HYDROGEOLOGY OF SHALLOW GROUNDWATER RESOURCES, AURORA AND VICINITY, KANE COUNTY, ILLINOIS

Timothy H. Larson
Stephen S. McFadden
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Open File Series 1991-12

ILLINOIS STATE GEOLOGICAL SURVEY
Morris W. Leighton, Chief

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CONTENTS

FIGURES

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ABSTRACT

The St. Charles aquifer, a highly productive sand and gravel aquifer, is present in the Aurora and St. Charles bedrock valleys, buried about 100 to 150 feet deep beneath ground surface. Within the St. Charles bedrock valley, the aquifer is locally more than 100 feet thick in the northwestern part of the study area. A shallower sand and gravel aquifer, the Kaneville aquifer member of the Elburn aquiformation, is present above the Aurora and St. Charles bedrock valleys and other parts of the area. The Kaneville aquifer member is generally less than 30 feet thick. Areas of aquifer interconnection, known for high yields, occur south of Sugar Grove.

Declining water levels and high concentrations of radium and chloride in the present source of water, the deep (400 to 2,000 ft) sandstone aquifers in the Basal and Midwest Aquigroup, have made it necessary for the City of Aurora to explore other water sources. To support their investigation, the Illinois State Geological Survey has mapped the shallow aquifers of the area using a combination of existing records, surficial geophysical surveys, and test-hole drilling. Maps prepared for this report can be used to explore further and test other areas for aquifer interconnection.

INTRODUCTION

Sandstone aquifers of the Basal Bedrock and Midwest Bedrock Aquigroups have supplied most of the water for northeastern Illinois. The City of Aurora in Kane County (fig. 1) has relied almost exclusively on this water source. However, declining water levels due to overpumping (Sasman et al. 1982) and high concentrations of naturally occurring radium and chlorides in these aquifers (Gilkeson et al. 1984) have made it advisable for the City to evaluate alternative water sources. Other possible sources of water include sand and gravel aquifers in the glacial deposits (Prairie Aquigroup), aquifers in the shallow fractured bedrock (Upper Bedrock Aquigroup), and the Fox River.

This study identified the shallow groundwater resources (Upper Bedrock Aquigroup and Prairie Aquigroup) in the Aurora area, specifically in Aurora and Sugar Grove Townships (T38N, R8 and 7E) Kane County. The Illinois State Geological Survey (ISGS) has mapped the distribution of shallow aquifers. In a separate study, the Illinois State Water Survey is evaluating the hydraulic properties of the shallow aquifers. Aquifer pump tests will determine well yield, well spacing, potential aquifer yield, and shallow groundwater chemistry.

Two other studies in Kane County provided additional information on the shallow groundwater hydrology of the study area. Kane County and many communities funded a regional study of the county's shallow groundwater resources. The results of this study conducted by the ISGS were reported in Curry and Seaber (1990). The Kane County area was also part of an extensive geotechnical study for siting the proposed Superconducting Super Collider (SSC). Graese et al. (1988) summarized the SSC-related investigations.

METHODOLOGY

Well records, surficial geophysical surveys, test borings, and existing reports and maps provided information on the glacial drift, drift thickness, bedrock surface and lithology, aquifer properties, and groundwater quality. The maps and general conclusions of this report are derived from Graese et al. (1988) and Curry and Seaber (1990). We have included specific information relevant to Aurora and Sugar Grove Townships and revised the maps accordingly.

Well Records

Well records on file at the Illinois State Geological and Water Surveys were used in the study. (Well locations are shown on fig. 1.) Well logs, recorded at the time of drilling, document the locations of wells and the geologic materials encountered during drilling. Well records included those from privately drilled wells, municipal and industrial wells, and test wells. Commonly, well

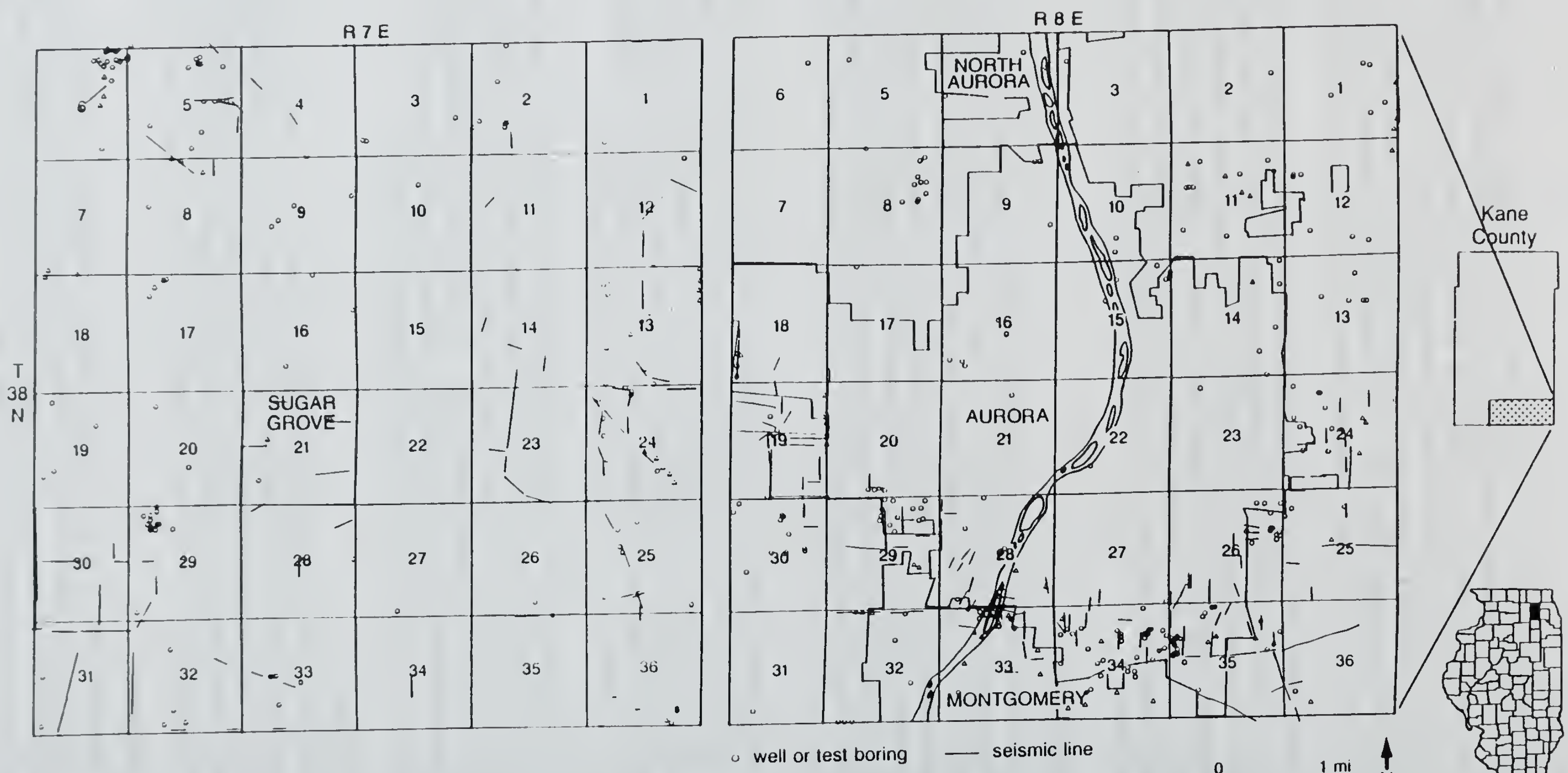

Figure 1 Location of the study area in Kane County.

locations described in the logs from private wells are inaccurate or very general. Private well locations were verified at the Kane County Permit Office. In most cases, descriptions of glacial drift were adequate to poor, but data on the depth to bedrock were generally considered reliable. Records of wells with unverified locations were used in areas of sparse data coverage and provided general information on geologic trends. Records of public water-supply wells for the municipalities in Kane County provided detailed and reliable data of the lithologic units.

Published sources of well records in Kane County include Lund (1965), Reed (1975), Woller and Sanderson (1978), Kempton et al. (1985, 1987a, 1987b), Curry et al. (1988), and Vaiden et al. (1988). These records provided information on the depth and lithology of bedrock, and on the thickness and lithology of glacial drift.

Surficial Geophysical Surveys

Seismic refraction, a surficial geophysical method, was used for detailed mapping of the bedrock topography and glacial drift thickness. (Locations are shown on fig. 1.) Seismic energy traveling through the ground is refracted back to ground surface from the interface between the glacial sediments and the bedrock. A buried explosive charge or weight-drop system was used as an energy source to produce seismic waves. Reversed profile seismic data were gathered using a 24-channel signal-enhancement seismograph. Field data were automatically processed with a modified version of a ray-tracing program (SIPT-1) written by the U.S. Bureau of Mines (Scott et al. 1972). The SIPT-1 program corrects for irregular surface terrain along the seismic profile and also calculates the depth to bedrock beneath each geophone. Geophones were spaced 50 feet apart along lines 650 feet long, or 100 feet apart along lines 1,300 feet long, depending upon the thickness of the glacial drift and seismic velocities of the materials.

Anomalously great depths to bedrock are calculated from the seismic refraction method in areas where thick sand and gravel deposits are overlain by thick, clay-rich glacial till (Zohdy et al. 1974). This occurs because the sand and gravel layer has a lower seismic velocity than both the overlying till and underlying bedrock. The error in calculated depth is proportional to the thickness of the sand layer and always results in greater calculated depths to bedrock than actually exist. Because the anomalies are caused by buried sand and gravel, the anomalies are potential targets for further groundwater resource evaluation.

A second surficial geophysical method, electrical earth resistivity, was used as a qualitative tool to determine the texture of the geologic materials present in the glacial drift (fig. 1). A Schlumberger electrode configuration was used (Zohdy et al. 1974), and the data were inverted to layering parameters using the Zohdy method (1973). In freshwater environments, sand and gravel units have a higher resistivity than finer grained deposits with greater clay content and can be easily identified by this method. Identification is difficult where the sand and gravel deposits are thin or deeply buried (McGinnis and Kempton 1961). Thickness determinations are not possible where the bedrock and overlying glacial deposits have similar resistivities, such as a fine-grained glacial till overlying shale, or coarse sand and gravel overlying dolomite. Therefore, electrical earth resistivity data were primarily used in conjunction with seismic refraction to identify sand and gravel deposits within the glacial drift.

Test Drilling

Test holes for new public supply sources were drilled in favorable areas identified by the geophysical surveys conducted as part of this and related local studies. Test holes were geophysically logged with a natural gamma-ray probe to identify aquifer materials and to assist in making stratigraphic correlations. Test drilling also provided the specific information required for the design of an aquifer test and production well.

Favorable results from test drilling have resulted in several aquifer tests for Aurora to date. Gilkeson et al. (1987) reported on two tests and several others are summarized in Curry and

Seaber (1990). A final report on the test drilling will be prepared by the Illinois State Water Survey.

Test drilling in Kane County was also conducted for siting of the proposed SSC. Continuous cores of the bedrock sequence and discontinuous cores of glacial drift were collected and suites of geophysical logs were run. Results of this drilling are reported in Kempton et al. (1987a, 1987b), Curry et al. (1988), and Vaiden et al.(1988).

GEOLOGIC FRAMEWORK

Stratigraphy

The geology of the area includes Precambrian crystalline basement rocks, Paleozoic sedimentary rocks, and Quaternary uncemented sediments. In northern Illinois, the Paleozoic history from 600 million to 245 million years ago is represented by rocks of marine origin (fig. 2) with a maximum thickness of 4,000 feet (Kempton et al. 1985). The Paleozoic rocks are overlain by Quaternary sediments as much as 150 feet thick.

Bedrock The Paleozoic rocks most significant to the shallow groundwater resources in the area are the Ordovician Maquoketa Group and the Silurian Kankakee and Elwood Formations (Willman et al. 1975) (fig. 3). (The deeper aquifers are beyond the scope of this study, but are discussed in Visocky et al. [1985].) The Maquoketa Group is composed of shale, argillaceous dolomite and limestone, and interbeds of shale and dolomite; it is present at the bedrock surface in buried bedrock valleys beneath the study area. The regionally important formations of the Maquoketa include, in ascending order, the Scales Shale, Ft. Atkinson Limestone, Brainard Formation, and Neda Formation (Kolata and Graese 1983); but these cannot be readily differentiated in Kane County (Graese et al. 1988). Here, the Maquoketa consists of two sequences of basal shales that become increasingly carbonate rich.

The Elwood and Kankakee Formations are composed of thin to medium-thick beds of dolomite; the Kankakee also contains abundant nodules and interbeds of chert. Because the lithology of these units is similar (Curry and Seaber 1990), they are not differentiated in this report. The distribution of Silurian dolomite (fig. 3) is determined chiefly by the buried bedrock topography. The shallow carbonate rocks are thickest where Silurian dolomite overlies the limestone and dolomite units of the upper Maquoketa Group. In the study area, this occurs on the north and east sides of Aurora, where the combined thickness of these carbonate units is generally more than 100 feet and locally exceeds 150 feet.

Quaternary deposits Local stratigraphic classification of Quaternary deposits is illustrated on figure 4a; the sediments consist of glacial till, glacial outwash, glacial lakebed materials, windblown sediments (loess), and recent deposits along steep slopes and floodplains (Curry and Seaber 1990). Distribution of the surficial drift units is shown on figure 4b. These deposits were produced in a variety of depositional environments associated with major glacial advances and retreats approximately 1.6 million to 14,000 years ago. Successive glacial advances modified the sediments deposited during earlier events and further complicated the geometry of the various units. Finally, since the retreat of the most recent glaciers, glacial deposits have been modified by erosion, predominantly in fluvial environments such as the Fox River valley.

The oldest glacial sediments identified in Kane County are Illinoian and may correlate to the Glasford Formation near Rockford in Boone and Winnebago Counties (Berg et al. 1985). This includes the Herbert Till Member, which occurs as valley fill within the Aurora bedrock valley. Illinoian deposits are covered by Sangamonian and early to middle Wisconsinan colluvium composed of organic carbon-rich silty deposits that have been modified by soil formation; these include the Berry Clay and Robein Silt (fig. 4). These sediments may be as much as 25 feet thick in Kane County, but more commonly, they are thin or absent (Curry and Seaber 1990).

ERA	SYSTEM	Group	FORMATION (thickness in feet)	GRAPHIC COLUMN (not to scale)	DESCRIPTION	Aquigroup
CENOZOIC	QUATERNARY		(0–150)		silt and loess peat and muck sand and gravel diamicton (clay, silt, sand, gravel, and boulders; commonly till)	Prairie
PALEOZOIC	SILURIAN		Joliet-Kankakee (0-50) Elwood (0-30) Wilhelmi (0-20)		dolomite, fine-grained, cherty	Upper Bedrock
PALEOZOIC	ORDOVICIAN	Maquoketa	(0-210)		shale, argillaceous dolomite and limestone	Upper Bedrock
PALEOZOIC	ORDOVICIAN	Galena	(155-185)		dolomite, some limestone, fine- to medium-grained, slightly cherty	Midwest Bedrock
PALEOZOIC	ORDOVICIAN	Platteville	(140-150)			Midwest Bedrock
PALEOZOIC		Ancell	Glenwood-St. Peter (60-520)		sandstone, white, fine- to medium-grained,sandy	Midwest Bedrock
PALEOZOIC		Prairie du Chien	(0-400)		dolomite, sandstone	Midwest Bedrock
PALEOZOIC	CAMBRIAN		Eminence (20-150)		dolomite, fine to medium grained, sandy	Midwest Bedrock
PALEOZOIC	CAMBRIAN		Potosi (90-225)		dolomite, fine grained, trace sand and glauconite	Midwest Bedrock
PALEOZOIC	CAMBRIAN		Franconia (75-150)		sandstone, fine-grained, glauconitic; green and red shale	Midwest Bedrock
PALEOZOIC	CAMBRIAN		Ironton-Galesville (155-220)		sandstone, fine- to medium-grained, dolomitic	Midwest Bedrock
PALEOZOIC	CAMBRIAN		Eau Claire (350-450)		sandstone, fine grained, glauconitic; siltstone, shale, and dolomite	Basal Bedrock
PALEOZOIC	CAMBRIAN		Mt. Simon (1400-2600)		sandstone, white, coarse grained, poorly sorted	Basal Bedrock
PRECAMBRIAN (13,000+)					granite	Crystalline

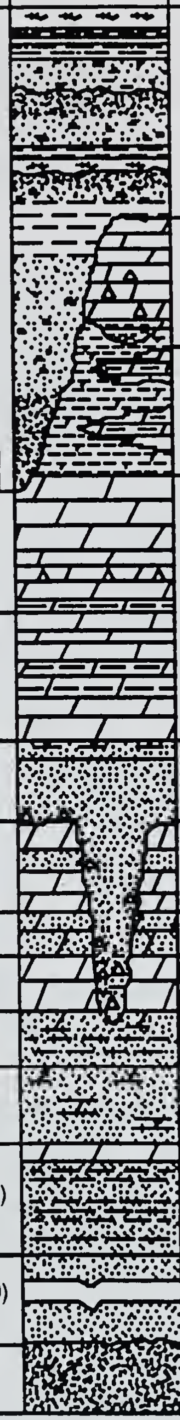

Figure 2 Stratigraphy of rocks underlying the Aurora area.

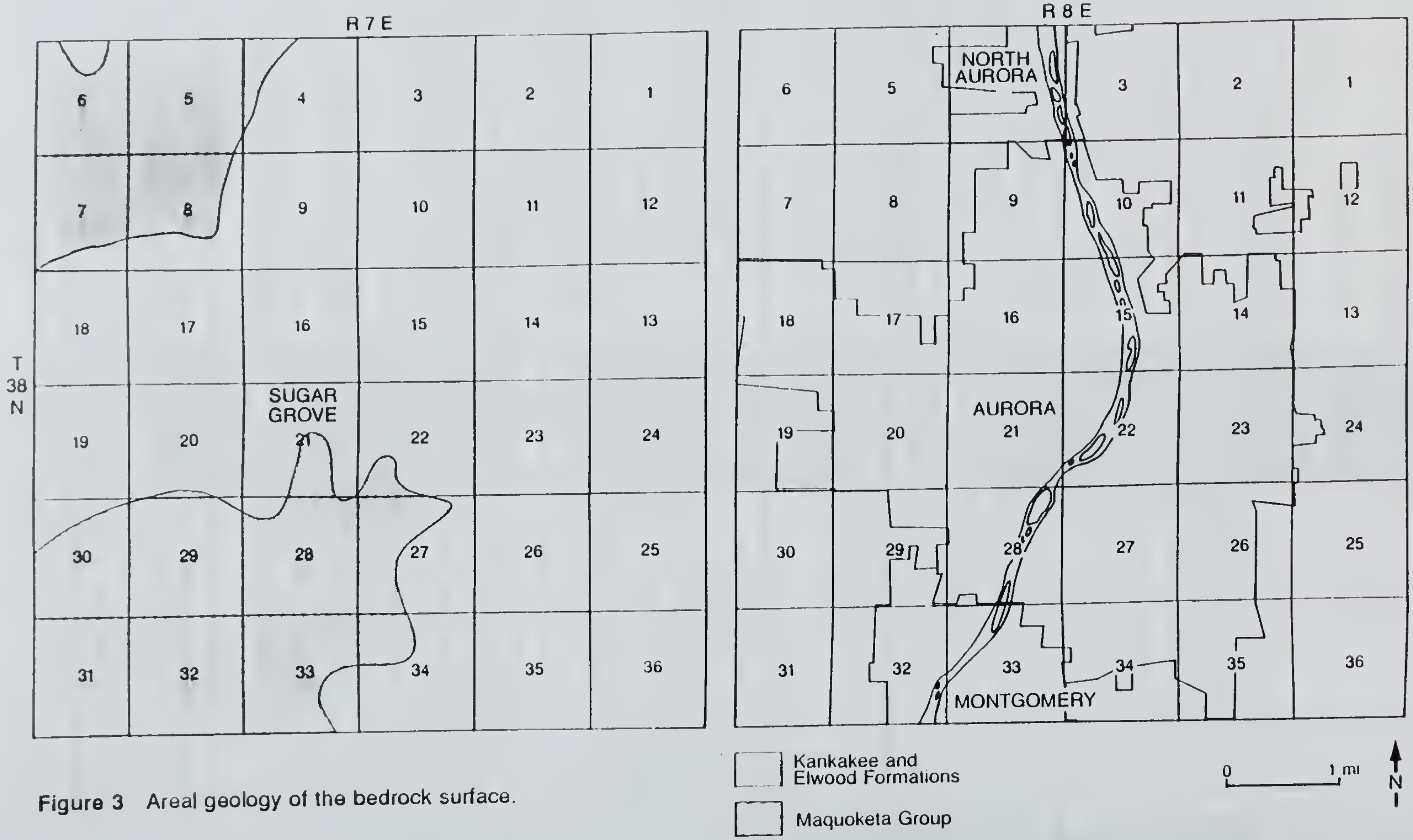

Figure 3 Areal geology of the bedrock surface.

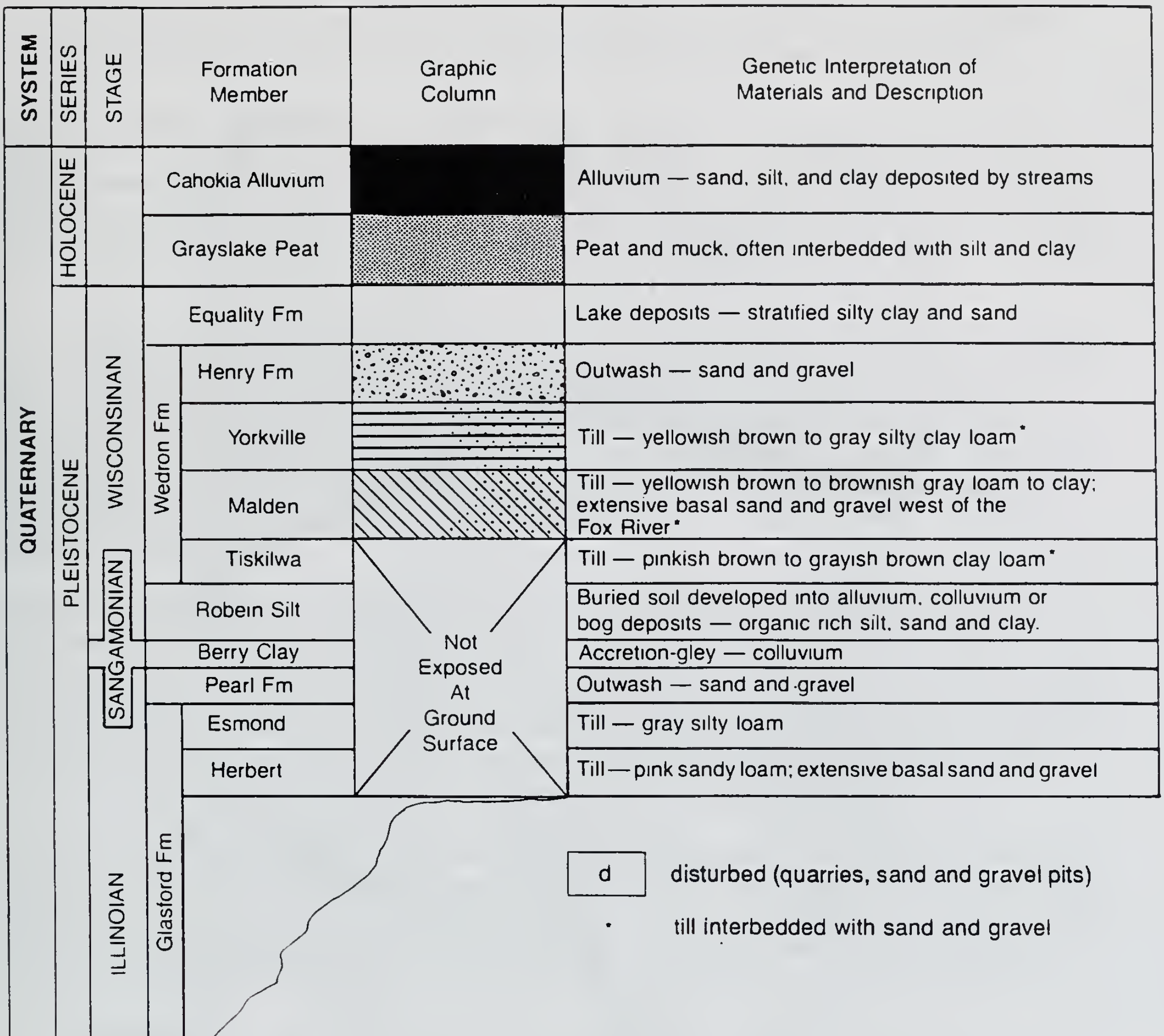

Figure 4a Stratigraphy of glacial drift (Prairie Aquigroup) underlying the Aurora area.

The late Wisconsinan Wedron Formation, Henry Formation, and related formations (Willman and Frye 1970) cover the Robein Silt. The bulk of the late Wisconsinan deposits belong to the Wedron Formation; its representative members in Kane County are, in ascending order, the Tiskilwa, Malden, Yorkville, and Haeger Till Members (fig. 4a and 4b). Till members consist of diamicton (poorly sorted sediment deposited directly or indirectly by glacial ice) interlayered with outwash (well-sorted sand and gravel deposited by glacial meltwater). The Yorkville Till Member is the predominant surficial deposit in Aurora Township; the Malden is predominant in Sugar Grove Township; the Tiskilwa is commonly present in the subsurface; however, the Haeger is not present in the township. The Henry Formation consists of sand and gravel; its distribution and thickness are relatively well known because of its importance as an aggregate resource (Masters 1978). The Equality Formation is composed of stratified to massive sand, silt, and clay associated with sedimentation in lakes; it is a common surficial deposit across Kane County (Graese et al. 1988), including most of the northwest part of Aurora Township and much of the southern third of Sugar Grove Township. Generally, it is less than 20 feet thick, but may be as much as 45 feet thick (Curry and Seaber 1990). Richland Loess mantles the upland landscape, but it is generally less than 2 feet thick and has not been mapped in this report.

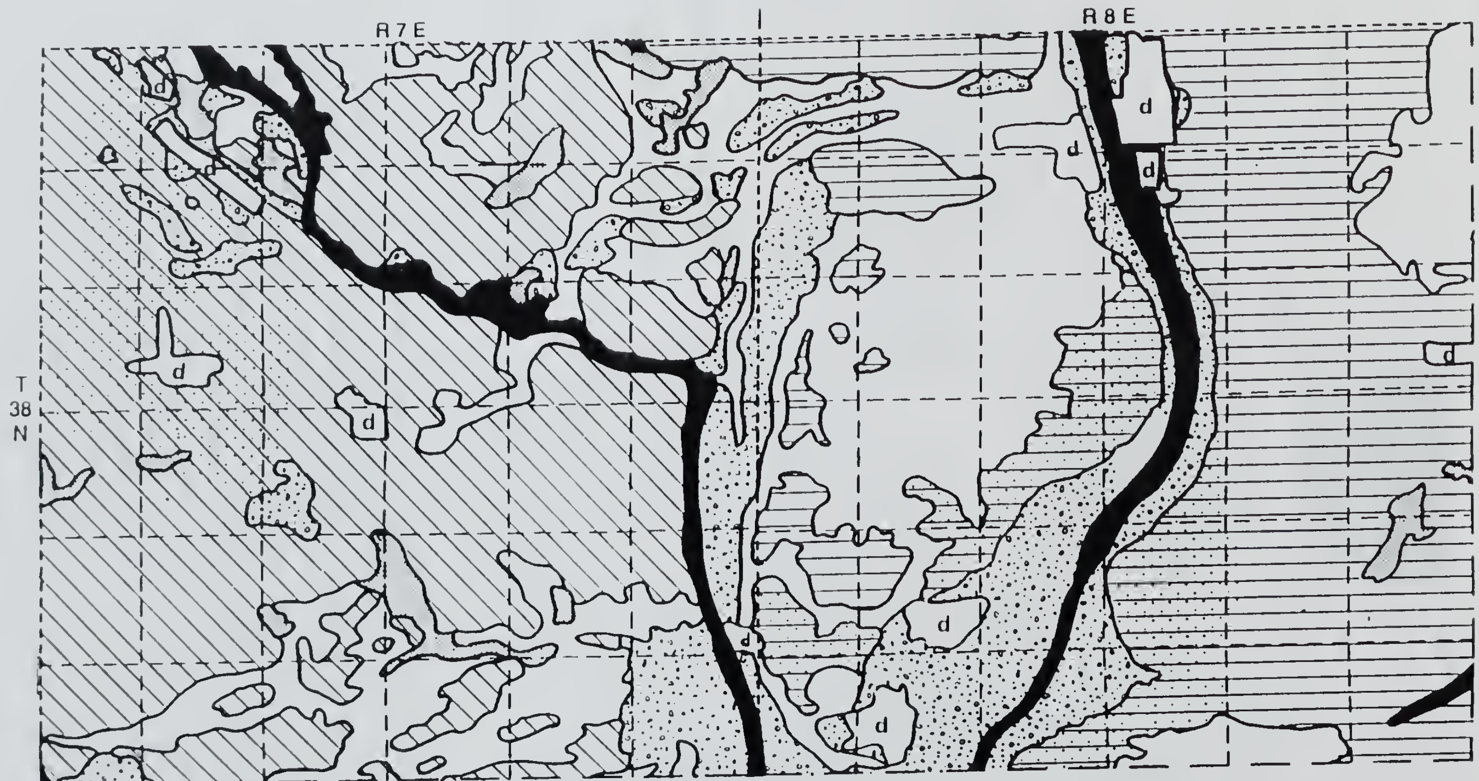

Figure 4b Surficial drift map of the Aurora area.

Sediments deposited since the last glaciers melted away are thin and occur along drainage ways (Cahokia Alluvium) and in shallow or drained wetlands (Greyslake Peat; fig. 4b).

Bedrock Surface Topography

The bedrock topography of the state was mapped by Horberg (1950). More recently, bedrock topography maps have been published for all or part of Kane County by Graese, et al. (1988) and Curry and Seaber (1990). A bedrock surface map of the Aurora area (fig. 5) was prepared for this report from existing data supplemented with data provided by seismic refraction and test drilling. This map is modified from the map provided by Curry and Seaber (1990).

The bedrock surface is characterized by bedrock uplands dissected by gently sloping valleys that trend generally east-west. The buried bedrock surface typically does not follow the present-day topography, which is related to Pleistocene glaciation. The bedrock valleys represent a previous drainage system that developed prior to glaciation. These ancient valleys were extensively modified and eventually buried by processes related to glacial activity. Elevation of the bedrock surface in the study area varies from less than 550 feet above mean sea level (msl) in the Aurora bedrock valley southwest of Sugar Grove to more than 700 feet msl northwest of Aurora.

The Aurora and St. Charles bedrock valleys are the major bedrock drainage features of the study area. The Aurora bedrock valley enters the area as three tributaries on the south, southeast, and northeast sides of Aurora. Bedrock surface elevations are generally below 575 feet msl near the centers of these valleys. The tributaries merge to form one channel that lies beneath the Phillips Park area of southeast Aurora. From there, the valley trends generally westward. South of Sugar Grove, the Aurora bedrock valley takes a more southwesterward course, eventually exiting Kane County and joining with the St. Charles bedrock valley.

The St. Charles bedrock valley (called the Newark bedrock valley in some previous reports) is the largest bedrock valley underlying Kane County; it enters the county north of Aurora near Elgin, trends southwestward, and exits beneath the extreme southwestern corner of the county. The St. Charles bedrock valley passes beneath the northwestern corner of the study area, where it is locally more than 1 mile wide and bedrock elevations fall below 550 feet msl.

Drift Thickness

Variations in the thickness of glacial drift (sediments) are the result of bedrock topography, glacial landforms such as moraines, and erosion in postglacial environments. In the study area, the glacial drift is up to 150 feet thick in the St. Charles bedrock valley. Glacial moraines, which are ridges of thick drift deposited directly from glaciers, may not be associated with bedrock topography. Moraines formed at locations where ice margins remained relatively stable over long periods of time. An example of this occurs northeast of Aurora, where the drift thickness reaches more than 75 feet. The third factor controlling drift thickness is demonstrated along the Fox River. Erosion of glacial materials probably occurred when the Fox River Valley formed, resulting in relatively thin drift and locally exposed bedrock along the course of the river.

HYDROGEOLOGY

Major hydrostratigraphic units were formally defined for the area by Visocky et al. (1985). The Prairie and Upper Bedrock Aquigroups provide the shallow groundwater resources for Kane County. For consistency, we will adopt the informal names defined for local or regional drift aquifers (Prairie Aquigroup) in Kane County by Curry and Seaber (1990). Many older reports use different names for the same aquifers. Table 1 provides a comparison between aquifer names used in this report and previous usage.

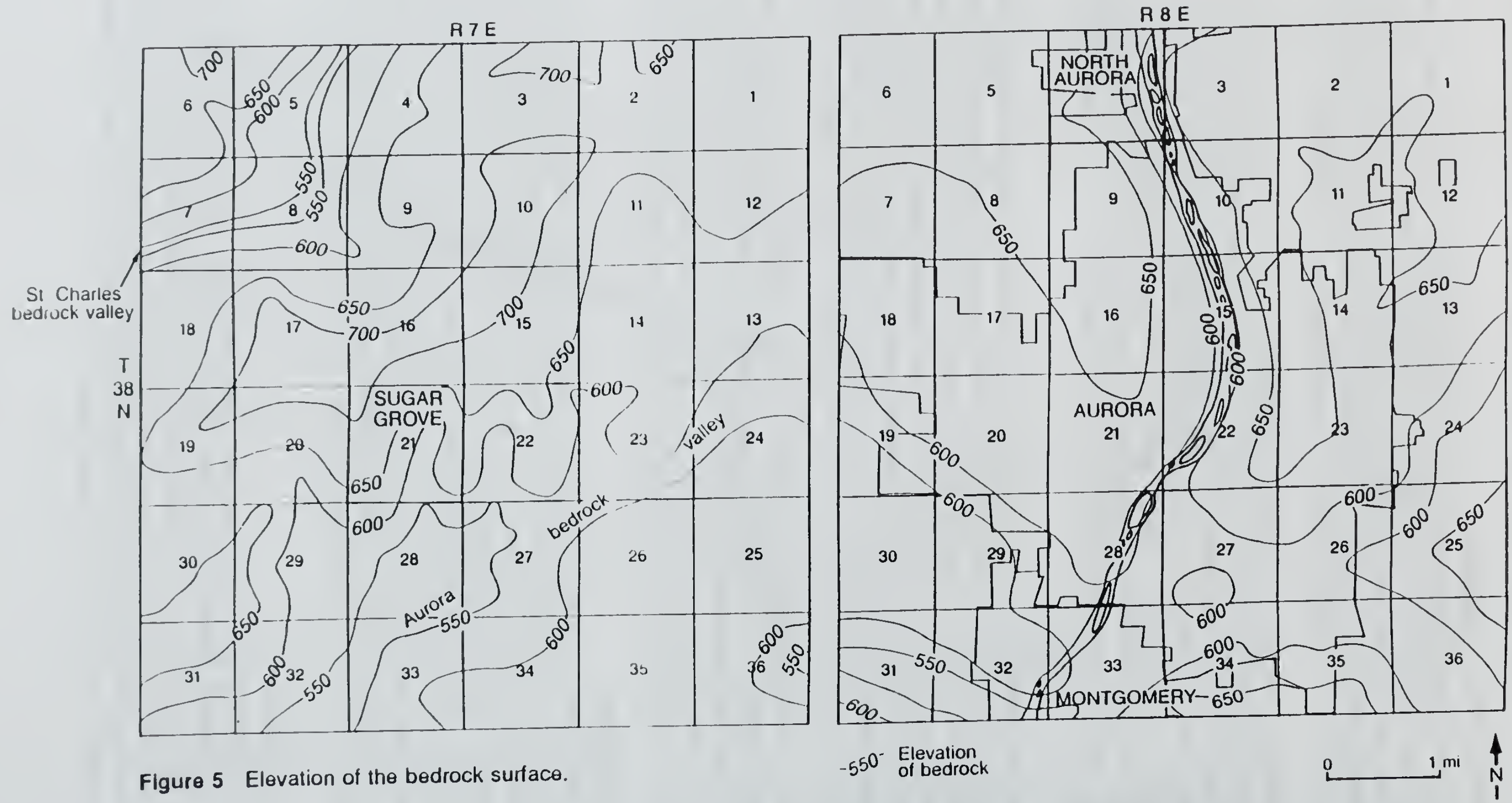

Figure 5 Elevation of the bedrock surface.

Table 1 Informal classifications of drift aquifers compared with hydrostratigraphic units in the Prairie Aquigroup

Informal classifications (as used in this report)			Prairie Aquigroup
McFadden et al. (1989)	Schicht et al. (1976)	Graese et al. (1988)	Curry and Seaber (1990) and this report
Upper sand and gravel aquifer	Surficial sand and gravel aquifer	Surficial drift aquifer	Valparaiso aquifer Kaneville aquifer, Elburn aquiformation
	Interbedded sand and gravel aquifer	Basal drift aquifer	Bloomington aquifer
Lower sand and gravel aquifer	Basal sand and gravel aquifer	Buried drift aquifer	St. Charles aquifer

Upper Bedrock Aquigroup

The Upper Bedrock Aquigroup consists of local and intermediate flow systems in sedimentary rocks that directly underlie and interconnect with the glacial sediments of the Prairie Aquigroup. In Kane County, the aquigroup consists of the Ordovician Maquoketa Group and Silurian Elwood and Kankakee Formations.

The most significant and productive aquifer is the Silurian dolomite aquifer or shallow dolomite aquifer (figs. 2 and 3), which sustains pumping rates as great as 100 to 200 gpm (Visocky et al. 1985). The Silurian rocks thin westward and are replaced at the bedrock surface by rocks of the Maquoketa Group. Where the Maquoketa Group rocks are dominated by shale, the Upper Bedrock Aquigroup becomes much less productive. The hydrogeology and yields of these units are discussed in detail in Csallany and Walton (1963). Packer test data for these units are presented and summarized in Curry et al. (1988). Areas in which sand and gravel aquifers of the Prairie Aquigroup contact fractured dolomite bedrock are particularly suitable for developing groundwater production. If sand and gravel and bedrock aquifers are hydraulically connected, the response to pumping the sand and gravel aquifer is generally that of a much larger aquifer (Gilkeson et al. 1987). Yields are generally higher than yields from wells pumping exclusively in the fractured dolomite, and drawdown is typically less than in wells tapping sand and gravel aquifers isolated from bedrock by till units of low permeability.

Table 2 Informal hydrostratigraphic hierarchy in Kane County (modified from Curry and Seaber 1990)

Aquigroup	Aquiformation	Aquimember
Prairie	Valparaiso aquifer Elburn aquiformation Bloomington aquifer Pingree Grove aquiformation Marengo aquitard St. Charles aquifer	 Kaneville aquifer member

Prairie Aquigroup

In Kane County, the Prairie Aquigroup has local and intermediate flow systems in noncemented geologic materials, including glacial drift, alluvium, and other recent sediments. The aquifers are confined locally by fine-grained sediments. Recharge to the system is mainly from local precipitation. Of the six hydrostratigraphic units informally recognized in Kane County by Curry and Seaber (1990) (table 2), four are important in Aurora and Sugar Grove Townships: the St. Charles aquifer, the Marengo aquitard, the Kaneville aquifer member of the Elburn aquiformation, and the Pingree Grove aquiformation.

St. Charles aquifer Composed chiefly of sand and gravel of the Wedron and Glasford Formations, the St. Charles aquifer occurs primarily within the buried St. Charles and Aurora bedrock valleys where it is highly productive. The aquifer has been test-pumped at more than 1,000 gpm in several locations (Gilkeson et al. 1987, Curry and Seaber 1990).

Figure 6a shows the distribution of the St. Charles aquifer. Here, the aquifer is composed of proglacial outwash of the Tiskilwa Till Member of the Wedron Formation and the Herbert Till Member of the Glasford Formation. Because of the complex relationship between till and outwash, the boundary of the sand and gravel within the St. Charles aquifer, as shown on figure 6a, is only approximate.

Vertically, the St. Charles aquifer is shown in relation to other Prairie Aquigroup members on the cross sections of figures 7a-c. Figure 7a is oriented east-west across the St. Charles bedrock valley beneath western Sugar Grove Township. (Locations are shown in fig. 6.) Figure 7b is also oriented east-west and located east of Aurora over a tributary of the Aurora bedrock valley. In this area, the aquifer is thin and relatively fine-grained. Figure 7c is oriented east-west across the main channel of the Aurora bedrock valley in southwestern Sugar Grove Township. Here the aquifer is much thicker and more like the material found within the St. Charles bedrock valley.

Marengo aquitard The Marengo aquitard covers the St. Charles aquifer in much of the study area (fig. 7a-b). In some places, the relationship of the two units is more complex, as shown in figure 7c. In this part of the Aurora bedrock valley, the St. Charles aquifer occupies the center of the valley, whereas the Marengo aquitard occupies the valley sides. The aquitard is chiefly made up of diamicton (till) of the Herbert Till Member of the Glasford Formation (Graese et al. 1989).

The Marengo aquitard has a field-measured hydraulic conductivity on the order of 0.2 to 0.002 gal/day/ft^2 (10^{-6} to 10^{-8} cm/sec) (Jennings 1985). Materials with such low hydraulic conductivities restrict the flow of water and contaminants. Where the Marengo aquitard occurs above the St. Charles aquifer, well yields within the aquifer may be reduced. However, the presence of the overlying aquitard affords some protection from surface contamination to the underlying aquifer. Scattered occurrences of relatively small bodies of sand and gravel have been found in the Marengo aquitard (fig. 7a), but these supply only small amounts of groundwater (Graese et al. 1988).

Kaneville aquifer member, Elburn aquiformation Underlying most of central and south-central Kane County is the Elburn aquiformation, primarily an aquitard (chiefly diamicton, but also lacustrine deposits). It also contains deposits of sand and gravel outwash that potentially are aquifers. In this area, the Elburn aquiformation consists of the Malden and Yorkville Till Members of the Wedron Formation. The Kaneville aquifer member of the Elburn aquiformation represents the ice-contact and outwash sand and gravel sequences of these units (fig. 6b).

In northwestern Sugar Grove Township (fig. 7a), the aquifer occurs at depths of 10 feet or less. Groundwater protection is an important consideration in this area, as the aquifer may be susceptible to surface sources of contamination. At some locations the Kaneville aquifer member lies directly over the St. Charles aquifer and forms one vertically continuous aquifer. Areas of interconnection are present in the Aurora bedrock valley in southeast Aurora, southwest Aurora, and southwest of Sugar Grove (fig. 7c). More commonly, the Kaneville aquifer member is separated from the St. Charles aquifer lying below it by low-permeability till of the Marengo aquitard (fig. 7a-b).

The Kaneville aquifer member is also extensive over much of the study area beyond the locations of buried bedrock valley systems. The aquifer is generally less than 30 feet thick but may locally be as much as 80 feet thick. Small areas of thicker aquifers are present south of

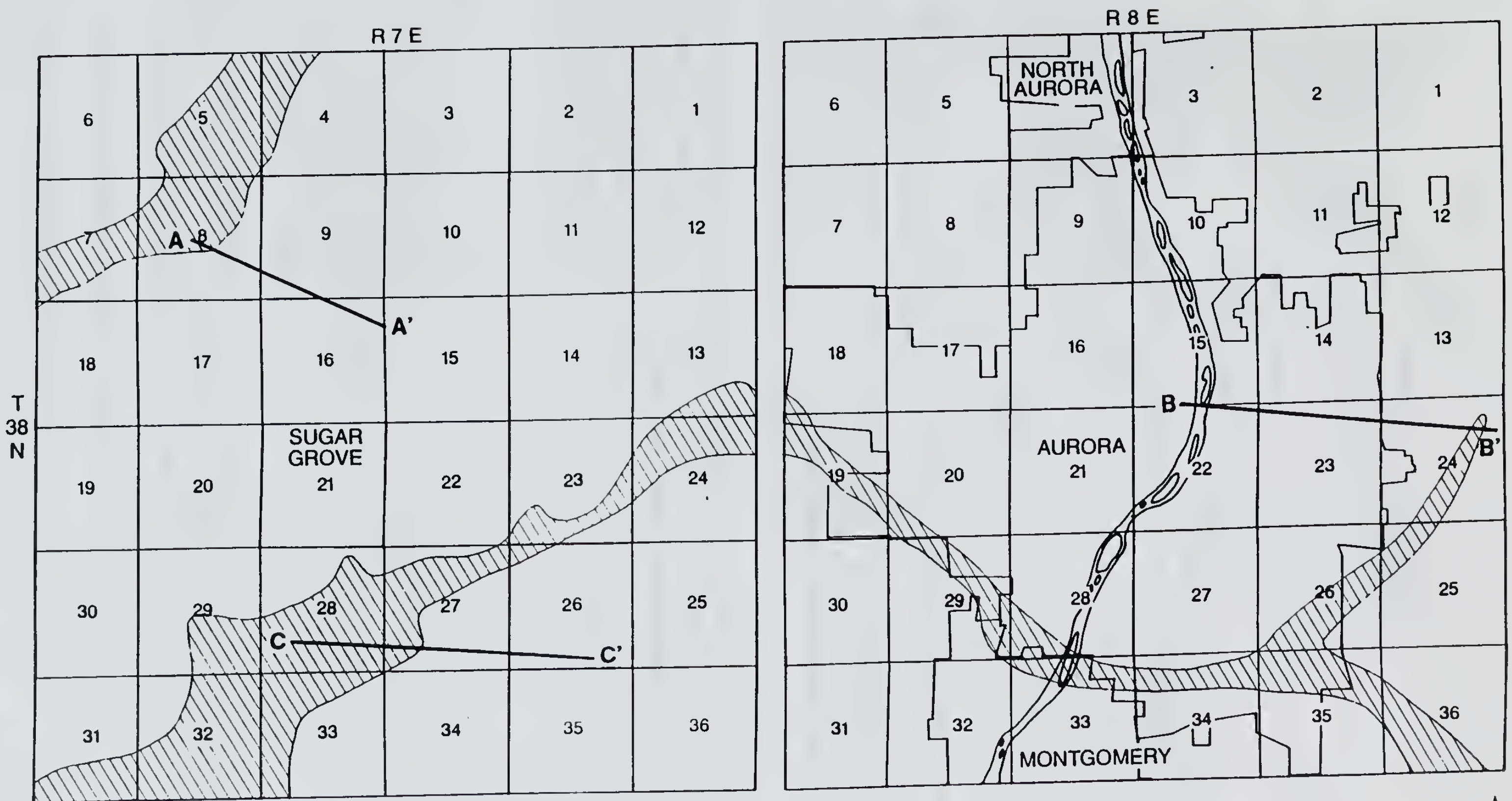

Figure 6a St. Charles aquifer, Prairie Aquigroup, a major aquifer in the Aurora area.

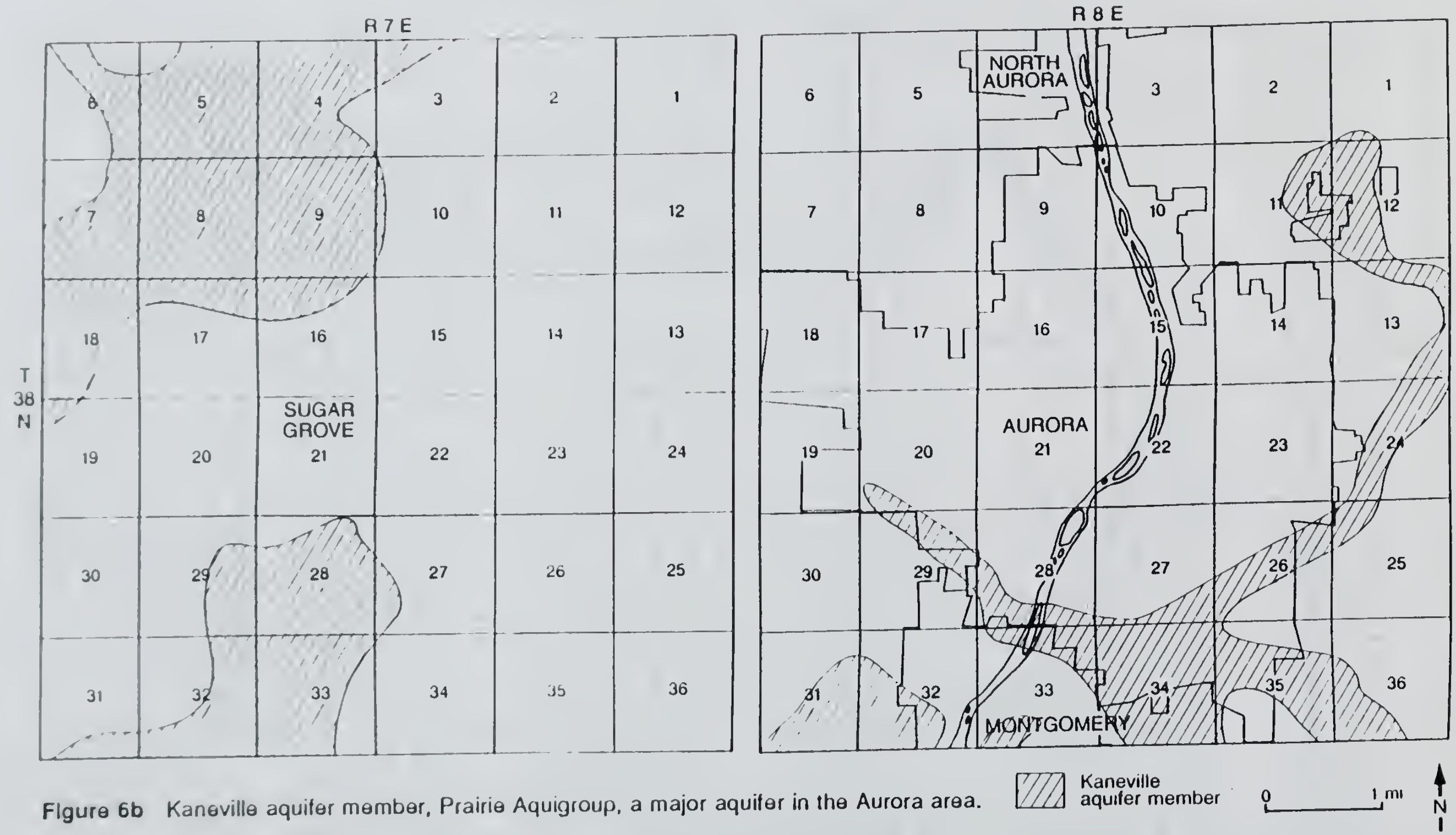

Figure 6b Kaneville aquifer member, Prairie Aquigroup, a major aquifer in the Aurora area.

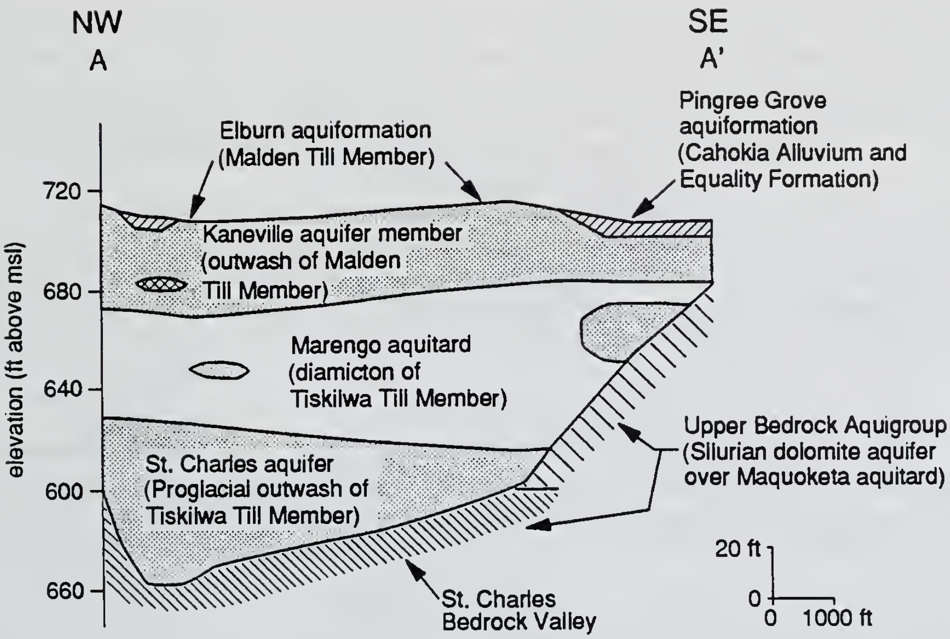

Figure 7a Cross section of the St. Charles bedrock valley in northwest Sugar Grove Township.

Aurora, southwest of Montgomery, in some areas adjacent to the Aurora and St. Charles bedrock valleys west of Aurora, and in other isolated areas. Closer to the City of Aurora, the Kaneville aquifer member is thin or absent. This is particularly true along the Fox River where all glacial drift has been removed by erosion in some places.

Pingree Grove aquiformation Composed of stratified sands, silt, clay, marl, and peat, this unit underlies present lakes, rivers, and streams. We do not consider it to be an aquifer, thus it was not included in this investigation. The Pingree Grove aquiformation is composed of the Equality Formation, Greyslake Peat, and Cahokia Alluvium (Curry and Seaber 1990). It is associated with wetland resources and is found at several locations in Sugar Grove Township, particularly along Blackberry Creek.

SUMMARY

Because of declining water levels and high concentrations of radium and chloride in the Basal and Midwest Bedrock Aquigroups, the City of Aurora is seeking alternative sources of water for public supply. The Illinois State Geological Survey has mapped shallow aquifers in the Aurora area as part of a comprehensive study of the shallow groundwater resources in the region. A combination of existing records, surficial geophysical surveys, and test drilling was used in the aquifer mapping phase of this study.

A second phase of this study involves aquifer pump testing to determine hydraulic properties, spacing of wells for optimal aquifer development, potential aquifer yield, and groundwater chemistry. This phase of the investigation will be reported by the Illinois State Water Survey.

Results of the geologic mapping of shallow aquifers in the Aurora area are as follows:

- The St. Charles aquifer, a potential source of municipal water supply, is present in the Aurora and St. Charles bedrock valleys. Within the St. Charles bedrock valley in the northwestern part of the study area, the aquifer locally exceeds 100 feet. Within the Aurora bedrock valley, the aquifer is thickest west of the Fox River. East of the Fox River, the aquifer tends to be thinner and finer-grained, and thus less useful for public water supplies.

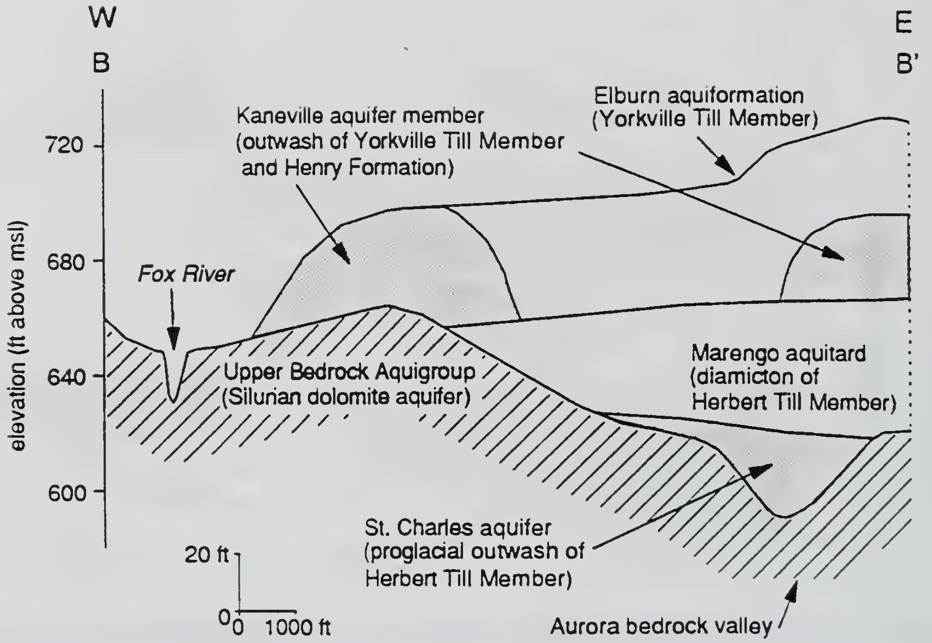

Figure 7b Cross section of the glacial materials east of Aurora.

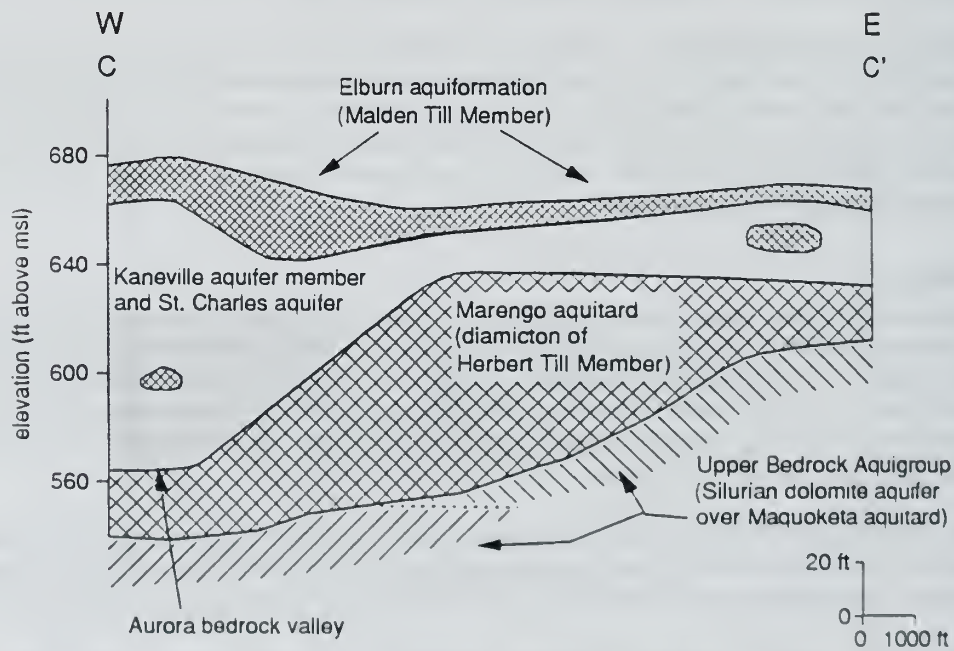

Figure 7c East-west cross section of the Aurora bedrock valley southwest of Sugar Grove.

- In some areas, the Kaneville aquifer member of the Elburn aquiformation is thick enough to be considered an important water resource. More commonly, it is less than 30 feet thick. The thickest aquifer materials lie mostly south of Aurora and adjacent to the Aurora and St. Charles bedrock valleys to the west of Aurora. The aquifer is thin or absent near the Fox River in the study area and under Aurora, which is situated on a bedrock high.

- Areas of aquifer interconnection are generally more productive and thus more suitable for development of a municipal water source. Aquifers that interconnect generally have higher yields, less drawdown, and greater storage capacity than aquifers that are separated by materials of low permeability. Areas of interconnection are known to exist south of Sugar Grove. Maps prepared for this report can be used to explore further and test for other areas of aquifer interconnection.

ACKNOWLEDGMENTS

This study would not have been possible without the support of George W. Petree, Director of Utilities for the City of Aurora. Richard N. Young of the Kane County Environmental Department has also supported the regional and local groundwater investigations in Kane County.

Doug Laymon, Doug Cantwell, Joe McGinnis, Walter Morse, Philip Orozco, Steve Padovani, and Charles Tindell assisted in the geological field work. George Lin and Robert McGinnis processed much of the seismic field data; Paul Heigold and Vickie Poole lent their geophysical expertise toward interpretation of the data. Cheryl Wegsheid directed the database development, assisted by Craig Gendron, John Skinner, Faith Stanke, and Charles Tindell. Brandon Curry and Ardith Hansel frequently advised the authors on the glacial geology of the area.

REFERENCES

Berg, R. C., J. P. Kempton, L. R. Follmer, and D. P. McKenna, 1985, Illinoian and Wisconsinan Stratigraphy and Environments in Northern Illinois: The Altonian Revised: prepared for the Midwest Friends of the Pleistocene 32nd Field Conference, Illinois State Geological Survey, Champaign, Guidebook 19, 177 p.

Csallany, S., and W. C. Walton, 1963, Yields of Shallow Dolomite Wells in Northern Illinois: Illinois State Water Survey, Champaign, Report of Investigation 46, 43 p.

Curry, B. B., A. M. Graese, M. J. Hasek, R. C. Vaiden, R. A. Bauer, D. A. Schumacher, K. A. Norton, W. G. Dixon, Jr., 1988, Geological-Geotechnical Studies for Siting the Superconducting Super Collider in Illinois: Results of the 1986 Test Drilling Program: Illinois State Geological Survey, Champaign, Environmental Geology Notes 122, 108 p.

Curry, B. B., and P. R. Seaber, 1990, Hydrogeology of Shallow Groundwater Resources, Kane County, Illinois: Illinois State Geological Survey, Champaign, Contract/Grant Report 1990-1, 37 p.

Gilkeson, R. H., E. C. Perry, Jr., and R. B. Holtzman, 1984, Isotopic Studies of Natural Sources of Radium in Groundwater in Illinois: University of Illinois at Urbana-Champaign, Water Resources Center Report 84-187, 50 p.

Gilkeson, R. H. , S. S. McFadden, D. E. Laymon, and A. P. Visocky, 1987, Hydrogeological evaluation of groundwater resources in buried bedrock valleys, *in* Northeastern Illinois, Focus on Midwestern Ground Water Issues (conference): National Water Well Association, p. 145-167.

Graese, A. M., R. A. Bauer, B. B. Curry, R. C. Vaiden, W. G. Dixon, Jr., and J. P. Kempton, 1988, Geological-Geotechnical Studies for Siting the Superconducting Super Collider in Illinois: Regional Summary: Illinois State Geological Survey, Champaign, Environmental Geology Notes 123, 100 p.

Horberg, C. L., 1950, Bedrock Topography in Illinois: Illinois State Geological Survey, Champaign, Bulletin 73, 111 p.

Jennings, R. L., 1985, Report of Hydrogeological Investigations, Proposed Pyott Road Sanitary Landfill, McHenry County, Illinois: prepared for Laidlaw Waste Systems, Inc., Hinsdale, Illinois, Vol. I, II, 107 p.

Kempton, J. P., R. C. Vaiden, D. R. Kolata, P. B. DuMontelle, M. M. Killey, and R. A. Bauer, 1985, Geological-Geotechnical Studies for Siting the Superconducting Super Collider in Illinois: Preliminary Geological Feasibility Report: Illinois State Geological Survey, Champaign, Environmental Geology Notes 111, 63 p.

Kempton, J. P., R. A. Bauer, B. B. Curry, W. G. Dixon, A. M. Graese, P. C. Reed, M. L. Sargent, and R. C. Vaiden, 1987a, Geological-Geotechnical Studies for Siting the Superconducting Super Collider in Illinois: Results of the Fall 1984 Test Drilling Program: Illinois State Geological Survey, Champaign, Environmental Geology Notes 117, 102 p.

Kempton, J. P., R. A. Bauer, B. B. Curry, W. G. Dixon, A. M. Graese, P. C. Reed, and R. C. Vaiden, 1987b, Geological-Geotechnical Studies for Siting the Superconducting Super Collider in Illinois: Results of the Spring 1985 Test Drilling Program: Illinois State Geological Survey, Champaing, Environmental Geology Notes 120, 102 p.

Kolata, D. R., and A. M. Graese, 1983, Lithostratigraphy and Depositional Environments of the Maquoketa Group (Ordovician) in Northern Illinois: Illinois State Geological Survey, Champaign, Circular 528, 49 p.

Lund, C. R., 1965, Data from Controlled Drilling Program in Kane, Kendall, and De Kalb Counties, Illinois: Illinois State Geological Survey, Champaign, Environmental Geology Notes 6, 56 p.

Masters, J. M., 1978, Sand and Gravel and Peat Resources in Northeastem Illinois: Illinois State Geological Survey, Champaign, Circular 503, 11 p.

McGinnis, L. D., and J. P. Kempton, 1961, Integrated Seismic, Resistivity, and Geologic Studies of Glacial Deposits: Illinois State Geological Survey, Champaign, Circular 323, 23 p.

Reed, P. C., 1975, Data from Controlled Drilling Program in Kane County, Illinois: Illinois State Geological Survey, Champaign, Environmental Geology Notes 75, 38 p.

Sasman, R. T., C. R. Benson, R. S. Ludwigs, and T. L. Williams, 1982, Water-Level Trends, Pumpage, and Chemical Quality in the Deep Sandstone Wells in Northern Illinois: Illinois State Water Survey, Champaign, Circular 154.

Schicht, R. J., J. R. Adams, and J. B. Stall, 1976, Water Resources Availability, Quality, and Cost in Northeastern Illinois: Illinois State Water Survey, Champaign, Report on Investigation 83, p. 18-24.

Scott, J. H., B. L. Tibbetts, and R. G. Burdick, 1972, Computer Analysis of Seismic Refraction Data: U.S. Bureau of Mines, R17595, 99 p.

Vaiden, R. C., M. J. Hasek, C. R. Gendron, B. B. Curry, A. M. Graese, and R. A. Bauer, 1988, Geological-Geotechnical Studies for Siting the Superconducting Super Collider in Illinois: Results of Drilling Large-Diameter Test Holes in 1986: Illinois State Geological Survey, Champaign, Environmental Geology Notes 124, 58 p.

Visocky, A. P., M. G. Sherrill, and Keros Cartwright, 1985, Geology, Hydrogeology, and Water Quality of the Cambrian and Ordovician Systems in Northern Illinois: Illinois State Geological Survey and Illinois State Water Survey, Champaign, Cooperative Groundwater Report 10, 136 p.

Wickham, S. S., W. H. Johnson, and H. D. Glass, 1988, Regional Geology of the Tiskilwa Till Member, Wedron Formation, Northeastern Illinois: Illinois State Geological Survey, Champaign, Circular 543, 35 p.

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

Willman, H. B., and J. C. Frye, 1970, Pleistocene Stratigraphy of Illinois: Illinois State Geological Survey, Champaign, Bulletin 94, 204 p.

Woller, D. M., and E. W. Sanderson, 1978, Public Groundwater Supplies in Kane County: Illinois State Water Survey, Champaign, Bulletin 60, 92 p.

Zohdy, A.A.R., 1973, A Computer Program for the Automatic Interpretation of Schlumberger Sounding Curves over Horizontally Stratified Media: National Technical Information Service, U.S. Department of Commerce PB-232 703, 32 p.

Zohdy, A.A.R., G. P. Eaton, and D. R. Mabey, 1974, Application of surface geophysics to ground-water investigations, *in* Techniques of Water-Resources Investigations of the USGS: U.S. Geological Survey, Chapter D1, Book 2, 116 p.