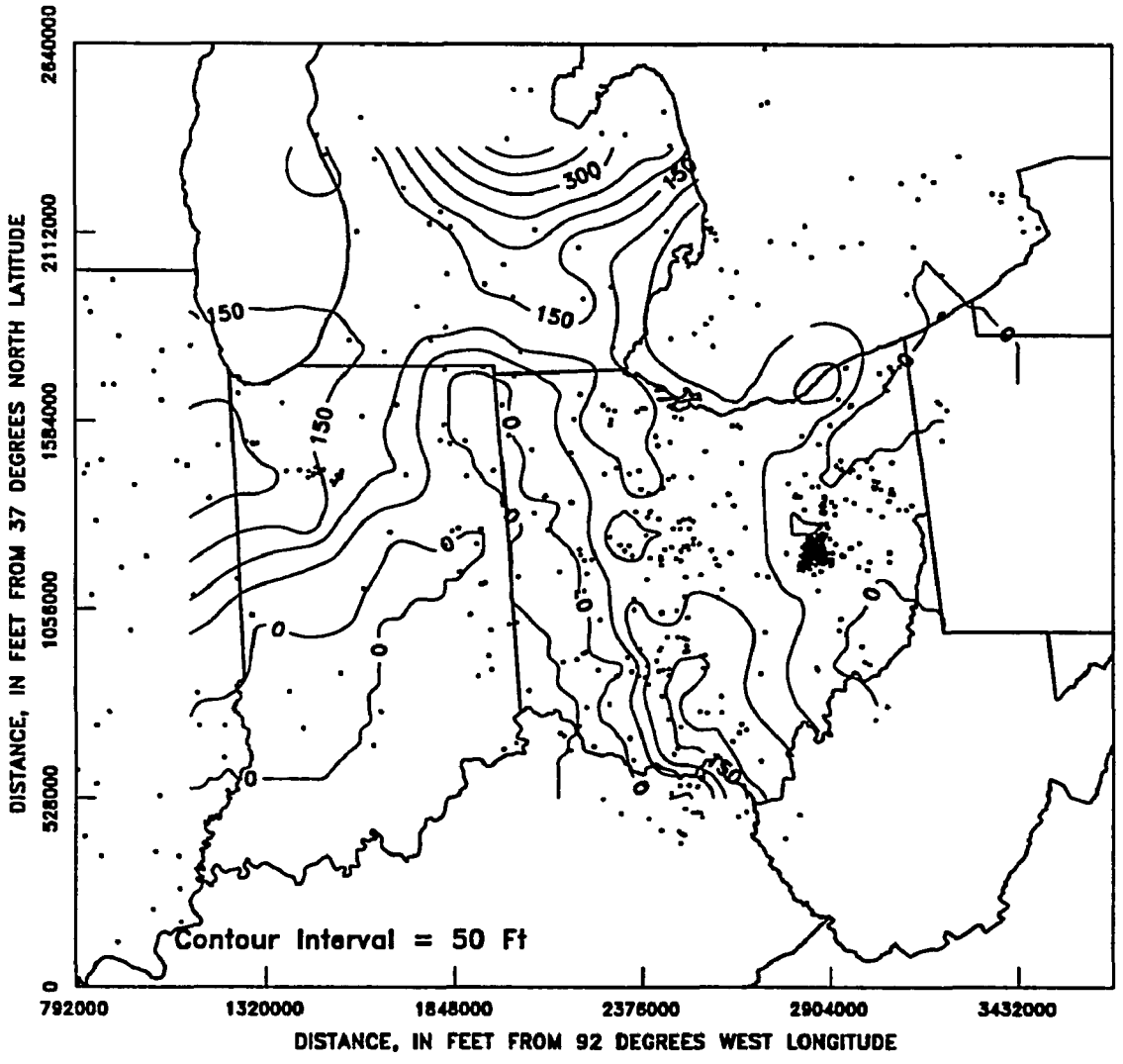

Figure 9. Isopach map of Kerbel/Ironton/Galesville sandstones

are relatively thin and partly eroded from the Cincinnati Arch and show gradual thickening into the adjacent basins.

The Upper Cambrian to Lower Ordovician Knox Dolomite has been divided into three units (Janssens, 1973) in eastern Ohio (fig. 4). The lowest of these, the Copper Ridge Dolomite along with the entire undivided Knox Dolomite in western Ohio, and the Prairie Du-Chien Dolomite in the remainder of the study area, form a dense crystalline carbonate HSU. This unit increases in thickness from zero in northern Ohio to about 1400 ft in the south and as much as 4000 ft in the Illinois Basin (fig. 10). In eastern Ohio, the Cooper Ridge Dolomite of the Knox Formation is overlain by the Rose Run Sandstone. This coarse to fine-grained sandstone has a thickness of up to 200 ft and has sufficient regional continuity (Janssens, 1973) for it to be treated as a separate HSU in this area (fig. 11). This unit has been a major target for hydrocarbon exploration in eastern Ohio. The Rose Run Sandstone is overlain by the Beekmantown Dolomite Member of the Knox Dolomite in eastern Ohio. Based on lithologic characteristics, this uppermost part of the Knox Dolomite is combined with the overlying carbonate HSU (fig. 4).

Throughout the study area, the Upper Cambrian to Lower Ordovician Knox Dolomite is unconformably overlain by a sequence of limestones interbedded with thin lenses of dolomite, shale, and siltstone. The major stratigraphic units included in this Middle Ordovician HSU are the Wells Creek, Black River, and Trenton Limestones in Ohio, and their equivalents in adjacent states (fig. 4). Parts of this unit, such as the Trenton limestone in northwestern Ohio, have been major hydrocarbon reservoirs in

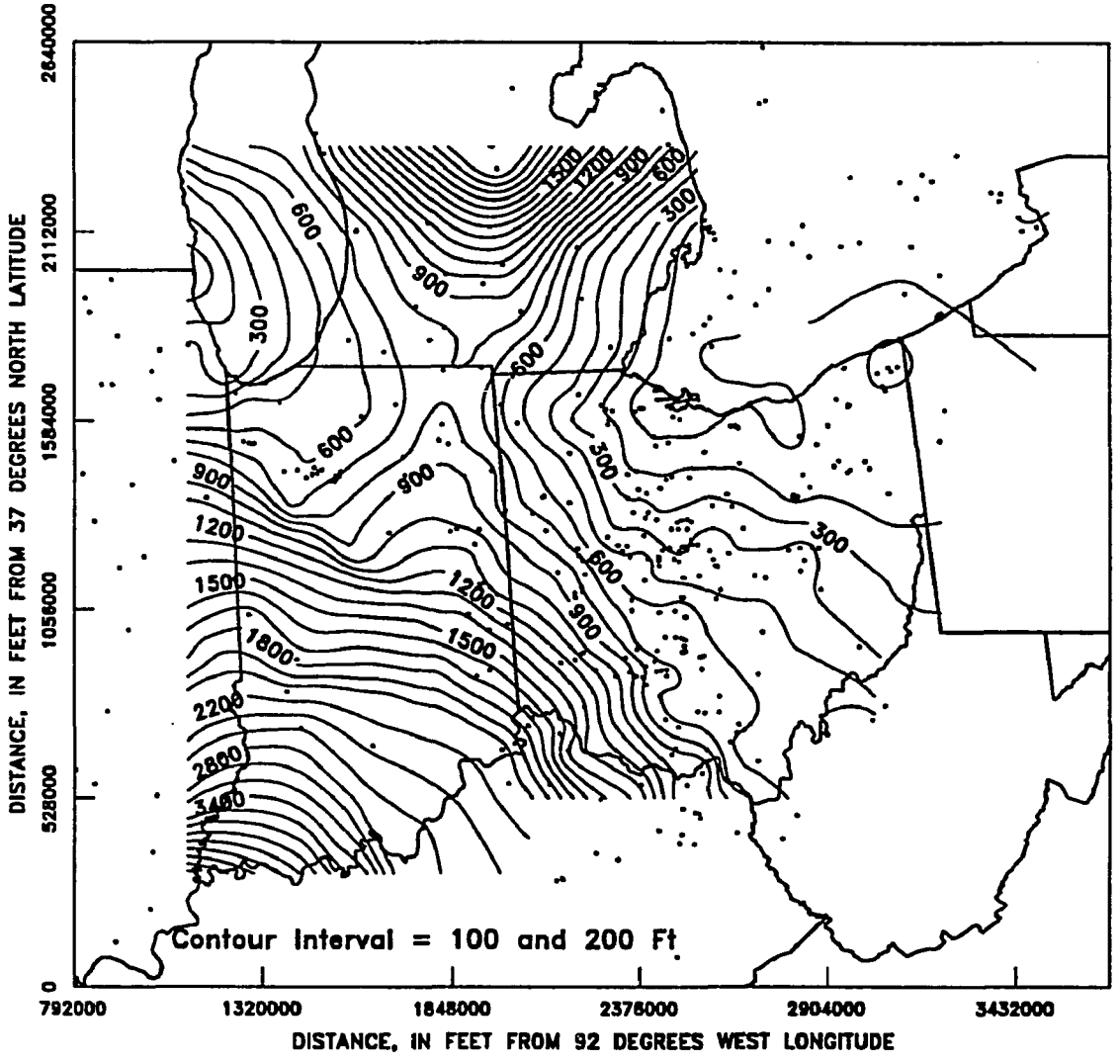

Figure 10. Isopach map of Knox Dolomite

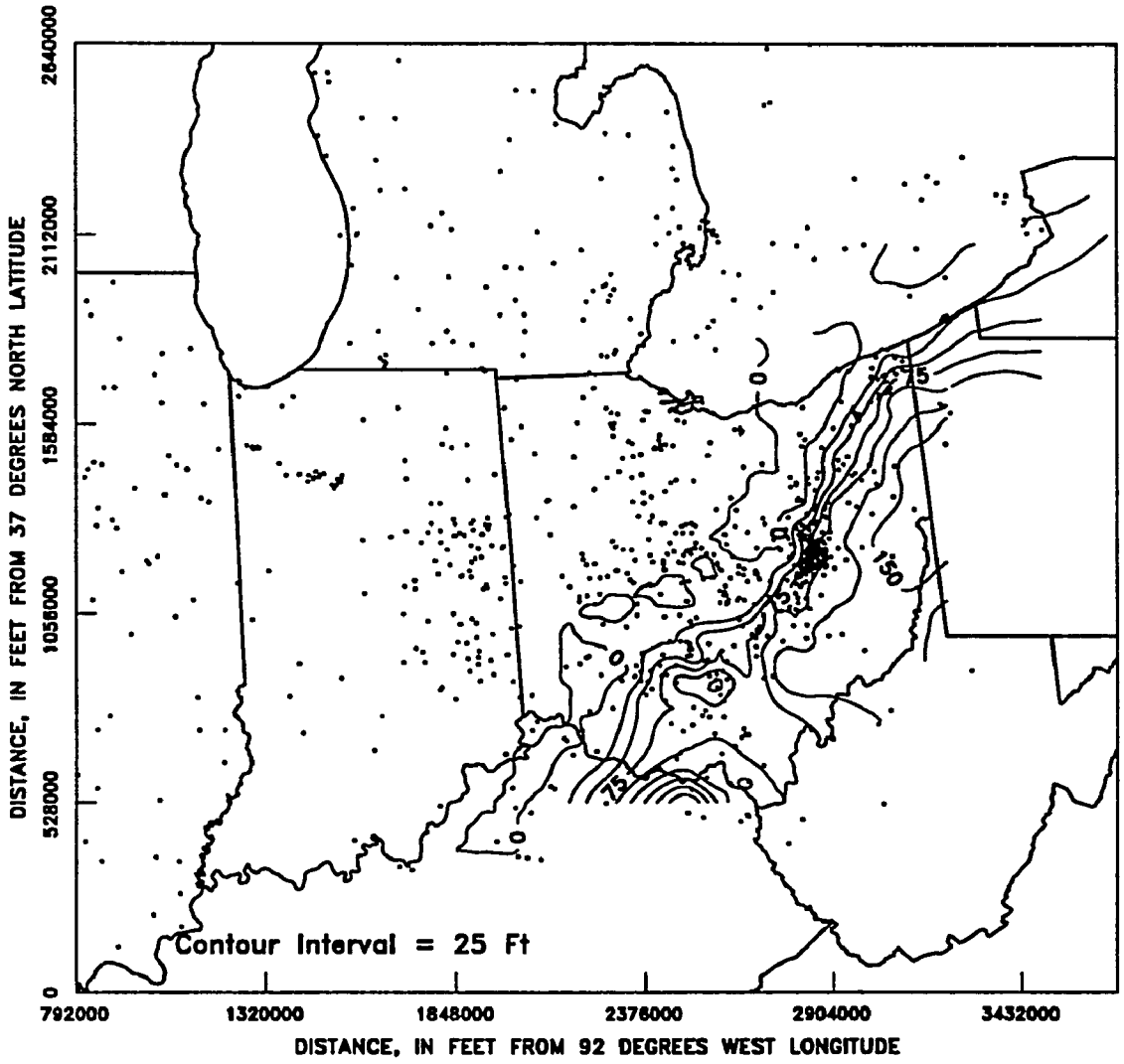

Figure 11. Isopach map of Rose Run Sandstone

the past. These reservoirs are associated with high secondary porosity in carbonates due to dissolution, faulting, and fracturing. The combined thickness of these formations varies from 400 to 1000 ft in most of the study area (fig. 12).

The Upper Ordovician sediments in the study area consist of a succession of calcareous shales. These shales are known as the Cincinnatian Group in Ohio and Michigan, and as the Maquoketa Group in Indiana and Illinois. The carbonate content in the Cincinnatian Group decreases away from the Cincinnati Arch (Janssens, 1977). The Ordovician shales crop out in southwestern Ohio. Their thickness increases from 200 ft in eastern Illinois to about 2000 ft in the Appalachian Basin (fig. 13).

Geologic units overlying the Ordovician shales and underlying the Upper Devonian shales form the Silurian-Devonian carbonates HSU. These rocks form the bedrock beneath the unconsolidated glacial deposits in the central part of the study area in western Ohio and eastern Indiana. The Silurian-Devonian HSU shows large variations in hydraulic conductivity due to heterogeneous fracturing, jointing, and dissolution of carbonates. The thickness of this unit ranges from zero in southwestern Ohio to more than 4000 ft in the Michigan Basin (fig. 14). The Silurian-Devonian group has more lithologic variation than any other HSU in the study. It consists mainly of limestone and dolomite with intervening layers of shale, evaporite, and sandstone.

The Silurian-Devonian carbonates are overlain by Upper Devonian and Mississippian shales consisting of the Olentangy, Ohio, Bedford, New Albany, and Antrim shales. These shale layers have been eroded from the uplifted platform areas and are only present in the deep basins. They show gradual thickening from the

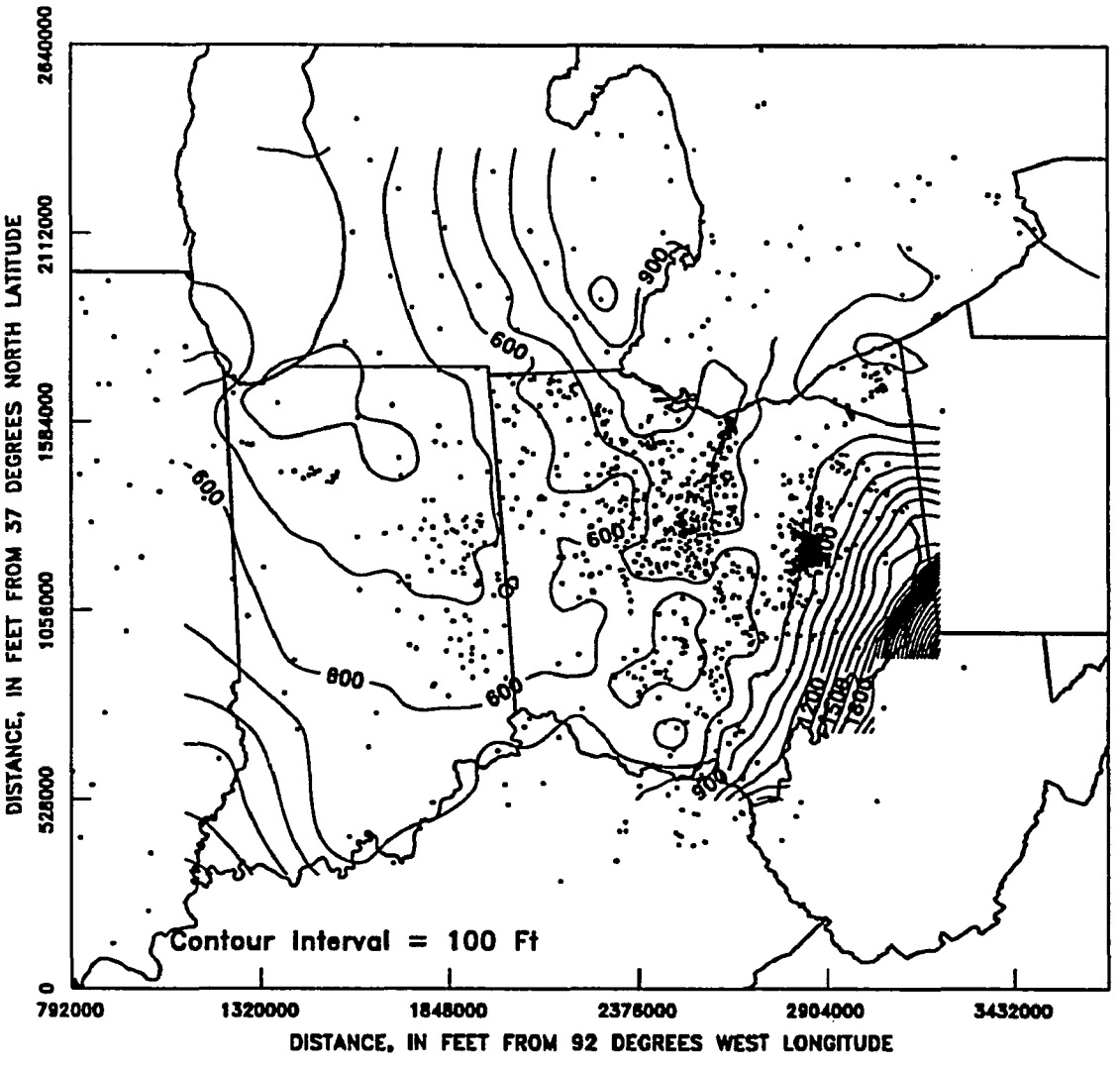

Figure 12. Isopach map of Ordovician limestones

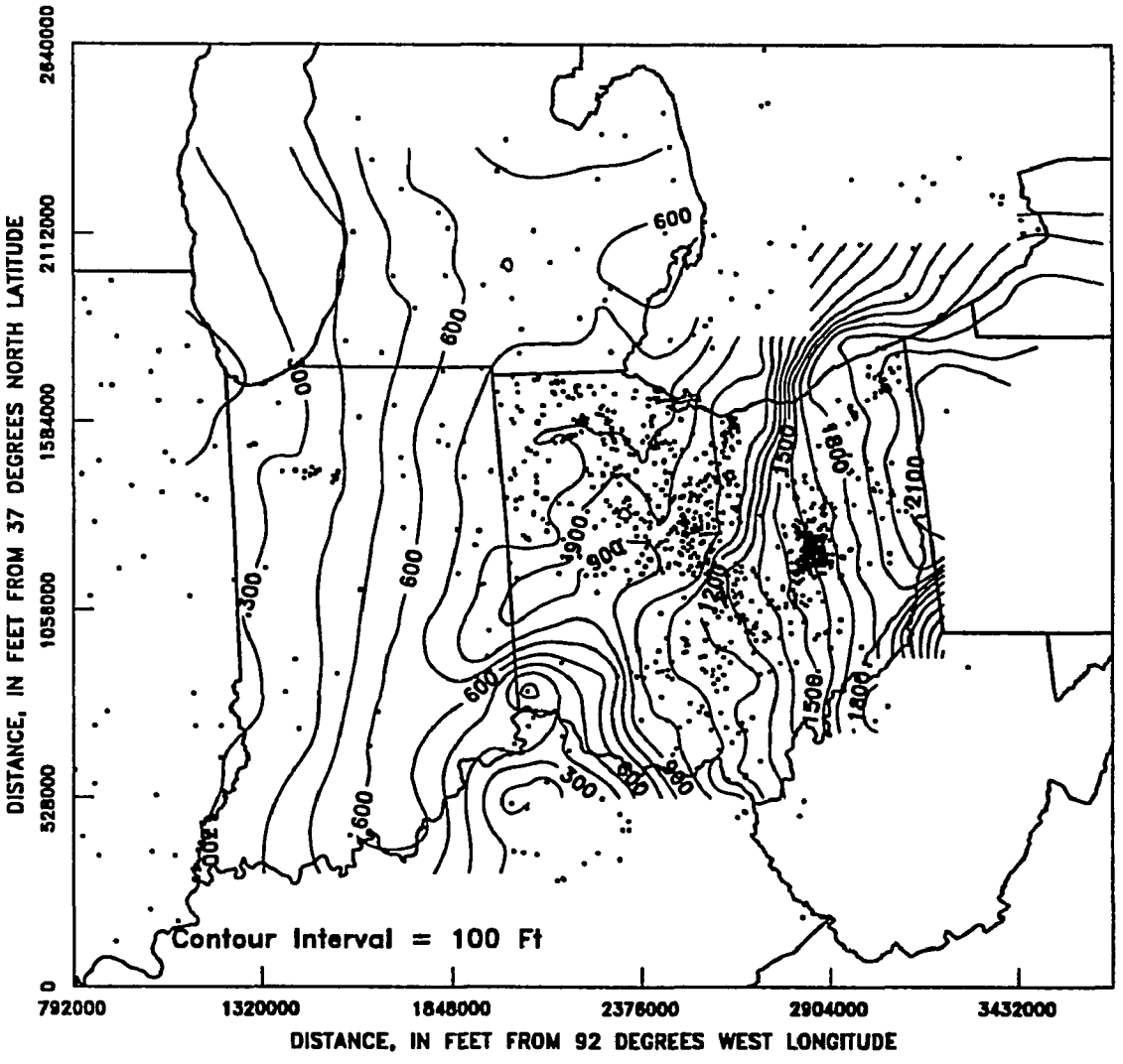

Figure 13. Isopach map of Ordovician shales

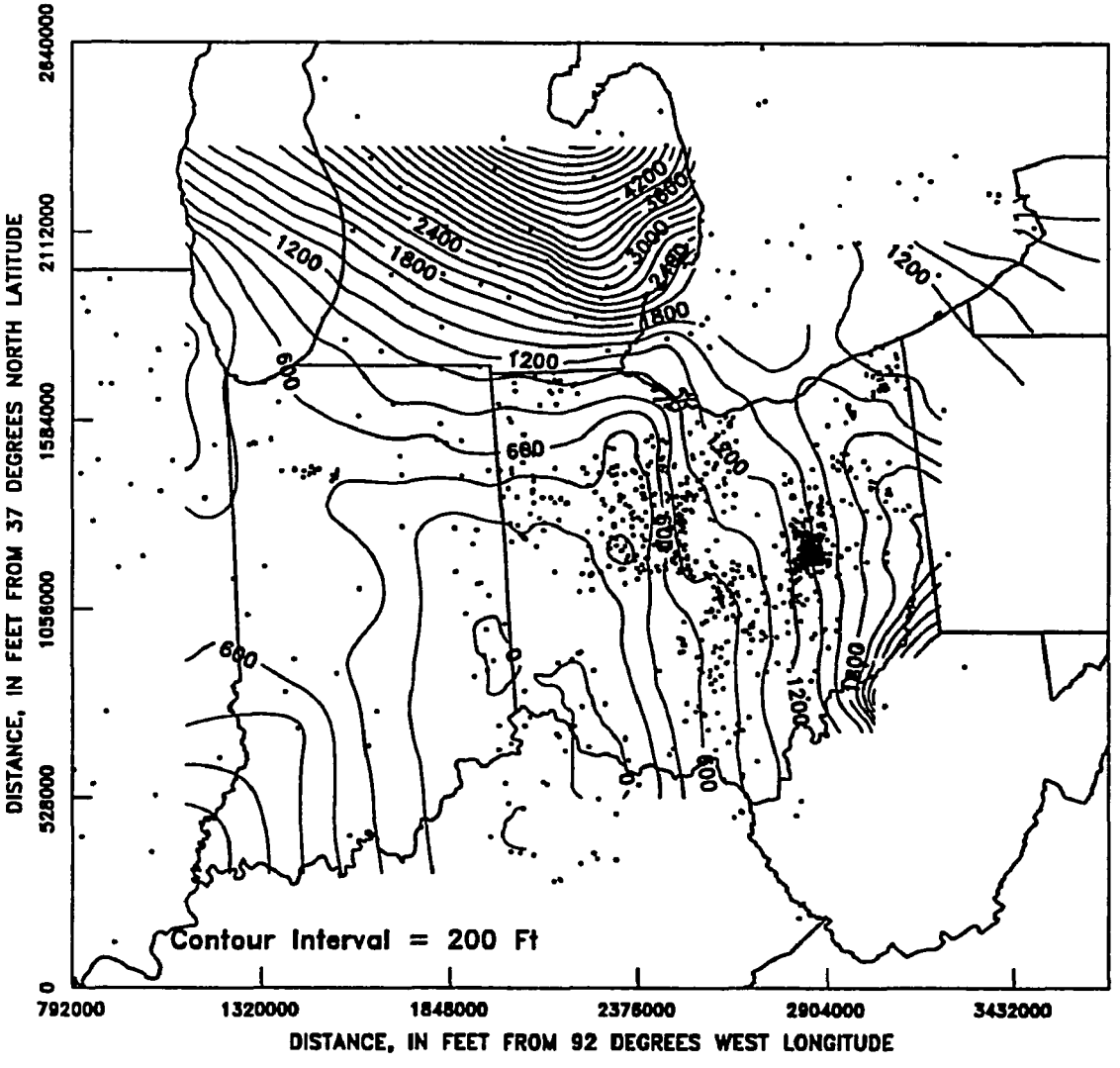

Figure 14. Isopach map of Silurian-Devonian carbonates

erosional edges into the deep basins with a maximum thickness of about 3000 ft in the Appalachian Basin (fig. 15). In eastern Ohio and southeastern Michigan the thin but continuous Berea Sandstone overlies the Devonian shales. The Berea Sandstone varies in thickness from zero at its erosional edge to more than 200 ft (fig. 16) and is treated as a separate HSU due to its regional continuity.

In the Appalachian, Michigan, and Illinois basins the Devonian shales and the Berea Sandstone generally are overlain by younger rocks of Mississippian to Permian age. These rocks generally consist of shales and limestones with thin interbedded, discontinuous coal and sandstone layers. The youngest consolidated rocks are overlain by a thin veneer of unconsolidated Quaternary sediments. Over most of the study area these sediments were deposited by one or more advances of the extensive Pleistocene ice sheets, resulting in relatively flat to gently rolling topography (fig. 17). The glacial deposits consist mainly of till, morainal materials, and outwash deposits with a total thickness rarely exceeding a few hundred feet. The unglaciated region in the southern and southeastern part of the study area consist of low-lying hills that are part of the Appalachian Plateau (fig. 17). In this study all of the consolidated rocks and the unconsolidated sediments above the Berea Sandstone have been combined to form the uppermost HSU to the flow system. The total thickness of this unit varies between a few feet to more than 4000 ft in the Illinois Basin (fig. 18).

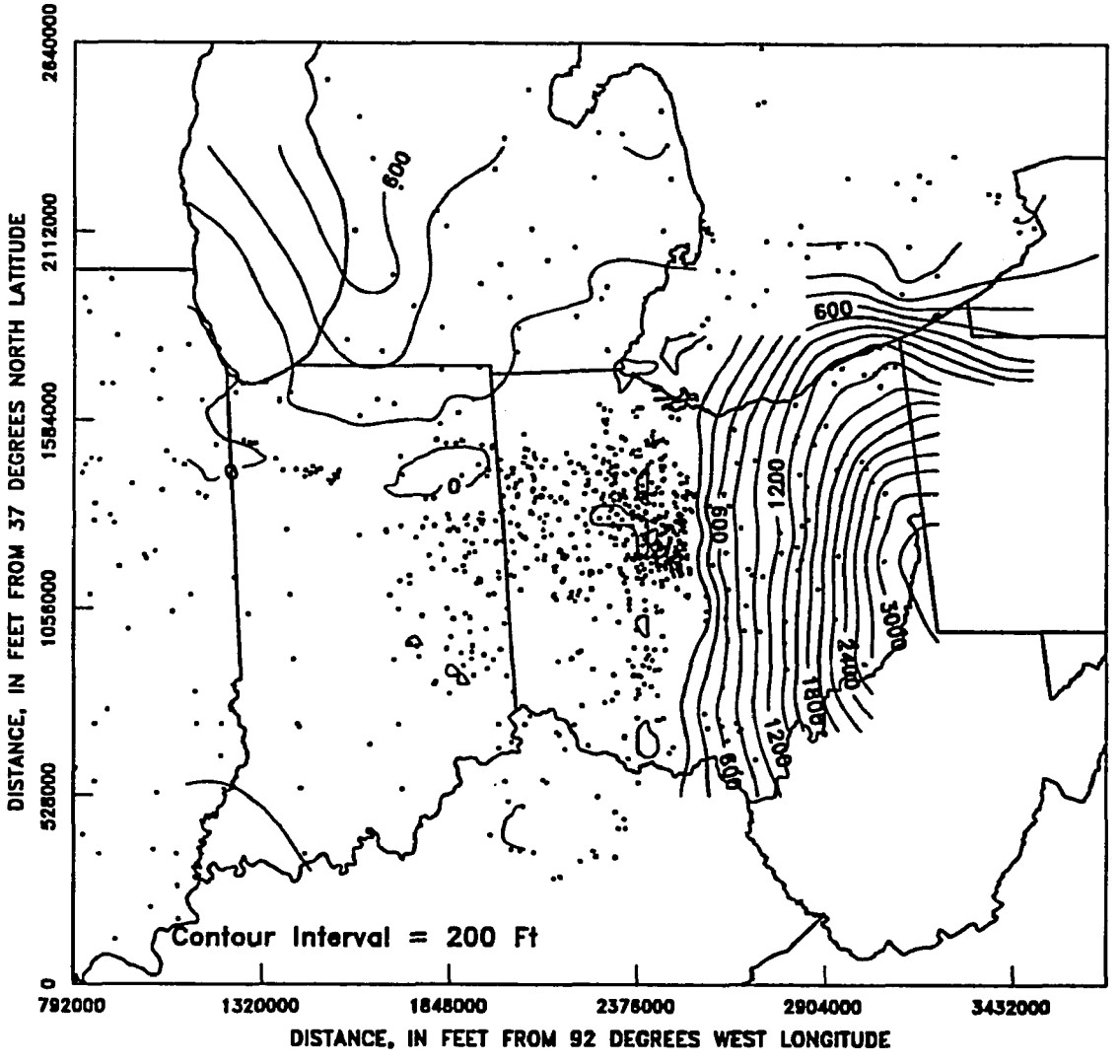

Figure 15. Isopach map of Devonian shales

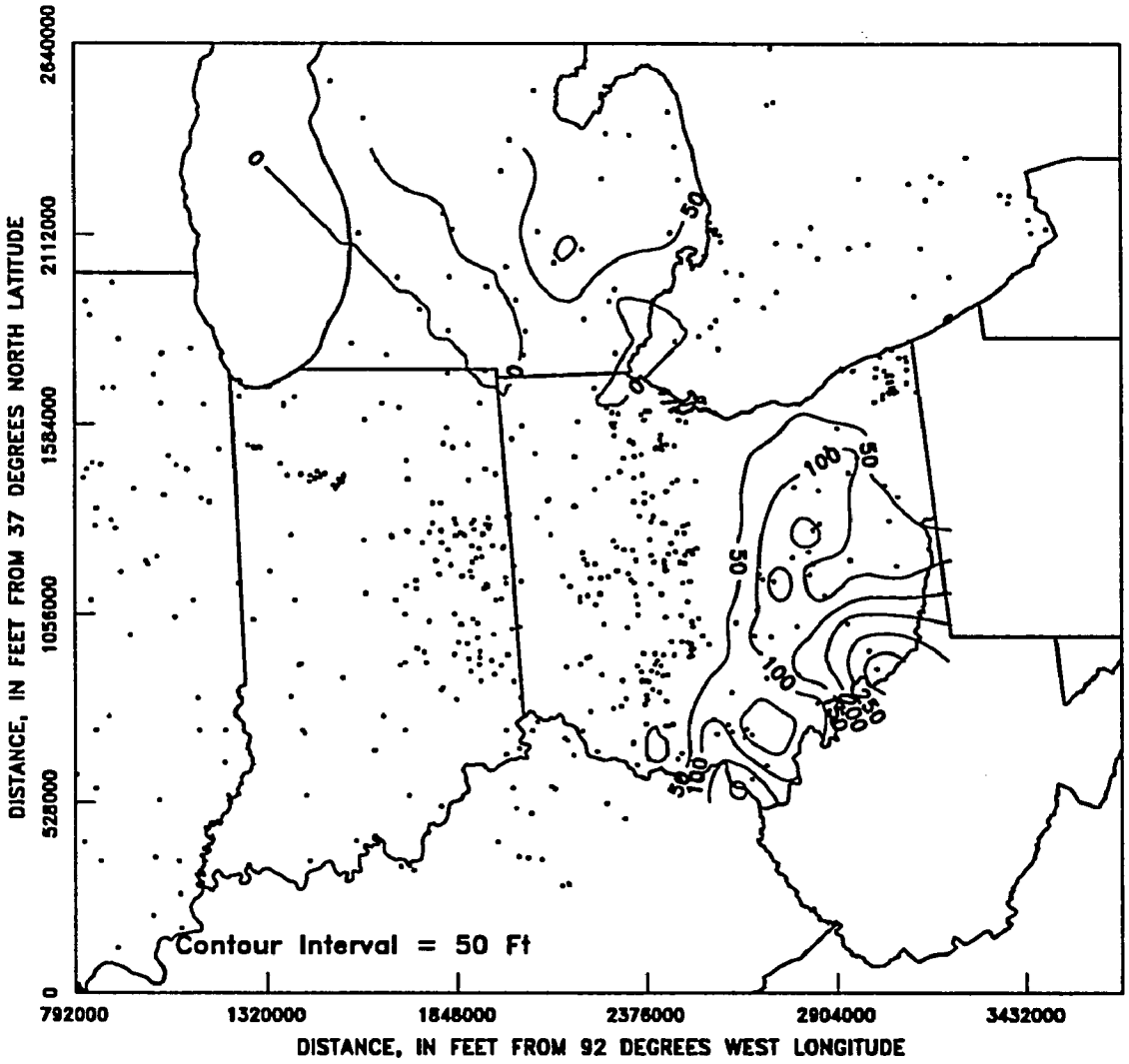

Figure 16. Isopach map of Berea Sandstone

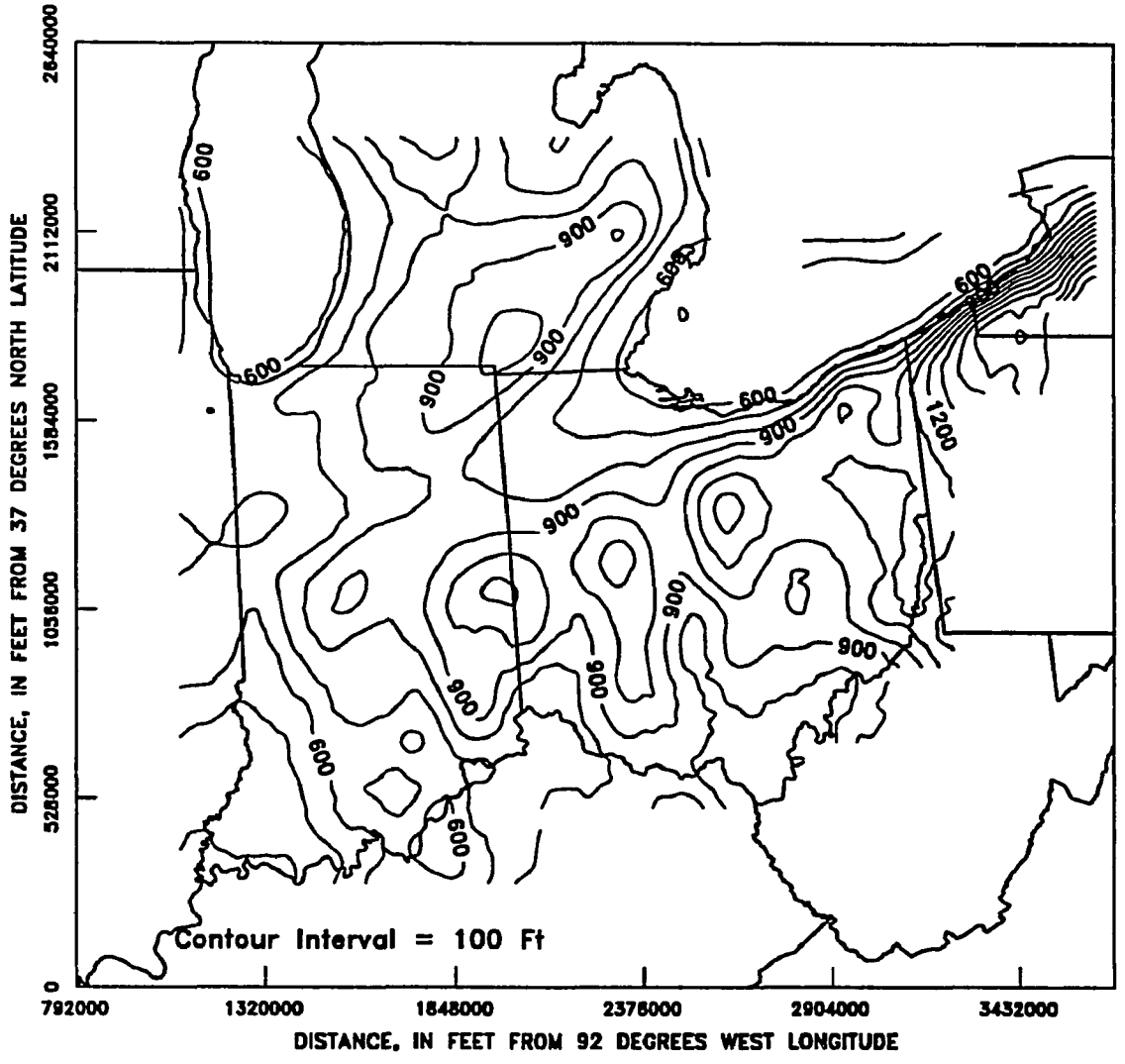

Figure 17. Generalized topographic surface based on 30-second Digital Elevation Model data (contours in feet above mean-sea level)

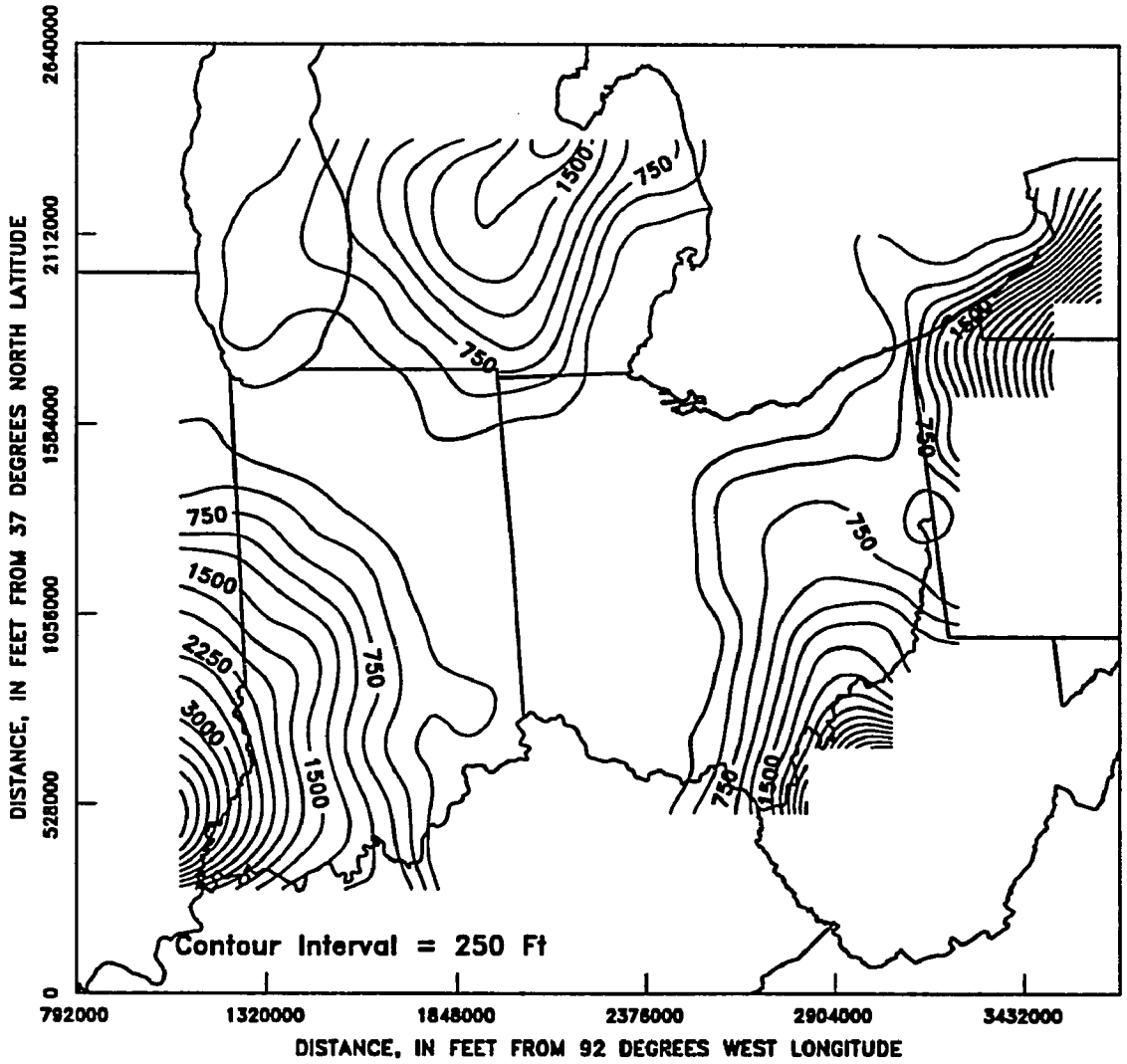

Figure 18. Isopach map of the Mississippian/Pennsylvanian-Quaternary units derived by subtracting the combined thickness of underlying Paleozoic rocks from the depth to Precambrian surface

Hydraulic Parameters

A detailed analysis of the regional flow dynamics requires an understanding of hydrologic controlling factors such as the formation-fluid density, hydraulic conductivity, fluid pressures, and water levels. These parameters and their regional distribution are discussed here.

Formation-Fluid Density

The deeper HSUs in the study area contain fluids with high total dissolved solids content and high fluid density. The formation-fluid density data for these HSUs were compiled from a variety of sources. Previously published compilations of fluid density used in this study include Stout et al (1932), Lamborn (1952), Stith (1979), and Knapp and Stith (1989) for Ohio; Vugrinovich (1986) for Michigan; Keller (1983) for Indiana; Meents et al (1952) and Bond (1972) for Illinois; and Faust et al (1980) for Kentucky. More recent data obtained from state geological survey records were added to these data. All data used were from actual chemical analysis of fluid samples rather than from interpretation of geophysical logs. Over 1800 fluid-density values were compiled for the study area. These values are listed in Appendix C. In addition to these actual data, if necessary, several control points were added to make the fluid-density contour maps realistic. For example, in areas where a particular HSU outcrops or is absent, data points with a fluid-density equal to freshwater (1.00 gm/cc) were added to prevent extrapolation of unrealistic higher fluid densities into these areas.

The injection wells operated by Aristech Chemical Corporation in southern Ohio have been sampled for fluid analysis from multiple horizons. A specific gravity versus depth graph for this site shows very little increase in fluid density with depth in the deep Lower Paleozoic samples (fig. 19), but a significant increase in fluid density in the samples from the shallower strata. A similar trend is observed in the data obtained from the "No Migration" petitions for the British Petroleum site in Lima, Ohio, and the Dupont site in Jefferson, Kentucky. Stout et al (1932) show that in the deep Paleozoic units in Ohio, the total dissolved solids concentration, and hence fluid density, remains nearly constant with depth. This indicates that for the deeper HSUs in this regional study, the fluid-density data from adjacent units can be combined. Therefore, the low permeability confining layers, for which few fluid-density data are available, were assigned the same fluid-density distribution as the adjacent high permeability units.

The 11 HSUs were grouped into five fluid-density distributions, as shown by the maps for the Mt. Simon Sandstone through Kerbel Sandstone (fig. 20); Knox Dolomite through Ordovician shales (fig. 21); Silurian-Devonian carbonates (fig. 22); Devonian shales and Berea Sandstone (fig. 23); and Pennsylvanian and overlying layers (fig. 24). A fluid density equal to that of freshwater was assigned to units that crop out or are present at shallow depths. The final fluid-density contour maps were created from these data sets after removing locally anomalous values and smoothing the calculated grids. Anomalous points were removed only if they were not supported

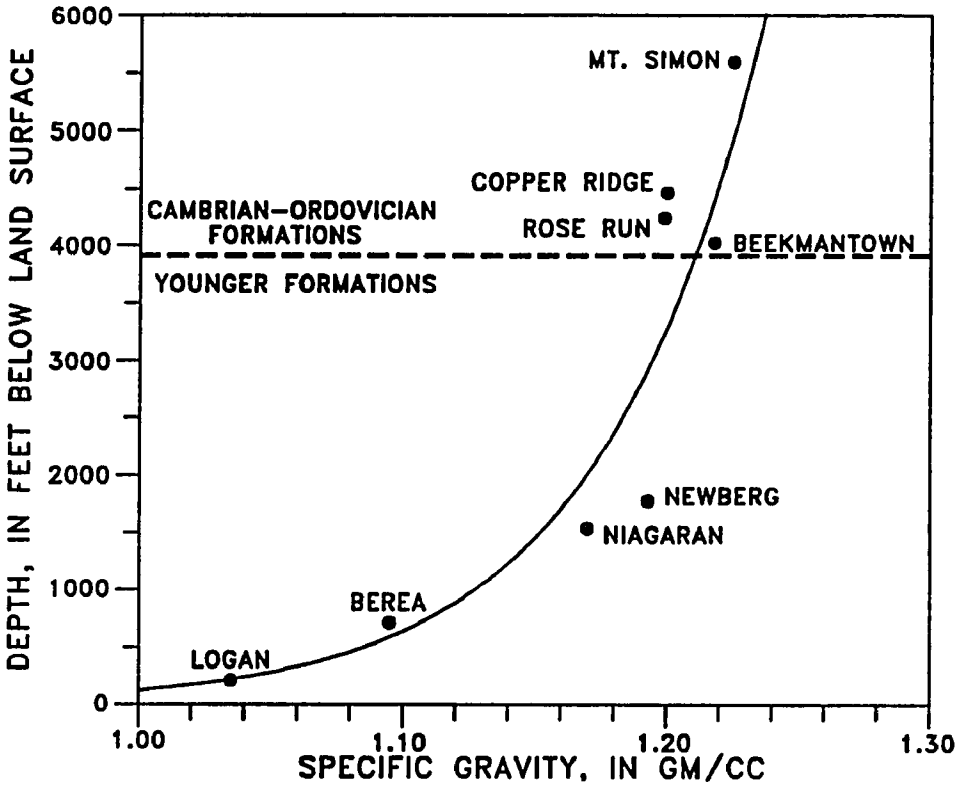

Figure 19. Fluid density versus depth variations at Aristech Chemical Corporation site

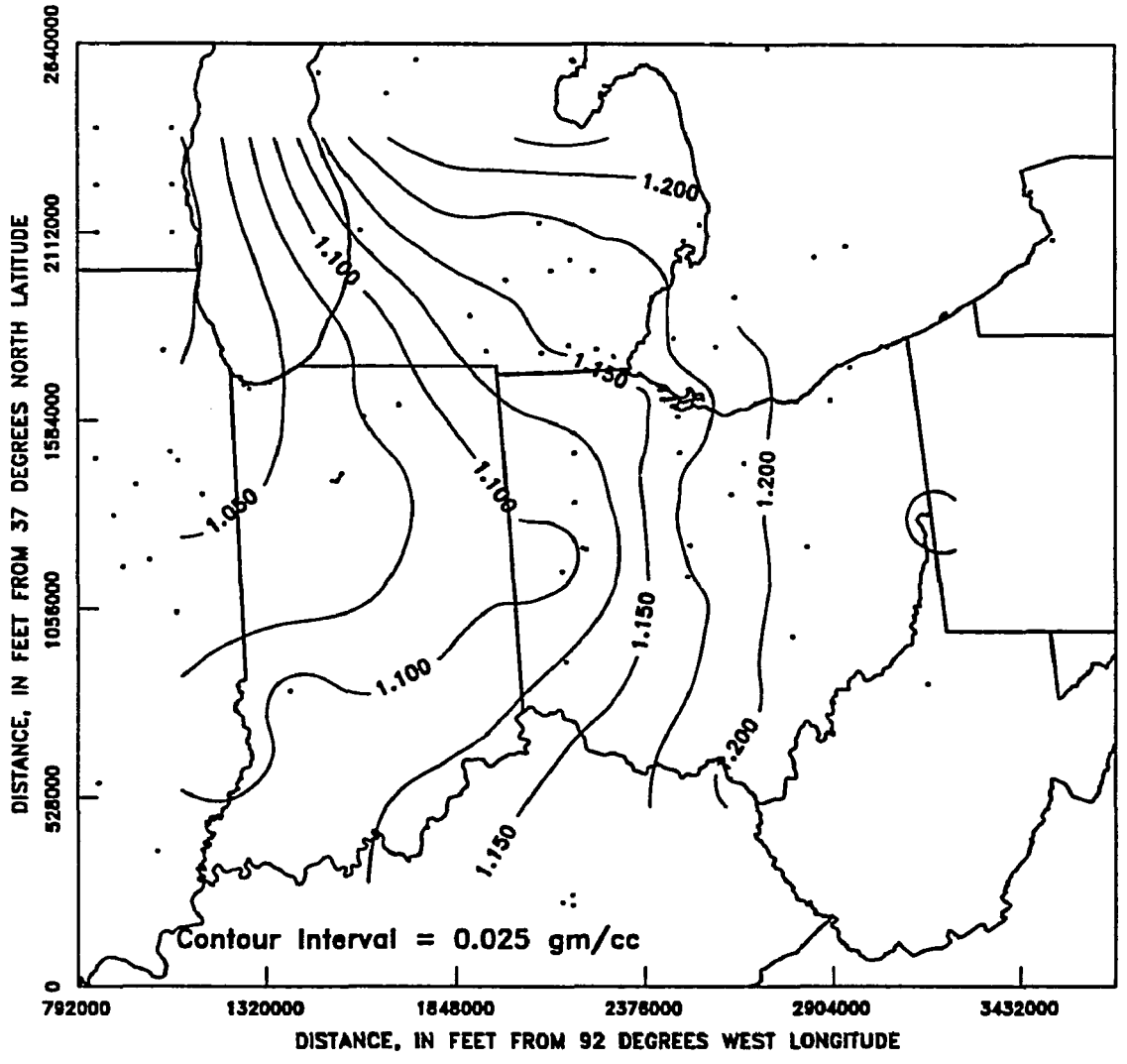

Figure 20. Fluid density-distribution for Mt. Simon Sandstone to Kerbel Sandstone

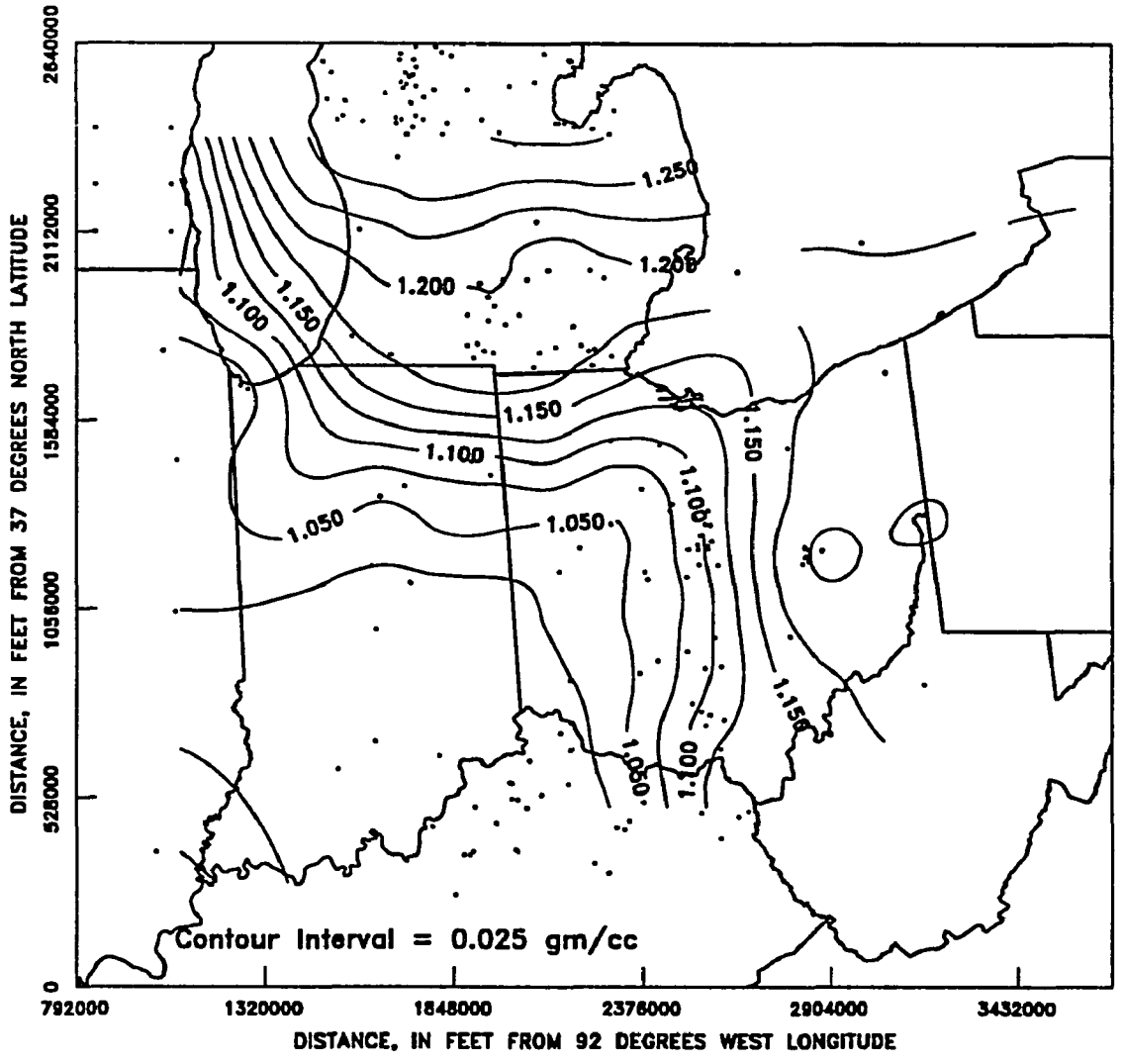

Figure 21. Fluid density-distribution for Knox Dolomite to Ordovician shales

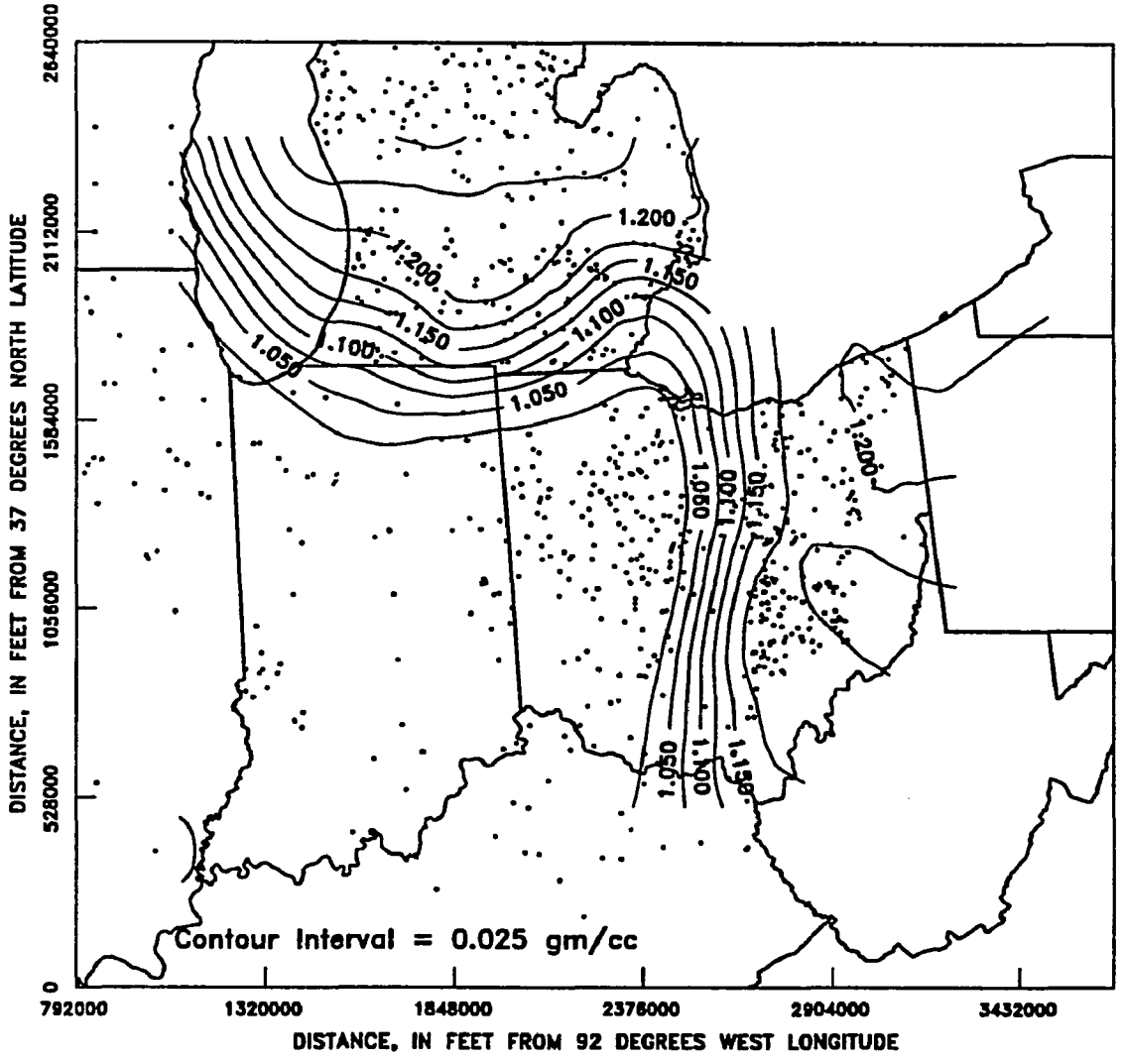

Figure 22. Fluid density-distribution for Silurian-Devonian carbonates

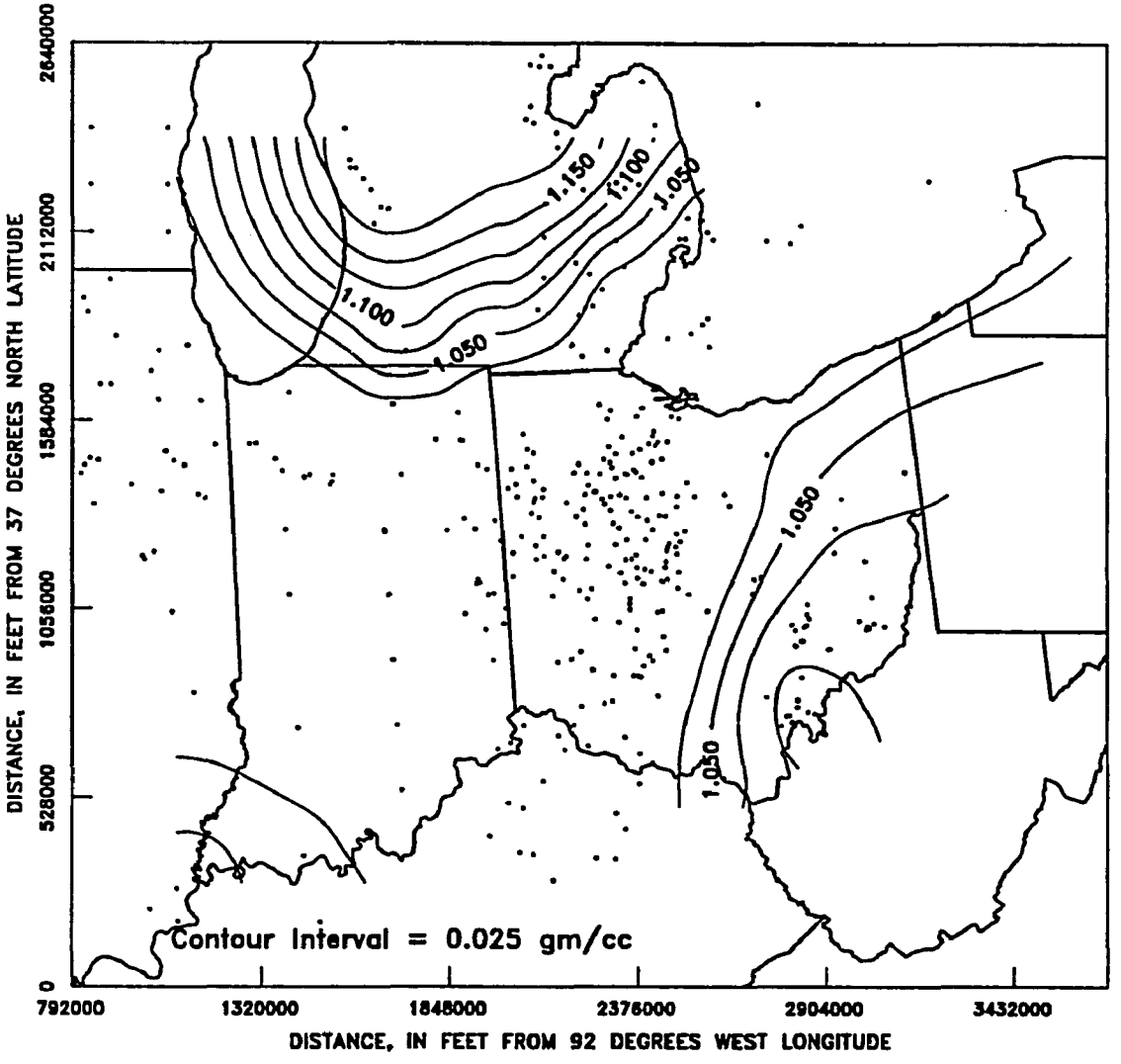

Figure 23. Fluid density-distribution for Devonian shales and Berea Sandstone

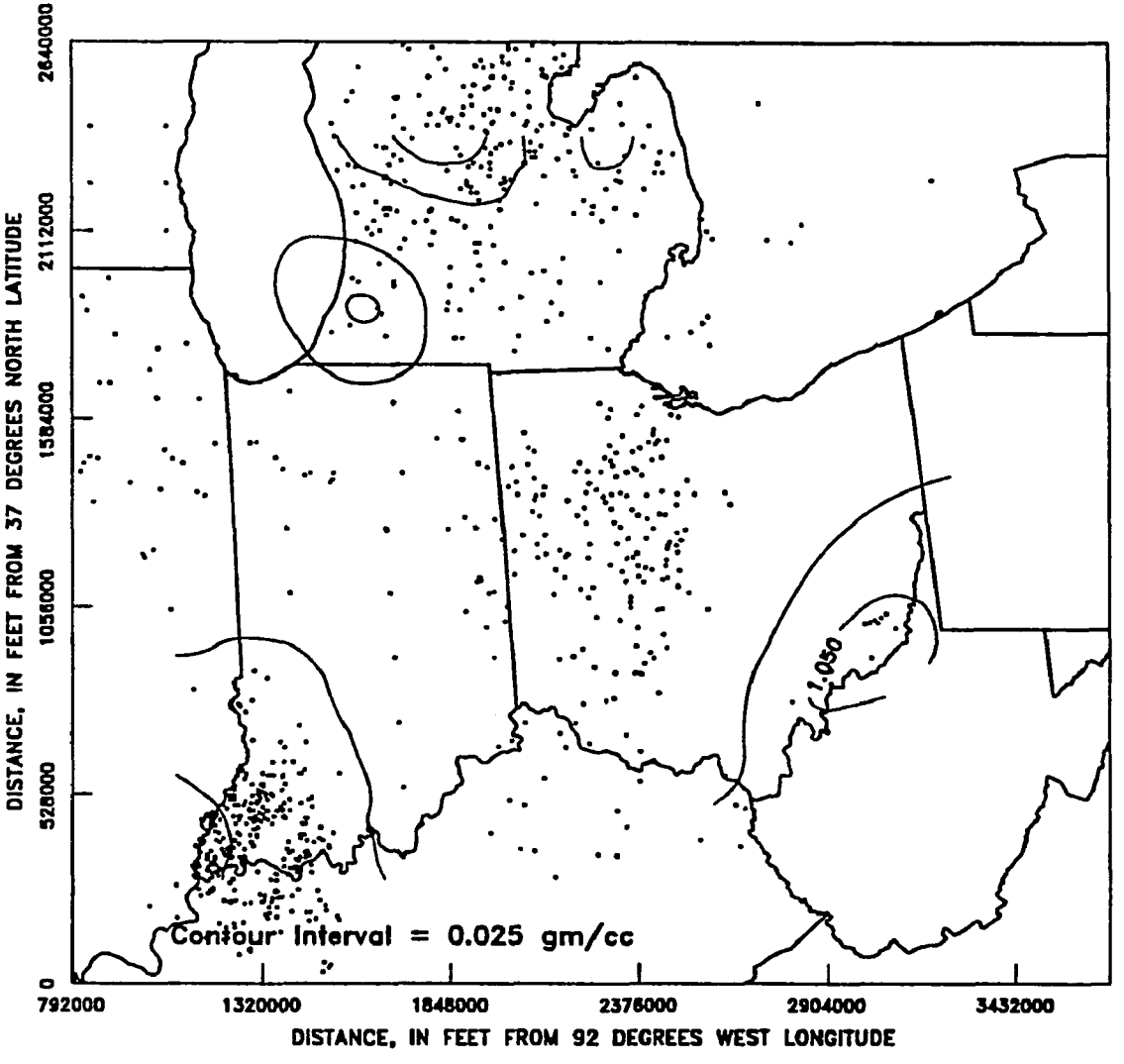

Figure 24. Fluid density-distribution for Mississippian/Pennsylvanian-Quaternary layers

by nearby data with similar fluid density or if the original data were of suspicious nature due to sampling over multiple horizons.

The five contour maps (figs. 20-24) provide a generalized view of vertical and lateral changes in fluid density in the Paleozoic strata of the midwestern United States. There is a large increase in fluid density from near surface recharge areas into the deeper parts of the basins. In the Mt. Simon Sandstone and adjacent units (fig. 20) the fluid density increases from that of freshwater in the recharge areas in Wisconsin and Illinois to as much as 1.25 gm/cc in the basins. This density corresponds to a total dissolved solids content of about 300,000 mg/l.

There are some areas on the maps of fluid density that show a vertically reversed density distribution -- lower density fluids overlain by higher density fluids. This is seen for the Mt. Simon Sandstone in central Michigan and northeastern Ohio. In these areas, the fluid density in the Mt. Simon Sandstone (fig. 20) is lower than that in the overlying Ordovician group (fig. 21), which in turn is lower than that in the overlying Silurian-Devonian carbonate unit (fig. 22). There are two possible reasons for thisreversal. First, data for the Mt. Simon Sandstone fluid density in the Michigan Basin are sparse and this may produce unrealistic maps. An attempt was made to test this by adding some of the overlying Knox Dolomite data to the Mt. Simon Sandstone data. However, this did not create appreciable changes in the fluid-density differences suggesting that the observed density reversal is not due to gridding errors alone. Second, the lower part of Silurian-Devonian carbonates in the Michigan Basin and in northern Ohio includes the evaporite deposits of the Salina Group. The original data

for the samples from the Salina Group show the highest fluid densities of all samples in this study. The salt beds in the Salina Group are a possible source of solutes for the formation of high-density brines in the Paleozoic strata. Thus, the apparent density reversals in the Michigan Basin and in northeastern Ohio may be realistic. The buoyancy effects related to these density distributions may cause some local density-driven flow to exist in these areas and in the process lead to mixing of brines of different origins.

Fluid Pressures and Water Levels

The water table in the unconsolidated sediments and in the shallow bedrock units usually is close to the land surface and mimics changes in land surface elevation. Therefore, on a regional scale in which the flow system is several thousand feet thick, the upper water-table boundary to the flow system can be defined by the elevation of the land surface (fig. 17). Below the near surface layers, potentiometric data are extremely sparse because the deep saline aquifers cannot be used as a source of groundwater. Most available data for the deep Paleozoic units are from oil and gas drilling operations and from studies related to deep-well injection permits. There are no published regional potentiometric maps except for the Mt. Simon Sandstone (Clifford, 1972; Warner, 1988, see Appendix A). The fluid-pressure measurements for oil and gas wells are generally taken from drill-stem tests but the results of these tests are seldom submitted to state or federal agencies and, therefore, are not readily available.

Results of drill-stem tests performed at some of the deep-well injection sites (Table 1) in the study area for several geologic units are available in the "No Migration" petitions. These data can be used to determine the potential for vertical flow between pairs of tested units. This is done by extrapolating the observed shut-in pressure at one depth to the pressure at the gage depth of a second drill-stem test. Two such observations of multiple-level drill-stem tests are from the Cincinnati Arch area at Lima (BP), in western Ohio, and at Vickery (CWM), in northern Ohio. Tests at both these locations indicate a downward flow gradient from the overlying Ordovician rocks into the Mt. Simon Sandstone (fig. 25). Downward flow from the Ordovician to the Cambrian strata also was indicated by Vugrinovich (1986) for parts of Michigan (fig. 25). Multiple drill-stem test observations also are available from deep-well waste-injection sites at Haverhill (Aristech), in southern Ohio; Jefferson, in northwestern Kentucky (Du Pont), and Danville (Nieto, 1989) in east-central Illinois (fig. 25). These sites are at the margins of the Appalachian and Illinois basins and are characterized by upward flow gradients from the Mt. Simon Sandstone into the overlying Rose Run Sandstone and Ironton-Galesville Sandstone (fig. 25). In addition, the data from the Haverhill, Ohio, site also indicate a downward flow gradient from the Silurian Newburg zone into the Rose Run Sandstone (fig. 25). This indicates that the relatively thin but permeable Rose Run Sandstone may be a regional pathway for groundwater flow derived from adjacent overlying and underlying hydrologic units. Although limited, these observations provide constraints on possible regional flow patterns and targets for numerical simulations.

Table 1. Observed water level and pressure data

State	Site	Geologic Unit	Surf. Elev (ft)	Gage Depth (ft)	Gage Elev. (ft)	Pres-sure (psi)	Fluid Density (gm/cc)	Hydr-aulic Head (ft)	EFWH (ft)
Ohio	Armco #1	Mt. Simon	666	2892	-2226	1301	1.12	457	779
Ohio	BP Chemicals #1	Mt. Simon	872	2776	-1904	1150	1.1	510	752
Ohio	BP Chemical test well	Knox	870	2173	-1303	820	1.075	459	591
Ohio	CWM #1	Mt. Simon	620	2745	-2125	1132	1.089	276	489
Ohio	CWM #2	Ordovician	607	2389	-1782	1031	1.0975*	388	509
Ohio	CWM #4	Conasauga	609	2530	-1921	1053	1.0975*	295	511
Ohio	Aristech #1	Mt. Simon	558	5514	-4956	2625	1.225	-7	1106
Ohio	Aristech #1	Rose Run	558	4230	-3673	1934	1.199	53	795
Ohio	Calhio #1	Mt. Simon	701	5886	-5185	2760	1.218	48	1189
Ohio	Empire Reeves	Mt. Simon	1176	4961	-3785	2050	1.206	141	949
Ohio	RES	Mt. Simon	650	5950	-5300	2733	1.169	99	1012
Kentucky	Dupont	Mt. Simon	462	5397	-4935	2571	1.14	273	1003
Kentucky	Dupont	Copper Ridge	462	3360	-2898	1469	1.018	435	495
Indiana	USS Steel #1	Mt. Simon	600	3300	-2700	1420	1.072	359	579
Indiana	USS Steel #1	Eau Claire	600	2090	-1490	880	1.002	538	542

Table1. continued

State	Site	Geologic Unit	Surf. Elev (ft)	Gage Depth (ft)	Gage Elev. (ft)	Pres-sure (psi)	Fluid Density (gm/cc)	Hydr-aulic Head (ft)	EFWH (ft)
Indiana	Hoskins	Mt. Simon	829	3417	-2588	1454	1.0899	493	770
Indiana	Inland Steel #1	Mt. Simon	608	2582	-1974	1046	1.016	404	442
Indiana	Inland Steel #1	Mt. Simon	608	3873	-3265	1643	1.09	216	529
Indiana	Inland Steel #1	Eau Claire	608	2202	-1594	879	1.001	434	436
Indiana	Inland Steel #2	Mt. Simon	607	4265	-3658	1887	1.08	377	700
Indiana	Midwest	Mt. Simon	615	3449	-2834	1433	1.08	230	475
Indiana	Pensinger	Mt. Simon	601	6681	-6080	3033	1.13	119	925
Indiana	FMC	Mt. Simon	650	5805	-5155	2427	1.148	-273	450
Michigan	Allied Chemical #1	Mt. Simon	600	4100	-3500	1925	1.14	400	946
Michigan	Consumer Gas BD-#1	Mt. Simon	616	4498	-3882	2145	1.195	263	1072
Michigan	Holland Suco #1	Mt. Simon	623	5025	-4402	2346	1.16	269	1016

Table1. continued

State	Site	Geologic Unit	Surf. Elev (ft)	Gage Depth (ft)	Gage Elev. (ft)	Pres-sure (psi)	Fluid Density (gm/cc)	Hydr-aulic Head (ft)	EFWH (ft)
New York	Bethlehem	Mt. Simon	592	4131	-3539	1950	1.2	214	964
Illinois	Panhandle East	Mt. Simon	679	3995	-3316	1757	1.081	438	742
Illinois	Humble #1	Mt. Simon	538	7978	-7440	3666	-NA-	399	1028
Illinois	Johnson #1	Mt. Simon	541	8892	-8351	4050	1.165	-322	1002

Notes:
Reference datum = mean sea level
* = estimated
EFWH = equivalent freshwater head
NA = not available

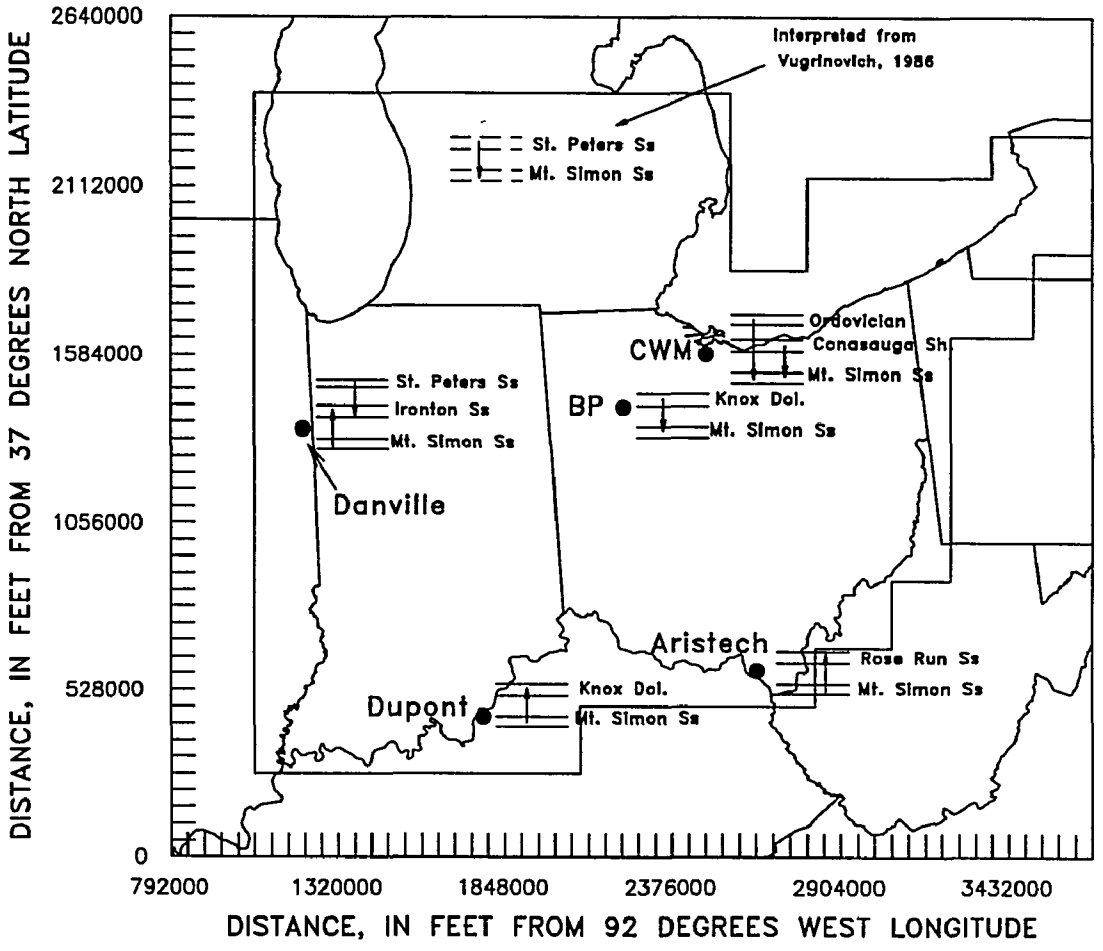

Figure 25. Schematic representation of observed vertical flow directions in the deep hydrostratigraphic units

The availability of reliable pressure versus depth data for the entire study area generally was limited to the Mt. Simon Sandstone (Table 1). A regression plot of these data provides some information on the nature of hydrostatic equilibrium for this unit (fig. 26). All of the data points on Figure 26 fall below the hydrostatic pressure line, i.e. the observed pressure is always less than the hydrostatic pressure. This regional underpressuring may indicate the lingering effect of erosional unloading following Pleistocene glaciation and the resulting expansion of pore sizes in the sedimentary layers (Russell, 1972). Russell (1972) also showed that the entire Paleozoic sequence in the Appalachian Basin region is regionally underpressured.

The observed pressure (p), fluid density (ρ), and gage elevation (z) for the drill-stem test, and a freshwater pressure gradient of 0.433 pounds per square inch (psi) are used to calculate variable-density head and equivalent freshwater head as:

$$\textit{Variable-Density Head} = \frac{p}{0.433 * \rho} - z \qquad (1)$$

$$\textit{Equivalent Freshwater Head} = \frac{p}{0.433} - z \qquad (2)$$

Variable-density heads are the actual water-level elevations in the well bore. Equivalent freshwater heads are hypothetical water levels, normalized to a fluid density of 1.0 gm/cc, such that the pressure of the normalized water column is the same as that of the variable-density water column. Only about 20 reliable fluid-pressure

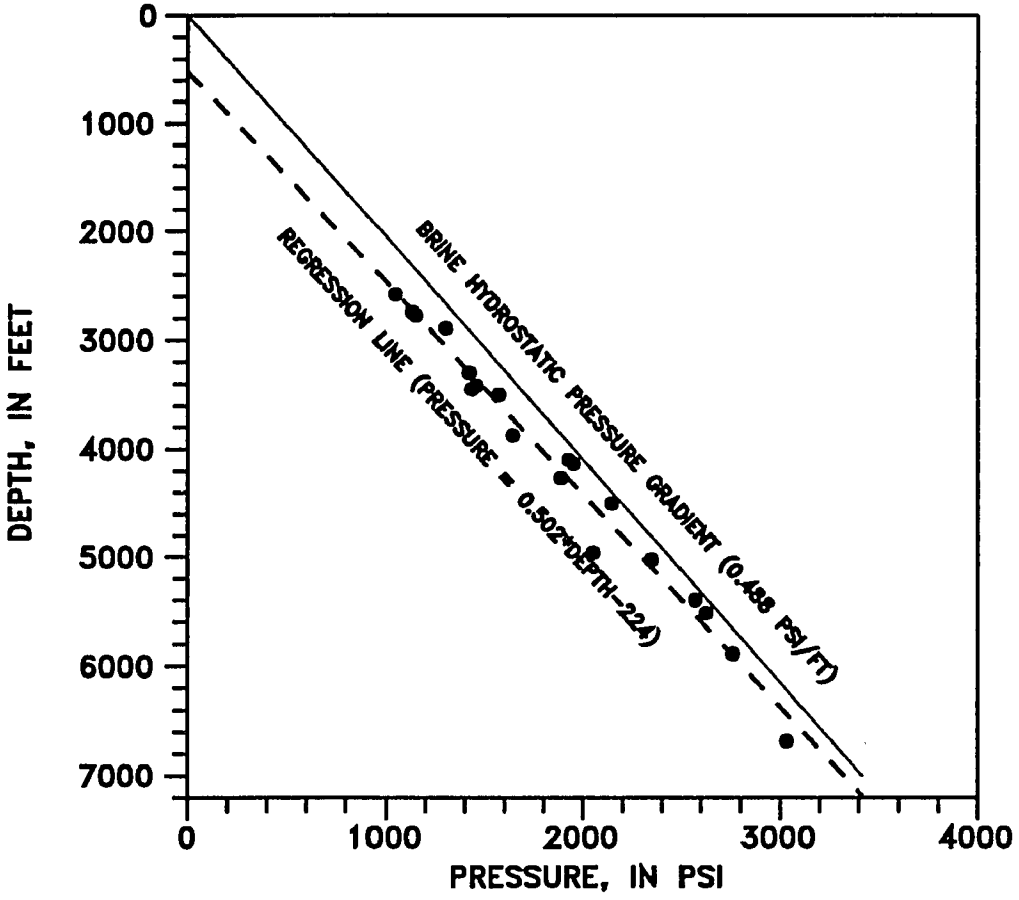

Figure 26. Pressure-depth diagram for Mt. Simon Sandstone

measurements are available for the Mt. Simon Sandstone. These observations were used to generate potentiometric-surface maps based on variable-density heads (fig. 3) and equivalent freshwater heads (fig. 2). These maps are similar to those previously published by Warner (1988, see Appendix A) and Clifford (1972), which show grossly differing interpretations of regional flow patterns, only one of which can be correct. The variable-density potentiometric surface (fig. 3) shows the highest fluid potential in Wisconsin and northwestern Illinois. This region is the major recharge location for the Cambrian-Ordovician formations, which are at or near ground surface in these areas. The variable-density water levels show a gradual decrease in elevation into the Illinois and Appalachian basins. There is a significant high in the contours of potential in the variable-density-head map along the Cincinnati Arch in western Ohio and eastern Indiana. This is in contrast with a regional low in the contours of potential in the equivalent freshwater head map in the same area. There are not enough data in the Michigan Basin to define consistent trends in the potentiometric surface.

Potentiometric-surface data for the deep hydrologic units overlying the Mt. Simon Sandstone are not available for most of the study area. One significant exception is the Michigan Basin area for which a detailed compilation of observed pressure and water-level data were made by Vugrinovich (1986). Some water-level maps also are available for the Cambrian-Ordovician aquifers in northern Illinois (Mandle and Kontis, in press), but the area covered by these maps coincides only with a small area in the northwestern corner of the present study.

Hydraulic-Conductivity Distribution

Due to the large study area and sparse distribution of available hydraulic conductivity (K) data, the construction of a detailed K distribution map for each HSU is not feasible. Therefore, an attempt was made to arrive at generalized values for each HSU based on published K values and known lithologic variations. Lithologically, the 11 HSUs consist mainly of sandstones, shales or carbonates. Representative K ranges for various lithologies are given in Domenico and Schwartz (1990). These ranges are $8.0x10^{-05}$ to $2.0x10^{0}$ ft/day for sandstones; $3.0x10^{-08}$ to $6.0x10^{-04}$ ft/day for shales; and $3.0x10^{-04}$ to $2.0x10^{0}$ ft/day for carbonates. These values provide upper and lower limits of possible K values for various layers. The vertical hydraulic conductivities are generally assumed to be one order less than the horizontal hydraulic conductivities.

To achieve more accurate estimates of K values, the published data were reviewed. The most important sources of these data are the "No Migration" injection well petitions and publications related to the RASA studies at the U.S. Geological Survey. For the Mt. Simon Sandstone, K data consist of about 10 drill-stem tests and about 35 sets of core-test data. Some K values also are available for the overlying geologic units. In general, K values for sandstones are about 5 to 6 orders of magnitude higher than K values for shales and about 2 to 3 orders of magnitude higher than K values for carbonates. Lateral variations in K were not evaluated in detail. However, a porosity distribution map for the Mt. Simon Sandstone (Warner, 1988) shows a decrease in porosity in eastern Ohio due to increased cementation. This decrease in porosity is likely to result in lower K in this region. Lateral facies

variations such as the presence of the Rome sandstone facies (Janssens, 1972) in Ohio will also cause lateral heterogeneity.

Secondary permeability due to fracturing, faulting, and jointing also may result in higher K in some areas. Wickstrom et al (1990) presented evidence for local faulting in northwestern Ohio. Onasch and Kahle (1991) and Dean et al (1991) also present evidence for development of faulting and jointing in northwest Ohio. These tectonic features likely produce an increase in K in this area. According to Norris and Fidler (1973), a large region of high secondary permeability in the Silurian-Devonian carbonates surrounds the uplifted Cincinnati Arch complex in western Ohio and eastern Indiana. This secondary permeability due to dissolution and fracturing is the primary reason for the ability of the carbonate sequence to act as a major source of groundwater in western Ohio. Thus, several arguments can be made that the uplifted arch region in the center of the study area has higher hydraulic conductivity than the rocks in the same units in the surrounding basinal regions.

CHAPTER III

CONCEPTUAL HYDRODYNAMIC FRAMEWORK

The data and observations available for formulating the various HSUs in the study area were presented in the previous chapter. Although data for characterizing spatial variations in hydraulic parameters are meager, some interpretations regarding flow patterns in the Paleozoic strata, particularly in the Mt. Simon Sandstone, can be made. The conceptual framework of the HSUs and flow patterns form the basis for construction of a numerical flow model and the evaluation of various geologic and hydrologic controls on flow patterns

Hydrostratigraphic Units and Flow Domain

The sequence of sedimentary rocks overlying the Precambrian in the midwestern United States was divided into 11 HSUs based on lithologic similarity and continuity. The combined thickness of all units increases from about 2000 ft in the central uplifted regions along the Cincinnati Arch to more than 15,000 ft in the structural basins (fig. 27). In general, the HSUs dip away from the Cincinnati-Findlay-Kankakee arch region into the Illinois, Michigan, and Appalachian basins.

The lateral and vertical extent of the study area and of the numerical model were determined by evaluating the hydrologic significance of various regional

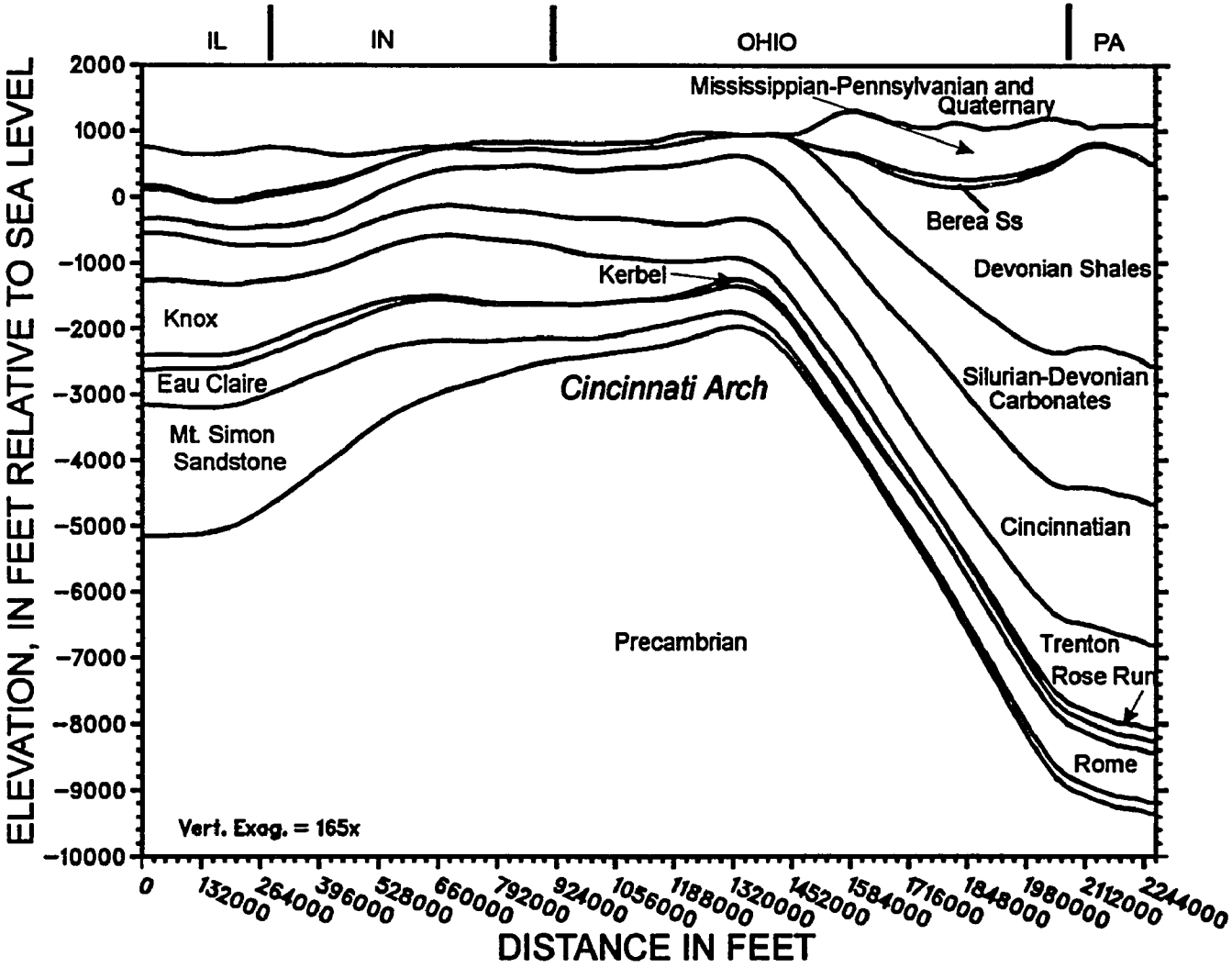

Figure 27. West-east hydrostratigraphic cross section from east-central Illinois to west-central Pennsylvania (along model row 50)

structural features. According to Anderson and Woessner (1992), it is advisable to use physical features such as extremely low permeability rocks, fault zones, and surface-water bodies as model boundaries because they usually form stable features of the flow system that coincide with natural hydraulic boundaries such as groundwater divides. Therefore, whenever possible, the model domain was extended to significant geologic boundaries. The southern boundary of the study area coincides with zones of extensive faulting in Illinois and Kentucky (fig. 1). The eastern boundary approximately parallels an area of growth faulting in Pennsylvania (Wagner, 1976) and is roughly parallel to the strike of the Appalachian Basin. Along the northeastern boundary, the Paleozoic rocks overlap the Precambrian Shield in southern Ontario, Canada. There are no obvious geologic boundaries in Michigan and Indiana. As a result, mathematical hydrologic boundaries needed to be used. The northwestern boundary of the study area was extended to the approximate middle of the Michigan Basin. The western side of the study area was extended to eastern Illinois, which is approximately along the north-south axis of the Illinois Basin. The flow system is bounded on the bottom by the poorly permeable Precambrian basement rocks and on the top by the water table, which is represented by the ground surface (fig. 27).

Regional Flow Patterns

Conceptually, flow patterns in simple regional aquifers consist of flow systems of local, intermediate, and regional extent (Toth, 1963). Small local-scale flow systems recharge at topographic highs and discharge water at adjacent topographic lows in

small streams and lakes (fig. 28). These local flow cells are generally only a few miles long and penetrate only the uppermost HSUs. In the study area, the water table in the shallow aquifers generally follows surface topography, and is commonly within a few tens of feet of the land surface throughout the study area. For the objectives of this regional-scale study, the water-table elevation is assumed to be the same as the ground-surface elevation. Local-scale flow cells have very little influence on flow paths in the deeper HSUs, which receive only a fraction of the recharge as cross-formational flow from adjacent shallow HSUs (Mandle and Kontis, in press). These regional-scale flow patterns, particularly those in the Mt. Simon Sandstone, are the major focus of this study.

Due to the multilayered stratigraphy, tectonic complexities, and fluid-density variations the flow system in this study is more complicated than the topography-driven model of Toth (1963) described above. Due to these complicating factors, the flow system in the study area may be more similar to the one shown in Figure 28 that shows the influence on vertical and lateral flow patterns of multiple aquifer and confining layers, geologic structures, and topographic variations. In the midwestern United States, recharge or leakage into regional flow cells occurs in topographically high areas as well as in the tectonically uplifted areas. For the Mt. Simon Sandstone and the other deep HSUs, the major surface recharge area is in the northwestern part of the study area (Mandle and Kontis, in press). In this region, the Cambrian-Ordovician aquifers are at or are close to the land surface and a high percentage of precipitation can infiltrate into these aquifers as downward leakage through the glacial

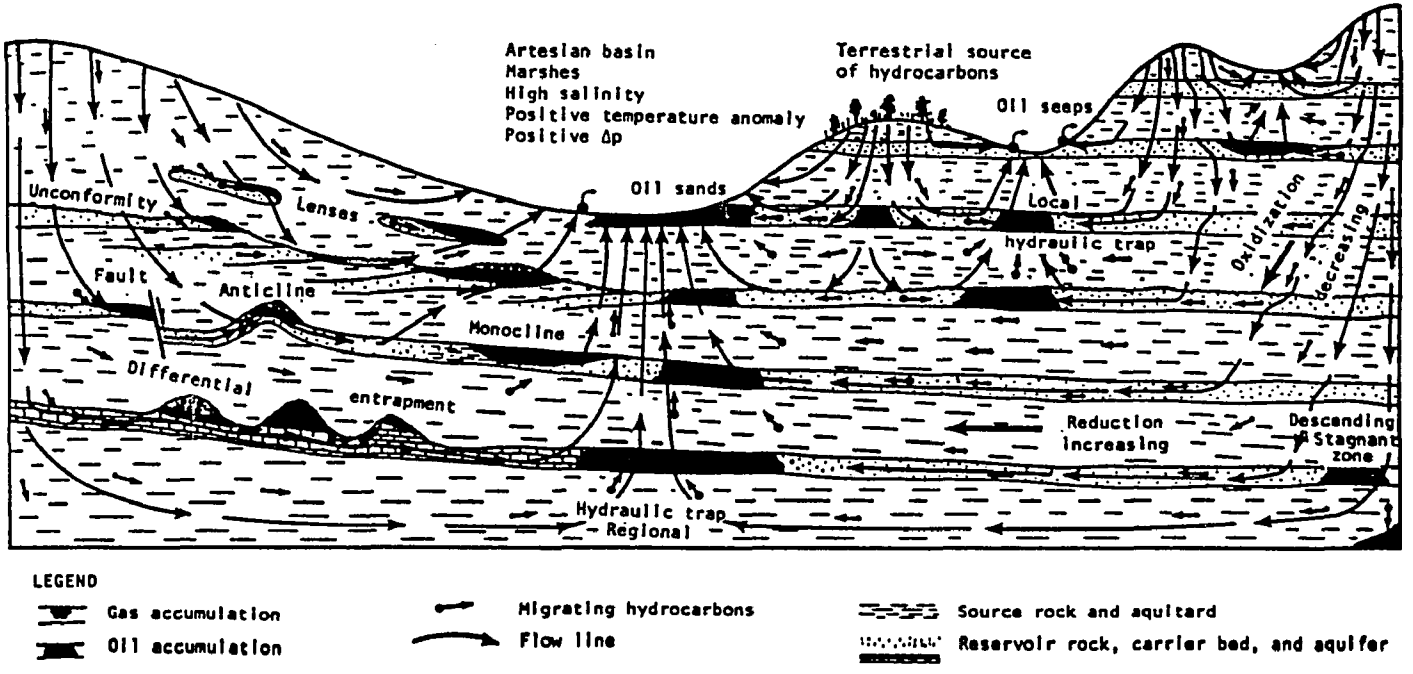

Figure 28. Conceptual flow diagram showing the influence of topography and hydraulic-conductivity variations on flow patterns in a stratified, regional flow system (from Toth, 1980)

drift, where present, and directly where the glacial drift is absent. Most of the present day recharge to the deep aquifers occurs directly in these outcrop areas. A secondary mechanism of groundwater flow into the deep aquifers is downward leakage through overlying confining layers. This is most likely to occur in areas where the total sedimentary thickness is small, abundant faulting and jointing provide enhanced vertical hydraulic conductivity, and downward hydraulic gradients exist, i.e., in the central uplifted arch region. Evidence of this leakage is the groundwater mound in the central part of the study area, as seen in the Mt. Simon Sandstone potentiometric surface (fig. 3). This downward leakage also is indicated by the pressure-depth data from drill-stem tests performed in wells along the Cincinnati Arch (fig. 25).

Potentiometric-surface maps for the Mt. Simon Sandstone (fig. 3) and similar maps for the overlying geologic units prepared by Mandle and Kontis (in press) for the northern midwest region show that regional groundwater flow is from the higher elevation recharge areas in northwest Illinois and Wisconsin towards the deeper parts of the Illinois Basin in southern Illinois and Indiana. The role of the Illinois Basin as a discharge area in the western part of the study area also is indicated by analysis of temperature anomalies (Cartwright, 1970), hydraulic gradients (Bond, 1972), and theoretical flow modeling (Bredehoeft et al, 1963). The most likely mechanism for this discharge is upward cross-formational flow across regionally important confining layers in regions of extensive faulting and fracturing in southern Illinois.

Regional flow studies similar to those in the Illinois Basin have not been performed in the Michigan and Appalachian basins. However, based on the principles

of regional groundwater flow and the geometric similarity with the Illinois Basin, flow is expected to be from recharge areas along the basin margins, with downward leakage in the Cincinnati Arch region, flowing towards discharge points as upward leakage in the central parts of the basins. Most of the flow in the permeable sandstone aquifers is expected to be parallel to bedding, along the dip of the formation into the basins. Vertical flow is expected to occur across the confining layers (fig. 28).

In the Illinois and Appalachian basins the occurrence of cross-formational flow in the basins is indicated by upward hydraulic gradients based on the drill-stem data at deep-well waste-injection sites (fig. 25). Vugrinovich (1986), however, indicated a downward flow gradient in the Cambrian-Ordovician rocks in the Michigan Basin. This anomalous behavior in the Michigan Basin is not yet resolved but may be related to geologic factors or to the fluid-density distribution.

There are no studies of the hydraulic connection between the regional flow system in the Lower Paleozoic units and surface-water bodies such as the Ohio River and Lake Erie. These water bodies may or may not be the ultimate discharge points for the regional flow system, as suggested from the theoretical work of Toth (1963, 1978), which assumed uniform fluid densities. The Lower Paleozoic units are shallow in northern Illinois and Wisconsin, and in these areas they are hydraulically connected to the flow system at local and intermediate scales (Mandle and Kontis, in press).

Flow at Boundaries

Characterization and definition of flow conditions at the boundaries of the study area are necessary for proper understanding of regional hydrodynamics. Under steady-state conditions, boundary conditions influence the orientation of flowpaths within the flow system. Consequently, the correct definition of these boundary conditions is critical to realistic prediction of flow patterns (Anderson and Woessner, 1992). This is relatively easy where the study area can be extended to regional physical features that effectively isolate the flow system from surrounding regions. The Kentucky River Fault Zone and the Rough Creek Fault Zone in the south are assumed to separate the flow system in the study area from the flow system in the Rome Trough (fig. 1). The pinch out of the Lower Paleozoic rocks in the northeastern part of the study area forms an ideal geologic boundary for these units. Lack of significant geologic boundaries on the other sides of the study area necessitates use of (mathematical) boundaries that provide for realistic flow between the study area and the areas immediately outside it.

Flow conditions at these boundaries are defined such that flow patterns in the Mt. Simon Sandstone are mainly from recharge areas in the northwest to regional discharge points to the south and east. Furthermore, any flow at the borders of the study area must provide a reasonable match with the hydraulic head observations and vertical flow directions within the study area. The observed permeability of the shale layers is usually more than 3 to 4 orders of magnitude lower than in the sandstone units. Therefore, it can be assumed that the dominant flow directions in the shale units are vertical and there is no lateral flow in the shale layers at the boundaries. This

leaves only the sandstone and carbonate HSUs for which flow at the boundaries of the study area needs to be determined.

The major complicating factor in characterizing regional flow patterns is variations in fluid density. Most of the deep aquifers in the study area contain waters with high fluid densities and salinities, particularly in the deeper parts of the basins. The spatial variations in fluid-density distributions can generate buoyancy forces that cause relatively fresh water (low-density fluids) to float upwards and the more dense waters to sink downwards. These density-related forces in combination with gravitational forces can create flow patterns that are significantly different than those interpreted from simple potentiometric maps.

The fluid-density variations also complicate the determination of flow across the boundaries of the study area. Use of equivalent freshwater heads instead of variable-density heads for the determination of flow at the boundaries also may produce inaccurate flow patterns. For the purpose of this study, fluid density is assumed to be spatially variable but constant with time. This assumption implies that flow patterns determined in this study reflect only present day conditions. Future changes in flow patterns due to freshwater recharge or leaching of solutes from salt beds cannot be accounted for in this analysis. Additionally, this assumption precludes analysis of flow directions related to injection of liquid wastes having fluid-densities different than that of the native brines. It also precludes consideration of the effects of solute transport due to changes in concentration of the brines.

Although based on sparse datasets, the conceptual model provides a general framework of the regional hydrodynamics of the mid-continent that should be reproducible by a numerical model. In general, the hydrostratigraphy of the region can be represented as a thick sequence of sandstone, shale, and carbonates containing fluids of variable density. The shallow HSUs contain local-scale flow cells that are not influenced by variations in fluid density, whereas the deeper flow cells are strongly influenced by fluid-density variations. Recharge to the deep flow system is in the outcrop and subcrop areas in Illinois and Wisconsin. Vertical leakage into and out of the deep flow system occurs as cross-formational flow. Discharge areas for the deep flow systems are likely to be in the central parts of the basins with most discharge occurring as upward cross-formational flow.

CHAPTER IV

NUMERICAL SIMULATION OF FLOW

Numerical Model

The geologic and hydrologic data and a conceptual framework of the regional hydrodynamics in the midwestern Unites States were presented in previous chapters. It is evident the available information by itself is insufficient for analysis of the hydrodynamic controls on the regional flow system. In situations like this construction of a numerical model to simulate the flow system can significantly enhance the understanding of underlying processes. In particular, a numerical model can be used to integrate all the available data about the flow system and to test hypotheses regarding the influence of various hydrologic and geologic parameters on regional flow patterns. This type of model, one used for analysis of the flow system behavior, is known as an *interpretive model*, in contrast to the more commonly used *predictive model* that is used for a quantitative determination of flow system components at a specific site (Anderson and Woessner, 1992).

To estimate flow velocities and flow patterns and to better understand the processes affecting the regional hydrodynamics, a steady-state numerical flow model was constructed. The vast areal extent, geologic complexity, and fluid-density variations make it necessary to use a three-dimensional code that can incorporate fluid-

density-related flow components. There are many general and specialized programs available for this purpose. These include some of the most sophisticated finite-difference codes, such as the Heat and Solute Transport program (HST3D) (Kipp, 1987) and the Sandia Waste Isolation Flow and Transport program (SWIFT) (Reeves and Cranwell, 1981), which can simulate coupled fluid, mass, and energy transport in a complex three-dimensional, transient flow system. The level of sophistication used in these codes requires that a very small grid spacing be used in order minimize numerical dispersion and to achieve convergence. Therefore it is not efficient to use these codes for large regional scale problems.

Recently, a series of computer codes has been developed under the Regional Aquifer-Systems Analysis (RASA) program of the U.S. Geological Survey. These codes simulate three-dimensional flow of variable-density fluids under steady-state conditions (Kuiper, 1983, 1985; Weiss, 1982; and Kontis and Mandle, 1988). The variable-density flow code called VARDEN developed by Kuiper (1983, 1985) was chosen for this study because it meets the objectives of this study -- analysis of steady-state, variable-density hydrodynamics. VARDEN is a three-dimensional, steady-state, variable-density FORTRAN code that uses the integrated finite-difference method to simulate complex hydrogeologic settings. Fluid density can be variable in space but constant in time. The solution of the numerical equations is based on the assumption that there is no change in the fluid-density distribution due to flow, mixing, or chemical reactions over significant periods of time. This is a reasonable assumption with respect to the objective of the simulation -- to examine regional flow patterns --

because of the extremely low flow velocities in the deep regional aquifers and the slow changes in fluid density due to advective transport, pressure, or temperature variations (Kuiper, 1983). For example, White (1965) showed that the density of Salton Sea Brine decreased from 1.264 gm/cc at 25°C to 1.249 gm/cc at 50°C, a change of less than two percent over a 25°C change in temperature. According to an extrapolation of the thermal log from the deep well drilled by the Ohio Geological Survey in Warren county, Ohio, the difference in temperature between the surface and a depth of 12,000 feet would be 52°C. Thus, the change in density due to temperature at the greatest depth would be less than about 5 percent.

The governing flow equation solved in the VARDEN code is:

$$\bar{q} = -\left(\frac{k}{\mu}\right)(\nabla h + \rho g \nabla z) \qquad (3)$$

Equation (3) is a generalized vector form of the Darcy's equation where $\bar{q}$ is the specific discharge, k is the intrinsic permeability tensor of the porous medium, μ is the dynamic viscosity of the fluid, h and ρ are the hydraulic head and density of the fluid, g is the acceleration due to gravity, and z is the vertical distance measured upward. A detailed derivation of the approximating integrated finite-difference equations in given is Kuiper (1983).

The code was verified by reproducing the example problem in the user's manual (Kuiper, 1985) and by reproducing Henry's seawater intrusion problem simulated with parameter values given in Senger and Fogg (1990). The code has been used previously

to simulate variable-density flow in the Gulf Coast aquifer system (Williamson et al, 1990) and in the Palo Duro Basin of Texas (Kelley, 1989).

VARDEN uses the principle of conservation of mass to compute the flux across the face of each grid block based on the cell dimensions, hydraulic conductivity, fluid density, and the pressure gradient among adjacent nodes. Input parameters include layer thickness, fluid density, hydraulic conductivity, and boundary conditions. Variable-density head values are used at the fixed-head boundary nodes. These are converted to equivalent freshwater heads and the model solves the flow equation in terms of variable fluid-density for unknown equivalent freshwater heads. After a solution is obtained using the preconditioned conjugate-gradient method, the computed equivalent freshwater heads are converted to variable-density heads.

Two types of simulations were performed: one based on uniform freshwater fluid density (1.00 gm/cc for all model nodes) and another based on actual fluid densities. In both cases variable-density heads are used at the fixed-head boundary cells. All flow simulations were performed on a Digital 5400 server and a Digital 3100 workstation in the Hydrogeology Laboratory at The Ohio State University.

Model output includes simulated variable-density heads, equivalent freshwater heads, flux across each grid block face, and the flow budget. The simulated head values were used to construct contour maps of simulated potentiometric surfaces. The simulated vertical fluxes were contoured to distinguish regions of upflow from regions of downflow. An ancillary computer code was written by the author to read the flux values for each run and resolve a three-dimensional velocity vector for each grid block.

These vectors represent Darcy (discharge) velocities and are plotted as arrows representing two-dimensional projections of flow direction and magnitude. Differences in the direction and magnitude of velocity vectors between the two types of simulations show the effects of fluid-density variations on regional flow patterns. A graphic interface code also was written by the author to plot the velocity vectors using DISSPLA (Computer Associates, 1991), which is accessed on the Cray Y-MP computer at the Ohio Supercomputer Center. The vector plots can be portrayed in either plan view or in cross-section view.

Discretization

Numerical simulation requires that the flow system be discretized into rectangular grid blocks to which values of input parameters are assigned. The large areal extent of the model necessitates the use of large grid-block dimensions. A uniform lateral grid spacing of five miles was used in the x and y dimensions. This spacing is justified because of the focus on regional-scale flow patterns rather than local-scale flow patterns. This grid spacing leads to a lateral grid size of 110 columns and 101 rows with a total of 11,110 cells per model layer (fig. 29). Of these only 6,066 cells per model layer are active and cover the study area from eastern Illinois to western Pennsylvania and from central Michigan to northern Kentucky (fig. 29).

Vertical discretization of the flow system is in the form of a thickness grid for each model layer and an elevation grid for the base of the flow system. The 11 HSUs (fig. 4) discussed in previous chapters represent the 11 model layers. The grids of layer

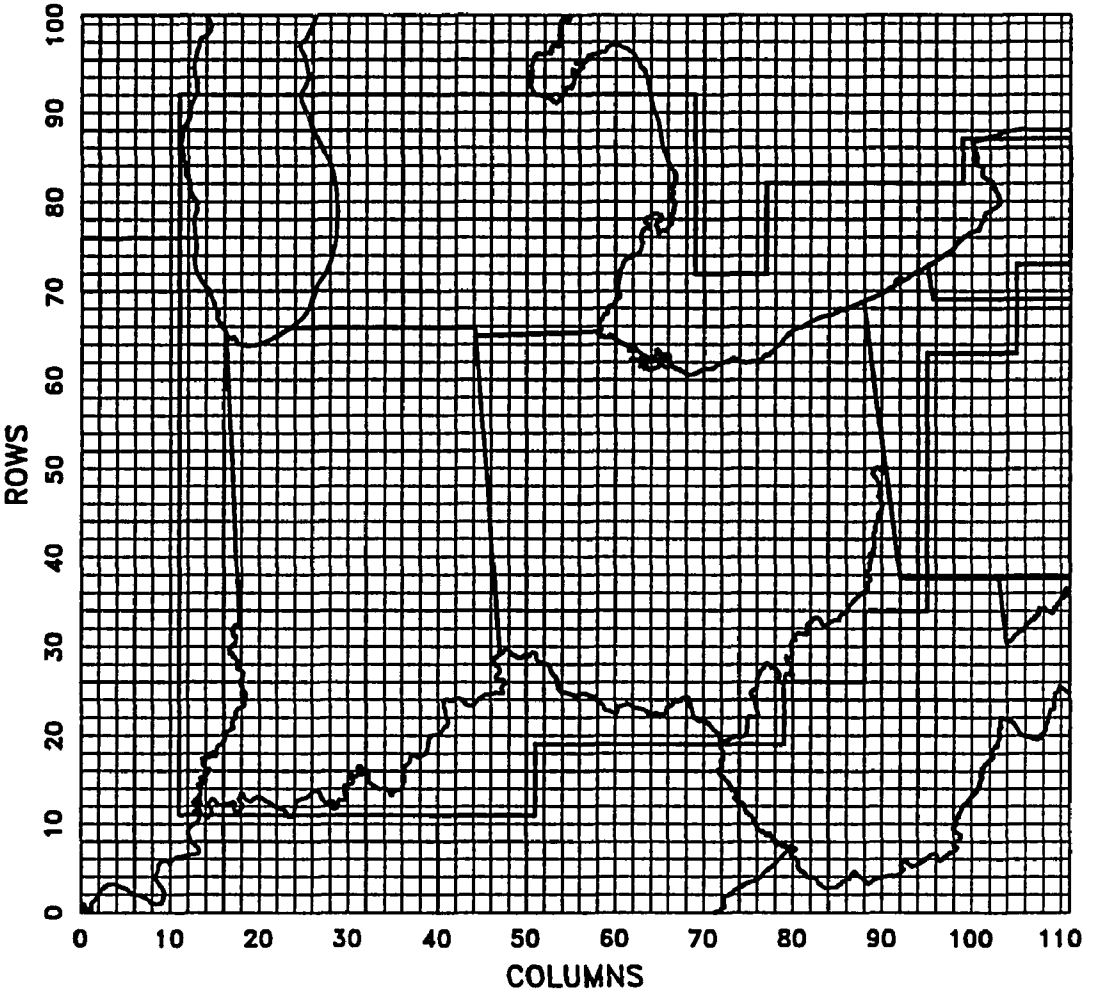

Figure 29. Finite-difference grid of lateral discretization of the study area (only alternate rows and columns are shown)

thickness and structure contour maps presented in Chapter II are used as model input. In addition to the 11 HSUs, a 2-ft thick twelfth layer was inserted below the bottom of the Mt. Simon Sandstone to simulate the very low permeability basal model boundary. However, this added layer proved unnecessary and inconsequential to model results. The flow system is represented by a 111x101x12 grid containing 72,792 active cells out of a total of 134,532 cells. All the model layers contain the same number of active cells and have the same areal extent even though some of the layers (e.g., the Rose Run Sandstone) pinch-out within the model area. Using the VARDEN code this is possible because areas of zero thickness for a specific model layer permit unrestricted vertical flow between the overlying and underlying model layers (Kuiper, 1985).

Calibration Targets

Interpretive simulations of the type performed in this study do not necessarily require a detailed or highly accurate calibration or history-matching process (Anderson and Woessner, 1992). Therefore, the effort in this study is to achieve simulation results that reasonably mimic the observed and conceptual flow system. The only quantitative history-matching criterion used is calculation of the mean absolute value of the differences between measured heads and simulated heads in the Mt. Simon Sandstone, which is referred to as the mean absolute error (MAE). An attempt is made to minimize the MAE by adjusting uncertain parameter values used in the model within reasonable bounds. The qualitative calibration criteria include comparison of general

shapes of observed potentiometric maps (figs. 2 and 3) with simulated potentiometric maps and correspondence of observed vertical flow directions with simulated vertical flow directions.

In relative terms, there is greater certainty associated with the geometry and fluid-density distribution of model layers. Therefore, no major adjustments in thickness, elevation, or fluid-density variations of model layers were implemented during the calibration process. Information on boundary-condition values and variations in K are limited and uncertain. Therefore, during calibration these two parameters were adjusted within realistic bounds until the best-fit simulations were obtained based on the quantitative and qualitative calibration criteria. Some of these changes are discussed in the following sections.

Boundary Conditions

Lateral and vertical model boundary conditions that can be utilized with VARDEN include no-flow, specified-head, and specified-flux cells. Specific boundary conditions were selected based on the conceptual flow model using the available hydraulic-head data. In some locations, boundary conditions were changed based on evaluations made during the calibration processes. The initial boundary conditions and values used in the model were tested during calibration to determine their effects on the flow system and adjusted until the calibration criteria were satisfied.

The bottom of the model is represented by the extremely low permeability rocks underlying the Mt. Simon Sandstone and is represented in the model as a no-

flow boundary. The boundary at the top of the model is a specified-head boundary with values of head set equal to the land-surface elevation (fig. 17). Values of head assigned to this layer were obtained from a digital elevation model provided by the U.S. Geological Survey at a resolution of 30 arc seconds (about 900 meters). In a regional-scale model this allows recharge in areas of high elevation and discharge in areas of low elevation, which produces local flow-cells in the upper model layers.

The flow through the low permeability shale layers is generally vertical. Therefore, these model units - layer 4 (Eau Claire-Rome-Conasuaga), layer 9 (Cincinnatian shales), and layer 11 (Devonian shales) - are designated as no-flow boundaries along the outside borders of the model. Layer 6 (Knox Dolomite) and layer 8 (Trenton Limestone) also are modeled with no-flow boundaries in these regions. These units, although locally permeable due to dissolution, are composed of dense crystalline carbonates with hydraulic conductivities 3 to 4 orders of magnitude lower than the sandstone layers. No-flow boundaries also are used for layer 12 (Berea Sandstone), which, due to its shallow occurrence, is dominated by small-scale, local flow cells (Eberts et al, 1990) rather than regional flow cells that are more affected by lateral boundary conditions.

It is not appropriate to represent the remaining four model layers (layers 3, 5, 7, 10 in fig. 4) with no-flow boundaries along the borders of the model. Of these four layers, layer 3 (Mt. Simon Sandstone), is the only layer for which regional variable-density head data are available (fig. 3). Gridded values from this variable-density head map (fig. 3) were used as specified-heads along model borders in the initial model

runs. The specified-head boundaries for layer 3 are along the western, eastern, southwestern sides of the model and along the northern side in Michigan (fig. 30). The remaining boundary cells for layer 3 were modeled as a no-flow boundary (fig. 30). During calibration, the specified-head values along model boundaries were modified to remove several anomalous, unrealistic local flow cells in the regional flow system.

Within the model area, layer 5 (Kerbel-Ironton-Galesville sandstones) pinches out in all directions, except along the Illinois and Michigan boundaries (fig. 9). In northern Illinois, the Ironton-Galesville and the Mt. Simon Sandstone units are generally considered part of the same Cambrian-Ordovician regional aquifer and have similar hydraulic heads (Mandle and Kontis, in press). A similar relation is expected in Michigan. Therefore, specified-head values from the Mt. Simon Sandstone were used for the boundary condition for layer 5 in Illinois and Michigan (fig. 31).

There is no hydraulic head or flux information near model boundaries for layer 7 (Rose Run Sandstone) or for layer 10 (Silurian-Devonian carbonates). The boundary conditions for these units were determined using an iterative modeling process based on computed boundary fluxes from a simulation with no-flow boundaries as the input boundary fluxes. The flux values for these boundary cells were taken from the simulated flux maps. These values were taken from cells that were 5-10 nodes away from the model borders. This was done to avoid the effects of using flux values from no-flow boundary nodes that do not reflect an accurate flux in the model cells. Layer 7 is present only in eastern Ohio (fig. 11) and has no outcrop areas. Thus, all the flow entering layer 7 occurs as vertical leakage from adjacent layers and its discharge is

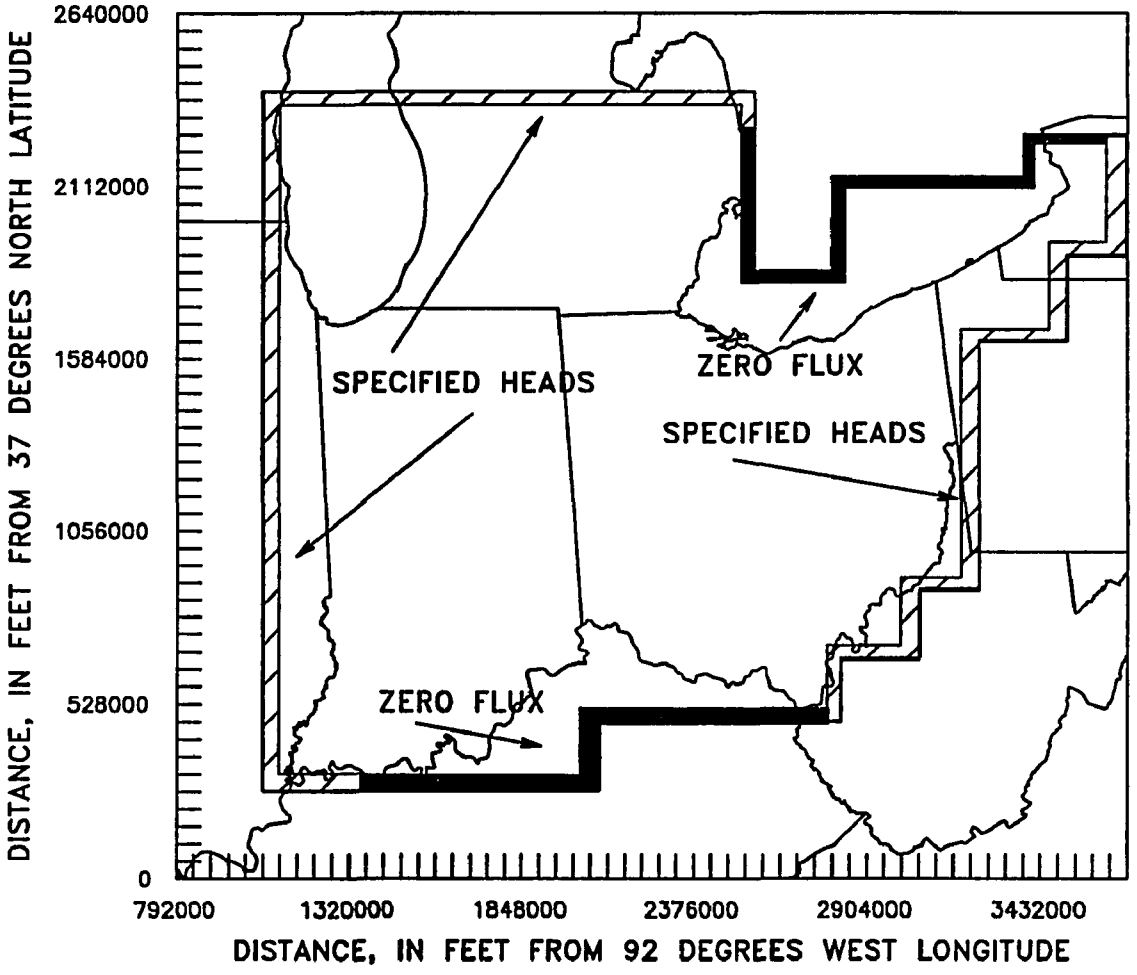

Figure 30. Lateral boundary conditions for model layer 3 (Mt. Simon Sandstone)

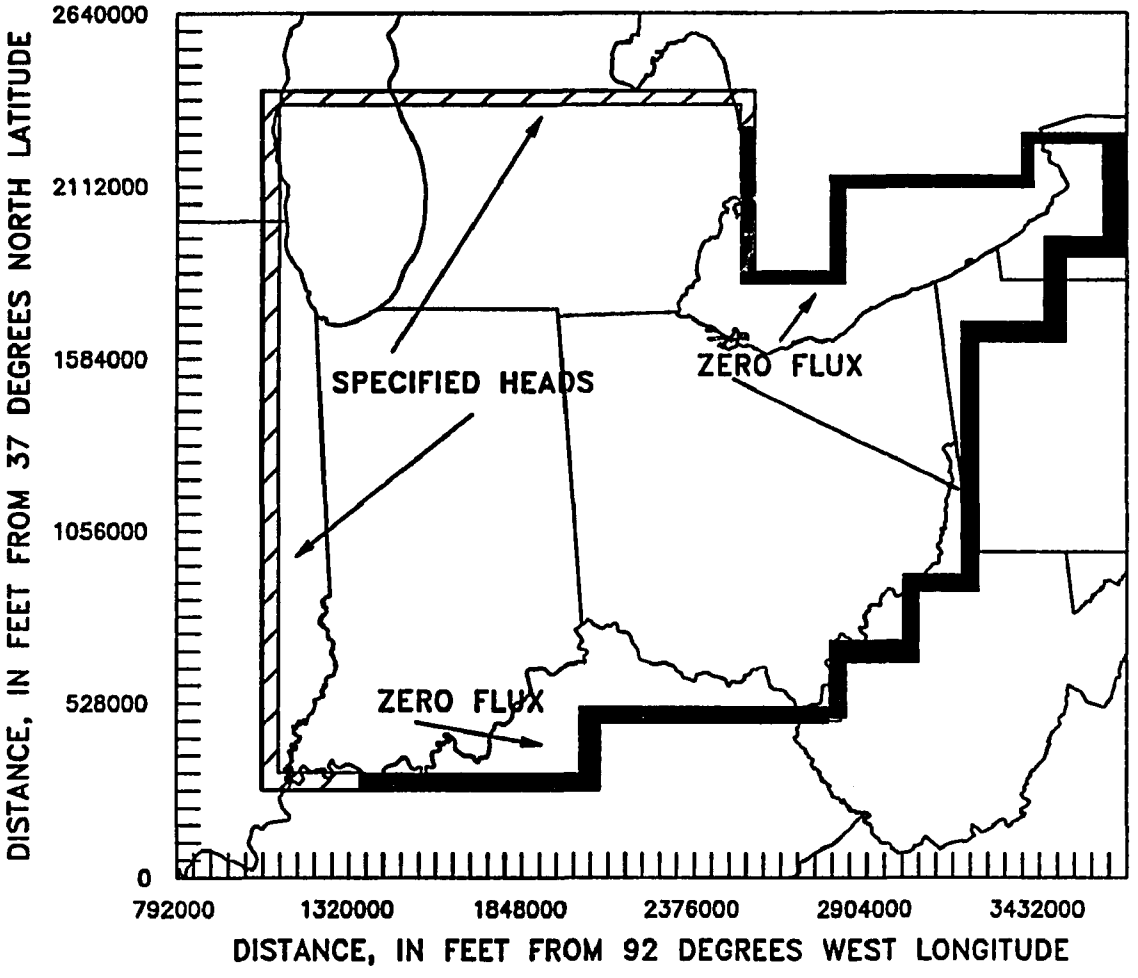

Figure 31. Lateral boundary conditions for model layer 5 (Kerbel Sandstone)

lateral across the eastern model boundary (fig. 32). Specified fluxes on the eastern boundary of layer 7 were taken from a model run where a no-flow boundary was assigned to that side.

Layer 10 forms the regional carbonate aquifer along the Cincinnati Arch and some potentiometric data are available in that area (ODNR, 1970, Appendix A; Norris and Fidler, 1973, Appendix A). No water-level data from this layer were available in the deeper basins. Therefore, the boundary fluxes for layer 10 were taken from a simulation with a no-flow boundary assigned to this layer. The specified-flux cells for layer 10 provide recharge to the model in northern Illinois and discharge in southern Illinois and along the eastern model boundary (fig. 33).

The boundary conditions for the model layers described above and for other model layers were tested to determine the sensitivity of the model to the types of boundaries and their specified values. These tests included the use of specified heads or specified fluxes for the Knox Dolomite, no-flow boundaries for the Mt. Simon Sandstone in the Michigan and Appalachian basins, and variations in the boundary fluxes for the Rose Run Sandstone. In general, these other boundary configurations were rejected because they either resulted in very high MAE values or generated unrealistic flow patterns.

Hydraulic Conductivity

The most reasonable set of K values used for each model layer was determined during the calibration process. Initially all the model layers were simulated as

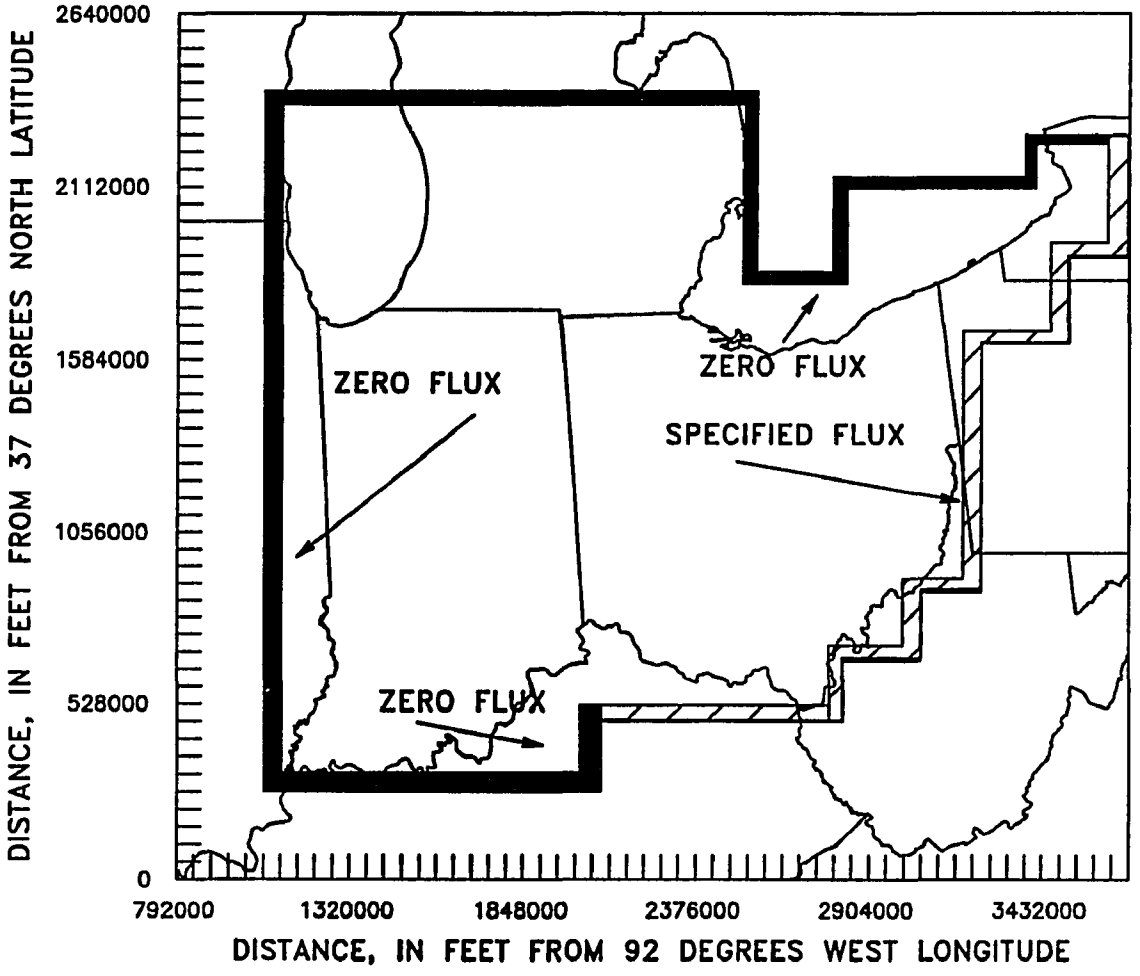

Figure 32. Lateral boundary conditions for model layer 7 (Rose Run Sandstone)

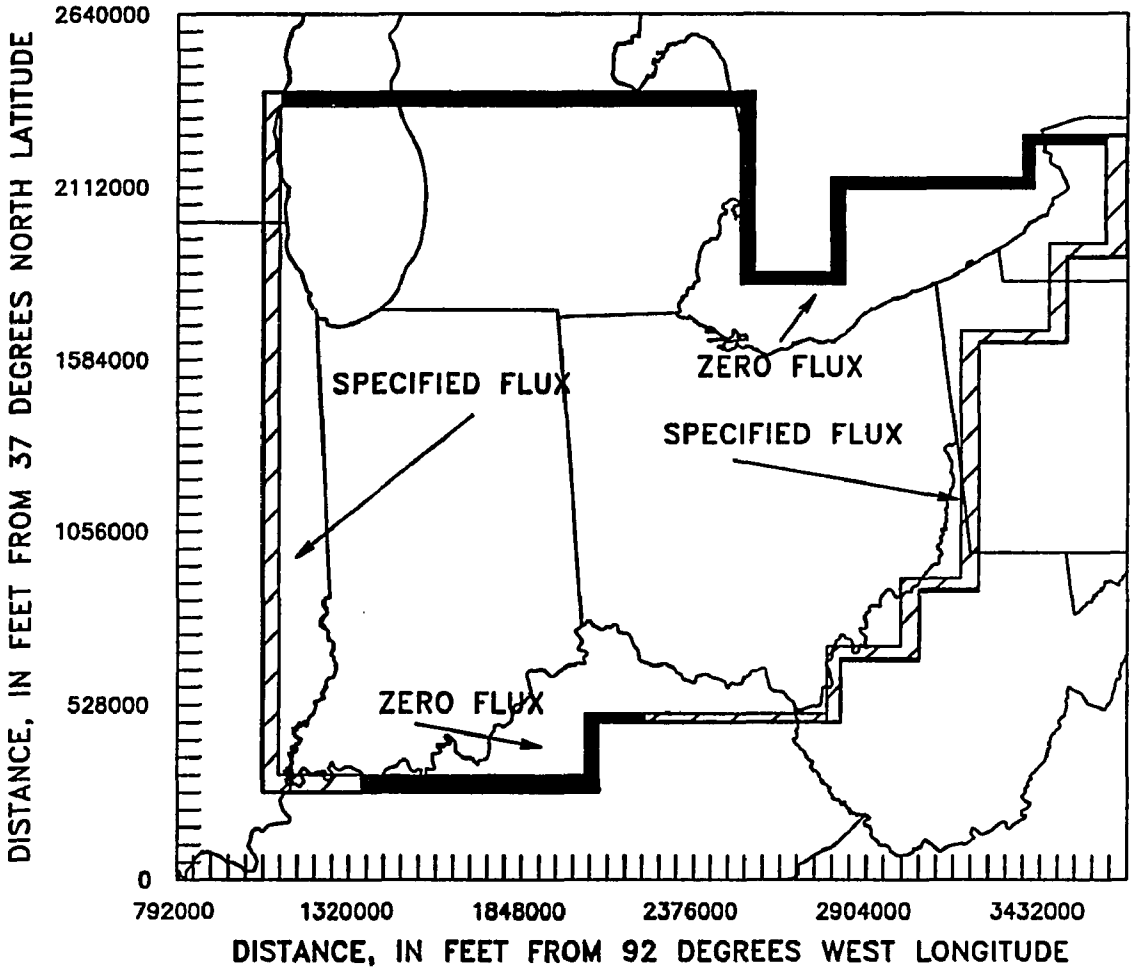

Figure 33. Lateral boundary conditions for model layer 10 (Silurian-Devonian carbonates)

homogeneous and isotropic. The values used in these early model runs (Table 2) were taken from a survey of K data gleaned from published reports and geological survey records. These first attempts at simulation of the entire flow system resulted in high MAE values, generally exceeding 300 ft, and the simulated potentiometric surfaces did not satisfactorily match the observed data. During calibration a number of variations to the initial K distributions were used. The variations in K were within the range of field-measured values or the range of established literature values. These changes included modifying the overall K values of the model layers, adding heterogeneities, and varying anisotropy ratios. The major focus of these variations was the Mt. Simon Sandstone and the immediate overlying layers, which had sufficient field data to guide the changes in K values. The K values in the other layers were changed only to the extent that was necessary to achieve satisfactory calibration in the Mt. Simon Sandstone, as most of the calibration targets are in this layer.

In general, the water levels and the flow directions in the Mt. Simon Sandstone were more responsive to lateral changes in K values than to the anisotropy ratio. The tests concerning heterogeneity in the Mt. Simon Sandstone included simulations with a linear or exponential decrease in the horizontal (Kh) and vertical (Kv) hydraulic conductivities from west to east corresponding to an eastward decrease in the porosity in the Mt. Simon Sandstone in Ohio (Warner, 1988). Although these scenarios provided excellent results in Ohio, in the Illinois and Michigan basins the discrepancy between observed and simulated heads was too high to be acceptable. Similar problems

Table 2. Initial and calibrated hydraulic-conductivity values (ft/day) for numerical simulations.

Hydrostratigraphic Unit	Model Layer	Initial K Value	Calibrated K Value Kh	Kv	Kh/ Kv
Pennsylvanian-Quaternary	13	$1.0x10^{-5}$	$1.0x10^{-2}$	$1.0x10^{-3}$	10
Berea Sandstone	12	$1.0x10^{-1}$	$1.0x10^{-0}$	$5.0x10^{-1}$	2
Devonian shale					
Cincinnati Arch region	11	$1.0x10^{-8}$	$5.0x10^{-5}$	$1.0x10^{-5}$	5
Basinal regions		$1.0x10^{-8}$	$5.0x10^{-6}$	$1.0x10^{-7}$	50
Sil.-Dev. limestone	10	$1.0x10^{-4}$	$1.0x10^{-1}$	$1.0x10^{-3}$	100
Cincinnatian shale					
Cincinnati Arch region	9	$1.0x10^{-8}$	$5.0x10^{-5}$	$1.0x10^{-5}$	5
Basinal regions		$1.0x10^{-8}$	$5.0x10^{-6}$	$1.0x10^{-7}$	50
Trenton Limestone	8	$1.0x10^{-4}$	$5.0x10^{-2}$	$5.0x10^{-3}$	10
Rose Run Sandstone	7	$1.0x10^{-2}$	$1.0x10^{0}$	$5.0x10^{-1}$	2
Knox Dolomite	6	$1.0x10^{-6}$	$5.0x10^{-2}$	$5.0x10^{-3}$	10
Kerbel-Galesville-Ironton	5	$1.0x10^{-1}$	$1.0x10^{0}$	$5.0x10^{-1}$	2
Eau Claire-Rome					
Cincinnati Arch region	4	$1.0x10^{-7}$	$5.0x10^{-5}$	$1.0x10^{-7}$	500
Basinal regions		$1.0x10^{-7}$	$5.0x10^{-7}$	$1.0x10^{-7}$	5
Mt. Simon Sandstone					
Cincinnati Arch region	3	$1.0x10^{-1}$	$1.5\ x10^{1}$	$1.5x10^{-1}$	100
Basinal regions		$1.0x10^{-1}$	$3.0x10^{-1}$	$3.0x10^{-2}$	10

were encountered when 5 to 6 zones of varying K values were assigned to model layers 3 and 4.

The lowest MAE values (between 80 and 90 ft) were obtained from simulations that provided for relatively greater downward leakage in the Cincinnati Arch region. This series of runs used Kh and Kv values for some model layers that are 1 to 2 orders of magnitude higher along the Cincinnati Arch than in the surrounding basinal areas (fig. 34). The model layers most responsive to this scenario are the low permeability shales. This is because the predominant vertical flow in these layers is enhanced due to higher Kh and Kv that provide for greater hydraulic connection between the Mt. Simon Sandstone and the overlying model layers. The use of high Kh and Kv in the Cincinnati Arch region is justified because of the evidence for localized faulting and fracturing in this area (Norris and Fiddler, 1973; Dean et al, 1986; Onasch and Kahle, 1991). The final calibrated Kh and Kv values for the three shaly layers (layers 4, 9, and 11) and the Mt. Simon Sandstone (layer 3) were based on this scheme (Table 2). Homogeneous but anisotropic K values were used for all the other model layers. The final calibrated range of anisotropy values was 2 to 500 (Table 2).

Comparison of initial and final calibrated values of K (Table 2) shows that for sandstone layers very little adjustment in K was needed during the calibration process. However, during calibration, K values for the carbonate and shale layers had to be increased by 2 to 3 orders of magnitude over their initial estimates.

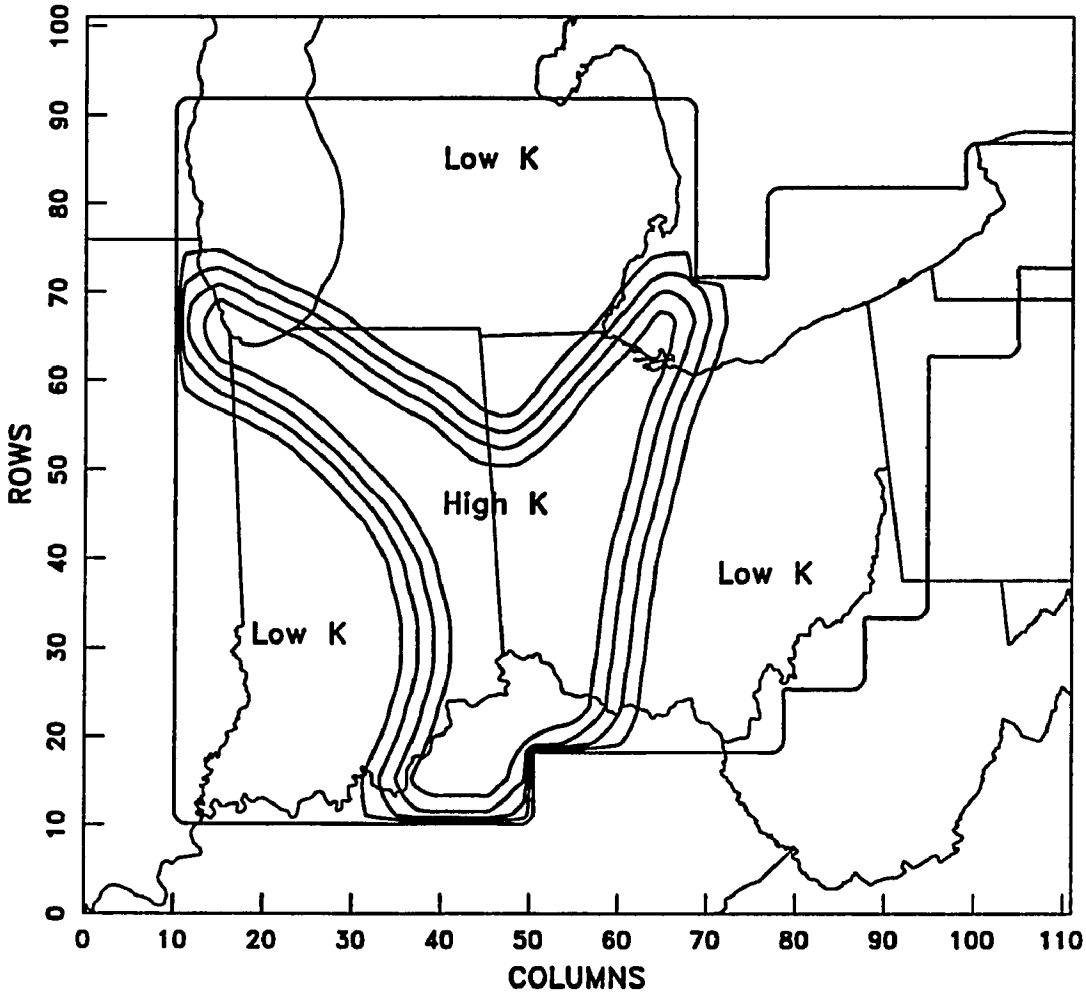

Figure 34. Lateral hydraulic conductivity configuration for heterogeneous layers

Simulated Flow System

Matching the values of the calibration targets described earlier was achieved through adjustments to values of K and changes to the boundary conditions for the various model layers. The most reasonable match between the observed and simulated variable-density heads is obtained when, in some model layers, the Cincinnati Arch region is assigned a higher K compared to the surrounding areas. This allows for greater vertical leakage of fluids across these model layers.

The simulated variable-density head map for the Mt. Simon Sandstone (fig. 35) shows high water levels along the Cincinnati Arch in northwestern Ohio as well as in the northwestern part of the study area. The variable-density heads are relatively low in the Appalachian and Illinois basins but there is a distinct area of higher heads in the Michigan Basin (fig. 35). These features show a general correspondence to the contour map of observed variable-density heads for the Mt. Simon Sandstone (fig. 3). The overall flow patterns on the simulated variable-density head map for the Mt. Simon Sandstone also are similar to the map published by Warner (1988, see Appendix A). The MAE for the Mt. Simon Sandstone variable-density heads in the calibrated simulation is 90 ft with a range of errors between -177 and 51 ft. The high negative errors are from grid cells along the borders of the Appalachian and Michigan basins. No further attempt was made to minimize these errors because the uncertainty associated with the generation of contour maps from the sparse field data may be greater than the difference between the simulated and observed variable-density heads.

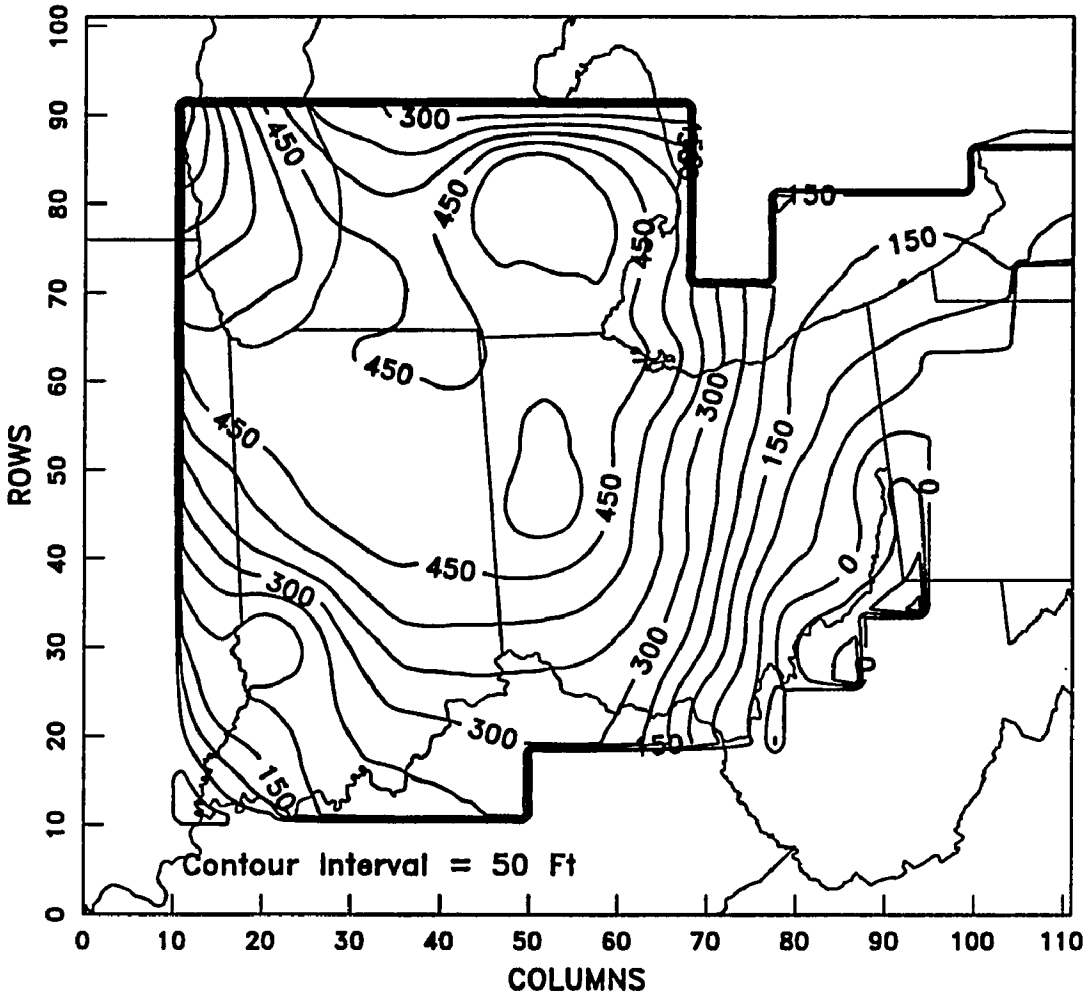

Figure 35. Simulated variable-density heads for Mt. Simon Sandstone

The VARDEN code also calculates the simulated equivalent freshwater head distribution for each model layer. The simulated equivalent freshwater head map for the Mt. Simon Sandstone (fig. 36) shows the lowest head values in the middle of the study area along the Cincinnati Arch. This region of low equivalent freshwater heads extends to the northwest into northern Indiana, Illinois, and Wisconsin. The highest equivalent freshwater heads are in the deepest parts of the three basinal regions (fig. 36), in areas where the Mt. Simon Sandstone has the highest fluid densities (fig. 20). These contour patterns correspond with the general trends in the contour map of observed equivalent freshwater heads for the Mt. Simon Sandstone (fig. 2). The simulated equivalent freshwater head map for the Mt. Simon Sandstone (fig. 36) also shows a close resemblance with the previously published maps by Clifford (1973) and Warner (1988, see Appendix A). The MAE for the equivalent freshwater head map for the Mt. Simon Sandstone is 103 ft and the range of errors is between -352 and 280 ft.

Measured potentiometric data for layers other than the Mt. Simon Sandstone are not available. Therefore, there is no opportunity to compare the observed and simulated water levels. Potentiometric-surface maps of the Silurian-Devonian carbonates (model layer 10) are available for small areas in northwestern Ohio (ODNR, 1970, see Appendix A) and in southwestern Ohio (Norris and Fidler, 1973, see Appendix A). The simulated variable-density head map for this layer (fig. 37) show a close similarity to the regional trends and shapes of water-level contours in these areas. In general, both the simulated and observed potentiometric surfaces in the carbonate aquifers follow the regional topography reflecting their shallow occurrence

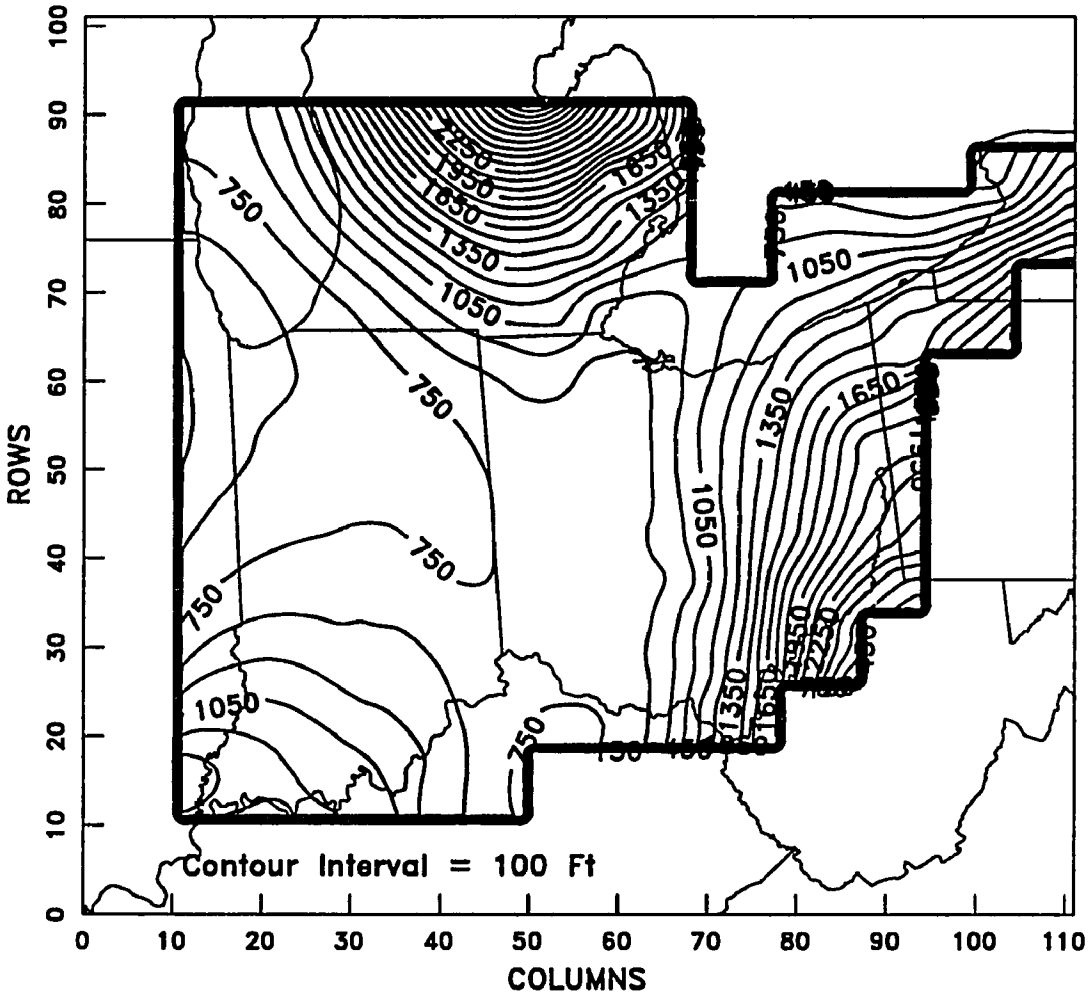

Figure 36. Simulated equivalent freshwater heads for Mt. Simon Sandstone

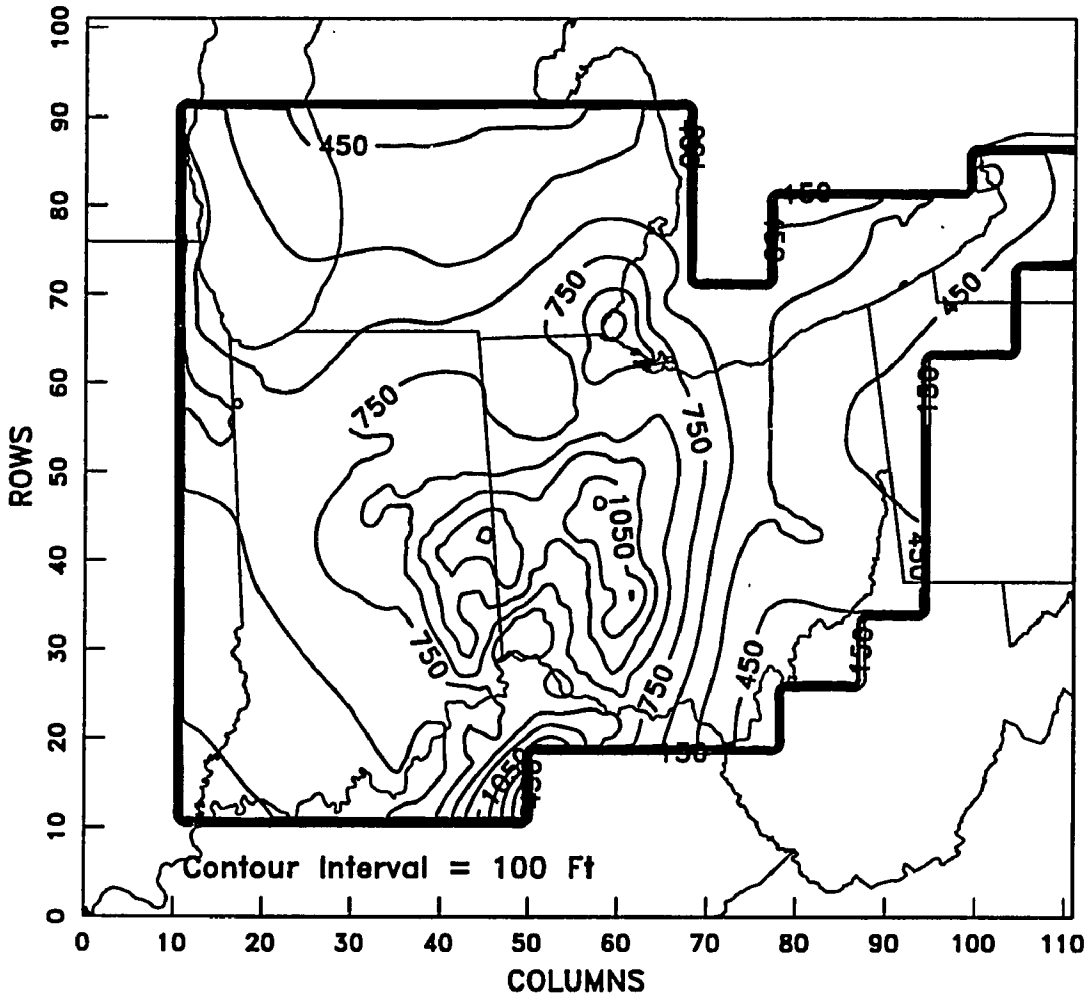

Figure 37. Simulated variable-density heads for Silurian-Devonian carbonates

along the Cincinnati Arch. Quantitative comparison between the simulated and previously published potentiometric surfaces is not possible because the published maps incorporate the effects of pumping in urban areas, whereas the simulated potentiometric surface (fig. 37) is indicative of predevelopment water levels.

The other calibration criterion used in this study was the vertical flow directions between the Mt. Simon Sandstone and the overlying layers, as indicated by the multi-layer drill-stem tests. The simulated vertical flow directions between the Mt. Simon Sandstone and the immediate overlying layer (Eau Claire - Rome - Conasauga) (fig. 38) show large regions of downward flow along the uplifted arch region in the middle and northeastern parts of the study area and in the Michigan Basin. The remaining areas in the Illinois and Appalachian basins show possible upward flow from the Mt. Simon Sandstone into the overlying layers. These simulated vertical flow patterns are similar to the observed vertical flow directions from teh drill-stem tests (fig. 25) that indicate vertically downward flow along the uplifted arch regions and possible upward flow in the basinal areas. They also are in agreement with the conclusions of Cartwright (1970) regarding upward flow in the Illinois Basin and of Vugrinovich (1980) regarding possible downward flow in the Michigan Basin.

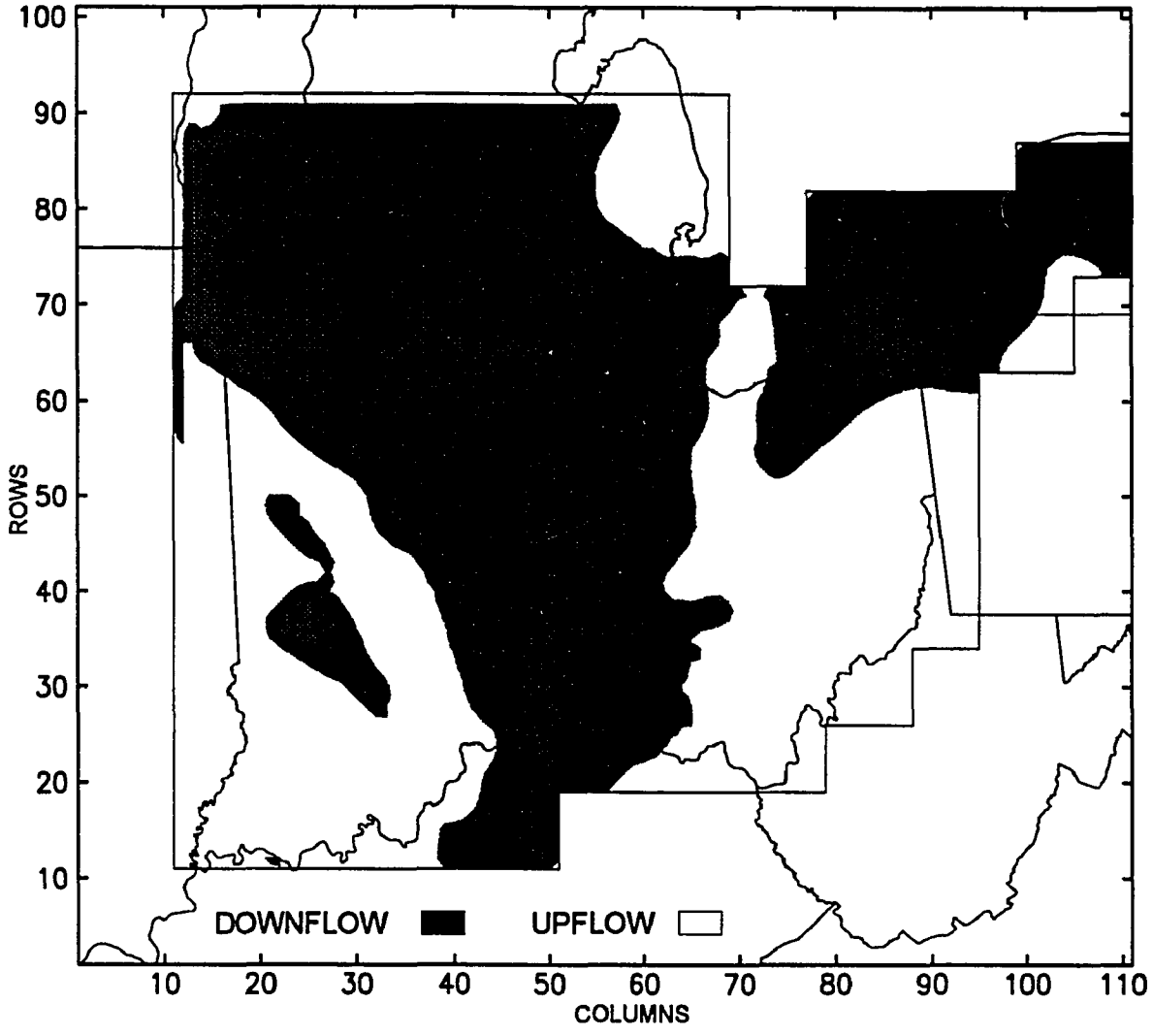

Figure 38. Vertical flow directions at the top of Mt. Simon Sandstone: variable-density simulation

CHAPTER V

DISCUSSION

Simulated Flow Directions and Flow Velocities

The calibrated steady-state flow model presented in the previous chapter was used to determine flow directions and Darcy velocities for fluids in the Mt. Simon Sandstone and in the overlying geologic units. In variable fluid-density systems flow directions are not always perpendicular to potentiometric contours. This is because actual flow directions in these systems are resultant of pressure-driven force components, determined from potentiometric maps, and the fluid-density-driven force components (fig. 39) (Davies, 1989). Therefore, the simulated hydraulic-head maps for the Mt. Simon Sandstone (figs. 35 and 36) alone are not sufficient for determination of reliable flow patterns. A more accurate determination of the magnitude and direction of flow is obtained by plotting the Darcy velocity vectors calculated from the simulated variable-density flux in the i, j, and k directions. These vector plots were calculated in plan view for each of the 12 model layers.

The Darcy velocity vector plot for the Mt. Simon Sandstone (fig. 40) shows the presence of a north-south trending groundwater divide in western Ohio, approximately parallel but to the east of the area of high variable-density heads in western Ohio (fig. 35). To the east of this divide flow is predominantly toward the east and southeast into

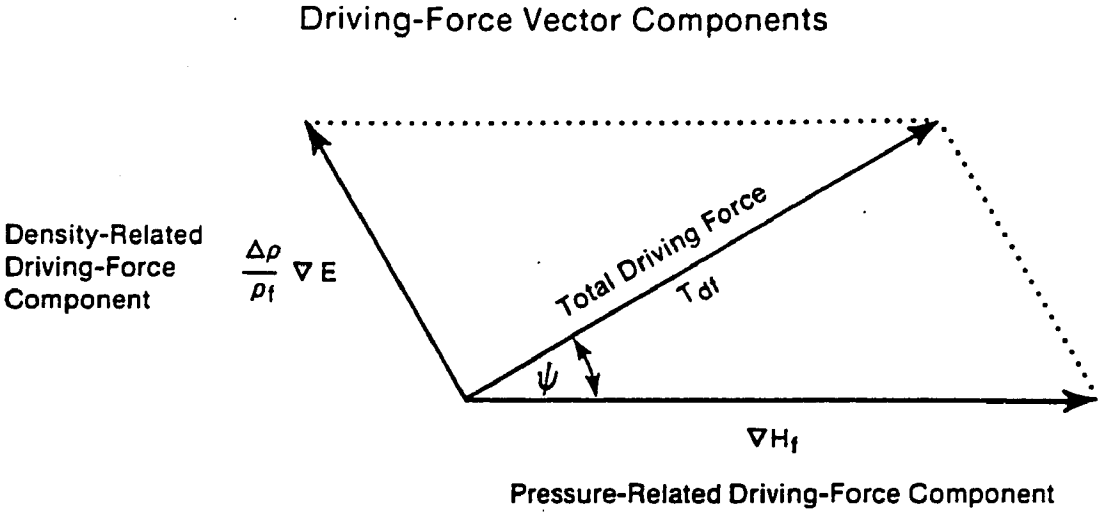

Figure 39. Relation of pressure-related and density-related driving components to the total driving force (Davies, 1989)

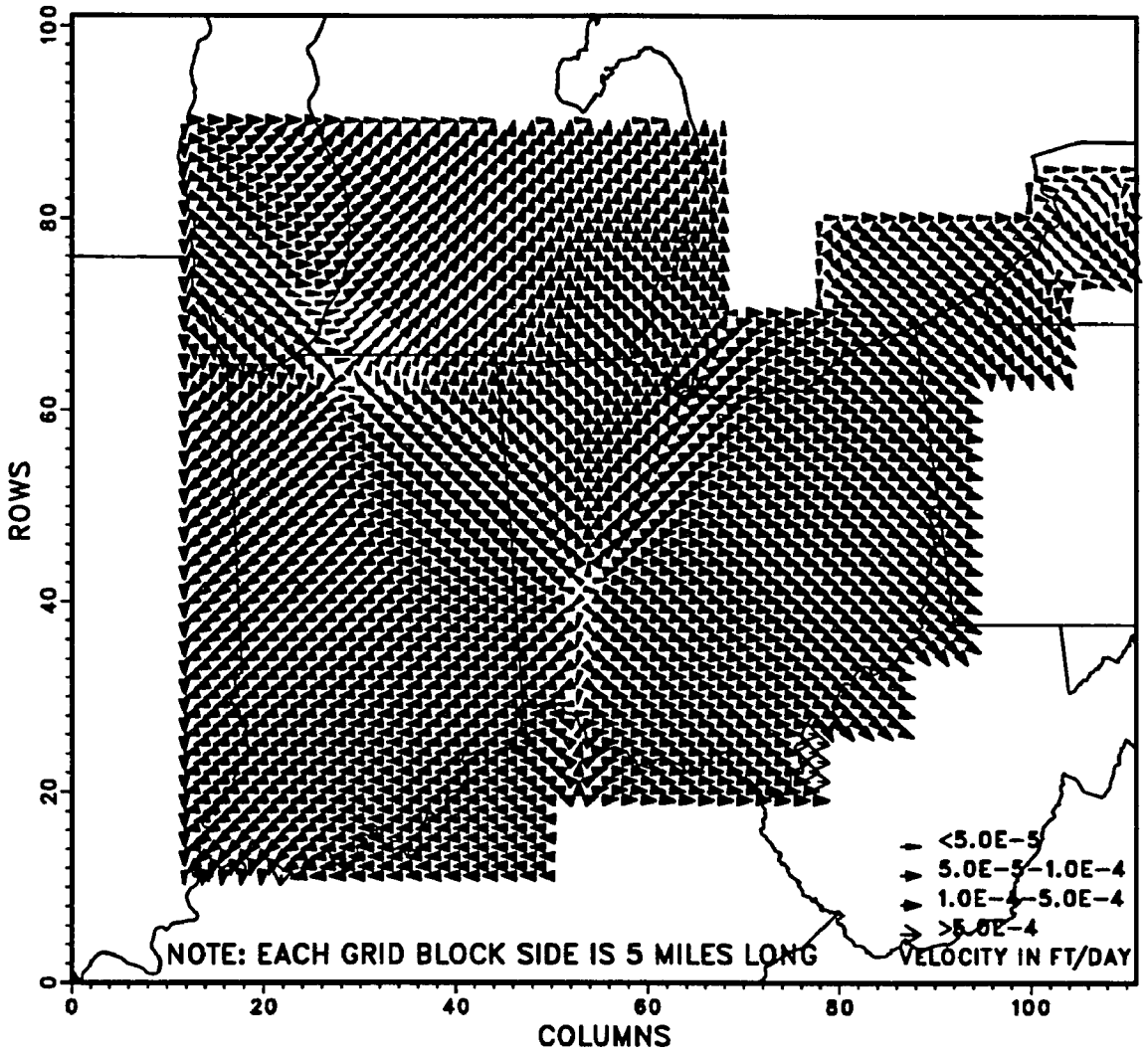

Figure 40. Plan-view Darcy velocity vectors showing simulated lateral flow in Mt. Simon Sandstone: variable density simulation

the Appalachian Basin. Flow in the Mt. Simon Sandstone to the west of the divide is generally into the Illinois Basin. Thus, in the Illinois and the Appalachian basins flow is generally away from the uplifted Cincinnati Arch region and toward the deeper basins along the direction of dip. The flow pattern in the Michigan Basin is different than in the other two basins in that flow is mainly from the deeper, central part of the basin towards the shallower regions to the south (fig. 40).

The Darcy velocities in the Mt. Simon Sandstone range from 5.0×10^{-6} to 7.0×10^{-4} ft/day (fig. 40) and the mean velocity is 2.0×10^{-4} ft/day. A histogram of the Darcy velocity matrix shows that 90% of the cells in the Mt. Simon Sandstone have a velocity of approximately 5.0×10^{-4} ft/day. Thus, within this layer there is little spatial variation in Darcy velocities. Review of the simulated velocity matrix shows that most of the variation is along the Cincinnati Arch where the flow velocities are 10 to 30% larger than the velocities in the basinal regions. It should be noted that even greater variability may have been observed had the porosity distribution in the Mt. Simon Sandstone been incorporated through calculation of average linear flow velocities instead of Darcy velocities.

Simulated lateral flow patterns similar to those in the Mt. Simon Sandstone (fig. 40) are present in model layer 4 (Eau Claire-Rome-Conasauga) and in model layer 5 (Kerbel-Ironton-Galesville). The Darcy velocities are 3 to 5 orders of magnitude smaller in the low K shale and dolomite in layer 4 than in the sandstones of layers 3 or 5. Histogram analysis of the Darcy velocities in layer 4 shows a strong bimodal distribution due to velocities in the cells in the high K regions on the Cincinnati Arch

being about two orders of magnitude greater than those in the basinal regions. Flow patterns in these layers are quite regular in most of the study region (fig. 40) indicating a strong influence due to regional-scale flow.

In layers 6, 7 (fig. 41), 8, 9, and 10, regional flow on the eastern flank of the Cincinnati Arch is directed into the Appalachian Basin, similar to the flow pattern of the deeper layers. However, in the Michigan Basin the south and southeast oriented flow vectors in layers 3 (fig. 40), 4, and 5 show a reversal in flow directions relative to layers 6, 8, 9, and 10 (fig. 42) with flow being dominantly towards the center of the basin.

There are no regionally significant flow cells in the three top model layers (layers 11, 12, and 13), most flow cells are narrow and do not extend over large areas. The Ordovician and overlying units above layer 5 show progressively greater influence of shallow local flow systems that discharge to local surface-water bodies. In general, the flow patterns are most irregular above the Cincinnati Arch (fig. 42) where the model layers are shallow subcrops or outcrops and where the younger geologic units have been eroded. Darcy velocities also are higher in the shallower model layers and in the shallower (updip) regions of these layers. This is shown for the Silurian-Devonian Carbonates (fig. 42) where velocities are about one order of magnitude greater in the central part of study region along the uplifted arches. In addition, the velocities in the near surface Berea Sandstone are about 10 times faster than in the deeper Mt. Simon Sandstone.

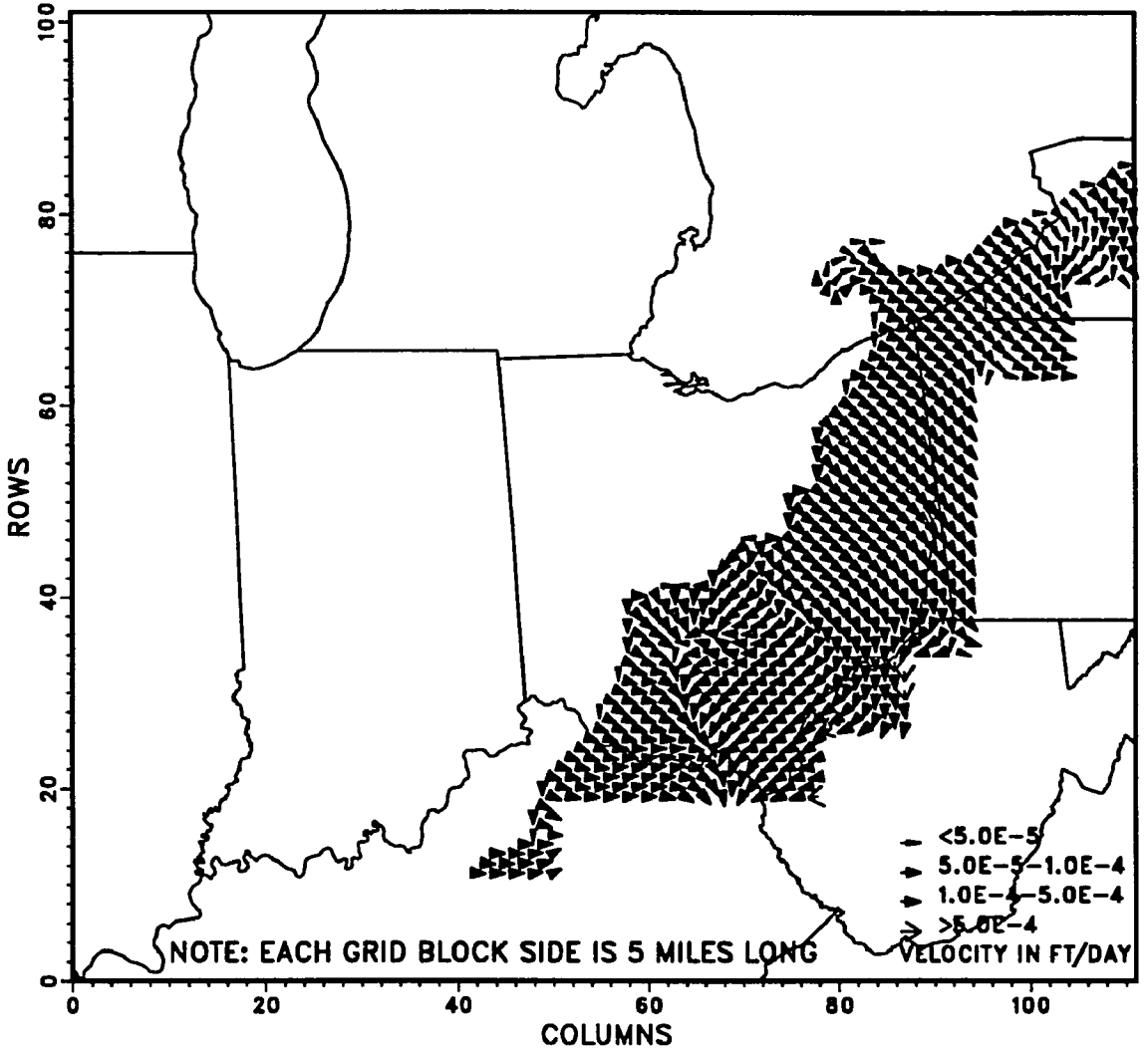

Figure 41. Plan-view Darcy velocity vectors showing simulated lateral flow in Rose Run Sandstone: variable-density simulation

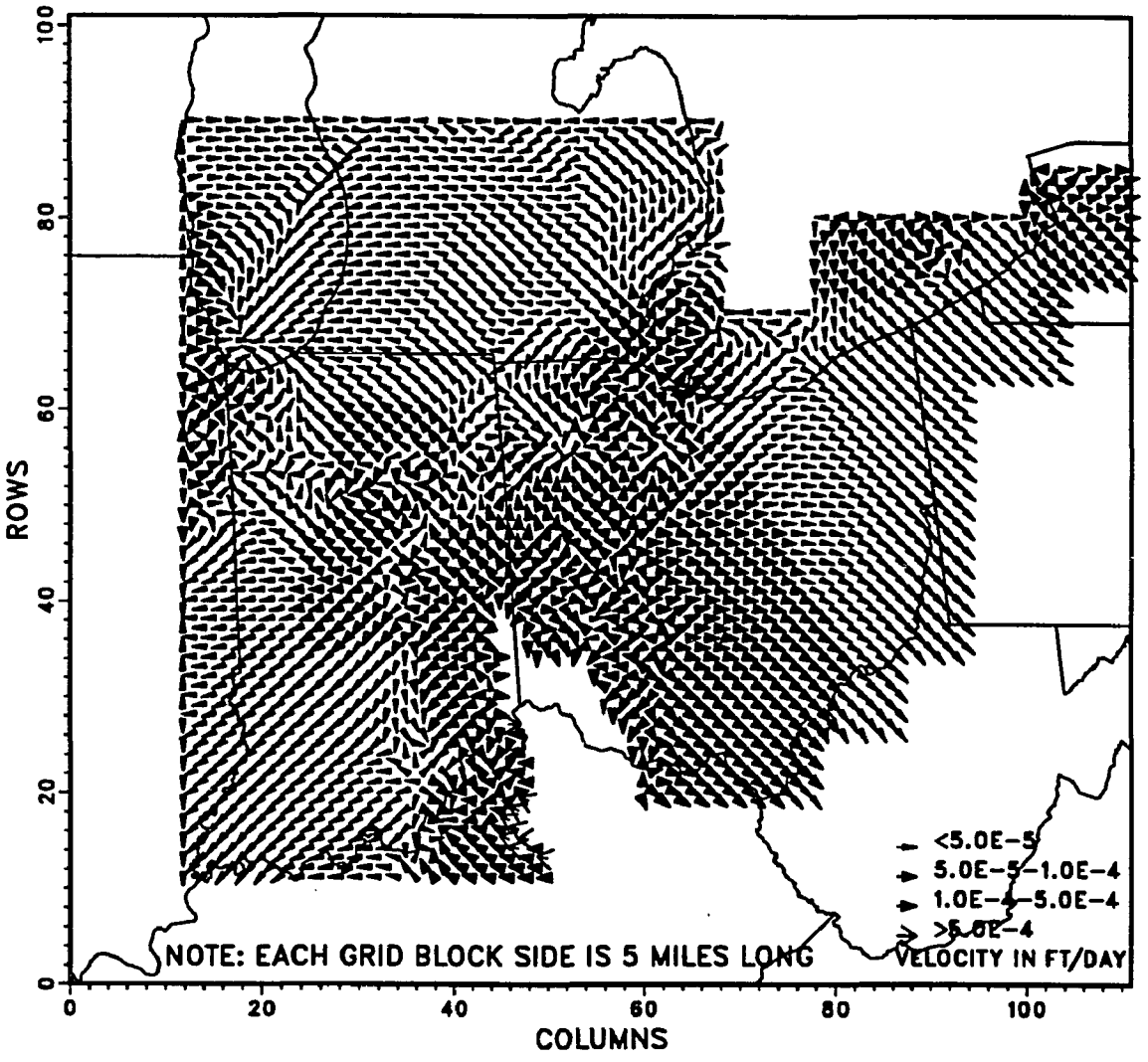

Figure 42. Plan-view Darcy velocity vectors showing simulated lateral flow in Silurian-Devonian carbonates: variable-density simulation

The vector plots presented above do not provide any insight into the vertical flow directions in the study area. Two other types of diagrams were constructed to gain this information: (1) maps of vertical flux between adjacent model layers, and (2) profile plots of Darcy velocity vectors. The vertical flux map for layer 4 (fig. 38) shows regions of upflow and downflow between the Mt. Simon Sandstone and the overlying Eau Claire-Rome-Conasauga formations. The large shaded region in the middle of the map shows that along the uplifted arches region in western Ohio and eastern Indiana groundwater flow is downward from the overlying formations into the Mt. Simon Sandstone. Flow also is downward in the northwestern part of the study area, which is the major surficial recharge region for the Cambrian-Ordovician formations. Flow also is downward from layers 6 through 10 into layers 3, 4, and 5 in the northeastern part of the study area and in the Michigan Basin. The regions of upward flow from the Mt. Simon Sandstone into the overlying units exist mainly on the western flank of the Appalachian Basin and the northeastern flank of the Illinois Basin.

Vertical flux maps for successive model layers overlying the Mt. Simon Sandstone generally show an increasing number of smaller flow cells, exemplified by the greater irregularity in the vertical-flux map for flow between layers 5 and 6 (fig. 43). However, the general locations of regions of upward and downward flow present in the Mt. Simon Sandstone (fig. 38) are maintained in the overlying layers (fig. 43). Thus, in the Cambrian and Ordovician sequence downward flow mostly occurs along the uplifted arches region and in the recharge areas in the northwest, whereas upward

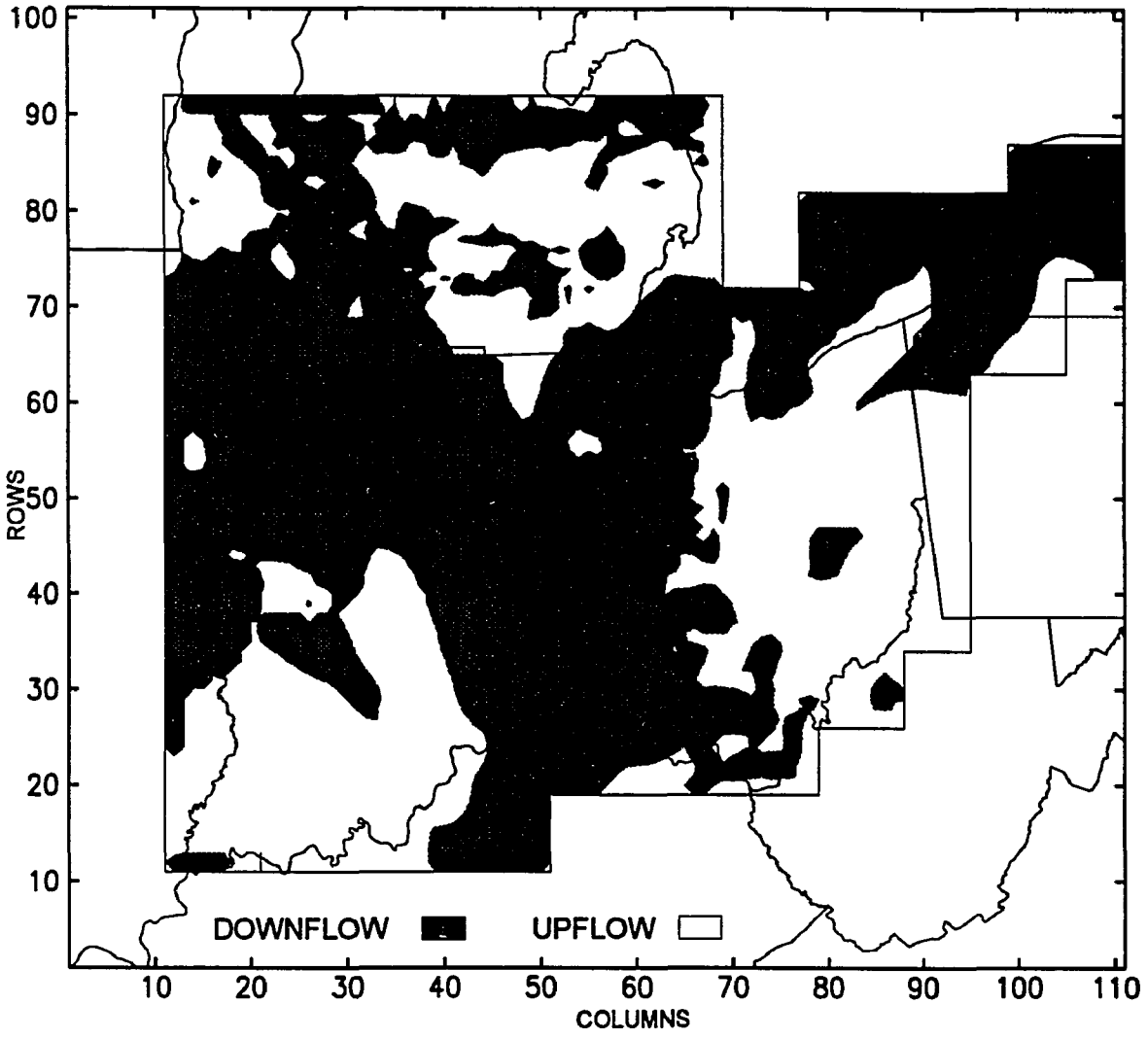

Figure 43. Vertical flow directions at the top of Kerbel or Eau Claire/Conasauga formations: variable-density simulation

flow occurs in the deeper parts of the basins. A major exception to this observation is in the Michigan Basin where downward flow is seen in the middle of the basin in the Cambrian layers (3 (fig. 38), 4, and 5). The influence of local-scale flow cells on shallow units can be seen in the vertical-flux map for flow between the top model layer (layer 13) and the immediate underlying formations (fig. 44) by the development of numerous, small, adjacent areas of upward flow and downward flow that correspond to surface topographic variations and surface-water drainages.

Interpretation of flow patterns in the study area also was made from cross-sectional Darcy velocity vectors plotted along any model row or column. Figure 45, a west-east profile along model row 60 across central Ohio, shows that flow in the high K sandstones (layers 3, 5, 7, and 9) is predominantly horizontal, whereas flow in the low K shales (layers 4, 9, and 11) is vertical. The intermediate K carbonates (layers 6, 8, and 10) generally show horizontal flow but some vectors are at intermediate angles. In the cross section along row 60 (fig. 45), vertical flow directions in the deep model layers are downward on the Cincinnati Arch and upward along the western flank of the Appalachian Basin. The Cincinnatian and Devonian shales (layers 9 and 11) show downward flow along this cross section (fig. 45). This probably reflects the effect of higher K in layers 7 and 10 that tends to preferentially attract fluids from adjacent lower K layers. Alternatively, the predominant downward flow in these layers also may be due to the larger gravitational flow components below the elevated Appalachian Plateau region in eastern Ohio. The shallowest layers in the cross section (fig. 45) show the development of local flow cells created by topographic variations and

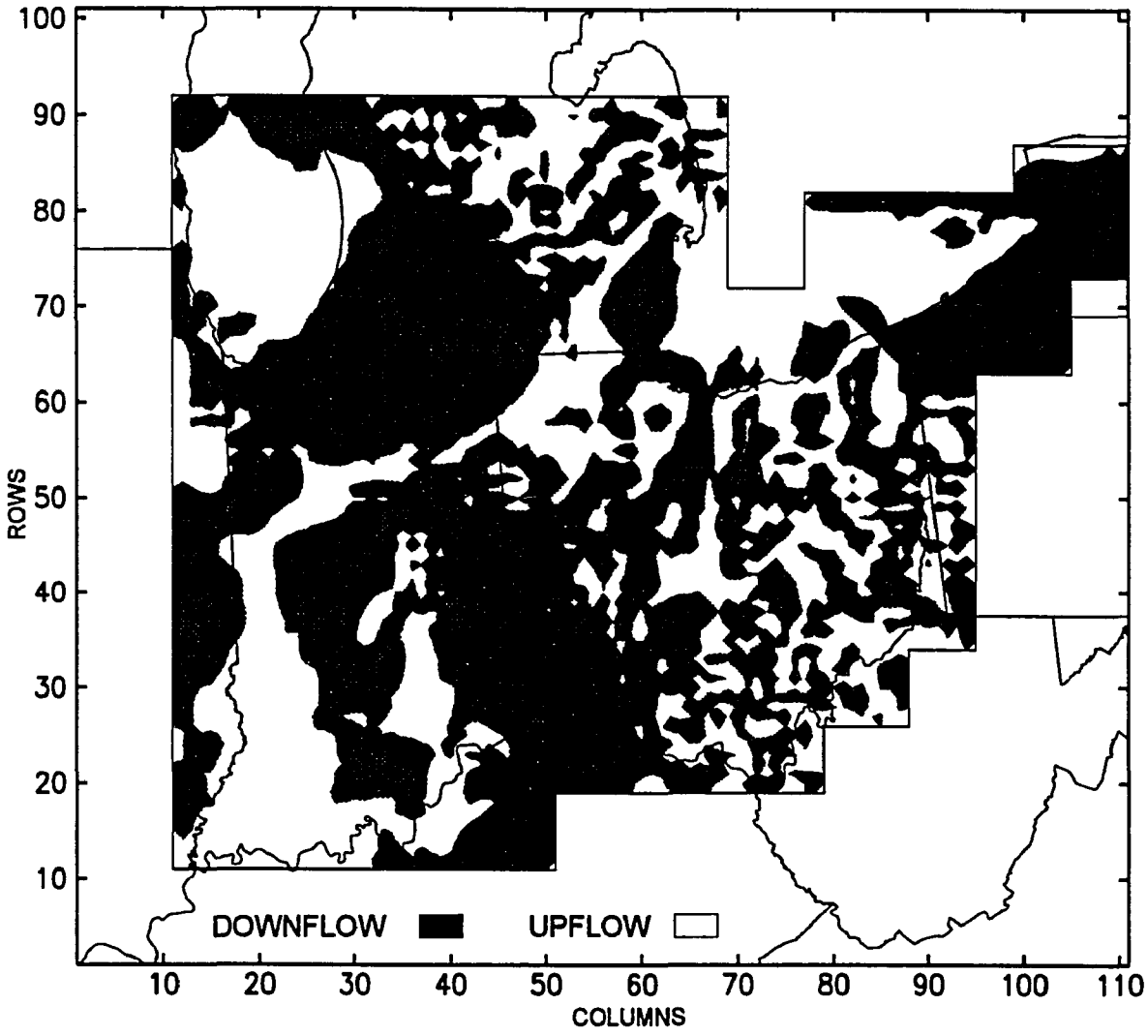

Figure 44. Vertical flow directions at the top of Berea Sandstone or Devonian shales: variable-density simulation

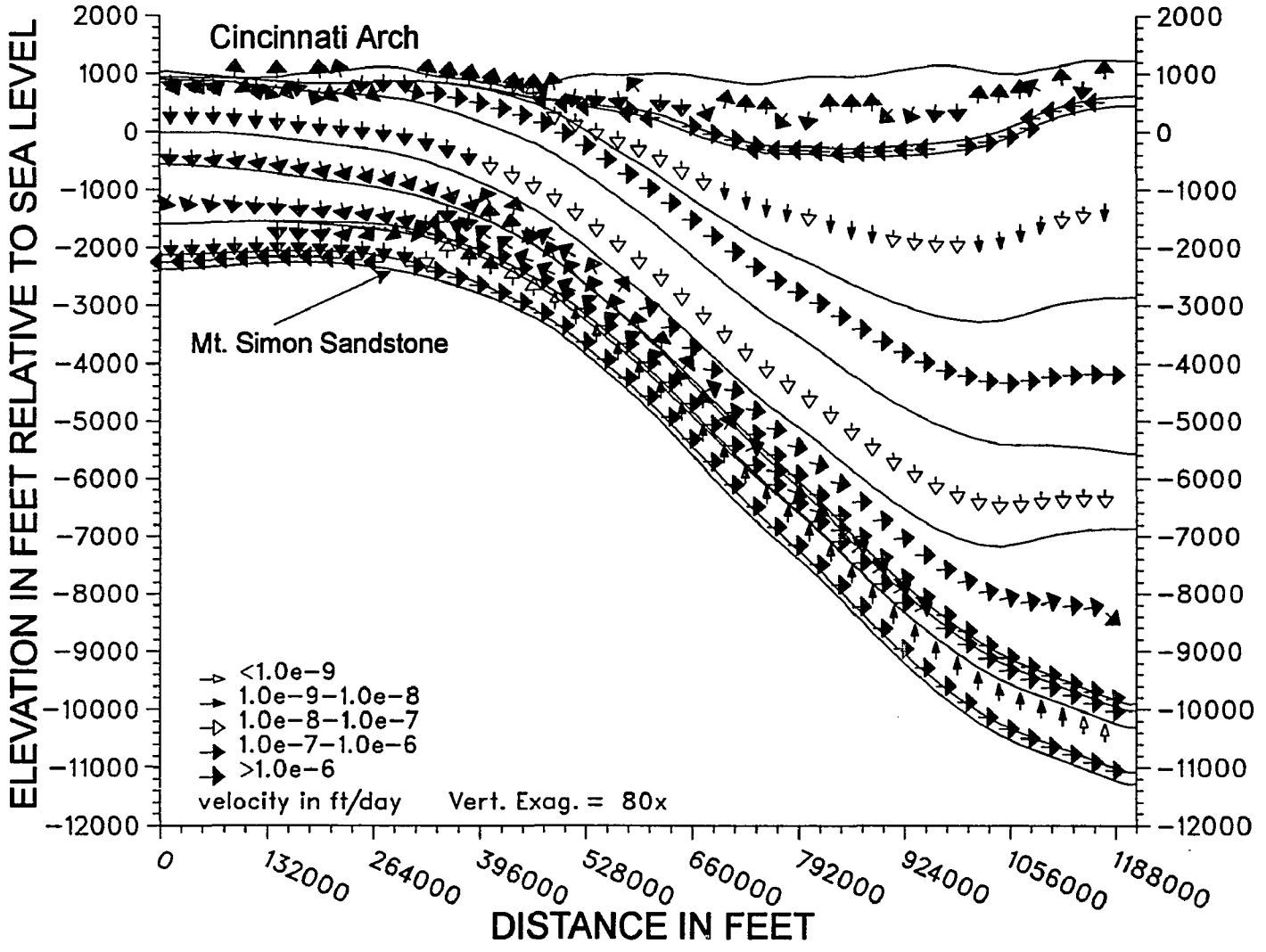

Figure 45. West-east Darcy velocity profile across Ohio (along model row 60): variable-density simulation

discharge to local surface-water bodies. Cross sections similar to the one shown in Figure 45 were plotted for many other regions. These plots generally show that most of the region underlying the area of uplifted arches is dominated by downward vertical flow.

Flow Budget

The simulation shows that much of the groundwater flow into the deeper model layers is by downward leakage directly in the outcrop regions and indirectly by cross-formational flow across confining layers. Water inflow and outflow also occurs laterally across the boundary cells in the sandstone and carbonate layers. Conversely, discharge from the deeper model layers occurs through upward cross-formational flow and laterally out of the boundary cells in the high K layers that act as pathways for flow out of the model area.

A schematic representation of the flow budget for each model layer is shown in Figure 46. This diagram shows the amount of flow into and out of the top and bottom of each model layer and the net flow across model boundaries. It should be noted that Figure 46 does not incorporate the effects of pinching out of model layers and the resulting flow across zero thickness cells. Thus, the 798,000 ft^3/d flux out of the bottom of layer 6 includes flow into layer 5 as well as directly into layer 4, where layer 5 is absent.

The maximum amount of recharge and discharge in the model is in the shallow model layers, as expected. The lateral recharge and discharge to the model is from the

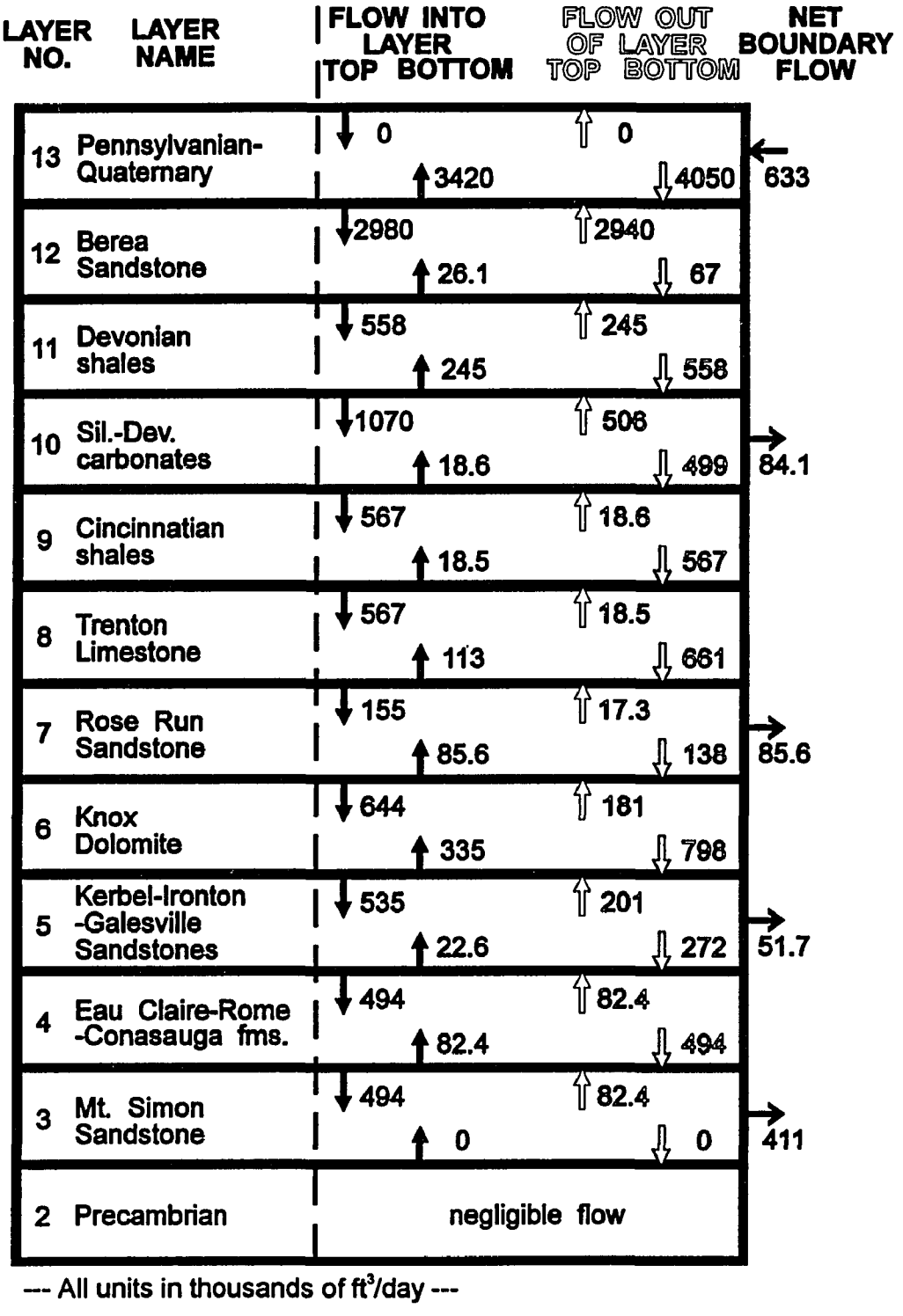

Figure 46. Flow budget for variable-density simulation

five relatively high K layers (see fig. 46 - layers 3, 5, 7, 10, and 13). In the Mt. Simon Sandstone (layer 3), a total of 494,000 ft^3/day enters as downward leakage. Of this amount, 411,000 ft^3/day exits the model at lateral boundary cells and 82,400 ft^3/day flows upward as leakage across confining layers. Thus, about 17% of the total downward leakage into the Mt. Simon Sandstone exits as upward leakage into the overlying confining layers and most of this is in the Appalachian and Illinois basins (fig. 38). The remaining 83% of the flow in the Mt. Simon Sandstone exits the model at the eastern model boundary and probably moves upwards across the overlying formations in the Appalachian Basin east of the model area. Alternatively, some of the fluid also may be accommodated in the pore spaces in the deep sedimentary sequence. This is possible because of the regional underpressuring in the sandstone layers in the Appalachian Basin (Russell, 1972). This underpressuring is probably a result of glacial unloading and erosion. The accumulation of the fluids within the sandstone layers in the Appalachian Basin can continue until the fluid-pressures have increased to hydrostatic conditions.

Controls on Regional Hydrodynamics

The previous discussion of the simulated flow system indicates that the hydrodynamics in the sedimentary sequence in the midwestern United States is controlled by a combination of geologic and hydrologic factors. These include the role of geologic structure, as shown by the effect of the Cincinnati Arch region, variations

in K, and variations in fluid density. The specific effects of these factors are discussed below.

Effects of Geologic Structure and Topography

The current level of understanding of regional groundwater flow patterns in sedimentary basins is based largely on the early work of Josef Toth (1963) describing the development of local, intermediate, and regional-scale flow cells in response to topographic variations in homogeneous basins containing uniform density water, and his later work examining cross-formational flow and settings for oil entrapment (Toth, 1978, 1980). The general features of Toth's flow systems, as related to the formation of progressively larger flow cells with increasing depth can be observed in the flow system in the midwestern United States. This is shown by the vertical-flux maps for layer 3, one of the deeper model layers (fig. 38), for layer 5, one of the intermediate model layers (fig. 43), and for layer 13, one of the shallow model layers (fig. 44). These maps show an increase in the size of flow cells and a decrease in the number of flow cells with depth. This is consistent with the formation of Toth's local, intermediate, and regional flow cells.

According to Toth's work, which deals only with uniform density fluids, flow patterns in geologic basins are developed in response to topographic-related gravitational forces. This implies that the dominant regional flow directions in all the HSUs in the eastern part of the study area should be from the higher elevation recharge areas in the Appalachian Plateau towards the relatively low elevation glaciated regions

further to the west. Furthermore, these gravitational forces would cause flow in the higher elevation Appalachian Plateau to be downward and flow in the discharge areas to be upwards. These conditions appear to be satisfied for the shallow model layers only. Simulated flow in the deeper model layers is predominantly towards the higher elevation Appalachian Basin region (fig. 40) and there is significant upward flow in model layers 3 (fig. 38), 4, and 5 in this region. The observed vertical flow directions (fig. 25) support this observation. This indicates that driving forces other than just topographic driving forces are responsible for the observed flow patterns.

The discrepancy in flow directions between Toth's analysis assuming uniform fluid density and the current study can be resolved based on the basin flow concepts developed by Coustau and others (1975), who present juvenile and mature basins as two end members for describing flow conditions in sedimentary basins (fig. 47). The depositionally active juvenile basins are characterized by updip movement of fluids due to compression from depositional loading (fig. 47a) and the development of abnormally high fluid pressures due to rapid deposition. The mature basins develop following uplift and erosion. These basins contain flow systems with recharge at the basin margins, downdip fluid movement, and cross-formational discharge in the basin centers (fig. 47b).

This model of a depositionally mature basin appears to apply to the regional flow system in the Appalachian Basin. Therefore, the simulated flow patterns indicating flow from the basin margin along the Cincinnati Arch towards the basin center beneath the topographically higher Appalachian Plateau are reasonable. The

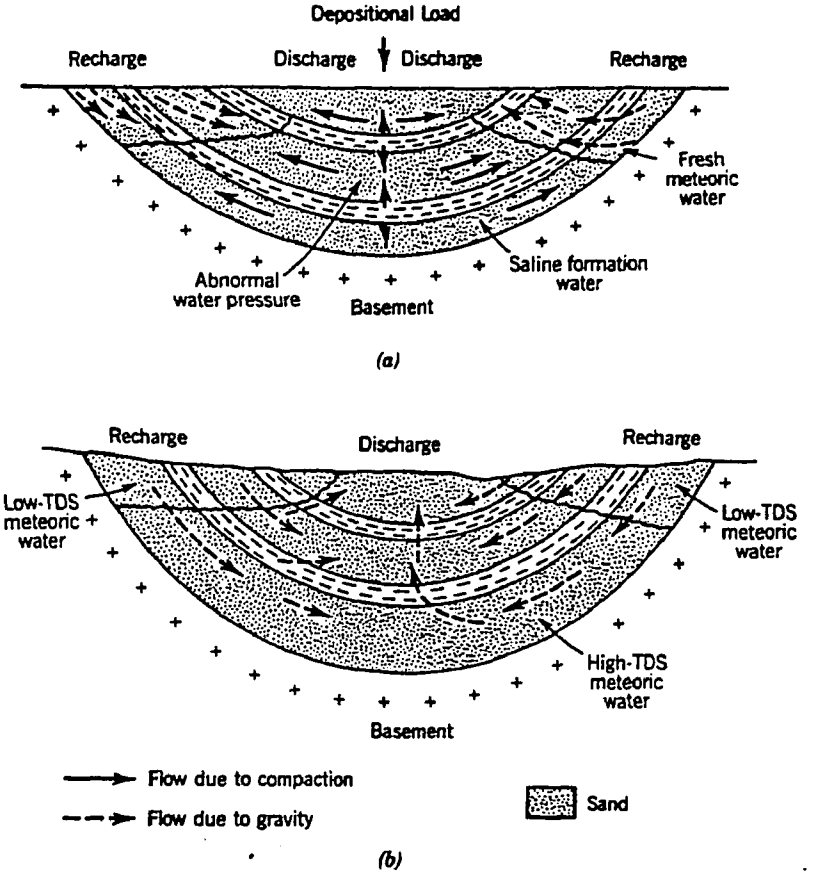

Figure 47. Hydrology of (a) compacting and (b) mature basins (from Domenico and Schwartz, 1990; modified from Coustau et al, 1975)

simulated upward flow in the basin center is in agreement with the mature basin model of Coustau and others (1975) and with Toth's (1980) concept of cross-formational flow across the low permeability confining layers. Thus, the deeper flow system in the Appalachian Basin is governed principally by the basin structure although the topographic variations are influential in the shallow layers.

Coustau and others' (1975) model for flow in mature basins also applies to the Illinois Basin where the dominant flow directions in the Mt. Simon Sandstone (fig. 40) are from the basin margins in the north and northeast towards the center of the basin in the southwest. Regional upward flow in the middle of this basin is shown on the vertical flow maps (figs. 38, 43, and 44). The Michigan Basin also is a geologically mature basin similar to the Illinois and Appalachian basins. However, flow in the deeper formations in this basin is not from the basin margins towards the basin center (fig. 40), as expected for geologically mature basins. This seeming anomaly in flow directions is related to the fluid-density distribution rather than to tectonic factors and will be discussed later in this chapter.

The above discussion shows that the Cincinnati Arch and surrounding basins are the most significant controls on the flow patterns in the deep HSUs in the midwestern United States, whereas surface topography controls the flow patterns in the shallow HSUs.

Effect of Hydraulic Conductivity

The most significant effect of K variations in the simulations is on the extent of vertical cross-formational flow across the confining layers. In this respect, the Kv values assigned to the shale layers control the amount of fluid that flows downwards into the deeper formations in the recharge regions and the amount of fluid that flows upwards from the deeper formations in the discharge regions. During the simulations it was observed that changing the Kv values within an order of magnitude does not alter the flow directions in the Mt. Simon Sandstone. The main effect is that the overall simulated heads are slightly different. Similarly, increasing the Kv values in the confining layers in the Cincinnati Arch region (fig. 34) is necessary to produce higher variable-density heads in western Ohio (fig. 35), which are consistent with the drill-stem test data. Using this Kv configuration leads to slightly faster Darcy velocities but the overall flow directions are not perceptibly altered.

The second major impact of K variations is due to the contrast in K between adjacent model layers. This contrast determines whether the dominant flow direction in a model layer is lateral or vertical. In the present study the K values for the sandstone layers are 2 to 3 orders of magnitude higher than those for the carbonate layers and 5 to 7 orders of magnitude higher than those for the shale layers (table 1). This contrast is reflected in the simulated flow directions shown in Figure 45 with flow in the high K layers (3, 5, 7, and 12) being predominantly lateral and the flow in the low K layers (4, 8, and 9) being mainly vertical. Thus, the sandstone layers have a "draining" effect on most of the flow system even though their total thickness is much

smaller than the combined thickness of the low K layers. This "draining" effect of the thin but high K layers is similar to the numerical analysis results of Freeze and Witherspoon (1967), who showed that even very thin units of high K adjacent to units of low K can act as preferred pathways for faster movement of fluids from recharge regions to discharge regions.

Effect of Fluid-Density Variations

The effects of spatial variations in fluid density on the flow system were evaluated by comparing the results of the variable-density simulation with the results of a simulation using uniform freshwater density. All of the other variables in the two simulations were exactly the same. Figure 48 shows the simulated potentiometric surface for the Mt. Simon Sandstone for the freshwater simulation. In general, both this potentiometric surface and the one of the Mt. Simon Sandstone based on variable-density fluid (fig. 35) show higher hydraulic heads in the Cinicinnati Arch region and decreasing hydraulic heads in the surrounding basins. The major difference between Figures 48 and 35 is the disappearance of the region of higher hydraulic heads in the Michigan Basin under equivalent freshwater head conditions. Additionally, the simulated heads are somewhat higher in the Appalachian Basin under the uniform freshwater density conditions.

The plan view Darcy velocity plots for the Mt. Simon Sandstone also show different flow directions in the Michigan Basin. In the variable-density simulation, flow in the Mt. Simon Sandstone in the Michigan Basin was to the south from the basin

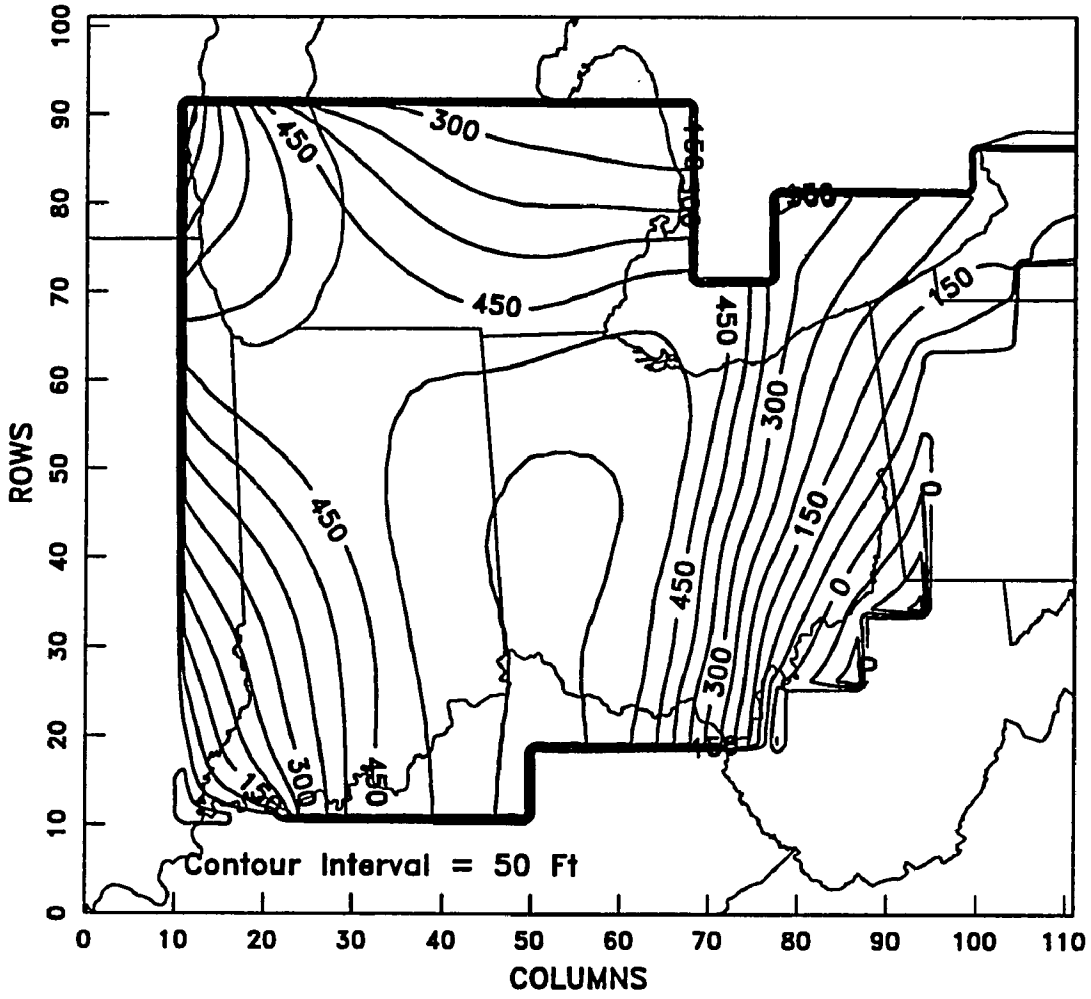

Figure 48. Simulated hydraulic-head map for Mt. Simon Sandstone: uniform freshwater density simulation

center towards the basin margins (fig. 40). In the freshwater density simulation, flow is to the north towards the center of the Michigan Basin (fig. 49). Thus, consideration of fluid-density variations can cause the interpretation of flow directions to be different by as much as 180°. Compared to the differences in the Michigan Basin, the differences in lateral flow directions between the two simulations in the Illinois and Appalachian basins are minor. The plot of vertical flux on top of the Mt. Simon Sandstone under uniform freshwater conditions (fig. 50) shows upward flow compared to the downward flow in the same region under variable-density conditions (fig. 38).

The reversal in flow directions in the Mt. Simon Sandstone in the Michigan Basin can be explained on the basis of the fluid-density distribution. As shown in chapter II (figs. 20-21), in the Michigan Basin the relatively high-density fluids in the Silurian-Devonian carbonates overlie the low-density fluids in the Mt. Simon Sandstone and adjacent layers. Although it may be argued that this density reversal may be partly due to the sparse data available in the deeper units in this region, it is probably due to the presence of the Salina salt beds in the Silurian sequence. Dissolution of salt from these beds causes the formation of high-density brines in the shallow layers. These high-density fluids that overlie the deeper low-density fluids tend to sink under the influence of gravity into the underlying units and in the process create downward flow gradients in most of the Michigan Basin. This downward sinking of more dense fluids is similar to the density-driven convective flow near salt domes where the dissolution of salt diapirs causes the formation of highly saline brines at shallow depths and results in the formation of fluid convection cells (Hanor, 1987).

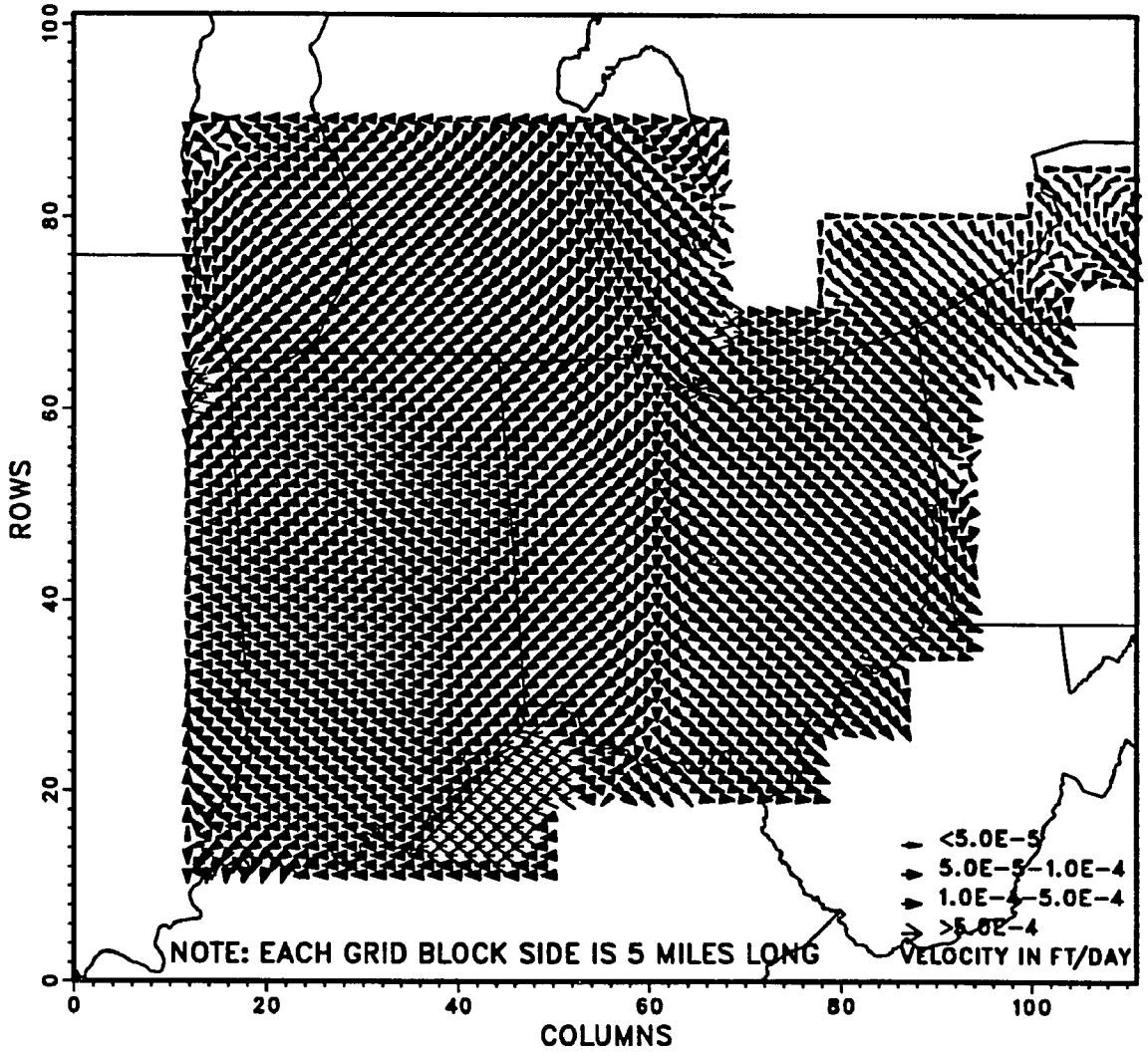

Figure 49. Plan-view Darcy velocity vectors showing simulated lateral flow in the Mt. Simon Sandstone: uniform freshwater density simulation

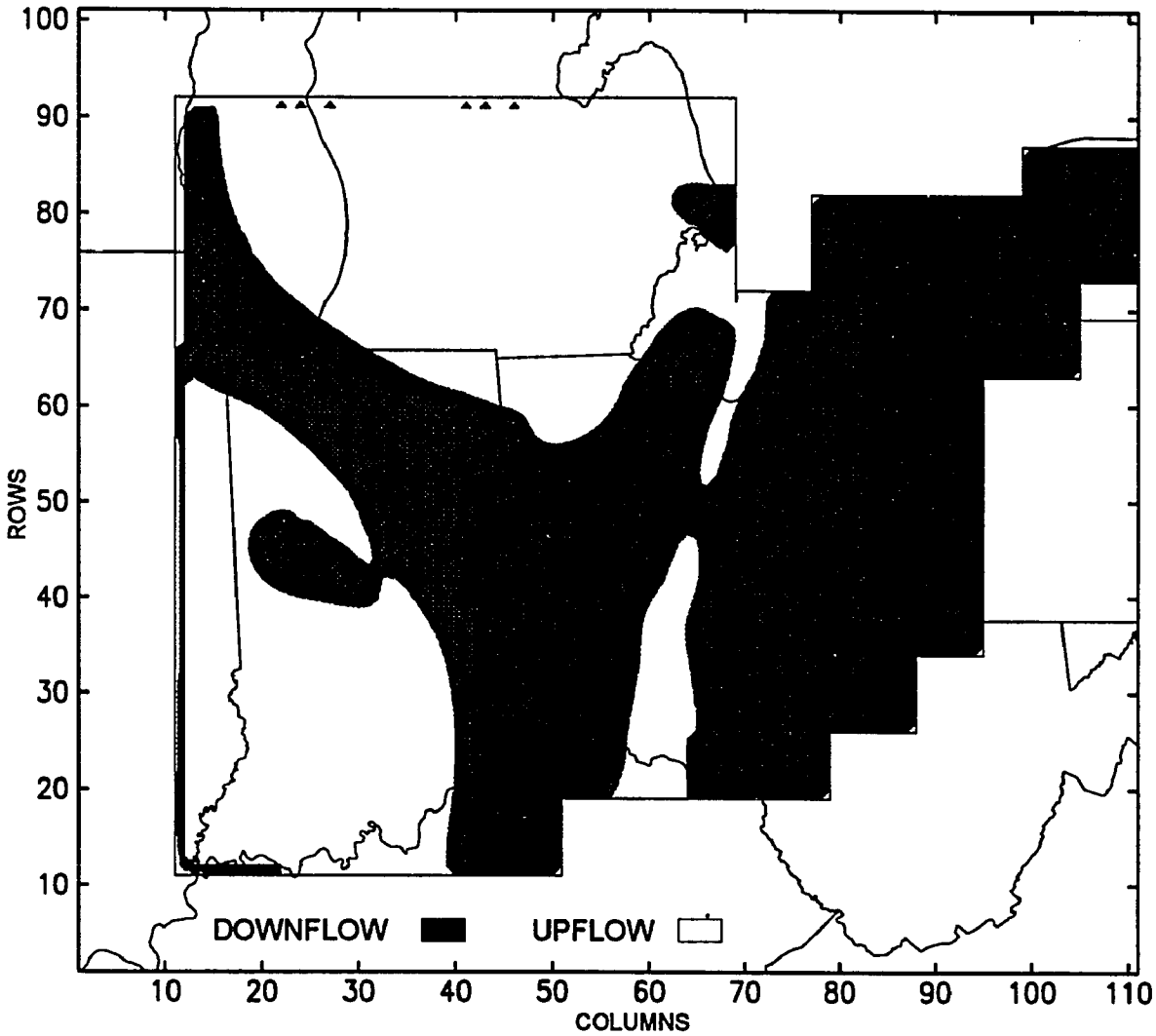

Figure 50. Vertical flow directions at the top of Mt. Simon Sandstone: uniform freshwater density simulation

Comparison of Figures 38 and 50 also shows that in the Appalachian Basin the vertical direction of flow at the top of the Mt. Simon Sandstone is upward into the overlying layers in the variable-density simulation but is downward in the uniform freshwater simulation. This reversal in the direction of vertical flow in the Appalachian Basin is not accompanied by any significant change in lateral flow directions (see figs. 40 and 50). This effect is apparently related to variations in fluid density. However, it is difficult to relate this to any specific fluid-density configuration.

A second consideration regarding the fluid-density affects arises due to two different approaches to the analysis of variable-density systems. In many previous studies the determination of flow directions in variable-density systems has been based on the concept of equivalent freshwater heads (e.g. Clifford, 1973; Senger and Fogg, 1990). Lusczynski (1961) showed analytically that this approach only accounts for the horizontal flow gradients and that in systems with high vertical gradients this approach can provide erroneous flow directions. Davies (1989) showed that even very small variations in fluid density or very small angles of formation dip can create sufficient vertical gradients to render the equivalent freshwater approach unreliable for most regional studies of flow in sedimentary basins. Therefore, in this study only variable-density heads were used to define flow at model boundaries and actual fluid-density variations were incorporated into the model. Use of variable-density heads at model boundaries provides the necessary driving force for flow away from uplifted arches into the surrounding basins. If equivalent freshwater heads were used along the model boundaries, the resulting flow directions will be opposite of those shown in Figure 40.

For example, the flow would be from the basin center toward the uplifted regions. In addition, the equivalent freshwater head approach predicts downward flow in the area of higher equivalent freshwater heads in the Appalachian Basin (fig. 3) and upward flow in the Cincinnati Arch region. This does not match with the observed vertical flow directions (fig. 25) or with the mature basin concept (fig. 47b) of Coustau et al (1975). Therefore, use of equivalent freshwater heads for interpretation of flow patterns in the current study would be erroneous.

Some recent studies have used the chemical composition of brines for interpretation of possible flow directions in the Lower Silurian Clinton Sandstone (Lowry et al, 1988; Sanders, 1991). This evidence indicates that the flow in the deeper formations in the Appalachian Basin is east-to-west instead of the west-to-east flow directions predicted by the variable-density simulations. However, Sanders (1991) suggests that this interpretation of flow directions, which is based on the geochemical distributions, is a reflection of paleoflow directions at the time when the Appalachian Basin was at a younger stage of evolution (fig. 47a) and that the flow directions are not indicative of present day flow patterns.

CHAPTER VI

SUMMARY AND CONCLUSIONS

This study involves an analysis of the geologic and hydrologic factors controlling regional groundwater flow directions and flow velocities in the midwestern United States. Although the major focus of this study is on the Cambrian Mt. Simon Sandstone, the entire stratigraphic column overlying this basal sandstone is included in the analysis. Data on formation elevation, thickness, hydraulic conductivity, water levels, and fluid density were collected and analyzed. Based on geologic and hydrologic similarities and lateral continuity the stratigraphic column was divided into 11 HSUs.

The available data were used for the development of a conceptual flow model, followed by the construction of a three-dimensional, finite-difference, steady-state, variable-density mathematical model consisting of 111 columns, 101 rows, and 12 layers. The purpose of the flow model was to make interpretive simulations to study the effects of topography, structure and fluid-density-related driving forces on the regional hydrodynamics. The flow system was simulated using the numerical code VARDEN (Kuiper, 1983, 1985). The simulations were calibrated by comparison of simulated and observed hydraulic heads and by comparison of simulated flow directions with observed flow directions. The results of the steady-state flow simulation

were used to determine the flow patterns and flow velocities in the Mt. Simon Sandstone and in the overlying layers and to evaluate the effects of topography, geologic structure, hydraulic conductivity, and fluid-density variations on regional flow patterns.

The major assumption involved in this simulation is that the fluid-density distribution remains constant over long periods of time so that regional flow can be considered to be steady state with respect to fluid density. It also should be noted that most of the calibration targets in this study are related to flow in the Mt. Simon Sandstone, which is the primary formation of interest and the only deep formation for which sufficient fluid pressure and water-level data are available. Therefore, the simulated flow patterns are expected to be more accurate for the Mt. Simon Sandstone than for the shallower HSUs.

The simulation results show that in shallow layers topographic variations created by upland areas and adjacent stream valleys are the dominant control on flow directions. This is seen by the development of numerous local-scale flow cells. Flow patterns in the deeper HSUs are influenced more by regional geologic structures. A series of uplifted arches -- Cincinnati Arch, Findlay Arch, and Kankakee Arch -- form the major structural controls on flow directions in the deeper HSUs. In the Appalachian and Illinois basins regional flow is away from the system of arches and into the deeper parts of the basin along directions of dip. In the Michigan Basin similar flow patterns are present, except in the deepest layers.

A second effect of these structural features on the flow system is due to the presence of local faulting, fracturing, and jointing in the Cincinnati Arch region. The resulting increase in hydraulic conductivity combined with the relatively shallow depth to the Mt. Simon Sandstone in these uplifted regions account for the greater downward flow of fluids in this region. This allows for the development of the higher variable-density heads in western Ohio that is required to obtain a best-fit simulation matching simulated heads with observed heads.

The anomalous flow directions in the deep layers in the Michigan Basin are possibly due to salinity differences created by the Salina salt beds, which are a source of high-density brines. The presence of these dense fluids in the relatively shallow layers overlying less dense fluids in the deeper formations is the probable cause of the downward flow in the center of Michigan Basin. It also causes the lateral flow in the Mt. Simon Sandstone to be from the basin center towards the basin margins. Fluid-density related effects in the other regions are less significant and are generally reflected as small differences in flow directions between the variable-density model and the uniform freshwater density model.

The major effect of variations in K is due to the contrast in K between adjacent model layers. This contrast determines whether flow through a layer is predominantly lateral or vertical. In addition, the high K of the sandstone layers allows large volumes of fluids to flow through them. Although thin compared to the thickness of adjacent shale layers, these sandstone layers account for most of the flow into and out of the various basins.

Overall I conclude that topographic driving forces are not the sole factor in the development of the regional flow systems in the midwestern United States and an understanding of the geologic structure, K variations, and fluid-density variations is essential for proper interpretation of regional basin-scale flow.

There are some significant ramifications of the above conclusions for the use of the Mt. Simon Sandstone as a reservoir for hazardous liquid-waste injection. Presently, many of the "No Migration" petitions submitted for permission to inject liquid wastes into this formation are based on the concept of equivalent freshwater heads, as used by Clifford (1973) to define regional flow patterns in the Mt. Simon Sandstone. As a result, it has been generally assumed that the major regional flow direction in the deep formations in Ohio is from east-to-west, from the deeper parts of the Appalachian Basin toward the shallow Cincinnati Arch region. The data presented herein, the conceptual model, and the simulated flow patterns do not support this assumption. Based on the results of the simulations, the dominant flow direction in the deep formations in Ohio is from west-to-east, toward the deeper parts of Appalachian Basin. Due to the low flow velocities, this discrepancy may not lead to significant environmental problems in the short time scale of the waste-injection wells. However, the impact of this discrepancy over the period while the injected waste is still potent needs to be evaluated.

A second ramification to the waste-injection practices derives from the vertical flow directions in various parts of the area. In general, regions where the dominant flow direction is vertically downward are considered to be more favorable for

hazardous-waste injection, whereas regions of dominant upward flow are not considered to be suitable. The simulated vertical flow patterns at the top of the Mt. Simon Sandstone show that the uplifted arch region in the central part of the study area is a region of downward flow, whereas potential upward flow exists in the Appalachian Basin region in southeastern Ohio. Although the lack of sufficient hydraulic data prevents an exact delineation of the extent of these regions in all the deep formations, the results of the simulations can be used for additional site-specific studies that may be useful in determining the suitability of hazardous-waste injection sites.

LIST OF REFERENCES

Anderson, M.P., and W.W. Woessner, 1992. Applied Groundwater Modeling - Simulation of Flow and Advective Transport: Academic Press, Inc., San Diego, California, 381 p.

Bair, E.S., 1987. Analysis of hydraulic gradients across the host rock at the proposed Texas Panhandle nuclear-waste repository site: Ground Water, vol. 25, no. 4, p. 440-447.

Becker, L.E., A.J. Hreha, and T.A. Dawson, 1978. Pre-Knox (Cambrian) stratigraphy in Indiana: Indiana Geological Survey Bulletin 57, 72 p.

Bond, D.C., 1972. Hydrodynamics of deep aquifers of the Illinois basin: Illinois State Geological Survey Circular 470, 72 p.

Bredehoeft, J.D., C.R. Bluth, W.A. White, and G.B. Maxey, 1963. Possible mechanism for concentration of brines in subsurface formations: Amer. Assoc. Petro. Geol. Bull., vol. 47, p. 257-269.

Cartwright, K., 1970. Groundwater discharge in the Illinois basin as suggested by temperature anomalies: Water Resources Research, vol. 6, no. 3, p. 912-918.

Clifford, M.J., 1972. Feasibility of Deep-Well Injection of Industrial Liquid Wastes in Ohio: unpublished M.S. thesis, Department of Geological Sciences, The Ohio State University, Columbus, Ohio, 94 p.

Clifford, M.J., 1973. Silurian rock salt of Ohio: Ohio Division of Geological Survey, Report of Investigations no. 90, 42 p.

Computer Associates, 1991. **DISSPLA** (Disspla Integrated Software System and Plotting Language) User's Manual.

Coustau, H., et al, 1975. Classification hydrodynamique des basins sedimentaires, utilization combinee avec d'autres methods pour rationaliser l'exploration dans des bassins non-productifs: World Petroleum Congress Proc., vol. 2, no. 9, p. 105-119.

Davies, P.B., 1989. Variable-density ground-water flow and paleohydrology in the Waste Isolation Pilot Plant (WIPP) region, Southeastern New Mexico: U.S. Geological Survey Open-File Report 88-490, 139 p.

Dean, S.L., W.B. Armstrong, B.R. Kulander, 1986. Precambrian basement control on joint domains in northwest Ohio: Amer. Assoc. Petro. Geol. Bull., vol. 70, p. 1065.

Domenico, P.A. and F.W. Schwartz, 1990. Physical and Chemical Hydrogeology: John Wiley & Sons, Inc., 824 p.

Eberts, S.M., E.S. Bair, and J.T. DeRoche, 1990. Variations in ground-water quality and simulation of regional ground-water flow and increased ground-water development, Geauga County, Ohio: U.S. Geological Survey, Water-Resources Investigations Report 90-4026, 117 p.

Faust, R.J., G.R. Banfield, and G.A. Willinger, 1980. A compilation of ground water quality data for Kentucky: U.S. Geological Survey Open-File Report 80-685, 963 p.

Freeze, R.A., and P.A. Witherspoon, 1966. Theoretical analysis of regional groundwater flow: 1. Analytical and numerical solutions to the mathematical model: Water Resources Research, vol. 2, no. 4, p. 641-656.

Freeze, R.A., and P.A. Witherspoon, 1967. Theoretical analysis of regional groundwater flow: 2. effect of water-table configuration and subsurface permeability variations: Water Resources Research, vol. 3, no. 2, p. 623-634.

Golden Software Inc., 1989. **SURFER**, version 4, Reference Manual: Golden Software Inc., Golden, CO.

Hanor, J.S., 1987. Origin and migration of subsurface sedimentary brines: Society of Economic Paleontologists and Mineralogists, Short Course no. 21, 247 p.

Hauwert, N.M., S.L. Dean, and B.R. Kulander, 1991. Joint development and small scale faulting along the Bowling Green Fault Complex, Waterville, Ohio, and vicinity: Geol. Soc. Amer., North-Central Section, Abstracts with Program, p. 17

Hitchon, B., 1969a. Fluid flow in the Western Canada sedimentary basin, 1. effect of topography: Water Resources Research, vol. 5, no. 1, p. 186-195.

Hitchon, B., 1969b. Fluid flow in the Western Canada sedimentary basin, 2. effect of geology: Water Resources Research, vol. 5, no. 2, p. 460-499.

Janssens, A., 1973. Stratigraphy of the Cambrian and Lower Ordovician rocks in Ohio: Ohio Division of Geological Survey Bulletin 64, 197 p.

Janssens, A., 1977. Silurian rocks in the subsurface of northwestern Ohio: Ohio Division of Geological Survey, Report of Investigations no. 100, 96 p.

Keller, S.J., 1983. Analysis of subsurface brines of Indiana: Indiana Geological Survey Occasional Paper 41, 30 p.

Kelley, M.E., 1989. Differences in Flow Directions and Flow Velocities Resulting From Simulation of Regional Ground-Water Flow in the Texas Panhandle Using Equivalent Freshwater and Variable-Density Heads: unpublished M.S. thesis, Department of Geological Sciences, The Ohio State University, 151 p.

Kelley, M.E., and E.S. Bair, 1988. Differences in hydrodynamic interpretations based on equivalent freshwater heads versus variable-density heads: Geol. Soc. Amer., South-Central Section, Abstracts with Program.

Knapp, N.F., and D.A. Stith, 1989. Characterization of trace metals in Ohio brines: Ohio Division of Geological Survey Open-File Report 89-1, 15 p., 94 analyses.

Kipp, K.L., Jr., 1987. HST3D; a computer code for simulation of Heat and Solute Transport in Three Dimensional ground-water flow systems: U.S. Geological Survey, Water-Resources Investigations Report 86-4095, 517 p.

Kontis, A.L., and R.J. Mandle, 1988. Modification of a three-dimensional ground-water flow model to account for variable water density and effects of multiaquifer wells: U.S. Geological Survey, Water-Resources Investigations Report 87-4265, 78 p.

Kuiper, L.K., 1985. Documentation of a numerical code for the simulation of variable-density ground-Water flow in three dimensions: U.S. Geological Survey Water-Resources Investigations Report 84-302.

Kuiper, L.K., 1983. A numerical procedure for solution of the steady state variable density groundwater flow equation: Water Resources Research, vol. 19, no. 1, p. 234-240.

Lamborn, R.E., 1952. Additional analysis of brines from Ohio: Ohio Geological Survey, Report of Investigations no. 11, 56 p.

Lillienthal, R.T., 1978. Stratigraphic cross sections of the Michigan basin: Michigan Geological Survey, report of investigations 19, 36 p.

Lowry, R.M., G. Faure, D.I. Mullet, and L.M. Jones, 1988. Interpretation of chemical and isotopic compositions of brines based on mixing and dilution, "Clinton" sandstones, eastern Ohio, U.S.A.: Applied Geochemistry, vol. 3, p. 177-184.

Lusczynski, N.J., 1961. Head and flow of ground water of variable density: Journal of Geophysical Research, vol. 66, no. 12, p. 4247-4256.

Mandle, R.J., and A.L. Kontis, in press. Simulation of ground-water flow in the Cambrian-Ordovician aquifer system in the northern midwest, United States: U.S. Geological Survey Professional Paper 1405-C.

Meents, W.F., A.H. Bell, O.W. Rees, and W.C. Tilbury, 1952. Illinois oil field brines, their geologic occurrence and chemical composition: Illinois State Geological Survey, Illinois Petroleum 60, 38 p.

Nealon, D.J., 1982. A Hydrological Simulation of Hazardous Waste Injection in the Mt. Simon, Ohio: unpublished M.S. thesis, Department of Geology, Ohio University, Athens, Ohio, 285 p.

Nieto, A.E., 1989. Well Injection Petition Demonstration, Allied Signal WDW 1, Danville Illinois, Section 2: available at the Illinois State Geological Survey.

Norris, S.E., and R.E. Fiddler, 1973. Availability of water from limestone and dolomite aquifers in southwest Ohio and the relation of water quality to the regional flow system: U.S. Geological Survey, Water-Resources Investigations 17-73, 42 p..

Ohio Department of Natural Resources, 1970. Ground water for planning in northwest Ohio, a study of the carbonate-rock aquifers: Div. of Water, Ohio Water Plan Inventory Rep. 22, 63 p.

Ohio Environmental Council, 1992. Groundwater at Risk: 76 p.

Onasch, C.M., and C.F. Kahle, 1991. Recurrent tectonics in a cratonic setting: an example from northwest Ohio: Geol. Soc. Amer. Bull., vol. 103, p. 1259-1269.

Reeves, M., and R.M. Cranwell, 1981. User's Manual for the Sandia Waste Isolation Flow and Transport Model (SWIFT), Release 4.81: U.S. Nuclear Regulatory Commission, NUREG/CR-2324, SAND81-2516, 146 p.

Rupp, J., 1989. Structure and isopach maps of the Paleozoic rocks of Indiana: Indiana Geological Survey Special Report 48, 105 p.

Russell, W.L., 1972. Pressure depth relations in the Appalachian Basin: Amer. Assoc. Petro. Geol. Bull., vol. 56, p. 528-536.

Sanders, L.L., 1991. Geochemistry of formation waters from the Lower Silurian Clinton formation (Albion Sandstone), Eastern Ohio: Amer. Assoc. Petro. Geol. Bull., vol. 75, no. 10, p. 1593-1608.

Sanford, B.V., and R.G. Quinlan, 1959. Subsurface stratigraphy of Upper Cambrian rocks in southwestern Ontario: Geological Survey of Canada Paper 58-12, 17 p.

Senger, R.K., and G.E. Fogg, 1990. Stream functions and equivalent freshwater heads for modeling regional flow of variable-density groundwater, 2. application and implications for modeling strategy: Water Resources Research, vol. 26, no. 9, 2097-2106.

Shrake, D.L., R.W. Carlton, L.H. Wickstrom, P.E. Potter, B.H. Richard, P.J. Wolfe, and G.W. Sitler, 1991. Pre-Mount Simon basin under the Cincinnati Arch: Geology, vol. 19, p. 139-142.

Stith, D.A., 1979. Brine Analysis, 1972-1974: Ohio Division of Geological Survey, Open-File Reports 79-1, 75 analyses.

Stout, W., R.E. Lamborn, and D. Schaaf, 1932. Brines of Ohio: Geological Survey of Ohio, Bull. 37, 123 p.

Toth, J., 1963. A theoretical analysis of groundwater flow in small drainage basins: Journal of Geophysical Research, vol. 68, p. 4795-4812.

Toth, J., 1978. Gravity-induced cross-formational flow of formation fluids, Red Earth Region, Alberta, Canada: analysis, patterns, evolution: Water Resources Research, vol. 14, p. 805-843.

Toth, J., 1980. Cross-formational gravity-flow of groundwater: a mechanism of the transport and accumulation of petroleum (The generalized hydraulic theory of petroleum migration): in AAPG Studies in Geology no. 10: Problems of petroleum migration, p. 121-167.

Vugrinovich, R., 1986. Patterns of regional subsurface fluid movement in the Michigan basin: Michigan Geological Survey Open-File Report 86-6, 27 p.

Wagner, W.R., 1976. Growth faults in Cambrian and Lower Ordovician rocks of western Pennsylvania: Amer. Assoc. Petro. Geol. Bull., vol. 60, no. 3, p. 414-427.

Warner, D.L., 1988. Hydrogeologic and hydrochemical assessment of the Basal Sandstone and overlying Paleozoic age units for wastewater injection and confinement in the north central region (Draft Final Report): Underground Injection Practices Council, Oklahoma City, OK.

Webb, E.J., 1980. Cambrian Sedimentation and Structural Evolution of the Rome Trough in Kentucky: unpublished Ph.D. dissertation, Department of Geology, University of Cincinnati, 97 p.

Weiss, E., 1982. A model for the simulation of flow of variable density ground-water in three dimensions under steady-state conditions: U.S. Geological Survey, Open-file Report 82-352, 70 p.

White, D.E., 1965. Saline waters of sedimentary rocks: in Fluids in Subsurface Environments--A Symposium: AAPG Memoir 4, p. 342-366.

Wickstrom, L.H., 1990. A new look at Trenton (Ordovician) structure in northwestern Ohio: Northeastern Geology, vol. 12, no. 3, p. 103-113.

Williamson, A.K., H.F. Grubb, and J.S. Weiss, 1990. Ground-water flow in the Gulf Coast aquifer systems, south central United States -- a preliminary analysis: U.S. Geological Survey Water-Resources Investigation Report 89-4071, 124 p.

Willman, H.B., E. Atherton, T.C. Buschbach, C. Collinson, J.C. Frye, M.E. Hopkins, J.A. Lineback, and J.A. Simon. 1975. Handbook of Illinois stratigraphy: Illinois State Geological Survey Bulletin 95, 261 p.

APPENDIX A

PUBLISHED WATER-LEVEL MAPS

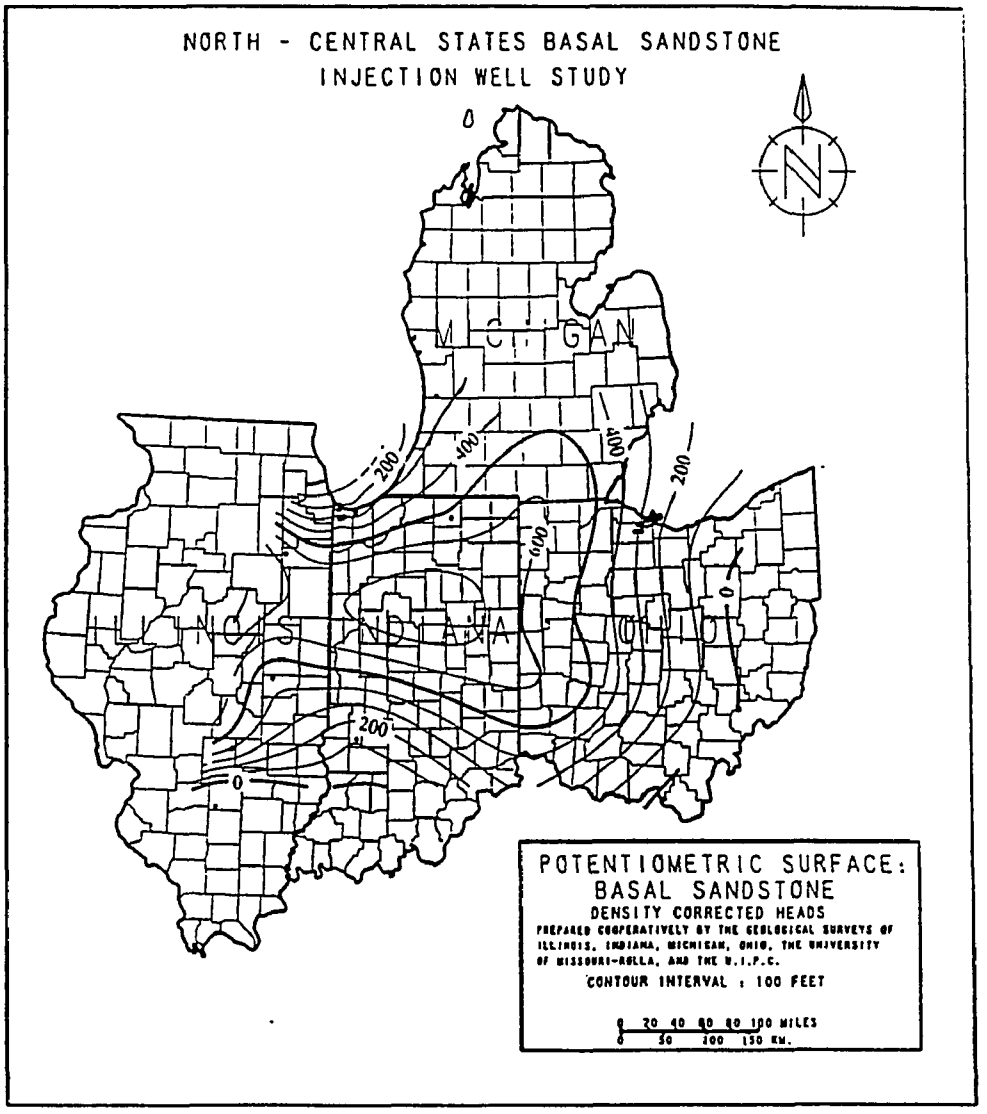

Figure 51. Warner (1988) variable-density heads for Mt. Simon Sandstone

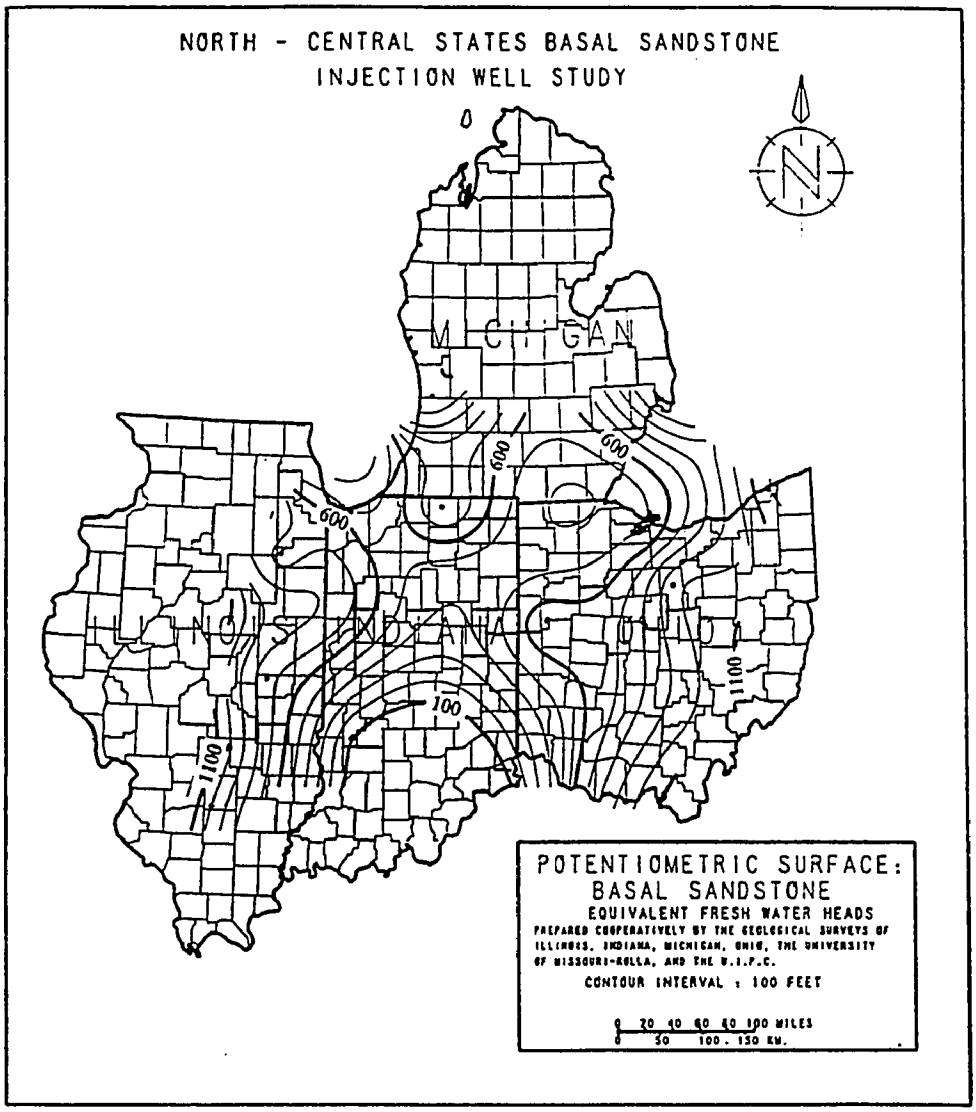

Figure 52. Warner (1988) equivalent freshwater heads for Mt. Simon Sandstone

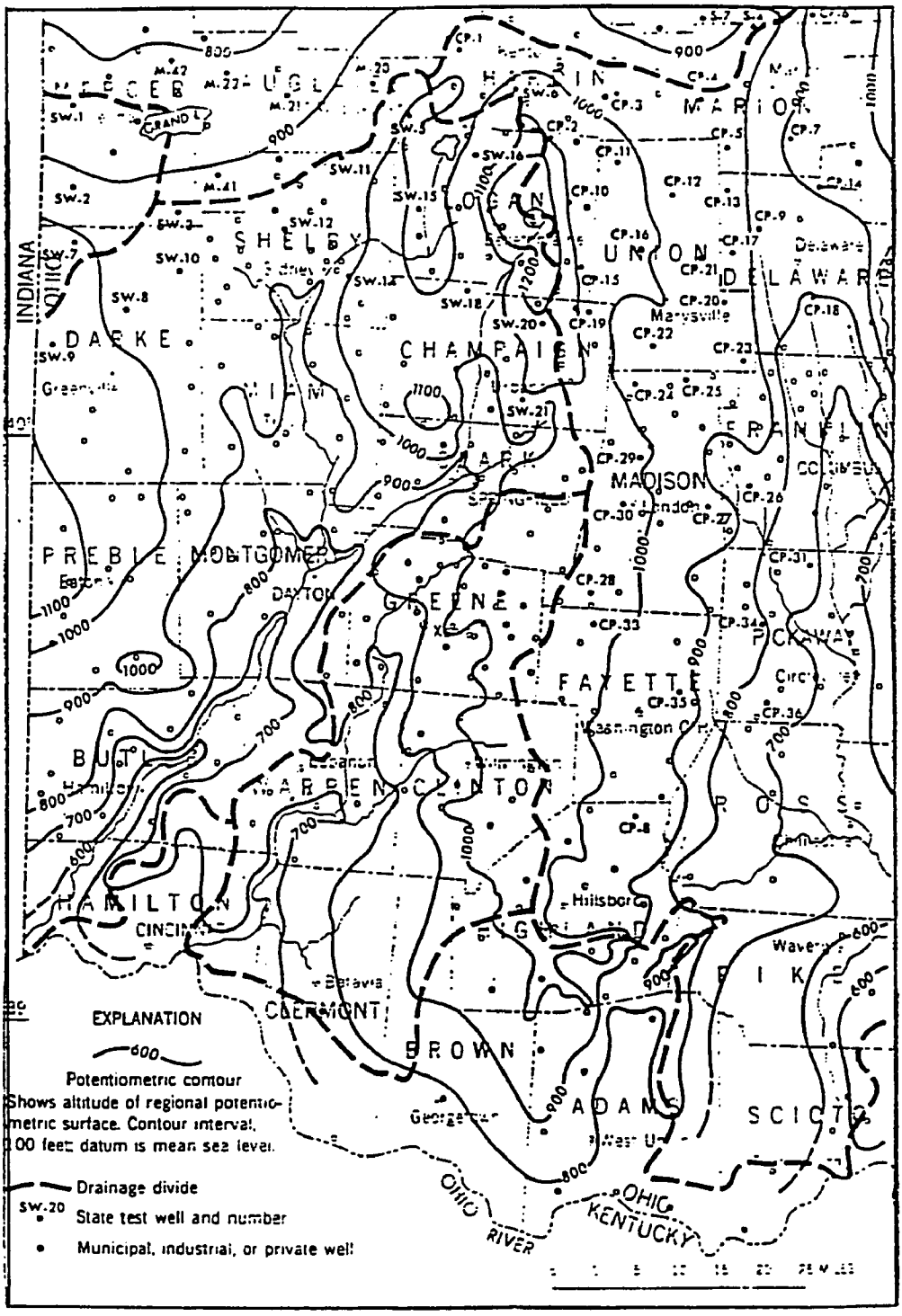

Figure 53. Norris and Fidler (1973) water-level map for Silurian-Devonian carbonates in southwestern Ohio

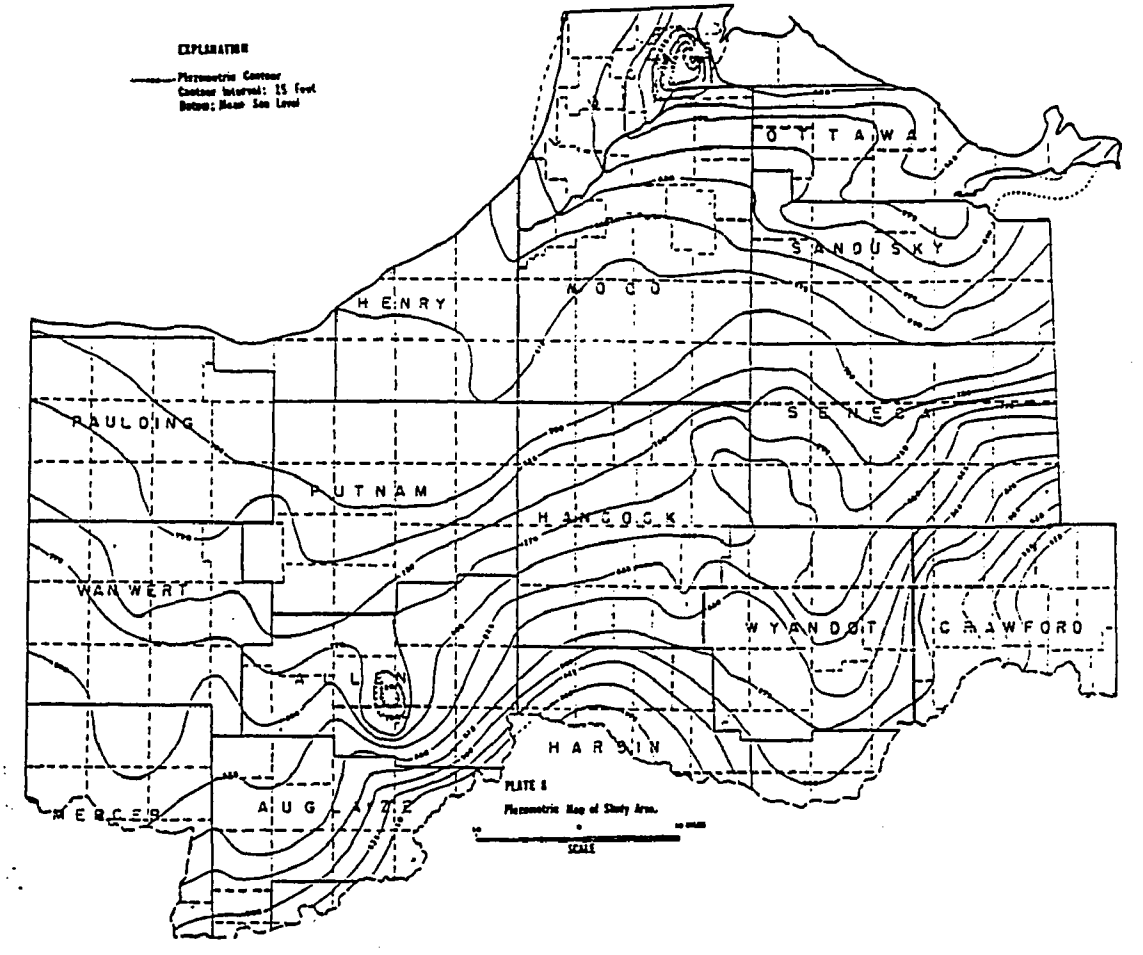

Figure 54. ODNR (1970) water-level map for Silurian-Devonian carbonates in northwestern Ohio

APPENDIX B

GEOLOGIC DATA TABLES

Table 3. Geologic data for Ohio. (Reference datum = mean sea level. Layer designations given in figure 4.)

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
ADAMS	LIBERTY	3400110001	1678500	286300	S	38.7806	83.6278	2380884	649790		765										0	0
ADAMS	SPRIGG	3400110002	1657150	234800	S	38.6383	83.7003	2364969	597861												0	0
ADAMS	FRANKLIN	3400110003	1758500	382200	S	39.0464	83.3503	2450537	746787													0
ADAMS	JEFFERSON	3400120004	1762188	285696		38.7814	83.3342	2464289	650082	3790	714	-3055	68	530	165	828	98	587	994	359	0	0
ADAMS	JEFFERSON	3400120005	1774175	301825		38.8260	83.2926	2474559	666357	3829	624	-3148	44	557	158	896	100	596	998	372	0	0
ADAMS	MONROE	3400120006	1711150	258935	S	38.7064	83.5122	2416248	622712	2039	527						104	708			0	0
ADAMS	FRANKLIN	3400120011	1755500	383050		39.0485	83.3609	2447463	747554	3886	852	-3013	319	552	157	712	85	619	998		0	0
ADAMS	BRATTON	3400120012	1743425	377425		39.0328	83.4032	2436030	741824	2957	960				0						0	0
ADAMS	BRATTON	3400120013	1737450	378025	S	39.0342	83.4242	2430036	742335												0	0
ADAMS	MONROE	3400160007	1711325	259025	S	38.7067	83.5117	2416380	622822	2401	532										0	0
ALLEN		9	1616370	1052927		40.8825	83.8869	2237640	1416831		852						0				0	0
ALLEN		14	1602337	1014208		40.7756	83.9356	2227810	1377820		933						0				0	0
ALLEN		15	1533174	1005563		40.7486	84.1844	2160002	1367967		810						0			314	0	0
ALLEN		16	1554666	1043298		40.8533	84.1094	2177276	1406175		782						0				0	0
ALLEN		23	1487793	1030889		40.8158	84.35	2112125	1392490		770						0				0	0
ALLEN		57	1592909	971842		40.6589	83.9669	2223066	1335233		1037						0	521	942	460	0	0
ALLEN		59	1614376	1039922		40.8467	83.8933	2237066	1403766		881						0	639	816	429	0	0
ALLEN		62	1482147	1009919		40.7578	84.3689	2108752	1371324		810						0	579	758	305	0	0
ALLEN	SPENCER	63	1486658	1009532		40.7569	84.3525	2113310	1370996		816							587				
ALLEN		68	1548887	991495		40.7108	84.1269	2177120	1354173		866						0			330	0	0
ALLEN		69	1549536	992320		40.7131	84.1247	2177653	1355012		873						0			339	0	0
ALLEN		70	1548886	992495		40.7136	84.1269	2177029	1355194		865						0			331	0	0
ALLEN		113	1514105	995868		40.7211	84.2525	2142080	1357931		836						0		836	310	0	0
ALLEN		125	1504213	1009174		40.7569	84.2892	2130791	1370996		810						0			330	0	0
ALLEN	SPENCER	3400320060	1478840	408000		40.7711	84.3817	2104796	1376178	3207	807	-2400	339	446	0	614	0	591			0	0
ALLEN	SPENCER	3400320064	1479700	405550		40.7645	84.3784	2105916	1373769	3265	811	-2397	355	444	0	618	0	595			0	0
ALLEN	RICHLAND	3400320065	1609840	432075		40.8440	83.9102	2232517	1402781	2877	885			202			0	616			0	0
ALLEN	SHAWNEE	3400320067	1548750	386600		40.7163	84.1279	2176664	1356180	3133	872	-2261	303	414	0	583	0	580	846	328	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
ALLEN	SHAWNEE	3400320071	1546255	386000		40.7145	84.1369	2174236	1355523	3170	853	-2290	326	420	0	553	0	606	855	313	0	0
ALLEN	SHAWNEE	3400320084	1547209	387508		40.7187	84.1335	2175038	1357056	3170	856	-2289	325	414	0	580	0	561	850	322	0	0
ALLEN	SHAWNEE	3400360000				40.7122	84.1309	2175981	1354701	3300	874				0		0				0	0
ASHLAND	RUGGLES	3400520248	2039800	492000		41.0171	82.3558	2654108	1465950	5251	1114			375	73	198	0				770	
ASHTABULA	SHEFFIELD	3400710001	2498700	800100	N	41.8483	80.6697	3077785	1769278								0					0
ASHTABULA	ROME	3400711002	2452800	762000	N	41.7464	80.8408	3036205	1732091													0
ASHTABULA	ASHTABULA	3400720000	2481200	821440		41.9079	80.7323	3057946	1791027	6055	650	-5322	92	411							1550	
ASHTABULA	ASHTABULA	3400720003	2481200	821440	N	41.9078	80.7322	3057978	1790991	6060	650	-5322	86	438			38	554	1992	1268	1550	0
ASHTABULA	LENOX	3400720015	2473600	749400	N	41.7106	80.7656	3058343	1719027													0
ASHTABULA	DORSET	3400720053	2511200	730100	N	41.6556	80.6292	3096074	1698956	6349	1052								2062	1409		0
ASHTABULA	MONROE	3400720073	2515000	802400	N	41.8536	80.6097	3093802	1771212	5710	860						0	603	2003	1290		0
ASHTABULA	TRUMBULL	3400720191	2426775	744300		41.6991	80.9372	3012233	1714830	6750	983	-5755	116	439			0	616	1932	1483	1550	0
ASHTABULA	PIERPONT	3400720193	2515620	768960		41.7565	80.6102	3098367	1735777	6916	977	-5931	162	474	0	224	88	583	2053	1373	1710	0
ASHTABULA	HARPERSFIELD	3400720196	2431375	769450	N	41.7678	80.9186	3014060	1739901	6200	857						18	596	1941	1384		0
ASHTABULA	ANDOVER	3400720206	2534720	705820	N	41.5875	80.5453	3124203	1674104	6509	1063							618	2110	1456		0
ASHTABULA	MONROE	3400720211	2518590	790525	N	41.8208	80.5975	3098702	1759242	5852	912						0			1292		0
ASHTABULA	JEFFERSON	3400720213	2464550	751550	N	41.7169	80.7983	3049155	1721326	6438	914						25	622	2016	1350		0
ASHTABULA	NEW LYME	3400720214	2482100	705300	N	41.5892	80.7375	3071776	1674725	6364	1053							634	2044	1462		0
ASHTABULA	LENOX	3400720217	2470200	733300	N	41.6867	80.7792	3058735	1703007	6025	964						33	615	2004	1434		0
ASHTABULA	MORGAN	3400720286	2457750	748150		41.7081	80.8236	3042695	1718115	6670	861	-5745	118	476	0	206	42	621	1984	1398	1560	0
ASHTABULA	MORGAN	3400720290	2460300	731500	N	41.6622	80.8153	3047128	1701365	5954	880						15	633	1998	1446		0
ASHTABULA	WINSDOR	3400720358	2416450	674550	N	41.5083	80.9794	3009660	1645202	6551	1032						42	674	1925	1574		0
ASHTABULA	NEW LYME	3400721847	2469550	713800		41.6132	80.7828	3058298	1683483	7108	950	-6152	166	478	0	226	94	612	2020	1474	1700	0
ASHTABULA	NEW LYME	3400722038	2468050	710350		41.6038	80.7886	3057165	1680053	7118	942	-6164	178	484	0	241	64	631	2016	1477	1700	0
ASHTABULA	NEW LYME	3400722045	2474450	701000	N	41.5778	80.7658	3084610	1670565	6836	1021				0	170	146	600	2042	1466		0
ASHTABULA	NEW LYME	3400722071	2475500	711450	N	41.6064	80.7614	3064448	1681002	6414	1029									1471		0
ASHTABULA	NEW LYME	3400722078	2471900	713300	N	41.6117	80.7742	3060711	1682936													0
ASHTABULA	NEW LYME	3400722101	2464900	716710	N	41.6214	80.7997	3053308	1686475	6514	916	-6192	211	499					2004	1011		0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
ASHTABULA	NEW LYME	3400722272	2470700	715200		41.6170	80.7785	3059288	1684870	7151	973	-6147	180	400	0				1947		1700	0
ASHTABULA	DENMARK	3400723192	2489075	764960		41.7525	80.7076	3072102	1734317	7008	932	-5824	89	475	0	255	113	619	2029	1425	1600	18
ASHTABULA	NEW LYME	3400723791	2464650	707200	N	41.5953	80.8011	3054165	1676951	6242	912						95	628	1988	1491		0
ASHTABULA	NEW LYME	3400723818	2474275	718800	N	41.6267	80.7653	3062421	1688410	6227	1025						70	622	2016	1457		0
ASHTABULA	NEW LYME	3400723820	2467100	704700	N	41.5883	80.7925	3056839	1674396	6344	924						89	627	2003			
ASHTABULA	NEW LYME	3400723821	2478150	713900	N	41.6131	80.7514	3066852	1683447	6426	1024						78	628	2036	1458		
ASHTABULA	ORWELL	3400723839	2441300	696075	N	41.5681	80.8872	3032089	1686295	6160	815						85	664	1976	1520		0
ASHTABULA	ROME	3400723842	2460500	702450	N	41.5825	80.8167	3050522	1672280	6248	893						93	631	1979	1531		0
ASHTABULA	ROME	3400723859	2459300	704050	N	41.5869	80.8211	3049115	1673885	6230	898						90	626	2000	1532		0
ASHTABULA	NEW LYME	3400723860	2473350	714600	N	41.6153	80.7689	3061983	1684249	6295	1010						79	637	1987	1480		0
ASHTABULA	NEW LYME	3400723870	2463150	704550	N	41.5881	80.8069	3052928	1674323	6183	893							648	1994	1511		0
ASHTABULA	NEW LYME	3400723888	2472450	703300	N	41.5842	80.7731	3062317	1672900	6368	972						92	636	2026	1484		0
ASHTABULA	ROME	3400723889	2456950	703900	N	41.5867	80.8297	3046782	1673813	6222	925							628	2012	1544		0
ASHTABULA	DENMARK	3400723895	2496200	754300	N	41.7228	80.6822	3080429	1723479	6441	967				0	244	76	622	2048	1353		
ASHTABULA	ROME	3400723905	2460250	698750	N	41.5725	80.8178	3050696	1668631	6256	895						82	641	1720	1822		0
ASHTABULA	ROME	3400723906	2459500	700450	N	41.5772	80.8206	3049710	1670348	6250	897						82	655	1989	1530		0
ASHTABULA	NEW LYME	3400723907	2473320	716350	N	41.62	80.7689	3061759	1685965													
ASHTABULA	MORGAN	3400723909	2444270	739000	N	41.6836	80.8736	3030258	1709174	6162	815						13	627	1990	1436		
ASHTABULA	SAYBROOK	3400723934	2445550	800700	N	41.8528	80.8647	3024677	1770920	5496	646						0			1324		0
ASHTABULA	COLEBROOK	3400723952	2463750	695750	N	41.5639	80.8053	3054508	1665492	6300	898											
ASHTABULA	NEW LYME	3400723956	2474875	720900	N	41.6325	80.7628	3062825	1690526													
ASHTABULA	ORWELL	3400723959	2439330	683850	N	41.5325	80.8953	3031460	1654033	6282	815						72	664	1996	1564		0
ATHENS	CARTHAGE	3400921827	2165500	441350	S	39.2103	81.9158	2849905	806599	7490	661							1144	1506	1297	1800	65
ATHENS	DOVER	3400923062	2119870	520390	S	39.4281	82.0756	2796057	886080	6502	895							885	1395	1203	1400	181
ATHENS	ROME	3400923210	2178100	493220	S	39.3525	81.8667	2857950	858492	7440	725								1494	1328		
AUGLAIZE		5	1593433	929684		40.5433	83.9628	2228053	1293047		1020						0				0	0
AUGLAIZE		20	1571037	950424		40.5992	84.0444	2203605	1313447		980						0				0	0
AUGLAIZE		21	1519185	945940		40.5844	84.2308	2152485	1308046		855						0			230	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
AUGLAIZE		22	1485570	959149		40.6189	84.3528	2117612	1320636		835						0				0	0
AUGLAIZE		41	1473888	897851		40.45	84.3903	2112557	1259000		930						0				0	0
AUGLAIZE	GOSHEN	41	1611536	930194		40.5456	83.8975	2248066	1293887		1030							516				
AUGLAIZE	GOSHEN	42	1607737	926592		40.5356	83.9111	2242634	1290237		1027							508	1012			
AUGLAIZE	GOSHEN	44	1611836	929394		40.5433	83.8964	2248448	1293047		1025							476				
AUGLAIZE	DUCHOUQUET	55	1534212	963374		40.6331	84.1781	2165496	1325818		883							561				
AUGLAIZE		83	1466257	950853		40.595	84.4217	2099295	1311914		862						0		810	244	0	0
AUGLAIZE		85	1477758	938710		40.5622	84.3784	2112042	1299944		878						0		805	202	0	0
AUGLAIZE	ST. MARYS	3401120071	1473200	310700		40.5038	84.3945	2109699	1278633	3067	896	-2210	271	430	0	756	0	556	806	108	0	0
BROWN	PERRY	3401510001	1595500	428300	S	39.1672	83.9267	2283428	780871						0		0			0	0	0
BROWN	JACKSON	3401520002	1641300	332900	S	38.9072	83.7606	2338975	695990						0					0	0	0
BROWN	HUNTINGTON	3401520004	1645300	269700	S	38.7339	83.7433	2349600	632748						0					0	0	0
BROWN	JACKSON	3401520005	1640075	329550	S	38.8978	83.7647	2338121	692559		990				0						0	
BROWN	JACKSON	3401560005	1640075	329550	S	38.8978	83.7647	2338121	692559	2276	990				0					0	0	0
BUTLER	LEMON	3401720004	1476100	546600		39.4860	84.3563	2152154	907210	3297	666	-2570	280	534	0	1176	0	633	520	0	0	0
BUTLER	LEMON	3401720005	1477300	546450		39.4857	84.3521	2153345	907100	3285	671	-2557	280	533	0	1249	0	515	646	0	0	0
CARROLL	BROWN	3401920286	2386250	364120	N	40.6578	81.1078	3013457	1334831	8814	1182				0		141	1054	1866	1821		
CARROLL	WASHINGTON	3401920553	2420600	346050	N	40.6064	80.9853	3049654	1316074	9073	1126				0			1159	1935	1883	2850	80
CHAMPAIGN		12	1648151	811004		40.22	83.78	2295232	1175066		1069						0	709	836	158	0	0
CHAMPAIGN		15	1591440	787110		40.1519	83.9614	2241423	1150215		1196						0	708		222	0	0
CHAMPAIGN		16	1686550	783980		40.0922	83.6203	2338518	1128429		1239						0	720	906	275	0	0
CHAMPAIGN		19	1707250	804700		40.2047	83.5481	2354745	1169483		1072						0					0
CHAMPAIGN		20	1678425	800650		40.1825	83.6511	2326489	1165031		1275						0					0
CHAMPAIGN		21	1669400	756000		40.0697	83.6811	2322331	1120218		1100						0					0
CHAMPAIGN		21	1686313	805603		40.2064	83.6231	2333806	1170103		1364						0	772	792	450		0
CHAMPAIGN		121	1681150	815050		40.2322	83.6419	2327685	1178518		1358						0					0
CHAMPAIGN		122	1665900	817300		40.2378	83.6967	2312243	1181562		1260						0					0
CHAMPAIGN		3061	1594900	797550		40.1808	83.9497	2243727	1160761		1070						0				0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
CHAMPAIGN		10666	1679000	793000		40.1717	83.6486	2327899	1157440								0				0	0
CHAMPAIGN	GOSHEN	3402120002	1692900	742000		40.0321	83.5967	2347171	1106496	3323	1267			366			0	501			0	0
CHAMPAIGN	UNION	3402120003				40.1303	83.6022	2342262	1142345	2252	1227						0	689	906		0	0
CHAMPAIGN	WAYNE	3402120005				40.1539	83.6322	2333070	1150956	2178	1325						0	674			0	0
CHAMPAIGN	CONCORD	3402120010				40.1783	83.8570	2269624	1159856	2761	1133						0	686	870	187	0	0
CHAMPAIGN	SALEM	3402120011				40.2238	83.7515	2297469	1176460	2719	1072						0	641	888	210	0	0
CHAMPAIGN	JOHNSON	3402120013				40.1673	83.9343	2248458	1155846	1962	1127						0	674	881	199	0	0
CHAMPAIGN	SALEM	3402120014				40.2242	83.7687	2292656	1176595	1915	1076						0	648	881	159	0	0
CHAMPAIGN	JACKSON	3402120017				40.0447	83.9555	2246819	1111097	1980	1162						0	666		145	0	0
CHAMPAIGN	WAYNE	3402120020	1677700	196750		40.2009	83.6537	2325476	1168096	3325	1318			323			0	537		397	0	0
CLARK		21	1638800	699200		39.9128	83.7878	2297844	1062961		1020						0				0	0
CLARK		22	1693425	704500		39.9292	83.5931	2351719	1068945		1160						0				0	0
CLARK	MADISON	3402300002	1658600	655000		39.7821	83.7150	2322283	1018914	4647	1087	-2279	136				0				0	0
CLARK	PLEASANT	3402320002	1695700	718900		39.9688	83.5857	2352423	1083398	3649	1249	-2375	274	500	90	668	0	544			0	0
CLARK	HARMONY	3402320003	1692700	689400		39.8877	83.5951	2352586	1053801	3578	1167	-2363	212	449	149	680	0	681			0	0
CLARK	PIKE	3402320008				39.9667	84.0085	2234358	1082619	2390	1013						0	506			0	0
CLERMONT	STONELICK	3402520003	1529900	421100		39.1444	84.1576	2218882	782550	3436	817	-2493	175	551	0	1261	0	708		0	0	0
CLERMONT		3402520005				38.9951	84.2509	2197157	728054	1102	681				0		0			0	0	0
CLERMONT		3402520006				38.8411	84.1259	2237422	671860	1581	883				0		0			0	0	0
CLINTON	WAYNE	3402720002	1685000	506100		39.3843	83.6145	2364322	870096	3392	1080	-2310	140	504	0	956	0	526	1008		0	0
CLINTON	WASHINGTON	3402720004	1628700	506100		39.3822	83.8136	2308294	869330	3351	1069			532	0	99	0	585	585		0	0
CLINTON	WAYNE	3402720005	1685000	504600		39.3801	83.6144	2364493	868564	3263	1092	-2126	38	482	0	943	0	511	984		0	0
CLINTON	WAYNE	3402720007	1682600	503300		39.3765	83.6228	2362248	867250	3473	1087	-2365	142	531	0	955	0	555	1013		0	0
CLINTON	WAYNE	3402720009	1684700	529825		39.4494	83.6166	2361522	893853	3325	1068				0		0				0	0
CLINTON	WILSON	3402720010	7116652C	557810		39.4944	83.6500	2350597	910279	3603	1098	-2455	153	589	0	898	0	710	892		0	0
COLUMBIANA	HANOVER	3402920559	2443580	391070	N	40.7289	80.8994	3067756	1360778	8970	1169				0				1981	2111		
COLUMBIANA	KNOX	3402920592	2418000	443950	N	40.8753	80.9883	3036503	1414203	8269	1163				0			1018	1925	2060	2620	54
COLUMBIANA	CENTER	3402920607	2456550	411750	N	40.785	80.8511	3078482	1381250	9031	1299				0				2019	2054		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
COLUMBIANA	CENTER	3402920612	2458550	410400	N	40.7811	80.8442	3080566	1379827	8903	1216				0				2052	2082		
COLUMBIANA	BUTLER	3402920620	2424400	423000	N	40.8175	80.9667	3045111	1393110	36703	1309				0			1093	1942	2019		
COLUMBIANA	MADISON	3402920626	2505090	379320	N	40.6933	80.6783	3130451	1347786	10200	1137				0		166	1360	2133	2207		
COLUMBIANA	CENTER	3402920631	2455500	421450	N	40.8117	80.8544	3076332	1390994	8860	1145				0			1093	2009	1911		
COLUMBIANA	HANOVER	3402920648	2451300	412050		40.7861	80.8702	3073164	1381652	10242	1193	EST		831	0	140	140	1139	1993	2074	2950	33
COLUMBIANA	SALEM	3402920656	2454800	424000	N	40.8186	80.8567	3075378	1393512	8893	1197				0			1088	2002	2048		
COLUMBIANA	KNOX	3402920665	2404900	424700	N	40.8231	81.0369	3025505	1395154	8240	1168				0			1028	1919	1994		
COLUMBIANA	MADISON	3402920668	2490300	386580	N	40.6592	80.7328	3116999	1335342	9937	1245				0			1380	2131	2135		
COLUMBIANA	KNOX	3402920670	2404300	431350	N	40.8414	81.0386	3024201	1401832	8301	1175				0				1928	1976		
COLUMBIANA	KNOX	3402920671	2407650	423450	N	40.8184	81.0272	3028348	1393804	8454	1233				0			1034	1916	2012		
COLUMBIANA	KNOX	3402920677	2411550	429600	N	40.8361	81.0125	3031635	1399898	8451	1237				0					2069		
COLUMBIANA	KNOX	3402921475	2407650	447100	N	40.8844	81.0256	3025814	1417524	8277	1085				0		114			1931		
COLUMBIANA	WAYNE	3402921476	2468490	386630	N	40.6606	80.8114	3095219	1335853	9916	1140				0		120	1278	2026	2098		
COSHOCTON	CLARK	3403120096	2148100	277850	N	40.4281	81.9681	2785264	1251008		790						0					
COSHOCTON	MONROE	3403121330	2117250	261500	N	40.3836	82.0792	2756275	1234768	5845	1129						0	743	1488	1098		
COSHOCTON	CRAWFORD	3403121825	2201700	283200	N	40.4417	81.7753	2838158	1255971	6700	1201				0		74	774	1595	1331		
COSHOCTON	CRAWFORD	3403121895	2193950	266000	N	40.3947	81.8036	2832293	1238819	6452	936				0		39	773	1590	1322		
COSHOCTON	JEFFERSON	3403122053	2138735	239700		40.3235	82.0025	2780042	1212838	6970	1040	-5924	104	605	0		0	754	1457	1187	1250	116
COSHOCTON	KEENE	3403122131	2187700	238000	N	40.3181	81.8269	2829045	1210868	6239	817				0		62	772	1573	1277		
COSHOCTON	VIRGINIA	3403122144	2161250	185500	N	40.1744	81.9231	2808286	1158428	6088	800						73	764	1511	1204		
COSHOCTON	WHITE EYES	3403122145	2210700	248900	N	40.3472	81.7442	2850786	1221485	6628	965				0		72	800	1603	1357		
COSHOCTON	CRAWFORD	3403122177	2199250	268070	N	40.4003	81.7847	2837300	1240863	6678	1191				0			781	1567	1333		
COSHOCTON	VIRGINIA	3403122183	2165929	185450	N	40.1742	81.9064	2812943	1158353	6101	800						70	778	1522	1212		
COSHOCTON	VIRGINIA	3403122268	2159350	184700	N	40.1722	81.9297	2806540	1157623		871											
COSHOCTON	JACKSON	3403122415	2168750	224440	N	40.2811	81.8953	2811588	1197363	6400	1000						28	770	1538	1202		
COSHOCTON	VIRGINIA	3403122460	2166064	196780	N	40.2053	81.9056	2811874	1169702	6178	1000							773	1522	1223		
COSHOCTON	WHITE EYES	3403122511	2212250	257600	N	40.3711	81.7383	2851411	1230207	6673	1010				0		93	785	1585	1375		
COSHOCTON	JACKSON	3403122552	2173200	207600	N	40.2347	81.8797	2817856	1180431	5966	752							770				

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	VIRGINIA	3403122570	2160360	183830	N	40.1697	81.9261	2807646	1156710	6148	859						67	771	1508	1210		
COSHOCTON	TUSCARAWAS	3403122576	2176471	209857	N	40.2408	81.8681	2820828	1182657		763				0		66	777	1544	1246		
COSHOCTON	JACKSON	3403122595	2171200	207650	N	40.235	81.8869	2815841	1180540	6238	920						55	779	1545	1230		
COSHOCTON	FRANKLIN	3403122599	2171850	204500	N	40.2264	81.8847	2816811	1177402	6408	1006				0		58	780	1550	1227		
COSHOCTON	TUSCARAWAS	3403122617	2187450	209450	N	40.2397	81.8286	2831859	1182255	6522	1039				0		70	787	1567	1266		
COSHOCTON	WHITE EYES	3403122621	2205150	238950	N	40.3203	81.7644	2846313	1211668	6645	987				0		92	789	1592	1360		
COSHOCTON	JACKSON	3403122633	2173220	209660	N	40.2406	81.8794	2817694	1182584	6213	917						62	772	1539	1235		
COSHOCTON	WHITE EYES	3403122653	2202500	238400	N	40.3186	81.7739	2843746	1211048	6660	1128				0			787	1580	1353		
COSHOCTON	CRAWFORD	3403122667	2210350	258500	N	40.3738	81.745	2849446	1231119	6650	971				0			862	1604	1361		
COSHOCTON	TUSCARAWAS	3403122686	2176800	213050	N	40.2497	81.8667	2820846	1185905	5968	745				0							
COSHOCTON	WHITE EYES	3403122688	2195850	241400	N	40.3272	81.7975	2836829	1214186	6532	1059				0			780	1587	1315		
COSHOCTON	WHITE EYES	3403122724	2200040	237440	N	40.3161	81.7828	2841379	1210136	6603	1048				0		99	782	1576	1347		
COSHOCTON	WHITE EYES	3403122725	2198250	238400	N	40.3189	81.7892	2839483	1211158	6302	855				0			792	1572	1316		
COSHOCTON	TUSCARAWAS	3403122733	2189050	220450	N	40.2697	81.8225	2832298	1193203	6379	1038				0			767	1569	1276		
COSHOCTON	WHITE EYES	3403122735	2199500	239500	N	40.3217	81.7844	2840699	1212179	6389	938				0			790	1591	1318		
COSHOCTON	WHITE EYES	3403122736	2196300	237350	N	40.3161	81.7961	2837685	1210136	6220	829				0				1582	1300		
COSHOCTON	TUSCARAWAS	3403122753	2184550	210400	N	40.2422	81.8389	2828890	1183168	6371	1032				0			776	1565	1271		
COSHOCTON	OXFORD	3403122757	2218860	209250	N	40.2383	81.7161	2863205	1181744	6754	854				0		99	853	1587	1404		
COSHOCTON	TUSCARAWAS	3403122758	2188700	222150	N	40.2744	81.8239	2831712	1194918	6375	1048				0			781	1583	1272		
COSHOCTON	TUSCARAWAS	3403122765	2188050	223700	N	40.2786	81.8261	2830924	1196451	6382	1046				0			785	1589	1272		
COSHOCTON	WHITE EYES	3403122768	2198950	232750	N	40.3033	81.7867	2840835	1205465	6655	1045				0		74	792	1604	1314		
COSHOCTON	TUSCARAWAS	3403122775	2191000	220550	N	40.27	81.8156	2834203	1193313	6326	968				0			778	1570	1288		
COSHOCTON	TUSCARAWAS	3403122793	2186950	219250	N	40.2664	81.83	2830351	1191999	6428	1028				0			773	1570	1271		
COSHOCTON	TUSCARAWAS	3403122823	2178800	215550	N	40.2564	81.8558	2823597	1188350						0							
COSHOCTON	WHITE EYES	3403122828	2197350	241300	N	40.3267	81.7922	2838322	1214004	6281	857				0				1585	1326		
COSHOCTON	WHITE EYES	3403122837	2199800	235600	N	40.3111	81.7836	2841368	1208311	6468	1020				0					1342		
COSHOCTON	WHITE EYES	3403122838	2200850	233850	N	40.3064	81.78	2842566	1206596	6600	1071				0			796	1582	1354		
COSHOCTON	CRAWFORD	3403122863	2214900	273350	N	40.4144	81.7283	2852349	1246008		1127				0							

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)								
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	LAFAYETTE	3403122888	2193100	219070	N	40.2658	81.8081	2836485	1191780	6482	970				0		91	792	1568	1281		
COSHOCTON	WHITE EYES	3403122895	2202530	240650	N	40.325	81.7736	2843559	1213384						0							
COSHOCTON	WHITE EYES	3403122913	2205070	245750	N	40.3389	81.7644	2845528	1218456	6483	953				0			793	1593	1353		
COSHOCTON	TUSCARAWAS	3403122917	2189650	228700	N	40.2925	81.8203	2831953	1201523	6242	770				0		113	781	1567	1274		
COSHOCTON	WHITE EYES	3403122919	2196250	249000	N	40.3481	81.7958	2836421	1221813	6614	1106				0		88	770	1573	1311		
COSHOCTON	TUSCARAWAS	3403122921	2178420	215640	N	40.2567	81.8681	2820165	1188459	3864	753				0							
COSHOCTON	TUSCARAWAS	3403122935	2187370	217230	N	40.2608	81.8286	2830975	1189955	6231	1108				0			735	1562	1282		
COSHOCTON	TUSCARAWAS	3403122951	2189820	213160	N	40.2497	81.82	2833832	1185905	6515	1046				0			782	1566	1278		
COSHOCTON	LAFAYETTE	3403122955	2196460	217550	N	40.2617	81.7961	2839973	1190284	6441	927				0			784	1573	1296		
COSHOCTON	TUSCARAWAS	3403122968	2189700	206980	N	40.2328	81.8206	2834374	1179737	6459	969				0			792	1564	1279		
COSHOCTON	WHITE EYES	3403122970	2201800	254570	N	40.3631	81.7758	2841396	1227287	6479	1044				0			770	1595	1349		
COSHOCTON	CRAWFORD	3403123080	2211250	272200	N	40.4114	81.7414	2848843	1244913						0							
COSHOCTON	CRAWFORD	3403123081	2212150	269450	N	40.4036	81.7383	2850034	1242067						0							
COSHOCTON	WHITE EYES	3403123091	2202440	235050	N	40.3094	81.7742	2844051	1207691						0							
COSHOCTON	KEENE	3403123092	2180170	235180	N	40.3103	81.8539	2821871	1208019	6314	948				0		69	761	1554	1258		
COSHOCTON	LAFAYETTE	3403123118	2195250	230300	N	40.2967	81.8	2837417	1203056						0							
COSHOCTON	WHITE EYES	3403123129	2205310	255600	N	40.3658	81.7633	2844696	1228273	6548	975				0		50	790	1598	1357		
COSHOCTON	WHITE EYES	3403123138	2212150	240540	N	40.3244	81.7392	2853139	1213165	6714	888				0		99	781	1596	1364		
COSHOCTON	TUSCARAWAS	3403123168	2176225	214065	N	40.2525	81.8686	2820201	1186926						0							
COSHOCTON	WHITE EYES	3403123169	2201750	242720	N	40.3306	81.7764	2842546	1215427	6626	1121				0			790	1573	1359		
COSHOCTON	TUSCARAWAS	3403123178	2184465	227810	N	40.29	81.8389	2826889	1200611						0							
COSHOCTON	LAFAYETTE	3403123197	2195250	230390	N	40.2969	81.8	2837409	1203129	6396	816				0		94	772	1539	1326		
COSHOCTON	WHITE EYES	3403123212	2201085	245820	N	40.3392	81.7786	2841572	1218568	6759	1138				0		85	791	1592	1344		
COSHOCTON	WHITE EYES	3403123213	2202765	249225	N	40.3483	81.7725	2842882	1221886	6568	1080				0			786	1595	1351		
COSHOCTON	WHITE EYES	3403123241	2200975	235950	N	40.3119	81.7794	2842501	1208603	6725	1100				0		108	782	1577	1347		
COSHOCTON	WHITE EYES	3403123244	2202450	237050	N	40.315	81.7742	2843815	1209734	6613	1027				0			793	1584	1354		
COSHOCTON	LAFAYETTE	3403123261	2202400	211150	N	40.2439	81.775	2846589	1183788	6720	1012				0		98	824	1570	1343		
COSHOCTON	WHITE EYES	3403123276	2203750	242180	N	40.3292	81.7692	2844604	1214916	6540	1000				0				1591	1352		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)								
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	WHITE EYES	3403123277	2209880	253860	N	40.3611	81.7469	2849448	1226557	6405	830				0			788	1600	1363		
COSHOCTON	WHITE EYES	3403123319	2183090	234000	N	40.3069	81.8436	2824875	1206778	6292	867				0			775	1575	1290		
COSHOCTON	WHITE EYES	3403123321	2203510	233220	N	40.3044	81.7703	2845345	1205866	6641	1046				0		94	792	1586	1353		
COSHOCTON	KEENE	3403123322	2189280	231700	N	40.3006	81.8214	2831307	1204479	6202	780				0		96	774	1556	1273		
COSHOCTON	ADAMS	3403123343	2220810	234960	N	40.3089	81.7083	2862380	1207508	6906	998				0		102	837	1600	1412		
COSHOCTON	LAFAYETTE	3403123347	2195560	228120	N	40.2906	81.7992	2837896	1200830	6202	766				0			790	1559	1302		
COSHOCTON	LAFAYETTE	3403123377	2194750	222815		40.2761	81.8021	2837700	1195539	7449	970			506	0	454	98	790	1570	1277	1660	75
COSHOCTON	FRANKLIN	3403123462	2180960	192450		40.1831	81.8523	2827215	1165250	7536	879	-6671	100	636	0	448	80	786	1574	1268	1550	69
COSHOCTON	FRANKLIN	3403123464	2182260	201650	N	40.2183	81.8475	2827498	1174446	6620	885				0		67	792	1581	1261		
COSHOCTON	WHITE EYES	3403123474	2217260	240070	N	40.3231	81.7208	2858305	1212690	6724	888				0		96	808	1607	1385		
COSHOCTON	ADAMS	3403123478	2221000	255900	N	40.3664	81.7069	2860326	1228492	6750	1087				0				1614	1391		
COSHOCTON	ADAMS	3403123486	2221950	249175	N	40.3478	81.7039	2861950	1221704	6850	1068				0			804	1606	1390		
COSHOCTON	KEENE	3403123493	2191000	256300	N	40.3681	81.8144	2830415	1229112	6302	990				0			752	1534	1286		
COSHOCTON	ADAMS	3403123494	2220650	254010	N	40.3611	81.7083	2860163	1226557	6863	1037				0		109	804	1611	1392		
COSHOCTON	ADAMS	3403123495	2232150	246250	N	40.3394	81.6672	2872498	1218639	6923	1068				0			850	1621	1424		
COSHOCTON	ADAMS	3403123500	2228150	248775	N	40.3467	81.6814	2868244	1221303	6863	948				0		114	815	1614	1407		
COSHOCTON	ADAMS	3403123529	2219800	251670	N	40.3547	81.7114	2859574	1224222	6623	970				0				1609	1393		
COSHOCTON	JACKSON	3403123541	2170000	212160	N	40.2475	81.8911	2814153	1185102	6135	846						52	777	1531	1233		
COSHOCTON	ADAMS	3403123548	2231600	252730	N	40.3572	81.6689	2871266	1225134	6924	1068				0			814	1620	1420		
COSHOCTON	ADAMS	3403123573	2229400	245350	N	40.3372	81.6772	2869814	1217836						0							
COSHOCTON	ADAMS	3403123580	2222870	231810	N	40.3003	81.7011	2864745	1204370	6902	1010				0			848	1603	1409		
COSHOCTON	TUSCARAWAS	3403123615	2185500	206440	N	40.2314	81.8356	2830260	1179226	4176	928				0					1268		
COSHOCTON	ADAMS	3403123622	2219600	249350	N	40.3483	81.7122	2859624	1221886	7055	1040				0		114	794	1606	1379		
COSHOCTON	CRAWFORD	3403123626	2211900	263250	N	40.3867	81.7394	2850445	1235900						0							
COSHOCTON	WHITE EYES	3403123632	2218300	254000	N	40.3611	81.7167	2857831	1226557	6616	938				0			785	1605	1383		
COSHOCTON	KEENE	3403123635	2189250	234600	N	40.3086	81.8214	2830971	1207399	6233	800				0		70	778	1570	1280		
COSHOCTON	CRAWFORD	3403123640	2216000	264300	N	40.4444	81.7239	2852295	1256956	6678	1149				0			755	1620	1369		
COSHOCTON	TUSCARAWAS	3403123658	2180310	210200	N	40.2417	81.8542	2824656	1182985	6167	890				0			769	1548	1251		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lat-itude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	LAFAYETTE	3403123668	2201090	214200	N	40.2522	81.7797	2844833	1186817	6518	932				0			791	1583	1358		
COSHOCTON	LAFAYETTE	3403123669	2201000	217610	N	40.2617	81.7797	2844533	1190284	6573	897				0		105	802	1572	1358		
COSHOCTON	TUSCARAWAS	3403123671	2191080	228800	N	40.2925	81.815	2833426	1201523	6124	769				0				1592	1293		
COSHOCTON	FRANKLIN	3403123686	2170190	193500	N	40.1961	81.8908	2816375	1166344	6161	745				0		68	777	1529	1233		
COSHOCTON	LAFAYETTE	3403123689	2204290	211855	N	40.2458	81.7683	2848372	1184481	4162	970				0							
COSHOCTON	WHITE EYES	3403123753	2193700	254780	N	40.3639	81.805	2833201	1227579	6556	1029				0			749	1554	1310		
COSHOCTON		3403123787	2153500	250325	N	40.3525	81.9492	2793644	1223419	6310	786					400	0	752	1512	1190		
COSHOCTON	TUSCARAWAS	3403123804	2187390	216030	N	40.2578	81.8286	2831101	1188860	6489	998				0		86			1282		
COSHOCTON	WHITE EYES	3403123820	2217080	250350	N	40.3511	81.7211	2857034	1222908	6638	920				0				1554	1373		
COSHOCTON	KEENE	3403123825	2189700	253495	N	40.3606	81.8194	2829343	1226375	6414	1008				0		89	745	1570	1292		
COSHOCTON	WHITE EYES	3403123857	2216150	255500	N	40.3653	81.7244	2855515	1228090	6732	1008				0		86	794	1614	1382		
COSHOCTON	ADAMS	3403123891	2224380	245800	N	40.3386	81.6953	2864729	1218347	6904	990				0			822	1622	1402		
COSHOCTON	ADAMS	3403123892	2226500	251275	N	40.3536	81.6872	2866339	1223821	6880	997				0		140	800	1612	1397		
COSHOCTON	ADAMS	3403123893	2238725	252870	N	40.3575	81.6433	2878360	1225244	6815	891				0			856	1623	1426		
COSHOCTON	ADAMS	3403123895	2223300	256030	N	40.3667	81.6988	2862617	1228601	6892	1037				0		110	802	1613	1403		
COSHOCTON	ADAMS	3403123934	2234680	237700	N	40.3161	81.6586	2875880	1210136	6909	865				0			850	1628	1432		
COSHOCTON	TUSCARAWAS	3403123947	2190230	224030	N	40.2794	81.8183	2833058	1196743	6306	887				0		71	794	1578	1279		
COSHOCTON	LAFAYETTE	3403123967	2199400	217460	N	40.2614	81.7656	2842905	1190174	6494	1022				0			752	1568	1334		
COSHOCTON	TUSCARAWAS	3403123981	2189820	212030	N	40.2467	81.82	2833958	1184810	6503	997				0		79	785	1569	1282		
COSHOCTON	KEENE	3403124047	2192100	253330	N	40.36	81.8108	2831755	1226156	6505	1020				0		67	754	1561	1292		
COSHOCTON	CRAWFORD	3403124073	2202645	258920	N	40.375	81.7728	2841671	1231630	6364	860				0		112	725	1589	1348		
COSHOCTON	ADAMS	3403124092	2236780	253325	N	40.3589	81.6503	2876357	1225755	7000	1030				0			869	1634	1428		
COSHOCTON	ADAMS	3403124093	2227500	253820	N	40.3606	81.6836	2867041	1226375	6732	910				0			806	1618	1396		
COSHOCTON	ADAMS	3403124094	2238060	249400	N	40.3481	81.6458	2878068	1221813	6882	850				0			894	1658	1420		
COSHOCTON	ADAMS	3403124107	2240100	253650	N	40.3597	81.6386	2879571	1226047	6929	894				0							
COSHOCTON	KEENE	3403124118	2185690	256710		40.3693	81.8336	2825035	1229550	7347	852	-6412	112	642	0	451	51	756	1579	1275	1420	159
COSHOCTON	ADAMS	3403124119	2224750	239700	N	40.3217	81.6939	2865836	1212179	6732	851				0			834	1613	1414		
COSHOCTON	WHITE EYES	3403124282	2204220	239460	N	40.3217	81.7678	2845310	1212179	6772	1123				0		87	798	1586	1360		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	ADAMS	3403124283	2235500	234930	N	40.3083	81.6556	2877046	1207289	6816	814				0				1659	1439		
COSHOCTON	JACKSON	3403124309	2174870	207330	N	40.2339	81.8736	2819586	1180139													
COSHOCTON	ADAMS	3403124335	2241395	248180	N	40.3447	81.6342	2881434	1220573	7052	885				0		122	893	1634	1442		
COSHOCTON	JACKSON	3403124350	2175005	225350	N	40.2836	81.8728	2817735	1198276	6160	740						56	781	1551	1240		
COSHOCTON	CRAWFORD	3403124443	2198900	267080	N	40.3975	81.7858	2837113	1239841	6624	1146				0		55	781	1596	1340		
COSHOCTON	WHITE EYES	3403124546	2207440	245490	N	40.3381	81.7558	2847950	1218164	6620	979				0		81	789	1598	1354		
COSHOCTON	FRANKLIN	3403124548	2178400	195800	N	40.2022	81.8614	2824303	1168571	6282	880				0			794	1558	1256		
COSHOCTON	WHITE EYES	3403124590	2199055	233310	N	40.3047	81.7864	2840859	1205976	6708	1103				0		72	792	1597	1771		
COSHOCTON	TUSCARAWAS	3403124610	2185050	213900	N	40.2519	81.8372	2828957	1186707	6447	918				0		86	780	1572	1271		
COSHOCTON	ADAMS	3403124738	2239200	254910	N	40.3631	81.6417	2878565	1227287	6830	903				0				1634	1440		
COSHOCTON	CRAWFORD	3403124742	2218970	259680	N	40.3767	81.7142	2857862	1232250	6762	994				0			797	1618	1384		
COSHOCTON	KEENE	3403124759	2192250	248000	N	40.3453	81.8103	2832512	1220792	6476	978						72			1303		
COSHOCTON	ADAMS	3403124790	2221370	233035	N	40.3036	81.7064	2883133	1205574	6678	850				0			835	1599	1404		
COSHOCTON	TUSCARAWAS	3403124824	2186120	225900	N	40.2847	81.8331	2828723	1198677	6529	1049				0		81	777	1579	1270		
COSHOCTON	KEENE	3403125050	2191120	254960	N	40.3644	81.8142	2830626	1227762	6428	1086				0		93	740	1559	1291		
COSHOCTON	WHITE EYES	3403125083	2218500	250300	N	40.3511	81.7161	2858422	1222908	6715	891				0		99	804	1614	1386		
COSHOCTON	ADAMS	3403125120	2234513	247170	N	40.3419	81.6589	2874696	1219551	6814	1038				0				1631	1442		
COSHOCTON	CRAWFORD	3403125127	2214000	272200	N	40.4111	81.7317	2851546	1244804	6804	1128				0			790	1625	1367		
COSHOCTON	WHITE EYES	3403125252	2213810	246490	N	40.3406	81.7331	2854147	1219076	6651	892				0			793	1625	1370		
COSHOCTON	TUSCARAWAS	3403125298	2191125	229925	N	40.2958	81.815	2833287	1202728						0							
COSHOCTON	TUSCARAWAS	3403125299	2189450	230475	N	40.2972	81.8208	2831617	1203239	6083	778				0				1565	1273		
COSHOCTON	WHITE EYES	3403125515	2188180	235890	N	40.3119	81.7884	2839723	1208603	6584	1034				0		93	787	1585	1323		
COSHOCTON	WHITE EYES	3403125526	2193500	257150	N	40.3703	81.8056	2832765	1229915	6555	1192				0			767	1572	1301		
COSHOCTON	ADAMS	3403125530	2240590	256270	N	40.3669	81.6367	2879790	1228674	7120	1063				0			864	1673	1446		
COSHOCTON	ADAMS	3403125531	2228275	247050	N	40.3419	81.6811	2868531	1219551	6848	984				0			817	1620	1414		
COSHOCTON	WHITE EYES	3403125538	2196770	234450	N	40.3081	81.7944	2838494	1207216	6470	925				0			778	1575	1309		
COSHOCTON	ADAMS	3403125543	2237730	255130	N	40.3639	81.6469	2877087	1227579	4650	908				0					1435		
COSHOCTON	ADAMS	3403125548	2222600	254110	N	40.3614	81.7014	2862066	1226687	6888	1118				0				1599	1396		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)								
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	LAFAYETTE	3403125555	2212310	227040	N	40.2872	81.7389	2854797	1199589	6468	781				0					1362		
COSHOCTON	CRAWFORD	3403125585	2213950	277100	N	40.4247	81.7317	2850969	1249767	6881	946				0		111	792	1607	1356		
COSHOCTON	WHITE EYES	3403125653	2201300	248730	N	40.3472	81.7778	2841456	1221485	6684	1133				0		91	781	1589	1340		
COSHOCTON	KEENE	3403125659	2192100	251800	N	40.3558	81.8108	2831932	1224623	6310	988				0					1297		
COSHOCTON	CRAWFORD	3403125687	2216680	278350	N	40.4281	81.7217	2853598	1251008	7109	1116				0		116	778	1619	1367		
COSHOCTON	CRAWFORD	3403125695	2215025	267575	N	40.3966	81.7281	2853076	1240242	7083	1100				0		101	790	1614	1368		
COSHOCTON	CRAWFORD	3403125709	2217950	278350	N	40.4281	81.7172	2854846	1251008	6865	1083				0		110	789	1605	1368		
COSHOCTON	ADAMS	3403125787	2240780	249830	N	40.3492	81.6381	2880714	1222215	7051	990				0			885	1629	1434		
COSHOCTON	ADAMS	3403125796	2237400	243000	N	40.3306	81.6486	2878038	1215427	7014	968				0			865	1634	1425		
COSHOCTON	ADAMS	3403125803	2223110	252580	N	40.3572	81.6994	2862799	1225134	6900	1093				0			814	1610	1399		
COSHOCTON	ADAMS	3403125809	2239960	247210	N	40.3419	81.6392	2880166	1219551	6926	850				0			886	1638	1436		
COSHOCTON	TUSCARAWAS	3403125810	2189620	227680	N	40.2694	81.8203	2832083	1200392	6073	767				0				1568	1279		
COSHOCTON	ADAMS	3403125814	2220889	238781	N	40.3194	81.7078	2862073	1211340	6674	830				0			820	1612	1390		
COSHOCTON	WHITE EYES	3403125818	2200560	247700	N	40.3442	81.7806	2840805	1220390	6725	1155				0		78	790	1589	1338		
COSHOCTON	ADAMS	3403125849	2238600	244050	N	40.3333	81.6442	2879145	1216413	7052	835				0		115	878	1638	1425		
COSHOCTON	ADAMS	3403125852	2243700	239250	N	40.32	81.6261	2884741	1211559	7260	1148				0			870	1678	1445		
COSHOCTON	WHITE EYES	3403125884	2212325	256685	N	40.3686	81.7381	2851573	1229294	6564	970							780	1593	1371		
COSHOCTON	ADAMS	3403125885	2240080	251370	N	40.3533	81.6386	2879845	1223711	7126	1050				0			911	1622	1431		
COSHOCTON	CRAWFORD	3403125886	2212250	258630	N	40.3739	81.7383	2851293	1231229	6862	1030				0			777	1608	1364		
COSHOCTON	ADAMS	3403125887	2241400	250790	N	40.3517	81.6339	2881218	1223127	7147	1080				0			881	1633	1443		
COSHOCTON	ADAMS	3403125889	2239430	256350	N	40.3669	81.6408	2878652	1228674	7290	860				0	372	111	861	1640	1448		
COSHOCTON	ADAMS	3403125890	2241985	247375	N	40.3425	81.6319	2882167	1219770	7163	1055				0			889	1640	1448		
COSHOCTON	CRAWFORD	3403125896	2214600	283350	N	40.4419	81.7292	2850932	1256044	6811	1059				0							
COSHOCTON	CRAWFORD	3403125902	2211350	278400	N	40.4283	81.7408	2848293	1251081						0							
COSHOCTON	ADAMS	3403125905	2241370	245800	N	40.3375	81.6342	2881742	1217945	6924	915				0				1635	1437		
COSHOCTON	ADAMS	3403125906	2237350	239850	N	40.3219	81.6489	2878327	1212252	6938	866				0			69	2440	1426		
COSHOCTON	ADAMS	3403125907	2244130	250695	N	40.3514	81.6242	2883924	1223018	7099	945				0			884	1642	1448		
COSHOCTON	ADAMS	3403125908	2241960	238965	N	40.3192	81.6322	2883060	1211267	7230	1100				0			901	1638	1438		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)								
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	OXFORD	3403125911	2238810	228570	N	40.2908	81.6439	2881044	1200903	7202	915				0		97	877	1642	1443		
COSHOCTON	ADAMS	3403125926	2240090	238700	N	40.3186	81.6392	2881162	1211048	7090	850				0		109	884	1642	1435		
COSHOCTON	ADAMS	3403125929	2238870	248210	N	40.3447	81.6431	2878963	1220573	6950	880				0			881	1635	1426		
COSHOCTON	ADAMS	3403125933	2244020	253520	N	40.3592	81.6244	2883534	1225864	7236	1103				0		103	887	1637	1447		
COSHOCTON	ADAMS	3403125934	2245260	249190	N	40.3472	81.62	2885270	1221485	7166	1040				0			902	1638	1446		
COSHOCTON	ADAMS	3403125935	2245490	254030	N	40.3606	81.6192	2884918	1226375	7102	1075				0			888	1634	1451		
COSHOCTON	ADAMS	3403125936	2243930	248000	N	40.3439	81.625	2884023	1220281	6928	980				0				1638	1445		
COSHOCTON	ADAMS	3403125937	2243720	237520	N	40.3153	81.6261	2884942	1209844	7305	1100				0		100	896	1648	1444		
COSHOCTON	ADAMS	3403125940	2240000	240620	N	40.3239	81.6392	2880935	1212982	7100	1000				0			878	1638	1432		
COSHOCTON	WHITE EYES	3403125953	2209630	243180	N	40.3317	81.7481	2850359	1215829	6594	853				0		93	785	1603	1370		
COSHOCTON	WHITE EYES	3403125955	2194940	252070	N	40.3564	81.8006	2834738	1224842	6534	1130				0		84	767	1551	1304		
COSHOCTON	CRAWFORD	3403125957	2215260	260400	N	40.4336	81.7267	2851878	1253015	6890	1087				0			785	1611	1376		
COSHOCTON	JACKSON	3403125958	2165050	218370	N	40.2644	81.9086	2808584	1191269	6135	1075						47	771	1540	1206		
COSHOCTON	ADAMS	3403125960	2221380	252375	N	40.3567	81.7056	2861099	1224952	6872	1040				0		124	793	1605	1392		
COSHOCTON	ADAMS	3403125962	2240175	245530	N	40.3372	81.6386	2880533	1217836	6899	860				0			876	1637	1435		
COSHOCTON	ADAMS	3403125963	2240000	236190	N	40.3117	81.6394	2881401	1208530	7115	980				0			875	1645	1428		
COSHOCTON	WHITE EYES	3403125978	2208950	257420	N	40.3708	81.75	2848177	1230097	6459	840				0		66	789	1605	1370		
COSHOCTON	TUSCARAWAS	3403125979	2181480	209480	N	40.2397	81.85	2825908	1182255	6487	1035				0		68	783	1564	1250		
COSHOCTON	ADAMS	3403125980	2240380	235040	N	40.3086	81.6381	2881895	1207399	7319	1088				0		105	910	1687	1441		
COSHOCTON	LAFAYETTE	3403125981	2193700	208320	N	40.2364	81.8064	2838172	1181051	6558	1028				0			798	1574	1295		
COSHOCTON	ADAMS	3403125988	2245350	241490	N	40.3261	81.62	2886174	1213785	7258	1068				0			915	1654	1456		
COSHOCTON	ADAMS	3403125989	2242390	241550	N	40.3264	81.6308	2883161	1213895	7127	898				0		123			1447		
COSHOCTON	FRANKLIN	3403125992	2189200	204400	N	40.2256	81.8225	2834147	1177110	6481	1008				0			804	1572	1278		
COSHOCTON	ADAMS	3403125993	2241230	242900	N	40.33	81.6347	2881924	1215208	7020	930				0			885	1644	1439		
COSHOCTON	ADAMS	3403125994	2245335	242840	N	40.3297	81.62	2886019	1215099	7255	1115				0			899	1646	1454		
COSHOCTON	ADAMS	3403125995	2244025	245610	N	40.3375	81.6247	2884380	1217945	7125	1035				0			882	1636	1446		
COSHOCTON	TUSCARAWAS	3403125998	2191100	226870	N	40.2872	81.815	2833648	1199589	6165	768				0			782	1562	1271		
COSHOCTON	OXFORD	3403126002	2242800	220600	N	40.2989	81.63	2885842	1192911	7050	793				0			1041	1564	1442		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)								
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	OXFORD	3403126003	2238850	217820	N	40.2614	81.6442	2882215	1190174	7034	818				0	88		894	1629	1460		
COSHOCTON	ADAMS	3403126005	2244080	244470	N	40.3344	81.6244	2884596	1216814	7157	1050				0			895	1637	1449		
COSHOCTON	OXFORD	3403126006	2238000	211950	N	40.2453	81.6475	2881984	1184299	7358	1043				0	86		813	1771	1478		
COSHOCTON	TUSCARAWAS	3403126007	2178280	208500	N	40.2372	81.8614	2822842	1181343	6231	758				0	69		784	1551	1245		
COSHOCTON	WHITE EYES	3403126009	2197500	243670	N	40.3333	81.7917	2838183	1216413	6588	1075				0			796	1565	1314		
COSHOCTON	OXFORD	3403126014	2232790	217550	N	40.2608	81.6658	2876236	1189955	6999	813				0	100		887	1611	1458		
COSHOCTON	ADAMS	3403126020	2242970	253520	N	40.3592	81.6281	2882507	1225864	7212	1058				0			888	1646	1447		
COSHOCTON	ADAMS	3403126021	2242860	251860	N	40.3547	81.6286	2882561	1224222	7242	1048				0	119		884	1658	1448		
COSHOCTON	ADAMS	3403126022	2241380	251880	N	40.3547	81.6339	2881090	1224222	7224	1088				0	113		888	1631	1446		
COSHOCTON	ADAMS	3403126024	2242760	244750	N	40.335	81.6292	2883238	1217033	7062	1050				0				1638	1443		
COSHOCTON	WHITE EYES	3403126025	2215340	253790	N	40.3606	81.7272	2854938	1226375	6811	1000				0	72		798	1606	1386		
COSHOCTON	OXFORD	3403126026	2240980	220620	N	40.2689	81.6367	2883980	1192911	7004	788				0			894	1678	1526		
COSHOCTON	OXFORD	3403126027	2240000	218080	N	40.2619	81.64	2883361	1190357	7010	798				0	87		887	1633	1571		
COSHOCTON	OXFORD	3403126029	2241950	229650	N	40.2936	81.6328	2884008	1201925	7079	868				0			897	1671	1445		
COSHOCTON	OXFORD	3403126030	2237380	226390	N	40.285	81.6492	2879818	1198787	7150	908				0	103		900	1674	1452		
COSHOCTON	WHITE EYES	3403126032	2211750	251858	N	40.3556	81.7403	2851513	1224550	6547	877				0			769	1598	1357		
COSHOCTON	WHITE EYES	3403126033	2211156	250311	N	40.3511	81.7425	2851093	1222908	6656	980				0	71		800	1605	1360		
COSHOCTON	ADAMS	3403126035	2235575	232350	N	40.3014	81.6556	2877340	1204771	7117	995				0	107		862	1629	1438		
COSHOCTON	LAFAYETTE	3403126043	2194800	218720	N	40.265	81.8028	2837972	1191488	6625	1060				0	89		794	1573	1283		
COSHOCTON	TUSCARAWAS	3403126047	2191270	223630	N	40.2783	81.8144	2834189	1196341	6567	1018				0	77		790	1582	1284		
COSHOCTON	OXFORD	3403126048	2244800	217000	N	40.2589	81.6231	2888188	1189262	7039	808				0			917	1636	1470		
COSHOCTON	ADAMS	3403126049	2235725	242825	N	40.33	81.6544	2876453	1215208	6990	995				0			869	1645	1529		
COSHOCTON	OXFORD	3403126050	2231930	229880	N	40.2947	81.6686	2874014	1202326	6979	858				0	99		859	1627	1441		
COSHOCTON	ADAMS	3403126051	2230335	239830	N	40.3219	81.6739	2871383	1212252	6973	1005				0			823	1618	1428		
COSHOCTON	LAFAYETTE	3403126056	2202970	228450	N	40.2914	81.7725	2845282	1201122	6356	780				0	101		779				
COSHOCTON	LAFAYETTE	3403126059	2204680	221410	N	40.2719	81.7667	2847717	1194006	4200	815				0					1364		
COSHOCTON	CRAWFORD	3403126064	2210380	269050	N	40.4028	81.7447	2848292	1241775	6748	1084				0	120		769	1610	1345		
COSHOCTON	OXFORD	3403126069	2231250	227300	N	40.2875	81.6711	2873628	1199699	7160	1003				0	100		977	1512	1429		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	OXFORD	3403126071	2242560	226430	N	40.2647	81.6306	2885000	1198677	7063	873				0			907	1644	1460		
COSHOCTON	WHITE EYES	3403126072	2215280	246500	N	40.3406	81.7278	2855619	1219078	6648	860				0		77	804	1608	1373		
COSHOCTON	CRAWFORD	3403126073	2208100	269100	N	40.4028	81.7528	2846045	1241775	6464	856				0		78	794	1598	1346		
COSHOCTON	CRAWFORD	3403126074	2209480	264900	N	40.3914	81.7481	2847832	1237615	6500	871				0			759	1610	1347		
COSHOCTON	LAFAYETTE	3403126081	2195510	215950	N	40.2572	81.7894	2839245	1188642	6566	990				0		96	752	1566	1340		
COSHOCTON	LAFAYETTE	3403126085	2207210	213610	N	40.2506	81.7578	2851089	1186233	6588	940				0			836	1570	1366		
COSHOCTON	LAFAYETTE	3403126086	2198780	207180	N	40.2331	81.7881	2843400	1179847	6764	1048				0		102	813	1567	1309		
COSHOCTON	ADAMS	3403126087	2220110	246660	N	40.3408	81.7106	2860387	1219149	6748	960				0			793	1605	1389		
COSHOCTON	WHITE EYES	3403126088	2197125	250500	N	40.3519	81.7928	2837093	1223200	6864	1150				0		74	774	1585	1318		
COSHOCTON	ADAMS	3403126089	2231390	239550	N	40.3211	81.6703	2872417	1211960	6885	890				0			850	1636	1422		
COSHOCTON	TUSCARAWAS	3403126090	2173760	199990	N	40.2139	81.8778	2819252	1172840	6248	848				0		87	783	1558	1249		
COSHOCTON	FRANKLIN	3403126091	2190500	200450	N	40.2147	81.8181	2835828	1173132	6598	1008				0		83	791	1569	1278		
COSHOCTON	LAFAYETTE	3403126092	2197500	213230	N	40.2497	81.7825	2841479	1185905	6693	1100				0		105	789	1564	1302		
COSHOCTON	OXFORD	3403126093	2232840	228420	N	40.2906	81.6653	2875106	1200830	7063	913				0			863	1633	1441		
COSHOCTON	LAFAYETTE	3403126094	2192430	206890	N	40.2319	81.8108	2837137	1179409	6555	973				0		108	798	1572	1287		
COSHOCTON	LINTON	3403126095	2231800	190000	N	40.1853	81.6706	2878112	1162403	7023	815				0		111	867	1616	1451		
COSHOCTON	CRAWFORD	3403126105	2207000	263850	N	40.3883	81.7569	2845521	1236484	6482	870				0		77	774	1591	1352		
COSHOCTON	CRAWFORD	3403126106	2207200	275000	N	40.4192	81.7558	2844518	1247760						0							
COSHOCTON	CRAWFORD	3403126107	2199800	270650	N	40.4072	81.7825	2837619	1243361	6825	1047				0		56	778	1590	1331		
COSHOCTON	ADAMS	3403126109	2243850	244510	N	40.3344	81.6253	2884348	1216814	7141	1045				0			896	1631	1450		
COSHOCTON	OXFORD	3403126111	2229070	224000	N	40.2786	81.6792	2871753	1196451	6839	798				0		92	858	1623	1425		
COSHOCTON	OXFORD	3403126112	2227470	225820	N	40.2836	81.6847	2870012	1198278	6839	788				0		98	867	1627	1224		
COSHOCTON	OXFORD	3403126113	2227180	222790	N	40.2753	81.6858	2870059	1195247	6917	798				0		97	869	1623	1427		
COSHOCTON	OXFORD	3403126115	2242050	212030	N	40.2453	81.6331	2885989	1184299	7364	1068				0			928	1666	1478		
COSHOCTON	OXFORD	3403126116	2231550	215190	N	40.2542	81.6706	2875182	1187547	6962	940				0			893	1642	1445		
COSHOCTON	OXFORD	3403126117	2239500	229800	N	40.2942	81.6414	2881593	1202144	6998	848				0			883	1639	1440		
COSHOCTON	OXFORD	3403126118	2229300	215190	N	40.2544	81.6786	2872950	1187620	6962	1040				0			892	1643	1445		
COSHOCTON	OXFORD	3403126120	2238140	213320	N	40.2492	81.6542	2879955	1185722	7022	863				0			918	1678	1452		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)								
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	OXFORD	3403126121	2234950	216620	N	40.2581	81.6583	2878436	1188970	6928	955				0			866	1674	3454		
COSHOCTON	OXFORD	3403126122	2244690	226240	N	40.2842	81.6231	2887106	1198495	7300	1068				0				1648	1446		
COSHOCTON	OXFORD	3403126126	2241700	217050	N	40.2592	81.6342	2885089	1189371	7090	798				0		87	907	1639	1475		
COSHOCTON	OXFORD	3403126127	2242790	218770	N	40.2639	81.63	2886056	1191087	7013	788				0			931	1672	1483		
COSHOCTON	OXFORD	3403126128	2223550	222710	N	40.2753	81.6989	2866418	1195247	6781	783				0		98	869	1624	1417		
COSHOCTON	OXFORD	3403126129	2222450	224610	N	40.2803	81.7028	2865122	1197071	6715	783				0		102	842	1628	1419		
COSHOCTON	WHITE EYES	3403126135	2212645	251010	N	40.3531	81.7369	2852563	1223638	6510	820				0		96	795	1589	1363		
COSHOCTON	VIRGINIA	3403126140	2157460	186190	N	40.1764	81.9367	2804417	1159155	5888	872								1509	1205		
COSHOCTON	VIRGINIA	3403126148	2144200	193500	N	40.1967	81.9839	2790441	1166563	5796	803							760	1497	1169		
COSHOCTON	LAFAYETTE	3403126147	2200050	219900	N	40.2681	81.7831	2843318	1192619	6479	815						106	794	1602	1320		
COSHOCTON	ADAMS	3403126151	2239500	249900	N	40.3494	81.6408	2879401	1222288	7051	1035							890	1633	1414		
COSHOCTON	WHITE EYES	3403126152	2210220	252935	N	40.3583	81.7458	2849872	1225536	6610	950				0		91	779	1595	1356		
COSHOCTON	ADAMS	3403126153	2228700	243790	N	40.3328	81.6797	2869308	1216230	6985	1055							839	1616	1417		
COSHOCTON	ADAMS	3403126158	2242340	239930	N	40.3219	81.6308	2883354	1212252	7040	1078				0				1640	1448		
COSHOCTON	ADAMS	3403126157	2220780	243630	N	40.3325	81.7081	2861433	1216121	6827	1002				0			800	1608	1404		
COSHOCTON	WHITE EYES	3403126160	2203475	235260	N	40.31	81.7706	2845026	1207910	6574	990				0			793	1577	1357		
COSHOCTON	ADAMS	3403126161	2242260	232300	N	40.3011	81.6314	2884077	1204662	7263	1095				0			910	1641	1438		
COSHOCTON	LAFAYETTE	3403126167	2204650	215970	N	40.2572	81.7669	2848281	1188642	6500	880				0			784	1578	1361		
COSHOCTON	WHITE EYES	3403126182	2214300	234150	N	40.3067	81.7317	2855972	1206705	6753	1010				0			816	1601	1379		
COSHOCTON	CRAWFORD	3403126184	2213700	264410	N	40.3897	81.7328	2852149	1236994	6600	950				0			799	1625	1376		
COSHOCTON	WHITE EYES	3403126186	2199730	242700	N	40.3306	81.7836	2840546	1215427	6615	1070				0			800	1584	1333		
COSHOCTON	ADAMS	3403126187	2221930	256840	N	40.3689	81.7036	2861136	1229404	6801	1057				0			803	1614	1390		
COSHOCTON	ADAMS	3403126188	2236330	252000	N	40.3553	81.6519	2876067	1224441	6995	1040				0			843	1639	1427		
COSHOCTON	LINTON	3403126192	2202120	196430	N	40.2036	81.7764	2847896	1169081	6573	885				0			817	1571	1338		
COSHOCTON	LINTON	3403126193	2198520	196680	N	40.2042	81.7894	2844253	1169300	6757	1081				0			807	1580	1310		
COSHOCTON	OXFORD	3403126195	2222260	230200	N	40.2658	81.7033	2864325	1202728	6992	998				0		91	846	1605	1428		
COSHOCTON	CRAWFORD	3403126201	2212280	261220	N	40.3811	81.7381	2851043	1233856	6726	1000				0		88	795	1612	1363		
COSHOCTON	LINTON	3403126214	2210660	180610	N	40.16	81.7484	2858082	1153171	6778	936				0			876	1574	1369		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	MILL CREEK	3403126216	2175910	284630	N	40.4461	81.8681	2812243	1257576	6020	1011							756	1580	1244		
COSHOCTON	LINTON	3403126225	2199300	203400	N	40.2228	81.7864	2844306	1176088	6593	1050								1570	1326		
COSHOCTON	ADAMS	3403126226	2242540	243240	N	40.3311	81.63	2883182	1215610	7138	1030							889	1649	1442		
COSHOCTON	LAFAYETTE	3403126227	2211900	212300	N	40.2469	81.7408	2855973	1184883	6560	820							820	1588	1373		
COSHOCTON	KEENE	3403126230	2189740	256365	N	40.3683	81.8192	2829074	1229185	6301	940							742	1586	1288		
COSHOCTON	KEENE	3403126231	2190800	250790	N	40.3531	81.8156	2830713	1223638	6433	1080				0			765	1579	1294		
COSHOCTON	OXFORD	3403126233	2229450	217450	N	40.2606	81.6781	2872825	1189882	6908	837							876	1634	1444		
COSHOCTON	LAFAYETTE	3403126236	2197800	214780	N	40.2539	81.7914	2841608	1187437	6670	1170							793	1576			
COSHOCTON	ADAMS	3403126241	2223180	247750	N	40.3439	81.6994	2883365	1220281	6894	1063				0			826	1614	1399		
COSHOCTON	ADAMS	3403126242	2243710	236310	N	40.3119	81.6261	2885087	1208803	7215	1120								1636	1448		
COSHOCTON	ADAMS	3403126243	2240130	242540	N	40.3292	81.6389	2880792	1214916	6908	856								1640	1430		
COSHOCTON	ADAMS	3403126244	2222080	251390	N	40.3539	81.7033	2861857	1223930	6857	1075							800	1609	1393		
COSHOCTON	WHITE EYES	3403126245	2217640	243520	N	40.3325	81.7194	2858295	1216121	7015	1005				0		101	808	1613	1365		
COSHOCTON	WHITE EYES	3403126246	2199720	249810	N	40.35	81.7836	2839728	1222507	6611	1030							780	1590	1352		
COSHOCTON	CRAWFORD	3403126253	2194950	277560	N	40.4264	81.7997	2832038	1250387	6146	998								1588	1299		
COSHOCTON	KEENE	3403126254	2184910	254360	N	40.3628	81.8364	2824531	1227178	6288	942						101	708	1547	1278		
COSHOCTON	JACKSON	3403126255	2152120	218490	N	40.265	81.955	2785659	1191488	6103	1046						20	763	1540	1177		
COSHOCTON	LAFAYETTE	3403126259	2208475	215640	N	40.2561	81.7531	2852184	1188240	6630	850						97	839	1573	1363		
COSHOCTON	WHITE EYES	3403126261	2208670	252800	N	40.3581	81.7514	2848325	1225463	6322	815								1610	1369		
COSHOCTON	WHITE EYES	3403126262	2208610	251370	N	40.3542	81.7517	2848407	1224039	6428	855							787	1598	1365		
COSHOCTON	OXFORD	3403126263	2245050	228500	N	40.2906	81.6217	2887221	1200830	7304	1080							928	1670	1447		
COSHOCTON	LAFAYETTE	3403126265	2213525	220875	N	40.2703	81.735	2856596	1193422	6890	810						94	835	1598	1362		
COSHOCTON	LAFAYETTE	3403126268	2206950	209680	N	40.2397	81.7589	2851243	1182255	6752	940						101	820	1590	1360		
COSHOCTON	VIRGINIA	3403126269	2155270	188190	N	40.1819	81.9444	2802046	1161162	6080	845						72	742	1506	1198		
COSHOCTON	OXFORD	3403126273	2228050	216310	N	40.2575	81.6831	2871567	1188751	7082	1060							864	1628	1440		
COSHOCTON	LAFAYETTE	3403126278	2214290	217070	N	40.26	81.7322	2857810	1189863													
COSHOCTON	KEENE	3403126282	2182475	251725	N	40.3558	81.8453	2822354	1224623	6160	916						113	715	1549	1263		
COSHOCTON	VIRGINIA	3403126284	2157640	185630	N	40.2022	81.9358	2803589	1168571	6266	996						48	779	1533	1204		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
COSHOCTON	KEENE	3403126285	2182270	251640	N	40.3556	81.8461	2822140	1224550	6094	891							751	1543	1261		
COSHOCTON	ADAMS	3403126290	2241570	255075	N	40.3636	81.6331	2880931	1227470	6858	970								1628	1442		
COSHOCTON	BETHLEHEM	3403126294	2151710	249110	N	40.3492	81.9558	2791949	1222215	5879	800						0	756	1544	1198		
COSHOCTON	BETHLEHEM	3403126295	2150900	250620	N	40.3533	81.9586	2791001	1223711	5841	800									1203		
COSHOCTON		3403126305	2201840	189010	N	40.1831	81.7778	2848369	1161600	6795	870						96	827	1552	1314		
COSHOCTON		3403126306	2202890	192860	N	40.1936	81.7739	2849012	1165432	6854	1090						97	828	1564	1336		
COSHOCTON	MILL CREEK	3403126313	2186200	284550	N	40.4458	81.8311	2822514	1257467													
COSHOCTON		3403126361	2222970	210620	N	40.2419	81.7014	2867141	1183058	7012	1030						96	864	1605	1418		
CRAWFORD		1	1853858	1016205		40.7886	83.0275	2477981	1382564		950						0				32	0
CRAWFORD		4	1831851	1017500		40.7919	83.1072	2455866	1383768		952						0			753		0
CRAWFORD		5	1859761	1008304		40.7869	83.0061	2484698	1374645		1004						0	784	929	886	23	0
CRAWFORD		6	1852163	990348		40.7178	83.0331	2479077	1356727		972						0				32	0
CRAWFORD	VERNON	6	1936078	1056130		40.8992	82.7311	2555490	1422925		1087							782	973	1000		
CRAWFORD	VERNON	8	1929978	1027720		40.8211	82.7531	2552442	1394424		1130							798	970	974		
CRAWFORD	JEFFERSON	10	1904673	1006411		40.7625	82.8439	2529635	1373039		1076							782				
CRAWFORD		11	1842956	1009501		40.77	83.0069	2487800	1375776		973						0	747	928	820		0
CRAWFORD		12	1841142	1067989		40.9306	83.0747	2459672	1434384		940						0					0
CRAWFORD		12	1890764	1045821		40.8706	82.8947	2511512	1412488		1030						0	791	950	980	36	0
CRAWFORD		13	1876255	1069576		40.9356	82.9478	2494423	1436208		989						0				33	0
CRAWFORD		15	1885269	998706		40.7411	82.9139	2511122	1365230		1029						0	784	943	903	27	0
CRAWFORD	SANDUSKY	16	1890714	1045921		40.8708	82.895	2511422	1412561		1062							811	958	993		
CRAWFORD		18	1875859	1042717		40.8617	82.9486	2496994	1409240		1052						0	757	926	940	30	0
CRAWFORD		19	1889169	1009359		40.7703	82.9	2513855	1375886		1050						0	768	948	895	29	0
CRAWFORD		21	1832706	996485		40.7342	83.1036	2458996	1362712		934						0	758	916	748		0
CRAWFORD	POLK	23	1930707	988059		40.7122	82.75	2557489	1354683		1202							798	976			
CRAWFORD		27	1908174	1006981		40.7639	82.8314	2533032	1373550		1085						0	778	979	928	39	0
CRAWFORD	POLK	28	1931432	992360		40.7242	82.7472	2557801	1359063		1185							799	980			
CRAWFORD	POLK	30	1907225	999609		40.7439	82.8347	2532884	1366252		1102							750	948	930		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
CRAWFORD	JEFFERSON	32	1917276	1012674		40.7797	82.7986	2541481	1378316		1142							766	955			
CRAWFORD	SANDUSKY	35	1912271	1043323		40.8639	82.8169	2533209	1410043		1053							789	962			
CRAWFORD	VERNON	40	1924174	1052352		40.8886	82.7742	2544026	1419057		1093							792	968	975		
CRAWFORD	CRANBERRY	41	1910296	1060636		40.9661	82.8247	2527144	1447339		974							759				
CRAWFORD		42	1838956	1004098		40.7553	83.0811	2464427	1370412		866						0	764	918	802		0
CRAWFORD		45	1840140	1076522		40.9539	83.0786	2457730	1442886		953						0	733	906	852		0
CRAWFORD		46	1915376	1012339		40.7789	82.8056	2539580	1379024		1126						0	698	945	942	42	0
CRAWFORD		49	1891058	1020503		40.8008	82.8933	2514547	1387016		1048						0	772	941	918	30	0
CRAWFORD	JACKSON	73	1926930	1004613		40.7578	82.7636	2551981	1371324		1179							800				
CRAWFORD	CHATFIELD	77	1894062	1060776		40.9114	82.8831	2513157	1427377		1013							777	947			
CRAWFORD		79	1867317	988000		40.7114	82.9786	2494371	1354392		1007						0			1039		0
CRAWFORD	BUCYRUS	83	1867802	1011686		40.7764	82.9772	2492318	1378112		1013							781	923			
CRAWFORD		86	1900221	1014442		40.7844	82.8603	2524275	1381031		1077						0	782	942	920	36	0
CRAWFORD		3067	1877116	1006106		40.7614	82.9433	2502239	1372638		1025						0			893	27	0
CRAWFORD	LYKENS	3403320044	1844300	456350		40.9179	83.0634	2463257	1429749	3415	977	-2433	210	342	68	226	0	764	860			0
CRAWFORD	CHATFIELD	3403320050	1894000	453175		40.9099	82.8835	2513104	1426830	3775	1008			360	80	230	0	763	939	994	34	0
CUYAHOGA	BROOKLYN	3403520821	2222540	656194		41.4850	81.6880	2818270	1629401	5801	603	-5015					0				1260	
DARKE	WASHINGTON	3403720064				40.1426	84.7312	2027194	1146827	1729	1076				0		0	466	868		0	0
DARKE	JACKSON	3403720065				40.2620	84.7825	2006557	1190395	1802	1038				0		0	528	890		0	0
DEFIANCE	MARK	17	1414665	1218883		41.3264	84.63	2019110	1578822		722								763	737		
DEFIANCE	NOBLE	25	1483605	1217316		41.3269	84.3792	2087761	1579004		707								786			
DEFIANCE	FARMER	31	1409453	1229765		41.3564	84.65	2012706	1589770		752							562	766	742		
DEFIANCE	FARMER	33	1398848	1228956		41.3536	84.6886	2002229	1588748		749							544				
DEFIANCE	WASHINGTON	38	1439242	1252823		41.4217	84.5436	2039773	1613599		741							578	768			
DEFIANCE	ADAMS	39	1498868	1240231		41.3906	84.3253	2100459	1602250		745							599	783			
DEFIANCE	NOBLE	45	1478782	1218794		41.3306	84.3969	2082796	1580355		709								790			
DEFIANCE	TIFFIN	52	1482150	1223159		41.3428	84.385	2085663	1584807		702								787			
DEFIANCE	TIFFIN	61	1484582	1223060		41.3428	84.3761	2088099	1584807		709								782			

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
DEFIANCE	MARK	3403920028	1425400	611100		41.3251	84.5922	2029500	1578347	3610	702			560	0	520	0	551				0
DELAWARE		9	1814889	854518		40.3442	83.1639	2456619	1220390		900						0				0	0
DELAWARE	OXFORD	11	1867888	876581		40.4056	82.9744	2506971	1242797		977							762	943			
DELAWARE		13	1793631	877764		40.4075	83.2408	2432968	1243490		920						0				0	0
DELAWARE		13	1867789	872482		40.3944	82.9747	2507305	1238710		984						0			1000	40	0
DELAWARE		14	1822484	872971		40.395	83.1372	2462177	1238929		922						0			532	0	0
DELAWARE		14	1855436	879079		40.4122	83.0192	2494293	1245205		950						0				32	0
DELAWARE		17	1779041	839057		40.3011	83.2922	2422526	1204662		940						0				0	0
DELAWARE		17	1807386	863787		40.3694	83.1911	2448147	1229586		917						0	765	915	513	0	0
DELAWARE		18	1848299	813175		40.2314	83.0433	2494284	1179226		940						0				38	0
DELAWARE	TRENTON	19	1916598	822686		40.2583	82.7989	2561265	1189043		1081							804	952			
DELAWARE	KINGSTON	29	1891395	839683		40.3047	82.8894	2534354	1205976		992							795	954			
DELAWARE		38	1808047	823115		40.2578	83.1878	2453119	1188860		935						0	730	900	586	0	0
DELAWARE		40	1871001	802979		40.2036	82.9617	2518023	1169081		867						0			845	53	0
DELAWARE		42	1842693	843474		40.3144	83.0642	2485413	1209515		878						0			805	0	0
DELAWARE		44	1791679	883084		40.4219	83.2481	2430421	1248745		917						0	758	914	416	0	0
DELAWARE		48	1843543	843374		40.3142	83.0611	2486282	1209442		907						0				0	0
DELAWARE		60	1842692	844034		40.3158	83.0642	2485361	1210026		886						0			807	0	0
DELAWARE		67	1834674	835282		40.2917	83.0925	2478382	1201232		949						0			732	0	0
DELAWARE		69	1851987	875278		40.4019	83.0314	2491289	1241447		944						0			816	30	0
DELAWARE		75	1842332	845794		40.3208	83.0653	2484871	1211851		880						0			818	0	0
DELAWARE		78	1840042	846324		40.3222	83.0736	2482513	1212362		897						0			790	0	0
DELAWARE		80	1841492	844054		40.3161	83.0683	2484211	1210136		922						0			789	0	0
DELAWARE		83	1856187	873979		40.3983	83.0164	2495586	1240133		963						0			815	32	0
DELAWARE		84	1851885	884429		40.4269	83.0319	2490224	1250570		956						0	763	928	855	0	0
DELAWARE		87	1843961	849865		40.3319	83.0597	2486018	1215902		916						0				0	0
DELAWARE		92	1843742	844864		40.3183	83.0603	2486353	1210939		900						0			813	0	0
DELAWARE		96	1813089	854417		40.3439	83.1706	2454769	1220281		925						0			558	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
DELAWARE		104	1870044	840279		40.3061	82.9658	2513067	1206486		945						0	792	934	840	37	0
DELAWARE	KINGSTON	117	1882718	850432		40.3342	82.9206	2524577	1216741		984							745	932			
DELAWARE		118	1836148	819422		40.2483	83.0869	2481532	1185394		943						0	773	905	810	0	0
DELAWARE		119	1872214	790030		40.1681	82.9572	2520596	1156126		930						0	793	927	657	52	0
DELAWARE		124	1843271	850425		40.3336	83.0622	2485261	1216522		984						0			795	0	0
DELAWARE	PORTER	131	1918947	831886		40.2836	82.7806	2562614	1198276		1087							800	956			
DELAWARE		133	1844572	847755		40.3261	83.0575	2486843	1213785		924						0			843	0	0
DELAWARE	HARLEM	146	1919062	790297		40.1694	82.7897	2567194	1156601		1083							697	974	885		
DELAWARE	PORTER	153	1927845	852288		40.3397	82.7589	2569289	1218748		1202							792	974			
DELAWARE		157	1842394	793364		40.1789	83.0639	2490556	1159338		895						0	724	900	817	0	0
DELAWARE	BERKSHIRE	160	1887509	815032		40.2369	82.9028	2533171	1181234		934							769	928			
DELAWARE	ORANGE	161	1861301	804027		40.2064	82.9967	2508177	1170103		944							787	918	833		
DELAWARE	BERKSHIRE	163	1899770	810274		40.2242	82.8589	2545862	1176599		945							821	934			
DELAWARE		180	1837091	850273		40.3331	83.0842	2479167	1216340		943						0			813	0	0
DELAWARE		182	1847153	794375		40.1797	83.0469	2495187	1160360		789						0			748	0	0
DELAWARE		184	1801085	864615		40.3717	83.2139	2441732	1230426		915						0	754	906	445	0	0
DELAWARE		187	1844013	842584		40.3119	83.0592	2486894	1208603		913						0			843	0	0
DELAWARE	BERKSHIRE	188	1894098	825983		40.2672	82.8794	2538543	1192291		966							807	939	877		
DELAWARE		189	1845193	843935		40.3158	83.055	2487918	1210026		928						0			859	0	0
DELAWARE		205	1797232	873815		40.3969	83.2278	2436960	1239622		927						0			453	0	0
DELAWARE	BERLIN	206	1868499	814579		40.2356	82.9708	2514300	1180759		863							801	917	833		
DELAWARE		208	1799086	861989		40.3644	83.2208	2440081	1227762		928						0			470	0	0
DELAWARE		212	1851706	830316		40.2783	83.0314	2495863	1196341		951						0			821	37	0
DELAWARE		214	1826557	824730		40.2628	83.1214	2471405	1190685		948						0	780	896	711	0	0
DELAWARE		223	1852244	840026		40.305	83.0297	2495348	1206085		950						0				34	0
DELAWARE	GENOA	227	1882815	780862		40.1431	82.9192	2532112	1147003		922							784	916	865		
DELAWARE		229	1868796	830978		40.2806	82.9703	2512766	1197181		940						0	744		848	42	0
DELAWARE		231	1875402	798080		40.1903	82.9458	2522944	1164228		920						0	740	922	850	50	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or M	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
DELAWARE		246	1845951	804824		40.2083	83.0514	2492881	1170797		885						0			870	0	0
DELAWARE		249	1854995	835126		40.2917	83.0197	2498620	1201232		951						0			828	34	0
DELAWARE	HARLEM	251	1908352	792435		40.1753	82.8281	2556278	1158754		1046								1122			
DELAWARE		253	1843781	849345		40.3306	83.0603	2485899	1215427		907						0			808	0	0
DELAWARE		266	1841668	852349		40.3389	83.0678	2483510	1218456		892						0	791	925	810	0	0
DELAWARE		278	1843912	848725		40.3289	83.0587	2486129	1214807		915						0				0	0
DELAWARE		281	1842883	843174		40.3136	83.0633	2485692	1209223		876						0			784	0	0
DELAWARE	OXFORD	282	1876190	866582		40.3783	82.9444	2516317	1232834		983							741	945			
DELAWARE		283	1845942	845875		40.3206	83.0525	2488435	1211778		936						0	755	911	814	31	0
DELAWARE	HARLEM	285	1917002	791761		40.1733	82.7969	2565041	1158024		1071							798	913			
DELAWARE	HARLEM	289	1916001	800436		40.1972	82.8006	2563107	1166746		1062							820	951			
DELAWARE		297	1826543	880533		40.4158	83.1228	2465412	1246519		957						0			742	0	0
DELAWARE	BERKSHIRE	313	1898323	819809		40.2503	82.8642	2543405	1186124		952							752	840			
DELAWARE		2630	1818762	860919		40.3619	83.1503	2459751	1226849		908						0				0	0
DELAWARE		2631	1840813	863775		40.37	83.0711	2481447	1229805		937						0				0	0
DELAWARE		2633	1821245	830894		40.2784	83.1406	2465459	1196743		881						0				0	0
DELAWARE		2641	1774041	838057		40.2981	83.31	2417686	1203567		943						0				0	0
DELAWARE		2648	1850368	852526		40.3394	83.0367	2492131	1218639		910						0				32	0
DELAWARE	ORANGE	3404120001	1852100	??783750		40.1400	83.0425	2497874	1145872	4291	920	-2925	135	460	75	448	0					0
DELAWARE	OXFORD	3404120008	1853600	259000		40.3764	83.0254	2493899	1232141	3637	957	-2638	28	424	56	348	0	637	935			0
DELAWARE	OXFORD	3404120009	1879400	265500		40.3948	82.9330	2518872	1238783	4006	996	-3004	150	465	70	412	0					0
DELAWARE	OXFORD	3404120015	1874700	265400		40.3943	82.9498	2514220	1238673	3786	981	-2729		372			0	605				0
DELAWARE	RADNOR	3404120022	1817300	256800		40.3697	83.1557	2457868	1229696	3428	945	-2475	145	485	90	360	0	784	904	588		0
DELAWARE	DELAWARE	3404120050	1840120	223950		40.2799	83.0730	2484237	1196925	3487	906	-2548			68	382	0	624				0
DELAWARE	DELAWARE	3404120098	1827750	226650		40.2871	83.1174	2471628	1199553	3497	951			416	88	439	0	599		678		0
DELAWARE	OXFORD	3404120126	1862900	260400		40.3804	82.9921	2502996	1233601	3749	974			402	78	384	0	828		815	33	0
DELAWARE	BROWN	3404120242	1864060	250380		40.3529	82.9877	2505241	1223565	4035	992	-2998	194	476	80	423	0	779	933	825	33	0
DELAWARE	GENOA	3404120269	1892750	178250		40.1553	82.8837	2541545	1151455	4071	919	-3134	58	455	70	424	0					

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
DELAWARE	PORTER	3404120270	1928500	247150		40.3448	82.7565	2569761	1220609	4689	1205	-3480	125	425	65	477	0					
DELAWARE	THOMPSON	3404120322	1797600	250250		40.3512	83.2261	2439087	1222945	3362	933	-2410	177	464	76	414	0	602		487		0
DELAWARE	TROY	3404120329	1843850	246950		40.3431	83.0601	2485494	1219989	3569	919	-2635	84	416	68	374	0	628				0
DELAWARE	HARLEM	3404120339	1819660	183400		40.1697	82.7875	2567795	1156710	4607	1090						0					
ERIE	BERLIN	9	2002401	1215605		41.3369	82.4914	2604066	1582654		664							763	1049	1285		
ERIE	OXFORD	10	1940316	1213001		41.3294	82.7172	2542581	1579917		710									1208		
ERIE	FLORENCE	12	2030917	1204748		41.3069	82.3875	2633706	1571706		826							812	1047	1341		
ERIE	FLORENCE	14	2039621	1204948		41.3075	82.3558	2642358	1571925		775							812	1056			
ERIE	FLORENCE	15	2041272	1202422		41.3006	82.35	2644225	1569407		833							813	1107			
ERIE	FLORENCE	16	2039522	1206274		41.3111	82.3561	2642130	1573239		828							808	1052			
ERIE	FLORENCE	18	2037020	1205048		41.3078	82.3653	2639745	1572034		825							808	1071			
ERIE	FLORENCE	20	2039472	1207600		41.3147	82.3564	2641901	1574552		817							808	1072			
ERIE	VERMILLION	21	2039072	1225960		41.3653	82.3578	2639464	1593018		764							811	1061	1338		
ERIE	FLORENCE	24	2033068	1202477		41.3008	82.3797	2636087	1569480		738							807	1056			
ERIE	FLORENCE	25	2030517	1214054		41.3325	82.3889	2632287	1581048		831							799	1054	1338		
ERIE	FLORENCE	26	2020421	1203818		41.3044	82.4258	2623323	1570784		830							793	1037			
ERIE	VERMILLION	28	2020031	1227257		41.3689	82.4269	2620423	1594331		630							773	1062	1315		
ERIE	FLORENCE	29	2033969	1219857		41.3486	82.3784	2635054	1586823		795							795	1060			
ERIE	FLORENCE	30	2042223	1203597		41.3039	82.3464	2645077	1570611		812							814	1062			
ERIE	FLORENCE	31	2036320	1214104.		41.3328	82.3678	2638048	1581157		800							801				
ERIE	VERMILLION	34	2030317	1229212		41.3742	82.3897	2630380	1596265		720							785	1055			
ERIE	FLORENCE	63	2042073	1204748		41.3069	82.3469	2644818	1571706		835							814	1059			
ERIE	FLORENCE	77	2022613	1217958		41.3433	82.4178	2623944	1584989		786							783	1042			
ERIE	FLORENCE	78	2038896	1207550		41.3147	82.3586	2641299	1574552		809							811	1061			
ERIE	FLORENCE	3404320007	2027700	595800		41.3020	82.3992	2630701	1569918	4417	817	-3583	90	308	53	117	0	806	1044	1309		
ERIE	FLORENCE	3404320011	2041000	596400		41.3036	82.3508	2643885	1570502	4463	828	-3627	95	330	60	108	0	813	1057			
ERIE	FLORENCE	3404320019	2040700	599100		41.3110	82.3519	2643283	1573202	3938	829	-3620	89				0	813	1067			
FAIRFIELD	LIBERTY	3404510001	1951100	682300	S	39.8733	82.6742	2610677	1048546													

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)								
													3	4	5	6	7	8	9	10	11	12
FAIRFIELD	RUSH CREEK	3404510002	2031500	620500	S	39.7036	82.3881	2697347	986618													
FAIRFIELD	VIOLET	3404510003	1922300	688400	S	39.8842	82.7769	2581542	1052524													
FAIRFIELD	VIOLET	3404510004	1920400	687500	S	39.8872	82.7836	2579556	1053618													
FAIRFIELD	VIOLET	3404510005	1929500	685600	S	39.8822	82.7511	2588833	1051794													
FAIRFIELD	PLEASANT	3404510006	1982050	638450	S	39.7531	82.5639	2646156	1004682													
FAIRFIELD	AMANDA	3404520185	1908800	609400	S	39.6728	82.8239	2576310	975378													
FAIRFIELD	VIOLET	3404520287	1921300	688200	S	39.8892	82.7806	2580319	1054348	3328	827								1254	700		
FAIRFIELD	VIOLET	3404520317	1925300	689750	S	39.8936	82.7661	2584208	1055854	3250	842											
FAIRFIELD	VIOLET	3404520325	1922100	684400	S	39.8789	82.7775	2581574	1050589	3377	817								1255	705		
FAIRFIELD	VIOLET	3404520407	1921400	689500	S	39.8928	82.78	2580351	1055862	3410	821								1255	705		
FAIRFIELD	VIOLET	3404520409	1930100	689950	S	39.8392	82.7489	2591073	1036102	3404	785								1257	718		
FAIRFIELD	VIOLET	3404520412	1921050	687350	S	39.8869	82.7814	2580182	1053509	3271	819							600	1248	696		
FAIRFIELD	VIOLET	3404520413	1920500	687500	S	39.8872	82.7833	2579640	1053618	3340	817								1279	700		
FAIRFIELD	VIOLET	3404520414	1917525	685700	S	39.8822	82.7939	2576864	1051794	3283	784											
FAIRFIELD	VIOLET	3404520415	1919000	686600	S	39.8847	82.7886	2578252	1052706	3342	811											
FAIRFIELD	VIOLET	3404520416	1923120	688900	S	39.8911	82.7739	2582121	1055042													
FAIRFIELD	VIOLET	3404520419	1922350	686575	S	39.8847	82.7767	2581579	1052706	3238	831								1252	699		
FAIRFIELD	CLEAR CREEK	3404520420	1917850	599580	S	39.6458	82.7917	2586354	965525													
FAIRFIELD	WALNUT	3404520424	1990700	672900	S	39.8475	82.5331	2651138	1039131	4128	689							680	1318			
FAIRFIELD	VIOLET	3404520425	1922575	690425	S	39.8953	82.7758	2581431	1056574	3350	839											
FAIRFIELD	VIOLET	3404520426	1922320	682610	S	39.8739	82.7767	2581987	1048765	3315	818								1250	703		
FAIRFIELD	VIOLET	3404520427	1925025	687168	S	39.8864	82.7672	2584172	1053328	3430	850								1254	707		
FAIRFIELD	BLOOM	3404520429	1910700	647800	S	39.7781	82.8178	2574082	1013805													
FAIRFIELD	VIOLET	3404520433	1923850	691650	S	39.8992	82.7714	2582514	1057998	3396	852								1249	715		
FAIRFIELD	CLEAR CREEK	3404520434	1923220	586500	S	39.61	82.7725	2593085	952461	3772	1099						113	640	1218	656		
FAIRFIELD	CLEAR CREEK	3404520435	1916610	572480	S	39.5714	82.7958	2587987	938374	3662	1027						15	631	1258	647		
FAIRFIELD	MADISON	3404520436	1939410	583050	S	39.6006	82.715	2609584	949030	3740	898							644	1218	700		
FAIRFIELD	VIOLET	3404520440	1942000	684900	S	39.8803	82.7067	2601322	1051100	3638	894								1265	731		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
FAIRFIELD	WALNUT	3404520441	2000400	675100	S	39.8536	82.4986	2660554	1041357	4329	984							668	1326	810		
FAIRFIELD	RUSH CREEK	3404520444	2013050	628800	S	39.7264	82.4536	2678097	994938	4566	1024						52	636	1328	838		
FAIRFIELD	WALNUT	3404520446	1978500	702600	S	39.9292	82.5731	2636799	1068945	3996	924								1307	749		
FAIRFIELD	RUSH CREEK	3404520452	2011500	628775	S	39.7264	82.4592	2676527	994938	4518	990							664	1331	845	830	121
FAIRFIELD	LIBERTY	3404520453	1964000	665800	S	39.8281	82.6281	2625301	1032051	3764	842							667	1282	746	720	72
FAIRFIELD	RUSH CREEK	3404520460	2013100	630650	S	39.7317	82.4533	2677875	996872	4614	1039						62	737	1235	840		
FAIRFIELD	PLEASANT	3404520465	2003250	629400	S	39.7281	82.4883	2668306	995558	4345	862							672	1313	834		
FAIRFIELD	RUSH CREEK	3404520522	2021400	621800	S	39.7072	82.4239	2687170	987931	4807	797						70	688	1302	890		
FAIRFIELD	RICHLAND	3404520538	2026975	645250	S	39.7717	82.4042	2690170	1011469	5094	1079						28	683	1342	894		
FAIRFIELD	WALNUT	3404520543	1989200	665250	S	39.8264	82.5383	2650499	1031431	4082	943								1307	755		
FAIRFIELD	WALNUT	3404520571	1980200	672450	S	39.8464	82.5706	2640689	1038729	4242	885						0	668	1292	748		
FAIRFIELD	GREENFIELD	3404520581	1956800	645300	S	39.7717	82.6536	2620316	1011469													
FAIRFIELD	HOCKING	3404520947	1957860	599050	S	39.6447	82.6503	2626076	965123	4248	1002						45	661	1237	749		
FAIRFIELD	RICHLAND	3404520974	2008580	663115	S	39.8206	82.4694	2670007	1029314	4378	992								1271			
FAIRFIELD	PLEASANT	3404521007	1987640	654880	S	39.7981	82.5439	2650024	1021103	4278	930						114	676	1294	758		
FAIRFIELD	BERNE	3404521008	1998270	593460	S	39.6294	82.5061	2667131	959540	4525	790											
FAIRFIELD	LIBERTY	3404521014	1956100	699410	S	39.9203	82.6564	2613860	1065697	3950	1075							645	1276	750		
FAIRFIELD	RUSH CREEK	3404521055	2013170	632650	S	39.7369	82.4531	2677828	998770													
FAIRFIELD	RICHLAND	3404521076	2026370	641980	S	39.7625	82.4061	2689998	1008112	5000	1102						100	658	1311			
FAIRFIELD	RUSH CREEK	3404521080	2027600	604000	S	39.6583	82.4019	2695248	970087	4642	815							683	1327	879		
FAIRFIELD	HOCKING	3404521085	1943150	620260	S	39.7028	82.7019	2609397	986328	4000	1030											
FAIRFIELD	HOCKING	3404521088	1946250	623250	S	39.7111	82.6911	2612111	989355	4000	1030											
FAYETTE	UNION	3404700002	1733500	561100	S	39.5367	83.445	2406797	925711												0	0
FAYETTE	UNION	3404720001	1741700	546900		39.4980	83.4153	2416493	911589	4708	965	-2582	162	596	152	695	87	643	904		0	0
FAYETTE	CONCORD	3404720002	1714000	531300		39.4544	83.5129	2390540	895678	3494	1017	-2323	130	512	102	847	81	486	1022		0	0
FAYETTE	UNION	3404720003	1725800	550300	S	39.5069	83.4714	2400406	914836	1875	992										0	0
FAYETTE	JASPER	3404720004	1696200	580800		39.5897	83.5780	2367595	945052	3410	1044	-2288	106	566	145	664	31	543	1053		0	0
FAYETTE	UNION	3404720005	1729300	578600	S	39.5875	83.4606	2400650	944250		986										0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
FAYETTE	PERRY	3404720006	1729800	525500	S	39.4389	83.4567	2406894	890021												0	0
FAYETTE	PERRY	3404720007	1744400	517900		39.4185	83.4047	2422243	882577	3640	1002	-2634	156	593	112	695	46	544	1023		0	0
FAYETTE	MARION	3404720008	1781710	575910	S	39.5786	83.2744	2453270	941002	2204	875										0	0
FAYETTE	MADISON	3404720009	1778080	612700		39.6796	83.2885	2445732	977859	3375	907	-2593	67	513	169	654	48	554	1085		0	0
FAYETTE	WAYNE	3404720010	1757590	519770		39.4240	83.3581	2435173	884584	3750	980	-2752	162	537	39	794	45	585	1092	420	0	0
FAYETTE	MARION	3404720011	1753110	576650		39.5800	83.3759	2424706	941513	3352	948	-2284	10		151	641	0	581	1090		0	0
FRANKLIN			1861800	731100		40.0064	82.9931	2516576	1097118		830						0				22	0
FRANKLIN		1	1853700	724500		39.9881	83.0222	2509125	1090440		735						0					0
FRANKLIN		11	1910150	683710		39.8767	82.82	2569771	1049787		784						0			696	54	0
FRANKLIN		12	1826610	683290		39.8194	83.1172	2488724	1028876		872						0					0
FRANKLIN		12	1914500	727600		39.9972	82.8053	2569348	1093760		950						0				67	0
FRANKLIN		13	1909550	683725		39.8769	82.8222	2569148	1049860		786						0			695	52	0
FRANKLIN		15	1906450	658250		39.8069	82.8331	2568720	1024315		793						0			770	55	0
FRANKLIN		24	1841940	663630		39.8208	83.0628	2503901	1029387		771						0					0
FRANKLIN		79	1860120	724150		39.9872	82.9992	2515581	1090111		770						0				54	0
FRANKLIN		570	1860350	714450		39.9606	82.9981	2516868	1080404		760						0					0
FRANKLIN		599	1862350	719950		39.9756	82.9911	2516271	1085878		785						0					0
FRANKLIN		874	1839500	730000		40.0028	83.0728	2494457	1095804								0					0
FRANKLIN		875	1848500	733000		40.0114	83.0408	2503076	1098942		790						0					0
FRANKLIN		1063	1838300	725700		39.9911	83.0769	2493740	1091534								0					0
FRANKLIN		3053	1856675	728125		39.9981	83.0117	2511689	1094089		740						0				14	0
FRANKLIN		10587	1792800	691100		39.8953	83.2383	2452106	1056574								0					0
FRANKLIN		10635	1795000	700000		39.9197	83.2308	2453328	1065479								0					0
FRANKLIN		10641	1833700	744800		40.0433	83.0939	2487088	1110584								0					0
FRANKLIN		10642	1833500	748400		40.0533	83.0947	2486500	1114233								0				23	0
FRANKLIN		10643	1829000	753550		40.0672	83.1108	2481501	1119305								0					0
FRANKLIN		10645	1829000	768900		40.1094	83.1114	2479784	1134705								0					0
FRANKLIN		12726	1834250	732000		40.0083	83.0917	2488980	1097811								0					0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
FRANKLIN	HAMILTON	3404900005	1859800	677300		39.8585	83.0001	2520068	1043145	3656	720						0					0
FRANKLIN	PERRY	3404920006				40.1281	83.1108	2479283	1141547	2500	846						0					0
FRANKLIN	PLEASANT	3404920007	1814110	686280		39.8824	83.1624	2473796	1051867	3753	898			520	60	632	0	563				0
FRANKLIN	JACKSON	3404920010	1842070	689050		39.8356	83.0627	2503389	1034788	3710	790			424	132	630	0	577				0
FRANKLIN	FRANKLIN	3404920014	1836800	724800		39.9886	83.0824	2492296	1090622	3622	697	-2923	164	461	115	629	0	497	1071			0
FULTON	SWAN CREEK	12	1609663	1295547		41.5478	83.925	2204581	1659617		680								716	933		
FULTON	CHESTERFIELD	13	1531957	1330423		41.6397	84.2111	2123498	1693154		733								770	997		
FULTON	GORHAM	14	1501823	1347215		41.6842	84.3222	2091781	1709393		785								757			
FULTON	YORK	15	1574812	1291123		41.5339	84.0519	2170427	1654544		720							647	768			
FULTON	PIKE	16	1564979	1334448		41.6522	84.0906	2155908	1697715		771							646	733	1023		
FULTON	CLINTON	17	1532374	1305306		41.5708	84.2078	2126669	1668010		758							640	776	952		
FULTON	YORK	18	1563896	1306027		41.5744	84.0928	2157912	1669324		758							641	769	959		
FULTON	CHESTERFIELD	19	1547866	1335137		41.6533	84.1533	2138793	1698117		797							643	768			
FULTON	CHESTERFIELD	21	1548868	1336139		41.6561	84.1497	2139681	1699138		814							649	768	1023		
FULTON	CHESTERFIELD	22	1547854	1353851		41.7047	84.1544	2136785	1716874		815							661	763	1067		
FULTON	YORK	23	1586823	1286227		41.5211	84.0078	2182893	1649873		692							641	773			
FULTON	GORHAM	24	1495373	1341106		41.6669	84.3456	2085971	1703080		820							705	782	1000		
FULTON	FULTON	26	1607716	1323075		41.6231	83.9339	2199584	1687096		723							690	692	1005		
FULTON	FULTON	27	1620865	1325223		41.6294	83.8867	2212229	1689395		713							691				
FULTON	FULTON	28	1597893	1316905		41.6058	83.9689	2190634	1680783		743							658	766	985		
FULTON	CLINTON	32	1537582	1298605		41.5528	84.1883	2132581	1661441		777							630	768	932		
FULTON	GORHAM	33	1484466	1340097		41.6636	84.3853	2075266	1701875		835							621	765			
FULTON	CLINTON	35	1536378	1303958		41.5672	84.1931	2130797	1666896		765							641	772			
FULTON	GORHAM	36	1495970	1345099		41.6781	84.3436	2086153	1707167		810							623	749	987		
FULTON	CHESTERFIELD	37	1547265	1335137		41.6533	84.1556	2138167	1698117		806							644	763			
FULTON	CHESTERFIELD	38	1543963	1335135		41.6531	84.1675	2134932	1698044		813							638	765			
FULTON	CHESTERFIELD	39	1547315	1335888		41.6556	84.1553	2138172	1698956		819								765			
FULTON	CHESTERFIELD	41	1546465	1334986		41.6528	84.1583	2137448	1697934		812								762			

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
FULTON	CHESTERFIELD	44	1546565	1334386		41.6514	84.1581	2137549	1697423		806								768			
FULTON	DOVER	45	1537332	1328384		41.6344	84.1914	2129040	1691220		778							650				
FULTON	CHESTERFIELD	46	1548556	1335738		41.655	84.1508	2139417	1698737		809							644	761			
FULTON	CHESTERFIELD	47	1541907	1341038		41.6692	84.1756	2132192	1703919		775							651				
FULTON	DOVER	48	1548620	1328801		41.6389	84.1503	2140069	1692862		800								764			
FULTON	CHESTERFIELD	50	1547958	1331680		41.6439	84.1528	2139242	1694686		794								740			
FULTON	SWAN CREEK	51	1597795	1304396		41.5714	83.9689	2191803	1668229		722							660	762			
FULTON	FULTON	52	1598561	1320583		41.6158	83.9669	2190840	1684432		754								764			
FULTON	SWAN CREEK	3405120049	1606900	687175		41.5439	83.9360	2201713	1658194	3644	689	-2871	194	314	52	384	0	662	732			
GEAUGA	CHARDON	3405510001	2340000	719100	N	41.6339	81.2564	2928404	1691037												1560	
GEAUGA	MUNSON	3405520339	2334750	673100	N	41.5078	81.2778	2928298	1645020	6600	1088				120	113	0	695	1839	1683		
GEAUGA	BURTON	3405521109	2365550	658050	N	41.4653	81.1661	2960709	1629510	6660	1177				0	155	9	692	1870	1648		
GEAUGA	BURTON	3405521327	2363280	653420	N	41.4525	81.1747	2958947	1624839	6662	1147				0	141	7	701	1878	1647		
GEAUGA	BURTON	3405521375	2369400	656950	N	41.4619	81.1522	2964658	1628270	6696	1171				0	155		704	1896	1656		
GEAUGA	TROY	3405521456	2370700	642600	N	41.4225	81.1483	2967527	1613891	6648	1137						95	667	1878	1679		
GEAUGA	BURTON	3405521457	2365600	644700	N	41.4286	81.1667	2962223	1616117	6528	1128						38	706	1870	1668		
GEAUGA	TROY	3405521459	2370000	636000	N	41.4044	81.1511	2967590	1607286	6636	1130							649	1880	1732		
GEAUGA	TROY	3405521460	2370850	637000	N	41.4072	81.1481	2968282	1608308	6641	1128						51	705	1888	1721		
GEAUGA	TROY	3405521482	2373750	634700	N	41.4008	81.1375	2971471	1605973	6683	1177						45	711	2248	1421		
GEAUGA	TROY	3405521500	2369400	642100	N	41.4214	81.1531	2966266	1613490	6620	1110						48	705	1884	1670		
GEAUGA	TROY	3405521501	2379950	629100	N	41.3853	81.1153	2978247	1600316	6838	1249						59	719	1886	1736		
GEAUGA	TROY	3405521524	2372600	633350	N	41.3972	81.1411	2970652	1604659	6729	1154						48	711	1893	1731		
GEAUGA	TROY	3405521527	2371600	631150	N	41.3911	81.1456	2969702	1602433	6746	1155						72	701	1885	1732		
GEAUGA	TROY	3405521532	2375850	631550	N	41.3919	81.1303	2973845	1602725	6720	1222						52	715	1885	1740		
GEAUGA	TROY	3405521534	2377200	621700	N	41.365	81.1258	2976308	1592908	6844	1165						68	722	1885	1745		
GEAUGA	TROY	3405521538	2378150	626550	N	41.3783	81.1183	2977748	1597762	6858	1235						65	717	1893	1727		
GEAUGA	TROY	3405521567	2370350	640050	N	41.4156	81.1497	2967460	1611373	6626	1121						53	701	1887	1682		
GEAUGA	TROY	3405521569	2373950	628700	N	41.3844	81.1372	2972304	1599988	6844	1255						48	722	1893	1745		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
GEAUGA	TROY	3405521604	2381050	639450	N	41.4136	81.1108	2978177	1610644	6802	1262						48	702	1904	1688		
GREENE	BATH	3405720003				39.8142	83.9471	2256542	1026962	1740	1034				0		0				0	0
GUERNSEY	ADAMS	3405920782	2218500	742700		40.0500	81.6700	2884021	1113029	8622	1007	-7324	88	823	0	370	158				1900	
GUERNSEY	WESTLAND	3405920881	2227410	716165	S	39.9636	81.6886	2882486	1081499	7350	1034							952	1588	1388		
GUERNSEY	WHEELING	3405923748	2243675	800075	S	40.1933	81.6278	2889683	1165323	7244	1043									1491		
GUERNSEY	WHEELING	3405923789	2240330	795650	S	40.1814	81.64	2886795	1160980	7120	783							969	1659	1471		
GUERNSEY	MONROE	3405923791	2284290	784600	S	40.1497	81.4831	2931835	1149412	8026	1028								1670	1593		
GUERNSEY	MONROE	3405923792	2288920	791400	S	40.1683	81.4661	2935763	1156199	8118	1068							1085	1736	1618		
HAMILTON	CROSBY	3406120001				39.2673	84.7169	2057107	827416	2730	815				0		0	1047	145	0	0	0
HANCOCK		1	1745386	1128065		41.0931	83.4233	2357853	1493684								0				0	0
HANCOCK		2	1718020	1138759		41.1217	83.5231	2329422	1504121		784						0				0	0
HANCOCK		2	1725800	1069334		40.9314	83.4919	2344763	1434676		840						0				0	0
HANCOCK		4	1685203	1143998		41.135	83.6422	2296253	1508975		750						0				0	0
HANCOCK		4	1690839	1065968		40.9211	83.6183	2310315	1430917		840						0				0	0
HANCOCK		5	1666786	1055754		40.8922	83.7047	2287519	1420370		850						0				0	0
HANCOCK		6	1641879	1151280		41.1533	83.8	2252302	1515653		722						0				0	0
HANCOCK		6	1644920	1073049		40.9389	83.7847	2263873	1437413		806						0				0	0
HANCOCK		7	1664859	1111224		41.0444	83.7144	2279578	1475912		765						0				0	0
HANCOCK		117	1691349	1044961		40.8636	83.6156	2313070	1409934		891						0	550	962	350	0	0
HANCOCK		118	1695589	1071622		40.9367	83.6014	2314423	1436610		840						0	619	920	339	0	0
HANCOCK		119	1693757	1142801		41.1319	83.6111	2304900	1507844		786						0		809	282	0	0
HANCOCK	JACKSON	135	1696388	1073273		40.9414	83.5986	2315029	1438325		829							588				
HANCOCK	JACKSON	136	1694780	1090579		40.9889	83.6053	2311518	1455659		805							652				
HANCOCK		138	1682150	1146398		41.1414	83.6536	2292900	1511310		777						0		820	310	0	0
HANCOCK		142	1648870	1075952		40.9469	83.7706	2267480	1440332		811						0		861	432	0	0
HANCOCK		143	1675879	1077116		40.9511	83.6731	2294179	1441865		840						0	568	876	365	0	0
HANCOCK		145	1698880	1093632		40.9972	83.5906	2315271	1458688		798						0	672	881	225	0	0
HANCOCK		148	1649472	1071751		40.9356	83.7683	2268502	1436208		829						0	652	854	410	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
HANCOCK		150	1661862	1101218		41.0167	83.725	2277621	1465804		793						0	666	822	389	0	0
HANCOCK		151	1683736	1068086		40.9287	83.6442	2302986	1432960		848						0	626	914	332	0	0
HANCOCK		153	1642045	1119216		41.0656	83.7975	2256003	1483649		806						0		822	598	0	0
HANCOCK	WASHINGTON	233	1742685	1127914		41.0928	83.4331	2355172	1493575		835							655	870			
HANCOCK	ORANGE	257	1643994	1042477		40.855	83.7667	2266197	1406795		889								905			
HANCOCK		12734	1680119	1102878		41.0219	83.6589	2295619	1467702								0				0	0
HANCOCK		12735	1680647	1039905		40.8492	83.6539	2303013	1404679								0				0	0
HANCOCK		12736	1691693	1059168		40.9025	83.615	2311875	1424129								0				0	0
HANCOCK		14838	1679117	1105228		41.0283	83.6625	2294406	1470037								0				0	0
HANCOCK		16796	1680819	1102728		41.0217	83.6564	2296314	1467629								0				0	0
HANCOCK		16797	1679267	1105628		41.0294	83.6819	2294533	1470438								0				0	0
HANCOCK	MARION	3406300001	1699200	519000		41.0861	83.5912	2311878	1491130	2980	830	-1940	410	275			0	842			0	0
HANCOCK	UNION	3406320139	1649800	485400		40.9371	83.7676	2268643	1436756	3017	824	-2184	308	305	98	324	0	622	858	427	0	0
HANCOCK	AMANDA	3406320140	1720000	484300		40.9366	83.5135	2338630	1436573	2799	833	-1962	237	358	110	184	0	607	964	285	0	0
HANCOCK	JACKSON	3406320152	1685390	482065		40.9842	83.6396	2302245	1453944	2807	809	-1986	245	346	89	165	0	609	877	301	0	0
HANCOCK	WASHINGTON	3406320232				41.0998	83.4773	2342773	1496124	2525	823						0	662	848			0
HARDIN		1	1624215	974160		40.6667	83.8544	2253913	1338079		988						0				0	0
HARDIN		3	1712615	1022413		40.8022	83.5378	2336682	1387527		912						0				0	0
HARDIN		3	1728199	945401		40.5914	83.4788	2360481	1310600		945						0			233	0	0
HARDIN		6	1662086	947648		40.5956	83.7167	2294431	1312133		1095						0				0	0
HARDIN		8	1723984	980407		40.6875	83.495	2352549	1345670		920						0			231	0	0
HARDIN		13	1654453	1011984		40.7717	83.7472	2279951	1376397		937						0				0	0
HARDIN		15	1673610	1007992		40.7614	83.6781	2299384	1372638		965						0				0	0
HARDIN		75	1648607	1001279		40.7422	83.7678	2275275	1365631		946						0	557	977	349	0	0
HARDIN		79	1725393	959503		40.63	83.4892	2356185	1324686		994						0	571	1030	278	0	0
HARDIN		80	1732092	964956		40.6453	83.4653	2362254	1330270		980						0	587	1010	240	0	0
HARDIN		82	1668327	967730		40.6508	83.695	2298535	1332277		1006						0	528	1010	360	0	0
HARDIN	MARION	83	1637006	996041		40.7272	83.8094	2264297	1360157		1010							548				

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
HARDIN	MCDONALD	85	1634432	945059		40.5872	83.8161	2267203	1309068		1034							524				
HARDIN		86	1697471	997500		40.7336	83.5914	2324294	1362493		911						0	550	1004	240	0	0
HARDIN		87	1741600	948807		40.6011	83.4303	2373506	1314140		931						0	539	1015	180	0	0
HARDIN		88	1634531	946409		40.5911	83.8158	2267154	1310491		1031						0	524	976	330	0	0
HARDIN		89	1712429	986854		40.7047	83.5369	2340364	1351947		923						0	565	1009	269	0	0
HARDIN		94	1697895	941838		40.5811	83.5875	2330698	1306842		1040						0	539	1009	358	0	0
HARDIN		99	1707319	1007957		40.7625	83.5564	2332946	1373039		923						0	535	979	230	0	0
HARDIN		102	1673246	930325		40.5483	83.6758	2307440	1294872		1067						0	538	1005	362	0	0
HARDIN		103	1671548	925124		40.5339	83.6814	2306329	1289617		1070						0	522		387	0	0
HARDIN		106	1653965	986978		40.7031	83.7478	2282140	1351363		997						0	527	989	365	0	0
HARDIN		107	1723306	924196		40.5331	83.4953	2357914	1289325		1038						0	567	1011	362	0	0
HARDIN		108	1673925	975784		40.6731	83.6753	2303213	1340415		984						0	518	989	346	0	0
HARDIN	PLEASANT	122	1695141	973653		40.6681	83.5986	2324592	1338590		974							530				
HARDIN	JACKSON	123	1712002	1004758		40.7539	83.5392	2337897	1369901		946							567	991			
HARDIN		125	1698915	1012205		40.7739	83.5867	2324181	1377200		920						0			280	0	0
HARDIN		128	1698821	997551		40.7336	83.5864	2325675	1362493		912						0	532	991	247	0	0
HARDIN		3064	1630491	1021425		40.7867	83.8342	2255084	1385520		925						0			374	0	0
HARDIN		12737	1684209	1016750		40.7858	83.64	2309054	1381542								0				0	0
HARDIN		12739	1685436	956936		40.6217	83.6331	2316685	1321658								0				0	0
HARDIN		12740	1712821	1007059		40.7603	83.5372	2338324	1372237		929						0				0	0
HARDIN		12741	1633292	1020976		40.7956	83.8242	2257881	1385118								0				0	0
HARDIN		12742	1682318	995943		40.7286	83.6458	2309441	1360668								0				0	0
HARDIN		16784	1682418	995543		40.7275	83.6456	2309535	1360267								0				0	0
HARDIN		16795	1633142	1022027		40.7983	83.8247	2257651	1386104								0				0	0
HARDIN	JACKSON	3406520074	1715200	398600		40.7507	83.5279	2341230	1368733	2834	941	-1899	252	369	69	290	0	550			0	0
HARDIN	DUDLEY	3406520079	1726800	358700		40.6415	83.4844	2357106	1328883	2992	971	-1989	210	415	95	314	0	589			0	0
HARRISON	GREEN	3406720103	2428050	220600	N	40.2619	80.9664	3070600	1190357	10178	1126				0			1536	1834	2052	3150	68
HARRISON	GREEN	3406720355	2430770	245490	N	40.33	80.955	3070667	1215208	10285	1235				0		158	1428	1834	2049		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
HARRISON	MOOREFIELD	3406720737	2364000	195350	N	40.1953	81.1972	3009413	1166053						0							
HARRISON	MONROE	3406720765	2348400	270150	N	40.4014	81.2492	2985807	1241264	8564	903				0		151	1128	1794	1748		
HARRISON	NOTTINGHAM	3406720777	2371770	219700	N	40.2619	81.1681	3014539	1190357	9064	1178				0				1838	1851		
HARRISON	FREEPORT	3406720860	2340300	203900	N	40.2197	81.2814	2984909	1174957	8614	878				0				1823	1742		
HENRY	RICHFIELD	12	1607564	1218568		41.3392	83.9283	2210783	1583493		684								792			
HENRY	RIDGEVILLE	19	1501680	1266959		41.4639	84.3169	2100382	1628999		720							597	773	822		
HENRY	FREEDOM	20	1547109	1267691		41.4683	84.1514	2145449	1630605		718							637	768	849		
HENRY	PLEASANT	22	1525114	1165338		41.1867	84.2244	2134722	1527842		732								820			
HENRY	MARION	22	1569725	1183406		41.2383	84.0636	2177118	1546672		710								812			
HENRY	MARION	23	1582141	1184039		41.2406	84.0186	2189377	1547511		706								802			
HENRY	MARION	24	1584331	1185891		41.2458	84.0108	2191341	1549409		706								824			
HENRY	RICHFIELD	27	1600610	1193780		41.2683	83.9522	2206641	1557620		701								813			
HENRY	MARION	30	1582831	1184610		41.2422	84.0161	2190009	1548095		707								813			
HENRY	MARION	31	1572378	1180106		41.2294	84.0539	2180075	1543424		713								824			
HENRY	MARION	32	1582310	1185980		41.2461	84.0181	2189330	1549518		705								813			
HENRY	RICHFIELD	34	1618277	1215532		41.3286	83.8892	2221846	1579625		676								807			
HENRY	RICHFIELD	35	1599152	1214665		41.3256	83.9586	2202950	1578530		684								791			
HENRY	DAMASCUS	41	1613373	1227556		41.3614	83.9078	2215637	1591594		678								790			
HENRY	RICHFIELD	42	1613231	1213873		41.3239	83.9075	2216997	1577910		686								795			
HENRY	DAMASCUS	43	1608137	1232946		41.3761	83.9269	2209911	1596959		678								782			
HENRY	RICHFIELD	45	1604115	1214138		41.3242	83.9406	2207925	1578019		683								795			
HENRY	DAMASCUS	46	1608214	1237989		41.3897	83.9269	2209449	1601922		676								787			
HENRY	RICHFIELD	64	1592119	1214276		41.3242	83.9842	2195989	1578019		685								803			
HENRY	RICHFIELD	68	1594809	1216409		41.33	83.9744	2198476	1580136		685								806			
HENRY	DAMASCUS	71	1594426	1221812		41.3447	83.9764	2197432	1585500		681								794			
HENRY	DAMASCUS	77	1591794	1221625		41.3442	83.9858	2194876	1585318		683								794			
HENRY	DAMASCUS	82	1601980	1221776		41.345	83.9489	2204948	1585610		682								788			
HENRY	DAMASCUS	84	1597077	1221863		41.345	83.9667	2200077	1585610		683								801			

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)										
													3	4	5	6	7	8	9	10	11	12
HENRY	RICHFIELD	86	1602251	1219675		41.3394	83.9478	2205439	1583566		682								795			
HENRY	RICHFIELD	89	1597949	1219723		41.3392	83.9633	2201203	1583493		683								795			
HENRY	DAMASCUS	95	1599806	1227098		41.3594	83.9569	2202271	1590865		683								798			
HENRY	DAMASCUS	98	1610422	1227064		41.36	83.9183	2212812	1591083		680								791			
HENRY	DAMASCUS	99	1613525	1224924		41.3542	83.9069	2216129	1588967		680								777			
HENRY	DAMASCUS	100	1610373	1224923		41.3542	83.9183	2213009	1588967		679								801			
HENRY	DAMASCUS	107	1613642	1230147		41.3688	83.9069	2215638	1594222		678								784			
HENRY	RICHFIELD	108	1607596	1216048		41.3297	83.9281	2211160	1580026		683								801			
HENRY	DAMASCUS	109	1605590	1224940		41.3539	83.9358	2208231	1588857		680								797			
HENRY	DAMASCUS	115	1608183	1222250		41.3467	83.9261	2211130	1586230		682								792			
HENRY	PLEASANT	123	1551040	1175060		41.2144	84.1311	2159404	1537850		723								813			
HENRY	PLEASANT	124	1545652	1169134		41.1961	84.1503	2154676	1532002		732								794			
HENRY	MARION	125	1585742	1184114		41.24	84.0783	2173032	1547292		711								816			
HENRY	PLEASANT	126	1547722	1170288		41.2014	84.1428	2156625	1533206		728								747			
HENRY	PLEASANT	129	1555670	1178745		41.225	84.1144	2163633	1541818		717								819			
HENRY	MARION	131	1572356	1184088		41.2403	84.0542	2179628	1547402		710								816			
HENRY	HARRISON	3406920036	1581919	619850		41.3580	84.0230	2184232	1590354	3475	683	-2757	182	558	98	248	0	644	788			0
HIGHLAND	DODSON	3407100002	1618300	434500	S	39.1853	83.8467	2305446	797476												0	0
HIGHLAND	DODSON	3407100003	1633800	456500	S	39.2461	83.7931	2318581	819683												0	0
HIGHLAND	LIBERTY	3407100004	1684300	439000	S	39.2	83.6139	2370730	802840												0	0
HIGHLAND	MADISON	3407100005	1729800	472400	S	39.2931	83.4547	2412494	836815												0	0
HIGHLAND	FAIRFIELD	3407100006	1696350	503800	S	39.3783	83.5742	2375881	867807												0	0
HIGHLAND	FAIRFIELD	3407120001	1702700	501600		39.3725	83.5517	2382419	865790	3513	1043	-2472	206	629	140	755	49	506	1054		0	0
HIGHLAND	PAINT	3407120003	1746100	447800	S	39.2261	83.3964	2431266	812365	3160	881				148	675	61	739	1033		0	0
HIGHLAND	PENN	3407120004	1692850	465050	S	39.2719	83.585	2376455	829079	2392	1139						88	589			0	0
HIGHLAND	LIBERTY	3407120005	1692890	451900	S	39.2358	83.5842	2377906	815905	1751	977							570			0	0
HIGHLAND	FAIRFIELD	3407120007	1711050	480900		39.3159	83.5213	2392925	845135	3610	957	-2648	236	693	154	725	72	579			0	0
HIGHLAND	MADISON	3407160006	1730500	473000	S	39.2947	83.4522	2413144	837399												0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
HIGHLAND	CONCORD	3407162626	1682600	384300	S	39.0497	83.6175	2374780	747992	1762	1110								894		0	0
HOCKING	STARR	3407321222	2031250	509350		39.3985	82.3894	2708885	875278	6495	970	-5500	70	579	86	565	75	878	1156	949	1000	37
HOCKING	MARION	3407321342	2019700	596800	S	39.6386	82.43	2688131	962897	4516	773						122	614				
HOCKING	FALLS	3407321664	2017050	570100	S	39.5653	82.4394	2688341	936148	4627	782						77	653	1308	857		
HOCKING	PERRY	3407321683	1950150	542300	S	39.4889	82.6767	2624566	908268	3782	818							757	1127	783		
HOCKING	PERRY	3407321828	1934800	556800	S	39.5286	82.7319	2607548	922755	4094	945						23	744	1103	787		
HOCKING	WARD	3407323181	2090300	541390	S	39.4861	82.18	2764368	907246	5715	830								1368	1048		
HOCKING	STARR	3407323278	2057390	516110	S	39.4169	82.2969	2734210	881993	5640	940						144	762	1260	1053		
HOCKING	STARR	3407323283	2059000	514200	S	39.4117	82.2911	2736047	880095	5710	973						140	732				
HOLMES	CLARK	3407520135	2204700	287100	N	40.4522	81.7644	2840736	1259802													
HOLMES	BERLIN	3407521279	2204100	318600	N	40.5389	81.7656	2836730	1291442	6701	1088						51	785	1610	1341	1500	195
HOLMES	SALT CREEK	3407521283	2202200	362300	N	40.6589	81.7711	2830115	1335233	7362	1314				0	436	0	780	1614	1335		
HOLMES	HARDY	3407521288	2176800	316450	N	40.5336	81.8639	2809736	1289507	6184	932								1575	1230		
HOLMES	CLARK	3407521297	2208800	290650	N	40.4619	81.7497	2844400	1263342	6824	1123						100	769	1606	1345		
HOLMES	WASHINGTON	3407521299	2077850	349100	N	40.6244	82.2194	2707612	1322643	5179	1174						0	698	1451	1054		
HOLMES	RICHLAND	3407521303	2102630	289570	N	40.4608	82.1311	2738721	1262941								0					
HOLMES	PRAIRIE	3407521312	2148300	352200	N	40.6322	81.9658	2777417	1325489	5882	1086						0	753				
HOLMES	CLARK	3407521328	2209000	289450	N	40.4588	81.7489	2844762	1262138	6562	1084						92	774	1597	1342		
HOLMES	KNOX	3407521334	2080775	333950	N	40.5831	82.2092	2712110	1307571								0					
HOLMES	WALNUT CREEK	3407521351	2225450	335250	N	40.5839	81.6883	2856207	1307863	6819	1214						77	792	1635	1399	1660	124
HOLMES	CLARK	3407521352	2204700	287100	N	40.4522	81.7644	2840736	1259802	6653	1158						68	810	1569	1331		
HOLMES	CLARK	3407521391	2210450	287350	N	40.4528	81.7439	2846394	1260021	6680	1160											
HOLMES	PAINT	3407521409	2229200	341250	N	40.6003	81.6747	2859268	1313848	6560	1000						74	789	1639	1412		
HOLMES	CLARK	3407521417	2203600	303000	N	40.4961	81.7681	2837652	1275823	6654	1191						73	784	1593	1344		
HOLMES	MECHANIC	3407521522	2185250	296525	N	40.4786	81.8342	2820275	1269436	6177	991						48	764	1573	1258		
HOLMES	CLARK	3407521609	2208050	294150	N	40.4717	81.7522	2843292	1266918	6552	1045						79	780	1607	1332		
HOLMES	CLARK	3407522093	2208850	290650	N	40.4619	81.7494	2844483	1263342	6588	1131							775	1599	1341		
HOLMES	CLARK	3407523549	2230550	285150	N	40.4464	81.6717	2866682	1257686	6987	1138						108	784	1645	1419		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
HOLMES	KILLBUCK	3407524527	2140800	298380		40.4846	81.9938	2775797	1271626	6532	810	-5702	94	596			0	777	1521	1179	1200	
HOLMES	CLARK	3407524602	2214190	288210	N	40.4553	81.7303	2850058	1260934	6673	1170							791	1608	1365		
HOLMES	CLARK	3407524615	2226400	289100	N	40.4572	81.6864	2862148	1261627	6817	1126							768	1635	1409		
HOLMES	CLARK	3407524696	2227200	290200	N	40.4603	81.6836	2862790	1262758	7005	1054						89	812	1644	1406		
HOLMES	WALNUT CREEK	3407524705	2211400	337400	N	40.5903	81.7389	2841835	1310199	6584	1116						32	795	1620	1351		
HOLMES	WALNUT CREEK	3407524709	2217300	335000	N	40.5836	81.7178	2848058	1307754	6721	1149						48	799	1638	1363		
HOLMES	MECHANIC	3407524713	2183010	291470	N	40.4647	81.8064	2828568	1264364	6500	1152						60	782	1595	1299		
HOLMES	CLARK	3407524716	2230710	292780	N	40.4672	81.6708	2866043	1265276	6858	1100							802	1635	1413		
HOLMES	CLARK	3407524738	2222580	291850	N	40.465	81.7	2858044	1264473	6723	1013							794	1631	1390		
HOLMES	CLARK	3407524754	2199600	287100	N	40.4525	81.7828	2835623	1259912	6690	1077						70	772	1602	1324		
HOLMES	CLARK	3407524759	2217080	299240	N	40.4853	81.7197	2851720	1271881	6744	1110							760	1602	1386		
HOLMES	CLARK	3407524760	2222180	287720	N	40.4536	81.7017	2858058	1260313	6710	1030							775	1613	1380		
HOLMES	MECHANIC	3407524763	2175600	305150	N	40.5025	81.8686	2809740	1278158	6313	1130						84	764	1576			
HOLMES	WALNUT CREEK	3407524768	2213650	336500	N	40.5878	81.7308	2844283	1309287	6519	1041						45	791	.1617	1358		
HOLMES	CLARK	3407524770	2199900	294300	N	40.4722	81.7814	2835178	1267101													
HOLMES	BERLIN	3407524783	2203000	327200	N	40.5625	81.7694	2834677	1300054	6667	1234						84	746	1588	1330		
HOLMES	BERLIN	3407524784	2200500	326150	N	40.5597	81.7783	2832333	1299032	6660	1236						40	778	1593	1323		
HOLMES	CLARK	3407524793	2213450	287450	N	40.4806	81.7328	2848290	1270166	6686	1050							753	1603	1361		
HOLMES	CLARK	3407524795	2215800	296750	N	40.4786	81.7242	2850758	1269436	6665	1056								1014	1368		
HOLMES	MECHANIC	3407524797	2173430	304880	N	40.5019	81.8764	2807604	1277839	6242	1071						20	768	1580	1226		
HOLMES	CLARK	3407524800	2216800	286450	N	40.4503	81.7217	2852654	1259109	6814	1150						84	770	1593	1373		
HOLMES	CLARK	3407524801	2202650	294400	N	40.4725	81.7717	2837853	1267210													
HOLMES	CLARK	3407524806	2225300	288520	N	40.4558	81.6906	2861041	1261116													
HOLMES	CLARK	3407524807	2206210	288810	N	40.4569	81.7589	2842062	1261518													
HOLMES	CLARK	3407524808	2211570	286840	N	40.4508	81.7397	2847643	1259291													
HOLMES	CLARK	3407524813	2203480	293340	N	40.4694	81.7689	2838761	1266079	6427	1180							592	1599	1323		
HOLMES	CLARK	3407524815	2201520	285850	N	40.4489	81.7758	2837715	1258598													
HOLMES	CLARK	3407524817	2202025	293270	N	40.4694	81.7739	2837375	1266079	6710	1185											

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)								
													3	4	5	6	7	8	9	10	11	12
HOLMES	MECHANIC	3407524818	2172480	304070	N	40.4997	81.8797	2806782	1277136													
HOLMES	CLARK	3407524820	2210300	294820	N	40.4733	81.7442	2845441	1267502													
HOLMES	CLARK	3407524821	2208200	285300	N	40.4472	81.7519	2844413	1257978													
HOLMES	CLARK	3407524825	2203750	294900	N	40.4739	81.7678	2838875	1267721													
HOLMES	CLARK	3407524842	2207970	300250	N	40.4883	81.7522	2842587	1272976													
HOLMES	CLARK	3407524843	2204300	295860	N	40.4767	81.7656	2839366	1268743	6325	1101								1586	1331		
HOLMES	MECHANIC	3407524845	2180500	305950	N	40.5047	81.8508	2814579	1278961													
HOLMES	HARDY	3407524847	2177830	337830	N	40.5922	81.8597	2808436	1310892	6464	1172						20	814	1582	1266		
HOLMES	CLARK	3407524848	2207650	301300	N	40.4911	81.7533	2842164	1273998	6650	1145						144	786	1600	1354		
HOLMES	CLARK	3407524849	2211600	305250	N	40.5019	81.7392	2845612	1277839	6737	1171						58	790	1630	1348		
HOLMES	CLARK	3407524850	2208700	305150	N	40.5017	81.7494	2842795	1277866	6654	1182							792	1620	1357		
HOLMES	CLARK	3407524853	2196350	291600	N	40.485	81.7944	2831879	1264473	6280	1030								1581	1315		
HOLMES	CLARK	3407524854	2210200	288600	N	40.4584	81.7447	2846019	1261335	6543	1105								1590	1342		
HOLMES	CLARK	3407524855	2209100	302900	N	40.4956	81.7481	2843414	1275640	5800	1187								1616	1358		
HOLMES	CLARK	3407524856	2210500	304300	N	40.4994	81.7431	2844637	1277027	6000	1207								1618	1367		
HOLMES	CLARK	3407524857	2206450	300300	N	40.4886	81.7578	2841023	1273086	6611	1187									1352		
HOLMES	MECHANIC	3407524859	2182375	310630	N	40.5175	81.8442	2815869	1283632													
HOLMES	CLARK	3407524860	2207300	287300	N	40.4528	81.755	2843317	1260021													
HOLMES	CLARK	3407524862	2204700	288450	N	40.4506	81.7644	2840804	1259218													
HOLMES	CLARK	3407524864	2206850	285950	N	40.4492	81.7567	2842998	1258708	6567	1125											
HOLMES	CLARK	3407524872	2200325	296750	N	40.4789	81.78	2835282	1269546													
HOLMES	MECHANIC	3407524873	2179250	293470	N	40.4703	81.8558	2814638	1266408													
HOLMES	MECHANIC	3407524878	2187500	308350	N	40.5111	81.8258	2821234	1281297													
HOLMES	KILLBUCK	3407524882	2142460	292160	N	40.4675	81.9881	2778065	1265396	5443	825						0	690	1498	1149		
HOLMES	CLARK	3407524883	2203030	298850	N	40.4847	81.77	2837808	1271663													
HOLMES	BERLIN	3407524884	2186570	329820	N	40.57	81.8283	2818059	1302791	6212	1068						57	782	1628	1270		
HOLMES	CLARK	3407524886	2205670	294060	N	40.4714	81.7608	2840921	1266809													
HOLMES	MECHANIC	3407524888	2185600	300525	N	40.4897	81.8328	2820186	1273487													

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
HOLMES	MECHANIC	3407524889	2182540	308690	N	40.5122	81.8436	2816258	1281698													
HOLMES	MECHANIC	3407524893	2181420	305150	N	40.5025	81.8478	2815502	1278158	6372	1160						42	788	1578	1278		
HOLMES	BERLIN	3407524895	2181950	314075	N	40.5289	81.8456	2815085	1287062													
HOLMES	BERLIN	3407524902	2179930	312510	N	40.5225	81.8528	2813277	1285457													
HOLMES	MECHANIC	3407524911	2181520	300360	N	40.4892	81.8114	2826147	1273305	6225	1040							772	1590	1294		
HOLMES	MECHANIC	3407524912	2182490	296850	N	40.4792	81.8442	2817479	1269655													
HOLMES	CLARK	3407524913	2221825	289450	N	40.4583	81.7028	2857553	1262028	6704	1038							774	1606	1383		
HOLMES	MECHANIC	3407524915	2182500	298540	N	40.4842	81.8439	2817352	1271480													
HOLMES	HARDY	3407524916	2172800	325875	N	40.5584	81.8781	2804722	1298923													
HOLMES	CLARK	3407524919	2208000	287950	N	40.4547	81.7525	2843929	1260715	7												
HOLMES	CLARK	3407524920	2202540	306180	N	40.5047	81.7717	2836490	1278961													
HOLMES		3407524922	2177450	288480	N	40.4587	81.8622	2813435	1261445	6287	888						28	804	1548	1237		
HOLMES	MECHANIC	3407524924	2190700	304930	N	40.5017	81.8142	2824844	1277866	6300	1085						43	782	1574	1301		
HOLMES	MONROE	3407524925	2138570	320000	N	40.5439	82.0014	2771236	1293268	5974	1187						0	748	1541			
HOLMES	CLARK	3407524930	2202700	297830	N	40.4819	81.7714	2837539	1270641	6417	1183								1595	1329		
HOLMES	CLARK	3407524932	2195100	303060	N	40.4964	81.7986	2829389	1275932													
HOLMES	BERLIN	3407524944	2202000	323600	N	40.5525	81.7731	2834077	1296405	6549	1156						49	766	1594	1330		
HOLMES		3407524947	2186175	292000	N	40.4861	81.8308	2821744	1264875	6359	1048						123	710	1568	1273		
HOLMES		3407524957	2178850	296710	N	40.4792	81.8572	2813876	1269655	6089	910						57	730	1568	1236		
HOLMES		3407524987	2179190	314210	N	40.5272	81.8558	2812304	1287172	6242	1195						121	703	1562	1226		
HOLMES		3407524988	2168600	320750	N	40.5456	81.8933	2801093	1293887	6082	1158						60	716	1564	1234		
HOLMES		3407524989	2170100	322300	N	40.5497	81.8878	2802444	1295383	5996	1063						94	700	1555	1230		
HURON	NEW HAVEN	28	1958413	1102769		41.0272	82.6506	2572663	1469636		787							796	990			
HURON	RICHMOND	30	1917064	1113149		41.0556	82.8006	2530332	1480000		957							768	931	1030		
HURON	FITCHVILLE	32	2006352	1117696		41.0683	82.4769	2618774	1484634		980							835	1046			
HURON	GREENFIELD	33	1944125	1129489		41.1006	82.7028	2555455	1496421		880							778	967	1085		
HURON	NORWICH	35	1914862	1123304		41.0833	82.8066	2527068	1490106		914									1040		
HURON	RIPLEY	36	1980092	1099598		41.0186	82.5722	2594554	1466497		1044							819	1057	1064		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
HURON	NEW LONDON	38	2023460	1126860		41.0933	82.415	2634775	1493757		989									1243		
HURON	NEW HAVEN	39	1955682	1101098		41.0228	82.6606	2570085	1468030		966							782	968	1082		
HURON	NEW LONDON	40	2021750	1140646		41.1311	82.4211	2631582	1507552		949							825	1062	1256		
HURON	LYME	41	1915455	1185209		41.2531	82.8072	2520903	1552073		784							781	904	1119		
HURON	FITCHVILLE	42	1993046	1133563		41.1119	82.5253	2603747	1500545		1021							812	1018			
HURON	FITCHVILLE	43	1994672	1138965		41.1211	82.5194	2605001	1503902		1003							800	1021	1191		
HURON	TOWNSEND	46	2008634	1187350		41.2584	82.4686	2613412	1554372		883							789	1045			
HURON	TOWNSEND	50	2009314	1187840		41.2611	82.4661	2614028	1554992		884							757	1064	1259		
HURON	TOWNSEND	54	2014557	1188840		41.2633	82.4469	2619199	1555795		877							796	1045			
HURON	TOWNSEND	57	1998399	1183813		41.2497	82.5058	2603609	1550832		890							780	1024			
HURON	BRONSON	58	1963432	1154772		41.17	82.6328	2571951	1521747		833							767	994			
HURON	TOWNSEND	59	2006433	1187450		41.2597	82.4767	2611181	1554481		903							754	1055			
HURON	HARTLAND	60	2001150	1149696		41.1561	82.4958	2610084	1516675		955							829	1034	1217		
HURON	TOWNSEND	61	2006203	1191292		41.2703	82.4775	2610538	1558349		862							804	1041			
HURON	BRONSON	62	1966108	1160875		41.1867	82.6231	2573955	1527842		805							765	1008			
HURON	TOWNSEND	63	2002601	1188639		41.2575	82.4806	2607462	1553678		885							803	1008			
HURON	HARTLAND	67	2006678	1169155		41.2094	82.4758	2613440	1536125		934							825	1040			
HURON	CLARKSFIELD	69	2019008	1149270		41.155	82.4311	2627879	1516273		943							813	1066	1260		
HURON	CLARKSFIELD	72	2041695	1162976		41.1925	82.3486	2648893	1528958		914							820	1090	1322		
HURON	FITCHVILLE	74	1996498	1119907		41.0744	82.5128	2608669	1486860		998							821	1025	1159		
HURON	HARTLAND	75	1999324	1161301		41.1881	82.5025	2606971	1528352		953							835	1021			
HURON	TOWNSEND	76	2005502	1176584		41.2297	82.48	2611477	1543533		926							822	1035			
HURON	BRONSON	81	1973837	1145068		41.1433	82.595	2583373	1512004		919							769	994	1171		
HURON	HARTLAND	84	2003476	1159576		41.1833	82.4875	2611276	1526801		949							820	1024			
HURON	TOWNSEND	88	1996998	1180936		41.2417	82.5108	2602558	1547913		892							772	1040			
HURON	FITCHVILLE	91	1995397	1137165		41.1217	82.5167	2605718	1504121		988							807	1027			
HURON	TOWNSEND	94	2012108	1191142		41.2697	82.4561	2616422	1558131		880							774	1051			
HURON	WAKEMAN	95	2020780	1192556		41.2736	82.4244	2624947	1559554		859							792	1050			

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
HURON	WAKEMAN	105	2023712	1179535		41.2381	82.4139	2629253	1546599		891							803	1058			
HURON	PERU	3407720011	1953700	561200		41.2070	82.6683	2560764	1535250	4270	749						0					
HURON	GREENFIELD	3407720025	1943800	524500		41.1062	82.7039	2554835	1498465	3865	891			322	75	154	0	786	958			
HURON	WAKEMAN	3407720103	2042950	585480		41.2736	82.3484	2645759	1559554	4574	856						0	812	1069		650	
JACKSON	JEFFERSON	3407900168	1952900	324700	S	38.8914	82.6656	2650154	690224													
JACKSON	SCIOTO	3407920048	1918700	360000	S	38.9881	82.7825	2613422	725512	3682	648								1183	675	610	112
JACKSON	FRANKLIN	3407920076	1973580	351770		38.9658	82.5829	2687973	717374	6320	816	-5414	80	607	118	572	88	845	1193	840	820	36
JACKSON	HAMILTON	3407920078	1930700	319100		38.8759	82.7434	2628659	684567	5681	685	-4913	184	520	147	573	81	897	1105	775	650	
JACKSON	FRANKLIN	3407920079	1951600	344100		38.9447	82.6207	2660889	709674	5991	841	-5149	150	517	125	593	87	787	1208	768	730	17
JACKSON	FRANKLIN	3407920086	1964075	352355	S	38.9675	82.6264	2658416	717995	4836	856						146	808	1199	778		
JACKSON	FRANKLIN	3407920102	1960650	367350		39.0085	82.6385	2653448	732957	6043	834	-5150	99	625	115	696	78	813	1235	718	780	20
JACKSON	FRANKLIN	3407920104	1961050	369650	S	39.0147	82.6369	2653868	735219	4468	798							778	1206	772		
JACKSON	FRANKLIN	3407920108	1963700	372900	S	39.0239	82.6278	2655899	738577	4569	797							778	1209	790		
JACKSON	FRANKLIN	3407920110	1961600	371700	S	39.0206	82.6353	2653900	737372	4494	791							782	1204	778		
JACKSON	FRANKLIN	3407920123	1968250	348150	S	38.9558	82.6117	2663022	713725	4545	726											
JACKSON	MILTON	3407920132	1994550	388450	S	39.0667	82.5192	2685017	754195	4933	802								1236	909		
KNOX	HOWARD	3408321288	2052000	265200	N	40.3944	82.3133	2690869	1238710	4876	1024						0					
KNOX	PIKE	3408321413	2031300	310850		40.5198	82.3874	2665319	1284471	5745	1252			440	90	375	0				850	
KNOX	MILFORD	3408321468	1982000	240200		40.3260	82.5646	2623792	1213749	5375	1204	-4162	178	458	110	399	0	640			700	
KNOX	HILLIAR	3408321604	1936300	223600		40.2802	82.7283	2580064	1197035	4810	1183	-3590	114	439	70	418	0					
KNOX	WAYNE	3408321684	1968320	276580	N	40.4258	82.6139	2606228	1250168	4045	1187						0					
KNOX	MIDDLEBURY	3408323860	1968490	303720	N	40.5003	82.6133	2603501	1277355	4272							0					
KNOX	MIDDLEBURY	3408323864	1965310	305890	N	40.5061	82.6247	2600117	1279472	4191	1254						0					
LAKE	PERRY	3408520142	2366500	762200		41.7510	81.1569	2950105	1733770	6075	701	-5359	122	298	100	166	0	659			1510	0
LAKE	PERRY	3408520280	2365010	760300		41.7458	81.1625	2948822	1731872	6110	712	-5384	134	319	93	164	0				1520	0
LAKE	PAINESVILLE	3408520681	2336450	761100		41.7492	81.2671	2920244	1733113	5975	623						0				1480	0
LAWRENCE	SYMMES	3408720174	2004480	266200		38.7309	82.4843	2707684	631653	7002	609	-6341	118	524	126	586	82	1055	1298	878	900	57
LAWRENCE	ELIZABETH	3408720219	1959100	220550	S	38.6056	82.6431	2667207	585927	5273	734						150	1005	1189	831		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
LAWRENCE	ELIZABETH	3408720255	1960900	229600	S	38.6303	82.6369	2668053	594941	5386	891							978	1196	808	650	198
LAWRENCE	ELIZABETH	3408720256	1957700	221850	S	38.6089	82.6481	2665660	587132	5230	675							987	1183	826		
LICKING	NEWARK	3408910001	2019100	741700	S	40.0364	82.4317	2672110	1108066													
LICKING	HANOVER	3408910003	2079400	759200	S	40.0842	82.2164	2730258	1125509													
LICKING	HANOVER	3408910004	2079400	741300	S	40.035	82.2164	2732233	1107555													
LICKING	MCKEAN	3408910009	1985300	784500	S	40.1539	82.5525	2633849	1150945													
LICKING	UNION	3408910010	1995000	711500	S	39.9536	82.5178	2651305	1077850													
LICKING	NEWARK	3408910114	2019800	743000	S	40.04	82.4292	2672666	1109379													
LICKING	NEWARK	3408910118	2015800	740850	S	40.0342	82.4436	2668876	1107263													
LICKING	NEWARK	3408910120	2018100	740700	S	40.0338	82.4353	2671216	1107044													
LICKING	NEWARK	3408910121	2018300	740950	S	40.0344	82.4347	2671352	1107336													
LICKING	NEWARK	3408910122	2019400	738900	S	40.0286	82.4308	2672667	1105219													
LICKING	NEWARK	3408920227	2019250	741350	S	40.0356	82.4314	2672225	1107774	4375	886											
LICKING	MARY ANN	3408921826	2049900	785300		40.1560	82.3215	2698102	1151711	5991	1060	-4910	100	495	84	443	0	697	1397	942	980	82
LICKING	MARY ANN	3408921973	2048500	787800	S	40.1628	82.3284	2696467	1154192	5191	1096						25	699	1390	953		
LICKING	LIBERTY	3408921981	1968800	788200	S	40.1639	82.6117	2616974	1154594	4500	1307						0	660	1307	831		
LICKING	HARTFORD	3408921998	1946300	810800	S	40.2258	82.6922	2592186	1177183	4475	1180				91	421	0	660	1288	778		
LICKING	EDEN	3408922030	2041100	800000	S	40.1964	82.3528	2687783	1166454	5023	1140						0	694	1321	1021	900	90
LICKING	HARTFORD	3408922033	1936200	823900	S	40.2619	82.7286	2580679	1190357	4000	1161						0	623	1355	716		
LICKING	HARTFORD	3408922047	1947100	809700	S	40.2228	82.6894	2593080	1176088	4030	1179						0	627	1278	775		
LICKING	BURLINGTON	3408922051	1991900	801150	S	40.1997	82.5289	2638638	1167658	4395	1099						58	668	1334	843		
LICKING	HARTFORD	3408922057	1939900	813400		40.2330	82.7152	2585511	1179810	4952	1178	-3732	160	435	94	440	0	655	1300	767	570	
LICKING	GRANVILLE	3408922066	1983000	763500	S	40.0961	82.5808	2633779	1129852	4280	1047								1331	823		
LICKING	ST. ALBANS	3408922067	1977100	744950	S	40.0453	82.5817	2629916	1111313	4253	1149								1317	807	680	
LICKING	EDEN	3408922129	2043200	800700	S	40.1983	82.3453	2689795	1167147	5094	1185						0	699	1396	938		
LICKING	EDEN	3408922130	2041000	808100	S	40.2188	82.3533	2686762	1174555	5012	1165						0	674	1393	928		
LICKING	MCKEAN	3408922135	1994502	776788	S	40.1328	82.5197	2643807	1143245	4513	1178								1347	854		
LICKING	ETNA	3408922163	1950050	716050	S	39.9658	82.6783	2606004	1082302	3890	1037						0	618	1288	723		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
LICKING	UNION	3408922181	1980850	726080	S	39.9936	82.5683	2635653	1092447	4222	1078						0	658	1311	795		
LICKING	JERSEY	3408922189	1952300	787200	S	40.1064	82.6706	2602776	1133610	4053	1147						0	674	1285	810		
LICKING	HARRISON	3408922191	1954450	719925	S	39.9764	82.6625	2610011	1086170	3868	982						0	658	1289	730		
LICKING	UNION	3408922219	2001050	728075	S	39.9989	82.4964	2655520	1094381	4438	995						0	637	1365	780		
LICKING	HARRISON	3408922224	1952200	723050	S	39.985	82.6706	2607421	1089308	3875	989						0	658	1288	726		
LICKING	LIMA	3408922252	1932825	720500		39.9780	82.7397	2588391	1086754	4803	1090	-3699	121	438	104	517	7	642	1266	710		
LICKING	HANOVER	3408922254	2071300	738000	S	40.0258	82.2453	2724538	1104197	5424	884						0	719	1412	991		
LICKING	LIMA	3408922261	1946240	727550	S	39.9975	82.6919	2600996	1093870	3644	1017								1271	722		
LICKING	ETNA	3408922272	1951550	715550	S	39.9644	82.6728	2607593	1081791	4020	1031								1294	728		
LICKING	UNION	3408922273	1999400	739300	S	40.0297	82.5022	2652702	1105621	4409	1029								1331	877		
LICKING	UNION	3408922294	1986550	734400	S	40.0164	82.5481	2640409	1100767	4445	1063						27	645	1323	816		
LICKING	BURLINGTON	3408922300	2006800	797250	S	40.1889	82.4756	2653897	1163717	4796	1230						0	677	1339	883		
LICKING	LIMA	3408922315	1933850	720400	S	39.9778	82.7361	2589404	1086681	3750	1089								1270	713		
LICKING	LIMA	3408922316	1946233	728015	S	39.9986	82.6919	2600954	1094271	3728	1022								1279	728		
LICKING	ETNA	3408922319	1952750	709050	S	39.9467	82.6686	2609442	1075332	3955	1065								1292	679		
LICKING	UNION	3408922338	1987550	710375	S	39.9503	82.5444	2644002	1076645	4231	905								1319	768		
LICKING	GRANVILLE	3408922378	1986500	761355	S	40.0903	82.5483	2637488	1127735	4295	1048								1331	822		
LICKING	BURLINGTON	3408922430	1995700	822100	S	40.2572	82.5153	2640178	1188642	4357	993						0	631	1316	860		
LICKING	LIMA	3408922473	1940700	719500	S	39.9753	82.7117	2596313	1085768													
LICKING	LIMA	3408922609	1944250	724170	S	39.9881	82.6989	2599400	1090440	3728	1040								1283	717		
LICKING	LIMA	3408922674	1946800	726800	S	39.9953	82.6906	2601443	1093087													
LICKING	ETNA	3408922699	1949950	716500	S	39.9672	82.6786	2605866	1082813	3779	1025											
LICKING	JERSEY	3408922735	1948310	751150	S	40.0622	82.6847	2600535	1117481	4331	1245						0	657	1263	790		
LICKING	ETNA	3408922795	1949550	715850	S	39.9653	82.68	2605548	1082119	3770	1038											
LICKING	GRANVILLE	3408922906	1983050	763350	S	40.0958	82.5606	2633846	1129742													
LICKING	NEWTON	3408923195	2016000	779750	S	40.1408	82.4428	2664917	1146164	3195	928						0	671	1358	872		
LICKING	ETNA	3408923236	1949960	715960	S	39.9656	82.6786	2605927	1082229	3754	1036								1291	725		
LICKING	JERSEY	3408923658	1948110	751210	S	40.0625	82.6853	2600357	1117580	4235	1256						0	658	1286	792		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
LICKING	ETNA	3408924288	1950050	716050	S	39.9658	82.6783	2606004	1082302	3759	1042								1286	723		
LICKING	PERRY	3408924792	2079850	779300		40.1393	82.2144	2728601	1145617	6237	808	-5407	180	497	75	485	0	725	1441	1017	1090	246
LICKING	MONROE	3408924935	1927400	779450	S	40.1397	82.7597	2576676	1145763	3574	1127								1280	734		
LICKING	JERSEY	3408925167	1935900	754500	S	40.0714	82.7289	2587857	1120838	4108	1175						0	625	1276	730		
LICKING	LIMA	3408925251	1947550	742800	S	40.0392	82.6872	2600717	1109087													
LICKING	HARRISON	3408925253	1956950	728650	S	40.0006	82.6536	2611570	1095001	4016	1060						0	630	1276	735		
LICKING	LIMA	3408925314	1946900	743350	S	40.0408	82.6897	2599958	1109671	4079	1206						110	572	1258	739		
LICKING	HOPEWELL	3408925343	2083160	717940	S	39.9708	82.2033	2738465	1084126	5591	1060						114	732	1419	985		
LICKING	LIMA	3408925358	1948050	745200	S	40.0458	82.6856	2600911	1111496	4708	1217				75	482	51	615	1264	738		
LICKING	LIMA	3408925359	1944940	742550	S	40.0386	82.6967	2598069	1108868	3989	1149						60	610	1263	734		
LICKING	LIMA	3408925368	1948800	740700	S	40.0336	82.6828	2602158	1107044	4051	1167						55	611	1269	740		
LICKING	WASHINGTON	3408925390	2023080	815010	S	40.2375	82.4172	2668237	1181452	4668	1108											
LICKING	BURLINGTON	3408925395	2009660	813850	S	40.2344	82.4653	2654978	1180321	4412	1092						0	613	1312	838		
LICKING	WASHINGTON	3408925396	2010860	814480	S	40.2361	82.4611	2656080	1180942													
LICKING	UNION	3408925399	1999290	706290	S	39.9392	82.5025	2656139	1072595													
LICKING	WASHINGTON	3408925403	2026290	812450	S	40.2306	82.4058	2671680	1178934													
LICKING	WASHINGTON	3408925404	2026510	816250	S	40.2411	82.405	2671488	1182766													
LICKING	HARRISON	3408925410	1953000	741350	S	40.0353	82.6678	2606279	1107664	4053	1232						101	586	1267	758		
LICKING	JERSEY	3408925413	1950720	748460	S	40.0547	82.6761	2603221	1114744													
LICKING	LICKING	3408925448	2027340	715420	S	39.9642	82.4025	2683096	1081718	5273	1041						0	690	1358	861		
LOGAN		2	1687253	917780		40.5144	83.6247	2322714	1282501		1090						0				0	0
LOGAN		10	1695774	872428		40.3903	83.5919	2336118	1237213		1095						0				0	0
LOGAN		12	1687253	917780		40.5144	83.6247	2322714	1282501		1090						0				0	0
LOGAN		15	1596967	870279		40.3806	83.9464	2238016	1233674		990						0			160	0	0
LOGAN		15	1713992	831534		40.2786	83.525	2358597	1196451		1070						0				0	0
LOGAN		16	1635203	905103		40.4778	83.8111	2272298	1269145		1020						0			162	0	0
LOGAN		31	1687680	856924		40.3475	83.6203	2329714	1221594		1384						0			610		0
LOGAN		48	1697043	829447		40.2722	83.5856	2341968	1194115		1160						0			440	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
LOGAN		55	1704970	884833		40.4244	83.5594	2343952	1249657		1091						0	690			386	0	0
LOGAN		83	1674585	889520		40.4364	83.6689	2313153	1254037		1292						0	707	854		413	0	0
LOGAN		89	1597344	911434		40.4933	83.9475	2233959	1274801		998						0				264	0	0
LOGAN		92	1597994	911084		40.4925	83.9453	2234596	1274509								0					0	0
LOGAN		93	1703788	840880		40.3039	83.5619	2347455	1205684		1095						0				385	0	0
LOGAN		94	1661261	893915		40.4481	83.7169	2299435	1258306		1245						0				389	0	0
LOGAN		100	1671450	823550		40.2553	83.6769	2317153	1187848		1370						0						0
LOGAN		101	1660900	846550		40.3161	83.7158	2304187	1210866		1360						0						0
LOGAN		102	1661000	846900		40.3189	83.7156	2304216	1211158		1365						0						0
LOGAN		103	1684650	845800		40.3167	83.6308	2327860	1210355		1290						0						0
LOGAN		104	1681500	853250		40.3369	83.6425	2323912	1217726		1450						0						0
LOGAN		105	1680750	854200		40.3397	83.645	2323121	1218748		1460						0						0
LOGAN		106	1676200	853150		40.3367	83.6614	2318667	1217653		1460						0						0
LOGAN		107	1672200	858800		40.3519	83.6761	2314061	1223200		1230						0						0
LOGAN		108	1671950	859250		40.3533	83.6769	2313791	1223711		1230						0						0
LOGAN		109	1681550	850550		40.3289	83.7139	2304346	1214807		1390						0						0
LOGAN		110	1662050	851100		40.3306	83.7119	2304844	1215427		1430						0						0
LOGAN		111	1661900	852700		40.335	83.7128	2304444	1217033		1455						0						0
LOGAN		112	1662150	856050		40.3442	83.7119	2304379	1220390		1485						0						0
LOGAN		113	1664050	855600		40.3428	83.705	2306344	1219879		1435						0						0
LOGAN		114	1657200	853200		40.3361	83.7294	2299793	1217434		1330						0						0
LOGAN		115	1665500	857950		40.3494	83.7	2307507	1222288		1365						0						0
LOGAN		116	1654200	861950		40.36	83.7408	2295811	1226158		1382						0						0
LOGAN		117	1660550	864400		40.3669	83.7181	2301881	1228674		1530						0						0
LOGAN		118	1669600	865000		40.3689	83.6856	2310838	1229404		1270						0						0
LOGAN		119	1675350	861150		40.3586	83.6647	2316997	1225645		1420						0						0
LOGAN		120	1675750	862500		40.3622	83.6633	2317262	1226959		1450						0						0
LOGAN		123	1668400	816150		40.2347	83.6875	2314909	1180431		1300						0						0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
LOGAN		124	1692000	851600		40.3328	83.6047	2334557	1216230		1285						0					0
LOGAN		125	1681600	870750		40.385	83.6428	2322170	1235279								0					0
LOGAN		126	1688650	877200		40.4031	83.6178	2328484	1241884		1480						0					0
LOGAN		127	1677250	872000		40.3883	83.6586	2317669	1236484		1440						0					0
LOGAN		128	1656500	876700		40.4006	83.7333	2296509	1240972		1420						0					0
LOGAN		129	1655100	887600		40.4303	83.7389	2293940	1251810		1300						0					0
LOGAN		130	1663200	886000		40.4264	83.7097	2302176	1250387		1300						0					0
LOGAN		131	1664400	883300		40.4189	83.7053	2303654	1247650		1360						0					0
LOGAN		271	1659975	885412		40.3697	83.7203	2301174	1229698		1540						0					0
LOGAN		3065	1655625	883109		40.3633	83.7356	2297143	1227360		1390						0			631		0
LOGAN		5104	1680479	858621		40.3517	83.6464	2322318	1223127								0					0
LOGAN		5105	1655900	883900		40.3653	83.7347	2297325	1228090								0					0
LOGAN		5106	1648965	883508		40.4189	83.7606	2288307	1247650								0					0
LOGAN		5111	1658568	879912		40.4094	83.7258	2298290	1244183								0					0
LOGAN		5112	1695960	858427		40.3517	83.5906	2337819	1223127								0					0
LOGAN		5117	1672954	911422		40.4964	83.6758	2309173	1275932								0					0
LOGAN		5121	1683983	850922		40.3308	83.6333	2326679	1215500								0					0
LOGAN		10672	1692484	849425		40.3269	83.6028	2335289	1214077								0					0
LOGAN		10674	1675961	898622		40.4614	83.6644	2313540	1263160								0					0
LOGAN	MCARTHUR	3409120018	1645800	289900		40.4553	83.7728	2283684	1260934	3361	1190	-2062	307	430	128	421	0	559				0
LOGAN	LAKE	3409120050	1653900	271700		40.4057	83.7427	2293725	1242833	3276	1317			448			0	530		455		0
LOGAN	JEFFERSON	3409120068	1683650	248800		40.3400	83.6081	2389923	1218858	3234	1439			414	115	477	0	678	868	652		0
LOGAN	JEFFERSON	3409120087	1672950	264200		40.3858	83.6740	2313479	1235571	3276	1364			384	130	460	0	708	876	622		0
LOGAN	MIAMI	3409120090	1587700	225500		40.2760	83.9776	2232813	1195502	3222	1090			392	43	675	0	642	861	113	0	0
LOGAN	PERRY	3409120091	1697300	262450		40.3819	83.5865	2337909	1234148	3013	1101			437	99	468	0	716		375	0	0
LOGAN	ZANE	3409120093	1703800	233950		40.3039	83.5619	2347455	1205684	3140	1103			448	104	497	0	537			0	0
LORAIN	HENRIETTA	3409320794	2049100	591000		41.2887	82.3213	2652566	1565064	4590	650	-3723	93	325	44	137	0					
LUCAS	MONCLOVA	25	1647437	1299319		41.5597	83.7872	2241761	1663959		663								754			

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
LUCAS	SPRINGFIELD	39	1677468	1319698		41.6167	83.6786	2269375	1684760		635								760			
LUCAS	HARDING	3409520060	1639300	713650		41.6180	83.8192	2231015	1685235	3915	674	-2950	274	246			0		757			0
MADISON		4	1769000	697550		39.9122	83.3236	2427652	1062742		995						0				0	0
MADISON		24	1735780	761610		40.0872	83.4442	2387800	1126604		993						0				0	0
MADISON		25	1770565	763456		40.0933	83.32	2422218	1128830		965						0				0	0
MADISON		27	1782200	684810		39.8778	83.2761	2442159	1050188		968						0				0	0
MADISON		28	1707000	632900		39.7331	83.5419	2372802	997383		1055						0				0	0
MADISON		29	1738600	715600		39.9611	83.4325	2395492	1080587		1020						0				0	0
MADISON		30	1737200	687500		39.8839	83.4364	2397106	1052414		1035						0				0	0
MADISON		3409720002				40.0453	83.3378	2418968	1111318	2255	977						0					0
MADISON	FAIRFIELD	3409720003	1769600	681750		39.8690	83.3208	2429968	1046977	3631	995	-2622	214	503	30	620	0	588	1070		0	0
MAHONING	SMITH	3409920123	2404700	484000	N	40.9858	81.0342	3018801	1454528	8030	1069				0		79	989	1935	1969	2500	
MAHONING	SMITH	3409920212	2404700	482800	N	40.9825	81.0342	3018952	1453323	8194	1080				0	136	104	976	1934	1970	2500	
MAHONING	ELLSWORTH	3409920250	2464200	499320	N	41.025	80.8175	3076542	1468833	8352	1082				0		160	922	2037	1949		
MARION		4	1781264	936770		40.5692	83.2872	2414260	1302499		910						0				0	0
MARION		4	1814405	983487		40.6981	83.1692	2442205	1349538		920						0				0	0
MARION		5	1801125	898943		40.4658	83.2147	2438094	1264765		915						0				0	0
MARION	WALDO	6	1855681	902482		40.4767	83.0186	2492064	1268743		972							777	925			
MARION		7	1872377	935490		40.5675	82.9592	2505131	1301878		997						0	766	930	898	30	0
MARION		9	1877372	970598		40.6639	82.9419	2506298	1337058		1012						0	761	931	920	30	0
MARION		10	1854966	976995		40.6811	83.0228	2483291	1343334		1016						0	760	934	885	32	0
MARION		11	1877572	970998		40.665	82.9411	2506477	1337459		1006						0	767	930	900	30	0
MARION		12	1878622	971348		40.6658	82.9375	2507442	1337751		1011						0			917	27	0
MARION		13	1870482	907985		40.4919	82.9656	2506189	1274290		983						0			930	32	0
MARION		14	1860471	959292		40.6325	83.0025	2490718	1325599		999						0	773	927	900	27	0
MARION		17	1859271	954691		40.62	83.0069	2489967	1321037		999						0	783	926	922	25	0
MARION		18	1869576	940690		40.5817	82.9694	2501776	1307060		995						0	780	930	898	32	0
MARION		20	1897578	964700		40.6478	82.8689	2527088	1331182		1049						0			929	38	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
MARION	RICHLAND	21	1871381	915987		40.5139	82.9625	2506225	1282318		992							775				
MARION		22	1872978	934890		40.5658	82.9572	2505749	1301258		997						0	777	943	900	30	0
MARION		23	1784250	984782		40.7014	83.2419	2421996	1350742		892						0	767	856	402	0	0
MARION		24	1867079	922287		40.5311	82.9781	2501260	1288595		992						0	738	914	901	30	0
MARION		28	1865473	955192		40.6214	82.9844	2496139	1321548		1000						0			892	30	0
MARION		29	1803261	951977		40.6114	83.2083	2434565	1317899		832						0	773	874	473	0	0
MARION		36	1856871	952890		40.6153	83.0156	2487736	1319322		1002						0			879	24	0
MARION		41	1860480	911484		40.5014	83.0017	2495829	1277757		994						0	780	936	983		0
MARION		42	1804912	947577		40.5994	83.2025	2436608	1313520		925						0	762	905	475	0	0
MARION		44	1870480	907484		40.4906	82.9656	2506237	1273816		988						0	734	939		0	0
MARION		48	1841053	907479		40.49	83.0714	2476935	1273597		968						0	483	912		0	0
MARION		58	1767158	938954		40.575	83.3381	2399959	1304615		915						0	719	910		0	0
MARION	SCOTT	65	1869372	964395		40.6467	82.9706	2499008	1330781		1005							759				
MARION		66	1847528	935558		40.5672	83.0486	2480392	1301769		977						0	767	928	854	0	0
MARION		67	1859101	929386		40.5506	83.0069	2492556	1295711		987						0	726	917	892	37	0
MARION		74	1860226	932737		40.5597	83.0031	2493269	1299032		990						0	757	925	895	27	0
MARION		75	1850223	937536		40.5728	83.0392	2482786	1303813		984						0	781	924	910	25	0
MARION		78	1752155	941009		40.58	83.3922	2384803	1306440		927						0		926	224	0	0
MARION		81	1867226	937639		40.5733	82.9778	2499765	1303995		995						0	765	930	887	33	0
MARION	PROSPECT	82	1825981	889199		40.4397	83.125	2463924	1255241		967							745				
MARION		83	1790264	934570		40.5833	83.2547	2423472	1300346		914						0	740	908	419	0	0
MARION		84	1856546	954865		40.6203	83.0167	2487245	1321147		994						0	767	920	885	27	0
MARION		85	1744779	953989		40.6156	83.4192	2376061	1319432		980						0				0	0
MARION		86	1824084	914196		40.5081	83.1325	2459334	1280202		983						0	776	910	739	0	0
MARION		87	1815575	906273		40.4864	83.1628	2451732	1272283		953						0	773	920		0	0
MARION		89	1857330	911633		40.5017	83.0131	2492659	1277866		986						0	740	974	883	27	0
MARION		92	1764062	924860		40.5361	83.3486	2398446	1290420		922						0	711	908	284	0	0
MARION		93	1837150	919880		40.5242	83.0856	2471736	1286077		982						0	768	912	805	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
MARION		94	1869276	941865		40.585	82.9706	2501320	1308265		985						0			1055		0
MARION		95	1863348	950866		40.6094	82.9919	2494513	1317169		990						0	769	934	1015	0	0
MARION		96	1825368	962060		40.6394	83.1292	2455420	1328117		959						0			685	0	0
MARION		99	1864748	950891		40.6097	82.9869	2495885	1317278		990						0	774	925	1025	0	0
MARION		103	1893676	970600		40.6642	82.8831	2522541	1337167		1035						0	794	943	905	37	0
MARION		114	1833053	924490		40.5367	83.1006	2467120	1290639		977						0	782	910	788	0	0
MARION		117	1821443	919866		40.5236	83.1422	2456078	1285858		974						0			698	0	0
MARION		118	1821121	924227		40.5356	83.1433	2455333	1290237		974						0				0	0
MARION		124	1822323	919727		40.5233	83.1389	2457003	1285749		979						0			718	0	0
MARION		129	1823753	919787		40.5233	83.1339	2458388	1285749		985						0			720	0	0
MARION		130	1823874	916326		40.5142	83.1333	2458889	1282428		987						0		916	765	0	0
MARION	PLEASANT	133	1814672	919625		40.5228	83.1664	2449403	1285566		954							876				
MARION		138	1820874	915828		40.5125	83.1442	2455931	1281807		974						0			769	0	0
MARION		143	1872129	927348		40.545	82.96	2505753	1293668		1000						0					0
MARION		180	1766301	961318		40.6361	83.3419	2396712	1326913		907						0				0	0
MARION		181	1818621	923426		40.5333	83.1525	2452869	1289398		992						0				0	0
MARION		184	1838478	909329		40.495	83.0806	2474200	1275421		973						0				0	0
MARION		185	1792091	943152		40.5869	83.2483	2424387	1308958		925						0			451	0	0
MARION		187	1817821	923078		40.5325	83.155	2452206	1289106		981						0				0	0
MARION		189	1846541	900860		40.4719	83.0514	2483148	1266991		981						0			802	22	0
MARION		2643	1807725	903798		40.4794	83.1911	2444142	1269728		912						0				0	0
MARION		2643	1807725	903798		40.4794	83.1911	2444142	1269728		912						0				0	0
MARION		2644	1848456	899805		40.4692	83.0447	2485106	1266006		955						0				25	0
MARION		2644	1848456	899805		40.4692	83.0447	2485106	1266006		955						0				25	0
MARION		2645	1808468	928474		40.5469	83.1892	2442206	1294361		907						0				0	0
MARION		2647	1826881	889274		40.4397	83.1219	2464784	1255241		949						0				0	0
MARION		2647	1826881	889274		40.4397	83.1219	2464784	1255241		960						0				0	0
MARION		10664	1817598	917925		40.5183	83.1558	2452504	1283924								0				0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
MARION		16596	1746341	978165		40.6819	83.4144	2375026	1343626								0				0	0
MARION	CLARIDON	3410120008	1860300	333600		40.5812	83.0029	2492522	1306878	3675	1001	-2664	81	434	80	424	0	697	915	870		0
MARION	CLARIDON	3410120049	1846900	328150		40.5661	83.0510	2479768	1301368	3459	981			424	36	338	0	776	924	848		0
MARION	PLEASANT	3410120144	1827850	311050		40.5188	83.1182	2462627	1284107	3485	998	-2472			114	323	0	626				0
MARION	RICHLAND	3410120150	1848220	309710		40.5155	83.0459	2483057	1282902	3432	978			399	78	276	0	694				0
MARION	RICHLAND	3410120151	1847620	309470		40.5148	83.0480	2482501	1282647	3521	971						0					0
MARION	RICHLAND	3410120165	1847100	309100		40.5138	83.0489	2482012	1282282	3657	965	-2638	13	627	55	356	0	664				0
MARION	GRAND	3410120167	1768400	357400		40.6446	83.3418	2396434	1330014	2934	905	-2019	215	416	75	288	0	748	887	250	0	0
MARION	BIG ISLAND	3410120168	1790500	335950		40.5863	83.2543	2422748	1308739	3074	926	-2134	120	496	98	296	0	735			0	0
MARION	MONTGOMERY	3410120173	1757250	340950		40.5992	83.3742	2389099	1313447	2990	974	-2011	207	408	85	349	0	530			0	0
MARION	BIG ISLAND	3410120174	1797850	336150		40.5870	83.2278	2430058	1308995	3198	916	-2167	139	580			0	685	902		0	0
MARION	MONTGOMERY	3410120175	1766350	355100		40.6383	83.3419	2396833	1327715	2935	901	-2034	237	408	41	327	0	508			0	0
MARION	BIG ISLAND	3410120176	1790250	336600		40.5881	83.2552	2422434	1309396	3078	924	-2138	137				0	740	820	438	0	0
MEDINA	HINCKLEY	3410321143	2219400	570200		41.2290	81.7024	2824574	1543278	7033	1200	-5380	60	600	86	47	0	715			1410	
MEDINA	GRANGER	3410321201	2209600	551100		41.1768	81.7386	2816906	1524229	6731	1116	-5546	125	617			0				1410	
MEDINA	HOMER	3410321819	2091925	500500		41.0400	82.1668	2705125	1474307	5658	1092	-4558	122	528			0	688			940	
MEDINA	HINCKLEY	3410324540	2208260	584520	N	41.2686	81.7425	2811880	1557729								0					
MERCER		1	1381092	938382		40.5553	84.7272	2015914	1297426		850						0			185	0	0
MERCER		2	1379687	887274		40.415	84.7275	2020052	1246227		845						0			182	0	0
MERCER		3	1448955	872330		40.3783	84.4778	2090509	1232834		955						0			170	0	0
MERCER		42	1446574	963316		40.6281	84.4936	2078360	1323993		830						0				0	0
MERCER		103	1455986	995605		40.7169	84.4622	2084268	1356399		828						0			304	0	0
MERCER	JEFFERSON	129	1414553	931459		40.5386	84.6061	2049973	1291332		862							604				
MERCER		132	1441552	971038		40.6489	84.5122	2072566	1331584		823						0	590	746		0	0
MERCER		142	1393957	981912		40.6756	84.6847	2024037	1341327		818						0	597	700		0	0
MERCER		148	1419750	893387		40.4344	84.5842	2059238	1253307		932						0		741	232	0	0
MERCER		149	1412180	899053		40.4494	84.6119	2051093	1258781		930						0		755	220	0	0
MERCER		150	1418330	899758		40.4517	84.59	2057098	1259620		921						0		727	220	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
MERCER		151	1406202	907449		40.4722	84.6342	2044211	1267101		918						0		716	220	0	0
MERCER		3060	1402326	932274		40.54	84.6503	2037683	1291843		858						0			201	0	0
MERCER	CENTER	3410720141	1440472	357881		40.6312	84.5160	2072065	1325124	3135	837	-2313	199	572	0	700	0	612	752	228	0	0
MERCER	BLACK CREEK	3410720164	1363653	368940		40.6564	84.7937	1994469	1334321	2885	830			500	0	739	0	593			0	0
MIAMI		865	1550750	732100		39.9992	84.1036	2206747	1094490								0				0	0
MIAMI		1579	1480900	730200		39.9903	84.3528	2137427	1091242		925						0				0	0
MIAMI		12771	1489250	720800		39.965	84.3222	2146770	1082010								0				0	0
MIAMI		12772	1485300	727100		39.9819	84.3367	2142188	1088177								0				0	0
MIAMI		14491	1541550	715850		39.9542	84.1353	2199343	1078089								0				0	0
MIAMI		15652	1527700	726400		39.9822	84.1856	2184390	1088286								0				0	0
MIAMI		15653	1485100	737700		40.0111	84.3383	2140825	1098833								0				0	0
MIAMI		16599	1516900	777200		40.1211	84.2275	2168257	1138975								0				0	0
MIAMI	WASHINGTON	3410920001	1494000	799000		40.1798	84.3109	2143152	1160396	3412	894	-2288	252	526	0	877	0	586	982	63	0	0
MIAMI	LOST CREEK	3410920003	1557000	744200		40.0326	84.0820	2211695	1106679	3510	1035	-2215	164	536	0	801	0	681	839	120	0	0
MIAMI	STAUNTON	3410920008	1533200	728520		39.9884	84.1660	2189666	1090549	3015	801			528	0	857	0	664			0	0
MIAMI	STAUNTON	3410920009	1534700	741010		40.0228	84.1614	2189846	1103103	3061	859			526	0	831	0	533			0	0
MIAMI	BROWN	3410920011				40.1653	84.0354	2220364	1155099	3064	1138				0	755	0	662	880	200	0	0
MORGAN	DEERFIELD	3411520536	2163000	619500	S	39.6994	81.9208	2828520	985085	8797	1061	-7659	210	740			107	934	1915	1930		
MORGAN	BRISTOL	3411521214	2200450	620800	S	39.7022	81.7875	2865772	986107													
MORGAN	DEERFIELD	3411521235	2137700	624500	S	39.7136	82.0106	2802768	990267	6240	1034											
MORGAN	HOMER	3411521249	2135625	544000	S	39.4928	82.0194	2809258	909691	6514	862							898	1434	1191		
MORGAN	CENTER	3411523168	2229900	584900	S	39.6031	81.6842	2898886	949943	7805	848											
MORGAN	CENTER	3411523250	2238800	585500	S	39.6044	81.6525	2907730	950417	8018	915								1623	1466		
MORGAN	BRISTOL	3411523341	2205750	622000	S	39.7056	81.7686	2870928	987348	7576	893						94	1045	1549	1349		
MORGAN	MANCHESTER	3411523465	2225830	628940	S	39.7242	81.6967	2890300	994135	7898	993							1118	1606	1386		
MORGAN	BRISTOL	3411523703	2195720	610270	S	39.6736	81.8047	2862137	975670	7280	970							998	1577	1271		
MORGAN	MANCHESTER	3411523802	2225900	627630	S	39.7206	81.6969	2890395	992821	8060	893						135	1097	1573	1391		
MORGAN	MANCHESTER	3411523803	2235790	636630	S	39.745	81.6614	2899315	1001726	7868	925								1594	1419		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
MORGAN	MANCHESTER	3411524165	2231120	624880	S	39.7128	81.6783	2895935	989975													
MORROW	HARMONY	41	1918789	904692		40.4833	82.7919	2554658	1271152		1178							799	969			
MORROW	CHESTER	58	1956495	884893		40.4294	82.6561	2594382	1251482		1227							783	990	954		
MORROW	SOUTH BLOOMFIE	93	1936595	860390		40.3619	82.7275	2577161	1226849		1293							816	960			
MORROW	WESTFIELD	121	1880187	886685		40.4336	82.9303	2518160	1253015		994							689	925			
MORROW	LINCOLN	124	1906588	902890		40.4786	82.8358	2542668	1269436		1070							714	952			
MORROW	GILEAD	297	1910386	918183		40.5203	82.8222	2544854	1284654		1161							704	942			
MORROW	GILEAD	359	1911085	928095		40.5475	82.82	2544429	1294580		1101							747	949			
MORROW	WESTFIELD	545	1864583	896683		40.4808	82.9867	2501500	1262941		980							700	931			
MORROW	CARDINGTON	706	1885184	909488		40.4961	82.9128	2520665	1275823		1005							756	941			
MORROW	BENNINGTON	962	1830894	873390		40.3975	82.7481	2570081	1239841		1267							802	972			
MORROW	CARDINGTON	1067	1894385	913190		40.5064	82.8797	2529449	1279581		1038							721	939			
MORROW	CONGRESS	1420	1925685	947200		40.6003	82.7675	2556946	1313848		1260							817				
MORROW	HARMONY	1439	1922040	904817		40.4839	82.7803	2557851	1271371		1195							767	960			
MORROW	CARDINGTON	1549	1891957	929292		40.5506	82.8886	2525315	1295711		1037							779	945			
MORROW	HARMONY	1568	1934641	906244		40.4878	82.735	2570257	1272794		1180							756	976			
MORROW	FRANKLIN	1579	1944991	923397		40.535	82.6978	2578749	1290018		1349							824	991			
MORROW	CONGRESS	1593	1944089	944701		40.5933	82.7014	2575505	1311294		1398							816	983	971		
MORROW	CHESTER	1729	1949693	905295		40.4853	82.6808	2585376	1271881		1175							803	990			
MORROW	FRANKLIN	1780	1959894	909948		40.4981	82.6442	2595024	1276553		1299							825	1003			
MORROW	BENNINGTON	1922	1909691	882788		40.4233	82.8244	2547827	1249256		1113							793	961			
MORROW	CARDINGTON	1958	1882232	916289		40.5203	82.9236	2516762	1284654		1011							823	954			
MORROW	CARDINGTON	1964	1897134	920592		40.5269	82.87	2531362	1287062		1037							745	949			
MORROW	FRANKLIN	2132	1926988	922505		40.5325	82.7625	2560926	1289106		1226							827	983			
MORROW	GILEAD	2345	1910984	940697		40.5822	82.8203	2543025	1307243		1161							750	954			
MORROW	PERU	2439	1904541	878287		40.4108	82.8428	2543295	1244694		1071							758	952			
MORROW	PERRY	2517	1956492	940051		40.5808	82.6567	2588359	1306732		1410							795	995	1015		
MORROW	WASHINGTON	2562	1909356	953899		40.6183	82.8264	2539963	1320417		1166							676	949			

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
MORROW	BENNINGTON	2869	1929295	856239		40.3506	82.7536	2570345	1222726		1196							822	975	910		
MORROW	CONGRESS	2961	1927888	931397		40.5567	82.7594	2560858	1297937		1261							791	968			
MORROW	CANAAN	3003	1891154	948445		40.6033	82.8919	2522411	1314943		1032							749	937			
MORROW	CONGRESS	3036	1931710	959603		40.6342	82.7461	2561565	1326219		1376							812	980			
MORROW	BENNINGTON	3323	1906793	862086		40.3664	82.8344	2547306	1228492		1068							796				
MORROW	CHESTER	3365	1934817	894593		40.4558	82.7342	2571706	1261116		1231							784				
MORROW	CARDINGTON	3402	1897835	913811		40.5083	82.8672	2532841	1280275		1049							745	932			
MORROW	GILEAD	3415	1897731	943595		40.59	82.8681	2529500	1310089		1058							760				
MORROW	LINCOLN	3420	1898039	888437		40.4386	82.8661	2535780	1254839		1053							803				
MORROW	NORTH BLOOMFII	3424	1941536	977557		40.6836	82.7108	2569422	1344247		1340							809	984			
MORROW	CANAAN	3411720012	1885700	329400		40.5701	82.9114	2518267	1302827	4090	1016	-2986	137	475	75	337	0					
MORROW	WESTFIELD	3411720033	1881800	280800		40.4366	82.9246	2519628	1254110	4048	995	-3014	144	475	90	420	0					
MORROW	TROY	3411720047	1949725	373000		40.6904	82.6813	2577311	1346728	4890	1398	-3472	120	435	55	364	0				650	
MORROW	BENNINGTON	3411721388	1910000	251350		40.3561	82.8229	2550890	1224733	4450	1140	-3305	75				0					
MORROW	PERU	3411721681	1896900	265250		40.3941	82.8701	2536349	1238600	4215	1007	-3178	145	450	100	439	0					
MORROW	CARDINGTON	3411721835	1872700	310250		40.5173	82.9578	2507400	1283559	3867	999			461	90	371	0	583				
MORROW	CANAAN	3411722550	1874800	336050		40.5862	82.9508	2506680	1309432	3876	1004	-2871	115	440	110	285	0	620				
MUSKINGUM	SALT CREEK	3411820689	2188100	679600	S	39.8639	81.83	2847149	1045116													
MUSKINGUM	BLUE ROCK	3411920778	2187500	668100	S	39.8325	81.8325	2847754	1033657													
MUSKINGUM	SALT CREEK	3411920787	2182200	698400	S	39.9158	81.8506	2839235	1064055													
MUSKINGUM	HOPEWELL	3411921820	2075575	707030	S	39.9408	82.2306	2732041	1073178	5277	902							841	1401	981		
MUSKINGUM	ADAMS	3411924663	2179070	779750	S	40.1392	81.8594	2827487	1145580	6713	798						104	787	1541	1252		
MUSKINGUM	PERRY	3411925831	2173125	732940	S	40.0108	81.8819	2826552	1098723	6524	940						108	819	1515	1240		
MUSKINGUM	SALEM	3411926036	2168125	750300	S	40.0586	81.8994	2819689	1116167	6498	868											
MUSKINGUM	ADAMS	3411926387	2169220	773750	S	40.1228	81.895	2818252	1139595	6718	1058						105	787	1522	1223		
MUSKINGUM	WASHINGTON	3411926992	2162130	727200	S	39.9953	81.9214	2816170	1093067	6384	821									3596		
MUSKINGUM	WASHINGTON	3411926998	2151760	734200	S	40.0144	81.9583	2805084	1100037	6219	938						85	777	1468	1193		
MUSKINGUM	MADISON	3411927076	2152150	772970	S	40.1211	81.9561	2801300	1138975	7381	928	-6445	200	587	256	252	73	769	1504	1190		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
MUSKINGUM	CLAY	3411927094	2131140	655890	S	39.8	82.0333	2792895	1021797	6207	995					80		812	1434	1134	1420	109
MUSKINGUM	ADAMS	3411927261	2169220	773950	S	40.1233	81.895	2818231	1139778	6377	1078							774	1528	1224		
MUSKINGUM	FALLS	3411927350	2125210	709410	S	39.9469	82.0533	2781324	1075405	5900	879					84		748	1436	1105		
MUSKINGUM	ADAMS	3411927395	2170740	773700	S	40.1228	81.8894	2819812	1139595	6374	1050								1525	1225		
MUSKINGUM	HARRISON	3411927526	2168390	658220	S	39.8058	81.9006	2829802	1023913	6650	690					146		900	1484	1244		
MUSKINGUM	MONROE	3411927528	2211700	784600	S	40.1517	81.7428	2859435	1150142	6830	1005								1581	1382		
MUSKINGUM	HOPEWELL	3411927543	2099970	696460	S	39.9117	82.1436	2757520	1062559	5631	990					143		714	1399	1025		
MUSKINGUM	WASHINGTON	3411927578	2148460	712290	S	39.9544	81.9706	2804117	1078142	6075	904							756	2494	197		
MUSKINGUM	MUSKINGUM	3411927579	2147000	746825	S	40.0492	81.975	2798983	1112737	5902	714					68		780	1542	1112		
MUSKINGUM	WAYNE	3411927586	2146770	698770	S	39.9175	81.9767	2803927	1064676	6009	771					90		780	1471	1193		
MUSKINGUM	WAYNE	3411927591	2141150	701760	S	39.9256	81.9967	2798006	1067632	6218	906					102		770				
MUSKINGUM	PERRY	3411927624	2166110	713170	S	39.9567	81.9075	2821645	1078981	6434	875							813	1498	1213		
MUSKINGUM	WASHINGTON	3411927628	2150990	719810	S	39.975	81.9614	2805839	1085659	6191	900					85		783	1469	1185		
MUSKINGUM	MUSKINGUM	3411927629	2135350	759280	S	40.0836	82.0164	2786037	1125290													
MUSKINGUM	PERRY	3411927633	2164910	707350	S	39.9406	81.9119	2821081	1073106													
MUSKINGUM	SALT CREEK	3411927635	2122290	698800	S	39.9178	82.0639	2779547	1064785	5900	955					80		752	1452			
MUSKINGUM	UNION	3411927636	2192200	719470	S	39.9733	81.8142	2847009	1085039	6805	942							878	1548	1288		
MUSKINGUM	WAYNE	3411927639	2149400	701120	S	39.9239	81.9672	2806318	1067011	6093	820							788	1496	1167		
MUSKINGUM	SALT CREEK	3411927659	2181280	703760	S	39.9306	81.8536	2837782	1069456	6670	786					80		896	1558	1251		
MUSKINGUM	MADISON	3411927672	2162500	765650	S	40.1008	81.9192	2812421	1131587	6339	963					82		803	1561	1147		
MUSKINGUM	CASS	3411927679	2126310	782370	S	40.1472	82.0483	2774544	1148500	5600	725					110		684				
MUSKINGUM	MUSKINGUM	3411927680	2120450	757380	S	40.0786	82.0697	2771382	1123465	5483	795								1454	1102		
MUSKINGUM	SALT CREEK	3411927682	2177840	705120	S	39.9342	81.8658	2834224	1070770	6523	721					98		866	1517	1249		
MUSKINGUM	WASHINGTON	3411927683	2144570	710880	S	39.9506	81.9844	2800418	1076755	5893	731							775	1476	1164		
MUSKINGUM	WASHINGTON	3411927689	2149880	729290	S	40.0011	81.965	2803761	1095184													
MUSKINGUM	MUSKINGUM	3411927695	2122150	759890	S	40.0856	82.0636	2772798	1126020													
MUSKINGUM	MADISON	3411927697	2144700	769600	S	40.1119	81.9828	2794239	1135618													
MUSKINGUM	SALEM	3411927698	2166450	758550	S	40.0811	81.9053	2817111	1124378		798											

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
MUSKINGUM	MUSKINGUM	3411927700	2118750	749610	S	40.0572	82.0758	2770553	1115656	5740	926							743	1468	1105		
MUSKINGUM	MUSKINGUM	3411927701	2128590	753640	S	40.0683	82.0406	2779916	1118707													
MUSKINGUM	FALLS	3411927703	2135960	733790	S	40.0136	82.0147	2789378	1099745													
MUSKINGUM	MUSKINGUM	3411927706	2139500	740500	S	40.0319	82.0019	2792200	1106423		770											
NOBLE	ELK	3412121278	2324750	588750		39.6106	81.3473	2993117	952752	11442	1035	-10375	209	638	0	413	142	1566	1759	1848	2630	272
NOBLE	NOBLE	3412121576	2276110	666085	S	39.6247	81.5169	2936383	1030810	8529	1043				0			1211				
NOBLE	NOBLE	3412121633	2273380	664460	S	39.8203	81.5267	2933829	1029205	8548	1082				0			1190	1645	1597	2220	234
NOBLE	OLIVE	3412121730	2266350	632200	S	39.7319	81.5531	2930210	996945	8680	984				0		133	1209	1625	1552		
OTTAWA	CARROLL	44	1826278	1306391		41.5842	83.1344	2418878	1672900		576								745			
OTTAWA	CARROLL	48	1823076	1306941		41.5856	83.1464	2415555	1673411		579								735			
OTTAWA	CARROLL	49	1823726	1309693		41.5933	83.1439	2415948	1676221		578								738			
OTTAWA	CARROLL	50	1821825	1306941		41.5856	83.1508	2414356	1673411		579								734			
OTTAWA	CARROLL	55	1823776	1307041		41.5858	83.1436	2416311	1673484		580								742			
OTTAWA	CARROLL	56	1825277	1306991		41.5858	83.1383	2417756	1673484		578								738			
OTTAWA	CARROLL	58	1827279	1306742		41.5853	83.1308	2419819	1673302		576								743			
OTTAWA	CARROLL	62	1823776	1306191		41.5836	83.1436	2416393	1672681		577								740			
OTTAWA	CARROLL	69	1823101	1307541		41.5872	83.1461	2415577	1673995		579								737			
OTTAWA	HARRIS	70	1804470	1281619		41.5158	83.2136	2399829	1647839		600								734			
OTTAWA	HARRIS	72	1798472	1282154		41.4822	83.2347	2396055	1628379		610								740			
OTTAWA	SALEM	73	1825986	1273169		41.4831	83.1347	2422211	1639655		589								762			
OTTAWA	CLAY	76	1759789	1285607		41.5258	83.3767	2354955	1651588		631								753			
OTTAWA	SALEM	77	1815576	1284674		41.5244	83.1731	2410561	1651078		601								737			
OTTAWA	ALLEN	79	1767087	1306324		41.5828	83.3508	2359938	1672389		607								724			
OTTAWA	BENTON	80	1800416	1284069		41.5225	83.2283	2395570	1650384		607								735			
OTTAWA	CATAWBA ISLANI	82	1901733	1289444		41.5389	82.8586	2495809	1656369		601								858			
OTTAWA	SALEM	89	1826583	1286578		41.53	83.1331	2421265	1653121		590								750			
PAULDING		3	1469161	1133113		41.095	84.4253	2082514	1494378		720						0		802	588	0	0
PAULDING		4	1467854	1127635		41.08	84.4292	2081818	1488904		722						0			528	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
PAULDING	BROWN	4	1469159	1134964		41.1003	84.4253	2082348	1496312		715							521	813			
PAULDING	BENTON	6	1372033	1116476		41.0433	84.7758	1987771	1475511		758							516				
PAULDING		22	1444660	1145960		41.1289	84.515	2056805	1506749		726						0		805	614	0	0
PAULDING		29	1471549	1117433		41.0522	84.4153	2086621	1478759		720						0				0	0
PAULDING		30	1372043	1116376		41.0431	84.7758	1987777	1475438		756						0				0	0
PAULDING	JACKSON	31	1444686	1151163		41.1431	84.5156	2056195	1511931		721							573	803			
PAULDING		64	1436059	1106380		41.0197	84.5431	2052498	1466899		730						0			491	0	0
PAULDING		66	1446540	1095560		40.9908	84.5042	2064104	1456352								0				0	0
PAULDING	LATTY	67	1432182	1111825		41.0344	84.5575	2048079	1472263		741							537	775			
PAULDING		68	1441707	1122237		41.0636	84.5239	2056408	1482919								0				0	0
PAULDING		111	1446509	1186021		41.2389	84.5117	2054255	1546891		716						0			750	0	0
PAULDING	JACKSON	3412520013	1454010	536420		41.1220	84.4819	2066112	1504231	3440	724	-2668	245	508	0		0	591	811	601	0	0
PAULDING	CARRYALL	3412520060	1393000	577800		41.2318	84.7071	2000901	1544300	3300	728			580	0		0					0
PERRY	BEARFIELD	3412721132	2123400	612400	S	39.6806	82.0617	2789781	978224													
PERRY	THORN	3412722321	2025075	698925	S	39.9189	82.4106	2682612	1065187	4446	902							697			900	85
PERRY	JACKSON	3412723141	2067000	612100	S	39.6803	82.2619	2733651	978115	5399	1112							719	1365	853		
PERRY	BEARFIELD	3412723142	2129620	624530	S	39.7139	82.0392	2794740	990376	6183	918							813	1418	1134		
PERRY	PLEASANT	3412723308	2095590	611690	S	39.6789	82.1603	2762199	977604	5827	986						132	758	1392	1030		
PERRY	JACKSON	3412723310	2059400	622600	S	39.7092	82.2889	2724836	988661	5170	962							717	1359	951		
PERRY	READING	3412723319	2027720	638390	S	39.7556	82.4014	2691584	1005584	4712	1017							669	1304	915		
PERRY	READING	3412723358	2029400	641300	S	39.7608	82.3958	2693006	1007492	4759	1023							686	1325	907		
PERRY	JACKSON	3412723481	2065900	613100	S	39.6831	82.2658	2732446	979137	5301	985							724	1375	948		
PERRY	READING	3412723572	2032050	641350	S	39.7608	82.3861	2695667	1007492	5095	1023						34	691	1333	910		
PERRY	READING	3412723607	2029300	640100	S	39.7575	82.3958	2693079	1006287	5128	1026						35	687	1323	907		
PERRY	READING	3412723641	2033950	653550	S	39.7944	82.3792	2696281	1019753	5080	983						34	693	1333	865		
PERRY	MADISON	3412724061	2075850	678400	S	39.8622	82.2297	2735433	1044495													
PERRY	JACKSON	3412725611	2052750	602750	S	39.6547	82.3128	2720386	968773	5308	972							728	1359	931		
PERRY	JACKSON	3412726595	2055900	625850		39.7182	82.3013	2721105	991946	6395	820	-5434	110	498	94	547	89	711	1359	936	1050	140

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
PERRY	HOPEWELL	3412726870	2048690	686060	S	39.8836	82.3264	2707540	1052305	5056	865						91	717	1353	824		
PERRY	MONROE	3412726952	2122180	593940	S	39.63	82.0661	2790583	959759												1400	
PERRY	CLAYTON	3412726958	2086000	652430	S	39.7908	82.1839	2748305	1018439													
PERRY	CLAYTON	3412726959	2083720	652260	S	39.7906	82.2019	2746073	1018366													
PICKAWAY	HARRISON	3412910001	1867600	628700	S	39.7253	82.9708	2533171	994537													0
PICKAWAY	MONROE	3412920002	1808500	612800		39.6800	83.1804	2476042	978005	3257	857	-2323	0	330	114	599	0	551				0
PICKAWAY	DEER CREEK	3412920003	1826200	572000		39.5689	83.1165	2497979	937462	3525	715				136	629	0	597	1129	517		0
PICKAWAY	JACKSON	3412920004	1883200	605000		39.6604	82.9149	2551241	970853	3730	798	-2944	145	516	128	623	25	581	1108	473		0
PICKAWAY	JACKSON	3412920005	1830700	604300	S	39.6578	83.1014	2499007	969904	2553	803						48	603	1133			0
PICKAWAY	PICKAWAY	3412920006	1869600	557950		39.5310	82.9823	2542693	923631	4178	693	-3455	178	580	157	621	0	565	1170	572		
PICKAWAY	JACKSON	3412920007	1837300	590950	S	39.6211	83.0775	2507045	956511	3100	760						70	608	1148	521		0
PICKAWAY	DEER CREEK	3412920008	1831450	574700		39.5764	83.0980	2502906	940189	3720	758			544	135	672	0	589	1137	542		0
PICKAWAY	JACKSON	3412920009	1833000	603750	S	39.6561	83.0831	2501397	969284	2783	795						88	592				0
PICKAWAY	SCIOTO	3412920010	1843100	655640	S	39.7989	83.0583	2505960	1021395	2692	794						40	621	1172	552		0
PICKAWAY	JACKSON	3412920011	1835270	591280	S	39.6219	83.0847	2504994	956803	3090	763						8	581	1141	517		0
PICKAWAY	MUHLENBERG	3412920012	1833200	606200	S	39.6628	83.0925	2501323	971729	2711	793						57	523	1098	567		0
PICKAWAY	DEER CREEK	3412920013	1823850	571600	S	39.5678	83.1247	2495715	937061	3234	759				131	651	0	600	1132	512		0
PICKAWAY	JACKSON	3412920014	1833750	592600	S	39.6256	83.0903	2503288	958153	2758	773						72	599	1149	513		0
PICKAWAY	JACKSON	3412920015	1834625	592660	S	39.6258	83.0872	2504151	958226	2507	767						0	608	1152	520		0
PICKAWAY	JACKSON	3412920016	1834950	590970	S	39.6211	83.0858	2504714	956511													0
PICKAWAY	WALNUT	3412920017	1887400	605200	S	39.6811	82.9	2555396	971108	3273	830						73	613	1178	614		
PICKAWAY	MADISON	3412920018	1894730	651370	S	39.7878	82.8747	2557784	1017345	2986	756								1212	651		
PICKAWAY	MADISON	3412920019	1894870	651360	S	39.7878	82.8742	2557924	1017345	2986	765											
PICKAWAY	MUHLENBURG	3412920020	1824510	610310		39.6740	83.1235	2492220	975816	3816	799	-3004	229	581	130	734	51	558	1122	514		0
PICKAWAY	JACKSON	3412920021	1835900	591960	S	39.6239	83.0825	2505539	957533	2559	764							606	1142	504		0
PICKAWAY	JACKSON	3412920022	1830850	589000	S	39.6158	83.1006	2500758	954504	3537	782				129	514	0	604	1128			0
PICKAWAY	PICKAWAY	3412920024	1880225	561725		39.5415	82.9247	2552876	927463	4500	770	-3525	155	536	149	628	64	555	1158	584		
PICKAWAY	WALNUT	3412920029	1892970	615572	S	39.6894	82.8803	2559873	981436													

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
PIKE	MIFFLIN	3413100000	1755600	389600	S	39.0684	83.3608	2446870	754086													
PIKE	BENTON	3413100001	1794500	425300	S	39.1656	83.2247	2481887	790287													
PIKE	PERRY	3413100003	1781200	432380	S	39.1847	83.2719	2467877	797257													
PIKE	PEE PEE	3413110005	1860300	417300	S	39.1447	82.9925	2548264	782660													
PIKE	BEAVER	3413120001	1911200	380600	S	39.0447	82.8128	2602752	746167	4227	708							860			630	50
PIKE	UNION	3413120027	1876900	353600	S	38.97	82.9331	2571416	718907	3845	773						92	694	1064	640	480	176
PIKE	SUNFISH	3413120028	1816900	378950	S	39.0386	83.1447	2509017	743941	2920	634						78	616	1030	520		
PIKE	PEBBLE	3413120029	1824900	427800	S	39.1731	83.1175	2511914	793024	3612	940						58	625	1022	544		
PIKE	PEE PEE	3413120030	1848950	405150	S	39.1111	83.0322	2538254	770398	3638	672				130	655	82	621	1067	567		
PIKE	SEAL	3413120032	1872200	395100	S	39.0839	82.9503	2562405	760472	3384	865							632	1078	624	500	105
PIKE	PEE PEE	3413120033	1858100	419400	S	39.1508	83.0003	2545845	784813	3365	762						83	615	1057	596		
PIKE	SEAL	3413120034	1867300	401000	S	39.1	82.9675	2556854	766348	3860	686				126	648	89	631	1060	668		
PIKE	JACKSON	3413120035	1909750	401550	S	39.1022	82.8181	2599130	767150	3999	775						88	676				
PIKE	JACKSON	3413120036	1908550	402150	S	39.1038	82.8222	2597919	767661	5146	1001				161	617	98	669	1163	625		
PORTAGE	ROOTSTOWN	3413320167	2349550	521200	N	41.0903	81.2319	2959735	1492663	7092	1172							851	1844	1811	2000	139
PORTAGE	MANTUA	3413320610	2354950	608450	N	41.3294	81.2075	2955594	1579917	6895	1212						48	733	1854	1792		
PORTAGE	ROOTSTOWN	3413320867	2335100	523400	N	41.0969	81.2842	2945081	1495071	7071	1118						62	790	1814	1802		
PORTAGE	RANDOLPH	3413320949	2355350	484850	N	40.9903	81.2128	2969494	1456170	4805	1189									1859		
PORTAGE	DEERFIELD	3413322860	2394600	501850		41.0353	81.0696	3006804	1472592	8797	1061	-7659	210	740	0	132	107	934	1915	1930	2300	0
PORTAGE	BRIMFIELD	3413323684	2307850	512800	N	41.0689	81.3838	2919042	1484853	6856	1130						113	802	1790	1728		
PORTAGE	SUFFIELD	3413323714	2306050	487300	N	40.9989	81.3911	2920091	1459308	7124	1140				0	132	46	826	1785	1700		
PORTAGE	RANDOLPH	3413323777	2335565	489285	N	41.0033	81.2842	2949281	1460914	7211	1196							874	1817	1789		
PORTAGE		3413323809	2321370	501530	N	41.0375	81.335	2933791	1473394	7260	1160				0	132	56	826	1812	1783		
PORTAGE	RONDOLPH	3413323810	2333010	495440	N	41.0203	81.2931	2946073	1467118	7050	1130							861	1820	1862		
PREBLE		7	1382950	?854000		40.3239	84.7131	2026789	?1212982	16486	1060						0				0	0
PREBLE		8	1413300	?810800		40.2072	84.6006	2061619	?1170395	15728	968						0				0	0
PREBLE		9	1366300	?791250		40.1506	84.7669	2016993	?1149740	26644	1060						0				0	0
PREBLE		10	1447100	?835500		40.2772	84.4814	2092644	?1195940	07528	980						0				0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
PREBLE		19	1391900	7750500		40.0406	84.6719	2046778	71109598	25244	1025						0				0	0
PREBLE		64	1376250	7788100		40.1425	84.7311	2027213	71146784	3545	1077						0				0	0
PREBLE		65	1360210	7832010		40.2619	84.7925	2006559	71190356	38606	1038						0				0	0
PREBLE	JACKSON	3413583023				39.7942	84.7835	2022897	1019683	2100	1150				0		0					0
PUTNAM		8	1592836	1098981		41.0078	83.9747	2209241	1462556		730						0				0	0
PUTNAM		10	1577744	1075093		40.9417	84.0281	2196754	1438434		755						0				0	0
PUTNAM		17	1547950	1048635		40.8675	84.1339	2170054	1411357		770						0				0	0
PUTNAM		28	1489873	1094402		40.99	84.3472	2107335	1456060		720						0				0	0
PUTNAM		43	1500269	1113277		41.0425	84.3111	2115581	1475219		722						0		713		0	0
PUTNAM	UNION	44	1530863	1096241		40.9972	84.1989	2147910	1458688		732							621				
PUTNAM		48	1614008	1073883		40.94	83.8967	2232994	1437814		803						0	638	804	443	0	0
PUTNAM		51	1604997	1087834		40.9778	83.93	2222550	1451608		764						0			456	0	0
PUTNAM		52	1606997	1088285		40.9792	83.9228	2224484	1452119		761						0		802	460	0	0
PUTNAM		53	1604346	1088383		40.9792	83.9325	2221815	1452119		763						0		804	460	0	0
PUTNAM	RILEY	54	1605123	1086433		40.9739	83.9294	2222847	1450185		765								804			
PUTNAM	UNION	59	1533131	1074255		40.9372	84.1892	2152537	1436792		736							638				
PUTNAM		2312	1570323	1104670		41.0225	84.0567	2186195	1467920		735						0				0	0
PUTNAM		3063	1525140	1090260		40.9806	84.2192	2142864	1452630		726						0			435	0	0
PUTNAM	LIBERTY	3413720031	1562100	524600		41.0957	84.0888	2174943	1494633	3377	740	-2510	350	300	53	477	0	637			0	0
RICHLAND	JEFFERSON	276	1994298	933701		40.5633	82.5206	2626714	1300346		1179							845	1024			
RICHLAND	SHARON	285	1943882	1040025		40.855	82.7028	2564999	1406795		1121							789	993			
RICHLAND	BLOOMING GROV	286	1993797	1066236		40.9272	82.5225	2611839	1433143		1136							834	1025			
RICHLAND	TROY	289	1975194	964807		40.6486	82.5894	2604338	1331474		1416							787	1000			
RICHLAND	JACKSON	297	1964763	1053731		40.8928	82.6275	2584276	1420589		1105							768	996			
RICHLAND	CASS	303	1960085	1063634		40.92	82.6444	2578559	1430515		1070							788	989			
RICHLAND	TROY	308	1961491	964206		40.6469	82.6386	2590801	1330854		1352							774	996			
RICHLAND	FRANKLIN	312	1998559	1044229		40.8667	82.5053	2618971	1411065		1105							848	1055	1120		
RICHLAND	WELLER	321	2021466	1042978		40.8633	82.4225	2641924	1409824		1079							850	1052			

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
RICHLAND	JACKSON	322	1978643	1035876		40.8439	82.5772	2600054	1402744		1222							807	1008	1059		
RICHLAND	CASS	325	1974065	1067261		40.93	82.5939	2592071	1434165		1060							890	950			
RICHLAND	BUTLER	329	2012904	1076890		40.9564	82.4533	2629726	1443799		1198							846	1046	1174		
RICHLAND	PERRY	330	1968444	934350		40.565	82.6136	2600902	1300966		1224							806	1013			
RICHLAND	PLYMOUTH	331	1940278	1064463		40.9219	82.7161	2558742	1431209		1084							770	981			
RICHLAND	JACKSON	337	1967314	1050430		40.8836	82.6181	2587226	1417232		1117							795	986			
RICHLAND	WASHINGTON	342	2009552	977500		40.6836	82.4656	2637179	1344247		1306							806	1157			
RICHLAND	CASS	348	1972519	1086903		40.9839	82.5994	2588440	1453834		1083							799	1000	1102		
RICHLAND	BUTLER	351	2003401	1078968		40.9619	82.4878	2620013	1445806		1190							875	994			
RICHLAND	BLOOMING GROV	360	1990571	1070688		40.9394	82.5342	2608135	1437595		1132							829	1030			
RICHLAND	MIFFLIN	368	2022058	1013289		40.7817	82.4203	2645787	1380046		1143							835	1042	1123		
RICHLAND	SANDUSKY	372	1943185	996722		40.7361	82.705	2568996	1363405		1249							746	1033	1002		
RICHLAND	PLYMOUTH	377	1948231	1071811		40.9422	82.6872	2565910	1438617		1099							763	977	1016		
RICHLAND	WASHINGTON	379	1985747	965657		40.6511	82.5514	2614746	1332386		1157									1030		
RICHLAND	WELLER	382	2003876	1052856		40.8903	82.4861	2623326	1419677		1158							824	1030			
RICHLAND	BUTLER	389	2016505	1063085		40.9183	82.4403	2634824	1429895		1142							837	1027			
RICHLAND	WASHINGTON	390	2001650	979210		40.6883	82.4942	2629090	1345962		1386							806	1141			
RICHLAND	WASHINGTON	396	2006851	975759		40.6789	82.4753	2634685	1342531		1344							794	1016			
RICHLAND	JEFFERSON	401	2001775	958806		40.6322	82.4936	2631471	1325489		1365							852				
RICHLAND	MONROE	415	2017254	982111		40.6981	82.4378	2644364	1348808		1253							810	1027			
RICHLAND	MONROE	419	2013052	969158		40.6808	82.4531	2641537	1335926		1401							848	1032			
RICHLAND	MONROE	421	2013278	976410		40.6806	82.4522	2641001	1343152		1230							801	1027	1095		
RICHLAND	FRANKLIN	436	1998549	1055882		40.8986	82.5053	2617708	1422706		1092									1124		
RICHLAND	BLOOMING GROV	437	1998924	1058658		40.9084	82.5039	2617784	1425552		1155							822	1024	1123		
RICHLAND	WORTHINGTON	501	2020278	937776		40.5744	82.4269	2652212	1304396		1333							862	1049			
RICHLAND	WORTHINGTON	504	2017103	949804		40.6069	82.4383	2647768	1316257		1128							855	1033			
RICHLAND	SPRINGFIELD	554	1968030	1015489		40.7878	82.6156	2591662	1382272		1378							841	930			
RICHLAND	WASHINGTON	3413920431	2005375	372100		40.6880	82.4806	2632860	1345852	5503	1458	-4039	101	401	95	335	0	643			750	

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
RICHLAND	MADISON	3413920448	1994850	405200		40.7789	82.5193	2618582	1379024	5078	1176	-3888	74	430	120	243	0	834	1018	1085	680	
RICHLAND	JEFFERSON	3413920594	1998050	326850	N	40.5639	82.5069	2630483	1300565		1292						0					
ROSS	CONCORD	3414100010	1913800	509000	S	39.3972	82.805	2591895	874804													
ROSS	BUCKSKIN	3414120005	1783200	498500	S	39.3661	83.2669	2462897	863455	2566	922						144	536	1082			
ROSS	HARRISON	3414120006	1911530	495900	S	39.3611	82.8128	2591039	861630	3809	740						55	635	1166	690		
ROSS	JEFFERSON	3414120007	1913900	445400	S	39.2225	82.8039	2598693	811051	4190	625				100	650	85	634				
ROSS	GREEN	3414120008	1872100	523850		39.4274	82.9528	2549162	885825	4168	695			536	167	631	27	558	1166	608		
ROSS	CONCORD	3414120009	1773290	522510		39.4319	83.3026	2450521	887467	3862	1033	-2812	181	529	155	744	19	586	1088			
ROSS	COLERAIN	3414120010	1918850	529200	S	39.4528	82.7875	2594750	895094	3611	858						108	642	1187	669		
ROSS	COLERAIN	3414120011	1900340	520610	S	39.4289	82.8528	2577259	886372	3494	989						133	648	1168	541		
ROSS	DEERFIELD	3414120012	1787650	545600	S	39.4958	83.2525	2462369	910713	2458	832						121	600	1154			
ROSS	HARRISON	3414120013	1898630	483650	S	39.3275	82.8583	2579460	849369	3421	678						124	636	1164	638		
ROSS	LIBERTY	3414120014	1905680	463410	S	39.2719	82.8331	2588622	829079	3505	640						150	642	1168	650		
ROSS	GREEN	3414120016	1879610	515290	S	39.4142	82.9261	2557164	881008	3308	871						144	642	1158	597		
ROSS	SPRINGFIELD	3414120018	1896470	505350	S	39.3869	82.8664	2574983	871045	3480	827						171	624	1159	660		
ROSS	COLERAIN	3414120019	1929000	506900	S	39.3914	82.7511	2607292	872687	3788	898						147	641	1189	689		
ROSS	BUCKSKIN	3414120021	1770700	505950		39.3863	83.3113	2449675	870826	3880	985	-2627	140	534	155	769	30	563	1090			
SANDUSKY	BALLVILLE	103	1815101	1189667		41.2639	83.1722	2420498	1556014		676							796	759			
SANDUSKY	JACKSON	118	1802039	1207423		41.3122	83.2203	2405537	1573640		679								774			
SANDUSKY	SCOTT	137	1778076	1208416		41.3144	83.3075	2381585	1574443		711							860	725			
SANDUSKY	TOWNSEND	138	1885008	1224101		41.3594	82.9186	2486321	1590865		649							818	808			
SANDUSKY	WASHINGTON	139	1804809	1231930		41.3794	83.2106	2405651	1598163		637							773	739			
SANDUSKY	RILEY	140	1850984	1243681		41.4128	83.0431	2450250	1610352		587							842	767			
SANDUSKY	WASHINGTON	141	1810237	1233390		41.3836	83.1911	2410883	1599696		658							828	733			
SANDUSKY	WASHINGTON	148	1801515	1220390		41.3478	83.2225	2403620	1586631		663							828	740			
SANDUSKY	WOODVILLE	3414300001	1761600	637300		41.4127	83.3691	2381149	1610315	2822	650	-2017	190	305	120	70	0				0	0
SANDUSKY	RICE	3414320001	1847600	646800		41.4407	83.0558	2445727	1620533	2796	590	-2111	86				0				0	0
SANDUSKY	TOWNSEND	3414320077	1886700	615100		41.3543	82.9127	2488130	1589003	3128	644	-2448	134	319	111	16	0	817	803		0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
SANDUSKY	WASHINGTON	3414320117	1786100	645400		41.4356	83.2801	2384634	1618672	2720	633	-2071	188	308	115	31	0				0	0
SANDUSKY	BALLVILLE	3414320126	1812200	581400		41.2605	83.1831	2417638	1554773	2675	675	-1951	62				0				0	0
SANDUSKY	MADISON	3414320146	1768830	622580		41.3725	83.3423	2369941	1595645	2763	706	-2050	197				0				0	0
SANDUSKY	WOODVILLE	3414320147	1776180	646260		41.4377	83.3163	2374668	1618438	2785	647	-2113	230	310	120	49	0				0	0
SANDUSKY	RILEY	3414320210	1867877	621400		41.3713	82.9814	2468691	1595207	2933	620	-2297	107	280	105	59	0				0	0
SANDUSKY	RILEY	3414320224	1867397	621418		41.3713	82.9831	2468226	1595207	2960	616	-2334	146				0				0	0
SANDUSKY	RILEY	3414320225	1868122	620380		41.3685	82.9805	2469043	1594185	2902	618	-2267	84				0				0	0
SANDUSKY	RILEY	3414320226	1869065	620485		41.3688	82.9770	2469989	1594295	2905	618	-2287	89				0				0	0
SANDUSKY	RILEY	3414320235	1867600	621450		41.3714	82.9824	2468414	1595244	2980	615	-2327	134	328	62	50	0				0	0
SANDUSKY	RILEY	3414320237	1865375	621520		41.3716	82.9905	2466191	1595317	2942	617	-2313	138				0				0	0
SANDUSKY	RILEY	3414320238	1866780	622100		41.3732	82.9854	2467525	1595901	2955	605	-2325	136				0				0	0
SCIOTO	GREEN	3414500000	2420300	233200	S	38.6308	81.0289	3125729	595124													
SCIOTO	GREEN	3414520000	1908100	216100	S	38.5928	82.8214	2616892	581256													
SCIOTO	GREEN	3414520083	1923400	234600	S	38.6439	82.7681	2630199	599904	4183	609											
SCIOTO	HARRISON	3414520202	1892600	298400	S	38.8186	82.8769	2592870	663657	4320	923						140	769	1063	688		
SCIOTO	GREEN	3414520212	1908100	215830		38.5921	82.8215	2616889	581001	5617	558	-5002	46	457	145	636	80	834	1240	671	550	209
SCIOTO	GREEN	3414520252	1908000	216100		38.6021	82.8315	2613676	584650	6024	558	-5417	57	508	162	664	155	1018	1234	724	540	229
SCIOTO	RARDEN	3414520257	1788915	360660		38.9879	83.2426	2483061	725439	4432	1213	-3169	89	569	155	693	93	542	998			
SENECA		3	1820312	1158102		41.1775	83.1525	2429105	1524484		705						0				0	0
SENECA		16	1768549	1121720		41.0764	83.3392	2381560	1487590		800						0				0	0
SENECA		17	1839079	1122440		41.08	83.0833	2451733	1488904								0				0	0
SENECA		19	1767292	1138777		41.1231	83.3442	2378493	1504632		775						0				0	0
SENECA		98	1824530	1091624		40.995	83.1353	2440600	1457885		838						0	743	898	658	0	0
SENECA		102	1832934	1091626		40.9953	83.105	2448924	1457894		835						0			739	0	0
SENECA	LIBERTY	103	1809707	1157049		41.1742	83.1908	2418721	1523280		738							700	874			
SENECA		106	1860745	1091532		40.9956	83.0042	2476640	1458104		965						0			964		0
SENECA		111	1798017	1103221		41.0264	83.2317	2412931	1469344		840						0	768	794	544	0	0
SENECA	SCIPIO	113	1858237	1123445		41.0831	83.0139	2470681	1490035		954							752	886			

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
SENECA		121	1863195	1096509		41.0092	82.9956	2478493	1463067		947						0			955	0	0
SENECA	PLEASANT	122	1826514	1161555		41.1869	83.13	2434928	1527815		715							786	831			
SENECA		123	1809809	1148945		41.1519	83.1903	2419682	1515142		743						0	735	846	460	0	0
SENECA		131	1758225	1119626		41.0703	83.3764	2371559	1485364		834						0			420	0	0
SENECA	SCIPIO	132	1849379	1143527		41.1381	83.0467	2459607	1510106		838							741	880			
SENECA		140	1836298	1166060		41.1894	83.0944	2444224	1532476		732						0	782	840	591	0	0
SENECA		143	1793797	1164548		41.1944	83.2489	2402040	1530651		739						0	765	827	425	0	0
SENECA	LIBERTY	144	1788439	1178553		41.2328	83.2781	2393174	1544665		724							773	820			
SENECA	PLEASANT	145	1839145	1162909		41.1908	83.0842	2447343	1529338		740							754	854			
SENECA	HOPEWELL	146	1792100	1150240		41.1553	83.2547	2401885	1516383		765							738	828			
SENECA	REED	147	1882145	1141557		41.1331	82.9275	2492514	1508281		907							789	866			
SENECA	PLEASANT	148	1818954	1186336		41.2547	83.1581	2424703	1552657		677								814			
SENECA	LIBERTY	150	1807201	1174807		41.2231	83.2006	2414226	1541125		702							783	788			
SENECA		152	1824645	1112512		41.0525	83.1356	2438385	1478868		810						0			615	0	0
SENECA	ADAMS	161	1861031	1164414		41.1953	83.0047	2468976	1530980		804							772	853			
SENECA		206	1790086	1163296		41.1911	83.2622	2398514	1529447		745						0			418	0	0
SENECA	HOPEWELL	227	1809804	1149595		41.1539	83.1903	2419609	1515872		748							736	838			
SENECA	LIBERTY	229	1781622	1160520		41.1833	83.2567	2400309	1526601		760							740	813			
SENECA	JACKSON	234	1778142	1157590		41.175	83.3056	2387198	1523572		760							773				
SENECA	JACKSON	235	1771586	1165541		41.1967	83.3297	2379797	1531491		742							819	758			
SENECA	HOPEWELL	245	1800335	1147391		41.1475	83.2247	2410404	1513536		752							753	826			
SENECA	HOPEWELL	255	1796302	1150852		41.1569	83.2394	2406024	1516967		762								843			
SENECA	PLEASANT	265	1811478	1158150		41.1772	83.1844	2420366	1524375		732							736	837			
SENECA	CLINTON	272	1811589	1152947		41.1631	83.1839	2421025	1519229		740							725	868			
SENECA	PLEASANT	280	1825263	1163236		41.1917	83.1344	2433542	1529666		718							768	822			
SENECA		290	1826547	1110982		41.0483	83.1286	2440465	1477336		824						0	747	857	645	0	0
SENECA		295	1824125	1111762		41.0503	83.1375	2437945	1478065		814						0			634	0	0
SENECA		337	1787615	1094065		41.0011	83.2692	2403544	1460111		820						0			459	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
SENECA		351	1832077	1117638		41.0667	83.1086	2445277	1484050		808						0			638	0	0
SENECA		2580	1807801	1176108		41.2284	83.1983	2414735	1542329		697						0			510	0	0
SENECA	LIBERTY	3414700000	1807850	568990		41.2283	83.1985	2414684	1542293	2870	697	-2114	163	328	95	98	0	809	761		0	0
SENECA	PLEASANT	3414700032	1824200	556400		41.1921	83.1388	2432321	1529812	2935	710	-2070					0				0	0
SENECA	ADAMS	3414720128	1848750	552450		41.1817	83.0567	2455227	1526017	3171	796	-2352	148	350	90	133	0		1000	765	0	0
SENECA	PLEASANT	3414720211	1811050	555715		41.1900	83.1985	2419316	1529048	2847	720	-2070	161				0	776	816		0	0
SENECA	CLINTON	3414720212	1811580	544110		41.1581	83.1843	2421100	1517405	2860	741	-2059	131				0				0	0
SENECA	HOPEWELL	3414720213	1791980	544775		41.1585	83.2555	2401511	1517916	2617	769	-1831	0				0				0	0
SENECA	HOPEWELL	3414720214	1793650	546900		41.1654	83.2495	2402941	1520069	2595	766	-1726	48				0				0	0
SENECA	CLINTON	3414720216	1811680	541910		41.1521	83.1838	2421459	1515215	2790	759	-2003	112	400	64	92	0	732	848		0	0
SENECA	LIBERTY	3414720218	1795110	547960		41.1683	83.2442	2404288	1521127	2459	788	-1670	22				0	746	825		0	0
SENECA	LIBERTY	3414720226	1794102	548100		41.1687	83.2479	2403259	1521273	2405	765						0	732	838		0	0
SENECA	HOPEWELL	3414720239	1799740	545175		41.1608	83.2273	2409201	1518390	2427	752						0				0	0
SENECA	CLINTON	3414720242	1810660	542850		41.1547	83.1876	2420320	1516164	2469	735						0				0	0
SENECA	CLINTON	3414720243	1811275	542675		41.1542	83.1853	2420970	1515981	2480	747			164	106	90	0				0	0
SENECA	CLINTON	3414720244	1811600	542200		41.1529	83.1841	2421347	1515507	2830	751	-2053	196				0				0	0
SENECA	LOUDON	3414720273	1751890	528880		41.1149	83.4005	2363330	1501640	2525	804						0	780	742		0	0
SHELBY		11	1551093	903155		40.4686	84.1133	2188799	1265787		1020						0				0	0
SHELBY		12	1512968	860176		40.3486	84.2472	2155505	1221996		985						0				0	0
SHELBY	SALEM	20	1579727	851343		40.3278	84.0072	2222873	1214405		1058							636				
SHELBY	VAN BUREN	25	1517096	893231		40.4397	84.2347	2156057	1255241		986							637	735			
SHELBY		31	1470078	843594		40.3008	84.3997	2114630	1204552		1010						0				0	0
SHELBY		32	1467123	832289		40.2697	84.4084	2112906	1193203		1003						0				0	0
SHELBY		41	1523890	843432		40.3033	84.2069	2168158	1205465		993						0	600	840		0	0
SHELBY		42	1532561	841618		40.2989	84.1758	2176947	1203859		1049						0		874		0	0
SHELBY		46	1523284	836916		40.2853	84.2086	2168264	1198896		1004						0				0	0
SHELBY		48	1518894	837009		40.2853	84.2244	2163870	1198896		982						0				0	0
SHELBY		55	1524686	834883		40.28	84.2036	2169825	1196962		1027						0		854		0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)										
													3	4	5	6	7	8	9	10	11	12
SHELBY		57	1519377	847809		40.315	84.2233	2163223	1209734		1002						0				0	0
SHELBY	TURTLE CREEK	60	1510828	845224		40.3075	84.2539	2154957	1206997		985							578	860			
SHELBY		63	1523154	843882		40.3044	84.2097	2167345	1205868		990						0				0	0
SHELBY		94	1493842	904074		40.4681	84.3189	2131791	1265805		934						0				0	0
SHELBY		97	1492350	812290		40.2161	84.3178	2140083	1173643		1000						0				0	0
SHELBY		100	1497600	814100		40.2214	84.2982	2145093	1175577		988						0				0	0
SHELBY		118	1516572	855128		40.335	84.2339	2159636	1217033		1020						0				0	0
SHELBY		123	1513868	859626		40.3472	84.2439	2156467	1221485								0				0	0
SHELBY		3066	1510472	853874		40.3314	84.2558	2153885	1215719		990						0				0	0
SHELBY	PERRY	3414920012	1557700	256700		40.3602	84.0871	2199609	1226229	3275	1050	-2094	140	532	0	716	0	623	968		0	0
SHELBY	SALEM	3414920013	1556000	256700		40.3601	84.0932	2197918	1226193	3360	1037	-2245	292	498	0	660	0	452	1023		0	0
SHELBY	PERRY	3414920103	1564650	224150		40.2712	84.0601	2210023	1193751	3227	1074	-2139	141	608	0	740	0				0	0
STARK	LAKE	3415121052	2321850	478200	N	40.9733	81.3344	2936820	1449966	7256	1152				0			860	1804	1770	1940	116
STARK	LAKE	3415121054	2318400	478000	N	40.9731	81.3469	2933391	1449893	4612	1200				0					1758		
STARK	MARLBORO	3415121081	2341770	471150	N	40.9533	81.2628	2957408	1442667	7958	1144				0	141	87	845	1816	1785		
STARK	LEXINGTON	3415121123	2367480	457470	N	40.9147	81.1703	2984600	1428581	7815	1123				0		136	866	1864	1852		
STARK	CANTON	3415121999	2324150	394250	N	40.7428	81.3303	2948205	1365850	7699	1190				0		108	878	1781	1718		
STARK	SANDY	3415122001	2345100	383100	N	40.7114	81.2553	2970307	1354392	5251	1045				0		117	994	1847	1740		
STARK	SUGAR CREEK	3415123830	2251810	373820	N	40.6892	81.5919	2878327	1346290	6929	992				0		120	817	1690	1502		
STARK	LAWRENCE	3415124441	2251180	428280	N	40.8388	81.5922	2871772	1400810	6532	1035				0			807	1693	1509		
STARK	TUSCARAWAS	3415124508	2263050	401385	N	40.7644	81.5503	2886549	1373733	6799	1080				0			804	1697	1542		
STARK	BETHLEHEM	3415124507	2290150	373725	N	40.6878	81.4536	2916589	1345779	7158	1030				0			840	1734	1577		
STARK	SUGAR CREEK	3415124508	2257330	378975	N	40.7031	81.5719	2883249	1351363	6830	1073				0			814	1697	1537		
STARK	PERRY	3415124519	2264880	394820	N	40.7464	81.5439	2889096	1367164	6808	1005				0		113	826	1701	1537		
STARK	SUGAR CREEK	3415124527	2256950	380750	N	40.7081	81.5731	2882701	1353187	6756	1034				0		123	805	1683	1537		
STARK	BETHLEHEM	3415124537	2280710	386160	N	40.7222	81.4872	2905805	1358333	7088	1116				0			825	1731	1584		
STARK	SUGAR CREEK	3415124630	2263050	386925	N	40.7247	81.5508	2888138	1359245	6250	1020				0			766	1703	1535		
STARK	SUGAR CREEK	3415124631	2250180	356600	N	40.6419	81.5988	2878521	1329029	6803	1000				0		136	809	1673	1495		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
STARK	SUGAR CREEK	3415124633	2261950	375000	N	40.6922	81.5553	2888307	1347385	7012	1170				0			822	1705	1548		
STARK	SUGAR CREEK	3415124672	2255410	366050	N	40.6678	81.5782	2882762	1338481	6633	1050				0			761	1689	1512		
STARK		3415124751	2351230	477530	N	40.9703	81.2281	2966188	1448871	7725	1123				0	166	63	837	1723	1918		
SUMMIT	FRANKLIN	3415320100	2244000	462500	N	40.9328	81.6169	2860883	1435186	6483	1130						0	786				
SUMMIT	NORTHAMPTON	3415320907	2266150	548600		41.1684	81.5333	2873565	1521163	7185	1006	-6144	189	635	0	180	0	776	1728	1653	1640	87
SUMMIT	TWINSBURG	3415321581	2303000	599850		41.3079	81.3971	2904695	1572071	7225	1005	-6163	136	612	0	202	0	744	1788	1714	1670	54
SUMMIT	FRANKLIN	3415322587	2248000	478750	N	40.9772	81.6019	2863081	1451389	6334	1000						0	793	1706	1494		
SUMMIT	GREEN	3415322683	2288500	484280	N	40.9364	81.4558	2905059	1436500													
TUSCARAWAS	CLAY	3415720952	2296220	236500	N	40.3106	81.4378	2937442	1208202	7717	936				0			1008	1694	1616		
TUSCARAWAS	CLAY	3415720955	2281340	266450	N	40.3936	81.49	2919349	1238418	7757	1161				0		129	955	1684	1562		
TUSCARAWAS	RUSH	3415721030	2299816	234029	N	40.3039	81.4247	2941361	1205684	8223	1221				0		98	1030	1723	1642	2300	90
TUSCARAWAS	SUGAR CREEK	3415721145	2240800	311800	N	40.5192	81.6339	2874038	1284253	6968	996				0		84	814	1658			
TUSCARAWAS	BUCKS	3415722960	2230200	280600	N	40.4339	81.6731	2866828	1253124						0							
TUSCARAWAS	AUBURN	3415723447	2257000	294930	N	40.4725	81.5764	2891977	1267210	7323	1220				0		122	843	1696	1498		
TUSCARAWAS	BUCKS	3415723468	2224350	259200	N	40.3753	81.6947	2863334	1231739	6834	1088				0			798	1621	1403		
TUSCARAWAS	AUBURN	3415723624	2235800	292550	N	40.4664	81.6525	2871149	1264984	6945	1102				0		100	802	1642	1412		
TUSCARAWAS	AUBURN	3415723625	2242900	279100	N	40.4294	81.6275	2879865	1251482	7040	1070				0		115	835	1657	1443		
TUSCARAWAS	BUCKS	3415723635	2226350	259410	N	40.3758	81.6875	2865311	1231922	6898	1041				0			805	1620	1402		
TUSCARAWAS	AUBURN	3415723662	2232650	291600	N	40.4639	81.6639	2868096	1264072						0							
TUSCARAWAS	BUCKS	3415723698	2220150	260600	N	40.3792	81.7097	2859005	1233183	6748	935				0			806	1631	1400		
TUSCARAWAS	BUCKS	3415723715	2221550	257950	N	40.3719	81.705	2860620	1230499	7566	1178				0	432	112	800	1622	1394		
TUSCARAWAS	AUBURN	3415723716	2240400	288750	N	40.4558	81.6361	2876149	1261116	7048	1110				0		126	816	1664	1434		
TUSCARAWAS	AUBURN	3415723780	2238610	289850	N	40.4582	81.6425	2874229	1262357	4838	1088				0					1414		
TUSCARAWAS	AUBURN	3415723781	2246350	298220	N	40.4817	81.6144	2881051	1270568	6956	1038				0			828	1670	1456		
TUSCARAWAS	BUCKS	3415723981	2237150	277350	N	40.4247	81.6483	2874098	1249767	4769	1085				0							
TUSCARAWAS	BUCKS	3415724101	2225505	268600	N	40.4011	81.6903	2863456	1241155	6870	1030				0			803	1724	1298		
TUSCARAWAS	BUCKS	3415724330	2222920	259550	N	40.3764	81.7	2861816	1232141	7232	1068				0		114	802	1622	1410		
TUSCARAWAS	BUCKS	3415724336	2226050	268000	N	40.3939	81.6886	2864235	1238527	7376	1088				0		123	807	1625	1399		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (m)	Model Y (m)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)								
													3	4	5	6	7	8	9	10	11	12
TUSCARAWAS	BUCKS	3415724375	2244340	258610	N	40.3731	81.6231	2883299	1230937	7197	1030				0		123	854	1648	1453		
TUSCARAWAS	BUCKS	3415724405	2222115	274060	N	40.4161	81.7022	2859516	1246826	4351	989				0							
TUSCARAWAS	BUCKS	3415724440	2224680	262790	N	40.385	81.6936	2863226	1235279	6902	1113				0			802	1628	1400		
TUSCARAWAS	BUCKS	3415724448	2223740	262080	N	40.3833	81.6969	2862383	1234659	6943	1088				0		114	798	1628	1399		
TUSCARAWAS	BUCKS	3415724449	2223020	260580	N	40.3792	81.6984	2861864	1233163	6855	1068				0		113	808	1626	1399		
TUSCARAWAS	BUCKS	3415724458	2222020	261550	N	40.3817	81.7031	2860730	1234075	7126	1193				0		114	794	1619	1394		
TUSCARAWAS	BUCKS	3415724462	2231220	262970	N	40.3856	81.67	2869750	1235498	6947	1005				0		123	816	1631	1409		
TUSCARAWAS	OXFORD	3415724465	2265570	212880	N	40.2469	81.5486	2909416	1184883	7692	1068				0		21	950	1658	1539		
TUSCARAWAS	BUCKS	3415724467	2237210	259100	N	40.3747	81.6488	2876154	1231520	7130	1068				0		111	838	1632	1426		
TUSCARAWAS	SALEM	3415724473	2255950	241640	N	40.3261	81.5819	2896755	1213785	7374	970				0		107	937	1675	1490		
TUSCARAWAS	OXFORD	3415724481	2260010	207480	N	40.2322	81.5689	2904403	1179518	7452	938				0			987	1659	1518		
TUSCARAWAS	OXFORD	3415724483	2260210	214700	N	40.2522	81.5678	2903850	1186817	7604	1080				0			942	1655	1503		
TUSCARAWAS	OXFORD	3415724497	2264000	210200	N	40.2397	81.5544	2908113	1182255	7774	1050				0		123	966	1650	1528		
TUSCARAWAS	BUCKS	3415724498	2243230	264400	N	40.3892	81.6269	2881555	1236812	7214	1060				0		147	816	1645	1446		
TUSCARAWAS	SALEM	3415724517	2269980	242000	N	40.3267	81.5317	2910671	1214004	7294	840				0			948	1680	1540		
TUSCARAWAS	AUBURN	3415724545	2234420	292700	N	40.4669	81.6575	2869742	1265167	6982	1043				0		98	801	1640	1421		
TUSCARAWAS	LAWRENCE	3415724558	2288450	350050	N	40.6228	81.4808	2917446	1322059	7140	978				0			872	1717	1598		
TUSCARAWAS	BUCKS	3415724562	2226220	271865	N	40.41	81.6878	2863771	1244402	7000	1180				0		116	802	1636	1406		
TUSCARAWAS	BUCKS	3415724569	2224730	269780	N	40.4044	81.6931	2862539	1242359	6925	990				0		124			1402		
TUSCARAWAS	OXFORD	3415724574	2249810	218770	N	40.2836	81.6044	2893185	1190977	6997	810				0				1642	1488		
TUSCARAWAS	BUCKS	3415724580	2229900	263000	N	40.3856	81.6747	2868445	1235498	7017	1100				0		108	818	1638	1394		
TUSCARAWAS	BUCKS	3415724595	2226650	274330	N	40.4167	81.6861	2863956	1246847	7111	1288				0		112	803	1641	1399		
TUSCARAWAS	AUBURN	3415724623	2231630	282190	N	40.4383	81.6678	2868109	1254730	7050	1265				0			799	1642	1402		
TUSCARAWAS	AUBURN	3415724633	2231410	278480	N	40.4281	81.6689	2868240	1251008	7175	1335				0			790	1636	1407		
TUSCARAWAS	BUCKS	3415724648	2223370	278020	N	40.4269	81.6978	2860277	1250570	6945	1320				0				1622	1390		
TUSCARAWAS	OXFORD	3415724658	2253150	221940	N	40.2722	81.5928	2896041	1194115	7023	810				0				1656	1486		
TUSCARAWAS	OXFORD	3415724660	2246940	225250	N	40.2814	81.615	2889477	1197473	7251	928				0			904	1664	1470		
TUSCARAWAS	MILL	3415724669	2319280	255725	N	40.3628	81.3542	2958379	1227178	7970	863				0			1022	1768	1676		

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
TUSCARAWAS	MILL	3415724673	2323300	256350	N	40.3644	81.3397	2962333	1227762	8090	903				0			1063	1766	1676		
TUSCARAWAS	SALEM	3415724680	2246315	237685	N	40.3156	81.6167	2887540	1209953	7327	1105				0				1642	1459		
TUSCARAWAS	OXFORD	3415724700	2266230	221110	N	40.2694	81.5461	2909142	1193094	7375	830				0			962	1674	1512		
TUSCARAWAS	OXFORD	3415724702	2249400	229620	N	40.2933	81.6061	2891440	1201815	7163	839				0			915	1649	1475		
TUSCARAWAS	OXFORD	3415724703	2249840	227690	N	40.2881	81.6044	2892136	1199918	7137	860				0				1662	1473		
TUSCARAWAS	SALEM	3415724704	2248420	236680	N	40.3128	81.6092	2889743	1208931	7182	955				0			923	1643	1471		
TUSCARAWAS	BUCKS	3415724705	2226100	276510	N	40.4228	81.6881	2863142	1249074	6916	1150				0			790	1636	1394		
TUSCARAWAS	AUBURN	3415724706	2247600	278700	N	40.4308	81.6106	2884291	1251993	7187	1290				0				1669	1477		
TUSCARAWAS	BUCKS	3415724708	2243290	273390	N	40.4136	81.6264	2880648	1245716	7305	1320				0			840	1677	1459		
TUSCARAWAS	BUCKS	3415724709	2225790	257890	N	40.3717	81.6897	2864875	1230426	6834	1054				0			801	1617	1401		
TUSCARAWAS	SALEM	3415724712	2246750	242640	N	40.3292	81.615	2887430	1214916	7306	1130				0							
TUSCARAWAS	AUBURN	3415724713	2241200	292450	N	40.4661	81.6331	2876539	1264675	6948	1150				0				1659	1452		
TUSCARAWAS	OXFORD	3415724716	2267720	224350	N	40.2783	81.5406	2910287	1196341	7591	1070				0			956	1668	1533		
TUSCARAWAS	DOVER	3415724717	2260250	322850	N	40.5489	81.5636	2892222	1295091	4480	934				0					1505		
TUSCARAWAS	YORK	3415724719	2265850	282230	N	40.4372	81.545	2902205	1254328	7492	1210				0			914	1697	1518		
TUSCARAWAS	OXFORD	3415724720	2260680	222830	N	40.2744	81.5658	2903451	1194918	7182	820				0				1705	1542		
TUSCARAWAS	AUBURN	3415724722	2251510	286900	N	40.4506	81.5964	2887377	1259218	7263	1230				0			852	1672	1461		
TUSCARAWAS	DOVER	3415724723	2262950	313050	N	40.5219	81.5542	2895983	1285238	7220	1108				0		88	854	1702	1516		
TUSCARAWAS	FRANKLIN	3415724726	2257150	351750	N	40.6283	81.5736	2886020	1324066	6858	1030				0		104	818	1692	1508		
TUSCARAWAS	OXFORD	3415724732	2260180	224920	N	40.2803	81.5675	2902725	1197071	7216	815				0			964	1671	1529		
TUSCARAWAS	BUCKS	3415724736	2231070	261680	N	40.3819	81.6708	2869741	1234148	6903	1030				0			831	1646	1404		
TUSCARAWAS	OXFORD	3415724754	2248120	215760	N	40.2553	81.6111	2891678	1187948	4910	1017				0					1487		
TUSCARAWAS	WAYNE	3415724763	2251280	354480	N	40.6361	81.5947	2879849	1326913	6894	1080				0		96	824	1694	1507		
TUSCARAWAS	SUGAR CREEK	3415724768	2246925	321825	N	40.5469	81.6114	2879077	1294361	6904	1050				0			817	1669	1484		
TUSCARAWAS	FRANKLIN	3415724770	2260300	356800	N	40.6422	81.5619	2888652	1329139	6773	990				0			1498	986	1508		
TUSCARAWAS		3415724815	2255400	324750	N	40.5544	81.5808	2887223	1297098	6960	1009							805	1662	1493		
UNION		3	1720994	828336		40.27	83.4997	2365934	1193313		1093						0	801	780	420	0	0
UNION		4	1764305	795952		40.1822	83.3436	2412478	1161272		1042						0	744	886	428	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
UNION		5	1726788	842439		40.3089	83.4794	2370213	1207508		1078						0	652	878	367	0	0
UNION		6	1740198	816443		40.2378	83.4306	2386288	1181562		1043						0	733	879	377	0	0
UNION		8	1726002	806936		40.2114	83.4811	2373162	1171928		1015						0			295	0	0
UNION		10	1758692	834250		40.2872	83.365	2402784	1199589		1031						0	741	889	397	0	0
UNION		11	1731606	784641		40.1778	83.4806	2380049	1159666		998						0	720	888	307	0	0
UNION		12	1759928	876653		40.4036	83.3619	2399497	1242087		975						0				0	0
UNION		14	1756925	884653		40.4256	83.3731	2395604	1250095		991						0	729	896	344	0	0
UNION	MILL CREEK	15	1803198	817714		40.2431	83.205	2448867	1183496		930							712				
UNION		16	1740439	841344		40.3084	83.4306	2383868	1206596		1040						0				0	0
UNION		17	1806552	803165		40.2031	83.1825	2453795	1168899		980						0			652	0	0
UNION	LIBERTY	18	1733606	848732		40.3264	83.4553	2376298	1213895		1052							730	884			
UNION		20	1748070	868138		40.38	83.4042	2388584	1233455		1010						0	674	903	358	0	0
UNION		20	1793525	812400		40.2281	83.2394	2439838	1178022		942						0				0	0
UNION		21	1777117	837706		40.2972	83.2989	2420803	1203239		960						0				0	0
UNION		22	1747420	784197		40.1497	83.4036	2396916	1149412		980						0				0	0
UNION		23	1804199	813614		40.2317	83.2011	2450365	1179336		935						0	756	885	605	0	0
UNION		23	1806500	772800		40.1197	83.1919	2456982	1138464		940						0				0	0
UNION		28	1755024	886502		40.4306	83.3797	2393595	1251920		996						0	742	898	345	0	0
UNION		30	1780606	872584		40.3931	83.2875	2420525	1238235		945						0	744	896	395	0	0
UNION	PARIS	31	1763171	823401		40.2575	83.3483	2408486	1188751		996							764				
UNION		34	1787204	799059		40.1914	83.2617	2434952	1164629		971						0	761	890	526	0	0
UNION		38	1724396	900633		40.4686	83.4903	2361571	1265787		1052						0	675	894	376	0	0
UNION		78	1745703	801798		40.1978	83.4103	2393350	1166985		1022						0			375	0	0
UNION		79	1723963	776838		40.1286	83.4872	2374362	1141712		1020						0			208	0	0
UNION		2634	1804901	808014		40.2164	83.1986	2451615	1173752		894						0				0	0
UNION		2635	1747405	868423		40.3808	83.4067	2387871	1233747		993						0				0	0
UNION		2636	1767397	819303		40.2464	83.3331	2413110	1184700		980						0				0	0
UNION		2637	1753742	835199		40.2897	83.3828	2397746	1200502		1019						0				0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
UNION		2639	1780388	849458		40.3294	83.2875	2422816	1214989		957						0				0	0
UNION		2640	1760219	902831		40.4756	83.3617	2396981	1268342		957						0				0	0
UNION		2648	1768030	879537		40.4122	83.2611	2427164	1245205		927						0				0	0
UNION		2649	1778969	912639		40.5031	83.2911	2415564	1278377		962						0				0	0
UNION		2650	1767130	871155		40.3889	83.3358	2407267	1236702		972						0				0	0
UNION	UNION	3415920002	1737600	167100		40.1214	83.4382	2388271	1139084	3348	1001	-2349	175	520	85	486	0	682		0	0	0
UNION	WASHINGTON	3415920013	1748650	292300		40.4654	83.4033	2385810	1264619	2990	896	-1989	15	460	110	454	0	687	900	310	0	0
UNION	TAYLOR	3415920025	1753100	228400		40.2901	83.3850	2397120	1200648	3189	1025			379	103	554	0	722	867	380	0	0
UNION	DOVER	3415920067	1783350	213250		40.2494	83.2761	2428860	1185795	3435	968	-2484	120	570	116	453	0	746			0	0
UNION	DOVER	3415920069	1786250	205300		40.2276	83.2655	2432593	1177840	3500	971	-2479	90				0				0	0
UNION	DOVER	3415920070	1783600	232000		40.3008	83.2758	2427096	1204552	3340	962	-2358	160	460	60	470	0	596			0	0
UNION	DOVER	3415920071	1783200	223050		40.2762	83.2769	2427674	1195575	3395	987	-2403	160	420	60	570	0	578			0	0
UNION	DOVER	3415920074	1783300	204300		40.2248	83.2760	2429771	1176818	3438	974	-2445	83	586			0	704	939	448	0	0
VAN WERT		11	1388656	1068832		40.9136	84.7114	2009431	1428180		786						0				0	0
VAN WERT		12	1424404	1055938		40.8806	84.5811	2046354	1416137		770						0				0	0
VAN WERT		13	1412682	1017377		40.7742	84.62	2038902	1377309		820						0				0	0
VAN WERT		19	1460853	1007102		40.7489	84.4456	2087850	1368076		805						0				0	0
VAN WERT		24	1405465	1034856		40.8217	84.6478	2029772	1394643								0				0	0
VAN WERT		25	1383527	1065557		40.9044	84.7297	2004868	1424823		790						0				0	0
VAN WERT		26	1406469	1090370		40.9739	84.6489	2024801	1450185		750						0				0	0
VAN WERT		27	1454045	1028113		40.8081	84.4717	2078849	1388950		794						0		770	316	0	0
VAN WERT		27	1456036	1092636		40.9833	84.4697	2073834	1453615		725						0				0	0
VAN WERT		30	1457384	1031076		40.8144	84.46	2081817	1391979		796						0		754	314	0	0
VAN WERT		31	1454085	1028493		40.8072	84.4717	2078815	1389352		798						0		770	319	0	0
VAN WERT		32	1454164	1023712		40.7942	84.4708	2079471	1384608		795						0		769	329	0	0
VAN WERT	LIBERTY	54	1396437	1006460		40.7431	84.6778	2023890	1365960		842								716			
VAN WERT		58	1387234	1035880		40.8233	84.7136	2011569	1395227		822						0			340	0	0
VAN WERT		60	1403088	1077798		40.9392	84.66	2022809	1437522		768						0		699	402	0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Lati-tude	Long-itude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
VAN WERT		69	1402504	1077287		40.9378	84.6619	2022329	1437011		768						0	566		402	0	0
VAN WERT		81	1402217	1090492		40.9739	84.6642	2020589	1450185		756						0		699	442	0	0
VAN WERT		87	1369148	1013788		40.7614	84.7769	1995964	1372638		809						0		684	337	0	0
VAN WERT		96	1410548	1011803		40.7586	84.6275	2037310	1371616		830						0	571	725	301	0	0
VAN WERT		105	1459523	1072206		40.9275	84.4553	2079556	1433252		745						0		733		0	0
VAN WERT		110	1460154	1071532		40.9256	84.4531	2080222	1432559		752						0		730	397	0	0
VAN WERT	WILLSHIRE	121	1369805	1013758		40.7614	84.7744	1996655	1372638		806							542	692			
VAN WERT		124	1462811	1063931		40.905	84.4428	2083709	1425041		758						0		714	392	0	0
VAN WERT		150	1461391	1056227		40.8838	84.4475	2083088	1417232		765						0		712	396	0	0
VAN WERT		459	1410707	1047159		40.8558	84.6297	2033719	1407087		790						0				0	0
VAN WERT		3062	1368882	1067262		40.9628	84.7844	1997835	1446134		781						0			518	0	0
VAN WERT	JENNINGS	3416120044	1473770	403075		40.7573	84.3996	2100290	1371142	3240	820	-2394	272	542	0	632	0	584	775		0	0
VINTON	JACKSON	3416310001	1967700	473500	S	39.3	82.6142	2649317	839333													
VINTON	HARRISON	3416320302	1931800	470800	S	39.2925	82.7408	2613894	836598	4072	628						83	653	1190	722	600	108
WARREN		3416520007				39.5079	84.2157	2191034	915200	2833	827				0	1160	0			0	0	0
WARREN		3416520008				39.4245	84.0156	2249994	884775	2948	845				0	1105	0			0	0	0
WARREN	CLEAR CREEK	3416520010	1536300	570700		39.5554	84.1446	2209511	932535	3442	1048			575	0	1066	0	538		0	0	0
WARREN	WAYNE	3416562627				39.5969	84.1171	2216888	936718	5380	1025			630	0	992	0	681		0	0	0
WASHINGTON	LAWRENCE	3416723307	2341240	537770	S	39.4703	81.2911	3014997	901480	9135	651				0						2750	364
WASHINGTON	LAWRENCE	3416723310	2341080	537910	S	39.4706	81.2917	3014815	901590	9250	651				0				1850	1959		
WASHINGTON	WESLEY	3416728578	2191110	526630	S	39.4439	81.8233	2866413	891846						0							
WASHINGTON	WESLEY	3416728580	2191610	524380	S	39.4378	81.8217	2867115	889620						0							
WASHINGTON	LAWRENCE	3416728868	2328950	544350	S	39.4889	81.3344	3002016	908288	10196	855				0				1790	1888		
WASHINGTON	WESLEY	3416728713	2194220	520070	S	39.4258	81.8125	2870199	885241	7450	861				0				1472	1381		
WAYNE	CHIPPEWA	3416920071	2214900	461900		40.9319	81.7222	2831941	1434858	6919	960	-5944	134	670	0	158	0	774	1646		1550	
WAYNE	EAST UNION	3416921153	2194600	399600	N	40.7614	81.7975	2818470	1372638	6399	1124				54	160	0	781				
WAYNE	CANAAN	3416921186	2167000	463200	N	40.9364	81.8956	2784027	1436500	5597	1050						0	724	1588	1243		
WAYNE	BAUGHMAN	3416921188	2231900	426800	N	40.835	81.6619	2852717	1399497	6535	1030				0	189	0	793	1678	1465	1610	110

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
WAYNE	GREEN	3416921316	2182700	447900	N	40.8942	81.8392	2801339	1421100	5861	1085						0	754	1611	1273		
WAYNE	BAUGHMAN	3416921334	2215650	445000	N	40.8856	81.72	2834534	1417962	6186	1068						0	778	1649	1407		
WAYNE	GREEN	3416921398	2180600	441900	N	40.8778	81.8469	2799914	1415115	5832	1128						0	764	1606	1282		
WAYNE	WAYNE	3416921419	2164450	435450		40.8604	81.9055	2784504	1408766	6897	1151	-5577	142	696	0		0	720	1568	1248	1320	110
WAYNE	PLAIN	3416921721	2104850	405900	N	40.7803	82.1214	2728311	1379535													
WAYNE	PAINT	3416921765	2232650	385250	N	40.7211	81.6606	2857979	1357931	6495	1063						0	795	1650	1448		
WAYNE	PAINT	3416922133	2224700	373250	N	40.6883	81.6897	2851351	1345962	6689	1243						0	798	1634	1424		
WAYNE	EAST UNION	3416922778	2185700	399500	N	40.7614	81.8297	2809585	1372638	6179	1117				0	139	0	778	1611	1286		
WAYNE	EAST UNION	3416922779	2180200	400400	N	40.7639	81.8494	2804043	1373550	6225	1045				0	164	0	769	1603	1276		
WAYNE	EAST UNION	3416922780	2183550	404050	N	40.7739	81.8372	2806986	1377200	6258	1176				0	166	0	768	1610	1275		
WAYNE	MILTON	3416922990	2179370	451090	N	40.9031	81.8511	2797685	1424348													
WAYNE	GREEN	3416924018	2182550	441900	N	40.8778	81.8397	2801897	1415115	5860	1150						0	737	1617	1287		
WAYNE	CANAAN	3416924606	2153375	461875	N	40.9331	81.945	2770569	1435296													
WAYNE	CANAAN	3416924671	2165950	453550	N	40.91	81.8997	2784012	1426866													
WAYNE	CANAAN	3416924704	2161500	457700	N	40.9214	81.9158	2779154	1431026													
WAYNE	CANAAN	3416924706	2164300	454500	N	40.9128	81.9056	2782269	1427888													
WAYNE	CANAAN	3416924728	2159800	457600	N	40.9214	81.9217	2777475	1431026													
WILLIAMS	JEFFERSON	28	1435306	1306435		41.5683	84.5622	2030085	1667098		889								750	870		
WILLIAMS	MADISON	30	1435888	1329452		41.6314	84.5622	2028099	1690125		868							604	766	913		
WILLIAMS	ST. JOSEPH	33	1382502	1270567		41.4667	84.7519	1981449	1630021		848								742	816		
WILLIAMS	CENTER	37	1430037	1263903		41.4514	84.5781	2029412	1624438		779							580	768			
WILLIAMS	BRIDGEWATER	45	1425537	1352260		41.6933	84.6019	2015341	1712714		908							577	744			
WILLIAMS	FLORENCE	47	1378345	1308358		41.57	84.7706	1973185	1667718		917							528	732			
WILLIAMS	ST. JOSEPH	3417120034	1382900	662500		41.4632	84.7517	1981611	1628744	4137	842	-3080	231	513	0	604	0	562				
WILLIAMS	BRIDGEWATER	3417120046	1425900	741000		41.6816	84.6017	2015762	1708444	4490	915			505	0	565	0	577	742			
WOOD	PLAIN	53	1676009	1228738		41.3672	83.6797	2277840	1593711		681								775			
WOOD	PLAIN	203	1654991	1241035		41.4	83.7569	2255582	1605681		671							727	782			
WOOD	BLOOM	206	1691346	1165411		41.1939	83.6211	2299976	1530469		726							722	818			

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
WOOD	WASHINGTON	211	1661287	1256848		41.4436	83.7347	2260133	1621591		668							732	771			
WOOD	HENRY	215	1652616	1188004		41.2544	83.7628	2259016	1552547		698							698	801			
WOOD	WASHINGTON	232	1663192	1249014		41.4222	83.7272	2262928	1613782		675							728				
WOOD	PLAIN	234	1665098	1238889		41.3944	83.72	2265867	1603637		683							704	775			
WOOD	WASHINGTON	247	1649112	1242133		41.4028	83.7783	2249634	1606702		685							689	778			
WOOD	GRAND RAPIDS	248	1621878	1228511		41.3844	83.8767	2224043	1592689		681							659	786			
WOOD	HENRY	259	1676332	1178211		41.2314	83.6761	2283579	1544154		698							688				
WOOD	BLOOM	355	1690363	1171994		41.2119	83.6247	2298355	1537038		721							717	820			
WOOD	PERRY	364	1732415	1168479		41.2036	83.4719	2340551	1534009		748							764	823			
WOOD	PERRY	368	1723614	1160472		41.1814	83.5036	2332649	1525907		744							751	811			
WOOD	JACKSON	382	1626968	1161478		41.1808	83.8544	2236431	1525688		717							671				
WOOD	PERRYSBURG	387	1705998	1297575		41.5569	83.5736	2300119	1662838		637								738			
WOOD	BLOOM	409	1685837	1180591		41.2353	83.6417	2292873	1545577		707								787			
WOOD	PORTAGE	413	1715095	1197617		41.2831	83.5361	2320118	1563021		686								809			
WOOD	PORTAGE	414	1715094	1198413		41.2853	83.5361	2320040	1563823		686								800			
WOOD	HENRY	422	1661884	1159444		41.1767	83.7278	2271306	1524192		723								802			
WOOD	HENRY	424	1659577	1172099		41.2111	83.7367	2267671	1536748		708								807			
WOOD	PORTAGE	426	1688827	1201878		41.2839	83.6392	2291498	1566962		686								806			
WOOD	LIBERTY	433	1672714	1215029		41.3294	83.6911	2276044	1579917		693							722	777			
WOOD	LIBERTY	3417300008	1682200	602200		41.3138	83.6569	2285953	1574224	2927	688	-2211	283	275	134	268	0				0	0
WOOD	CENTER	3417320229	1686025	614750		41.3484	83.6436	2288377	1586850	2764	694	-2026	220	355	110	205	0	743	792		0	0
WOOD	LIBERTY	3417320231	1680000	580670		41.2547	83.6638	2286135	1552657	2770	698	-2062	234	294			0	723	805		0	0
WOOD	PLAIN	3417320236	1681400	644050		41.4286	83.6618	2280579	1616117	2785	677	-2093	284	276	160	141	0	755	768		0	0
WOOD	CENTER	3417320237	1698550	640150		41.4186	83.5991	2298069	1612468	2821	673	-2152	275	302	128	176	0	793	773		0	0
WOOD	MIDDLETON	3417320239	1667975	656000		41.4609	83.7114	2265894	1627905	2825	670	-2135	285	252	168	184	0	748	767		0	0
WOOD	PERRY	3417320367	1721650	566700		41.2177	83.5118	2329106	1539154	2740	721			230			0	759	814		0	0
WOOD	PERRY	3417320394	1731150	560100		41.2000	83.4770	2339281	1532685	2600	752			230			0	754	760		0	0
WOOD	LIBERTY	3417320423	1675500	612750		41.3425	83.6818	2278131	1584697	2880	691	-2165	240	276			0	765	695		0	0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
WOOD	LIBERTY	3417320432	1678050	607100		41.3271	83.6722	2281298	1579077	2867	690	-2174	254	278			0	732	772		0	0
WYANDOT		5	1798443	1011690		40.7753	83.2275	2423278	1377710		847						0				0	0
WYANDOT		7	1779245	989278		40.7133	83.2961	2406589	1355085		890						0				0	0
WYANDOT		80	1800842	1016492		40.7883	83.2189	2425176	1382454		890						0			475	0	0
WYANDOT		163	1784121	1071305		40.9383	83.2811	2402559	1437194		813						0			333	0	0
WYANDOT		165	1817747	1015996		40.7875	83.1581	2441983	1382163		901						0	783	884		0	0
WYANDOT		171	1826034	1079820		40.9628	83.1297	2443335	1446134		854						0	762	876	663	0	0
WYANDOT		172	1793332	1044748		40.8658	83.2489	2414623	1410736		811						0	755	897		0	0
WYANDOT		184	1761631	1016780		40.7883	83.3606	2386073	1382454		840						0			294	0	0
WYANDOT		185	1777317	1073295		40.9439	83.3058	2395555	1439237		835						0			290	0	0
WYANDOT		186	1789116	1011137		40.7736	83.2611	2414066	1377090		892						0			385	0	0
WYANDOT		189	1764511	1003327		40.7514	83.3497	2390410	1368989		889						0	719	876	315	0	0
WYANDOT		190	1827733	1087973		40.985	83.1236	2444190	1454236		880						0			698	0	0
WYANDOT		193	1771854	1003968		40.7533	83.3233	2397631	1369682		890						0	728	884	282	0	0
WYANDOT		206	1765801	1036387		40.8422	83.3461	2388132	1402124		846						0			260	0	0
WYANDOT		212	1825591	1050659		40.8828	83.1306	2446049	1416940		932						0	778	885		0	0
WYANDOT		229	1744602	1082446		40.9681	83.4244	2362036	1448068		890						0		734	488	0	0
WYANDOT		230	1746254	1079845		40.9608	83.4183	2363976	1445404		863						0			332	0	0
WYANDOT		231	1750007	1075845		40.95	83.4047	2368107	1441463		842						0			330	0	0
WYANDOT		232	1742902	1081045		40.9642	83.4306	2360469	1446845		892						0			375	0	0
WYANDOT		262	1765892	1063446		40.9164	83.3475	2385068	1429202		821						0				0	0
WYANDOT		283	1763642	1061095		40.91	83.3547	2383316	1426868		817						0			310	0	0
WYANDOT	JACKSON	3417500008	1744800	393600		40.7433	83.4210	2371012	1386033	5632	910	-2130					0	625			0	0
WYANDOT	CRAWFORD	3417520072	1747800	472700		40.9605	83.4132	2365391	1445295	2801	860	-1940	242	320	125	205	0	587			0	0
WYANDOT	SALEM	3417520173	1747400	420900		40.8184	83.4126	2370647	1393439	2875	868	-1992	210	410	102	276	0	554		290	0	0
WYANDOT	MIFFLIN	3417520174	1768700	409500		40.7876	83.3353	2393081	1382199	2800	846	-2011	199	418	120	339	0	694	856	290	0	0
WYANDOT	EDEN	3417520211	1828300	448300		40.8955	83.1211	2448196	1421575	3260	942	-2298	190	364	106	184	0	741	911			0
WYANDOT	EDEN	3417520258	1810050	423430		40.6269	83.1864	2432728	1396541	3167	887						0	745	915			0

Table 3. continued

County	Township	Permit No.	Ohio X (ft)	Ohio Y (ft)	S or N	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
													3	4	5	6	7	8	9	10	11	12
WYANDOT	EDEN	3417520259	1808950	423470		40.8270	83.1904	2431621	1396577	3149	893	-2173	184	376	96	225	0	692	669			0

Table 4. Geologic data for Illinois. (Reference datum = mean sea level. Layer designations given in figure 4.)

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
ADAMS	40	91	278549	1094782						0		0				190	0
BOONE	42.17	88.91	835701	1888675	2998	815	-2104			160	0	0	555	0	0	0	0
CALHOUN	39.3899	90.6002	310177	872140	2550	448			570	0	1300	0	418	0	0	0	0
CASS	40	90	559089	1094782						60		0				230	0
CHAMPAIGN	40	88	1118109	1094782						110		0		220		85	0
CHAMPAIGN	40.2746	88.432	993347	1184991	4497	759			516			0				0	0
CHAMPAIGN	40.3328	88.3374	1018802	1216230	4395	732			540			0				0	0
CHAMPAIGN	40.3	88.45	987965	1204260	4272	758			587	180	1348	0	695	205	452	120	0
CLARK	39.25	88	1130296	821087						0		0		260		125	0
CLINTON	38.6592	89.2044	796611	605488	7040	486	-6394	0	310	0	1700	0	850	190	994	65	0
COOK	41.9171	87.9055	1111743	1794385	1833	655			240	150	360	0	570	180	120	0	0
CRAWFORD	39	87.75	1205198	729855						0		0		285		135	0
DE KALB	41.99	88.63	914008	1820988	4484	910	-2953			175	100	0	620	245	0	0	0
DEWITT	40.2141	88.6999	919593	1172913	4933	736			508	160	1358	0	670	205	489	140	0
DOUGLAS	39.8	88.24	1038614	1386724	4151	668			760	110	1480	0	755	210	514	95	0
DOUGLAS	39.8689	88.1867	1067973	1046940	4414	679			646			0				90	0
DU PAGE	41.88	88.2	1032394	1780846	4043	741	-3279			200	170	0	620	80	250	0	0
FAYETTE	39	89	850767	729855						0		0		210		110	0
FAYETTE	39.1079	88.871	885992	769230	8615	538	-7676	1324	575	0	1680	0	820	225	502	105	0
FRANKLIN	38	89	862663	364927						0		0		150		90	0
FULTON	40.71	90.18	503444	1353881	2777	700				175	970	0	510	190	230	250	0
GALLATIN	37.75	88.25	1081969	273696						0		0				360	0
HAMILTON	38.0311	88.4751	1013153	376277	13051	393	-12574	0	670	0	4339	0	1080	200	1385	260	0
HANCOCK	40.248	91.2302	214414	1185284	3025	640			445	0	1143	0		50		260	0
HARDIN	37.5	88.25	1085615	182484						0		0		230		440	0
HENDERSON	40.771	90.9329	294911	1376141	3180	625	-2531	736	282	90	1126	0	400	150	47	300	0
HENRY	41.3423	90.4188	433210	1584624	3863	803	-3052	1305	172	150	925	0	480	210	310	0	0
IROQUOIS	41	88	1101561	1459710						255		0				0	0

Table 4. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
IROQUOIS	40.7777	87.8709	1140934	1378586	4005	652			590			0		230		0	0
IROQUOIS	40.7498	87.7953	1162308	1368405	3475	653			602	210	1078	0	650	220	298	0	0
JASPER	39	88	1134316	729855						0		0		270		150	0
JERSEY	38.9918	90.5098	422868	726862	2680	750			267	0	1483	0	530	100		30	0
JO DAVIESS	42.4	90.5	404090	1977907	1600	840				150		0	310	0	0	0	0
JOHNSON	37.343	88.8655	909352	125170	14284	594			1209	0	6263	0	1470	230	1294	210	0
KANE	41.72	88.29	1010466	1722457	2139	655				190	450	0	520	140	15	0	0
KANKAKEE	41.1568	87.6723	1188948	1516930	5050	622			490	240	700	0	530	210	280	0	0
KANKAKEE	41.0351	88.1046	1072188	1472519	5003	674			560	240	890	0	590	190	58	0	0
KANKAKEE	41.1057	88.1814	1049924	1498282	2330	622			446			0		100		0	0
KNOX	41	90	550816	1459710						170		0				220	0
KNOX	40.95	90.37	449259	1441463	2750	780			275	180	980	0	485	210	85		0
LA SALLE	41	89	826202	1459710						200		0				0	0
LA SALLE	41.62	88.81	870206	1685965	3659	681	-2788			200	228	0	0	0	0	0	0
LA SALLE	41.62	88.7	900210	1685965	3725	659	-3041			205	400	0	0	0	0	0	0
LA SALLE	41.0517	88.9408	841843	1478576	2732	663			408			0				0	0
LA SALLE	40.9384	89.0395	816086	1437230	5800	739	-4881	2110	390	205	1128	0	540	100	633	0	0
LA SALLE	41.4617	89.1364	783090	1628197	3556	677	-2838	2345	171	190	732	0	20	0	0	0	0
LAKE	42.4663	87.8113	1127474	1994803	3500	585	-2875	1820	390	135	0	0	480	230	305	0	0
LAWRENCE	38.7532	87.7692	1203930	639791	9261	501			870	0	2880	0	930	300	955	160	0
LEE	41.67	89.3	735979	1704211	3653	812	-2653			160	586	0	424	0	0	0	0
LEE	41.6933	89.3917	710727	1712714	3772	714	-3046	1970	150	160	615	0	763		0	0	0
LIVINGSTON	40.853	88.5372	955766	1406085	3485	730			457	240	1029	0	695	170	321	0	0
LIVINGSTON	41.0386	88.8631	863394	1473796	2778	637			405	205	1280	0	500	0	0	0	0
MACON	40	89	838612	1094782						130		0		195		150	0
MADISON	39	90	567192	729855						0		0				95	0
MADISON	38.67	89.75	641054	809429	5018	504	-4506	44	448	0	1568	0	660	160		35	0
MADISON	38.6627	89.772	634851	806765	5213	513	-4688	58	407	0	1569	0	640	155	560	35	0

Table 4. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
MADISON	38.6772	89.7536	639964	612058	4869	516	-4341	0	299	0	1591	0	660	160		35	0
MARION	38.5545	89.0195	650535	587280	9210	541	-8629	720	818	0	2256	0	900	200	935	110	0
Mc DONOUGH	40.58	90.8	332691	1299142	2800	751			284	90	1131	0	440	50	60	240	0
Mc DONOUGH	40.5814	90.7612	343338	1306951	2842	773			287			0				240	0
Mc DONOUGH	40.5229	90.7433	348603	1285603	2788	714			293			0				250	0
Mc HENRY	42.42	88.67	897033	1977907	1783	870				150	75	0	600	150	20	0	0
Mc LEAN	40.552	88.7358	905038	1296222	3990	767			403			0				170	0
Mc LEAN	40.5691	88.9349	849624	1302462	4234	799			412	225	1262	0	660	170	332	180	0
Mc LEAN	40.7025	88.9188	852381	1351144	3988	764			437			0				0	0
Mc LEAN	40.6105	88.774	893666	1317570	4125	745			402			0				0	0
MERCER	41.1188	90.8871	305953	1503063	3716	584	-2671	899	251	110	1065	0	410	210	238	34	0
MONROE	38.4052	90.1731	522431	512796	2768	668	-2093	0	283	0	1517	0	540			0	0
MORGAN	39.5725	89.992	564825	938776	4253	657			434			0				215	0
MORGAN	39.57	89.95	576659	937863	4250	681			438	0	1571	0	680	190	69	210	0
MOULTRIE	39.732	88.6342	944539	996982	6525	686			556	65	1466	0	700			110	0
OGLE	42.04	89.67	631465	1839234	2131	805				150	441	0	127	0	0	0	0
PERRY	38.15	89.15	617854	419867	8100	525				0		0	890	175	1497	40	0
PERRY	38.0625	89.4356	736784	387735	7057	486	-6464	0	0	0	2194	0	820	165	885	20	0
PIKE	39.72	90.9632	291021	992603	3206	716	-2488	456	270	0	1388	0	480			170	0
PIKE	39.6123	90.866	316801	953300	2228	812	-1409	0	74	0	1277	0	500			170	0
POPE	37.5896	88.5163	1007319	215161	14942	804			920	0	6420	0	1360	195		320	0
PUTNAM	41.2715	89.328	732838	1558787	4877	527	-4315	1842	431	160	711	0	520	180		0	0
RANDOLPH	38	90	575122	364927						0		0				0	0
STARK	41.1278	89.8975	577820	1506347	2822	757			348	150	767	0	520	170	250		0
STEPHENSON	42.48	89.85	578818	1992504	5272	990	-1187			140	383	0	425	0	0	0	0
STEPHENSON	42.45	89.87	573525	1988854	5442	996	-1182			135	396	0	419	0	0	0	0
STEPHENSON	42.51	89.85	578355	2010750	2096	905	-1090			140	178	0	478	0	0	0	0
UNION	37.3719	89.3346	772973	135717	8492	424			630	0	5762	0	1320	140	342	0	0

Table 4. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
VERMILLION	40.1258	87.5548	1240293	1140690	6675	662			604	80	1520	0	640	290	568	100	0
WABASH	38.5	87.75	1213672	547391						0		0		300		210	0
WASHINGTON	38.2215	89.2867	777864	445759	7338	458	-6838	0	328	0	1922	0	850	170	1018	30	0
WAYNE	38.4645	88.4126	1024984	534436	11614	504	-11010	357	954	0	2627	0	1213	195	1164	190	0
WHITE	38	88.25	1078302	364927						0		0		230		280	0
WILL	41.4994	88.2267	1031225	1641954	4300	632	-3593	2296	384	180	334	0	590	100	127	0	0
WILL	41.4917	87.7996	1148064	1639144	2700	730			329			0		180		0	0
WINNEBAGO	42.28	88.95	823448	1926817	3385	870	-1786			150	128	0	415	0	0	0	0

Table 5. Geologic data for Indiana. (Reference datum = mean sea level. Layer designations given in figure 4.)

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
ADAMS	41.1547	84.8431	1965924	1516164		747						0				0	0
ADAMS	41.1347	84.8492	1964849	1508865		747						0				0	0
ADAMS	41.1578	84.9547	1935194	1517295		765						0				0	0
ADAMS	40.5722	84.8747	1974552	1303594		785						0				0	0
ADAMS	40.6281	85.0114	1935075	1323977	2226	824						0	468			0	0
ADAMS	40.9153	84.9244	1950691	1428800		837						0				0	0
ADAMS	40.6347	84.8219	1987303	1326410	1762	841						0	487			0	0
ADAMS	41.1694	85.2128	1864006	1521528		846						0				0	0
ADAMS	40.5756	85.0033	1938827	1304818	2270	851						0	517			0	0
ADAMS	41.1867	85.1422	1882888	1527842		856						0				0	0
ADAMS	40.5825	85.0392	1928702	1307352	1870	859						0	574			0	0
ALLEN	41	85	1927383	1459710												0	0
ALLEN	40.9636	84.9022	1955376	1446426	3672	797	-2687	357	457	0	840	0	482	752	500	0	0
ALLEN	40.9194	85.1831	1879289	1430296	3524	822	-2668	419	491	0	909	0	436	725	410	0	0
ALLEN	41.1686	85.3147	1836057	1521238	3501	852			503	0	883	0	429	686	630	0	0
ALLEN	41.1914	85.1605	1877731	1529557	3571	856			477	0	781	0	489	698	700	0	0
BLACKFORD	40.4983	85.2647	1868584	1276638	2395	892						0	500			0	0
BLACKFORD	40.3847	85.4428	1822283	1235170	3167	862				0		0				0	0
BLACKFORD	40.4964	85.3644	1840997	1275932	3505	888			532	0	1032	0	484			0	0
BLACKFORD	40.5153	85.3	1858332	1282829	3302	892			533	0	994	0	506	688	100	0	0
BOONE	40.05	86.29	1594791	1113029	1825	916				0		0	508	490	558	0	0
BROWN	39.11	86.2	1642051	769997	1825	581				0		0	620	615	322	120	0
CASS	40.8803	86.5458	1504645	1416028	3077	711			609	127	718	0	443			0	0
CASS	40.8533	86.5284	1510612	1406175	3300	718			602	136		0				0	0
CASS	40.9022	86.4517	1530089	1424020	3138	732			585	124		0		383	400	0	0
CASS	40.895	86.4825	1521764	1421392	3026	737			596	123	688	0	444	378	360	0	0
CASS	40.8767	86.5017	1516890	1414714	2996	746			588	126	692	0	460	370	400	0	0
CLARK	38.4203	85.6956	1802158	518298	1608	482						0	671				0

Table 5. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
CLAY	39.2608	87.0928	1386381	824955	6751	601			958	0	2028	0	670	325	671	95	0
DAVIESS	38.5	87	1427800	547391												150	0
DEARBORN	39	85	1984724	729855											0	0	0
DEARBORN	39.2511	84.8369	2023698	821492	1483	755						0				0	0
DECATUR	39.3097	85.6164	1802078	842881	1690	832						0	576			0	0
DECATUR	39.3308	85.5978	1806784	850585	1672	869						0	579			0	0
DECATUR	39.2375	85.4678	1845916	816525	1589	903						0	580			0	0
DECATUR	39.4522	85.3083	1885148	894883	1775	1061						0	554			0	0
DEKALB	41.5	85	1912678	1642173												250	0
DEKALB	41.3997	85.1669	1869990	1605571		950						0				0	0
DELAWARE	40.3011	85.5711	1788857	1204866	1508	885						0	500			0	0
DELAWARE	40.1975	85.5486	1797867	1166855	1431	912						0	458			0	0
DELAWARE	40.2681	85.4247	1830467	1192603	1568	912						0	434			0	0
DELAWARE	40.2197	85.2369	1884062	1174965	1775	979						0	487			0	0
DELAWARE	40.1753	85.2256	1888472	1158746	1683	1006						0	370			0	0
DELAWARE	40.1014	84.2464	2163619	1131782	2100	1044						0	674			0	0
DELAWARE	40.18	85.32	1862027	1160469	2505	970				0	1190	0	409	721	70	0	0
ELKHART	41.5	86	1639558	1642173												285	0
ELKHART	41.465	85.8317	1686439	1629401	4132	829	-3280	691	547	100	659	0	414	519	813	285	0
FAYETTE	39.5803	85.2078	1910487	934316	1500	837						0	532			0	0
FAYETTE	39.6064	85.1969	1912259	951143	1451	919						0	512			0	0
FAYETTE	39.7119	85.2114	1905287	989663	1487	1040						0	536			0	0
FAYETTE	39.5367	85.0933	1943332	925711	3955	959	-2955	502	448	0	1559	0	509	896	0		0
FOUNTAIN	40.22	87.23	1328990	1175068	2175	648						0	554	305	544	100	0
FRANKLIN	39.5053	85.2158	1909736	914245	1594	959						0	523			0	0
FRANKLIN	39.3742	84.8883	2005654	886398	1804	986						0	594			0	0
FRANKLIN	39.5	85	1970612	912319											0	0	0
FRANKLIN	39.4278	85.0747	1951619	885971	3338	717			451	0	1639	0	510	637	0		0

Table 5. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
FRANKLIN	39.3786	85.2106	1914890	868016	3470	759			455	0	1677	0	534	720	0		0
FULTON	40.9417	86.4422	1531792	1438434	3000	740			605	107	705	0	421	344	500	0	0
FULTON	40.9175	86.4517	1529735	1429603	3496	744			599	119	707	0	417	362	440		0
FULTON	40.9242	86.4569	1528147	1432048	3047	749			599	118	678	0	438	348	450	0	0
FULTON	40.9622	86.4333	1533768	1445915	3023	758			594	120	698	0	430	360	430	0	0
FULTON	40.9172	86.4517	1529742	1429494	4056	762	-3150	1141	589	117	703	0	422	383	350		0
GRANT	40.53	85.83	1711016	1288184	2250	851					781	0	509	566	240	0	0
GRANT	40.4414	85.6972	1750132	1255857	1445	864						0	389			0	0
GRANT	40.5878	85.5783	1779239	1309278	1536	864						0	446			0	0
GRANT	40.5200	85.6203	1769414	1284544	1552	864						0	411			0	0
GRANT	40.5336	85.4994	1802546	1289512	2084	867						0	487			0	0
GRANT	40.4425	85.5017	1804379	1256283	1525	911						0	456				0
GREENE	39	87	1417831	729855												115	0
GREENE	38.9769	86.9839	1422860	721425	6785	568				0	2638	0	712	325	860	120	0
HAMILTON	40	86	1676987	1094782												0	0
HAMILTON	40.1058	85.8894	1705223	1133404	1602	814						0	540			0	0
HANCOCK	39.8906	85.9225	1701361	1054843	1531	855						0	552			0	0
HANCOCK	39.8378	85.6847	1769259	1035583	2069	941						0	545			0	0
HARRISON	38	86	1725101	364927												85	0
HENRY	39.8936	85.4256	1840335	1055958	2090	1028						0	562			0	0
HENRY	39.8553	85.2472	1891294	1041977	3664	1060	-2589	331	518	0	1410	0	501		0	0	0
HENRY	39.8156	85.3869	1858848	1027473	1560	1081						0	535			0	0
HOWARD	40.5	86	1664637	1277246												0	0
HOWARD	40.4867	85.9917	1687269	1272392	3996	821	-3124	875	725	0	990	0	427			0	0
HAWARD	40.4617	86.2703	1590587	1263257	1979	787						0	470			0	0
HUNTINGTON	40.7400	85.4808	1802121	1364828	1650	820						0	418			0	0
HUNTINGTON	40.7397	85.5642	1779102	1364727	1786	822						0	489			0	0
JACKSON	39	86	1701303	729855												130	0

Table 5. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
MADISON	40.0844	85.7892	1733741	1125598	1433	869						0	469			0	0
MARSHALL	41.3742	86.1869	1591588	1596265	4082	789	-3101	886	548	119	577	0	398	439	646	260	0
MONTGOMERY	40	87	1397570	1094782												110	0
MORGAN	39.4	86.57	1530984	875826	2112	580				0		0	596	447	425	120	0
NEWTON	41.1744	87.3272	1283390	1523353	3021	642			434	203	612	0	495			0	0
NEWTON	41.1603	87.3158	1286797	1518207	3021	658			437	194		0		289	480	0	0
NEWTON	41.1675	87.2939	1292670	1520835	2960	663			443	197	643	0	451	274	530	0	0
NOBLE	41.3125	85.3644	1818403	1573749	3694	971			488	0	854	0	412	670	700	260	0
PERRY	38.16	86.54	1566456	423316	3534	748						0	602	589	509	100	0
PORTER	41.5	87	1368382	1642173												195	0
PORTER	41.6286	87.1711	1317012	1689103	4308	615	-3637	2093	231	183	400	0	415	235	590	0	0
PORTER	41.6283	87.145	1324135	1688993	3945	624			235	198		0		206	630	0	0
PORTER	41.6283	87.1422	1324898	1688993	4301	624	-3637	2075	234	200	397	0	417	209	630	0	0
PORTER	41.6344	87.1214	1330444	1691220	4304	625	-3623	2058	219	197	466	0	350	213	545	0	0
PORTER	41.4789	87.0014	1366445	1634473	4548	784	-3745	2119	233	185	494	0	367	237	576	200	0
PORTER	41.4789	87.0017	1366363	1634473	4528	786	-3695	2084	233			0		228	580	200	0
POSEY	38	88	1150178	364927												310	0
POSEY	38.19	87.93	1167264	434264	7500	383						0		312	1289	260	0
PULASKI	40.9275	86.7253	1454104	1433252	3109	675			606	164	594	0	439	297	410	0	0
PULASKI	40.9642	86.8689	1413742	1446845	2900	680			586	188	611	0	465	288	500	0	0
PULASKI	40.9408	86.6706	1468883	1438108	3101	683			599	159	698	0	435	330	480	0	0
PULASKI	40.9269	86.7328	1452050	1433033	3151	685			608	162		0				0	0
PULASKI	40.985	86.6978	1460409	1454236	3102	687			618	138	590	0	438	309	480	0	0
PULASKI	40.9558	86.7731	1440313	1443580	3000	687			594	168		0		307	480	0	0
PULASKI	40.9597	86.6603	1471299	1445003	3106	690			609	164	592	0	433	319	450	0	0
PULASKI	40.9414	86.7183	1455726	1438325	3059	697			602	155	535	0	430	355	480	0	0
PULASKI	40.9692	86.6233	1481278	1448470	3100	704			606	153	638	0	407	340	500	0	0
PULASKI	40.9272	86.4869	1519810	1433143	3029	735			602	128	687	0	440	368	500	0	0

Table 5. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft) 1	4	5	6	7	8	9	10	11	12
JASPER	41.1733	87.2753	1297883	1522952	3658	668			452	192	669	0	419	287	580	0	0
JASPER	41.1653	87.2578	1302627	1520032	3105	673			461			0		263	630	0	0
JASPER	41.0447	87.0658	1357846	1476022	3373	684			564			0				0	0
JASPER	40.9581	87.0025	1377069	1444419	3195	693			607	202	649	0	413	344	560	0	0
JAY	40.4158	84.8244	1993128	1246519								0				0	0
JAY	40.5483	85.0167	1935922	1294884	1802	847						0	510			0	0
JAY	40.5422	85.1644	1895149	1292654	1723	899						0	508			0	0
JAY	40.3958	85.1253	1910159	1239220	3100	927			523	0	1096	0	440	745	80	0	0
JAY	40.4108	84.8739	1979535	1244707	1614	932						0	454			0	0
JAY	40.4153	85.1972	1889638	1246328	1664	938						0	447			0	0
JAY	40.4161	84.9908	1946914	1246633	1695	942						0	507			0	0
JAY	40.3958	84.8875	1976197	1239233	2200	944						0	512			0	0
JAY	40.5094	85.0772	1920266	1280676	3404	948	-2403	337	591	0	991	0	422			0	0
JAY	40.5075	85.0772	1920320	1279983	3395	949	-2384	335	573	0	975	0	429	771	150	0	0
JAY	40.3181	85.1642	1901558	1210849	1635	972						0	555			0	0
JAY	40.3281	85.1056	1917570	1214499	1605	998						0	542			0	0
JOGNSON	39.5192	85.9533	1701873	919313	1136	712						0					0
JOHNSON	39.5	86	1689209	912319												0	0
KOSCIUSKO	41.0697	85.7975	1706089	1485145	3295	855			305	140	775	0	375	563	520	0	0
LAGRANGE	41.7303	85.3125	1820817	1726216	4737	944	-3726	447	446	0	802	0	503	612	978	330	0
LAKE	41.6242	87.3872	1263628	1687497	4303	600			240	182	468	0	380			0	0
LAKE	41.6594	87.43	1245822	1700343	4385	607	-3721	2274				0				0	0
LAKE	41.6594	87.4306	1245658	1700343	4383	608	-3725	2284	239	200	151	0	668	171	470	0	0
LAKE	41.5531	87.4419	1244628	1661551	2458	623			266	196	451	0	412			0	0
LAKE	41.1678	87.3833	1267726	1528243	3052	640			455	189	620	0	478			0	0
LAPORTE	41.5506	86.8833	1397166	1660712	2785	828						0				230	0
LAWRENCE	38.8461	86.2963	1620261	673892	6806	800	-5841	1150	785	0	2346	0	599	616	369	120	0
MADISON	40.1483	85.7872	1732654	1148913	1350	857						0	468			0	0

Table 5. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
PUTNAM	39.5	87	1407754	912319												115	0
PUTNAM	39.51	86.98	1413180	915968	4756	877					1736	0	581	333	467	110	0
RANDOLPH	40.2900	85.2083	1890064	1200611	1400	936						0	329			0	0
RANDOLPH	40.1706	84.8828	1984114	1157023	2310	1108						0	546			0	0
RANDOLPH	40.1169	85.0778	1931305	1137458	1625	1118						0	503			0	0
RANDOLPH	40.0119	84.9444	1971524	1099141	2750	1164					1077	0	491			0	0
RANDOLPH	40.1272	84.8817	1985691	1141209	1875	1170						0	513			0	0
RANDOLPH	40.12	85.0828	1929818	1138573		1099						0				0	0
RANDOLPH	40.0119	84.9442	1971594	1099125		1149						0				0	0
RANDOLPH	40.0964	85.0731	1933194	1129961	3352	1151			568	0	1089	0	527	841	140	0	0
RANDOLPH	40.0847	85.1103	1923148	1125692	3358	1154			576	0	1150	0	486	784	170	0	0
RUSH	39.5836	85.4572	1839736	942830	1525	958						0	568			0	0
RUSH	39.6733	85.4056	1851853	975573	1500	968						0	558			0	0
RUSH	39.6653	85.3200	1876087	972633	1550	1048						0	551				0
RUSH	39.5506	85.3186	1879591	930768	1565	1078						0	557			0	0
SHELBY	39.6008	85.7803	1754120	949115	1550	790						0	551			0	0
SHELBY	39.5203	85.7458	1760302	919718	1595	790						0				0	0
SHELBY	39.6264	85.8233	1735760	958441	1653	804						0	577			0	0
SPENCER	38	87	1437661	364927												190	0
STEUBEN	41.7494	84.9169	1927895	1733186	6868	1058	-3831	328	409	0	798	0	511	683	1107	275	0
SWITZERLAND	38.8161	85.0175	1984904	882745	4151	794	-3280	384	502	0	2078	0	739	371	0	0	0
SWITZERLAND	38.8631	84.8878	2020419	879896	4000	880	-3094	337	505	0	1915	0	899	518	0	0	0
TIPPACANOE	40.5	87	1387279	1277248												110	0
UNION	39.5800	84.9222	1990200	941513	2758	997						0	506			0	0
VERMILLION	39.8503	87.4231	1282136	1040153	6160	650			860	0	1768	0	629	310	559	110	0
WABASH	40.9292	85.7897	1711881	1433873	3685	787	-2867	660	536	104	895	0	376	541	440	0	0
WASHINGTON	38.5	86	1713267	547391												110	0
WAYNE	40	85	1956351	1094782											0	0	0

Table 5. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
WAYNE	39.7356	85.0517	1949413	998295	3907	957	-2478	232	483	0	1380	0	505	835	0	0	0
WAYNE	39.8231	85.2033	1904468	1030210	1732	1019						0	538			0	0
WAYNE	39.7808	84.8631	2000985	1014790	3330	1030			529	0	1260	0	525	949	0	0	0
WELLS	40.6182	85.3544	1840378	1320733	1600	841						0	495			0	0
WELLS	40.5844	85.3419	1844796	1308062	1882	863						0	412			0	0
WELLS	40.6119	85.1561	1895480	1318097	1575	864						0	440			0	0
WELLS	40.5864	85.1822	1888975	1308772	1600	882						0	442			0	0
WHITE	40.9094	86.7847	1438127	1426647	3091	684			613	177	638	0	449	305	500	0	0
WHITLEY	41.1987	85.4114	1808735	1531491	3404	858			510	0	872	0	432	678	540	0	0

Table 6. Geologic data for Michigan. (Reference datum = mean sea level. Layer designations given in figure 4.)

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
ALLEGAN	42.555	86.1989	1559123	2027172	6000	688	-4894	837	429			0					
ALLEGAN	42.48	85.75	1682274	1992504		813						0	490	520	1530	660	0
BARRY	42.4647	85.2117	1826954	1994219	6618	910	-5715	425	303	120	1000	0	575	590	1870		0
BAY	43.6222	83.9536	2124806	2416622	14589	621	-13969	803	324			0					
BAY	43.88	84.15	2064065	2510701		670				500		0				410	100
BERRIEN	41.9583	86.2692	1554886	1809420	5647	804	-3813	1243	334	150	560	0	400	430	840	460	0
BRANCH	42.0497	85.2797	1820612	1842774	5432	890	-4490	550	413			0					
BRANCH	42.0558	85.2703	1822982	1845000	5475	889	-4528	542	379	130	790	0	555	595	1330	280	0
BRANCH	41.9717	85.2167	1839927	1814310	5253	911	-4313	515				0					
BRANCH	41.7683	84.9447	1919767	1740083	4633	1019						0					
BRANCH	41.9492	85.0226	1893215	1806099	5377							0					
CALHOUN	42.39	84.83	1931825	1966959		868				160	930	0	630	610	1930	200	0
CASS	41.8103	85.9142	1654997	1755410	3800	897						0					
CASS	41.8725	85.9142	1653388	1778109	3950	865				150	685	0	415	460	935	455	0
CASS	41.8497	85.9703	1638738	1769788	4007	840						0					
CASS	41.7761	85.9364	1649843	1742930	3851	987						0					
CASS	41.7803	85.9381	1649272	1744462	3300	848						0					
CASS	42.0542	85.9697	1633648	1844416	4000	884						0					
CASS	41.8261	85.9372	1648338	1761178	2998	929						0					
CHARLEVOIX	45.1397	84.7947	1854121	2970400	8900	1145	-7589	131	77			0					
CHARLEVOIX	45.625	85.5858	1636598	3147499	4800	741	-3985	196	100			0					
CHARLEVOIX	45.6583	85.5203	1652267	3159851	5383	678	-3885	170	110	190	860	0	315	550	2375	0	0
CLINTON	42.05	84.47	2039825	1842883		760				300		0	765	650	3785	175	0
CRAFORD	44.54	84.8	1872157	2751553		1225						0	505	700	6500	540	40
EATON	42.54	84.61	1986397	2021698		858				180	1100	0	580	730	2360	230	0
GENESEE	43.21	83.53	2251863	2268199		827				300		0	985	675	4850	340	90
GLADWIN	43.8839	84.335	2015325	2512124	15859	735			850	600	2410	0					
GRAND TRAVERSE	44.5786	85.7597	1621668	2765639	5778	997						0					

Table 6. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
GRAND TRAVERSE	44.9644	85.5867	1655501	2906428	11200	915	-9995	630	433	350	1630	0					
GRATIOT	43.2703	84.5731	1972781	2288204	17466	762	-11414	1075	294	107	2160	0	750	690	4480	395	0
HILLSDALE	41.87	84.51	2034741	1777196		1082				110		0	500	730	1280	200	0
HURON	43.7172	82.75	2438465	2451290	9071	711	-8311	232	259	160	1130	0	870	710	4800	475	85
INGHAM	42.5311	84.4533	2028779	2018450	7868	939	-6751	470				0					
IONIA	42.95	85.23	1807833	2171318		765				200		0	590	580	2770	400	0
IONIA	42.83	85.14	1835423	2127527		857				150		0	610	580	2630	280	0
JACKSON	42.1789	84.4563	2038839	1889923	6088	997			301	360	840	0					
JACKSON	42.1764	84.7094	1971076	1889010	5935	1018			365			0					
JACKSON	42.29	84.54	2013216	1930466		972				150		0	670	680	1890	270	0
KALAMAZOO	42.2181	85.5508	1742561	1904228	5800	873	-4682	615	420			0					
KALAMAZOO	42.2181	85.5508	1742561	1904228	5835	886				120	810	0	510	495	1405	430	0
KENT	42.8558	85.3519	1778015	2136942	7814	831			304	120	1180	0					
KENT	43.13	85.59	1706731	2237005		936				160		0	530	600	2880	530	0
LEELANAU	45.03	85.69	1626984	2930367		913				325		0	240	580	4270	50	0
LENAWEE	41.7347	83.845	2219952	1727822	3902	715	-3405	254	257			0					
LIVINGSTON	42.57	84.11	2119680	2032646		948						0	850	630	2740	240	110
LIVINGSTON	42.67	83.81	2196681	2069138		968	-6182	70	190	100	580	0	920	640	3760	260	100
MACOMB	42.8439	82.7444	2475256	2132599	5400	739	-4623	25	95			0					
MACOMB	42.7136	83.0169	2407518	2085049	5027	641	-4329	0	125			0					
MACOMB	42.8	82.87	2443436	2116579		690				70		0	910	590	2700	380	70
MANISTEE	44.5	85.92	1582166	2736956		896				325		0		550	4760	720	0
MASON	44.0136	86.4419	1458428	2559455	6617	645	-6813	500	90			0					
MASON	44.0167	86.3083	1493393	2560586	7492	679			85			0					
MASON	43.95	86.3	1497252	2536245		695						0			3540	765	0
MIDLAND	43.507	84.455	1996313	2374583		684				450		0		760	5470	400	50
MISSAUKEE	44.2719	85.8333	1610985	2653716	14713	1232				450	2710	0					
MONROE	41.8658	83.7111	2251758	1775664	3671	683	-2937	264	227			0					

Table 6. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
MONROE	41.9058	83.5517	2293595	1790188	3512	646	-2474	264		100	350	0					
MONROE	41.88	83.6489	2268848	1773547	5495	669						0					
MONROE	42.0306	83.2733	2364463	1835804	3377	597	-2750	165	255			0					
MONROE	41.88	83.57	2289549	1780846		637						0	900	750	1240	0	0
MUSKEGON	43.3833	86.3875	1488267	2329441	6514	644			65	100	950	0					
NEWAYGO	43.665	85.6378	1679111	2432241	10200	1093			139			0					
NEWAYGO	43.35	85.87	1626326	2317289		803				120		0	450	525	2905	690	0
NEWAYGO	43.67	85.98	1588706	2434066		821				180		0	400	510	3340	820	0
OCEANA	43.535	86.4544	1466847	2384801	7240	752	-5426	304	318	90	840	0					
OGEMAW	44.44	84.2	2031538	2715060		1457				120	2030	0	655	775	6840	415	85
OSCEOLA	44.1083	85.5497	1689721	2584013	12810	1213						0					
OTSEGO	44.94	84.53	1928914	2897524		1402						0	400	660	5410	590	0
OTTAWA	43.1175	85.8453	1639121	2232443	7245	891						0					
OTTAWA	42.7961	86.1189	1574492	2115158	5894	623			187	110	800	0					
OTTAWA	42.7988	86.1133	1575927	2116068	5945	604			230	120	640	0	450	400	1705	695	0
OTTAWA	42.7988	86.1133	1575927	2116068	5946	602			230			0					
OTTAWA	42.7811	86.1269	1572479	2113331	5915	603						0					
OTTAWA	42.7853	86.1283	1572251	2111214	6221	619	-5531	1105	195			0					
OTTAWA	42.9844	86.1372	1564808	2183872	5905	617						0					
OTTAWA	42.7833	86.2917	1528564	2110485	4844							0					
OTTAWA	42.7833	86.2917	1528564	2110485	5910	620			117			0					
OTTAWA	42.7833	86.2917	1528564	2110485	5550							0					
PRESQUE ISLE	45.2511	83.7761	2111881	3011052	6738	777	-5772	214	55	40	1022	0	495	615	4110	0	0
PRESQUE ISLE	45.4	84.23	1990171	3085390		795				60	930	0	390	575	3675	0	0
SAINT CLAIR	42.6933	82.6308	2511712	2077841	4550	603	-3848	41	53	0	54	0	895	600	2330	365	
SAINT CLAIR	42.9853	82.8	2454757	2184200	6310	804						0					
SAINT CLAIR	42.9158	82.9783	2409951	2158838	6696	801	-5760	126				0					
SAINT CLAIR	42.7006	82.6589	2503892	2080305	4571	608						0					

Table 6. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
SAINT CLAIR	42.7203	82.7253	2485322	2087494	4634	616	-3983	29	54			0					
SAINT CLAIR	42.6397	82.5261	2533749	2131067	4770	620	-4120	68	74			0					
SAINT CLAIR	42.6886	82.4964	2539668	2148911	4733	637	-4070	33	92			0					
SAINT CLAIR	42.6886	82.4883	2541831	2148911	4702	632	-4053	30				0					
SAINT JOSEPH	41.9567	85.4308	1782302	1808836	5283	892	-4182	606	383	90	760	0					
SANILAC	43.2881	82.7569	2454049	2294700	8512	765	-7534	100	342			0					
SANILAC	43.4558	82.7253	2455622	2355898	8975	785		77		297	740	0	950	700	4430	400	90
SANILAC	43.2	82.72	2467405	2262550		760				140		0	960	650	4010	380	90
SHIAWASSEE	42.81	84.25	2074059	2120228		831				230		0	860	650	3550	300	80
ST. CLAIR	42.62	82.54	2539024	2050892		579	-3561	30	80	0	50	0	900	615	2110	195	0
TUSCOLA	43.55	83.44	2263031	2390274		668				340		0	990	760	6010	420	80
TUSCOLA	43.54	83.19	2329450	2386825		727				270		0	980	750	5400	410	100
WASHTENAW	42.3594	83.7253	2230449	1955792	6330	842	-5388	464	303			0					
WASHTENAW	42.3947	83.6214	2257162	1968674	6410	915	-5459	340	186			0					
WASHTENAW	42.4056	83.59	2265220	1972652	6084	886	-5191	238	259			0					
WASHTENAW	42.3264	83.5497	2278940	1943749	5696	818	-4852	322	173			0					
WASHTENAW	42.2767	83.6097	2210622	1925612	4804	835	-4845	309	143	190	460	0					
WASHTENAW	42.14	83.86	2201820	1875727		659						0	820	650	1930	180	45
WASHTENAW	42.28	83.58	2272451	1926817		788						0	1090	740	2620	220	0
WAYNE	42.485	83.5242	2280034	2001627	5483	899						0					
WAYNE	42.145	83.3656	2335257	1877551	4048	605	-3360	211	247			0					
WAYNE	42.2883	83.1208	2395858	1929846	4308	602	-3672	92	295			0	845	570	2410	0	0
WAYNE	42.2883	83.1208	2395858	1929846	4110	600			282			0					
WAYNE	42.2883	83.1208	2395858	1929846	4112	600	-3505	69	282			0					
WAYNE	42.2883	83.1208	2395858	1929846	4127	601	-3525	80	274			0					
WAYNE	42.37	83.51	2288049	1959860		800				100		0		560	2880	120	0

Table 7. Geologic data for Kentucky, New York, Pennsylvania, West Virginia, and Ontario, Canada. (Reference datum = mean sea level. Layer designations given in figure 4.)

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
KENTUCKY																	
ANDERSON	38.0256	84.8838	2045177	374286	2838	760						0		220	0	0	0
ANDERSON	38.0349	84.9729	2019311	377680	1503	795						0		300	0	0	0
BATH	38.2022	83.8358	2340515	438714	1690	871							829	400		0	
BATH	38.2697	83.8336	2338974	463344	1875	883							796	420		0	
BATH	38.2004	83.8993	2322370	438061	1865	932							720	350		0	
BOONE	38.9979	84.7414	2058072	729103	3215	885					1784	0	644	470	0	0	0
BOONE	39.0652	84.6860	2071801	753632	4089	911	-2810	292	556		1664	0	658	530	0	0	0
BOYD	38.3467	82.6885	2663839	491448	7828	698	-6003	101									
BOYD	38.2972	82.7621	2644611	473374	7828	709	-6903			120	678	94	1305	955	757		
BOYD	38.3467	82.6885	2663831	491450	9595	862	-8624				944	78	1405	970	720		
CAMPBELL	38.9384	84.4346	2146807	707380	2977	695				0	1594	0			0	0	0
CAMPBELL	38.9203	84.4100	2154351	700777	3604	757	-2643	238	534	0	1572	0	714	320	0	0	0
CARTER	38.3277	83.1222	2540519	484516	5085	857	-4183	57	142	0	960	216	879				
CARTER	38.3333	83.2014	2517690	486570	3585	863				0							
CARTER	38.2933	83.1114	2544842	471950	5251	956	-4266	111	484	0	1252						
CARTER	38.3344	83.1575	2530203	486970	5062	985	-4057	44	448	0	1174		878				
CLARK	37.9831	84.1425	2259392	358770	1689	926									0	0	
CLARK	37.9468	84.3019	2214688	345528	1563	931								180	0	0	
CLARK	38.0248	84.1658	2251417	373976	3425	949	-2125	24	366		1818			300	0	0	
ELLIOTT	38.1222	83.0786	2560219	409506	4165	814							904				
ELLIOTT	38.0948	83.1967	2527313	399516	5394	979	-4205	56	361		1274		1037				
FLEMING	38.2830	83.6437	2392868	468198	2132	786				0							
GRANT	38.5675	84.6010	2110574	572040	2010	741						0	763	120	0	0	0
GRANT	38.5510	84.5891	2120143	566010	3557	867			475		1841	0			0	0	0
GREENUP	38.6394	83.0515	2549690	598272	5193	1053	-4125	116	496	131	1100	87	679				
GREENUP	38.6021	83.0671	2546565	584660	3824	1083				0			834				
GREENUP	38.5840	83.0830	2542684	578052	3930	1100				0			838				

Table 7. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
HENRY	38.4052	84.9611	2012434	512802	1754	603						0	728	110	0	0	0
JEFFERSON	38.2192	85.8404	1765868	444919	6011	465	-5479	752	852		2627	0	710	640	215	125	0
JESSAMINE	37.8295	84.5181	2155954	302723	4944	805					2496			170	0	0	0
JESSAMINE	37.8108	84.5746	2140223	295894	5800	956	-2341	290			2251			40	0	0	0
JESSAMINE	37.8190	84.5090	2158900	298868	6072	976	-5040				2438		846	200	0	0	0
LEWIS	38.5450	83.2160	2506154	563814	4190	560	-3628	76	490	0	902	200					
LEWIS	38.6021	83.0848	2541516	584635	3390	662				0			797				
LEWIS	38.4828	83.3965	2456808	541108	2605	734				0			824				
LEWIS	38.5342	83.2983	2482769	559883	3360	879				0			926				
LEWIS	38.3638	83.2728	2496221	497688	4550	903											
LEWIS	38.3638	83.2726	2496280	497682	4550	908	-3627	60		0	874	260	894				
LEWIS	38.5361	83.1305	2530844	560557	5082	1113	-3907	16	350	0	1298		886				
MASON	38.5474	83.6864	2377653	564685	3314	769	-2521	125	435	0	1319		799	570	0	0	
MEADE	37.9590	86.1271	1689517	349957	3380	637						0	765				0
MEADE	37.9313	86.0065	1724848	339847	5350	723						0					0
MONTGOMERY	37.9761	83.9557	2313301	356190	4481	1001	-3439				1918		894	600	0	0	
NICHOLAS	38.3239	83.9131	2314476	483143	1582	692				0				370	0	0	0
NICHOLAS	38.4399	84.0751	2264492	525467	2958	710	-2213	81	400	0	1520	88		280	0	0	0
OWEN	38.5590	84.9795	2002903	568934	2900	467					2062	0	706		0	0	0
OWEN	38.3661	84.8176	2054547	498534	1900	658						0		250	0	0	0
PENDLETON	38.8104	84.3593	2172078	660672	2330	705				0	1287	0		480	0	0	0
ROWAN	38.1975	83.5288	2428625	437001	3802	737	-3047	30	404	0	1374						
ROWAN	38.1915	83.3528	2479242	434827	3721	837				0			864				
ROWAN	38.1715	83.3278	2487085	427502	3353	905				0			968				
ROWAN	38.1654	83.3045	2493971	425297	4991	1199	-3768			0	1335		955				
ROWAN	38.0976	83.3347	2487617	400543	4977	1241	-3726	19	388	0	1391		957				
SHELBY	38.1500	85.1667	1960568	419667	2075	763						0			0	0	0
WOODWARD	38.0112	84.7533	2083069	369026	2812	859						0		200	0	0	0

Table 7. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
NEW YORK																	
CATTARAUGUS	42.05	78.55	3640926	1842883	11683	2295	-8760	195									
ERIE	42.73	78.85	3521429	2091034	4313	583	-3623	84									
NIAGARA	43.1	79	3460454	2226057	3058	582	-2447	126									
PENNSYLVANIA																	
CRAWFORD	41.49	80.272	3203465	1638524	6364	1022				0		115					
CRAWFORD	41.4725	80.244	3211971	1632138	6318	1023				0		75					
CRAWFORD	41.4255	80.1825	3231092	1614986	8030	1337	-6583	150	520	0	160	180	630	2170	1310		
ERIE	42.2	80.1	3214430	1897622	5972	650	-5302	48									
ERIE	42	79.85	3292238	1824637	7465	1474	-5961	55									
MCKEAN	41.8	78.5	3668818	1751652	11878	2240	-9638	183	755								
MERCER	41.1845	80.2735	3217652	1530688	8210	960	-8458	132	636	0	170	158					
WEST VIRGINIA																	
CABELL	38.3126	82.1547	2817735	479004	8552	667	-7838	80	521	121	585	89	1403	1360	1042		
EAYNE	38.1318	82.3205	2777230	413025	14591	622	-13928		1418	131	944	101	2400				
HANCOCK	40.3221	80.3327	3243810	1212325	10377	1052									2163		
KANAWHA	38.4347	81.3421	3044902	523581	17680	940	-16688		1138			195	2912				
MARSHALL	39.4547	80.3149	3290208	895787	16505	1435						72	4284	633	3586		
MASON	38.4249	82.093	2830974	519985	8633	609	-7979	30					1241	1359	1165		
WAYNE	37.5332	82.2337	2824974	194579	7900	688								1626	876		
WOOD	39.045	81.303	3030008	746277	13268	726	-12504	826	957	0	712	99	1992	1989	1644		
WOOD	39.1525	81.1621	3065187	785506	13331	1050	-12225	285	735	0	447	169	2035	2080	3487		
ONTARIO, CANADA																	
ESSEX	41.97	82.942	2456486	1813689	2805	593	-2420	70	110	0	60	0	840	660	1170	0	0
ESSEX	42.01	82.69	2523173	1828288	3347	638	-2610	10	70	0	70	0	800	680	1500	0	0

Table 7. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
ESSEX	42.13	82.5	2569745	1872078	3549	605	-2924	0	45	0	40	0	830	740	1820	0	0
ESSEX	42.08	82.558	2556090	1853831	3490	590	-2750	0	50	0	41	0	820	770	1500	0	0
ESSEX	41.91	82.513	2575137	1791794	3436	570	-2830	50	10	0	128	0	800	840	1480	0	0
KENT	42.23	82	2700564	1808570	4078	583	-3463	0	29	0	82	0	870	930	1885	100	0
KENT	42.35	81.842	2737954	1952362	4206	609	-3586	21	38		60	0	880	960	1700	300	0
KENT	42.48	82.183	2640659	1999802	5928	604	-3216	0	0	0	0	0	820	800	1720	300	0
KENT	42.5	82.335	2598985	2007101	3700	581	-3119	0	0	0	0	0	833	700	1700	300	0
KENT	42.29	82.26	2627921	1930466	3765	579	-3100	0	15	0	19	0	850	800	1800	100	0
MIDDLESEX	42.84	81.408	2832391	2131176	3408	700	-2696	0	0	0	0	0	800	970	1450	0	0
MIDDLESEX	42.72	81.784	2737279	2087385	3755	706	-3046	0	0	0	0	0	890	860	1800	20	0
MIDDLESEX	42.7	81.54	2803478	2080066	3582	678	-2882	0	0	0	25	0	850	970	1525	10	0
ELGIN	42.6	81.375	2852232	2043593	3580	597	-3100	30	25	0	0	0	820	1100	1500	0	0
ELGIN	42.68	81.033	2940124	2072788	3538	702	-3130	30	15	0	0	0	760	1200	1525	0	0
ELGIN	42.71	80.83	2993019	2083735	3484	625	-3120	30	50	0	0	0	750	1260	1375	0	0
NORFOLK	42.68	80.293	3138201	2072788	4270	704	-3071	0	277	0	0	0	690	1480	1080	0	0
NORFOLK	42.42	80.04	3217258	1992504	3925	575	-3640	45	350	0	40	0	700	1700	1180	0	0
NORFOLK	42.32	80.43	3119477	1941414	4270		-4250	110	275	0	150	0	720	1540		0	0
OXFORD	43.21	80.84	2966100	2266199	3786	1142	-1866	0	0	0	0	0	750	1050	1100	0	0
LAMBTON	42.73	82.355	2584040	2091034	4180	620	-3556	0	0	0	0	0	970			200	0
LAMBTON	42.78	82.362	2580081	2109280	4220	630	-3561	0	0	0	0	0	990	630	2270	200	0
LAMBTON	42.79	82.408	2567365	2112930	4307	634	-3670	5	34	0	0	0				250	0
LAMBTON	42.82	82.395	2569583	2123877	4424	647	-3740	25	19	0	0	0				250	0
LAMBTON	42.82	82.44	2557567	2123877	4534	644	-3871	27	68	0	0	0				300	0
LAMBTON	42.88	82.44	2555081	2145773	4849	608	-4241	22	71	0	93	0	950	580	2700	300	0
HURON	43.77	81.7	2712528	2470558	3645	719	-2900	45	0	0	0	0	715	680	2050	50	0
HURON	43.79	81.63	2730024	2477857	3555	786	-2759	30	0	0	0	0	725	690	2000	0	0
BRUCE	44.2	81.59	2721644	2627477	2923	607	-2360	90	0	0	40	0	610	680	1450	0	0
BRANT	43.17	80.32	3106124	2251602	2647	894	-1712	0	0	0	0	0	700	1250	550	0	0

Table 7. continued

County	Latitude	Longitude	Model X (ft)	Model Y (ft)	Total Depth (ft)	Surf. Elev. (ft)	Precambrian Elev. (ft)	Model Layer Thickness (ft)									
								3	4	5	6	7	8	9	10	11	12
BRANT	43.05	80.17	3152133	2207811	2723	708	-1942	0	10	0	0	0	665	1360	515	0	0
WENTWORTH	43.18	79.98	3195864	2255251	2160	561	-1587	0	13	0	0	0	700	1400	0	0	0
WENTWORTH	43.23	80.073	3168576	2273498	2675	820	-1515	0	10	0	0	0	675	1400	200	0	0
WELLAND	42.8	79.11	3448034	2116579	3680	589	-2900	0	250	0	0	0	680	1800	700	0	0
WELLAND	42.83	78.95	3489051	2127527	3470	593	-2680	0	250	0	0	0	710	1790	480	0	0
WELLAND	42.9	79.118	3440311	2153072	3307	613	-2520	0	170	0	0	0	700	1700	500	0	0
WELLAND	43.03	79.3	3384623	2200512	2462	375	-2140	0	100	0	0	0	720	1680	0	0	0
LINCOLN	43.08	79.278	3388237	2218759	2200	297	-1950	0	73	0	0	0	680	1650	0	0	0
LINCOLN	43.09	79.375	3361375	2222408	2313	305	-1960	0	70	0	0	0	670	1550	0	0	0
HALTON	43.375	79.673	3266835	2326412	1630	310	-1300	0	0	0	0	0	830	680	0	0	0

APPENDIX C

FLUID-DENSITY DATA TABLES

Table 8. Formation fluid-density data. (Layer designations given in figure 4.)

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
OHIO	ALLEN	40.7163	84.1279	2176664	1356180	3	2776	1.1
OHIO	ASHTABULA	41.9078	80.7322	3057978	1790991	3	5650	1.2084
OHIO	BUTLER	39.486	84.3563	2152154	907210	3	2892	1.12
OHIO	DELAWARE	40.14	83.0425	2497674	1145872	3	3820	1.15
OHIO	FAYETTE	39.5897	83.5781	2367567	945052	3	3210	1.0874
OHIO	LAKE	41.7458	81.1625	2950105	1733770	3	5886	1.218
OHIO	PUTMAN	41.0957	84.0888	2174943	1494633	3		1.0818
OHIO	PUTNAM	41.0957	84.0888	2174943	1494633	3	3054	1.0942
OHIO	RICHLAND	40.7789	82.5193	2818582	1379024	3	4981	1.206
OHIO	SANDUSKY	41.3713	82.9814	2468691	1595207	3	2850	1.089
OHIO	SCIOTO	38.5921	82.8215	2816889	581001	3	5590	1.225
OHIO	SHELBY	40.3602	84.0871	2199609	1226229	3	3160	1.0798
OHIO	WYANDOT	40.9605	83.4126	2365556	1445295	3	2750	1.0507
OHIO	ASHLAND	41.0171	82.3558	2654108	1465850	4	5045	1.2158
OHIO	DELAWARE	40.3804	82.9921	2502996	1233601	4	3535	1.232
OHIO	MIAMI	40.1798	84.3109	2143152	1160396	4	2905	1.0679
OHIO	MIAMI	40.1798	84.3109	2143152	1160396	4	2905	1.0679
OHIO	SENECA	41.1	83	2473862	1496202	4	3123	1.2119
OHIO	SHELBY	40.35	84.05	2210250	1222507	4	2883	1.0814
OHIO	SHELBY	40.3602	84.0871	2199609	1226229	4	2885	1.0723
OHIO	CUYAHOGA	41.5	81.4	2895316	1642173	5	5820	1.2239
OHIO	CLINTON	39.4	83.61	2365057	875826	6	1976	1.0132
OHIO	DEFIANCE	41.3536	81.6886	2822950	1588748	6	2370	1.047
OHIO	DELAWARE	40.35	82.9	2529707	1222507	6		1.113
OHIO	DELAWARE	40.35	83	2501932	1222507	6	2548	1.0403
OHIO	DELAWARE	40.14	83.0435	2497595	1145872	6	2750	1.05
OHIO	DELAWARE	40.35	82.8	2557481	1222507	6	3610	1.1277
OHIO	FAYETTE	39.498	83.415	2416578	911589	6	1905	1.0169
OHIO	HARDIN	40.55	83.75	2286774	1295492	6	2045	1.016
OHIO	HOLMES	40.6589	81.7711	2830115	1335233	6	6428	1.0169
OHIO	LICKING	40.233	82.715	2585566	1179810	6	3964	1.0785
OHIO	MEDINA	41.13	81.87	2782864	1507150	6	5861	1.2255
OHIO	MIAMI	40.1798	84.3109	2143152	1160396	6	1750	1.0125
OHIO	MIAMI	40.1798	84.3109	2143152	1160396	6	2408	1.0146
OHIO	MIAMI	40.1798	84.3109	2143152	1160396	6	2410	1.0146
OHIO	MORROW	40.6	82.9	2520294	1313739	6	2947	1.0899
OHIO	MORROW	40.3867	82.9006	2528162	1235900	6	2973	1.0938
OHIO	MORROW	40.4614	82.8681	2534918	1263160	6	3041	1.1035
OHIO	MORROW	40.55	82.8	2549672	1295492	6	3388	1.142
OHIO	MORROW	40.38	82.8	2556342	1233455	6	3625	1.1406
OHIO	MORROW	40.38	82.8	2556342	1233455	6	3800	1.1179
OHIO	MORROW	40.4161	82.7567	2566984	1246628	6	3826	1.1457
OHIO	PICKAWAY	39.5689	83.1165	2497979	937462	6	2990	1.098
OHIO	PIKE	39.1713	83.1175	2511978	792367	6		1.055
OHIO	PIKE	39.1111	83.0322	2538254	770398	6	2900	1.1

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
OHIO	PIKE	39	83	2551376	729855	6	3150	1.129
OHIO	PIKE	39.0839	82.9503	2562405	760472	6	3360	1.097
OHIO	PIKE	39.0447	82.8128	2602752	746167	6	3565	1.151
OHIO	PIKE	39.0447	82.8128	2602752	746167	6	4051	1.1659
OHIO	PIKE	39.0447	82.8128	2602752	746167	6	4186	1.1693
OHIO	ROSS	39.4375	82.9528	2548792	889511	6		1.087
OHIO	ROSS	39.4528	82.7875	2594750	895094	6	3410	1.12
OHIO	SCIOTO	38.8186	82.8769	2592870	663657	6	3840	1.178
OHIO	SCIOTO	38.5821	82.8215	2616889	581001	6	4020	1.218
OHIO	SCIOTO	38.5821	82.8215	2616889	581001	6	4460	1.2
OHIO	SHELBY	40.3602	84.0871	2189609	1226229	6	1650	1.0134
OHIO	UNION	40.1214	83.4382	2388271	1139084	6	2089	1.015
OHIO	UNION	40.1778	83.4606	2380049	1159666	6	2089	1.015
OHIO	WOOD	41.5	83.65	2281288	1642173	6	2050	1.038
OHIO	ASHTABULA	41.61	80.78	3059213	1682315	7	6360	1.166
OHIO	COSHOCTON	40.3	81.81	2834500	1204260	7	6140	1.216
OHIO	COSHOCTON	40.29	81.82	2832141	1200611	7	6145	1.228
OHIO	COSHOCTON	40.24	81.85	2825895	1182365	7	6155	1.224
OHIO	COSHOCTON	40.3558	81.8103	2832071	1224623	7	6187	1.2279
OHIO	COSHOCTON	40.3558	81.8103	2832071	1224623	7	6187	1.2281
OHIO	COSHOCTON	40.37	81.81	2831557	1229805	7	6225	1.226
OHIO	COSHOCTON	40.26	81.79	2841741	1189663	7	6490	1.222
OHIO	COSHOCTON	40.31	81.77	2845192	1207910	7	6550	1.227
OHIO	COSHOCTON	40.3472	81.7778	2841456	1221485	7	6567	1.2274
OHIO	COSHOCTON	40.35	81.77	2843504	1222507	7	6620	1.224
OHIO	COSHOCTON	40.3419	81.6392	2880166	1219551	7	6774	1.2147
OHIO	SCIOTO	38.5821	82.8215	2616889	581001	7	4240	1.199
OHIO	ASHTABULA	41.7106	80.7656	3058343	1719027	8	6062	1.2114
OHIO	BUTLER	39.4	84.56	2097424	875826	8	2900	1.11
OHIO	DEFIANCE	41.3536	84.6886	2822950	1588748	8	1855	1.038
OHIO	DELAWARE	40.14	83.0425	2497674	1145672	8	2750	1.05
OHIO	DELAWARE	40.2372	82.9044	2532714	1161343	8	2928	1.0992
OHIO	FAIRFIELD	39.6728	82.8239	2576310	975378	8	3263	1.089
OHIO	MARION	40.65	83.15	2449278	1331985	8	2245	1.025
OHIO	MARION	40.7	83.12	2455729	1350231	8	2245	1.0025
OHIO	MIAMI	40.1798	84.3109	2143152	1160396	8	1750	1.0125
OHIO	MORROW	40.6539	82.76	2556965	1333408	8	3471	1.1354
OHIO	MORROW	40.5433	82.7525	2563282	1293047	8	3570	1.1459
OHIO	PERRY	39.6806	82.0617	2789781	978224	8	6060	1.227
OHIO	PERRY			2789781	978224	8	6080	1.2273
OHIO	PIKE	39.0447	82.8128	2602752	746167	8	3885	1.1813
OHIO	SANDUSKY	41.4407	83.0558	2445727	1620533	8	2150	1.0031
OHIO	SANDUSKY	41.4407	83.0558	2445727	1620533	8	2159	1.004
OHIO	SENECA	41.1581	83.1842	2421127	1517405	8	1482	1.1428
OHIO	WARREN	39.35	84.3	2172233	857579	8	1220	1.0118

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
OHIO	WOOD	41.1836	83.6778	2284434	1530360	8		1.0407
OHIO	WOOD	41.5	83.65	2281288	1642173	8	1821	1.036
OHIO	WYANDOT	40.8184	83.4126	2370647	1393439	8	1894	1.007
OHIO	ASHLAND	40.87	82.29	2878165	1412269	10	1690	1.096
OHIO	ASHLAND	40.84	82.16	2715214	1401321	10	1980	1.175
OHIO	ASHLAND	40.93	82.15	2714271	1434165	10	2000	1.179
OHIO	ASHLAND	40.66	82.25	2897708	1335634	10	2674	1.219
OHIO	ASHTABULA	41.9022	80.7856	3043774	1788947	10		1.184
OHIO	ASHTABULA	41.9	80.55	3107733	1788144	10	1825	1.133
OHIO	ASHTABULA	41.9	80.55	3107733	1788144	10	2737	1.179
OHIO	ASHTABULA	41.9	80.55	3107733	1788144	10	2765	1.1696
OHIO	ASHTABULA	41.7903	80.9744	2997850	1748112	10	2903	1.2117
OHIO	ASHTABULA	41.8092	80.8114	3041208	1755009	10	3019	1.2182
OHIO	ASHTABULA	41.8158	80.74	3060272	1757417	10	3055	1.2082
OHIO	ASHTABULA	41.6706	80.8339	3041670	1704430	10	3124	1.137
OHIO	ASHTABULA	41.65	80.8	3051870	1696912	10	3337	1.195
OHIO	ASHTABULA	41.6294	80.7667	3061911	1689395	10	3524	1.2141
OHIO	ASHTABULA	41.6933	80.7344	3067652	1712714	10	3534	1.204
OHIO	ASHTABULA	41.61	80.78	3059213	1682315	10	3655	1.217
OHIO	ASHTABULA	41.54	80.74	3073438	1658770	10	3845	1.167
OHIO	ATHENS	39.4	82.3	2734001	875826	10	2772	1.234
OHIO	ATHENS	39.4	82.18	2767790	875826	10	2860	1.234
OHIO	ATHENS	39.42	82.2	2761366	883124	10	2880	1.156
OHIO	ATHENS	39.5381	82.1539	2769629	926222	10	3714	1.228
OHIO	ATHENS	39.5411	82.1508	2770380	927317	10	3761	1.2266
OHIO	CARROLL	40.6458	81.2603	2971654	1330452	10	5268	1.196
OHIO	CARROLL	40.6289	81.2458	2976616	1324285	10	5363	1.187
OHIO	CARROLL	40.5881	81.2419	2979516	1309396	10	5470	1.185
OHIO	COLUMBIANA	40.8733	81.0522	3018997	1413473	10	3294	1.242
OHIO	COLUMBIANA	40.8856	81.055	3017664	1417962	10	5223	1.165
OHIO	COLUMBIANA	40.8261	81.0614	3018616	1396249	10	5306	1.182
OHIO	COLUMBIANA	40.86	81.06	3017456	1408620	10	5315	1.187
OHIO	COSHOCTON	40.13	82.19	2735772	1142223	10	2660	1.2
OHIO	COSHOCTON	40.42	81.92	2798941	1248052	10	2840	1.1601
OHIO	COSHOCTON	40.26	82.16	2738867	1189663	10	2950	1.2295
OHIO	COSHOCTON	40.42	82.17	2729596	1248052	10	3000	1.18
OHIO	COSHOCTON	40.45	81.9	2803236	1259000	10	3025	1.1797
OHIO	COSHOCTON	40.4	81.95	2791451	1240753	10	3183	1.1705
OHIO	COSHOCTON	40.4106	82.1631	2731892	1244621	10	3260	1.229
OHIO	COSHOCTON	40.4317	82.1497	2734750	1252321	10	3370	1.232
OHIO	COSHOCTON	40.2089	82.0431	2773466	1171016	10	3558	1.2106
OHIO	COSHOCTON	40.3478	81.7036	2862033	1221704	10	4379	1.217
OHIO	CUYAHOGA	41.48	81.91	2757880	1627576	10	1310	1.162
OHIO	CUYAHOGA	41.46	81.91	2757860	1627576	10	1345	1.169
OHIO	CUYAHOGA	41.38	81.91	2761284	1598382	10	1473	1.128

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
OHIO	CUYAHOGA	41.39	81.7	2818253	1602031	10	1820	1.23
OHIO	CUYAHOGA	41.46	81.91	2757880	1627576	10	2325	1.237
OHIO	CUYAHOGA	41.47	81.71	2812047	1631225	10	2335	1.204
OHIO	CUYAHOGA	41.46	81.91	2757880	1627576	10	2345	1.237
OHIO	CUYAHOGA	41.38	81.91	2761284	1598382	10	2470	1.18
OHIO	CUYAHOGA	41.46	81.91	2757880	1627576	10	2500	1.236
OHIO	CUYAHOGA	41.38	81.91	2761284	1598382	10	2520	1.235
OHIO	CUYAHOGA	41.4	81.7	2817819	1605681	10	2776	1.0682
OHIO	CUYAHOGA	41.39	81.7	2818253	1602031	10	2820	1.239
OHIO	FAIRFIELD	39.7944	82.4556	2674890	1019753	10	2385	1.138
OHIO	GEAUGA	41.508	81.278	2928235	1645093	10	3360	1.23
OHIO	GEAUGA	41.5908	81.0064	2998461	1675309	10	3673	1.2133
OHIO	GEAUGA	41.4669	81.1019	2978157	1630094	10	3882	1.2195
OHIO	GEAUGA	41.3686	81.0117	3007329	1594222	10	3884	1.2238
OHIO	GEAUGA	41.5236	81.0733	2983345	1650788	10	3914	1.2232
OHIO	GUERNSEY	40	81.5	2933581	1094782	10	3776	1.1961
OHIO	GUERNSEY	40.06	81.6	2903115	1116678	10	4060	1.07
OHIO	GUERNSEY	40.09	81.65	2887899	1127626	10	4889	1.085
OHIO	GUERNSEY	40.02	81.6	2904822	1102081	10	4938	1.122
OHIO	GUERNSEY	40.0597	81.6308	2884540	1116568	10	4942	1.167
OHIO	GUERNSEY	40.0617	81.565	2912802	1117298	10	4965	1.172
OHIO	GUERNSEY	40.0928	81.6339	2892267	1128647	10	4974	1.13
OHIO	GUERNSEY	39.8772	81.6002	2910846	1049969	10	5400	1.163
OHIO	GUERNSEY	40.09	81.39	2960360	1127626	10	5700	1.166
OHIO	HOCKING	39.4558	82.4208	2697821	896189	10		1.171
OHIO	HOCKING	39.5	82.25	2744130	912319	10		1.201
OHIO	HOCKING	39.43	82.47	2684973	888774	10	1735	1.181
OHIO	HOCKING	39.38	82.57	2658733	868527	10	1850	1.0549
OHIO	HOCKING	39.38	82.57	2658733	868527	10	2150	1.1892
OHIO	HOCKING	39.566	82.442	2687584	936404	10	2225	1.1865
OHIO	HOCKING	39.56	82.44	2688379	934214	10	2402	1.1956
OHIO	HOCKING	39.5547	82.4661	2681251	932280	10	2410	1.2318
OHIO	HOCKING	39.5683	82.4531	2684376	937243	10	2545	1.132
OHIO	HOCKING	39.4142	82.4686	2685977	881008	10	2640	1.1317
OHIO	HOCKING	39.5652	82.44	2688177	938112	10	2645	1.233
OHIO	HOCKING	39.5272	82.3906	2703536	922245	10	2650	1.222
OHIO	HOCKING	39.565	82.439	2688465	936039	10	2660	1.225
OHIO	HOCKING	39.5652	82.44	2688177	938112	10	2665	1.2347
OHIO	HOCKING	39.5347	82.3622	2711226	924981	10	2780	1.222
OHIO	HOCKING	39.56	82.44	2688379	934214	10	2796	1.2216
OHIO	HOCKING	39.54	82.36	2711637	926916	10	2860	1.218
OHIO	HOCKING	39.4519	82.3664	2713279	894765	10	2925	1.0837
OHIO	HOCKING	39.5726	82.3564	2710521	938885	10	2973	1.2232
OHIO	HOCKING	39.5167	82.3228	2723005	918413	10	3100	1.2297
OHIO	HOLMES	40.61	82.18	2719095	1317388	10	2700	1.178

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
OHIO	HOLMES	40.48	82.08	2752099	1269947	10	2940	1.125
OHIO	HOLMES	40.5078	82.0731	2752869	1280092	10	3273	1.1077
OHIO	HOLMES	40.52	82.1	2744917	1284544	10	3318	1.157
OHIO	HOLMES	40.5894	81.9756	2776488	1309870	10	3435	1.143
OHIO	HOLMES	40.5633	81.9764	2777351	1300346	10	3453	1.123
OHIO	HOLMES	40.49	81.92	2786023	1273587	10	3758	1.198
OHIO	HOLMES	40.4633	81.8264	2823081	1263853	10	3940	1.2153
OHIO	HOLMES	40.4633	81.8264	2823081	1263853	10	3940	1.218
OHIO	HOLMES	40.6569	81.6831	2854520	1334503	10	4144	1.184
OHIO	HURON	41.28	82.66	2560174	1561869	10	1100	1.051
OHIO	JACKSON	38.9881	82.7825	2613422	725512	10		1.1062
OHIO	JACKSON	39.067	82.519	2685062	754305	10	2025	1.1398
OHIO	JACKSON	39.06	82.58	2668067	751750	10	2400	1.115
OHIO	JACKSON	39.067	82.519	2685062	754305	10	2500	1.2217
OHIO	JACKSON	39.067	82.519	2685062	754305	10	2840	1.2009
OHIO	JACKSON	39.066	82.519	2685100	753940	10	2828	1.2011
OHIO	JEFFERSON	40.45	80.82	3102605	1259000	10	4910	1.1995
OHIO	JEFFERSON	40.39	80.65	3152533	1237104	10	5160	1.211
OHIO	KNOX	40.47	82.33	2683212	1266298	10	2195	1.125
OHIO	KNOX	40.45	82.3	2692331	1259000	10	2300	1.125
OHIO	KNOX	40.27	82.24	2716220	1193313	10	2560	1.195
OHIO	KNOX	40.45	82.25	2706195	1259000	10	2590	1.159
OHIO	KNOX	40.4269	82.1883	2724240	1250570	10	2898	1.228
OHIO	KNOX	40.43	82.2	2720869	1251701	10	2966	1.209
OHIO	KNOX	40.3958	82.2275	2714623	1239220	10	3080	1.221
OHIO	KNOX	40.3981	82.2044	2720940	1240060	10	3235	1.228
OHIO	LAKE	41.8211	81.0036	2988482	1759351	10	1631	1.2167
OHIO	LAKE	41.7975	81.1297	2955348	1750739	10	2791	1.2112
OHIO	LAKE	41.7	81.25	2927134	1715159	10	2828	1.2214
OHIO	LAWRENCE	38.59	82.75	2637335	580235	10	2000	1.1897
OHIO	LAWRENCE	38.609	82.648	2665685	587168	10	2250	1.2062
OHIO	LAWRENCE	38.59	82.63	2671519	580235	10	2800	1.16
OHIO	LICKING	39.9914	82.3861	2686606	1091644	10		1.2
OHIO	LICKING	40.0484	82.3861	2684438	1111715	10	2265	1.2225
OHIO	LICKING	39.9972	82.4314	2673731	1093760	10	2384	1.2169
OHIO	LICKING	40.0192	82.4361	2671557	1101789	10	2424	1.2229
OHIO	LICKING	40.14	82.25	2718656	1145872	10	2495	1.1157
OHIO	LICKING	40.1047	82.2792	2711932	1132990	10	2678	1.23
OHIO	LICKING	40.0253	82.2967	2710216	1104015	10	2750	1.229
OHIO	LICKING	40.0264	82.2822	2714218	1104416	10	2800	1.212
OHIO	LICKING	39.9331	82.3253	2705889	1070369	10	2821	1.2313
OHIO	LICKING	40.11	82.3	2705924	1134924	10	2825	1.22
OHIO	LICKING	40.08	82.25	2721059	1123976	10	2842	1.213
OHIO	LICKING	40.2	82.25	2716250	1167768	10	2862	1.221
OHIO	LICKING	39.9472	82.2664	2721785	1075514	10	2842	1.187

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
OHIO	LICKING	40.0931	82.2333	2725169	1128757	10	2945	1.177
OHIO	LICKING	39.9386	82.265	2722518	1072376	10	2947	1.154
OHIO	LICKING	39.9808	82.2047	2737673	1087776	10	3160	1.167
OHIO	LORAIN	41.4	82.1	2708511	1605681	10	1150	1.125
OHIO	LORAIN	41.31	82.09	2715000	1572837	10	1285	1.125
OHIO	LORAIN	41.25	81.98	2747631	1550941	10	1530	1.18
OHIO	LORAIN	41.2	82	2744254	1532695	10	1625	1.18
OHIO	LORAIN	41.5	82.01	2728891	1642173	10	1985	1.0865
OHIO	LORAIN	41.5	82.02	2726162	1642173	10	2127	1.2403
OHIO	LORAIN	41.3	82.11	2709943	1569188	10	2130	1.225
OHIO	LORAIN	41.49	82.03	2723855	1638524	10	2172	1.2181
OHIO	MAHONING	40.9942	80.9603	3038730	1457593	10	5061	1.2431
OHIO	MARION	40.57	83.08	2471595	1302791	10	925	1.0091
OHIO	MEDINA	41.14	81.89	2776952	1510799	10		1.223
OHIO	MEDINA	41.12	82	2747610	1503501	10	1740	1.182
OHIO	MEDINA	41.21	81.9	2771241	1536344	10	1795	1.195
OHIO	MEDINA	41	82.14	2714140	1459710	10	1820	1.159
OHIO	MEDINA	41.16	82.02	2740447	1518098	10	2370	1.2168
OHIO	MEDINA	41.21	81.9	2771241	1536344	10	2695	1.229
OHIO	MEDINA	41.06	81.94	2766607	1481605	10	2865	1.211
OHIO	MEDINA	41.22	81.84	2787259	1539994	10	2870	1.216
OHIO	MEDINA	41.1011	81.7647	2812999	1496604	10	3506	1.1868
OHIO	MORGAN	39.7419	81.6561	2900930	1000594	10	3814	1.1917
OHIO	MORGAN	39.68	81.97	2815520	978005	10	4200	1.209
OHIO	MORGAN	39.6542	81.9597	2819483	968590	10	4236	1.22
OHIO	MORGAN	39.7439	81.8817	2837647	1001324	10	4544	1.2232
OHIO	MORGAN	39.6444	81.865	2846432	965014	10	4720	1.2059
OHIO	MORGAN	39.5675	81.8614	2850611	936851	10	4819	1.2335
OHIO	MORGAN	39.6175	81.7828	2867804	955197	10	5075	1.2121
OHIO	MORGAN	39.6175	81.7828	2867804	955197	10	5075	1.2136
OHIO	MORGAN	39.74	81.84	2905521	999901	10	5364	1.122
OHIO	MORROW	40.55	82.68	2583100	1295492	10		1.082
OHIO	MORROW	40.36	82.84	2545994	1226156	10	913	1.0576
OHIO	MORROW	40.46	82.65	2594891	1262649	10	1605	1.062
OHIO	MUSKINGUM	40.12	82.15	2747321	1138573	10	2500	1.179
OHIO	MUSKINGUM	39.98	82.19	2741809	1087484	10	2895	1.2
OHIO	MUSKINGUM	40.1036	82.1775	2740320	1132589	10	2834	1.0553
OHIO	MUSKINGUM	39.98	81.98	2800441	1087484	10	3146	1.082
OHIO	MUSKINGUM	39.8483	82.1639	2754395	1039423	10	3314	1.1867
OHIO	MUSKINGUM	40.0294	82.1056	2763371	1105511	10	3363	1.2329
OHIO	MUSKINGUM	39.75	81.99	2807057	1003550	10	3390	1.23
OHIO	MUSKINGUM	39.9014	82.1228	2763749	1058800	10	3450	1.2302
OHIO	MUSKINGUM	39.9014	82.1228	2763749	1058800	10	3450	1.2287
OHIO	MUSKINGUM	39.95	81.91	2821224	1076536	10	3462	1.212
OHIO	MUSKINGUM	39.9814	82.0439	2782543	1087995	10	3641	1.143

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
OHIO	MUSKINGUM	39.95	81.92	2818431	1076536	10	4000	1.137
OHIO	MUSKINGUM	39.9475	81.9086	2821718	1075624	10	4030	1.151
OHIO	MUSKINGUM	39.9472	81.9208	2818323	1075514	10	4060	1.144
OHIO	MUSKINGUM	39.9467	81.9158	2819740	1075332	10	4070	1.185
OHIO	MUSKINGUM	40.1411	81.88	2821670	1146273	10	4129	1.203
OHIO	MUSKINGUM	39.8217	81.8556	2841739	1029716	10	4293	1.2174
OHIO	MUSKINGUM	40.0619	81.7808	2852622	1117371	10	4370	1.172
OHIO	MUSKINGUM	40.0808	81.7356	2864429	1124268	10	4580	1.174
OHIO	MUSKINGUM	40.0808	81.7275	2866687	1124268	10	4600	1.172
OHIO	MUSKINGUM	40.0411	81.7553	2860607	1109781	10	4636	1.187
OHIO	MUSKINGUM	40.0689	81.7228	2868499	1119926	10	4690	1.114
OHIO	MUSKINGUM	39.8136	81.7542	2870452	1026760	10	4710	1.1042
OHIO	MUSKINGUM	39.8606	81.7111	2880538	1043911	10	4906	1.0911
OHIO	NOBLE	39.8	81.6	2914181	1021797	10		1.161
OHIO	NOBLE	39.6525	81.5183	2943348	967970	10	4301	1.1861
OHIO	NOBLE	39.71	81.57	2926405	988953	10	5161	1.162
OHIO	NOBLE	39.8	81.51	2939371	1021797	10	5287	1.174
OHIO	NOBLE	39.8003	81.6417	2902497	1021906	10	5360	1.136
OHIO	NOBLE	39.83	81.57	2921300	1032745	10	5370	1.178
OHIO	NOBLE	39.75	81.62	2910700	1003550	10	5432	1.182
OHIO	NOBLE	39.81	81.55	2927749	1025446	10	5488	1.099
OHIO	NOBLE	39.6456	81.555	2933348	965452	10	5757	1.1957
OHIO	PERRY	39.8464	82.3397	2705290	1038729	10		1.2118
OHIO	PERRY	39.9	82.44	2675134	1058289	10	2415	1.1881
OHIO	PERRY	39.9	82.44	2675134	1058289	10	2485	1.191
OHIO	PERRY	39.85	82.16	2755418	1040043	10	2628	1.224
OHIO	PERRY	39.77	82.23	2739028	1010849	10	2820	1.225
OHIO	PERRY	39.82	82.3	2717442	1029095	10	2889	1.222
OHIO	PERRY	39.6292	82.3753	2703849	959467	10	2906	1.1758
OHIO	PERRY	39.8	82.35	2704236	1021797	10	2955	1.2327
OHIO	PERRY	39.8886	82.2636	2724901	1054129	10	2996	1.221
OHIO	PERRY	39.6378	82.2639	2729161	962605	10	3160	1.229
OHIO	PERRY	39.6503	82.2478	2736796	967167	10	3186	1.2323
OHIO	PERRY	39.6275	82.2886	2728249	958847	10	3240	1.151
OHIO	PERRY	39.7597	82.1542	2760669	1007090	10	3489	1.2283
OHIO	PERRY	39.6778	82.1258	2771919	977203	10	3570	1.1815
OHIO	PERRY	39.6469	82.1478	2766988	965926	10	3679	1.129
OHIO	PERRY	39.7028	82.0611	2789051	986326	10	3802	1.2344
OHIO	PIKE	39.145	82.99	2548959	782769	10	552	1.01
OHIO	PORTAGE	41.2664	81.2575	2944766	1556926	10	4118	1.2313
OHIO	PORTAGE	41.03	81.07	3006937	1470657	10	4280	1.185
OHIO	PORTAGE	41.2339	81.1239	2982827	1545066	10	4364	1.2348
OHIO	PORTAGE	41.0833	81.1653	2978335	1490108	10	4623	1.2145
OHIO	RICHLAND	40.74	82.4	2653054	1364828	10	2005	1.115
OHIO	RICHLAND	40.59	82.39	2661803	1310089	10	2285	1.198

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
OHIO	SCIOTO	38.592	82.82	2617320	580984	10	1500	1.1817
OHIO	SCIOTO	38.5821	82.8215	2616889	581001	10	1535	1.17
OHIO	SCIOTO	38.5821	82.8215	2616889	581001	10	1775	1.193
OHIO	SCIOTO	38.5821	82.8215	2616889	581001	10	1805	1.2
OHIO	SCIOTO	38.8	82.75	2629593	656869	10	1900	1.1967
OHIO	STARK	40.743	81.33	2948279	1365923	10	3077	1.1712
OHIO	STARK	40.873	81.34	2935293	1449857	10	3550	1.185
OHIO	STARK	40.84	81.47	2905388	1401321	10	3770	1.229
OHIO	STARK	40.87	81.37	2931615	1412269	10	4303	1.15
OHIO	STARK	40.8933	81.2783	2955831	1420772	10	4778	1.2375
OHIO	STARK	40.7675	81.3047	2954171	1374864	10	4810	1.23
OHIO	STARK	40.7922	81.2656	2958338	1383878	10	4860	1.26
OHIO	STARK	40.7897	81.2881	2957760	1382985	10	4884	1.209
OHIO	STARK	40.66	81.3	2960251	1335634	10	5012	1.207
OHIO	STARK	40.7342	81.27	2965230	1362712	10	5020	1.21
OHIO	SUMMIT	41.12	81.68	2835432	1503501	10	2135	1.175
OHIO	SUMMIT	41.32	81.51	2873270	1576486	10	2470	1.1511
OHIO	SUMMIT	41.04	81.62	2855377	1474307	10	3270	1.197
OHIO	SUMMIT	41.32	81.51	2873270	1576486	10	3380	1.1892
OHIO	SUMMIT	41.1878	81.4492	2895767	1528243	10	3388	1.0278
OHIO	SUMMIT	40.9	81.54	2883478	1423217	10	3640	1.185
OHIO	SUMMIT	41.2556	81.3936	2907886	1552985	10	3863	1.2204
OHIO	TRUMBULL	41.4172	80.8492	3049457	1611957	10	3949	1.2252
OHIO	TUSCARAWAS	40.63	81.34	2950526	1324686	10	4248	1.23
OHIO	TUSCARAWAS	40.55	81.37	2945781	1295492	10	4522	1.235
OHIO	TUSCARAWAS	40.33	81.4	2947102	1215208	10	4725	1.124
OHIO	TUSCARAWAS	40.3908	81.5681	2898356	1237396	10	4878	1.163
OHIO	TUSCARAWAS	40.295	81.4681	2929711	1202436	10	5130	1.133
OHIO	TUSCARAWAS	40.25	81.5	2922795	1186014	10	5210	1.155
OHIO	TUSCARAWAS	40.2944	81.4583	2932460	1202217	10	5288	1.141
OHIO	VINTON	40.37	82.45	2653895	1229805	10		1.167
OHIO	VINTON	39.14	82.54	2676343	760945	10	2260	1.21
OHIO	VINTON	39.28	82.47	2690752	832034	10	2385	1.191
OHIO	WAYNE	40.85	82.1	2731340	1404970	10		1.178
OHIO	WAYNE	40.84	82.09	2734509	1401321	10	2140	1.179
OHIO	WAYNE	40.92	81.79	2813789	1430515	10	2272	1.164
OHIO	WAYNE	40.06	81.74	2864079	1116678	10	2574	1.202
OHIO	WAYNE	40.6719	82.0058	2764709	1339977	10	3203	1.136
OHIO	WAYNE	40.7911	81.8703	2797129	1383476	10	3483	1.2215
OHIO	WOOD	41.35	83.65	2286569	1587434	10	230	1.117
OHIO	MONROE	39.8	81.3047	2996830	1021797	11	1708	1.0794
OHIO	MONROE	39.7336	81.2372	3018635	997566	11	2034	1.0762
OHIO	MONROE	39.7583	81.2236	3021360	1006579	11	2254	1.0391
OHIO	MONROE	39.7519	81.2069	3026318	1004244	11	2754	1.0353
OHIO	ATHENS	39.1914	82.0042	2825709	799702	12	1635	1.1044

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
OHIO	ATHENS	39.3869	81.9389	2837022	863747	12	1656	1.1056
OHIO	BELMONT	39.98	81.15	3032137	1087484	12	1735	1.09
OHIO	GALLIA	38.995	82.1872	2778944	728030	12	1450	1.0951
OHIO	HARRISON	40.2619	81.1681	3014539	1190357	12	1400	1.0946
OHIO	LICKING	40.1375	82.2411	2721235	1144960	12	721	1.0353
OHIO	LICKING	40.122	82.24	2722163	1139303	12	735	1.044
OHIO	LICKING	40.0094	82.3406	2698596	1098213	12	700	1.0444
OHIO	LICKING	40.1194	82.3094	2702930	1138355	12	800	1.0357
OHIO	MAHONING	40.95	80.65	3126120	1441463	12	610	1.064
OHIO	MEDINA	41.08	82.04	2738301	1488804	12	460	1.063
OHIO	MEIGS	39.0167	82.075	2812687	735949	12	1490	1.1015
OHIO	MEIGS	39.0742	82.0981	2803861	756832	12	1496	1.0999
OHIO	MEIGS	39.0244	82.0836	2809946	738759	12	1501	1.1002
OHIO	MEIGS	39.0719	82.1342	2783740	756093	12	1556	1.0983
OHIO	MEIGS	39.1397	82.0133	2825218	780835	12	1608	1.103
OHIO	MEIGS	39	81.95	2848749	729855	12	1616	1.115
OHIO	MEIGS	39.1019	81.9131	2855069	767041	12	3235	1.1569
OHIO	MEIGS	39.0886	81.8483	2873934	762187	12	3240	1.1658
OHIO	MONROE	39.7819	81.1583	3038602	1015192	12	2090	1.0852
OHIO	MONROE	39.76	81.05	3069895	1007200	12	2150	1.06
OHIO	MONROE	39.74	81.2167	3024097	999901	12	2281	1.0709
OHIO	MONROE	39.7611	81.2231	3021377	1007601	12	3056	1.0938
OHIO	MORGAN	39.7542	81.8619	2842768	1005083	12	1364	1.0994
OHIO	MORGAN	39.7297	81.9525	2818394	998142	12	1373	1.0954
OHIO	MORGAN	39.65	81.89	2839188	967058	12	1422	1.1
OHIO	MORGAN	39.645	81.9028	2835802	965233	12	1516	1.0984
OHIO	MORGAN	39.6167	81.9669	2818973	954906	12	1539	1.0967
OHIO	MORGAN	39.61	81.96	2821183	952461	12	1560	1.094
OHIO	MORGAN	39.5889	81.6233	2916580	944761	12	1756	1.1068
OHIO	MUSKINGUM	39.7697	81.9822	2808438	1010739	12	1286	1.0917
OHIO	MUSKINGUM	39.6522	81.8225	2849733	1040846	12	1307	1.0981
OHIO	MUSKINGUM	39.9264	81.8058	2851312	1067924	12	1310	1.1049
OHIO	MUSKINGUM	39.8175	81.8025	2856772	1028183	12	1502	1.1043
OHIO	MUSKINGUM	39.7711	81.8356	2849434	1011250	12	1530	1.1009
OHIO	SCIOTO	38.82	82.97	2566382	664168	12	264	1.078
OHIO	SCIOTO	38.5821	82.8215	2616889	581001	12	710	1.095
OHIO	STARK	40.743	81.33	2948279	1365823	12	820	1.059
OHIO	TUSCARAWAS	40.3247	81.4675	2928588	1213274	12	710	1.0837
OHIO	TUSCARAWAS	40.51	81.43	2930906	1280895	12	672	1.0732
OHIO	VINTON	39.2161	82.3072	2739172	808716	12	1323	1.0869
OHIO	WASHINGTON	39.5839	81.6456	2910529	942936	12	1561	1.1053
OHIO	MEIGS	39.16	82.06	2805557	788243	13	450	1.08
OHIO	MEIGS	39.03	82.03	2824895	740803	13	1050	1.0713
OHIO	MEIGS	39.03	82.03	2824895	740803	13	1050	1.075
OHIO	MONROE	39.7728	81.2228	3020946	1011671	13		1.0208

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
OHIO	MONROE	39.79	81.17	3034969	1018147	13	805	1.044
OHIO	MONROE	39.77	81.14	3044252	1010849	13	1302	1.043
OHIO	MONROE	39.81	81.1	3053671	1025446	13	1345	1.056
OHIO	MONROE	39.84	81.05	3068320	1036394	13	1440	1.102
OHIO	MONROE	39.7644	81.2689	3008407	1008805	13	1542	1.083
OHIO	MONROE	39.7283	80.9719	3093189	995631	13	1590	1.0823
OHIO	SCIOTO	38.5921	82.8215	2616869	581001	13	210	1.035
OHIO	WASHINGTON	39.45	81.7	2900850	894072	13		1.069
OHIO	WASHINGTON	39.4	81.68	2914197	875828	13	836	1.058
OHIO	WASHINGTON	39.3	81.68	2912738	839333	13	1300	1.049
OHIO	WASHINGTON	39.5	81.25	3025260	912319	13	1400	1.092
ILLINOIS	17 21N 7E	40.2746	88.432	993347	1194991	3	3942	1.059
ILLINOIS	1 20N 4E	40.2141	88.6999	919593	1172913	3	4570	1.074
ILLINOIS	4 16N 8E	39.8689	88.1867	1067973	1046940	3	3995	1.061
ILLINOIS	9 39N 9E	41.88	88.2	1032394	1780848	3	2200	1
ILLINOIS	30 16N 1E	41.3423	90.4188	433210	1582624	3	2636	1.004
ILLINOIS	26 27N 13W	40.7777	87.8709	1140834	1378586	3	3400	1.061
ILLINOIS	32 30N 10E	41.0351	88.1046	1072188	1472519	3	2439	1.013
ILLINOIS	3 30N 9E	41.1057	88.1814	1049924	1498282	3	2204	1.004
ILLINOIS	24 30N 3E	41.0517	88.9408	841843	1478576	3	2508	1.011
ILLINOIS	32 35N 1E	41.4617	89.1364	783090	1628197	3	1421	1
ILLINOIS	33 28N 6E	40.853	88.5372	955766	1406065	3	3008	1.034
ILLINOIS	27 3N 6W	41.67	89.3	735979	1704211	3	4940	1.07
ILLINOIS	6 1N 2E	38.5545	89.0195	850535	587280	3	8892	1.165
ILLINOIS	20 25N 4E	40.6105	88.774	893866	1317570	3	3857	1.051
ILLINOIS	15 13N 8W	39.57	89.95	576659	937883	3	4100	1.035
ILLINOIS	3 32N 2W	41.2715	89.328	732838	1558787	3	3109	1.041
ILLINOIS	6 6S 7E	38.0311	88.4751	1013153	376277	4	11793	1.128
ILLINOIS	35 1S 10W	38.4052	90.1731	522431	512796	4	2750	1.013
INDIANA		41.465	85.8317	1686439	1629401	3	3500	1.0899
INDIANA		39.2606	87.0928	1386381	824955	3	6670	1.132
INDIANA		39.2606	87.0928	1386381	824955	3	6681	1.13
INDIANA	9 16N 9W	39.8258	87.405	1287665	1031212	3	5755	1.148
INDIANA	14 37N 9W	41.6151	87.3967	1255761	1684176	3	2591	1.016
INDIANA	14 37N 9W	41.6151	87.3967	1255761	1684176	3	3877	1.09
INDIANA	29 37N 6W	41.5864	87.3403	1271708	1673703	3	2453	1.01
INDIANA	29 37N 6W	41.5864	87.3403	1271708	1673703	3	2480	1.007
INDIANA	29 37N 6W	41.5864	87.3403	1271708	1673703	3	3298	1.071
INDIANA	29 37N 6W	41.5864	87.3403	1271708	1673703	3	3325	1.076
INDIANA	29 37N 6W	41.5864	87.3403	1271708	1673703	3	3344	1.068
INDIANA	29 37N 6W	41.5864	87.3403	1271708	1673703	3	3344	1.068
INDIANA	29 37N 6W	41.5864	87.3403	1271708	1673703	3	3776	1.092
INDIANA	29 37N 6W	41.5864	87.3403	1271708	1673703	3	3803	1.096

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
INDIANA	14 28N 1W	40.8767	86.5017	1516890	1414714	3	2920	1.062
INDIANA	14 37N 9W	41.6594	87.43	1245822	1700343	3	4265	1.08
INDIANA	17 28N 1W	40.8803	86.5458	1504845	1416028	3	2920	1.062
INDIANA	20 29N 1E	40.9417	86.4422	1531792	1438434	3	2784	1.065
INDIANA	21 34N 3E	41.3742	86.1869	1591588	1596265	3	2968	1.1
INDIANA	22 28N 1W	40.895	86.4825	1521764	1421392	3	2904	1.064
INDIANA	25 37N 7W	41.6286	87.1711	1317012	1689103	3	2160	1.04
INDIANA	25 37N 7W	41.6286	87.1711	1317012	1689103	3	3449	1.08
INDIANA	28 37N 6W	41.6344	87.1214	1330444	1691220	3	2234	1.048
INDIANA	28 37N 6W	41.6344	87.1214	1330444	1691220	3	3500	1.09
INDIANA	30 29N 1E	40.9242	86.4569	1528147	1432048	3	2769	1.045
INDIANA	14 37N 9W	41.6151	87.3967	1255761	1684176	4	1680	1.002
INDIANA	14 37N 9W	41.6151	87.3967	1255761	1684176	4	2238	1.011
INDIANA	29 37N 8W	41.5864	87.3403	1271708	1673703	4	1815	1.003
INDIANA	29 37N 8W	41.5864	87.3403	1271708	1673703	4	2100	1.002
INDIANA	14 37N 9W	41.6594	87.4306	1245858	1700343	4	2202	1.001
INDIANA	29 37N 8W	41.6242	87.3672	1263628	1687497	4	2090	1.002
INDIANA	15 37N 9W	41.6151	87.4155	1250633	1684176	6	1688	1.002
INDIANA	29 37N 8W	41.5864	87.3403	1271708	1673703	6	1788	1.004
INDIANA	7 30N 13E	41.0282	85.1159	1894676	1470001	8		1.04
INDIANA	13 28N 6E	40.8421	85.8081	1709060	1402088	8	1052	1.01
INDIANA	14 29N 14E	40.928	84.9297	1948855	1433435	8	1360	1.065
INDIANA	14 29N 14E	40.928	84.9297	1948855	1433435	8	1395	1.021
INDIANA	15 27N 4E	40.7562	86.0673	1639666	1370740	8	687	1.012
INDIANA	22 4N 8E	38.7665	85.6475	1807148	644644	8	1495	1.006
INDIANA	1 23N 3E	40.4413	86.1431	1626372	1255825	10	40	1.01
INDIANA	3 15N 9W	39.7542	87.3868	1294110	1005083	10	1232	1.002
INDIANA	7 4N 7E	38.7952	85.8093	1760428	655118	10	100	1.019
INDIANA	8 11N 7W	39.3964	87.2007	1353273	874512	10	1566	1.001
INDIANA	10 11N 9W	39.3964	87.3823	1302078	874512	10	1685	1
INDIANA	12 4N 6E	38.7952	85.8273	1755312	655118	10	105	1.024
INDIANA	15 7N 6W	39.0385	87.0527	1402127	743905	10	1745	1.015
INDIANA	15 12N 7W	39.4679	87.1644	1362107	900604	10	1376	1.001
INDIANA	20 10N 8W	39.2818	87.3096	1324744	832691	10	1898	1.002
INDIANA	20 36N 1W	41.5149	86.5497	1489056	1647611	10	278	1.008
INDIANA	20 36N 1W	41.5149	86.5497	1489056	1647611	10	281	1.005
INDIANA	20 36N 1W	41.5149	86.5497	1489056	1647611	10	282	1.013
INDIANA	22 7N 6W	39.0242	87.0527	1402411	738686	10	1747	1.01
INDIANA	28 8N 5W	39.0958	86.9623	1426582	764815	10	1520	1.007
INDIANA	33 12N 10W	39.425	87.5093	1265755	884949	10		1.007
INDIANA	34 4N 2E	38.7379	86.2947	1623748	634207	10	635	1
INDIANA	36 12N 9W	39.425	87.346	1311773	884949	10	1657	1.003
INDIANA	1 2S 6W	38.3801	87.0139	1426200	503636	13	755	1.042
INDIANA	1 2S 6W	38.3801	87.0139	1426200	503636	13	1454	1.051
INDIANA	1 2S 10W	38.3801	87.4454	1302802	503636	13		1.04

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
INDIANA	1 7S 14W	37.9506	87.8702	1188295	346900	13		1.058
INDIANA	2 2N 11W	38.6377	87.5712	1262300	597642	13	1662	1.047
INDIANA	2 4N 7W	38.8095	87.1397	1381931	660336	13		1.025
INDIANA	2 4S 14W	38.2083	87.8948	1177062	440942	13	2245	1.055
INDIANA	2 5S 6W	38.1224	87.0292	1426877	409595	13	1209	1.046
INDIANA	2 5S 10W	38.1224	87.4587	1303614	409595	13	2240	1.008
INDIANA	3 2N 11W	38.6377	87.5892	1257170	597642	13	1229	1.015
INDIANA	3 6S 12W	38.0365	87.6913	1238311	378247	13	2616	1.08
INDIANA	4 1S 9W	38.4659	87.3914	1316679	534947	13	1625	1.028
INDIANA	4 2N 5W	38.6377	86.96	1436463	597642	13	580	1.012
INDIANA	4 2S 7W	38.3801	87.1757	1379930	503636	13	1289	1.031
INDIANA	4 2S 10W	38.3801	87.4993	1287387	503636	13	1695	1.04
INDIANA	4 2S 10W	38.3801	87.4993	1287387	503636	13	1806	1.044
INDIANA	4 2S 10W	38.3801	87.4993	1287387	503636	13	1819	1.046
INDIANA	4 3S 9W	38.2942	87.3914	1318809	472289	13	1565	1.042
INDIANA	4 7S 6W	37.9506	87.065	1419931	346900	13	1489	1.014
INDIANA	5 6S 3W	38.0365	86.7608	1505670	378247	13	582	1.014
INDIANA	5 6S 12W	38.0365	87.7271	1228024	378247	13	2405	1.064
INDIANA	5 7S 6W	37.9506	87.0829	1414782	346900	13	1441	1.02
INDIANA	5 7S 14W	37.9506	87.9418	1167697	346900	13	2100	1.091
INDIANA	5 8S 14W	37.8647	87.9418	1169081	315553	13	2840	1.067
INDIANA	6 4S 13W	38.2083	87.8589	1187353	440942	13	1800	1.046
INDIANA	6 4S 13W	38.2083	87.8589	1187353	440942	13	2932	1.069
INDIANA	6 7S 7W	37.9506	87.2081	1378767	346900	13	1041	1.019
INDIANA	7 1S 9W	38.4516	87.4274	1306855	529729	13	1110	1.026
INDIANA	7 6S 12W	38.0222	87.745	1223119	373029	13	1126	1.019
INDIANA	7 6S 12W	38.0222	87.745	1223119	373029	13	1154	1.018
INDIANA	7 6S 12W	38.0222	87.745	1223119	373029	13	1182	1.018
INDIANA	8 1S 8W	38.4516	87.3016	1342596	529729	13	1159	1.026
INDIANA	8 1S 8W	38.4516	87.3016	1342596	529729	13	1555	1.046
INDIANA	8 2S 11W	38.3657	87.6252	1251631	498381	13	846	1.017
INDIANA	8 3S 7W	38.2799	87.1837	1376685	467071	13	1125	1.023
INDIANA	8 3S 11W	38.2799	87.6252	1253113	467071	13	2098	1.05
INDIANA	8 3S 13W	38.2799	87.8409	1191339	467071	13	1795	1.086
INDIANA	8 8S 6W	37.8504	87.0829	1416710	310334	13	975	1.021
INDIANA	9 3S 8W	38.2799	87.2836	1350941	467071	13	1365	1.033
INDIANA	9 3S 11W	38.2799	87.6072	1258268	467071	13	2375	1.065
INDIANA	9 5S 4W	38.1081	86.8503	1476507	404376	13	642	1.022
INDIANA	9 6S 7W	38.0222	87.1724	1387681	373029	13	1120	1.022
INDIANA	9 7S 6W	37.9363	87.065	1420208	341682	13	820	1.016
INDIANA	9 7S 6W	37.9363	87.065	1420208	341682	13	1360	1.042
INDIANA	9 7S 11W	37.9363	87.6018	1265756	341682	13		1.023
INDIANA	9 7S 11W	37.9363	87.6018	1265756	341682	13	1647	1.03
INDIANA	9 11N 9W	39.3984	87.4004	1296975	674512	13	1433	1.053
INDIANA	10 2N 11W	38.6234	87.5892	1257421	592423	13	1720	1.047

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
INDIANA	10 4S 4W	38.194	86.8341	1481411	435723	13	315	1.009
INDIANA	10 6S 11W	38.0222	87.5839	1269420	373029	13	1020	1.006
INDIANA	10 6S 13W	38.0222	87.7987	1207686	373029	13	2830	1.066
INDIANA	11 1S 9W	38.4516	87.3555	1327197	529729	13		1.048
INDIANA	11 2S 11W	38.3657	87.5712	1267077	498381	13	1863	1.048
INDIANA	11 3S 10W	38.2799	87.4634	1299450	467071	13	1983	1.056
INDIANA	11 3S 12W	38.2799	87.6791	1237677	467071	13	2542	1.066
INDIANA	11 4S 14W	38.194	87.8949	1177264	435723	13	2749	1.076
INDIANA	11 4S 14W	38.194	87.8949	1177264	435723	13	2880	1.088
INDIANA	11 5S 6W	38.1081	87.0292	1427156	404376	13	1043	1.033
INDIANA	11 5S 6W	38.1081	87.0292	1427156	404376	13	1308	1.047
INDIANA	11 5S 13W	38.1081	87.7807	1211435	404376	13	2901	1.088
INDIANA	11 8N 11W	39.1387	87.5766	1251868	780470	13	625	1.03
INDIANA	12 2S 12W	38.3657	87.6611	1241362	498381	13	2672	1.025
INDIANA	12 2S 13W	38.3657	87.769	1210497	498381	13	1084	1.027
INDIANA	12 2S 13W	38.3657	87.769	1210497	498381	13	1864	1.013
INDIANA	12 3S 14W	38.2799	87.8769	1181029	467071	13	2137	1.05
INDIANA	12 3S 14W	38.2799	87.8769	1181029	467071	13	2771	1.078
INDIANA	12 4S 10W	38.194	87.4454	1306148	435723	13	2090	1.064
INDIANA	12 8S 14W	37.8504	87.8702	1189915	310334	13		1.023
INDIANA	13 1S 12W	38.4373	87.6611	1240132	524510	13	1817	1.028
INDIANA	13 2N 6W	38.6091	87.0139	1421672	587205	13		1.022
INDIANA	13 2S 5W	38.3514	86.906	1457633	493163	13	791	1.021
INDIANA	13 3S 14W	38.2655	87.8769	1181263	461816	13		1.062
INDIANA	13 3S 14W	38.2655	87.8769	1181263	461816	13		1.088
INDIANA	13 5N 10W	38.8667	87.4501	1292654	681210	13	1495	1.045
INDIANA	13 6S 7W	38.0079	87.1187	1403387	367810	13	922	1.018
INDIANA	13 8N 11W	39.1244	87.5585	1257275	775252	13	1745	1.027
INDIANA	14 1S 9W	38.4373	87.3555	1327460	524510	13	1372	1.04
INDIANA	14 3S 14W	38.2655	87.8949	1176107	461816	13		1.072
INDIANA	14 5S 4W	38.0938	86.8145	1489074	399158	13	716	1.015
INDIANA	14 5S 12W	38.0938	87.6734	1242481	399158	13	1160	1.027
INDIANA	14 6S 4W	38.0079	86.8145	1490824	367810	13	554	1.024
INDIANA	14 7S 12W	37.9	87.72	1232354	328435	13	1792	1.036
INDIANA	15 1N 7W	38.5232	87.1577	1382332	555857	13	1535	1.045
INDIANA	15 1N 9W	38.5232	87.3735	1320741	555857	13	1638	1.05
INDIANA	15 1N 10W	38.5232	87.4813	1289973	555857	13	2378	1.058
INDIANA	15 1N 10W	38.5232	87.4813	1289973	555857	13	2421	1.063
INDIANA	15 1S 10W	38.4373	87.4813	1291512	524510	13	1417	1.034
INDIANA	15 1S 10W	38.4373	87.4813	1291512	524510	13	1590	1.032
INDIANA	15 1S 10W	38.4373	87.4813	1291512	524510	13	1744	1.047
INDIANA	15 1S 12W	38.4373	87.6971	1229845	524510	13	1670	1.03
INDIANA	15 2N 2W	38.6091	86.6184	1534408	587205	13	1530	1.048
INDIANA	15 2N 9W	38.6091	87.3735	1319163	587205	13	1270	1.036
INDIANA	15 2N 9W	38.6091	87.3735	1319163	587205	13	1495	1.014

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
INDIANA	15 3N 7W	38.695	87.1577	1378025	618552	13	500	1.01
INDIANA	15 3N 8W	38.695	87.2656	1348303	618552	13	1396	1.033
INDIANA	15 3S 9W	38.2655	87.3735	1325458	461816	13	1514	1.037
INDIANA	15 4S 10W	38.1797	87.4813	1296109	430505	13	1602	1.034
INDIANA	15 4S 10W	38.1797	87.4813	1296109	430505	13	1800	1.045
INDIANA	15 6S 4W	38.0079	86.8324	1485679	367810	13	475	1.017
INDIANA	15 6S 14W	38.0079	87.906	1177076	367810	13	2885	1.095
INDIANA	15 7S 14W	37.922	87.906	1178455	336463	13	2668	1.081
INDIANA	16 1N 9W	38.5232	87.3914	1315632	555857	13	1000	1.026
INDIANA	16 1S 8W	38.4373	87.2636	1348006	524510	13	1378	1.04
INDIANA	16 2S 9W	38.3514	87.3914	1318768	493163	13	1451	1.045
INDIANA	16 3N 6W	38.695	87.0678	1404621	618552	13	1212	1.016
INDIANA	16 3S 5W	38.2655	86.96	1443895	461816	13	835	1.033
INDIANA	16 3S 7W	38.2655	87.1757	1382114	461816	13	1160	1.036
INDIANA	16 3S 7W	38.2655	87.1757	1382114	461816	13	1192	1.033
INDIANA	16 3S 10W	38.2655	87.4993	1289425	461816	13	1990	1.054
INDIANA	17 3S 5W	38.2655	86.9779	1438768	461816	13	926	1.043
INDIANA	17 3S 5W	38.2655	86.9779	1438768	461816	13	938	1.048
INDIANA	17 3S 10W	38.2655	87.5173	1284269	461816	13	1525	1.042
INDIANA	17 3S 11W	38.2655	87.6252	1253362	461816	13	2447	1.052
INDIANA	17 5S 5W	38.0938	86.9755	1442853	399158	13	1156	1.072
INDIANA	17 6S 5W	38.0079	86.9755	1444548	367810	13	1057	1.034
INDIANA	18 2N 5W	38.6091	86.9659	1426803	587205	13	706	1.02
INDIANA	18 2N 10W	38.6091	87.5353	1273038	587205	13	1800	1.052
INDIANA	18 2S 7W	38.3514	87.2117	1370178	493163	13	1160	1.03
INDIANA	18 3S 13W	38.2655	87.8589	1186419	461816	13	1841	1.037
INDIANA	18 5S 13W	38.0938	87.8523	1191114	399158	13	2953	1.089
INDIANA	18 6S 13W	37.8361	87.8523	1195303	305116	13	2710	1.092
INDIANA	19 2N 8W	38.5948	87.3195	1334823	581966	13	1250	1.034
INDIANA	19 2N 10W	38.5948	87.5353	1273291	581966	13		1.037
INDIANA	19 3S 9W	38.2512	87.4274	1310277	456597	13	1624	1.043
INDIANA	19 4S 13W	38.1654	87.8589	1188053	425286	13	1923	1.034
INDIANA	19 6S 13W	37.8218	87.8523	1195535	299897	13	2290	1.068
INDIANA	20 1S 9W	38.423	87.4094	1312318	519292	13	1220	1.021
INDIANA	20 2S 10W	38.3371	87.5173	1283002	487944	13	1258	1.021
INDIANA	20 2S 12W	38.3371	87.733	1221277	487944	13	2269	1.061
INDIANA	20 3S 11W	38.2512	87.6252	1253609	456597	13	1752	1.027
INDIANA	20 5S 10W	38.0795	87.5123	1288968	393839	13	920	1.012
INDIANA	20 6S 12W	37.9936	87.7271	1226743	362592	13	1859	1.053
INDIANA	21 2N 7W	38.5948	87.1757	1375823	581966	13	918	1.014
INDIANA	21 2N 7W	38.5948	87.1757	1375823	581966	13	1319	1.03
INDIANA	21 2N 8W	38.5948	87.2636	1345059	581966	13	1403	1.043
INDIANA	21 5N 7W	38.8524	87.1791	1369905	675992	13		1.032
INDIANA	21 5S 13W	38.0795	87.8185	1201628	393839	13	2122	1.054
INDIANA	22 1N 9W	38.5089	87.3735	1321004	550639	13	1508	1.041

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
INDIANA	22 1S 12W	38.423	87.6971	1230088	519292	13	1977	1.031
INDIANA	22 1S 12W	38.423	87.6971	1230088	519292	13	2280	1.031
INDIANA	22 2N 8W	38.5948	87.2656	1350191	581986	13	1300	1.041
INDIANA	22 3S 13W	38.2512	87.8049	1202124	456597	13	2444	1.065
INDIANA	22 5S 7W	38.0795	87.1545	1391735	393839	13	1236	1.026
INDIANA	22 6S 7W	37.9936	87.1545	1393369	362592	13	951	1.014
INDIANA	22 7S 11W	37.9077	87.5639	1271401	331245	13	2407	1.054
INDIANA	22 7S 14W	37.9077	87.906	1178684	331245	13	2650	1.096
INDIANA	23 1S 12W	38.423	87.6791	1235233	519292	13	1790	1.04
INDIANA	23 3S 14W	38.2512	87.8948	1176367	456597	13		1.057
INDIANA	23 3S 14W	38.2512	87.8948	1176367	456597	13		1.058
INDIANA	23 3S 14W	38.2512	87.8948	1176367	456597	13		1.077
INDIANA	23 3S 14W	38.2512	87.8948	1176367	456597	13		1.056
INDIANA	23 5N 5W	38.6524	86.9262	1441751	675992	13		1.003
INDIANA	23 5N 5W	38.6524	86.9262	1441751	675992	13	806	1.044
INDIANA	23 6S 13W	37.9936	87.7607	1213332	362592	13	1636	1.03
INDIANA	23 6S 13W	37.9936	87.7607	1213332	362592	13	1808	1.012
INDIANA	23 6S 13W	37.9936	87.7607	1213332	362592	13	2477	1.077
INDIANA	23 6S 13W	37.9936	87.7607	1213332	362592	13	2527	1.064
INDIANA	23 7S 14W	37.9077	87.8881	1183836	331245	13		1.095
INDIANA	23 7S 14W	37.9077	87.8881	1183836	331245	13	2382	1.074
INDIANA	24 1S 5W	38.423	86.906	1456190	519292	13	508	1.009
INDIANA	24 1S 12W	38.423	87.6611	1240378	519292	13	2331	1.055
INDIANA	24 3S 9W	38.2512	87.3375	1336033	456597	13	1525	1.034
INDIANA	24 3S 10W	38.2512	87.4454	1305121	456597	13	1442	1.038
INDIANA	24 5S 5W	38.0795	86.904	1463666	393839	13	825	1.03
INDIANA	25 1S 7W	38.4087	87.1218	1394792	514073	13	1236	1.038
INDIANA	25 1S 9W	38.4087	87.3375	1333132	514073	13	902	1.01
INDIANA	25 1S 12W	38.4087	87.6611	1240623	514073	13	1950	1.052
INDIANA	25 1S 12W	38.4087	87.6611	1240623	514073	13	2100	1.023
INDIANA	25 2S 7W	38.3228	87.1218	1396449	482726	13	1194	1.048
INDIANA	25 2S 9W	38.3228	87.3375	1334715	482726	13	1615	1.056
INDIANA	25 3S 14W	38.2369	87.8769	1181728	451379	13		1.048
INDIANA	25 6S 13W	37.9793	87.7629	1218688	357373	13	1177	1.023
INDIANA	25 7S 13W	37.8934	87.7629	1220113	326026	13	1629	1.042
INDIANA	26 2S 8W	38.3228	87.2476	1360445	482726	13	1160	1.026
INDIANA	26 2S 9W	38.3228	87.3555	1329563	482726	13	1482	1.04
INDIANA	26 3S 14W	38.2369	87.8948	1176589	451379	13	2904	1.092
INDIANA	26 4S 3W	38.151	86.7083	1518372	420031	13	261	1.016
INDIANA	27 1S 5W	38.4087	86.942	1446188	514073	13	618	1.022
INDIANA	27 1S 12W	38.4087	87.6971	1230332	514073	13	1950	1.055
INDIANA	27 2S 10W	38.3228	87.4813	1293558	482726	13	1670	1.042
INDIANA	27 3S 10W	38.2369	87.4813	1295090	451379	13	1740	1.041
INDIANA	28 2N 7W	38.5805	87.1757	1376097	576768	13	930	1.018
INDIANA	28 2N 7W	38.5805	87.1757	1376097	576768	13	1169	1.035

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
INDIANA	28 4S 13W	38.151	87.8229	1198616	420031	13	2185	1.048
INDIANA	28 6S 5W	37.9793	86.9576	1450258	357373	13	1010	1.048
INDIANA	28 6S 5W	37.9793	86.9576	1450258	357373	13	1206	1.048
INDIANA	29 2S 7W	38.3228	87.1837	1375871	482726	13	1212	1.035
INDIANA	29 2S 10W	38.3228	87.5173	1283255	482726	13	2071	1.06
INDIANA	29 3S 9W	38.2369	87.4094	1315693	451379	13	1599	1.042
INDIANA	29 6S 14W	37.9793	87.9418	1167240	357373	13	2783	1.024
INDIANA	29 7S 6W	37.8934	87.0829	1415883	326026	13	1372	1.042
INDIANA	29 7S 6W	37.8934	87.0829	1415883	326026	13	1415	1.041
INDIANA	29 7S 6W	37.8934	87.0829	1415883	326026	13	1610	1.06
INDIANA	30 4S 11W	38.151	87.6432	1250172	420031	13	2202	1.062
INDIANA	30 5S 11W	38.0652	87.6376	1253250	388721	13	2350	1.052
INDIANA	30 6S 12W	37.9793	87.7449	1223864	357373	13	1141	1.03
INDIANA	30 7S 6W	37.8934	87.1008	1410730	326026	13	675	1.006
INDIANA	30 7S 6W	37.8934	87.1008	1410730	326026	13	897	1.016
INDIANA	30 7S 7W	37.8934	87.2082	1379811	326026	13	1190	1.028
INDIANA	31 1N 9W	38.4803	87.4274	1306135	540202	13	1495	1.035
INDIANA	31 1S 9W	38.3944	87.4274	1307691	508855	13	1633	1.044
INDIANA	31 2S 9W	38.3085	87.4274	1309243	477508	13	1860	1.06
INDIANA	31 4S 5W	38.1367	86.9959	1436152	414813	13	1220	1.03
INDIANA	31 6S 5W	37.965	86.9934	1440245	352155	13	1240	1.052
INDIANA	31 6S 5W	37.965	86.9934	1440245	352155	13	1282	1.048
INDIANA	31 6S 11W	37.965	87.6376	1254985	352155	13	2478	1.058
INDIANA	31 7S 6W	37.8791	87.1008	1411004	320808	13	1105	1.025
INDIANA	31 9N 9W	39.1673	87.4367	1290959	790907	13	677	1.014
INDIANA	32 1N 7W	38.4803	87.1837	1372875	540202	13	1105	1.032
INDIANA	32 3S 5W	38.2226	86.9779	1439618	446160	13	1054	1.05
INDIANA	32 3S 8W	38.2226	87.3016	1346848	446160	13	1472	1.036
INDIANA	32 4S 10W	38.1367	87.5173	1286544	414813	13	2207	1.05
INDIANA	32 4S 11W	38.1367	87.6252	1255582	414813	13	2563	1.077
INDIANA	32 5S 3W	38.0508	86.7608	1505376	383466	13	536	1.021
INDIANA	32 7S 6W	37.8791	87.0829	1416158	320808	13	919	1.01
INDIANA	33 5S 10W	38.0508	87.4945	1294607	383466	13	2341	1.065
INDIANA	33 6S 12W	37.965	87.7092	1234371	352155	13	2635	1.065
INDIANA	33 8N 10W	39.0815	87.5043	1273389	759596	13	749	1.007
INDIANA	34 6S 6W	37.965	87.0471	1424801	352155	13	1295	1.042
INDIANA	34 7S 7W	37.8791	87.1545	1395542	320808	13	1127	1.025
INDIANA	34 11N 8W	39.3391	87.2734	1333873	853602	13	1686	1.047
INDIANA	35 4S 6W	38.1367	87.0319	1425823	414813	13	1180	1.043
INDIANA	35 4S 10W	38.1367	87.4634	1302010	414813	13	1819	1.042
INDIANA	35 7S 7W	37.8791	87.1366	1400696	320808	13	938	1.017
INDIANA	35 7S 7W	37.8791	87.1366	1400696	320808	13	1545	1.051
INDIANA	36 1N 12W	38.4803	87.6611	1239393	540202	13	2084	1.054
INDIANA	36 1S 10W	38.3944	87.4454	1302544	508855	13		1.027
INDIANA	36 1S 10W	38.3944	87.4454	1302544	508855	13		1.033

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
INDIANA	36 1S 10W	38.3944	87.4454	1302544	508855	13		1.033
INDIANA	36 1S 11W	38.3944	87.5533	1271692	508855	13	1848	1.046
INDIANA	36 1S 11W	38.3944	87.5533	1271692	508855	13	2013	1.046
INDIANA	36 2N 11W	38.5661	87.5533	1268686	571513	13	1825	1.044
INDIANA	36 2S 14W	38.3085	87.8769	1180563	477508	13	2673	1.039
INDIANA	36 3S 6W	38.2226	87.0139	1429301	446160	13	1019	1.04
INDIANA	36 3S 11W	38.2226	87.5533	1274709	446160	13	1885	1.046
INDIANA	36 3S 12W	38.2226	87.6611	1243813	446160	13	2328	1.041
INDIANA	36 5S 15W	38.05	88.05	1135028	383174	13	2985	1.066
INDIANA	36 6S 14W	37.965	87.8702	1188062	352155	13		1.019
INDIANA	36 6S 14W	37.965	87.8702	1188062	352155	13		1.019
INDIANA	36 7S 15W	37.88	88.05	1137660	321136	13	2000	1.048
MICHIGAN	28 2S 11E	42.2683	83.1208	2395958	1929846	3	4100	1.14
MICHIGAN	31 4N 15E	42.7203	82.7253	2485322	2087494	3	4498	1.195
MICHIGAN	7 5N 17E	42.8505	82.5406	2529432	2135008	3	4580	1.204
MICHIGAN	1 7S 3E	41.9201	84.0402	2160581	1785479	3	4797	1.2
MICHIGAN	30 5N 15W	42.8076	86.0887	1582280	2119352	3	5400	1.16
MICHIGAN	36 12N 16W	43.3944	86.349	1498197	2333492	3	6040	1.16
MICHIGAN	27 19N 16W	44.01	86.4106	1466727	2558141	3	6342	1.16
MICHIGAN	14 2N 4E	42.5785	83.943	2164217	2035748	3	7152	1.204
MICHIGAN	30 46N 17W	46.3289	86.437	1401526	3404371	6	121	1
MICHIGAN	33 42N 21W	45.971	86.969	1301165	3273764	6	292	1
MICHIGAN	12 39N 23W	45.7706	87.0345	1263759	3200632	6	305	1
MICHIGAN	34 37N 24W	45.5416	87.1953	1227859	3117064	6	351	1
MICHIGAN	34 43N 23W	46.0569	87.0914	1242852	3305111	6	364	1
MICHIGAN	23 41N 22W	45.9137	86.9499	1281981	3252853	6	400	1
MICHIGAN	29 39N 22W	45.7277	86.9943	1274967	3184977	6	404	1
MICHIGAN	30 34N 29W	45.2982	87.8373	1068430	3028241	6	449	1
MICHIGAN	8 44N 2W	46.2	84.5844	1872366	3357332	6	499	1
MICHIGAN	16 45N 13W	46.2716	85.908	1536345	3383461	6	699	1
MICHIGAN	16 43N 13W	46.0998	85.8985	1543558	3320766	6	1010	1
MICHIGAN	26 44N 12W	46.1571	85.7368	1582796	3341677	6	1056	1
MICHIGAN	16 43N 13W	46.0998	85.8985	1543558	3320766	6	1056	1
MICHIGAN	12 41N 16W	45.971	86.2018	1470289	3273764	6	1257	1
MICHIGAN	1 8S 7E	41.8342	83.5849	2287145	1764132	6	2533	1.13
MICHIGAN	16 7S 6E	41.8914	83.7556	2238781	1785006	6	2743	1.13
MICHIGAN	21 7S 5W	41.8771	84.8938	1930324	1779787	6	3533	1.13
MICHIGAN	28 7S 1E	41.8628	84.3247	2085281	1774569	6	3583	1.13
MICHIGAN	17 4S 6W	42.1491	85.0302	1885208	1879048	6	4049	1.145
MICHIGAN	30 5N 15W	42.8076	86.0887	1582280	2119352	6	4062	1.13
MICHIGAN	31 4S 4W	42.1062	84.6204	1943239	1863392	6	4114	1.145
MICHIGAN	11 1S 3W	42.4211	84.6296	1984903	1978308	6	4951	1.15
MICHIGAN	6 16N 17W	43.8096	86.3408	1490047	2485010	6	5315	1.25
MICHIGAN	14 1N 6E	42.4928	83.7141	2228720	2004400	6	5410	1.15

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	13 1N 2E	42.4926	84.1528	2110806	2004400	6	5463	1.15
MICHIGAN	36 15N 17W	43.6521	86.2438	1519569	2427534	6	5502	1.25
MICHIGAN	26 18N 17W	44.01	86.2741	1502532	2558141	6	5883	1.25
MICHIGAN	29 29N 9E	44.8688	83.4291	2215687	2871541	6	6411	1.25
MICHIGAN	7 11N 11W	43.3658	85.6354	1688097	2323055	6	6677	1.27
MICHIGAN	5 5N 2E	42.8648	84.2283	2078017	2140226	6	6759	1.15
MICHIGAN	29 29N 9E	44.8688	83.4291	2215687	2871541	6	7093	1.25
MICHIGAN	8 14N 11W	43.6235	85.6232	1684126	2417097	6	7740	1.27
MICHIGAN	23 14N 10W	43.5948	85.4486	1731040	2406623	6	7933	1.27
MICHIGAN	31 31N 2E	45.0263	84.243	1999852	2929017	6	7963	1.27
MICHIGAN	29 15N 11W	43.6664	85.6232	1682923	2432752	6	7979	1.27
MICHIGAN	8 13N 10W	43.5376	85.5068	1717301	2385749	6	8038	1.27
MICHIGAN	9 29N 5E	44.9117	83.846	2106433	2887196	6	8104	1.25
MICHIGAN	7 13N 10W	43.5376	85.5262	1712173	2385749	6	8143	1.27
MICHIGAN	35 15N 11W	43.6521	85.565	1698679	2427534	6	8153	1.27
MICHIGAN	22 17N 12W	43.8525	85.7084	1655289	2500685	6	8661	1.27
MICHIGAN	35 15N 9W	43.6521	85.3322	1760100	2427534	6	8957	1.27
MICHIGAN	18 24N 9W	44.468	85.4218	1712682	2725278	6	9009	1.27
MICHIGAN	14 16N 10W	43.7809	85.4486	1725675	2474536	6	9131	1.27
MICHIGAN	19 15N 9W	43.6807	85.4098	1738798	2437870	6	9144	1.27
MICHIGAN	14 16N 10W	43.7809	85.4486	1725675	2474536	6	9259	1.27
MICHIGAN	9 13N 7W	43.5376	85.1383	1814707	2385749	6	9396	1.27
MICHIGAN	12 14N 7W	43.6235	85.0801	1827479	2417097	6	9403	1.27
MICHIGAN	31 17N 8W	43.8239	85.2987	1763867	2490228	6	9570	1.28
MICHIGAN	5 17N 10W	43.8954	85.5133	1705364	2516320	6	9596	1.27
MICHIGAN	19 18N 10W	43.9384	85.5328	1699011	2532012	6	9669	1.27
MICHIGAN	27 18N 10W	43.9241	85.4743	1714784	2528794	6	9888	1.27
MICHIGAN	33 18N 9W	43.9098	85.3767	1740836	2521575	6	9964	1.27
MICHIGAN	1 12N 1W	43.466	84.3818	2017037	2359621	6	10049	1.275
MICHIGAN	7 17N 7W	43.8811	85.1817	1792924	2511102	6	10075	1.27
MICHIGAN	26 27N 1W	44.697	84.4017	1970312	2808846	6	10151	1.27
MICHIGAN	14 21N 9W	44.2104	85.3433	1740744	2631273	6	10161	1.27
MICHIGAN	14 25N 2E	44.5539	84.1649	2036688	2756625	6	10174	1.27
MICHIGAN	1 18N 10W	43.9813	85.4353	1723367	2547668	6	10203	1.27
MICHIGAN	10 13N 9E	43.5376	83.3733	2281119	2385749	6	10256	1.29
MICHIGAN	28 27N 1W	44.697	84.4412	1960076	2808846	6	10266	1.27
MICHIGAN	27 19N 10W	44.01	85.4743	1712305	2558141	6	10268	1.27
MICHIGAN	19 20N 10W	44.1101	85.5328	1694094	2594670	6	10282	1.27
MICHIGAN	35 23N 3E	44.3392	84.0484	2074565	2678275	6	10328	1.27
MICHIGAN	30 14N 6E	43.5805	83.5478	2233424	2401405	6	10433	1.289
MICHIGAN	27 22N 5E	44.2676	83.8326	2133424	2652146	6	10492	1.27
MICHIGAN	5 15N 10E	43.7237	83.2957	2294496	2453662	6	10492	1.27
MICHIGAN	31 15N 3W	43.6521	84.7115	1923846	2427534	6	10600	1.28
MICHIGAN	10 19N 9W	44.0529	85.3572	1741753	2573796	6	10614	1.27
MICHIGAN	20 24N 2E	44.4537	84.225	2024557	2720059	6	10771	1.27

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	26 22N 2E	44.2676	84.1661	2046377	2652146	6	10804	1.28
MICHIGAN	7 14N 5E	43.6235	83.8969	2139721	2417097	6	10827	1.289
MICHIGAN	21 20N 9W	44.1101	85.3767	1734963	2594670	6	10843	1.27
MICHIGAN	22 20N 6E	44.1101	83.7186	2168970	2594670	6	10873	1.29
MICHIGAN	7 17N 4W	43.8811	84.8305	1885219	2511102	6	10883	1.28
MICHIGAN	21 14N 6E	43.5948	83.7418	2181685	2406623	6	10909	1.289
MICHIGAN	12 19N 6E	44.0529	83.6796	2181285	2573796	6	10942	1.29
MICHIGAN	12 25N 5W	44.5682	84.8556	1856808	2761644	6	10961	1.27
MICHIGAN	16 22N 4W	44.2962	84.794	1881550	2662583	6	10984	1.27
MICHIGAN	31 21N 6W	44.1674	85.0686	1813861	2615581	6	10997	1.27
MICHIGAN	12 19N 6E	44.0529	83.6796	2181285	2573796	6	11040	1.29
MICHIGAN	26 20N 6E	44.0959	83.6991	2174595	2589488	6	11076	1.29
MICHIGAN	12 20N 6W	44.1368	84.9671	1841299	2605144	6	11125	1.27
MICHIGAN	12 20N 6W	44.1368	84.9671	1841299	2605144	6	11322	1.27
MICHIGAN	27 22N 5E	44.2676	83.8326	2133424	2652146	6	11545	1.27
MICHIGAN	15 21N 7W	44.2104	85.1275	1797144	2631273	6	11575	1.27
MICHIGAN	12 24N 5W	44.4823	84.8528	1860278	2730496	6	11650	1.27
MICHIGAN	12 16N 4E	43.7952	83.9163	2128491	2479755	6	11654	1.289
MICHIGAN	26 20N 6E	44.0959	83.6991	2174585	2589488	6	11663	1.27
MICHIGAN	20 18N 3E	43.9384	84.1068	2072853	2532012	6	12047	1.289
MICHIGAN	3 43N 21W	46.1284	86.8488	1302567	3331203	8	59	1
MICHIGAN	6 42N 21W	46.0426	86.9094	1289253	3299893	8	66	1
MICHIGAN	34 45N 2E	46.2286	84.1788	1973666	3367769	8	92	1
MICHIGAN	6 41N 21W	45.9567	86.9084	1291256	3268545	8	92	1
MICHIGAN	22 45N 1E	46.2573	84.3009	1941862	3378242	8	121	1
MICHIGAN	25 44N 1W	46.1571	84.3822	1924883	3341677	8	131	1
MICHIGAN	36 40N 25W	45.7992	87.2757	1201773	3211069	8	200	1
MICHIGAN	24 44N 4W	46.1714	84.7461	1832521	3346885	8	207	1
MICHIGAN	13 32N 27W	45.1551	87.4791	1163271	2976019	8	322	1
MICHIGAN	8 44N 2W	46.2	84.5844	1872366	3357332	8	545	1
MICHIGAN	11 39N 21W	45.7992	86.8135	1319309	3211069	8	745	1
MICHIGAN	13 42N 16W	46.0139	86.2018	1469149	3289419	8	928	1
MICHIGAN	9 43N 3E	46.1141	84.0789	2003023	3325985	8	942	1
MICHIGAN	11 43N 9W	46.1141	85.3729	1676016	3325985	8	1112	1
MICHIGAN	24 7S 5E	41.8771	83.8126	2223812	1779787	8	2044	1.2
MICHIGAN	31 8S 6E	41.7626	83.7836	2232962	1738003	8	2234	1.2
MICHIGAN	10 6S 17W	41.9917	86.2407	1561796	1821608	8	2270	1.2
MICHIGAN	36 7S 14W	41.8485	85.8613	1668360	1769350	8	2280	1.2
MICHIGAN	2 8S 1W	41.7483	84.4005	2068397	1732785	8	2628	1.225
MICHIGAN	5 7S 5E	41.9201	83.8884	2201755	1795479	8	2726	1.2
MICHIGAN	9 8S 6W	41.8199	85.0077	1901102	1758914	8	2785	1.225
MICHIGAN	36 6S 6W	41.9344	84.9507	1913157	1800698	8	3022	1.225
MICHIGAN	12 7S 2E	41.9058	84.154	2130191	1790261	8	3045	1.2
MICHIGAN	29 7S 4W	41.8628	84.799	1956498	1774569	8	3094	1.225
MICHIGAN	14 5S 4E	42.0632	83.9453	2181407	1847700	8	3158	1.2

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	1 7S 7W	41.9201	85.0646	1882685	1795479	8	3426	1.225
MICHIGAN	10 5S 3W	42.0775	84.6472	1990990	1852919	8	3898	1.225
MICHIGAN	1 1S 7E	42.4354	83.5806	2266671	1983526	8	4022	1.225
MICHIGAN	23 3S 4W	42.2207	84.7441	1960324	1905176	8	4140	1.225
MICHIGAN	29 2S 4W	42.2923	84.8013	1942671	1931305	8	4216	1.225
MICHIGAN	13 4S 2W	42.1491	84.4961	2029583	1879048	8	4400	1.225
MICHIGAN	22 1S 5W	42.3924	84.8776	1919033	1967835	8	4455	1.225
MICHIGAN	11 1S 3W	42.4211	84.6296	1984903	1978308	8	4728	1.23
MICHIGAN	12 1S 1W	42.4211	84.3817	2051620	1978308	8	5010	1.225
MICHIGAN	30 20N 17W	44.0959	86.3521	1479923	2589488	8	5207	1.25
MICHIGAN	21 15N 16W	43.6807	86.1856	1534196	2437970	8	5873	1.25
MICHIGAN	25 23N 16W	44.3535	86.1478	1526736	2683494	8	5883	1.27
MICHIGAN	11 16N 16W	43.7852	86.1468	1541477	2479755	8	6063	1.25
MICHIGAN	5 14N 14W	43.6378	85.9723	1591590	2422315	8	6329	1.27
MICHIGAN	28 29N 9E	44.8688	83.4291	2215687	2871541	8	6335	1.27
MICHIGAN	7 11N 11W	43.3658	85.6354	1688097	2323055	8	6444	1.27
MICHIGAN	7 11N 11W	43.3658	85.6354	1688097	2323055	8	6568	1.27
MICHIGAN	1 29N 4E	44.9261	83.9056	2090525	2892451	8	7110	1.25
MICHIGAN	9 29N 5E	44.9117	83.846	2106433	2887196	8	7244	1.25
MICHIGAN	24 25N 13W	44.5396	85.8029	1611527	2751407	8	7283	1.27
MICHIGAN	31 31N 2E	45.0263	84.243	1999952	2929017	8	7359	1.27
MICHIGAN	16 30N 1W	44.9833	84.4416	1950250	2913325	8	7844	1.236
MICHIGAN	23 14N 10W	43.5948	85.4486	1731040	2406623	8	8015	1.27
MICHIGAN	35 15N 11W	43.6521	85.565	1698679	2427534	8	8051	1.27
MICHIGAN	22 17N 12W	43.8525	85.7084	1655289	2500685	8	8245	1.27
MICHIGAN	19 15N 9W	43.6807	85.4098	1738798	2437970	8	8510	1.27
MICHIGAN	14 16N 10W	43.7809	85.4486	1725675	2474536	8	8730	1.27
MICHIGAN	32 19N 9W	43.9956	85.3962	1733208	2552686	8	9012	1.28
MICHIGAN	34 25N 8W	44.5109	85.2504	1755969	2740833	8	9068	1.27
MICHIGAN	28 27N 1W	44.697	84.4412	1960076	2808846	8	9252	1.27
MICHIGAN	27 19N 10W	44.01	85.4743	1712305	2558141	8	9268	1.27
MICHIGAN	1 18N 10W	43.9813	85.4353	1723367	2547668	8	9327	1.27
MICHIGAN	5 20N 10W	44.1531	85.5133	1697963	2610362	8	9616	1.27
MICHIGAN	3 13N 2W	43.5519	84.537	1973161	2390968	8	9751	1.29
MICHIGAN	10 13N 9E	43.5376	83.3733	2281119	2385749	8	9885	1.289
MICHIGAN	21 14N 6E	43.5948	83.7418	2181685	2406623	8	9938	1.25
MICHIGAN	21 20N 9W	44.1101	85.3767	1734963	2594670	8	9984	1.27
MICHIGAN	29 25N 3E	44.5253	84.1057	2053074	2746188	8	10026	1.27
MICHIGAN	31 15N 3W	43.6521	84.7115	1923846	2427534	8	10135	1.27
MICHIGAN	12 24N 5W	44.4823	84.8528	1860278	2730496	8	10259	1.27
MICHIGAN	26 22N 2E	44.2676	84.1681	2046377	2652146	8	10351	1.28
MICHIGAN	20 24N 2E	44.4537	84.225	2024557	2720059	8	10358	1.27
MICHIGAN	11 14N 4E	43.6235	83.9357	2129484	2417097	8	10394	1.289
MICHIGAN	21 14N 6E	43.5948	83.7418	2181685	2406623	8	10420	1.289
MICHIGAN	27 22N 5E	44.2676	83.8326	2133424	2652146	8	10456	1.27

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	10 14N 5E	43.6235	83.8387	2155077	2417097	8	10495	1.289
MICHIGAN	31 21N 6W	44.1674	85.0886	1813881	2615581	8	10571	1.27
MICHIGAN	36 22N 7W	44.2533	85.0883	1806071	2646928	8	10623	1.27
MICHIGAN	12 20N 6W	44.1388	84.9671	1841299	2605144	8	10627	1.27
MICHIGAN	4 20N 4E	44.1531	83.9722	2101072	2610362	8	10669	1.27
MICHIGAN	29 22N 4W	44.2676	84.8136	1877350	2652146	8	10666	1.26
MICHIGAN	12 16N 4E	43.7952	83.9163	2128491	2479755	8	11109	1.29
MICHIGAN	36 18N 1W	43.9098	84.3819	2002131	2521575	8	11191	1.289
MICHIGAN	35 33N 7W	45.198	85.1211	1768370	2991675	10		1
MICHIGAN	1 34N 7W	45.3555	85.1011	1768589	3049151	10		1
MICHIGAN	8 33N 6E	45.2553	83.743	2120216	3012585	10	62	1
MICHIGAN	19 44N 11W	46.1714	85.6964	1592586	3346985	10	69	1
MICHIGAN	31 7S 7E	41.8485	83.6798	2260863	1769350	10	89	1
MICHIGAN	12 8S 5E	41.8199	83.8125	2225830	1758914	10	98	1
MICHIGAN	1 6S 5E	42.006	83.8125	2219344	1826827	10	106	1
MICHIGAN	26 42N 5E	46	83.8	2077780	3284347	10	118	1
MICHIGAN	29 39N 2W	45.699	84.3821	1940883	3174503	10	125	1
MICHIGAN	30 43N 8W	46.0712	85.3324	1687565	3310329	10	125	1
MICHIGAN	35 3S 7E	42.1821	83.5997	2270302	1694740	10	125	1
MICHIGAN	26 2S 9E	42.2823	83.3708	2328408	1931305	10	131	1
MICHIGAN	22 2S 10E	42.3066	83.2754	2353593	1936524	10	141	1
MICHIGAN	27 34N 1E	45.2982	84.3022	1975244	3028241	10	144	1
MICHIGAN	25 5S 5E	42.0346	83.8125	2218345	1837263	10	148	1
MICHIGAN	4 42N 10W	46.0426	85.5953	1621902	3299883	10	161	1
MICHIGAN	16 35N 1W	45.4127	84.442	1935475	3070025	10	184	1
MICHIGAN	14 43N 3W	46.0998	84.645	1860462	3320766	10	184	1
MICHIGAN	33 2S 11E	42.2779	83.1801	2380364	1926050	10	190	1
MICHIGAN	35 34N 1E	45.2839	84.2822	1980872	3023022	10	200	1
MICHIGAN	13 43N 1W	46.0998	84.3822	1926868	3320766	10	200	1
MICHIGAN	12 33N 3W	45.2553	84.6218	1694727	3012585	10	213	1
MICHIGAN	8 44N 2W	46.2	84.5844	1872366	3357332	10	217	1
MICHIGAN	23 35N 4E	45.3984	83.9227	2068875	3064806	10	223	1
MICHIGAN	7 39N 18W	45.7706	86.5322	1391551	3200632	10	233	1
MICHIGAN	31 42N 5W	45.971	84.9685	1782839	3273764	10	240	1
MICHIGAN	11 41N 14W	45.971	85.9794	1526658	3273764	10	240	1
MICHIGAN	29 2S 11E	42.2823	83.1981	2374697	1931305	10	249	1
MICHIGAN	18 30N 8E	44.9833	83.5284	2185675	2913325	10	249	1
MICHIGAN	32 42N 4W	45.971	84.827	1818693	3273764	10	269	1
MICHIGAN	11 42N 7W	46.0283	85.1302	1740062	3294874	10	279	1
MICHIGAN	6 37N 1W	45.6131	84.4826	1916238	3143156	10	289	1
MICHIGAN	2 3S 8E	42.2638	83.4852	2298814	1920832	10	308	1
MICHIGAN	24 42N 1W	45.9996	84.3822	1930389	3284201	10	318	1
MICHIGAN	12 32N 4E	45.1694	83.9056	2081644	2981238	10	322	1
MICHIGAN	24 28N 6W	44.7972	84.974	1818847	2845412	10	351	1
MICHIGAN	1 6S 9E	42.006	83.3573	2342630	1826827	10	351	1.01

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	19 1S 12E	42.3824	83.1038	2396565	1967835	10	377	1
MICHIGAN	23 31N 8W	45.0549	85.2357	1743297	2939454	10	417	1
MICHIGAN	28 32N 5W	45.1265	84.9181	1822810	2965563	10	427	1
MICHIGAN	14 32N 6W	45.1551	84.9975	1801481	2976019	10	463	1.005
MICHIGAN	10 1N 6E	42.507	83.7332	2223074	2009655	10	476	1.1
MICHIGAN	22 31N 8E	45.0549	83.4688	2198284	2939454	10	489	1
MICHIGAN	14 1N 6E	42.4926	83.7141	2228720	2004400	10	492	1.1
MICHIGAN	33 35N 5W	45.3698	84.9213	1814184	3054368	10	499	1
MICHIGAN	20 7S 6E	41.8771	83.7746	2234125	1779787	10	505	1.1
MICHIGAN	21 34N 5W	45.3125	84.9213	1816032	3033459	10	509	1
MICHIGAN	25 41N 14W	45.971	85.9582	1531777	3273764	10	518	1
MICHIGAN	36 1N 7E	42.4497	83.5806	2266154	1988745	10	531	1.1
MICHIGAN	10 8S 11W	41.8199	85.5578	1751611	1758914	10	545	1.1
MICHIGAN	11 1N 6E	42.507	83.7141	2228206	2009655	10	577	1.1
MICHIGAN	22 31N 8E	45.0549	83.4688	2198284	2939454	10	591	1
MICHIGAN	21 8S 2E	41.7913	84.2109	2118545	1748477	10	604	1.1
MICHIGAN	32 2N 7E	42.5356	83.6569	2242548	2020092	10	614	1.1
MICHIGAN	27 8S 3E	41.777	84.0781	2155121	1743258	10	643	1.05
MICHIGAN	23 7S 15W	41.8771	85.9941	1631572	1779787	10	728	1.02
MICHIGAN	6 8S 14W	41.8342	85.9561	1642994	1764132	10	735	1.02
MICHIGAN	14 7S 15W	41.8914	85.9941	1631207	1785006	10	745	1.02
MICHIGAN	8 37N 5W	45.5988	84.9448	1800836	3137838	10	778	1
MICHIGAN	14 1N 6E	42.4926	83.7141	2228720	2004400	10	804	1.15
MICHIGAN	24 4N 16E	42.736	82.5506	2531446	2093224	10	820	1.22
MICHIGAN	29 7S 13W	41.8628	85.8234	1676301	1774589	10	860	1.016
MICHIGAN	27 24N 16W	44.4394	86.187	1514288	2714841	10	873	1.1
MICHIGAN	23 1S 8E	42.3924	83.4852	2293907	1967835	10	879	1.01
MICHIGAN	22 8S 15W	41.7913	86.013	1628623	1748477	10	896	1.02
MICHIGAN	19 4N 16E	42.736	82.646	2505915	2093224	10	925	1.15
MICHIGAN	30 6S 10W	41.9487	85.5009	1763514	1805916	10	945	1.15
MICHIGAN	23 5S 3E	42.0489	84.0592	2151068	1842482	10	965	1.05
MICHIGAN	26 8N 16E	43.0652	82.5597	2515527	2213358	10	978	1.15
MICHIGAN	27 4S 4E	42.1205	83.9621	2174894	1868611	10	981	1.1
MICHIGAN	15 8S 2E	41.8056	84.1919	2123235	1753695	10	981	1.05
MICHIGAN	21 8S 3W	41.7913	84.6662	1994786	1748477	10	981	1.07
MICHIGAN	16 7S 7E	41.8914	83.6418	2269659	1785006	10	1001	1.2
MICHIGAN	1 21N 17W	44.239	86.2655	1498964	2641709	10	1004	1.1
MICHIGAN	35 6S 16W	41.9344	86.1079	1598233	1800698	10	1007	1.15
MICHIGAN	32 8N 17E	43.0509	82.5022	2531423	2208139	10	1014	1.23
MICHIGAN	5 29N 5E	44.9261	83.8659	2100769	2892451	10	1020	1.1
MICHIGAN	25 3N 4E	42.6358	83.9239	2167347	2056658	10	1030	1.15
MICHIGAN	11 3S 16W	42.2493	86.1174	1588744	1915813	10	1033	1.135
MICHIGAN	24 8S 4W	41.7913	84.7231	1979319	1748477	10	1060	1.07
MICHIGAN	19 5S 14W	42.0489	85.9561	1637468	1842482	10	1070	1.02
MICHIGAN	16 29N 7W	44.8974	85.1563	1768602	2881978	10	1165	1.1

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	11 33N 1W	45.2553	84.4021	1951105	3012585	10	1184	1.1
MICHIGAN	33 2S 16W	42.2779	86.1555	1577742	1926050	10	1217	1.15
MICHIGAN	6 23N 14W	44.4108	86.0104	1561036	2704404	10	1220	1.1
MICHIGAN	6 23N 14W	44.4108	86.0104	1561036	2704404	10	1220	1.1
MICHIGAN	4 7S 15W	41.9201	86.032	1620189	1795479	10	1230	1.02
MICHIGAN	11 4S 13W	42.1634	85.7741	1683710	1884266	10	1230	1.152
MICHIGAN	14 2N 16W	42.5785	86.1174	1580423	2035748	10	1270	1.18
MICHIGAN	27 3S 11W	42.2064	85.5642	1738264	1889858	10	1289	1.15
MICHIGAN	12 1S 14W	42.4211	85.8694	1651176	1978308	10	1332	1.18
MICHIGAN	31 5S 2E	42.0203	84.2489	2100662	1832045	10	1342	1.1
MICHIGAN	4 4S 7W	42.1777	85.1256	1858577	1889485	10	1362	1.16
MICHIGAN	4 5S 3W	42.0919	84.6662	1985397	1858174	10	1371	1.12
MICHIGAN	21 6S 3W	41.963	84.6662	1989430	1811135	10	1375	1.1
MICHIGAN	20 28N 9E	44.7972	83.3952	2227210	2845412	10	1394	1.01
MICHIGAN	9 21N 16W	44.2247	86.2066	1514722	2636491	10	1401	1.1
MICHIGAN	31 3N 14W	42.6215	85.9648	1620284	2051439	10	1444	1.17
MICHIGAN	8 17N 14E	43.8811	82.8213	2413053	2511102	10	1460	1.15
MICHIGAN	18 5S 1E	42.0632	84.3627	2068443	1847700	10	1463	1.17
MICHIGAN	21 19N 17W	44.0243	86.3131	1491942	2563360	10	1470	1.18
MICHIGAN	23 6S 11W	41.963	85.5388	1752841	1811135	10	1493	1.25
MICHIGAN	30 4S 2W	42.1205	84.5915	2004702	1868611	10	1506	1.19
MICHIGAN	17 29N 6W	44.8974	85.057	1794248	2881878	10	1509	1.1
MICHIGAN	13 5S 6E	42.0632	83.6987	2248141	1847700	10	1529	1.2
MICHIGAN	22 24N 13W	44.4537	85.8338	1605861	2720059	10	1532	1.1
MICHIGAN	34 28N 14W	44.7686	85.9608	1564293	2834975	10	1575	1.1
MICHIGAN	2 2N 16W	42.6072	86.1174	1579695	2046221	10	1578	1.21
MICHIGAN	8 16N 17W	43.7952	86.3214	1495514	2479755	10	1588	1.18
MICHIGAN	7 1S 11W	42.4211	85.6215	1717913	1978308	10	1591	1.18
MICHIGAN	15 3S 4W	42.235	84.7632	1954724	1910395	10	1608	1.19
MICHIGAN	8 4S 13W	42.1634	85.8313	1668248	1884266	10	1608	1.22
MICHIGAN	8 4S 13W	42.1634	85.8313	1668248	1884266	10	1611	1.15
MICHIGAN	27 24N 16W	44.4394	86.187	1514268	2714841	10	1654	1.1
MICHIGAN	6 1N 15W	42.5213	86.0792	1592141	2014874	10	1673	1.25
MICHIGAN	29 2N 12W	42.5499	85.7168	1688775	2025311	10	1677	1.18
MICHIGAN	2 4S 9W	42.1777	85.3163	1807046	1889485	10	1699	1.175
MICHIGAN	3 25N 12W	44.5825	85.724	1630831	2767062	10	1699	1.1
MICHIGAN	30 5N 15W	42.8076	86.0887	1582280	2119352	10	1709	1.165
MICHIGAN	32 31N 5E	45.0263	83.8659	2097098	2929017	10	1732	1.1
MICHIGAN	22 17N 17W	43.8525	86.2936	1501390	2500665	10	1736	1.15
MICHIGAN	18 14N 18W	43.6091	86.4572	1464303	2411842	10	1739	1.19
MICHIGAN	17 31N 5W	45.0662	84.9379	1819543	2944672	10	1752	1.05
MICHIGAN	10 4S 1E	42.1634	84.3054	2060656	1884266	10	1765	1.1
MICHIGAN	31 32N 1W	45.1121	84.4813	1935648	2960328	10	1765	1.1
MICHIGAN	32 12N 16E	43.3944	82.6074	2489332	2333492	10	1788	1.1
MICHIGAN	22 26N 16W	44.6255	86.1976	1506703	2782754	10	1801	1.05

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	27 10N 16E	43.237	82.5689	2506015	2276052	10	1814	1.265
MICHIGAN	28 4N 15W	42.7217	86.0411	1597230	2088005	10	1834	1.15
MICHIGAN	36 19N 16W	43.9956	86.1375	1536736	2552866	10	1841	1.17
MICHIGAN	16 29N 7W	44.8974	85.1583	1768802	2881978	10	1847	1.05
MICHIGAN	9 33N 3E	45.2553	84.0825	2033112	3012585	10	1860	1.29
MICHIGAN	9 25N 10W	44.5682	85.5069	1687631	2761844	10	1864	1.1
MICHIGAN	19 26N 10W	44.6255	85.5484	1675716	2782754	10	1867	1.1
MICHIGAN	11 23N 2E	44.3964	84.1661	2041884	2699149	10	1870	1.21
MICHIGAN	22 32N 2E	45.1408	84.1635	2011243	2970801	10	1873	1.15
MICHIGAN	3 20N 4E	44.1531	83.9527	2106171	2610362	10	1877	1.21
MICHIGAN	30 2N 11W	42.5499	85.6215	1714377	2025311	10	1916	1.15
MICHIGAN	18 20N 5E	44.1245	83.8942	2122499	2599825	10	1919	1.2
MICHIGAN	11 6S 10W	41.9917	85.425	1782884	1821608	10	1923	1.26
MICHIGAN	11 1S 1W	42.4211	84.4008	2046480	1978308	10	1949	1.2
MICHIGAN	15 3N 13W	42.6644	85.7831	1665211	2067095	10	1955	1.15
MICHIGAN	2 22N 3E	44.3249	84.0484	2075071	2673057	10	1959	1.21
MICHIGAN	31 21N 4E	44.1674	84.0091	2090815	2615581	10	1962	1.21
MICHIGAN	7 22N 4E	44.3106	84.0091	2085828	2667838	10	1969	1.21
MICHIGAN	4 20N 16W	44.1531	86.196	1519337	2610362	10	1972	1.15
MICHIGAN	24 28N 7W	44.7972	85.0925	1788189	2845412	10	1972	1.107
MICHIGAN	30 5N 13W	42.6076	85.8585	1643871	2119352	10	1978	1.17
MICHIGAN	19 37N 10W	45.625	85.52	1653327	3147489	10	1985	1.25
MICHIGAN	30 3N 16E	42.6358	82.646	2509985	2056658	10	1988	1.25
MICHIGAN	23 17N 15W	43.8525	86.04	1568085	2500685	10	1991	1.2
MICHIGAN	18 3N 12W	42.6644	85.7359	1680550	2067095	10	1995	1.2
MICHIGAN	13 22N 3E	44.2962	84.0288	2081200	2662583	10	1995	1.21
MICHIGAN	8 1N 16W	42.507	86.1748	1566856	2009655	10	2001	1.25
MICHIGAN	29 20N 6E	44.0959	83.7577	2159257	2589488	10	2021	1.2
MICHIGAN	8 2S 14W	42.3352	85.8457	1632867	1946961	10	2024	1.22
MICHIGAN	2 25N 8E	44.5825	83.4544	2220123	2767062	10	2024	1.15
MICHIGAN	2 25N 8E	44.5825	83.4544	2220123	2767062	10	2024	1.205
MICHIGAN	34 26N 8E	44.5968	83.4742	2214439	2772280	10	2034	1.15
MICHIGAN	11 9N 8E	43.194	83.4753	2266968	2260360	10	2041	1.1
MICHIGAN	6 13N 16W	43.5519	86.2244	1527231	2390988	10	2041	1.2
MICHIGAN	16 1N 2W	42.4926	84.5534	2003121	2004400	10	2057	1.2
MICHIGAN	35 37N 4W	45.5416	84.7639	1848862	3117084	10	2057	1.15
MICHIGAN	35 37N 4W	45.5416	84.7639	1848862	3117084	10	2057	1.25
MICHIGAN	25 10N 6E	43.237	83.6875	2209045	2276052	10	2060	1.215
MICHIGAN	4 5N 4E	42.8648	83.979	2144626	2140226	10	2067	1.175
MICHIGAN	10 16N 16W	43.7952	86.1662	1536370	2479755	10	2077	1.2
MICHIGAN	17 18N 4E	43.9527	83.9917	2103083	2537231	10	2100	1.21
MICHIGAN	25 2N 3W	42.5499	84.6106	1985821	2025311	10	2103	1.216
MICHIGAN	8 1N 16W	42.507	86.1746	1566856	2009655	10	2108	1.25
MICHIGAN	21 24N 1W	44.4537	84.4408	1968404	2720059	10	2126	1.21
MICHIGAN	19 24N 1W	44.4537	84.48	1958204	2720059	10	2149	1.2

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	6 28N 7W	44.8402	85.1911	1761364	2861104	10	2149	1.05
MICHIGAN	26 1N 4E	42.484	83.943	2168190	1993983	10	2149	1.15
MICHIGAN	8 3S 4E	42.2493	84.0002	2160183	1915613	10	2172	1.23
MICHIGAN	1 1N 9W	42.5213	85.2972	1802322	2014874	10	2182	1.15
MICHIGAN	7 3S 8W	42.2493	85.2781	1815308	1915613	10	2201	1.22
MICHIGAN	19 29N 5E	44.8831	83.8857	2097229	2876759	10	2201	1.15
MICHIGAN	5 29N 5E	44.9261	83.8659	2100769	2892451	10	2201	1.2
MICHIGAN	29 4N 7W	42.7217	85.1446	1837405	2088005	10	2208	1.205
MICHIGAN	8 1N 16W	42.507	86.1748	1566856	2009655	10	2218	1.22
MICHIGAN	4 24N 3E	44.4966	84.0876	2058792	2735715	10	2238	1.21
MICHIGAN	16 2N 2W	42.5785	84.5534	2000365	2035748	10	2241	1.216
MICHIGAN	29 17N 4E	43.8382	83.9917	2107134	2495447	10	2244	1.23
MICHIGAN	4 6S 2W	42.006	84.5524	2018916	1826827	10	2247	1.23
MICHIGAN	3 16N 4E	43.8096	83.9551	2117772	2485010	10	2251	1.23
MICHIGAN	21 14N 15E	43.5948	82.6944	2458118	2406623	10	2257	1.1
MICHIGAN	27 25N 4W	44.5253	84.7767	1878698	2748188	10	2257	1.19
MICHIGAN	16 27N 9E	44.7257	83.3755	2235071	2819320	10	2260	1.23
MICHIGAN	13 5S 6W	42.0632	84.9508	1909259	1847700	10	2274	1.25
MICHIGAN	5 6N 13W	42.9507	85.8393	1645188	2171573	10	2274	1.15
MICHIGAN	4 6N 12W	42.9507	85.7051	1681007	2171573	10	2280	1.2
MICHIGAN	2 1S 1W	42.4354	84.4008	2046013	1983526	10	2290	1.16
MICHIGAN	10 30N 4W	44.9976	84.7791	1862761	2918543	10	2300	1.1
MICHIGAN	23 1S 11W	42.3924	85.5452	1739248	1967835	10	2320	1.25
MICHIGAN	8 15N 13W	43.7094	85.8559	1620376	2448444	10	2336	1.21
MICHIGAN	36 29N 7W	44.8545	85.0967	1785326	2866322	10	2339	1.1
MICHIGAN	20 9N 3E	43.1654	84.1118	2098837	2249923	10	2346	1.22
MICHIGAN	15 3N 8W	42.6644	85.2209	1818644	2067085	10	2349	1.21
MICHIGAN	32 25N 8W	44.5109	85.2898	1745745	2740933	10	2362	1.15
MICHIGAN	2 36N 5W	45.5272	84.8814	1819326	3111809	10	2365	1.25
MICHIGAN	36 8N 1E	43.0509	84.2667	2061507	2208139	10	2382	1.1
MICHIGAN	24 19N 4E	44.0243	83.9137	2120988	2563360	10	2385	1.21
MICHIGAN	35 25N 8W	44.5109	85.2308	1761137	2740933	10	2402	1.15
MICHIGAN	36 15N 17W	43.6521	86.2438	1519569	2427534	10	2408	1.2
MICHIGAN	4 2S 9W	42.3485	85.3544	1791858	1952178	10	2411	1.23
MICHIGAN	31 15N 16W	43.6521	86.2244	1524689	2427534	10	2411	1.2
MICHIGAN	6 7N 1W	43.0366	84.4776	2005793	2202821	10	2421	1.216
MICHIGAN	12 3S 5W	42.2493	84.8394	1933715	1915613	10	2425	1.26
MICHIGAN	33 26N 8W	44.5968	85.2701	1748283	2772280	10	2428	1.15
MICHIGAN	35 13N 13W	43.4803	85.7977	1641960	2364839	10	2428	1.225
MICHIGAN	23 30N 3W	44.969	84.6401	1899542	2908106	10	2444	1.1
MICHIGAN	25 5N 8W	42.8076	85.1873	1823435	2119352	10	2444	1.18
MICHIGAN	33 18N 3E	43.9098	84.0893	2078972	2521575	10	2461	1.21
MICHIGAN	26 6N 2W	43.0652	84.516	1994630	2213358	10	2467	1.216
MICHIGAN	31 4N 15E	42.7074	82.7604	2476441	2082787	10	2487	1.24
MICHIGAN	16 2N 2W	42.5785	84.5534	2000365	2035748	10	2487	1.15

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	2 19N 3E	44.0672	84.0503	2083676	2579015	10	2493	1.212
MICHIGAN	12 12N 14E	43.4517	82.7617	2446161	2354402	10	2497	1.25
MICHIGAN	15 21N 1E	44.2104	84.3034	2012495	2631273	10	2500	1.22
MICHIGAN	34 20N 3E	44.0815	84.0698	2078066	2584233	10	2503	1.21
MICHIGAN	28 9N 10E	43.1511	83.2825	2319844	2244705	10	2523	1.2
MICHIGAN	5 3N 15E	42.6931	82.7413	2482127	2077568	10	2526	1.23
MICHIGAN	33 2S 4E	42.2779	83.9811	2164354	1926050	10	2539	1.265
MICHIGAN	26 20N 18W	44.0959	86.3911	1469708	2589488	10	2549	1.22
MICHIGAN	19 26N 9W	44.6255	85.428	1706442	2782754	10	2562	1.09
MICHIGAN	21 10N 10E	43.2513	83.2825	2316034	2281271	10	2605	1.2
MICHIGAN	8 19N 2E	44.0529	84.2258	2038203	2573796	10	2621	1.22
MICHIGAN	34 5N 15W	42.7933	86.0311	1598081	2114134	10	2635	1.25
MICHIGAN	10 26N 7E	44.6541	83.5926	2181557	2793191	10	2677	1.25
MICHIGAN	32 27N 3E	44.6827	84.1057	2047514	2803626	10	2687	1.159
MICHIGAN	16 2N 2W	42.5785	84.5534	2000385	2035748	10	2694	1.15
MICHIGAN	14 2N 4E	42.5785	83.943	2164217	2035748	10	2694	1.175
MICHIGAN	5 9N 8E	43.2084	83.5332	2251072	2265615	10	2700	1.295
MICHIGAN	5 9N 8E	43.2084	83.5332	2251072	2265615	10	2700	1.2
MICHIGAN	25 3S 3W	42.2064	84.6106	1996822	1899858	10	2707	1.25
MICHIGAN	1 24N 7W	44.4966	85.0883	1798578	2735715	10	2713	1.15
MICHIGAN	7 34N 5E	45.3412	83.8828	2081192	3043932	10	2713	1.305
MICHIGAN	2 5N 15E	42.8648	82.6748	2493006	2140226	10	2726	1.23
MICHIGAN	9 10N 2W	43.2799	84.5554	1977167	2291708	10	2730	1.225
MICHIGAN	13 15N 12W	43.685	85.6618	1671917	2443189	10	2749	1.21
MICHIGAN	28 5N 16E	42.8076	82.5981	2515820	2119352	10	2756	1.23
MICHIGAN	17 9N 5W	43.1797	84.9218	1883012	2255142	10	2759	1.225
MICHIGAN	35 13N 10W	43.4803	85.4486	1734332	2364839	10	2792	1.227
MICHIGAN	16 11N 13W	43.3515	85.8283	1637344	2317836	10	2805	1.21
MICHIGAN	29 35N 2E	45.3841	84.2223	1992703	3059588	10	2808	1.305
MICHIGAN	6 13N 1W	43.5519	84.4788	1968538	2390968	10	2808	1.23
MICHIGAN	19 10N 6W	43.2513	85.0568	1844950	2281271	10	2815	1.23
MICHIGAN	30 5N 14W	42.8076	85.9736	1613076	2119352	10	2822	1.25
MICHIGAN	27 10N 10E	43.237	83.2632	2321702	2276052	10	2822	1.29
MICHIGAN	18 5N 2W	42.8362	84.5927	1981565	2129789	10	2844	1.21
MICHIGAN	18 3N 12W	42.6644	85.7359	1680550	2067095	10	2881	1.242
MICHIGAN	32 15N 12E	43.6521	83.0629	2358622	2427534	10	2881	1.22
MICHIGAN	7 4N 15E	42.7646	82.7604	2474155	2103660	10	2884	1.23
MICHIGAN	11 4N 15W	42.7646	86.0029	1606352	2103660	10	2887	1.25
MICHIGAN	13 18N 12W	43.9527	85.6693	1662768	2537231	10	2887	1.185
MICHIGAN	13 20N 1W	44.1245	84.3819	1994889	2599925	10	2894	1.22
MICHIGAN	15 13N 1W	43.5233	84.4206	2004867	2380531	10	2923	1.22
MICHIGAN	2 3N 12E	42.6931	83.0275	2405474	2077568	10	2930	1.26
MICHIGAN	8 22N 4W	44.3106	84.8136	1875975	2667838	10	2940	1.2
MICHIGAN	33 28N 6W	44.7686	85.0333	1804400	2834975	10	2966	1.15
MICHIGAN	19 30N 6W	44.969	85.0769	1786878	2906106	10	2978	1.15

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	35 17N 4E	43.8239	83.9332	2123023	2490228	10	2992	1.21
MICHIGAN	12 19N 1E	44.0529	84.2648	2027986	2573796	10	3002	1.22
MICHIGAN	32 25N 8W	44.5109	85.2898	1745745	2740833	10	3005	1.105
MICHIGAN	32 5N 15E	42.7933	82.7323	2460521	2114134	10	3009	1.23
MICHIGAN	24 17N 2W	43.8525	84.4969	1973301	2500865	10	3025	1.22
MICHIGAN	12 1S 7E	42.4211	83.5806	2267189	1978308	10	3038	1.26
MICHIGAN	30 1S 5W	42.3781	84.9348	1904064	1962616	10	3051	1.22
MICHIGAN	27 10N 2E	43.237	84.1889	2075898	2276052	10	3064	1.215
MICHIGAN	30 22N 10W	44.2676	85.5385	1687822	2652146	10	3074	1.205
MICHIGAN	22 14N 6W	43.5948	85.2352	1787385	2406623	10	3077	1.24
MICHIGAN	28 23N 6W	44.3535	85.2648	1756973	2683494	10	3081	1.2
MICHIGAN	30 15N 3W	43.6664	84.7116	1923361	2432752	10	3097	1.23
MICHIGAN	18 18N 2E	43.9527	84.2453	2036534	2537231	10	3100	1.215
MICHIGAN	23 21N 11W	44.196	85.5788	1679803	2626018	10	3110	1.205
MICHIGAN	2 9N 6W	43.2084	84.9797	1886740	2265815	10	3140	1.21
MICHIGAN	17 3N 11W	42.6644	85.6024	1716349	2067095	10	3153	1.24
MICHIGAN	30 20N 2W	44.0959	84.5965	1939671	2589488	10	3182	1.22
MICHIGAN	12 8N 4E	43.1082	83.9214	2151472	2229050	10	3205	1.25
MICHIGAN	8 1S 5W	42.4211	84.9157	1907900	1978308	10	3212	1.26
MICHIGAN	14 34N 3E	45.3269	84.0426	2040769	3038714	10	3215	1.27
MICHIGAN	22 29N 4W	44.8831	84.7791	1866482	2876759	10	3219	1.1
MICHIGAN	25 12N 5E	43.4088	83.8032	2172165	2338747	10	3228	1.22
MICHIGAN	6 1S 8E	42.4354	83.5615	2271809	1983526	10	3238	1.26
MICHIGAN	9 17N 15W	43.8811	86.079	1557081	2511102	10	3264	1.25
MICHIGAN	27 13N 4W	43.4947	84.7697	1913491	2370094	10	3287	1.245
MICHIGAN	30 25N 7W	44.5253	85.1911	1770870	2746188	10	3346	1.105
MICHIGAN	21 12N 8W	43.4231	85.3654	1758009	2343965	10	3346	1.24
MICHIGAN	1 3N 11E	42.6931	83.1228	2379949	2077568	10	3366	1.23
MICHIGAN	31 14N 8E	43.5662	83.5478	2233955	2396186	10	3392	1.275
MICHIGAN	17 13N 1W	43.5233	84.4584	1994611	2380531	10	3406	1.225
MICHIGAN	31 24N 9W	44.4251	85.4218	1713941	2709622	10	3419	1.15
MICHIGAN	3 19N 5W	44.0672	84.8891	1863965	2579015	10	3422	1.215
MICHIGAN	5 1S 7E	42.4354	83.6569	2246147	1983526	10	3442	1.26
MICHIGAN	22 17N 12W	43.8525	85.7084	1655289	2500865	10	3445	1.22
MICHIGAN	2 19N 5W	44.0672	84.8696	1869073	2579015	10	3445	1.215
MICHIGAN	2 12N 18W	43.466	86.3683	1491317	2359621	10	3520	1.3
MICHIGAN	22 14N 6E	43.5948	83.7224	2186806	2406623	10	3524	1.26
MICHIGAN	34 12N 6W	43.3944	84.9989	1855947	2333492	10	3530	1.22
MICHIGAN	5 16N 17W	43.8096	86.3214	1495153	2485010	10	3537	1.3
MICHIGAN	3 33N 3E	45.2696	84.0625	2037730	3017804	10	3560	1.3
MICHIGAN	27 13N 4W	43.4947	84.7697	1913491	2370094	10	3586	1.22
MICHIGAN	10 10N 4E	43.2799	83.9575	2135842	2291706	10	3596	1.265
MICHIGAN	13 13N 1E	43.5233	84.2655	2045864	2380531	10	3622	1.225
MICHIGAN	6 33N 4E	45.2696	84.0026	2053095	3017804	10	3638	1.3
MICHIGAN	28 21N 3W	44.1817	84.6782	1916016	2620799	10	3642	1.215

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	17 1N 7E	42.4926	83.6569	2244093	2004400	10	3665	1.23
MICHIGAN	12 31N 8E	45.0835	83.4291	2207399	2949891	10	3671	1.3
MICHIGAN	17 33N 2E	45.241	84.2223	1997744	3007367	10	3684	1.305
MICHIGAN	26 18N 8W	43.9241	85.2207	1781387	2526794	10	3720	1.2
MICHIGAN	13 15N 1W	43.695	84.3818	2009374	2443189	10	3727	1.24
MICHIGAN	1 21N 2E	44.239	84.1485	2052492	2641709	10	3743	1.25
MICHIGAN	2 1N 4W	42.5213	84.7441	1950958	2014874	10	3753	1.26
MICHIGAN	4 2N 7W	42.6072	85.1256	1845894	2046221	10	3780	1.26
MICHIGAN	9 22N 10W	44.3106	85.5003	1696814	2667838	10	3789	1.15
MICHIGAN	11 19N 4E	44.0529	83.9332	2114855	2573796	10	3802	1.26
MICHIGAN	2 13N 18W	43.5519	86.3796	1486208	2390968	10	3816	1.29
MICHIGAN	10 13N 9E	43.5376	83.3733	2281119	2385749	10	3819	1.29
MICHIGAN	28 2N 3E	42.5499	84.0956	2124231	2025311	10	3822	1.26
MICHIGAN	35 1N 1W	42.4497	84.4008	2045545	1988745	10	3862	1.26
MICHIGAN	2 21N 6W	44.239	84.9902	1832135	2641709	10	3862	1.205
MICHIGAN	36 18N 5W	43.9098	84.8501	1879161	2521575	10	3871	1.219
MICHIGAN	8 1S 1E	42.4211	84.3435	2061901	1978308	10	3878	1.26
MICHIGAN	24 15N 18W	43.6807	86.3602	1488144	2437970	10	3891	1.3
MICHIGAN	36 4N 10E	42.7074	83.2373	2348738	2082787	10	3898	1.23
MICHIGAN	8 27N 6W	44.74	85.053	1800192	2824538	10	3914	1.225
MICHIGAN	12 3N 3E	42.6787	84.0364	2135167	2072313	10	3927	1.25
MICHIGAN	23 2N 3E	42.5842	84.0574	2134000	2030529	10	3937	1.26
MICHIGAN	8 21N 16W	44.2247	86.2262	1509599	2636491	10	3970	1.29
MICHIGAN	22 2N 3W	42.5842	84.6487	1975235	2030529	10	3986	1.26
MICHIGAN	14 3N 8W	42.6844	85.2018	1823766	2067095	10	3993	1.3
MICHIGAN	32 2N 5E	42.5356	83.8858	2181070	2020092	10	4012	1.26
MICHIGAN	20 22N 16W	44.2819	86.2262	1508131	2657365	10	4012	1.29
MICHIGAN	3 14N 5E	43.6378	83.8387	2154564	2422315	10	4042	1.27
MICHIGAN	16 26N 5W	44.6398	84.9148	1839162	2787972	10	4121	1.225
MICHIGAN	14 19N 4E	44.0366	83.9332	2115366	2568578	10	4154	1.266
MICHIGAN	28 23N 5E	44.3535	83.8522	2125183	2683494	10	4163	1.26
MICHIGAN	6 18N 17W	43.9813	86.3521	1482790	2547668	10	4167	1.3
MICHIGAN	12 2N 1E	42.5928	84.2673	2076691	2040968	10	4177	1.26
MICHIGAN	29 24N 1W	44.4394	84.4604	1963785	2714841	10	4193	1.26
MICHIGAN	21 15N 16W	43.6807	86.1856	1534196	2437970	10	4206	1.3
MICHIGAN	29 25N 3E	44.5253	84.1057	2053074	2746188	10	4216	1.25
MICHIGAN	26 18N 3E	43.9241	84.0503	2068711	2526794	10	4229	1.27
MICHIGAN	15 13N 1W	43.5233	84.4206	2004867	2380531	10	4285	1.295
MICHIGAN	15 23N 15W	44.3821	86.0693	1546450	2693931	10	4327	1.29
MICHIGAN	29 29N 9E	44.8688	83.4291	2215687	2871541	10	4341	1.23
MICHIGAN	11 24N 5W	44.4823	84.8724	1855180	2730496	10	4396	1.2
MICHIGAN	22 3N 6E	42.6501	83.7332	2217974	2061676	10	4400	1.25
MICHIGAN	31 19N 17W	43.9956	86.3521	1482432	2552866	10	4413	1.29
MICHIGAN	28 24N 4W	44.4394	84.794	1876952	2714841	10	4429	1.25
MICHIGAN	26 25N 2W	44.5253	84.5201	1945378	2746188	10	4452	1.25

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	32 20N 17W	44.0815	86.3328	1485393	2584233	10	4472	1.3
MICHIGAN	36 24N 15W	44.4251	86.03	1555549	2709622	10	4482	1.29
MICHIGAN	36 18N 1W	43.9098	84.3819	2002131	2521575	10	4511	1.288
MICHIGAN	12 17N 8W	43.8811	85.2012	1787800	2511102	10	4528	1.28
MICHIGAN	4 22N 15W	44.3249	86.0889	1542848	2673057	10	4531	1.29
MICHIGAN	31 24N 14W	44.4251	86.0104	1580654	2709622	10	4610	1.3
MICHIGAN	30 18N 10W	43.9241	85.5328	1699420	2526784	10	4642	1.28
MICHIGAN	4 31N 1W	45.0978	84.4416	1946349	2955109	10	4649	1.3
MICHIGAN	5 23N 14W	44.4108	85.9908	1566142	2704404	10	4656	1.3
MICHIGAN	20 24N 9W	44.4537	85.4022	1718203	2720059	10	4659	1.245
MICHIGAN	30 15N 3W	43.6684	84.7116	1923361	2432752	10	4705	1.298
MICHIGAN	28 29N 9E	44.8688	83.4291	2215687	2871541	10	4728	1.3
MICHIGAN	22 3N 2E	42.6501	84.191	2095236	2061876	10	4738	1.25
MICHIGAN	18 17N 4W	43.8668	84.8305	1885671	2505883	10	4744	1.285
MICHIGAN	10 18N 2W	43.967	84.5379	1959273	2542449	10	4810	1.27
MICHIGAN	21 31N 4E	45.0549	83.9651	2070508	2939454	10	4820	1.3
MICHIGAN	12 14N 3W	43.6235	84.6146	1950335	2417097	10	4823	1.28
MICHIGAN	29 32N 1E	45.1265	84.3423	1970908	2965583	10	4859	1.3
MICHIGAN	18 19N 4E	44.0386	84.0113	2094902	2568578	10	4882	1.283
MICHIGAN	28 15N 4W	43.6664	84.7891	1902922	2432752	10	4915	1.296
MICHIGAN	7 17N 7W	43.8811	85.1817	1792824	2511102	10	4928	1.27
MICHIGAN	23 21N 11W	44.196	85.5788	1679603	2626018	10	4948	1.27
MICHIGAN	28 31N 1W	45.0406	84.4416	1948299	2934235	10	4954	1.3
MICHIGAN	8 22N 4W	44.3106	84.8136	1875975	2667838	10	4957	1.25
MICHIGAN	21 22N 6W	44.2819	85.0294	1820566	2657365	10	4964	1.25
MICHIGAN	12 15N 2E	43.7094	84.1491	2070208	2448444	10	4964	1.28
MICHIGAN	30 12N 11W	43.4088	85.6354	1686900	2338747	10	4987	1.3
MICHIGAN	29 20N 6W	44.0959	85.0451	1822213	2589488	10	5030	1.27
MICHIGAN	10 18N 2W	43.967	84.5379	1959273	2542449	10	5062	1.27
MICHIGAN	26 16N 5W	43.7523	84.8867	1879759	2484099	10	5069	1.295
MICHIGAN	27 22N 5E	44.2676	83.8326	2133424	2652146	10	5144	1.28
MICHIGAN	15 30N 3E	44.9833	84.0644	2047501	2913325	10	5217	1.3
MICHIGAN	22 21N 7W	44.196	85.1275	1797584	2626018	10	5240	1.25
MICHIGAN	5 14N 14W	43.6378	85.9723	1591590	2422315	10	5279	1.3
MICHIGAN	31 24N 13W	44.4251	85.8927	1591308	2709622	10	5282	1.3
MICHIGAN	25 15N 15W	43.6664	86.0111	1580597	2432752	10	5315	1.29
MICHIGAN	3 25N 12W	44.5825	85.724	1630831	2767062	10	5367	1.3
MICHIGAN	1 23N 14W	44.4108	85.9123	1586581	2704404	10	5486	1.3
MICHIGAN	27 30N 7W	44.9547	85.1364	1771972	2902868	10	5495	1.3
MICHIGAN	5 29N 5E	44.9261	83.8659	2100769	2892451	10	5564	1.29
MICHIGAN	31 20N 2W	44.0815	84.5985	1940144	2584233	10	5604	1.27
MICHIGAN	5 30N 2W	45.0119	84.5806	1913454	2923762	10	5617	1.3
MICHIGAN	26 8N 2W	43.0652	84.516	1994830	2213358	10	5648	1.275
MICHIGAN	34 30N 2W	44.9404	84.5409	1926088	2897670	10	5751	1.3
MICHIGAN	9 30N 2W	44.9976	84.5607	1919062	2918543	10	5768	1.3

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	6 30N 1W	45.0119	84.4813	1939045	2923762	10	5856	1.305
MICHIGAN	12 24N 13W	44.4823	85.7946	1615273	2730496	10	5869	1.29
MICHIGAN	5 28N 7W	44.8402	85.1714	1766457	2861104	10	5879	1.3
MICHIGAN	29 25N 12W	44.5253	85.7635	1622167	2746188	10	5899	1.3
MICHIGAN	10 26N 10W	44.6541	85.4872	1690245	2793191	10	5961	1.29
MICHIGAN	30 30N 1E	44.9547	84.3622	1971706	2902888	10	5981	1.3
MICHIGAN	24 29N 7W	44.8831	85.0967	1784439	2876759	10	6079	1.3
MICHIGAN	20 27N 9W	44.7113	85.4082	1709048	2814065	10	6106	1.3
MICHIGAN	31 30N 1W	44.9404	84.4813	1941466	2897670	10	6125	1.3
MICHIGAN	35 30N 3W	44.9404	84.6401	1900490	2897670	10	6135	1.3
MICHIGAN	11 29N 4W	44.8118	84.7592	1870688	2887233	10	6181	1.3
MICHIGAN	1 24N 12W	44.4966	85.6769	1645491	2735715	10	6283	1.3
MICHIGAN	2 26N 9W	44.6684	85.349	1725666	2798409	10	6352	1.3
MICHIGAN	32 29N 4W	44.8545	84.8188	1857150	2866322	10	6417	1.3
MICHIGAN	34 30N 1E	44.9404	84.3026	1987576	2897670	10	6427	1.3
MICHIGAN	8 28N 6W	44.8259	85.053	1797513	2855885	10	6496	1.3
MICHIGAN	2 29N 3W	44.9261	84.6401	1900964	2892451	10	6512	1.3
MICHIGAN	26 14N 11W	43.5805	85.565	1700704	2401405	10	6526	1.3
MICHIGAN	13 25N 11W	44.5539	85.5661	1672664	2756625	10	6526	1.29
MICHIGAN	22 27N 8W	44.7113	85.2504	1749937	2814065	10	6552	1.3
MICHIGAN	22 27N 8W	44.7113	85.2504	1749937	2814065	10	6660	1.29
MICHIGAN	1 14N 11W	43.6378	85.5456	1704204	2422315	10	6673	1.3
MICHIGAN	22 29N 1E	44.8831	84.3026	1989560	2876759	10	6785	1.3
MICHIGAN	31 14N 8E	43.5662	83.5478	2233955	2396186	10	6841	1.3
MICHIGAN	13 28N 4W	44.8115	84.7372	1879642	2850630	10	6864	1.3
MICHIGAN	9 27N 6W	44.74	85.0333	1805293	2824538	10	7057	1.29
MICHIGAN	19 15N 9W	43.6807	85.4098	1738798	2437970	10	7169	1.3
MICHIGAN	19 15N 9W	43.6807	85.4098	1738798	2437970	10	7195	1.3
MICHIGAN	28 16N 10W	43.7523	85.4874	1716281	2464099	10	7280	1.3
MICHIGAN	14 16N 10W	43.7809	85.4486	1725675	2474536	10	7441	1.3
MICHIGAN	32 14N 8E	43.5662	83.5284	2239078	2396186	10	7451	1.3
MICHIGAN	28 14N 8E	43.5805	83.509	2243668	2401405	10	7516	1.3
MICHIGAN	12 25N 2E	44.5662	84.1452	2041303	2761844	10	7733	1.3
MICHIGAN	7 17N 9W	43.8811	85.4157	1731425	2511102	10	7772	1.3
MICHIGAN	2 14N 4E	43.6378	83.9357	2128976	2422315	10	7851	1.3
MICHIGAN	12 15N 7W	43.7094	85.0801	1824864	2448444	10	7890	1.3
MICHIGAN	35 22N 6W	44.2533	84.9902	1831690	2646928	10	7972	1.3
MICHIGAN	31 17N 8W	43.8239	85.2987	1763867	2490228	10	8163	1.29
MICHIGAN	12 20N 6W	44.1368	84.9671	1841299	2605144	10	8402	1.3
MICHIGAN	31 20N 6W	44.0815	85.0646	1817549	2584233	10	8698	1.3
MICHIGAN	1 19N 4W	44.0672	84.733	1904857	2579015	10	8907	1.3
MICHIGAN	2 31N 9W	45.0978	85.3151	1721552	2955109	11	128	1.002
MICHIGAN	34 30N 8E	44.9404	83.4688	2202685	2897670	11	141	1
MICHIGAN	2 8S 5E	41.8342	83.8315	2220173	1764132	11	148	1
MICHIGAN	27 31N 4E	45.0406	83.9453	2076126	2934235	11	203	1

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	19 3S 7E	42.2207	83.676	2248678	1905176	11	233	1
MICHIGAN	26 32N 2E	45.1265	84.1637	2016840	2965583	11	551	1
MICHIGAN	30 1N 7E	42.464	83.676	2239985	1993963	11	830	1.002
MICHIGAN	19 29N 6W	44.8831	85.0769	1789554	2878759	11	1299	1.15
MICHIGAN	25 30N 2W	44.9547	84.5012	1935849	2902868	11	1434	1.15
MICHIGAN	31 3S 2E	42.1921	84.2482	2095161	1894740	11	1552	1.15
MICHIGAN	21 26N 9W	44.6255	85.3885	1716693	2782754	11	1588	1.15
MICHIGAN	11 27N 7W	44.74	85.1122	1784860	2824538	11	1696	1.15
MICHIGAN	1 1S 2E	42.4354	84.1528	2112738	1983526	11	1752	1.15
MICHIGAN	19 24N 1E	44.4537	84.3623	1988831	2720059	11	1946	1.2
MICHIGAN	28 6N 16E	42.8935	82.5981	2512319	2150700	12	138	1
MICHIGAN	14 4S 5E	42.1491	83.8288	2209989	1879048	12	157	1
MICHIGAN	1 7S 4E	41.9201	83.9264	2191448	1795479	12	161	1
MICHIGAN	5 1N 10E	42.5213	83.3136	2335280	2014874	12	171	1
MICHIGAN	25 2N 5E	42.5499	83.8095	2201058	2025311	12	187	1
MICHIGAN	13 10N 16E	43.2656	82.5303	2515078	2286489	12	207	1
MICHIGAN	6 2S 8E	42.3495	83.5615	2274824	1952179	12	210	1
MICHIGAN	12 26N 9E	44.6541	83.3163	2253185	2793191	12	210	1
MICHIGAN	22 4N 15E	42.736	82.7032	2490607	2093224	12	217	1
MICHIGAN	13 32N 8W	45.1551	85.2159	1745329	2976019	12	220	1
MICHIGAN	19 4N 16E	42.736	82.646	2505915	2093224	12	220	1
MICHIGAN	28 7N 14E	42.9793	82.8282	2447479	2182010	12	220	1
MICHIGAN	28 3S 6E	42.2064	83.7523	2228587	1899958	12	243	1
MICHIGAN	23 7S 12E	41.8771	85.6526	1724304	1779787	12	413	1.2
MICHIGAN	24 31N 9W	45.0549	85.3151	1722846	2939454	12	443	1.02
MICHIGAN	17 4N 3E	42.7503	84.1147	2112279	2098442	12	600	1.22
MICHIGAN	26 4N 9E	42.7217	83.3708	2312453	2088005	12	1017	1.02
MICHIGAN	11 5N 14W	42.8505	85.8969	1632463	2135008	12	1024	1.2
MICHIGAN	7 10N 15W	43.2799	86.0983	1567591	2291708	12	1043	1.2
MICHIGAN	21 18N 13E	43.9384	82.9189	2385120	2532012	12	1066	1.15
MICHIGAN	19 11N 15W	43.3372	86.0983	1566113	2312618	12	1115	1.2
MICHIGAN	10 10N 15W	43.2799	86.0404	1582963	2291708	12	1138	1.2
MICHIGAN	27 7N 13W	42.9793	85.801	1654639	2182010	12	1142	1.2
MICHIGAN	32 7N 12W	42.965	85.7243	1675492	2176792	12	1148	1.2
MICHIGAN	10 20N 4E	44.1388	83.9527	2106682	2605144	12	1148	1.2
MICHIGAN	17 14N 14E	43.6091	82.8302	2421706	2411842	12	1165	1.1
MICHIGAN	8 9N 14W	43.194	85.9633	1605696	2260360	12	1207	1.2
MICHIGAN	11 8N 14W	43.1082	85.8969	1625632	2229050	12	1237	1.2
MICHIGAN	25 14N 16W	43.5805	86.1274	1552133	2401405	12	1316	1.2
MICHIGAN	29 9N 12E	43.1511	83.0703	2376281	2244705	12	1375	1.1
MICHIGAN	12 22N 3E	44.3106	84.0288	2080689	2687838	12	1463	1.2
MICHIGAN	20 9N 10E	43.1654	83.3016	2314171	2249923	12	1470	1.15
MICHIGAN	8 19N 4E	44.0529	83.9917	2099531	2573796	12	1486	1.202
MICHIGAN	27 9N 9E	43.1511	83.3789	2294214	2244705	12	1506	1.15
MICHIGAN	8 8N 7E	43.1082	83.6529	2222920	2229050	12	1578	1.19

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	32 10N 7E	43.2227	83.6489	2219815	2270834	12	1604	1.15
MICHIGAN	4 19N 3E	44.0672	84.0893	2073461	2579015	12	1611	1.2
MICHIGAN	21 22N 8E	44.2819	83.499	2219947	2657365	12	1640	1.18
MICHIGAN	6 19N 5E	44.0529	83.8747	2130180	2573796	12	1680	1.2
MICHIGAN	14 7N 3E	43.008	84.0557	2119195	2192484	12	1686	1.2
MICHIGAN	17 12N 5E	43.4374	83.8803	2150733	2349184	12	1834	1.22
MICHIGAN	10 15N 4E	43.7084	83.9551	2121324	2448444	12	1900	1.22
MICHIGAN	30 16N 3E	43.7523	84.1297	2073833	2464099	12	2041	1.22
MICHIGAN	5 13N 5E	43.5519	83.8775	2147395	2390968	12	2169	1.22
MICHIGAN	8 14N 3E	43.6235	84.1103	2083413	2417097	12	2392	1.22
MICHIGAN	34 15N 2E	43.6521	84.1879	2061954	2427534	12	2441	1.22
MICHIGAN	23 20N 5E	44.1101	83.8162	2143429	2594670	13	66	1
MICHIGAN	1 4S 7W	42.1777	85.0683	1874060	1889485	13	79	1
MICHIGAN	34 12N 14E	43.3944	82.8003	2438260	2333492	13	85	1
MICHIGAN	18 32N 5W	45.1551	84.9578	1811688	2976019	13	92	1
MICHIGAN	24 6S 7W	41.963	85.0648	1881417	1811135	13	95	1
MICHIGAN	31 18N 5E	43.9088	83.8942	2130204	2521575	13	105	1
MICHIGAN	12 6N 12W	42.9364	85.6476	1696749	2166355	13	108	1
MICHIGAN	32 11N 14E	43.3086	82.8369	2431479	2302181	13	108	1
MICHIGAN	12 16N 4E	43.7952	83.9163	2128491	2478755	13	112	1
MICHIGAN	17 16N 15W	43.7809	86.0887	1557145	2474536	13	118	1
MICHIGAN	28 2N 2W	42.5489	84.5534	2001283	2025311	13	118	1
MICHIGAN	36 3N 5W	42.6215	84.8394	1922257	2051439	13	121	1
MICHIGAN	25 19N 12E	43.967	82.9774	2368629	2542449	13	125	1
MICHIGAN	13 3S 8W	42.235	85.1828	1841449	1910395	13	125	1
MICHIGAN	33 14N 6E	43.5662	83.7418	2182723	2396186	13	125	1
MICHIGAN	20 6S 7W	41.963	85.1405	1860839	1811135	13	131	1
MICHIGAN	18 6N 6E	42.9221	83.7872	2193827	2161137	13	131	1
MICHIGAN	32 1S 7W	42.3638	85.1448	1847975	1957398	13	131	1
MICHIGAN	25 10N 13E	43.237	82.8774	2424124	2276052	13	135	1
MICHIGAN	24 1N 2E	42.4783	84.1528	2111289	1999182	13	135	1
MICHIGAN	27 7S 2W	41.8628	84.5334	2028616	1774569	13	135	1
MICHIGAN	32 5N 13W	42.7833	85.8393	1649389	2114134	13	141	1
MICHIGAN	6 1N 4W	42.5213	84.8204	1930455	2014874	13	141	1
MICHIGAN	10 3N 3W	42.6787	84.8487	1971603	2072313	13	141	1
MICHIGAN	18 12N 13E	43.4374	82.9739	2390595	2349184	13	141	1
MICHIGAN	2 5N 14W	42.8648	85.8969	1632085	2140226	13	144	1
MICHIGAN	22 6S 6E	41.963	83.7367	2241389	1811135	13	148	1
MICHIGAN	6 6S 19W	42.006	86.4114	1515182	1826827	13	148	1
MICHIGAN	14 31N 8W	45.0892	85.2357	1742861	2944672	13	151	1
MICHIGAN	21 5N 3W	42.8219	84.6694	1961514	2124571	13	151	1
MICHIGAN	21 10N 6E	43.2513	83.7453	2193182	2281271	13	154	1
MICHIGAN	22 28N 6W	44.7972	85.0135	1808628	2845412	13	157	1
MICHIGAN	2 4S 8W	42.1777	85.2018	1837987	1889485	13	157	1
MICHIGAN	11 8N 12E	43.1082	83.02	2391311	2229050	13	157	1

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	1 3N 5W	42.6931	84.8394	1920043	2077568	13	161	1
MICHIGAN	12 18N 2W	43.867	84.4989	1969506	2542449	13	164	1
MICHIGAN	13 14N 4E	43.6091	83.9163	2135114	2411842	13	164	1
MICHIGAN	2 6N 13W	42.9507	85.7818	1660534	2171573	13	171	1
MICHIGAN	27 10N 14E	43.237	82.8003	2444591	2276052	13	171	1
MICHIGAN	23 6N 11E	42.9078	83.1351	2368413	2155918	13	177	1
MICHIGAN	18 13N 6E	43.5233	83.7806	2174024	2380531	13	177	1
MICHIGAN	6 6S 19W	42.006	86.4114	1515182	1826827	13	177	1.05
MICHIGAN	18 6S 1W	41.9773	84.4765	2040399	1816353	13	180	1
MICHIGAN	2 9N 3E	43.2084	84.0539	2112741	2265615	13	180	1
MICHIGAN	15 9N 1W	43.1797	84.4204	2018311	2255142	13	180	1
MICHIGAN	24 1S 7E	42.3924	83.5806	2268228	1967835	13	187	1
MICHIGAN	26 1N 1E	42.464	84.2663	2075871	1993963	13	190	1
MICHIGAN	12 8N 2W	43.1082	84.4968	1998339	2229050	13	190	1
MICHIGAN	31 1S 12W	42.3638	85.7359	1688657	1957398	13	190	1
MICHIGAN	34 2S 1W	42.2779	84.4198	2046026	1926050	13	190	1
MICHIGAN	13 23N 15W	44.3821	86.03	1556693	2693931	13	194	1
MICHIGAN	24 22N 8E	44.2819	83.4402	2235288	2657365	13	194	1
MICHIGAN	8 2S 5W	42.3352	84.9157	1910513	1946961	13	197	1
MICHIGAN	11 16N 11W	43.7852	85.565	1694624	2479755	13	197	1
MICHIGAN	20 16N 11E	43.7666	83.1793	2323484	2469318	13	203	1.05
MICHIGAN	24 17N 15W	43.8525	86.0205	1573214	2500665	13	207	1
MICHIGAN	28 4N 11W	42.7217	85.5833	1719882	2088005	13	207	1
MICHIGAN	9 5N 10W	42.8505	85.475	1745259	2135008	13	207	1
MICHIGAN	35 3S 3W	42.1921	84.6296	1992142	1894740	13	210	1
MICHIGAN	14 4S 14W	42.1491	85.8885	1653159	1879048	13	217	1.1
MICHIGAN	9 4N 14W	42.7648	85.9267	1626754	2103660	13	217	1
MICHIGAN	22 9N 10E	43.1654	83.2632	2324431	2249823	13	217	1
MICHIGAN	20 12N 12W	43.4231	85.7318	1660869	2343865	13	217	1
MICHIGAN	4 6N 2W	42.9507	84.5544	1988107	2171573	13	220	1
MICHIGAN	11 24N 5E	44.4823	83.8129	2130732	2730496	13	220	1
MICHIGAN	17 6N 15W	42.9221	86.0695	1584474	2161137	13	223	1
MICHIGAN	17 19N 6E	44.0386	83.7577	2161350	2568578	13	226	1
MICHIGAN	2 11N 15E	43.3801	82.6653	2474587	2328273	13	230	1
MICHIGAN	23 14N 13E	43.5948	82.8884	2406924	2406623	13	230	1
MICHIGAN	24 14N 3E	43.5948	84.0327	2104894	2406623	13	230	1
MICHIGAN	8 11N 11E	43.3658	83.186	2337236	2323055	13	233	1
MICHIGAN	36 7N 9E	42.965	83.3461	2309942	2176792	13	233	1
MICHIGAN	23 7N 2E	42.9936	84.1708	2089004	2187229	13	240	1
MICHIGAN	1 10N 16W	43.2942	86.1176	1562099	2296926	13	240	1
MICHIGAN	1 26N 2W	44.6684	84.5004	1945697	2798409	13	240	1
MICHIGAN	24 8N 5W	43.0795	84.842	1907353	2218576	13	243	1
MICHIGAN	14 12N 3E	43.4374	84.0539	2104785	2349184	13	246	1
MICHIGAN	19 11N 5E	43.3372	83.6996	2149178	2312618	13	246	1
MICHIGAN	31 9N 14W	43.1368	85.9826	1602065	2239486	13	248	1.05

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	1 32N 2W	45.1837	84.5012	1928103	2986456	13	249	1
MICHIGAN	32 12N 6E	43.3944	83.7646	2182905	2333492	13	249	1
MICHIGAN	26 9N 2W	43.1511	84.5168	1991617	2244705	13	253	1
MICHIGAN	24 9N 11W	43.1654	85.539	1719307	2249823	13	253	1
MICHIGAN	12 30N 6E	44.9976	83.6673	2149334	2918543	13	256	1
MICHIGAN	36 20N 1W	44.0615	84.3819	1996342	2584233	13	256	1
MICHIGAN	2 5S 2E	42.0919	84.173	2118825	1858174	13	256	1
MICHIGAN	14 6N 7E	42.9221	83.5954	2245019	2161137	13	256	1
MICHIGAN	3 9N 6E	43.2084	83.7261	2199828	2265815	13	259	1
MICHIGAN	10 20N 6E	44.1388	83.7187	2167889	2605144	13	259	1
MICHIGAN	7 7N 7E	43.0223	83.6721	2220923	2197702	13	259	1
MICHIGAN	7 9N 12W	43.194	85.7511	1662114	2260360	13	259	1
MICHIGAN	25 3N 9E	42.6358	83.3517	2320776	2056658	13	262	1
MICHIGAN	25 7N 7E	42.9793	83.5762	2248051	2182010	13	266	1
MICHIGAN	6 6N 15W	43.1225	86.0887	1574197	2234268	13	269	1
MICHIGAN	24 3N 12W	42.6501	85.6405	1706525	2061876	13	269	1
MICHIGAN	7 9N 1W	43.194	84.4782	2000477	2260360	13	269	1
MICHIGAN	1 12N 1W	43.466	84.3818	2017037	2359621	13	272	1
MICHIGAN	14 5S 17W	42.0832	86.2217	1565185	1847700	13	272	1.1
MICHIGAN	21 14N 7W	43.5948	85.1383	1812984	2406623	13	272	1
MICHIGAN	36 4N 16W	42.7074	86.0983	1582269	2082787	13	272	1
MICHIGAN	18 4S 4E	42.1491	84.0193	2158452	1879048	13	272	1
MICHIGAN	36 6N 7W	42.8791	85.0722	1852079	2145445	13	276	1
MICHIGAN	13 26N 1E	44.6398	84.2636	2008078	2767972	13	276	1
MICHIGAN	20 1S 4E	42.3924	84.0002	2155271	1967835	13	282	1
MICHIGAN	31 11N 2E	43.3088	84.2468	2058097	2302181	13	285	1
MICHIGAN	10 14N 2E	43.6235	84.1879	2062937	2417097	13	289	1
MICHIGAN	14 2N 4E	42.5785	83.943	2164217	2035748	13	299	1
MICHIGAN	30 5N 14W	42.8076	85.9736	1613076	2119352	13	299	1
MICHIGAN	3 5N 8E	42.8648	83.4995	2272727	2140226	13	299	1
MICHIGAN	2 13N 3W	43.5518	84.634	1947532	2390968	13	299	1
MICHIGAN	17 14N 11E	43.6091	83.1793	2329599	2411842	13	299	1.1
MICHIGAN	24 6N 13W	42.9078	85.7626	1666820	2155918	13	299	1
MICHIGAN	4 5N 6W	42.8648	85.0146	1867902	2140226	13	302	1
MICHIGAN	19 5N 5W	42.8219	84.9379	1889712	2124571	13	305	1
MICHIGAN	9 1N 7W	42.507	85.1256	1848862	2009655	13	308	1
MICHIGAN	1 6N 5W	43.1225	84.842	1906013	2234268	13	308	1
MICHIGAN	10 10N 15W	43.2789	86.0404	1582963	2291708	13	308	1
MICHIGAN	8 8N 9E	43.1082	83.4228	2284145	2229050	13	315	1
MICHIGAN	6 15N 1W	43.7237	84.4788	1982857	2453662	13	315	1
MICHIGAN	21 12N 12W	43.4231	85.7125	1686081	2343965	13	318	1
MICHIGAN	32 7N 12W	42.965	85.7243	1675492	2176792	13	318	1
MICHIGAN	10 14N 2W	43.6235	84.537	1970814	2417097	13	322	1
MICHIGAN	4 18N 4E	43.9813	83.9722	2107184	2547868	13	322	1.15
MICHIGAN	30 30N 4E	44.8547	84.0048	2063896	2902868	13	322	1

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	23 22N 1E	44.2819	84.2638	2015163	2657365	13	325	1
MICHIGAN	24 17N 2E	43.8525	84.1478	2065587	2500665	13	325	1
MICHIGAN	5 9N 12W	43.2084	85.7318	1666851	2265615	13	325	1
MICHIGAN	5 23N 3E	44.4108	84.1072	2056718	2704404	13	325	1
MICHIGAN	11 18N 4E	43.967	83.9332	2117823	2542449	13	328	1
MICHIGAN	4 15N 2W	43.7237	84.5564	1962412	2453662	13	328	1
MICHIGAN	24 10N 17W	43.2513	86.2333	1532467	2281271	13	331	1.05
MICHIGAN	12 6N 9W	42.9364	85.3023	1788832	2166355	13	335	1.01
MICHIGAN	34 26N 5E	44.5968	83.8294	2122260	2772280	13	335	1
MICHIGAN	25 19N 12E	43.967	82.9774	2368629	2542449	13	335	1
MICHIGAN	22 10N 10E	43.2513	83.2632	2321156	2281271	13	335	1.05
MICHIGAN	9 17N 1E	43.8811	84.3234	2018468	2511102	13	338	1
MICHIGAN	35 11N 8E	43.3086	83.4753	2262722	2302181	13	338	1.1
MICHIGAN	13 20N 1W	44.1245	84.3819	1994869	2599925	13	344	1
MICHIGAN	33 14N 8E	43.5662	83.509	2244201	2396186	13	351	1.05
MICHIGAN	25 20N 3W	44.0959	84.616	1934566	2589488	13	351	1
MICHIGAN	17 3S 3E	42.235	84.1147	2129770	1910395	13	351	1
MICHIGAN	12 6N 9W	42.9364	85.3023	1788832	2166355	13	351	1.05
MICHIGAN	21 15N 1E	43.6807	84.3236	2025197	2437970	13	361	1
MICHIGAN	18 7N 13W	43.008	85.8585	1638532	2182484	13	361	1
MICHIGAN	22 9N 5W	43.1654	84.8832	1893719	2249923	13	361	1
MICHIGAN	7 15N 1W	43.7094	84.4788	1983330	2448444	13	364	1
MICHIGAN	9 1S 16W	42.4211	86.1555	1574150	1978308	13	364	1.1
MICHIGAN	7 21N 9W	44.2247	85.4218	1719809	2636491	13	367	1
MICHIGAN	19 1S 12W	42.3924	85.7359	1687888	1987835	13	371	1.1
MICHIGAN	18 19N 2W	44.0368	84.5865	1941551	2568578	13	374	1
MICHIGAN	28 14N 6E	43.5805	83.7418	2182204	2401405	13	374	1.05
MICHIGAN	12 18N 8W	43.967	85.2012	1785218	2542449	13	374	1
MICHIGAN	11 21N 5E	44.2247	83.8129	2140127	2636491	13	381	1
MICHIGAN	30 22N 6W	44.2676	85.0686	1810775	2652148	13	397	1
MICHIGAN	22 27N 8W	44.7113	85.2504	1749937	2814065	13	397	1
MICHIGAN	22 12N 2W	43.4231	84.5361	1977615	2343965	13	397	1
MICHIGAN	36 7N 9E	42.965	83.3461	2309942	2176782	13	400	1.2
MICHIGAN	4 13N 3E	43.5519	84.0909	2091020	2390968	13	400	1
MICHIGAN	23 15N 3W	43.6807	84.634	1943362	2437970	13	400	1
MICHIGAN	34 9N 5W	43.1368	84.8832	1894606	2239486	13	404	1
MICHIGAN	5 6N 12W	42.9507	85.7243	1675882	2171573	13	404	1
MICHIGAN	7 12N 1W	43.4517	84.4782	1992003	2354402	13	407	1
MICHIGAN	33 3S 14W	42.1821	85.9267	1641714	1894740	13	410	1.1
MICHIGAN	14 14N 17W	43.6092	86.2632	1515532	2411878	13	410	1
MICHIGAN	13 28N 7E	44.8115	83.5531	2185835	2850630	13	417	1
MICHIGAN	24 1S 16W	42.3924	86.0983	1590278	1987835	13	417	1.1
MICHIGAN	2 9N 3W	43.2084	84.6325	1959004	2265615	13	417	1
MICHIGAN	6 17N 4W	43.8954	84.8305	1884766	2516320	13	417	1
MICHIGAN	14 11N 2E	43.3515	84.1696	2077106	2317636	13	420	1

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	11 3N 9W	42.6787	85.3163	1792652	2072313	13	420	1
MICHIGAN	36 22N 4E	44.2533	83.911	2113476	2646928	13	427	1
MICHIGAN	12 10N 5W	43.2799	84.8447	1900382	2291708	13	436	1
MICHIGAN	34 12N 2E	43.3944	84.1689	2070523	2333492	13	436	1
MICHIGAN	26 16N 4W	43.7523	84.7504	1910386	2484089	13	436	1
MICHIGAN	6 17N 4W	43.8954	84.8305	1884766	2516320	13	440	1
MICHIGAN	7 10N 3W	43.2799	84.7096	1936241	2291708	13	440	1
MICHIGAN	36 7N 13W	42.965	85.7626	1665272	2176792	13	446	1
MICHIGAN	4 19N 1E	44.0672	84.3234	2012147	2579015	13	449	1
MICHIGAN	18 11N 3E	43.3515	84.1311	2087311	2317836	13	449	1
MICHIGAN	3 5N 9W	42.8648	85.3407	1780749	2140226	13	453	1
MICHIGAN	16 30N 2W	44.9833	84.5607	1919542	2913325	13	456	1
MICHIGAN	13 10N 3W	43.2656	84.6132	1962288	2286489	13	459	1
MICHIGAN	36 16N 2E	43.738	84.1491	2069219	2458881	13	459	1
MICHIGAN	13 6S 14W	41.9773	85.8613	1665015	1816353	13	459	1.1
MICHIGAN	6 11N 2W	43.3801	84.5939	1963704	2328273	13	463	1
MICHIGAN	26 11N 11W	43.3229	85.5583	1709745	2307399	13	469	1
MICHIGAN	24 13N 17W	43.509	86.2438	1523187	2375312	13	486	1.02
MICHIGAN	10 7N 4W	43.0223	84.7653	1929578	2197702	13	486	1
MICHIGAN	24 12N 6W	43.4231	84.9604	1865262	2343965	13	489	1
MICHIGAN	29 20N 3E	44.0959	84.1088	2067350	2589488	13	489	1
MICHIGAN	14 22N 1E	44.2962	84.2838	2014672	2662583	13	492	1.05
MICHIGAN	31 12N 3E	43.3944	84.1311	2085833	2333492	13	495	1
MICHIGAN	2 12N 2E	43.466	84.1696	2073180	2359621	13	495	1
MICHIGAN	27 9N 12W	43.1511	85.6933	1678860	2244705	13	512	1.05
MICHIGAN	36 2N 14W	42.5358	85.8894	1648155	2020092	13	518	1.1
MICHIGAN	31 18N 3W	43.9098	84.7135	1915040	2521575	13	522	1
MICHIGAN	15 19N 14W	44.0386	85.9424	1588769	2568578	13	525	1.05
MICHIGAN	34 23N 16W	44.3392	86.187	1516883	2678275	13	538	1
MICHIGAN	5 3N 4W	42.8831	84.8013	1930253	2077568	13	545	1.002
MICHIGAN	22 12N 3W	43.4231	84.6518	1946979	2343965	13	545	1
MICHIGAN	27 18N 1E	43.9241	84.3039	2022129	2526794	13	551	1
MICHIGAN	5 24N 2W	44.4966	84.5781	1931255	2735715	13	551	1
MICHIGAN	29 21N 2E	44.1817	84.225	2033971	2620799	13	554	1.05
MICHIGAN	1 16N 11W	43.8096	85.5456	1699321	2485010	13	581	1
MICHIGAN	6 6N 8W	42.9507	85.2831	1793641	2171573	13	584	1.02
MICHIGAN	26 24N 15W	44.4394	86.0496	1550065	2714841	13	584	1
MICHIGAN	12 19N 2W	44.0529	84.4969	1966654	2573796	13	574	1
MICHIGAN	8 9N 12W	43.194	85.7318	1667245	2260360	13	577	1.05
MICHIGAN	16 25N 11W	44.5539	85.6253	1657281	2756825	13	577	1
MICHIGAN	6 4N 8W	42.7789	85.2781	1799980	2108879	13	581	1
MICHIGAN	12 13N 3W	43.5376	84.6146	1953122	2385749	13	594	1
MICHIGAN	35 17N 4W	43.8239	84.7525	1907545	2490228	13	604	1
MICHIGAN	23 15N 5W	43.6807	84.8667	1882008	2437970	13	604	1
MICHIGAN	12 8N 6W	43.1082	84.9571	1875821	2229050	13	623	1

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	19 23N 6W	44.3678	85.0686	1807883	2688712	13	636	1
MICHIGAN	24 10N 7W	43.2513	85.0761	1839825	2281271	13	643	1.05
MICHIGAN	21 14N 8W	43.5948	85.2546	1782272	2406623	13	646	1
MICHIGAN	13 24N 5W	44.468	84.8528	1860734	2725278	13	646	1.05
MICHIGAN	17 25N 4W	44.5539	84.8162	1887501	2756625	13	650	1.05
MICHIGAN	7 17N 2W	43.8811	84.5965	1946708	2511102	13	659	1
MICHIGAN	12 18N 1W	43.967	84.3819	2000204	2542449	13	666	1
MICHIGAN	27 14N 4W	43.5805	84.7697	1910769	2401405	13	668	1
MICHIGAN	15 21N 1E	44.2104	84.3034	2012495	2631273	13	669	1.05
MICHIGAN	17 1S 4W	42.4068	84.8013	1939133	1973089	13	669	1.1
MICHIGAN	14 21N 3E	44.2104	84.0484	2079121	2631273	13	673	1
MICHIGAN	3 10N 12W	43.2942	85.6933	1674722	2296926	13	676	1.05
MICHIGAN	5 17N 16W	43.8954	86.4496	1459310	2516320	13	679	1
MICHIGAN	27 21N 1E	44.1817	84.3034	2013476	2620799	13	699	1.1
MICHIGAN	15 12N 13W	43.4374	85.809	1640134	2349184	13	702	11.05
MICHIGAN	19 9N 1W	43.1654	84.4782	2001415	2249823	13	709	1.17
MICHIGAN	35 15N 6W	43.6521	84.9831	1852199	2427534	13	715	1
MICHIGAN	17 9N 10E	43.1797	83.3018	2313628	2255142	13	722	1.2
MICHIGAN	22 19N 6W	44.0243	85.0061	1834644	2563360	13	725	1
MICHIGAN	21 19N 4E	44.0243	83.9722	2105656	2563360	13	728	1.1
MICHIGAN	21 8N 4W	43.0795	84.7845	1922685	2218576	13	735	1.15
MICHIGAN	8 15N 6W	43.7237	85.0607	1829541	2453682	13	755	1
MICHIGAN	9 7N 2W	43.0223	84.5544	1985791	2197702	13	781	1.1
MICHIGAN	7 11N 11W	43.3658	85.6354	1688097	2323055	13	807	1.1
MICHIGAN	36 11N 3W	43.3086	84.6132	1960900	2302181	13	896	1.21
MICHIGAN	28 15N 11W	43.6684	85.6038	1688040	2432752	13	942	1.05
MICHIGAN	33 11N 4W	43.3086	84.7868	1914846	2302181	13	974	1.19
MICHIGAN	32 23N 5W	44.3392	84.9313	1844369	2678275	13	991	1.15
MICHIGAN	28 21N 9W	44.1817	85.3826	1731316	2620799	13	994	1
MICHIGAN	32 14N 10W	43.5662	85.5068	1716486	2396186	13	1086	1.15
MICHIGAN	28 22N 2W	44.2676	84.5585	1943946	2652146	13	1145	1.05
MICHIGAN	16 14N 2W	43.6091	84.5564	1966165	2411842	13	1158	1.23
MICHIGAN	11 18N 2W	43.967	84.5184	1964390	2542449	13	1184	1.09
MICHIGAN	23 22N 4E	44.2619	83.9307	2107306	2657365	13	1217	1.18
MICHIGAN	25 13N 10W	43.4947	85.4292	1739051	2370094	13	1217	1.05
MICHIGAN	8 11N 5W	43.3658	84.9218	1877259	2323055	13	1224	1.216
MICHIGAN	18 22N 4E	44.2962	84.0091	2086340	2662583	13	1263	1.183
MICHIGAN	20 14N 5W	43.5948	84.9249	1869334	2406623	13	1293	1.23
MICHIGAN	21 14N 2E	43.5948	84.2073	2056801	2406623	13	1299	1.23
MICHIGAN	26 16N 4W	43.7523	84.7504	1910386	2484099	13	1319	1.23
MICHIGAN	10 14N 6W	43.6235	85.0025	1847961	2417097	13	1332	1.24
MICHIGAN	13 21N 10W	44.2104	85.4414	1715104	2631273	13	1335	1.015
MICHIGAN	23 15N 8W	43.6807	85.2158	1789956	2437970	13	1358	1.23
MICHIGAN	13 15N 7W	43.695	85.0801	1825303	2443189	13	1365	1.23
MICHIGAN	22 21N 7W	44.198	85.1275	1797584	2626018	13	1414	1.17

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
MICHIGAN	19 20N 6W	44.1101	85.0646	1816670	2594670	13	1421	1.17
MICHIGAN	9 19N 3W	44.0529	84.6745	1920645	2573796	13	1447	1.175
MICHIGAN	4 17N 2W	43.8954	84.5574	1956512	2516320	13	1493	1.2
MICHIGAN	36 16N 5W	43.738	84.8473	1885318	2458881	13	1499	1.23
MICHIGAN	36 17N 9W	43.8239	85.3182	1758737	2490228	13	1526	1.2
MICHIGAN	3 16N 11W	43.8096	85.5844	1689111	2485010	13	1562	1.1
MICHIGAN	33 15N 6W	43.6521	85.0219	1841983	2427534	13	1608	1.23
KENTUCKY	BOYD	38.3353	82.6714	2669151	487279	3	7550	1.119
KENTUCKY	CARTER	38.1739	82.9469	2596139	428384	3	7980	1.125
KENTUCKY	JEFFERSON	38.2189	85.8408	1765546	444806	3	5708	1.14
KENTUCKY	LAWRENCE	38.2269	82.7444	2652226	447748	3	8543	1.099
KENTUCKY	GARRARD	37.6431	84.5836	2142487	234669	4	4406	1.197
KENTUCKY	GARRARD	37.7025	84.4839	2169540	256361	4	4431	1.198
KENTUCKY	GARRARD	37.7025	84.4839	2169540	256361	4	4605	1.021
KENTUCKY	GARRARD	37.6219	84.4856	2171416	226965	4	4872	1.111
KENTUCKY	GARRARD	37.7025	84.4839	2169540	256361	4	4992	1.189
KENTUCKY	BATH	38.2697	83.8356	2338401	463356	6		1.009
KENTUCKY	BATH	38.2042	83.8992	2322289	439433	6	1362	1.007
KENTUCKY	BOYD	38.2972	82.7622	2644573	473392	6	5138	1.195
KENTUCKY	BOYD	38.3383	82.6558	2673485	488395	6	6033	1.127
KENTUCKY	BOYD	38.3383	82.6558	2673485	488395	6	6080	1.151
KENTUCKY	BOYD	38.2972	82.7622	2644573	473392	6	6316	1.2
KENTUCKY	BOYD	38.3383	82.6558	2673485	488395	6	6425	1.143
KENTUCKY	BOYD	38.2972	82.7622	2644573	473392	6	7600	1.174
KENTUCKY	BOYD	38.2972	82.7622	2644573	473392	6	8711	1.071
KENTUCKY	CAMPBELL	38.9383	84.4408	2145046	707351	6	1500	1.008
KENTUCKY	CAMPBELL	39.0217	84.3300	2173916	737762	6	2400	1.008
KENTUCKY	CRITTENDEN	37.4361	88.2222	1094562	159858	6	6300	1.103
KENTUCKY	CRITTENDEN	37.4361	88.2222	1094562	159858	6	7978	1.151
KENTUCKY	FLEMING	38.4081	83.6831	2377501	513838	6	1845	1.018
KENTUCKY	HENRY	38.4350	84.9703	2008978	523671	6	1401	1.007
KENTUCKY	JEFFERSON	38.2189	85.8408	1765546	444806	6	1700	1.017
KENTUCKY	JEFFERSON	38.2294	85.7606	1788290	448658	6	1952	1.014
KENTUCKY	JEFFERSON	38.2192	85.8425	1765082	444907	6	2200	1.011
KENTUCKY	JEFFERSON	38.2189	85.8408	1765546	444806	6	2503	1.006
KENTUCKY	JEFFERSON	38.2150	85.8428	1765083	443387	6	2650	1.015
KENTUCKY	JEFFERSON	38.2192	85.8425	1765082	444907	6	2760	1.014
KENTUCKY	JEFFERSON	38.2189	85.8408	1765546	444806	6	2780	1.015
KENTUCKY	JEFFERSON	38.2150	85.8428	1765083	443387	6	2970	1.014
KENTUCKY	JEFFERSON	38.2189	85.8408	1765546	444806	6	3024	1.01
KENTUCKY	JEFFERSON	38.2189	85.8408	1765546	444806	6	3070	1.017
KENTUCKY	JEFFERSON	38.2150	85.8428	1765083	443387	6	3090	1.015
KENTUCKY	JEFFERSON	38.2150	85.8428	1765083	443387	6	3140	1.017
KENTUCKY	JEFFERSON	38.2189	85.8408	1765546	444806	6	3450	1.018

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
KENTUCKY	JEFFERSON	38.2189	85.8408	1765546	444806	6	3950	1.031
KENTUCKY	JEFFERSON	38.2189	85.8408	1765546	444806	6	4230	1.038
KENTUCKY	JEFFERSON	38.2150	85.8428	1765083	443387	6	4270	1.038
KENTUCKY	NELSON	37.7025	85.5817	1852799	256361	6	1498	1.018
KENTUCKY	OLDHAM	38.3736	85.3333	1906889	501268	6	1350	1.007
KENTUCKY	OWEN	38.4308	84.9139	2025202	522150	6		1.006
KENTUCKY	OWEN	38.4617	84.6756	2092387	533402	6		1.027
KENTUCKY	OWEN	38.5531	84.9586	2009013	566753	6	900	1.004
KENTUCKY	OWEN	38.5592	84.9794	2002901	568983	6	2284	1.008
KENTUCKY	SHELBY	38.2503	85.1381	1966063	456281	6	1300	1.008
KENTUCKY	SPENCER	38.0342	85.3861	1900647	377396	6	1390	1.01
KENTUCKY	SPENCER	38.0072	85.4244	1890331	367563	6	1402	1.006
KENTUCKY	SPENCER	38.0089	85.4764	1875362	368171	6	1628	1.012
KENTUCKY	CARTER	38.3272	83.1236	2540144	484340	7	3840	1.147
KENTUCKY	CARTER	38.3272	83.1236	2540144	484340	7	4784	1.2
KENTUCKY	ELLIOTT	38.1353	82.9611	2593454	414294	7	5081	1.172
KENTUCKY	ANDERSON	38.0494	84.9728	2018951	382971	8	734	1.019
KENTUCKY	ANDERSON	38.0342	84.9556	2024319	377396	8	790	1.009
KENTUCKY	BOYD	38.3383	82.6558	2673485	488395	8	5600	1.15
KENTUCKY	CARLISLE	36.8525	89.0917	849225	-53827	8	2500	1.007
KENTUCKY	CLARK	37.8706	84.0750	2282296	317690	8	1445	1.02
KENTUCKY	CLARK	37.9467	84.2161	2239362	345465	8	1562	1.002
KENTUCKY	CLARK	37.8631	84.0922	2277572	314953	8	1618	1.008
KENTUCKY	GRANT	38.7281	84.7858	2059085	629905	8		1.005
KENTUCKY	GREENUP	38.6394	83.0514	2549713	598278	8	3370	1.014
KENTUCKY	HARRISON	38.5467	84.4014	2168102	564421	8	135	1.016
KENTUCKY	OWEN	38.3658	84.8264	2052042	498430	8	785	1.004
KENTUCKY	PENDLETON	38.8103	84.3508	2174488	660620	8	2292	1.005
KENTUCKY	NICHOLAS	38.2200	83.9719	2300937	445211	9	85	1.012
KENTUCKY	BATH	38.0653	83.5281	2433235	388749	10	660	1.058
KENTUCKY	BOYD	38.4228	82.6697	2666396	519211	10	2725	1.192
KENTUCKY	CRITTENDEN	37.4361	88.2222	1094562	159858	10	1498	1.001
KENTUCKY	CRITTENDEN	37.4361	88.2222	1094562	159858	10	2453	1.01
KENTUCKY	ELLIOTT	38.1011	83.1614	2537223	401826	10	1282	1.022
KENTUCKY	GARRARD	37.5389	84.3672	2208056	196655	10	75	1.016
KENTUCKY	HARDIN	37.9894	85.9514	1739323	361075	10	431	1.01
KENTUCKY	HARDIN	37.7414	85.7736	1796467	270553	10	434	1.01
KENTUCKY	LAWRENCE	38.0500	82.7256	2664095	383174	10	2215	1.177
KENTUCKY	LAWRENCE	38.0656	82.7111	2667673	388850	10	2650	1.128
KENTUCKY	LAWRENCE	38.0494	82.7336	2661803	382971	10	2688	1.181
KENTUCKY	OHIO	37.4939	86.8686	1485559	180234	11	1810	1.092
KENTUCKY	LAWRENCE	38.1297	82.6544	2681575	412267	12	1875	1.134
KENTUCKY	BOYD	38.3736	82.7475	2645969	501268	13	557	1.043
KENTUCKY	BOYD	38.3686	82.7431	2647442	499444	13	653	1.013
KENTUCKY	BOYD	38.3383	82.6558	2673485	488395	13	1032	1.046

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
KENTUCKY	BUTLER	37.1206	86.8256	1505480	43994	13		1.015
KENTUCKY	BUTLER	37.1394	86.8083	1510112	50867	13		1.02
KENTUCKY	BUTLER	37.1592	86.8847	1493325	58084	13	500	1.018
KENTUCKY	BUTLER	37.0861	86.8847	1488947	31424	13	500	1.035
KENTUCKY	CRITTENDEN	37.3447	87.9847	1164814	125789	13	1050	1.04
KENTUCKY	DAVIESS	37.6550	87.3358	1347406	239027	13		1.042
KENTUCKY	DAVIESS	37.7669	87.2919	1357661	287178	13	314	1.015
KENTUCKY	DAVIESS	37.7144	87.3025	1355946	260720	13	485	1.01
KENTUCKY	DAVIESS	37.7106	86.8969	1473060	259301	13	595	1.02
KENTUCKY	DAVIESS	37.6356	87.1806	1388860	304917	13	965	1.018
KENTUCKY	DAVIESS	37.6272	87.1744	1390778	301876	13	1000	1.018
KENTUCKY	DAVIESS	37.6675	87.1464	1401865	243589	13	1172	1.017
KENTUCKY	DAVIESS	37.7022	87.3117	1353523	256260	13	1432	1.026
KENTUCKY	DAVIESS	37.6622	87.2481	1372624	241663	13	1478	1.033
KENTUCKY	DAVIESS	37.7181	87.0858	1418404	262038	13	1674	1.045
KENTUCKY	DAVIESS	37.7014	87.2900	1359783	255956	13	1730	1.03
KENTUCKY	DAVIESS	37.6358	87.2892	1357562	305018	13	1830	1.08
KENTUCKY	DAVIESS	37.6389	87.2867	1358226	306134	13	1835	1.062
KENTUCKY	DAVIESS	37.6800	87.2853	1361816	240852	13	1865	1.056
KENTUCKY	DAVIESS	37.6472	86.9439	1456815	309175	13	1880	1.065
KENTUCKY	ELLIOTT	38.0964	83.1217	2548781	400102	13	741	1.068
KENTUCKY	HANCOCK	37.9067	86.9447	1455400	330868	13	900	1.035
KENTUCKY	HENDERSON	37.7914	87.3433	1342764	288799	13		1.03
KENTUCKY	HENDERSON	37.7150	87.7022	1240577	260923	13	1500	1.02
KENTUCKY	HENDERSON	37.7958	87.7089	1237300	290421	13	1730	1.041
KENTUCKY	HENDERSON	37.6806	87.4583	1311572	248353	13	1966	1.047
KENTUCKY	HENDERSON	37.6542	87.4678	1305776	311709	13	2160	1.058
KENTUCKY	HENDERSON	37.7667	87.7411	1226495	279778	13	2640	1.09
KENTUCKY	HENDERSON	37.8639	87.8339	1200155	315257	13	2655	1.079
KENTUCKY	HOPKINS	37.3339	87.8250	1211316	121645	13	1615	1.045
KENTUCKY	HOPKINS	37.2197	87.6831	1254394	80183	13	1765	1.167
KENTUCKY	HOPKINS	37.2561	87.5814	1283310	93462	13	1800	1.048
KENTUCKY	HOPKINS	37.2611	87.5800	1283629	95287	13	1870	1.014
KENTUCKY	HOPKINS	37.2439	87.5722	1286181	89002	13	1896	1.045
KENTUCKY	HOPKINS	37.2428	87.5700	1286845	88596	13	2195	1.051
KENTUCKY	HOPKINS	37.2681	87.5675	1287139	97821	13	2210	1.055
KENTUCKY	HOPKINS	37.5372	87.3767	1337726	196047	13	2220	1.079
KENTUCKY	HOPKINS	37.3442	87.7764	1225250	125596	13	2295	1.059
KENTUCKY	HOPKINS	37.5000	87.3906	1334296	182464	13	2760	1.092
KENTUCKY	HOPKINS	37.5386	87.3708	1339391	196554	13	2806	1.064
KENTUCKY	HOPKINS	37.5258	87.4158	1326601	191891	13	3012	1.067
KENTUCKY	JEFFERSON	38.2003	85.8700	1757638	438014	13	106	1.007
KENTUCKY	JEFFERSON	38.2014	85.8739	1756497	438420	13	113	1.043
KENTUCKY	LAWRENCE	38.0478	82.7389	2660349	382363	13	999	1.058
KENTUCKY	MCLEAN	37.6719	87.4139	1324559	245211	13		1.044

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
KENTUCKY	MCLEAN	37.3928	87.2750	1369784	143335	13	414	1.006
KENTUCKY	MCLEAN	37.6247	87.4384	1318017	227978	13	1645	1.017
KENTUCKY	MCLEAN	37.5483	87.1597	1400277	200102	13	1750	1.049
KENTUCKY	MCLEAN	37.5825	87.3742	1337638	212570	13	1809	1.051
KENTUCKY	MCLEAN	37.6450	87.3331	1348390	235378	13	1869	1.057
KENTUCKY	MCLEAN	37.6236	87.3475	1344804	227573	13	2227	1.069
KENTUCKY	MCLEAN	37.5825	87.2983	1359562	212570	13	2250	1.061
KENTUCKY	MCLEAN	37.6353	87.4233	1322485	231830	13	2375	1.074
KENTUCKY	MCLEAN	37.5092	87.3056	1358811	185809	13	2637	1.067
KENTUCKY	OHIO	37.4789	86.9842	1449510	174760	13		1.033
KENTUCKY	OHIO	37.5444	86.9792	1452575	198683	13		1.019
KENTUCKY	OHIO	37.5956	86.8331	1493810	217335	13	477	1.021
KENTUCKY	OHIO	37.6361	86.8792	1479675	232134	13	625	1.02
KENTUCKY	OHIO	37.4872	86.7006	1534336	177801	13	754	1.016
KENTUCKY	OHIO	37.5956	86.8331	1493810	217335	13	792	1.035
KENTUCKY	OHIO	37.5583	86.8250	1496887	203751	13	940	1.008
KENTUCKY	OHIO	37.5414	87.0181	1441366	197568	13	1034	1.03
KENTUCKY	OHIO	37.4953	86.9264	1468808	180740	13	1056	1.009
KENTUCKY	OHIO	37.5150	86.7194	1528299	187938	13	1320	1.078
KENTUCKY	OHIO	37.3550	86.8858	1483324	129549	13	1465	1.022
KENTUCKY	UNION	37.7219	87.9081	1181061	263457	13		1.068
KENTUCKY	UNION	37.6722	88.0219	1148964	245312	13	600	1.016
KENTUCKY	UNION	37.6306	87.7908	1216387	230107	13	1000	1.012
KENTUCKY	UNION	37.6381	87.8058	1212011	232844	13	1500	1.018
KENTUCKY	UNION	37.7242	87.9106	1180304	264268	13	1803	1.036
KENTUCKY	UNION	37.7172	87.9214	1177288	261734	13	1840	1.039
KENTUCKY	UNION	37.6878	87.9514	1169094	250989	13	1928	1.035
KENTUCKY	UNION	37.7050	87.9178	1178525	257274	13	1985	1.044
KENTUCKY	UNION	37.7189	88.0406	1142870	262342	13	2155	1.048
KENTUCKY	UNION	37.6275	87.8106	1210738	228982	13	2300	1.059
KENTUCKY	UNION	37.7119	87.9225	1177051	259808	13	2668	1.091
KENTUCKY	UNION	37.7050	87.9178	1178525	257274	13	2680	1.056
KENTUCKY	WEBSTER	37.4647	87.6281	1266234	169580	13		1.078
KENTUCKY	WEBSTER	37.4269	87.7161	1241362	155804	13		1.024
KENTUCKY	WEBSTER	37.6347	87.6947	1244087	231628	13	1270	1.015
KENTUCKY	WEBSTER	37.6258	87.7400	1231153	228384	13	1360	1.018
KENTUCKY	WEBSTER	37.6097	87.6075	1269714	222504	13	1364	1.009
KENTUCKY	WEBSTER	37.4583	87.8586	1199572	167258	13	1388	1.019
KENTUCKY	WEBSTER	37.6286	87.7403	1231026	229397	13	1543	1.015
KENTUCKY	WEBSTER	37.6167	87.5478	1286854	225039	13	1851	1.047
KENTUCKY	WEBSTER	37.4597	87.7208	1239450	167765	13	2410	1.066
KENTUCKY	WEBSTER	37.6169	87.7419	1230738	225140	13	2732	1.029
NEW YORK	ERIE	42.73	78.85	3521429	2091034	3	4131	1.2
NEW YORK	NIAGARA	43.1	79	3460454	2226057	3	2903	1.2

Table 8. continued

STATE	County or Location	Latitude	Longitude	Model X (ft)	Model Y (ft)	Model Layer No.	Depth (ft)	Fluid Density gm/cc
ONTARIO	BRUCE	44.2	81.59	2721644	2627477	3		1.22
ONTARIO	ELGIN	42.6	81.375	2852232	2043593	3		1.22
ONTARIO	ELGIN	42.68	81.033	2940124	2072788	3		1.22
ONTARIO	ESSEX	41.91	82.513	2575137	1791794	3		1.21
ONTARIO	KENT	42.29	82.26	2627821	1930468	3		1.22