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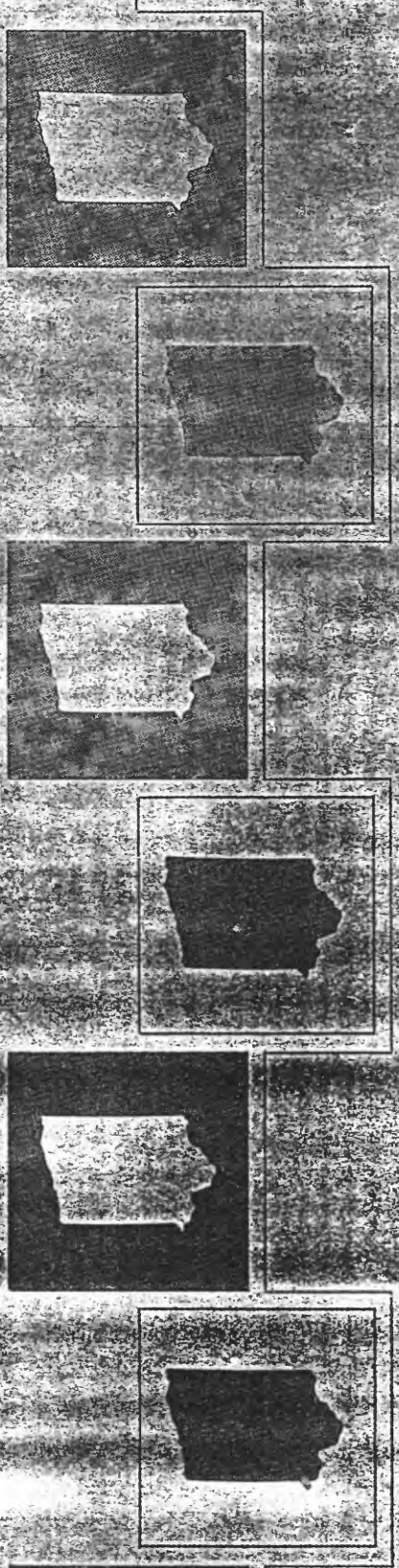

IOWA GROUND-WATER-QUALITY MONITORING PROGRAM

By
Mark G. Detroy

PREPARED BY
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

IN COOPERATION WITH THE
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IOWA GEOLOGICAL SURVEY

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ABSTRACT

A ground-water-quality monitoring network has been designed to collect data to describe the long-term chemical quality of major bedrock and Quaternary aquifer systems in Iowa. The network was designed because of data needs expressed by several State and Federal agencies. Areas where new or additional data are needed are nitrate and bacteria concentrations in alluvial and glacial drift aquifers, fluoride and radionuclides in deep bedrock aquifers, general quality of water in the Missouri River alluvium, changes in water quality of deep bedrock aquifers caused by large withdrawal, effects of land use on shallow aquifers, and the impact of agricultural injection wells on receiving aquifers.

Most of the ground-water-quality monitoring in the State has been directed at compliance or ambient monitoring of municipal water supplies. Some site-specific monitoring has occurred. More recently several special studies or research monitoring activities have been completed or begun.

The monitoring program utilizes a strategy that includes low frequency and sparse distribution of samples from Cambrian-Ordovician, Silurian-Devonian, Mississippian,Pennsylvanian, and Dakota aquifers. A larger density and greater frequency of samples will be obtained from shallow bedrock wells and from wells penetrating Quaternary aquifers such as alluvial, buried-channel, and other drift aquifers.

More than 1,200 wells are available and acceptable for the network. From these and newly completed wells, 200 samples will be collected and analyzed annually. Analyses will be made for common anions and cations, trace metals, nutrients, and radionuclides. One out of ten samples will be analyzed for priority pollutants and pesticides. Data from this program will be published annually in Water Resources Data, Iowa, U.S. Geological Survey Water-Data Report.

INTRODUCTION

About seventy-five percent of the water used in Iowa for private-domestic and municipal supplies comes from ground-water sources. The U.S. Geological Survey (USGS) the Iowa Geological Survey (IGS) and other Federal, State and local agencies have studied the quantity and quality of the ground-water resources in many areas of Iowa. However, in the last few years the protection and prudent management of ground-water resources has become a top priority of most government agencies involved in water resources. Effective management of Iowa's ground-water resources requires that more data on ground-water quality be made available to Federal, State and local agencies.

In order to collect adequate and reliable data, modern monitoring networks need to be researched, developed, and implemented. Although the USGS has a primary role in the collection and appraisal of the quality of ground water in the national interest, the magnitude and

complexity of the subject demand the participation of all Federal, State, and local agencies. The multiagency approach requires a coordinated effort of the human and fiscal resources made available by these agencies. This approach will allow a more efficient use of available resources to extend and expand existing knowledge of ground-water quality.

PURPOSE

The purpose of developing and implementing a ground-water-quality monitoring program is to satisfy the needs and interests of Federal, State, and local water regulators, managers, planners and researchers for information relevant to ground-water resources. The purpose of this report is to establish a ground-water-quality monitoring program that meets those needs and interests. The report reviews ground-water-quality monitoring activities in the State and lists current data needs and interests considered important by water resource agencies in the State. Three types of monitoring programs are presented and their strategies evaluated to assure that objectives chosen for the monitoring program are technically attainable and within the scope of available resources. This report details the operation of a ground-water-quality monitoring program for the State of Iowa.

DATA NEEDS

The types of ground-water-quality data needed by the various agencies in Iowa were solicited and are listed below.

(1) Data are needed to define the concentrations of nitrate, bacteria, and organic chemicals in alluvial and glacial drift aquifers and the effect of these concentrations on underlying bedrock aquifers. These constituents are major contaminants to shallow aquifer systems for numerous reasons, including: improper or deteriorating well construction, karst topography, poor waste disposal practices, induced infiltration from streams, and environmentally incompatible land-use practices.

(2) Data to define the distribution of fluoride in the Mississippian and the Cambrian-Ordovician aquifers and radioactive constituents in the Dakota and the Cambrian-Ordovician aquifers are needed. In water samples from many municipal wells these constituents exceed Safe Drinking Water Standards.

(3) Data are needed to determine the quality of water from the alluvial aquifers adjacent to the Missouri River and to define those areas where water quality may be affected by land-use and water-use practices.

(4) Data are needed to identify those areas in Iowa where large scale ground-water withdrawals may be causing deterioration of water quality. Steep hydraulic gradients in or between aquifers may result in the movement of poorer quality water into either an aquifer of better quality or to another part of the same aquifer which has better quality water.

(5) Data are needed to research site-specific problems involving shallow aquifers in the State. Gravel pits and quarries serve as direct recharge points to various aquifers and are potential avenues for contaminants to enter aquifers. The increasing use of ground-water heat pumps poses a potential threat to aquifer alteration by reinjection of thermally changed water into an aquifer. There are waste disposal sites that pose serious problems to local groundwater systems. All of these site-specific problems require data for evaluation.

(6) Agricultural injection wells have been used for many years in Iowa but little information is available as to the impact on the receiving aquifers. Data are needed to document the affects of injected surface runoff which often is contaminated with nutrients and pesticides.

MONITORING TYPES

Efforts to develop a statewide or regional monitoring program are complicated by differing monitoring requirements to which environmental, health, research, and regulatory agencies must respond. Several types of monitoring activities are required by various statutes, regulations, and environmental needs. Major types of monitoring described by Miller (1981) and Averett (1980) are (1) compliance or ambient trend, (2) site-specific monitoring and, (3) research monitoring. All of these monitoring types have been used in the State by different agencies.

Compliance or ambient monitoring is directed at measuring ground-water quality to

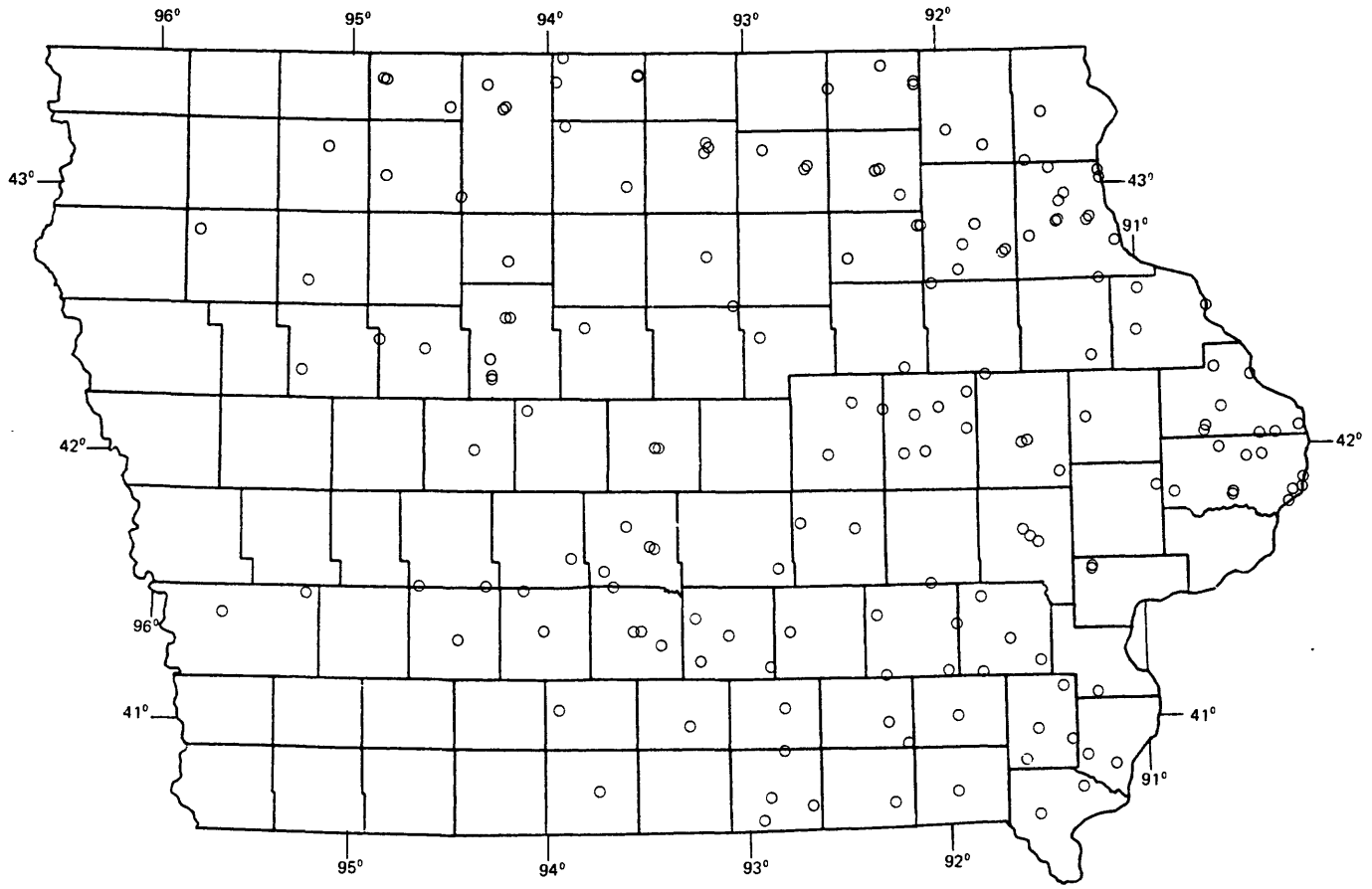

FIGURE 1. Location of Cambrian-Ordovician monitoring wells

observe any deviations from accepted chemical standards and to trace any temporal and spatial trends within a regional ground-water basin or area. This type of monitoring has been practiced the most in the State. Since the mid 1950's most ground-water-quality data in Iowa have been produced by the raw water monitoring program, a trend-type monitoring activity. This program was carried out by the University of Iowa Hygienic Laboratory (UHL) and the Iowa State Department of Health, the predecessor of the Iowa Department of Environmental Quality (IDEQ), to collect water-quality samples from municipal water supplies throughout the State. The program consisted of periodic sampling of municipal ground and surface water supplies to determine if raw water quality criteria were exceeded or met. Samples were collected by IDEQ for analysis by UHL. Because of budgetary constraints in recent years, data collected through this program have decreased significantly. In 1982, the USGS assumed a limited role in this previous sample collection activity and also investigated objectives, strategies, and approaches for the development and implementation of an improved ground-water-quality monitoring program. Data supplied by this program were largely responsible for the temporal study by Splinter and McDonald (1982) which pointed to increasing concentrations of nitrate in Iowa shallow water wells.

The USGS and the Iowa Geological Survey (IGS) have collected ground-water-quality data for many years. Their collection activities have been a part of investigations where aquifers are delineated and general chemical quality de-

scribed for a particular ground-water system or regional area. Municipal, domestic, and test wells were all utilized to obtain water-quality information. Both the UHL and the USGS Central Laboratories have been utilized for water sample analysis for these projects. Monitoring within these studies by IGS and USGS differ from the raw monitoring program because they produced interpretations of conditions in the aquifers as hydrologic units compared to the point evaluation of municipal supplies.

An example of a project involving the regional evaluation of ground-water-quality was a project conducted by the IGS and the USGS in northwest Iowa. The objective of this study was to evaluate the availability and quality of ground water in the Dakota aquifer. Ground-water-quality samples were obtained both from municipal wells and from test holes drilled for this project. A similar project is currently underway in west-central Iowa where alluvial, buried channel, basal Pleistocene, and Dakota aquifers are being described and their chemical quality characterized.

Site-specific monitoring has become prevalent because the Resource Conservation Recovery Act administered by the Environmental Protection Agency (EPA) requires monitoring at specific sites where there is a potential for ground-water contamination or where the ground water has already been contaminated. Sites include existing and proposed municipal and in-

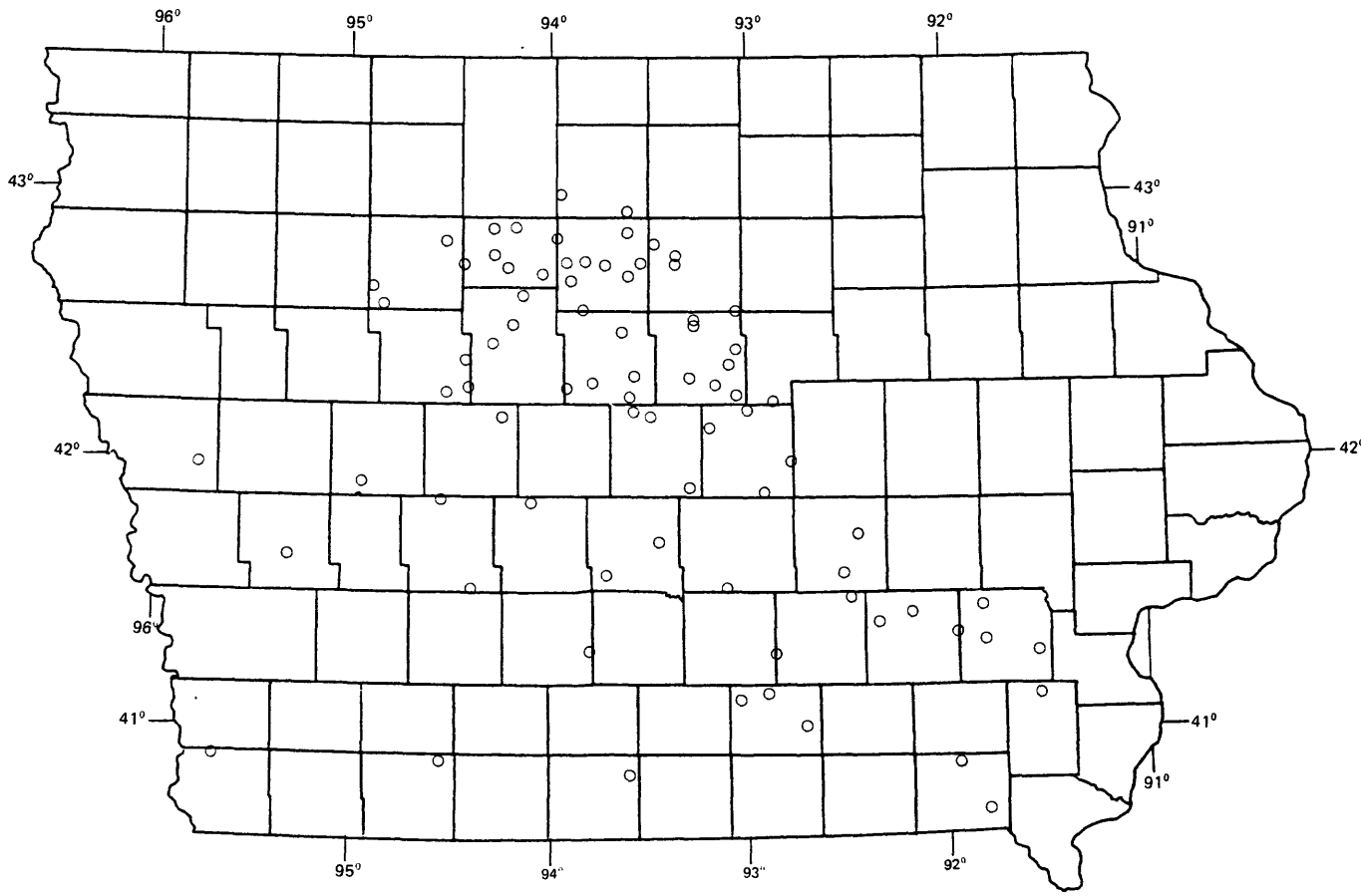

FIGURE 2. Location of Mississippian-Pennsylvanian monitoring wells

dustrial landfills and wastewater impoundments. This type of monitoring is spatially restricted and has been done recently at various locations where suspicions have arisen concerning the threat of ground-water contamination. Examples include a hazardous waste disposal facility in Black Hawk County, an abandoned pesticide processing plant near Council Bluffs, and a manufacturers' waste facility at Charles City where contaminants have leached into the Cedar River.

Certain water-resources management activities require special types of ground-water investigations and related research monitoring. These activities include; (1) the regional evaluation of ground-water resources, (2) the development of models to predict the migration of contaminants or natural constituents, and (3) the surveillance of a water-table aquifer to assess the degree of nitrate or bacteria present to determine the type of land use planning or control needed. Many studies of this type are now underway by agencies in the State, and several examples discussed below.

Selected USGS and IGS activities can be classified as special studies or research monitoring. The Northern Midwest Regional Aquifer-System Analysis by the USGS is a regional assessment of the ground water in the Cambrian-Ordovician aquifer system. The investigation includes the relationship of chemical composition of water in the aquifer to the flow system, geochemical models, the distribution of radioelements, trace metals and organic carbon, the potential movement of saline water into freshwater zones, and the determination of the effects of aquifer development on water quality. A special study is being conducted by the IGS regarding ground-water quality and movement in a karst area in northeast Iowa which includes an assessment of real or apparent water-quality degradation and its areal extent. Another project by the USGS, IGS, and UHL, which began in 1983, investigates nitrate distribution in a segment of the Iowa River alluvial aquifer. The ground-water flow system will be investigated and related to nitrate distribution in the aquifer.

MONITORING STRATEGY

It is practical and necessary to monitor ground water at specific points in time and space. The utility of individual water-quality analyses to describe ground-water quality depends on establishing the relationships among point values in both time and space. To define the variability of ground-water-quality characteristics and the factors or processes which cause the variability is the overall goal of a monitoring program. If sampling frequency and density are great enough, it is possible to define water-quality variations on a statistical basis. However, definition of the variations can be accomplished more efficiently if elements comprising the flow system are known.

An overall ground-water monitoring strategy, described by Hult (1979), involves the following four individual design elements.

(1) *Point sampling*—essentially non-repetitive sampling from a single well primarily for the purpose of defining present ground-water quality within an aquifer.

(2) *Point monitoring*—repetitive sampling from a single well to detect changes in ground-water quality with time.

(3) *Regional monitoring*—repeated sampling of a large number of wells in order to define time and space trends in water quality. Monitoring of this nature can make possible the evaluation of previously identified actual or potential contamination problems of regional extent.

(4) *Site-specific monitoring*—repeated sampling at critical times and places to define local problems.

Ground-water velocities are usually very small, and contamination of ground water tends to occur in slowly developing pockets around point sources of contamination or in shallow, slowly-expanding zones beneath areas of non-point pollution. Because of the nature of the emplacement process and the generally small flow velocities, actual volumes of contaminated ground water tend to remain small for long periods of time in comparison to the total volume of water circulating through the ground-water system. Thus, a monitoring strategy in which samples are collected from wells chosen for a wide areal coverage may fail to detect most point-source contamination problems until a large area of contamination has developed. Moreover, a monitoring effort, without prior analysis and interpretation of ground-water-flow characteristics, is virtually

guaranteed to fail. The directions of flow away from a contaminant must be understood before an efficient monitoring program can be designed.

A monitoring strategy used by the USGS in virtually all of its work related to ground-water contamination has been in study areas where point and non-point sources of pollution are known to affect ground-water-quality. Hydrologic and geochemical processes affecting the movement of water and its constituents in different hydrogeologic settings are studied in order to develop the scientific background for effectively and efficiently predicting contaminant disposition and movement.

PROGRAM OBJECTIVES

No statewide monitoring could realistically provide all the ground-water-quality data desired by the numerous agencies and organizations in the State. Some of the data needs pertain to problems that are local in nature and require site-specific monitoring while others pertain to regional problems more amenable to a statewide strategy. However, a well designed and properly managed statewide monitoring program will make a significant contribution to the data needs of the State. The program will provide uniform and representative ground-water chemical data for the important aquifers in Iowa. However, the program will rely on a less than adequate density of wells to address local problems. These data then can be used to generally describe the water quality in Iowa's aquifers and provide the basis for spatial and temporal studies. The data generated will aid in the formulation of new studies aimed at specific and local problems. Of the data needs listed earlier, only categories 5 and 6 would not benefit directly from the statewide ground-water-quality monitoring program.

The principal objective of the statewide data collection program is to collect data that will describe the long-term chemical quality of the major bedrock and Quaternary aquifer systems of the State. The bedrock aquifer systems include the Cambrian-Ordovician, Silurian-Devonian, Mississippian, Pennsylvanian, and Cretaceous (Dakota), and the Quaternary, which is comprised of alluvial, buried channel and drift aquifers. The bedrock aquifers are regional in extent and their characteristics less susceptible to local and short-term effects except in areas where they are near the land surface. Low frequencies of sampling and sparse distribution of wells can be utilized to meet this objective in regard to bedrock aquifers.

The statewide program also will provide data that describe the general chemical quality for shallow aquifers such as alluvium, drift, buried-channel, or bedrock aquifers near the surface. This part of the program is more difficult to implement because most of these aquifers are of local extent and are strongly influenced by conditions at the land surface and adjacent streams and lakes. These conditions change seasonally or may be dictated by man's activities. Frequency of monitoring must be greater in order to detect these temporal changes in chemical composition. The density of monitoring wells must be greater for shallow aquifers to accomodate the large chemical variability expected from these shallow aquifers. Alluvial, buried-channel, and drift aquifers are widespread throughout the State Only a fraction of the available shallow wells can be sampled with regularity. The emphasis for the State program is to sample a small representative population of these wells frequently. The best approach, large population of wells and a greater frequency of monitoring, is currently not feasible.

Because the network must be limited, priorities will be placed on areas where the aquifers are suspected of being stressed by heavy use, of contamination, or of deteriorating chemical quality. These priorities will follow categories (1) - (4) in the earlier section "DATA NEEDS". Priority will be placed on certain areas in the form of more intensive searching for monitoring wells, greater density of monitoring wells, greater frequency of sampling and the utilization of more industrial, domestic, and test water wells.

PROGRAM OPERATION

The Iowa ground-water-quality monitoring network will operate from a working list of about 1,200 water wells, most of which are used for public supply. A breakdown of the working list by network is shown in Table 1. The frequency of sampling is also shown in this table. The total number of water samples collected each year will be 200. Wells that comprise the bedrock monitoring program are listed by major aquifer(s) in Tables 2-5 and shown in Figures 1-4. Wells that will comprise the Quaternary monitoring pro-

gram are currently being compiled and a listing of these wells will be released at a later date. The bedrock listing and the future Quaternary listing should be regarded as working lists and subject to considerable refinement as more current well information is made available. Well abandonment, new well construction, and well name discrepancies are situations that will complicate the operation of the monitoring program. However, well lists for each aquifer system will be updated periodically and made available through open-file reports.

Personnel from the USGS District Office in Iowa City and field headquarters in Council Bluffs and Fort Dodge will collect water-quality samples for the program. USGS personnel will visit well locations and make contact with the local person(s) responsible for maintaining the water system. It is the responsibility of the field personnel to make sure: (1) the well to be sampled corresponds to the well designated on the field form, (figure 5), (2) a raw water sample will be obtained, (3) the well is pumped or has been pumping at least 20 minutes prior to obtaining a water sample, and (4) the sample obtained represents recent water from a single well penetrating the aquifer.

Having satisfied the above criteria, a water sample will be obtained and processed as quickly as possible to minimize alteration of the water after it is removed from its natural environment. Ground-water samples are assumed to be

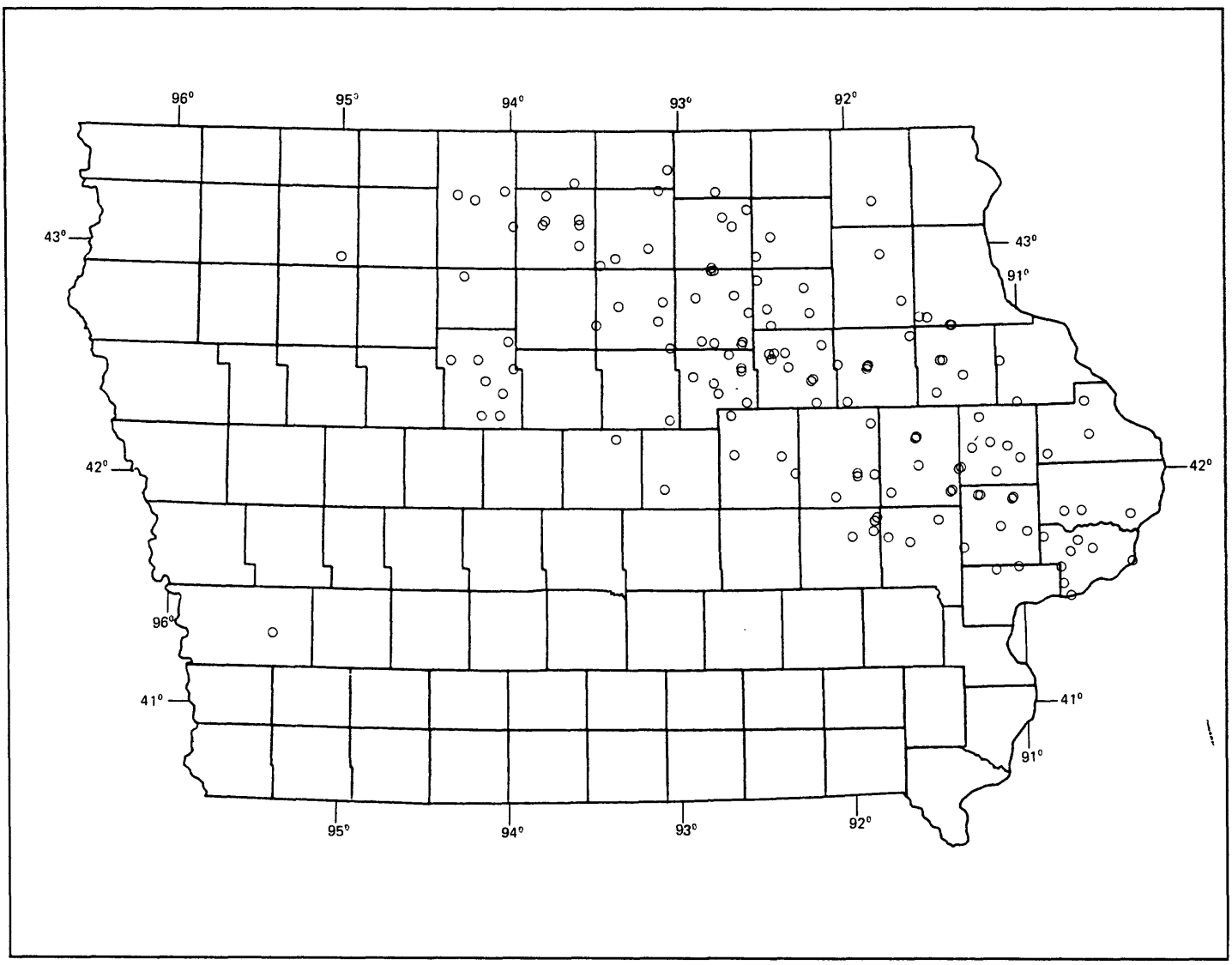

FIGURE 3. Location of Silurian-Devonian monitoring wells

unstable and, therefore, field measurements, including pH, temperature, specific conductance, and carbonate alkalinity should be done with a minimum of delay. Likewise, the subsamples for laboratory analyses should be treated and preserved without delay. Containers, subsample designations, and laboratory analyses to be performed are shown in Figure 6. Field data (Table 6) are entered on the completed field form shown in Figure 5. Water samples, along with the completed log-in forms shown in Figure 7, will be sent to the UHL in Des Moines.

Routine chemical analyses provided by UHL are listed in Tables 7-9 along with selected WATSTORE (National Water Data Storage and Retrieval System) codes and detection limits. Data generated by this program will be entered into WATSTORE by the UHL by a computer linked transfer through the USGS District Office. Data for nutrient parameters including ammonia, nitrate, and orthophosphate will be available on a real-time basis so that samples will not be too old for reanalysis if reruns are requested. To provide organic pollutant monitoring to the program, one of every ten samples will be analysed for priority pollutants and pesticides. Constituents considered priority pollutants are determined by EPA and are listed along with pesticides in Table 10.

Quality assurance, in the field, in the laboratory, and in the processing of data will be stressed and appropriate measures incorporated into the operation of the program. Field meters and sampling apparatus will be checked frequently and records kept of field calibrations and standardizations. Any additional information related to the collection of the ground-water sample will be noted. Analytical quality assurance outside the practices normally performed by the UHL will be provided by the USGS. The USGS will submit blind, duplicate, Standard Reference Water Samples and spiked regular ground-water samples to the UHL on a regular basis. Split samples will be sent to the USGS Central Laboratory in Denver, Colorado on a routine basis. These quality assurance data will be summarized yearly and the information made available to those participaring laboratories.

Data obtained from this program will be published annually in the U.S. Geological Survey Water-Data Report, Water Resources Data, Iowa. Summaries of water-quality data by aquifers will be published periodically. Statistical summaries and maps delineating regional distribution of selected constituents will be provided. Trend analyses will also be used in evaluating data generated by this program.

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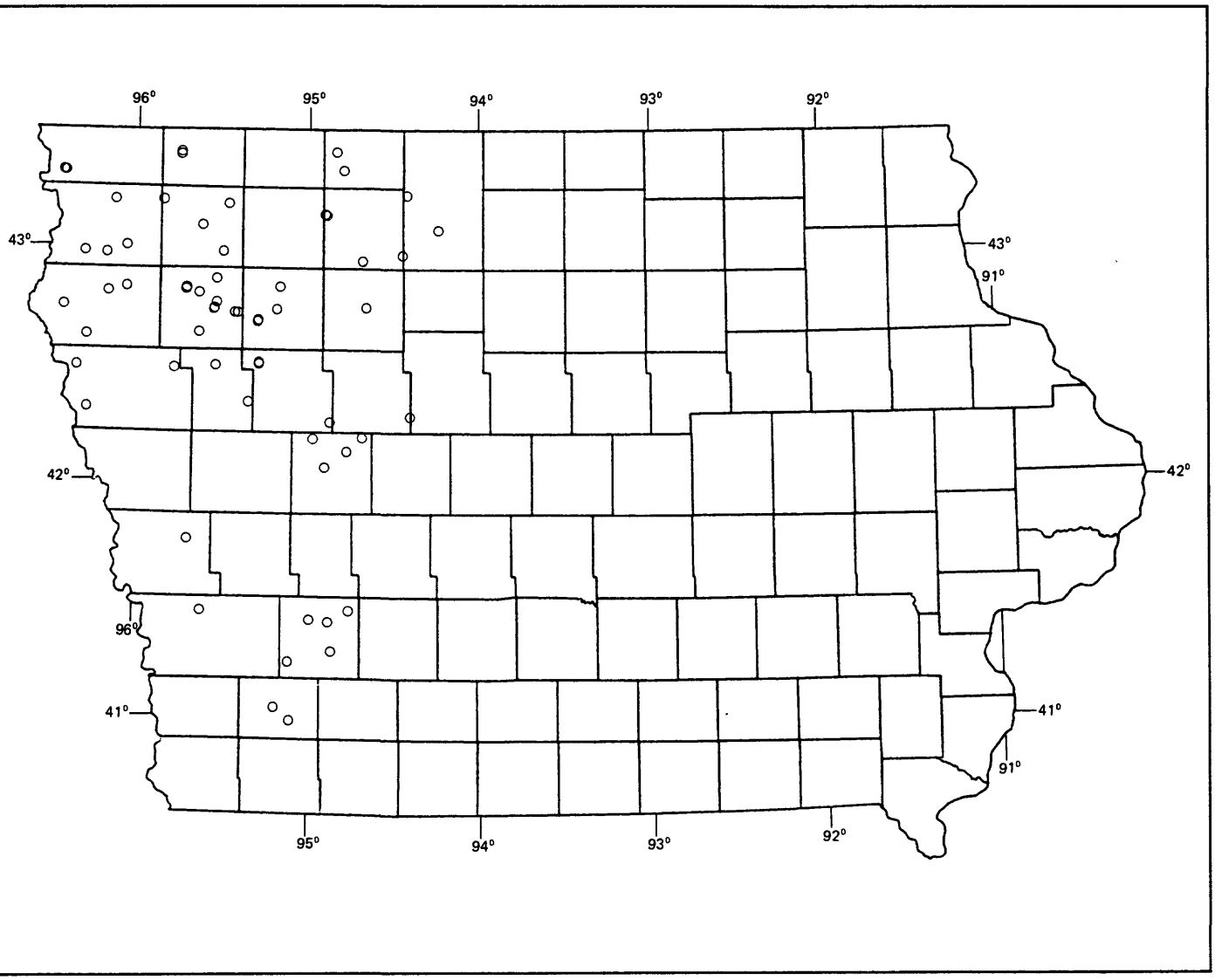


FIGURE 4. Location of Cretaceous monitoring wells

GW MONITORING FIELD FORM

AQUIFER | COUNTY | USGS SITE ID

NAME _____ WELL# _____ COUNTY CODE _____ COUNTY NO _____

DATE LAST SAMPLED _____ TOPO _____ CONSTRUCTION DATE _____

W-NUMBER _____ WELL ELEVATION (LSD) _____ ft (72000) WELL DEPTH _____ ft (72008)

LOCAL WELL NUMBER: T 0 _____ R _____ E/W Section _____ ___ ___ ___ ___ 1/4 Sections

QUALITY ASSURANCE DATA

6		H	G	A	9	9
Sample Medium	Geologic Unit	Analysis Status	Analysis Source	Hydrologic Condition	Sample Type	Hydrologic Event

Collect Agency 1028 (00027) Analyze Agency 9831 (00028) Sample Source Code 46 (72005)

FIELD DATA

University Hygienic Lab Analyses: REGULAR P/P OTHER Kit No _____

Quality assurance analyses _____

Date _____ Time _____ Sampled by _____

Contact _____ Address _____ Phone _____ Zip _____

Sampling point: WELLHEAD OTHER _____

Pumped at _____ GPM (00058) for _____ MINUTES (72004) Sampling Method _____ Code (82398)

FIELD PARAMETERS

pH	Specific Conductance	Temperature	Depth	Alkalinity
00400	micromhos (00095)	C (00010)	ft (72008)	99430

INVENTORY

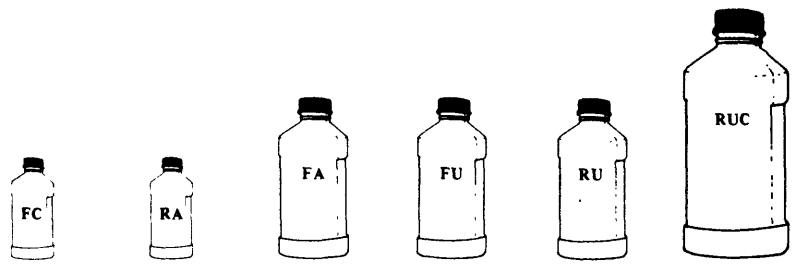
Well#	Depth	GUNIT	CDate	USGS Site ID	Remark	Status

COMMENTS

ASSIGNED TO _____ BY _____ DATE _____

CHECKED BY _____ DATE _____ STORED _____

FIGURE 5. Field form for sample collection



Sample Designation	FC	RA	FA	FU	RU	RUC
Sample Volume	250 ml	250 ml	500 ml	500 ml	500 ml	1/2 Gal
Field Treatment	filtered	raw	filtered	filtered	raw	raw
Preservation	H2SO4 & chilled	HNO3	HNO3	untreated	untreated	untreated
Reported as	dissolved	total	dissolved	dissolved	total	total
Constituents analyzed from sample	Nitrogen (NO3+NO2) Nitrogen (NH3) Phosphorus (PO4)	Iron Manganese	Calcium Magnesium Potassium Sodium Iron Manganese Trace metals As Ba Cd Cr Cu Pb Hg Se Ag Zn	solids Silica Floride Chloride Sulfate	ph (lab) conductance (lab) alkalinity solids	gross alpha gross beta radium 226 radium 228

FIGURE 6. Sample designations, containers, treatments, preservations, and analyses performed

*Collector please complete this side of card except**

Field Data

Source _____ WELL DATA

Sampling Point _____ Name of Number _____

_____ Construction Date _____ Depth _____

_____ Pumped _____ hrs. at _____ gpm.

Was sample free of turbidity when collected (Important) _____

Temperature °C _____ Alkalinity(mg/l$CaCO_3$) P _____ T _____ pH _____

Is a polyphosphate being used? _____

Fee: $ _____

Bottle No _____

UNIVERSITY HYGIENIC LABORATORY
DES MOINES BRANCH
Mineral Metals Analysis

* Lab No _____
*Mineral No _____
* _____ 19 _____

Town _____ Zip _____ County _____

Owner of Supply _____

Collector's Name _____

Date Collected _____ Date Received* _____

Report to: Name _____

Address _____

_____ Zip _____

Radiological Analysis
University Hygienic Laboratory

Lab No.:
Min. No.:
Rad. No.:

Town:
Collector:
Address:
County:

Date Collected:
Date Rec'd. UHL:
Source:
Point of Collection:
Well #:
Depth:

Bottle No.:
Date Counted:
Date Transferred:
Date Reported Out:

Gross Radio-Activity	pCi/	Total S	Dis S	Susp S	Examination by:
	Alpha				
	Beta-Gamma				

1373

FIGURE 7. Log-in forms for submittal of samples to UHL

Table 1.—Summary of monitoring networks, by aquifer

	CAMBRIAN-ORDOVICIAN	MISSISSIPPIAN-PENNSYLVANIAN	SILURIAN-DEVONIAN	CRETACEOUS	QUATERNARY
Number of potential monitoring wells	220	130	220	90	500
Frequency interval	6 year	6 year	4 year 6 year	6 year	2 year 4 year
Type of wells	municipal	municipal	municipal	municipal test	municipal test domestic
Number of samples per year	30	20	50	10	90

Table 2.—Cambrian-Ordovician monitoring wells

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
1	360OVCB	413015094391302	07733W04ABB	1968	ADAIR	2720	20388
1	360OVCB	411813094273301	07531W07DCDB	1929	GREENFIELD NO 1	3467	00033
1	371CMBRU	413014094185901	07830W33CCCD	1963	STUART NO 3	2800	
5	371MSMN	432139091125801	09903W29DAB	1943	LANSING NO 1	721	01681
5	371MSMN	432953091172001	10004W11BB	1925	NEW ALBIN NO 1	586	00211
5	371CMBRU	430512091333601	09606W33CBAB	1957	POSTVILLE NO 2	1071	08315
5	360OVCB	430522091333601	09606W33BDDC	1975	POSTVILLE NO 3	1085	23398
5	371CMBRU	431638091283401	09805W30ACDC	1915	WAUKON NO 3	910	00056
5	371JRDN	431638091282801	09805W30ACD	1957	WAUKON NO 4	662	08170
7	360OVCB	403741092554601	06718W03CBB	1967	CINCINNATI NO 1	2340	19808
7	360OVCB	405324092491701	07017W04DBB	1968	MORAVIA NO 4	2400	20573
7	360OVCB	404103092404001	06816W14CCB	1961	MOULTON NO 1	2377	12035
11	371JRDN	420838092085001	08511W29DAB	1958	GARRISON NO 2	1622	03239
11	364STPR	415955092120701	08312W13CBBB	1921	KEYSTONE NO 1	1360	
11	371TMPL	420520091524701	08409W15ACC	1928	SHELLSBURG NO 1	1736	00001
11	364STPR	421326091522701	08609W34AAA	1919	URBANA NO 1	1145	
11	371JRDN	420030092053001	08311W11DCD	1956	VAN HORNE NO 2	1870	07384
11	371JRDN	421011092012101	08510W16CDBB	1932	VINTON NO 2	1505	00025
13	360OVCB	421903092112601	08712W25DBBC	1972	LA PORTE CITY NO 4	1400	2018
15	364STPR	421028094061201	08528W15BCB	1949	BOXHOLM NO 1	1955	03928
17	367PRDC	425047092054202	09311W25BAB	1955	SUMNER NO 3	1120	06933
17	367PRDC	425049092063801	09311W26ABBB	1963	SUMNER NO 4	1240	16033
17	371JRDN	424336092281001	09114W02BACC	1899	WAVERLY NO 1	1720	00070
17	371JRDN	424337092280301	09114W02BADC	1930	WAVERLY NO 2	1263	00055
19	371JRDN	423807092024301	09010W05ADC	1964	FAIRBANK NO 3	1292	14135
21	371JRDN	423840095135001	09037W05AAD	1959	STORM LAKE NO 4	1690	10125
25	360OVCB	422338094380001	08833W36ADB	1950	ROCKWELL CITY NO 3	1965	04094
25	360OVCB	422339094375101	08833W36ADAA	1970	ROCKWELL CITY NO 4	1970	22007
31	361ODVCU	415311091035301	08202W27BADA	1977	CLARENCE NO 2	475	
31	371JRDN	415145090552701	08201W35DBD	1932	LOWDEN NO 1	1375	00150
33	371JRDN	430938093113501	09620W03BDC	1932	MASON CITY NO 10	1243	
33	371JRDN	430743093120301	09620W16DADA	1948	MASON CITY NO 12	1538	02971
33	371JRDN	430817093104801	09620W15AAAA	1957	MASON CITY NO 14	1297	08079
33	371JRDN	430929093113901	09620W03CAB	1934	MASON CITY NO 7	1230	00075
33	371TMPL	430933093114211	09620W03CABB	1912	MASON CITY NO 8	1765	00115
35	364STPR	424934095475501	09342W34CCBB	1914	MARCUS NO 1	1301	
35	364PRSR	424934095474701	09342W34CCAA	1948	MARCUS NO 2	880	03152
37	364STPR	425753092115501	09411W18BBB	1956	FREDERICKSBURG 2	790	
37	371JRDN	430337092190701	09513W12ADDD	1964	NEW HAMPTON 5	1325	15936
37	371TMPL	430328092182602	09512W07DBBC	1971	NEW HAMPTON 6	1300	22759
39	360OVCB	410235093564901	07227W10CDC	1968	MURRAY NO 1	3114	21135

Table 2.—Cambrian-Ordovician monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
43	371JRDN	425123091241701	09305W23BCD	1927	ELKADER NO 3	1423	00037
43	364STPR	425138091234901	09305W23ABBB	1965	ELKADER NO 5	225	18420
43	371JRDN	425730091215411	09404W18BCD	1939	FARMERSBURG CITY 1	705	00994
43	364ODVCM	425146091144701	09303W19BBA	1956	GARNAVILLO 2	815	07810
43	364ODVCM	425208091135801	09303W18DAAD	1976	GARNAVILLO 4	840	
43	371JRDN	424706091061101	09202W17ACC	1937	GUTTENBERG NO 1	450	00588
43	371TMPL	424653091060801	09202W17CADA	1937	GUTTENBERG NO 2	435	00666
43	364ODVCM	430330091264301	09505W09BCC	1958	LUANA NO 1	347	09689
43	371CMBRU	430240091110001	09503W15BD	1950	MARQUETTE NO 2	442	04488
43	371SLRC	430130091103001	09503W22DD	1952	MC GREGOR NO 6	116	05311
43	371JRDN	430241091234501	09505W14ACDD	1978	MONONA NO 3	850	25042
43	364STPR	425550091233001	09405W26AD	1951	ST OLAF NO 1	378	05197
43	364GLEN	424820091324001	09206W03CC	1957	VOLGA NO 1	225	08168
45	364STPR	414715090152001	08106E27CCC	1941	CAMANCHE NO 1	804	01314
45	364STPR	415740090280202	08304E26CC	1970	CHARLOTTE 3	740	
45	371GLVL	415025090110611	08107E07ACA	1936	CLINTON NO 7	2242	00344
45	371CMBRU	415226090103601	08207E29CCC	1944	CLINTON NO 8	2240	01860
45	371CMBRU	420000090363201	08303E16AAD	1927	DELMAR NO 1	1592	00112
45	371JRDN	414930090321601	08104E18ACBB	1923	DEWITT NO 3	1646	00183
45	371JRDN	414903090323401	08104E18CDB	1948	DEWITT NO 5	1421	03376
45	371JRDN	414902090320301	08104E18DCAD	1974	DEWITT NO 6	1295	23327
45	364STPR	415754090230201	08305E28CA	1911	GOOSELAKE 1	765	
45	371JRDN	415010090501801	08101E10BCC	1960	WHEATLAND 2	1325	10635
49	371JRDN	413638093530901	07926W33BAC	1965	WAUKEE NO 3	2737	17425
51	371JRDN	404144092163601	06812W18AAA	1969	PULASKI	2105	21281
53	367ODVCL	404422093445612	06925W29DDDC	1963	LEON NO 4	2853	14387
55	364STPR	423828091113501	09003W04ADA	1939	COLESBURG 1	822	01067
55	371JRDN	422925091080501	08903W25DADD	1979	DYERSVILLE NO 4	1150	26211
55	371TMPL	422108091143401	08703W18BAC	1963	HOPKINTON 3	1215	14650
57	360ODVC	405153091185301	07004W16ADA	1942	DANVILLE NO 1	1189	01572
57	360ODVC	405138091185201	07004W16DAA	1957	DANVILLE NO 2	1187	08739
57	360OVCB	404930091101101	07003W35ABB	1963	WEST BURLINGTON NO 4	1810	14131
61	371MSMN	423150090383001	08903E07DD	1924	DUBUQUE CITY 5	1811	00121
61	371MSMN	423150090383201	08903E07DDA	1935	DUBUQUE CITY 6	1504	00087
61	371MSMN	423141090385801	08903E07DCC	1934	DUBUQUE CITY 7	1560	00974
61	371MSMN	423140090384701	08903E07DDDC	1946	DUBUQUE CITY 8	1782	02363
61	371JRDN	422640091002701	08801W07CDA	1966	FARLEY 2	1233	17980
61	371JRDN	422940091000901	08801W07DBBA	1971	FARLEY 3	1330	22979
61	364GLEN	423606090594901	09001W19AAAA	1904	HOLY CROSS 1	625	00682
63	371JRDN	432412094503301	09934W10DBDD	1958	ESTHERVILLE NO 8	756	10262
63	364GLEN	431750094302701	09831W21ABA	1945	RINGSTED	505	02302
63	371SLRC	431750094303001	09831W21AB	1953	RINGSTED NO 3	1067	05759

Table 2.—Cambrian-Ordovician monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
65	371JRDN	424510091395001	09207W28DCDB	1955	ARLINGTON NO 3	1312	07201
65	371JRDN	424455091395501	09207W27CCBB	1980	ARLINGTON NO 4	1360	25958
65	364GLEN	430010091390102	09507W34ACAD	1924	CLERMONT NO 2 EAST	240	
65	364GLEN	425717091382601	09407W14CBAD	1948	ELGIN NO 1	208	
65	364GLEN	425717091382602	09407W14CBAD	1945	ELGIN NO 2	220	
65	364GLEN	425713091373101	09407W13CBCC	1962	ELGIN NO 3	150	13991
65	371JRDN	425100091490001	09308W29ACC	1964	FAYETTE NO 2	1338	17048
65	364STPR	424620091525001	09209W23BB	1959	MAYNARD NO 1	850	08873
65	364STPR	424639091522101	09209W14CDAA	1965	MAYNARD NO 2	835	
65	371JRDN	424054091543301	09109W21ACA	1942	OELWEIN NO 42	1328	01511
65	371JRDN	424029091535401	09109W22CDBB	1959	OELWEIN NO 59	1417	10600
65	361MQKT	424033091563101	09109W20CADA	1976	OELWEIN NO 76	145	
65	364STPR	430329092020901	09510W09CABD	1978	WAUCOMA NO 1	682	
67	371TMPL	430435092394901	09515W06BDD	1939	CHARLES CITY NO 4	1305	00814
67	371TMPL	430352092410201	09516W12BADC	1955	CHARLES CITY NO 6	1355	06987
67	371JRDN	430800092540301	09617W18CABB	1958	RUDD NO 2	1288	09845
69	360OVCB	424421093114801	09220W34BDC	1952	HAMPTON NO 3	1763	05443
73	360OVCB	420051094223301	08330W08CBB	1951	JEFFERSON NO 3	2307	04914
75	371TMPL	422611092552501	08818W14BCC	1960	WELLSBURG NO 1	2050	10984
77	360OVCB	413013094190901	07830W33CCC	1962	STUART	2801	13454
79	360OVCB	422821093485311	08925W32DDD	1925	WEBSTER CITY NO 1	2005	00043
79	360OVCB	422819093484601	08925W32DDDD	1954	WEBSTER CITY NO 5	2005	06993
79	360OVCB	422855093481501	08925W33BDAA	1979	WEBSTER CITY NO 6	2000	25409
81	371JRDN	430015093360502	09523W31ACA	1934	KLEMME NO 1	1512	00265
81	361MQKT	431350093544201	09726W10CBC	1948	WODEN NO 1	531	03217
83	360OVCB	423310093032801	08919W02BD	1957	ACKLEY NO 2	1919	08169
87	371JRDN	405741091334501	07106W09CBB	1935	MT PLEASANT NO 3	1896	00052
87	371JRDN	405522091233001	07105W26ADAB	1961	NEW LONDON NO 2	1872	12683
87	360OVCB	405116091371501	07007W24BBCD	1976	SALEM NO 4	1910	23625
87	360ODVC	410851091394401	07307W09AABD	1951	WAYLAND NO 2	1900	25274
87	371SLRC	410733091260101	07305W16ACA	1948	WINFIELD NO 2	1920	03153
89	364STPR	432225092065701	09911W23CCA	1924	CRESCO NO 1	670	00004
89	371TMPL	432257092065701	09911W23BBD	1965	CRESCO NO 3	1145	17075
89	364GLEN	432650092170201	10012W29DBDC	1944	LIMESPRINGS 2	358	01836
91	364GLEN	424317094120501	09128W06CCAA	1948	DAKOTA CITY NO 2	1026	03222
95	371JRDN	413048092043001	07811W36CDA	1947	NORTH ENGLISH 2	1940	02910
95	371TMPL	413047092043801	07811W36CDB	1972	NORTH ENGLISH 3	1942	23110
97	371CMBRU	421558090254301	08605E07CCD	1948	BELLEVUE NO 2	1500	03236
97	360ODVC	421745090370801	08703E33CDD	1959	LAMOTTE NO 1	865	11757
97	371CMBRU	420430090401001	08402E24AA	1957	MAQUOKETA 4	2140	07966
97	371CMBRU	420347090404501	08402E24CDC	1963	MAQUOKETA 5	2310	13997
97	364GLEN	420243090184601	08406E31BBD	1956	MILES	565	07664
97	364STPR	420241090232401	08405E33BBD	1937	PRESTON NO 1	628	00548
97	364STPR	420247090234201	08405E32AAA	1965	PRESTON NO 2	697	17615
97	371CMBRU	420414090113201	08407E19BD	1895	SABULA NO 1	973	
99	371JRDN	413423092503601	07817W08BDDD		SULLY	2240	16827
101	360OVCB	410102091571801	07210W24DCD	1957	FAIRFIELD NO 1	2155	08193

Table 2.—Cambrian-Ordovician monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
103	371JRDN	414110091344001	08006W32CC	1965	CORALVILLE NO 1	1677	17262
103	371JRDN	413950091322402	07906W10BCC	1962	IOWA CITY NO 1	1570	13136
103	371TMPL	414235091364101	08007W25BDB		IOWA SECURITY HOSP	1720	20104
105	371TMPL	420718091165401	08404W02BAB	1969	ANAMOSA NO 4	1640	21773
107	367PRDC	411019092183001	07413W36BDB	1948	HEDRICK NO 1	1724	03065
107	367PRDC	412138091570702	07610W25ACDA	1960	KEOTA NO 3	1556	11764
107	371JRDN	411108091594001	07410W27BDDD	1952	RICHLAND	1870	05358
107	371JRDN	412356092211001	07613W10CBCA	1964	WHAT CHEER NO 3	1925	15298
109	364ODVCM	431737094125601	09829W24ACBC	1960	BANCROFT NO 2	540	12277
109	364ODVCM	431731094133001	09829W24ACBB	1974	BANCROFT NO 3	590	
109	360ODVC	432300094184201	09929W19AAB	1945	SWEA CITY NO 1	471	02217
111	371JRDN	404436091202701	06904W29DBC	1971	DENMARK	1765	
111	371JRDN	403839091333801	06806W33CBB	1969	DONNELLSON NO 5	1850	21320
113	371TMPL	420200091363001	08307W01BADA	1966	MARION NO 4	1565	17979
113	371JRDN	420219091344101	08406W32BCBC	1972	MARION NO 5	1660	23249
113	371JRDN	421723091465002	08608W04ACD	1965	WALKER 2	1525	17349
115	371JRDN	410543091151601	07304W25ADDA	1963	MORNING SUN 2	1819	14419
117	360OVCB	405858093175701	07120W06ABD	1956	RUSSELL NO 1	2520	07948
121	360OVCB	412923094072301	07728W06CDCC	1967	EARLHAM NO 3	2950	18838
123	371TMPL	412020092471002	07617W35CA	1968	LEIGHTON NO 4	2200	20834
125	360OVCB	411213092531501	07418W13CCCC	1972	BUSSEY NO 3	2262	23062
125	371JRDN	411332093142101	07421W11ACDC	1973	DALLAS-MELCHER NO 1	2439	23292
125	360OVCB	411940093060101	07520W01DAAA	1961	KNOXVILLE NO 1	2290	19961
125	360OVCB	412310093160601	07621W15BCDC	1967	PLEASANTVILLE NO 1	2405	19067
131	364STPR	431701092484101	09817W25BBBB	1912	OSAGE CITY NO 2	810	
131	364GLEN	432144092332501	09915W25DABA	1964	RICEVILLE NO 3	468	17554
135	360OVCB	410305092490701	07217W09DBB	1956	ALBIA NO 1	2295	08109
139	371JRDN	413402091155501	07804W13BAB	1959	WEST LIBERTY 3	1663	10351
139	371JRDN	413336091161501	07804W13CBB	1964	WEST LIBERTY 4	1655	16614
147	364STPR	430218094495501	09534W23BBAA	1921	AYRSHIRE	877	
147	364STPR	430210094500001	09534W23BB	1962	AYRSHIRE NO 2	900	13839
147	371JRDN	425735094270201	09431W13AC	1959	WEST BEND	1360	10712
153	360OVCB	413859093280601	07923W13DA	1968	ALTOONA NO 2	2505	20165
153	360OVCB	413931093292001	07923W11DCDD	1976	ALTOONA NO 3	2530	23701
153	360OVCB	414356093363601	08024W23BAA	1961	ANKENY NO 4	2715	12574
153	371JRDN	413351093432301	07825W15BDDA	1971	WEST DES MOINES NO 2	2482	22808
155	360ODVC	412832095132701	07738W16BAAB	1971	WALNUT	2635	22927
157	371JRDN	414323092271601	08014W23CBB	1961	BROOKLYN NO 5	2040	2686
157	371JRDN	414432092433203	08016W16BCB	1926	GRINNELL NO 6	2500	0151
157	371JRDN	414430092433001	08016W16BC	1955	GRINNELL NO 7	2970	06931
157	371JRDN	414421092425001	08016W16ACDD	1974	GRINNELL NO 8	2505	
161	360OVCB	422527094511901	08834W19BDAA	1945	LYTTON NO 2	1854	02018
161	364STPR	422525094513401	08835W24ADBD	1954	LYTTON NO 3	1550	
161	360OVCB	421831095152101	08738W34BADD	1976	ODEBOLT NO 8	2135	23923
169	360OVCB	420139093265701	08322W06DAB	1951	NEVADA NO 3	3342	04909
169	360OVCB	420129093273701	08322W06CCAD	1971	NEVADA NO 4	2630	22721

Table 2.—Cambrian-Ordovician monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
171	371JRDN	421008092181001	08513W13DDB	1974	DYSART NO 3	1840	
171	371TMPL	420957092181801	08513W24ABA	1961	DYSART PARK	1880	12665
171	371JRDN	415938092350001	08315W15CDD	1961	TOLEDO JORDAN NO 1	2016	12687
171	371JRDN	415935092351801	08315W15CCDC	1977	TOLEDO JORDAN NO 2	1990	24528
171	371TMPL	421126092273801	08514W10ADB	1963	TRAER NO 3	1813	4136
177	360OVCB	404407091574001	06910W36BDDB	1954	KEOSAUQUA NO 2	1831	03723
177	360OVCB	405120091500401	07009W24A	1972	STOCKPORT NO 1	1880	23139
179	360OVCB	405500092121501	07112W26DCA	1961	ELDON NO 8	1901	12922
179	360ODVC	432016093380301	09824W01BCBD	1971	LELAND NO 1	310	
181	360OVCB	412025093322201	07623W31DADD	1976	INDIANOLA NO 11	2435	23702
181	360OVCB	412027093342701	07624W36CBC	1955	INDIANOLA NO 9	2525	06995
181	360OVCB	413019093402701	07725W01ADDA	1964	LAKEWOOD NO 1	2490	17560
181	360OVCB	411717093261601	07522W19BBD	1964	MILO NO 4	2550	16207
183	360OVCB	411735091333801	07506W21BBBB	1977	AINSWORTH NO 5	1820	24623
183	367ONOT	411040091493001	07408W31BA	1923	BRIGHTON NO 1	1810	00012
183	367PRDC	411309091322801	07406W15BBD	1956	CRAWFORDSVILLE NO 3	1514	07308
183	371JRDN	411808091411601	07507W17BDDD	1908	WASHINGTON 3	1808	00285
183	371JRDN	411822091411001	07507W17ABCA	1956	WASHINGTON 6	1900	07549
183	371TMPL	411812091412601	07507W17BD	1969	WASHINGTON 7	1825	21000
183	371JRDN	412740091500001	07709W24AD	1955	WELLMAN NO 3	1715	06902
187	360ODVC	422135094173911	08730W12BCD	1938	CALLENDER NO 1	1785	00918
187	360OVCB	423014094114902	08928W19CDA	1949	FT DODGE NO 15	2307	03218
187	360OVCB	423043094120401	08928W19BDBB	1962	FT DODGE NO 16	1830	13068
187	360OVCB	423034094130201	08929W24BDA	1969	FT DODGE NO 17	1980	21118
187	364STPR	421715094172401	08630W01BDDD	1926	GOWRIE NO 1	1842	00006
187	360ODVC	421650094171801	08630W01DCC	1962	GOWRIE NO 5	1856	13840
189	364GLEN	432321093571501	09926W18DACD	1959	BUFFALO CENTER NO 1	500	10664
189	364GLEN	432323093571601	09926W18DACD	1964	BUFFALO CENTER NO 2	465	16406
189	360ODVC	431616093383501	09824W26DCDC	1973	FOREST CITY NO 3	305	
189	360ODVC	432457093321401	09923W03DDD	1914	LAKE MILLS NO 1	384	00035
189	361MQKT	432519093321201	09923W02CBBB	1959	LAKE MILLS NO 2	440	11188
189	360ODVC	432501093320001	09923W02CCDA	1978	LAKE MILLS NO 3	460	
189	360ODVC	432851093551801	10026W16CAA	1939	RAKE NO 1	200	00967
189	361MQKT	432851093551802	10026W16CAA	1960	RAKE NO 2	137	
189	361MQKT	432218093462301	09925W23CCCC	1915	THOMPSON NO 1	249	
189	361MQKT	432218093462201	09925W23CCCC	1926	THOMPSON NO 2	259	
191	364STPR	431816091474401	09808W16CABD	1958	DECORAH NO 2	60	
191	371JRDN	430842091460301	09608W10DAD	1944	OSSIAN NO 1	981	01824
191	371JRDN	430842091460302	09608W10DAD	1962	OSSIAN NO 2	1017	13842
191	364GLEN	431216091572001	09709W19CAA	1960	SPILLVILLE NO 2	362	11755

Table 3.—Mississippian-Pennsylvanian monitoring wells

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
9	320PSLV	413745095041501	07936W29BBCA	1956	KIMBALLTON	319	
25	330MSSP	421620094245601	08631W12CBB	1932	FARNHAMVILLE	776	00327
25	339GLMC	421515094314901	08632W13CC	1959	LOHRVILLE NO 3	645	10722
25	330MSSP	422236094254601	08731W02BDC	1968	SOMERS NO 1	410	21059
27	330MSSP	415520094565001	08235W08CD	1956	TEMPLETON	977	07618
53	338OSGE	404931093362801	07024W34BBBA	1958	GARDEN GROVE	1143	09894
69	330MSSP	424825093283402	09222W05CCBA	1932	ALEXANDER	220	
69	330MSSP	424537093220501	09221W19CCD	1900	LATIMER NO 1	170	
69	330MSSP	424537093220502	09221W19DCCD	1951	LATIMER NO 2	170	
73	330MSSP	420148094142001	08329W04BCDB	1950	GRAND JUNCTION NO 1	352	
73	330MSSP	420146094142001	08329W04BCDC	1925	GRAND JUNCTION NO 2	320	
73	325DSMS	420950094151101	08529W20BAD	1948	PATON NO 1	400	03497
73	320CBVF	420947094150801	08529W20ABCC	1972	PATON NO 2	460	
75	330MSSP	421327092492101	08617W34BABB	1979	BEAMAN NO 3	125	
75	339HMPN	421322092522001	08617W31ABDA	1962	CONRAD 3	120	13238
75	339HMPN	421336092524401	08617W30CD	1966	CONRAD 4	130	19098
77	325DSMS	415111094332401	08132W03DCAA	1919	BAYARD NO 1	210	
77	325DSMS	415118094331301	08132W03DA	1960	BAYARD NO 2	205	12608
77	330MDVU	413115094241401	07831W27DCB	1947	MENLO NO 2	1679	02974
79	339KDRK	422842093383501	08924W35DBA	1938	BLAIRSBURG NO 1	360	00713
79	339KDRK	422846093383901	08924W35ACCA	1962	BLAIRSBURG NO 2	455	14992
79	339KDRK	421902093344701	08723W30CBB	1948	ELLSWORTH NO 3	365	03492
79	339KDRK	421902093344702	08723W30CBB	1953	ELLSWORTH NO 4	365	06237
79	339KDRK	421417093360701	08624W26AAA	1954	RANDALL NO 1	347	06622
79	339KDRK	421730093473501	08625W05BC	1963	STANHOPE NO 4	585	15874
79	339KDRK	421724093474101	08625W05BCCB	1973	STANHOPE NO 5	585	
79	330MSSP	421620093554001	08626W07CBD	1930	STRATFORD NO 2	495	
79	330MSSP	421610093553011	08626W07CD	1959	STRATFORD NO 3	1345	10811
79	330MSSP	422904093324201	08923W27DCDB	1965	WILLIAMS NO 3	425	18640
81	339HMPN	425936093572401	09426W06ABAA	1950	CORWITH NO 1	130	04864
81	339HMPN	425939093572302	09426W06ABAA	1953	CORWITH NO 2	130	06225
81	339HMPN	425528093364501	09423W30CCDA	1964	GOODELL NO 1	170	16849
81	330MSSP	425609093473801	09425W28AADA	1934	KANAWHA NO 1	157	
81	330MSSP	425610093473901	09425W28AADA	1958	KANAWHA NO 2	200	
83	339KDRK	423323093034701	08919W02BB	1942	ACKLEY NO 3	140	01576
83	330MSSP	423313093031801	08919W02ABCD	1912	ACKLEY NO 4	110	
83	330MSSP	423115093223801	08921W18CBAA	1918	ALDEN NO 1	320	
83	330MSSP	423100093223601	08921W18CCAD	1965	ALDEN NO 2	350	17997
83	330MSSP	422127093055401	08719W08CBCC	1935	ELDORA NO 3	305	
83	339HMPN	422134093060701	08719W07DAC	1936	ELDORA NO 4	315	
83	339HMPN	422133093055801	08719W07DAAD	1963	ELDORA NO 5	292	14548
83	330MSSP	421821093174501	08721W33ACAA	1891	HUBBARD NO 1	385	
83	339KDRK	421833093175601	08721W33ABCB	1945	HUBBARD NO 2	480	02162
83	339HMPN	423139093154001	08920W18BBBC	1894	IOWA FALLS NO 1	278	
83	339HMPN	423139093154002	08920W18BBBC	1920	IOWA FALLS NO 2	280	

Table 3.—Mississippian-Pennsylvanian monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
83	339HMPN	423139093154003	08920W18BBBC	1934	IOWA FALLS NO 3	280	
83	339HMPN	423131093164301	08921W13BBDD	1957	IOWA FALLS NO 4	221	08350
83	339KDRK	423036093163401	08921W13BABD	1957	IOWA FALLS NO 5	232	09059
83	330MSSP	421658093101101	08620W03CDC	1946	NEW PROVIDENCE NO 1	485	02364
83	330MSSP	421703093101301	08620W03CDBD	1973	NEW PROVIDENCE NO 2	460	
83	330MSSP	421852093255901	08722W29DBCC	1927	RADCLIFFE NO 2	280	
83	330MSSP	421856093260101	08722W29DBCB	1957	RADCLIFFE NO 3	365	08549
83	339HMPN	422453093035001	08819W21DDC	1951	STEAMBOAT ROCK NO 1	115	05188
83	339HMPN	422441093035701	08819W28AABB	1964	STEAMBOAT ROCK NO 2	115	
83	339HMPN	421455093034601	08619W21ADBD	1967	UNION NO 2	195	20260
83	330MSSP	421542093000801	08619W13ADDA	1978	WHITTEN NO 2	235	
87	330MSSP	410749091324001	07306W15BBB	1965	OLDS NO 1	274	18276
91	330MSSP	425201094172901	09329W17DBDD	1928	BODE NO 1	217	
91	330MSSP	425208094171101	09329W17DAAD	1947	BODE NO 2	259	
91	330MSSP	424308094132601	09129W01CCAC	1973	HUMBOLDT NO 1	150	
91	330MSSP	425205094110801	09328W17CBDB	1968	LIVERMORE NO 2	227	
91	330MSSP	425204094110801	09328W17CBDC	1971	LIVERMORE NO 3	227	
91	330MSSP	425204094110201	09328W17CBDA	1982	LIVERMORE NO 4	245	
91	330MSSP	424943093584201	09327W36ACDB	1941	RENWICK NO 1	294	
91	339HMPN	424939093584201	09327W36ACD	1951	RENWICK NO 2	226	04815
91	339GLMC	424548094171901	09229W20DDB	1948	RUTLAND NO 1	75	03374
91	339HMPN	424128094030901	09127W17DDB	1946	THOR NO 1	373	02525
91	339KDRK	424128094030902	09127W17DDB	1962	THOR NO 2	375	
99	325DSMS	413118093065501	07820W36BBA	1956	MONROE NO 5	305	07897
99	325DSMS	413118093063201	07820W36ABB	1960	MONROE NO 6	305	12081
107	330MSSP	412144092030101	07510W30ACAA	1965	HARPER NO 2	265	
107	330MSSP	412147092030001	07510W30ABDD	1970	HARPER NO 3	322	22143
107	330MSSP	412141092030101	07510W30ACAD	1975	HARPER NO 4	280	
107	339WSVL	412138091571501	07610W25ACCA	1943	KEOTA NO 2	153	01794
107	330MSSP	412027092122301	07612W35DBDC	1927	SIGOURNEY (ROCK ISL)	280	
107	330MSSP	412709092051701	07711W26AABB	1956	SOUTH ENGLISH NO 1	182	
107	330MSSP	412701092053001	07711W23ABCD	1974	SOUTH ENGLISH NO 4	330	
107	338OSGE	412614092104501	07711W31BBB	1954	WEBSTER NO 1	177	
107	339KDRK	412400092205601	07613W10CAB	1949	WHAT CHEER NO 2	281	04093
125	333MRMC	411647092520601	07517W19CBC	1966	TRACY NO 1	147	17989
127	330MSSP	415250092552701	08218W27DAD	1963	LAUREL 1	248	03073
127	339PPCH	420020092465001	08317W13BA	1955	LEGRAND 2	100	07265
127	339KDRK	420728093121301	08520W32DCC	1934	ST ANTHONY 1	439	00171
133	320PSLV	420134096053901	08345W04CCAB	1905	ONAWA	863	00094
133	330MSSP	415910095464401	08342W19CAAA	1962	SOLDIER NO 3	800	13754
151	339GLMC	423449094505001	09034W27CAA	1902	FONDA NO 1	331	
151	330MSSP	423449094504601	09034W27CAAA	1939	FONDA NO 2	302	00995
151	339HMPN	424350094260001	09130W06BA	1957	GILMORE CITY NO 2	207	09420
151	330MSSP	424907094313001	09231W05AAC	1947	ROLFE	185	02973
153	330MSSP	414147093273201	08022W31BBD	1951	BONDURANT NO 1	650	04843
153	320PSLV	413418093432401	07825W10CB	1956	WEST DES MOINES NO 4	44	08887

Table 3.—Mississippian-Pennsylvanian monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
157	333SPRG	412930092291001	07714W09BB	1957	BARNES CITY NO 1	230	08974
157	330MSSP	414224092333201	08015W26DBDC	1979	MALCOLM NO 4	220	
157	338HGCK	413429092420401	07816W09ADDD	1955	SEARSBORO NO 1	200	08551
157	338KKUK	413429092420402	07816W09ADDD	1968	SEARSBORO NO 2	120	
165	339GLMC	413840095190001	07938W19BA	1957	HARLAN NO 2	1040	08231
169	330MSSP	415402093180401	08221W21BD	1927	COLLINS NO 1	510	02401
169	339KDRK	415407093180401	08221W21BDAC	1964	COLLINS NO 2	559	15568
169	330MSSP	421013093300101	08523W14CBC	1945	ROLAND NO 4	235	02075
169	330MSSP	421110093351401	08524W12DBA	1945	STORY CITY	261	02158
177	330MSSP	404150091483001	06808W08CD	1949	BONAPARTE NO 1	205	03579
177	330MSSP	404153091482101	06808W08CDDB	1957	BONAPARTE NO 2	145	10301
177	330MSSP	405030092050501	07011W26AAAB	1970	DOUDS NO 2	380	
177	330MSSP	405001092052201	07011W26DBAC	1970	LEANDO NO 1 (DOUDS)	370	
183	339WSVL	412750091495201	07709W24AAD	1934	WELLMAN NO 1	115	00268
183	339WSVL	412013091485701	07608W31DDCC	1957	WEST CHESTER NO 1	243	08701
187	330MSSP	423654094084501	09028W15BBB	1948	BADGER NO 2	530	03303
187	330MSSP	423650094085501	09028W15BBCB	1973	BADGER NO 3	548	23299
187	339KDRK	423028094115101	08928W19CAA	1931	FT DODGE NO 12	541	
187	330MSSP	423021094114904	08928W19CAD	1923	FT DODGE NO 8	1436	00009
187	339KDRK	423018094120101	08928W19CACC	1931	FT DODGE NO 9	553	00216
187	339KDRK	422615094175801	08830W14AAAD	1957	MOORLAND NO 1	730	08215
197	339HMPN	425058093364001	09323W19CDCC	1911	BELMOND NO 1	500	
197	339HMPN	425058093363901	09323W19CDCC	1958	BELMOND NO 2	208	09241
197	339HMPN	424352093435901	09124W06BBBA	1905	CLARION NO 1	280	
197	339GLMC	424349093440001	09124W06BBBD	1958	CLARION NO 3	300	10665
197	339KDRK	424003093541001	09126W27BDD	1957	EAGLE GROVE NO 4	450	08847
197	330MSSP	424135093362801	09123W18DBCA	1945	GALT 1	146	
197	330MSSP	424405093551502	09226W33DCBB	1957	GOLDFIELD NO 2	370	
197	330MSSP	424415093500101	09225W31DADA	1946	HOLMES NO 1	205	
197	339KDRK	424422093324001	09223W34ACC	1947	ROWAN NO 1	225	02929
197	333STLS	423359093503001	09025W31ACC	1952	WOOLSTOCK NO 1	120	05762

Table 4.—Silurian-Devonian monitoring wells

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
11	358KNKK	415957091513601	08309W14DBB	1939	ATKINS NO 1	456	00973
11	350SLRN	415950091512501	08309W14DBD	1966	ATKINS NO 2	485	18068
11	340DVSL	415425092050701	08211W14DDD	1943	BLAIRSTOWN NO 1	748	01763
11	350SLRN	415950091574301	08310W13CAC	1940	NEWHALL NO 1	475	01126
11	355NIGR	415944091573501	08310W13CDA	1957	NEWHALL NO 2	478	08596
11	350SLRN	421326091525301	08609W34ABB	1959	URBANA NO 2	560	11586
11	350SLRN	421327091520901	08609W35BBBD	1980	URBANA NO 3	560	
13	344CDVL	423139092261401	08914W12DDCD	1949	CEDAR FALLS NO 2	105	
13	344CDVL	423042092265801	08914W24BBAA	1961	CEDAR FALLS NO 5	145	
13	344CDVL	423143092275801	08914W11CDDC	1967	CEDAR FALLS NO 7	170	
13	355NIGR	423351092092801	09011W33BCB	1940	DUNKERTON NO 1	272	01287
13	344CCVL	422801092152801	08812W04BBBC	1960	ELK RUN HEIGHTS 1	125	12372
13	344WPPC	422804092165501	08812W06AABB	1953	EVANSDALE NO 1	135	06144
13	344WPPC	422804092165401	08812W06AABB	1953	EVANSDALE NO 2	135	06145
13	344WPPC	422805092165901	08812W06ACAA	1958	EVANSDALE NO 3	140	10039
13	340DVNN	422457092125101	08812W23CDB	1951	GILBERTVILLE NO 1	200	04778
13	350SLRN	422450092131001	08812W23CC	1959	GILBERTVILLE NO 2	275	11169
13	350SLRN	421903092113701	08712W25CAA	1948	LA PORTE CITY NO 2	250	03419
13	344CDVL	422818092212801	08913W34DDA	1955	WATERLOO NO 15	206	07482
13	355NIGR	423200092224001	08913W09DA	1957	WATERLOO NO 16	204	08641
15	341LMCK	415806093491601	08326W25DCAA	1961	LUTHER NO 1	700	14285
17	344DVNNM	423908092271901	09114W35AD	1928	JANESVILLE NO 1	90	
17	350SLRN	423902092272501	09114W35ADD	1959	JANESVILLE NO 2	150	11754
17	344DVNNM	425058092315601	09314W20CC	1959	PLAINFIELD NO 1	150	11138
17	350SLRN	424219092132801	09112W11DB	1958	READLYN NO 1	170	
17	350SLRN	424224092133901	09112W11DBB	1960	READLYN NO 2	154	11991
17	344WPPC	424855092152701	09212W04AADD	1950	TRIPOLI NO 2	129	04694
17	350SLRN	424319092283401	09114W03DA	1967	WAVERLY NO 5	157	
19	350SLRN	421900092002001	08710W27CB	1955	BRANDON NO 2	405	03894
19	344CDVL	423807092032601	09010W05BCDD	1977	FAIRBANK NO 4	197	
19	350SLRN	423651091542001	09009W09DDDC	1980	HAZLETON NO 3	69	
19	350SLRN	422808091531801	08909W34DDC	1943	INDEPENDENCE NO 3	307	01856
19	350SLRN	422833091532001	08909W34ADC	1948	INDEPENDENCE NO 4	293	03714
19	350SLRN	422742091534801	08809W04DBA	1964	INDEPENDENCE NO 6	265	16147
19	350SLRN	422837092034401	08910W31ADDA	1903	JESUP NO 1	234	
19	358KNKK	422852092040101	08910W31AAB	1957	JESUP NO 2	380	09382
19	340DVSL	422810092035201	08910W31DDCA	1976	JESUP NO 3	400	
19	358KNKK	423600091381501	09007W23ABB	1952	LAMONT NO 1	160	05557
19	340DVSL	422833091431701	08908W36DCAA	1980	WINTHROP NO 3	290	25801

Table 4.—Silurian-Devonian monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
23	341LMCK	423512092521001	09017W29AAAA	1962	APLINGTON NO 2	112	
23	344CDVL	424627092542302	09217W18CCCC	1967	BRISTOW NO 2	180	20256
23	344CDVL	424704092400801	09215W18BCAA	1939	CLARKSVILLE NO 1	225	
23	344CDVL	425355092475801	09317W01ACCC	1948	GREENE NO 1	155	
23	344CDVL	425330092483701	09317W01DDDA	1960	GREENE NO 2	120	03522
23	344CDVL	423412092371701	09015W33ABBB	1914	NEW HARTFORD NO 1	275	
23	344CLVL	423401092373601	09015W33BCA	1956	NEW HARTFORD NO 2	165	07854
23	344CDVL	423436092471601	09016W30CBAC	1920	PARKERBURG NO 1	285	
23	344CDVL	423437092471001	09016W30CBD	1955	PARKERSBURG NO 2	300	07043
23	344CDVL	424239092350001	09115W11ACBB	1941	SHELL ROCK NO 1	156	
23	344CDVL	424239092350002	09115W11ACBB	1956	SHELL ROCK NO 2	160	
31	350SLRN	414423090582201	08001W16BB	1951	BENNETT NO 1	265	
31	355GOWR	415255091034301	08202W27ACBD	1950	CLARENCE NO 3	200	04868
31	350SLRN	415418091153401	08204W13DCB	1962	MECHANICSVILLE 2	455	13609
31	355NIGR	414554091075301	08002W06BCC	1956	TIPTON NO 5	470	08081
31	350SLRN	414558091074801	08002W06BC	1966	TIPTON NO 6	455	
31	355NIGR	414026091210201	07904W06DDBA	1957	WEST BRANCH NO 2	428	08612
31	358ALXD	414026091210602	07904W06DDBB	1968	WEST BRANCH NO 3	446	20575
31	358ALXD	414032091210001	07904W06DACD	1979	WEST BRANCH NO 4	440	
33	344CDVL	425455093282601	09422W32CBAA	1957	MESERVEY NO 1	573	09406
33	344CDVL	431426093073301	09719W06DD	1925	PLYMOUTH NO 1	268	
33	344CDVL	425923093112001	09420W03ACBB	1939	ROCKWELL NO 11	463	01023
33	344CDVL	425923093112301	09420W03ABCC	1962	ROCKWELL NO 2	459	13838
33	344CDVL	425641093230701	09422W24ACA	1955	THORNTON NO 2	539	07222
33	340DVNN	430756093263201	09622W16DABC	1977	VENTURA NO 1	500	25538
37	350SLRN	430211092270701	09514W24BBAC	1950	IONIA NO 1	250	04872
37	340DVNN	425714092320801	09414W18DDAA	1942	NASHUA NO 1	245	01505
41	344CDVL	425656095004801	09435W19ADAA	1956	WEBB NO 2	600	
41	344CDVL	425656095004802	09435W19ADAA	1974	WEBB NO 2	615	
43	350SLRN	423837091235001	09005W02ABB	1952	EDGEWOOD 2	269	05650
43	358ALXD	424043091350902	09106W22DABD	1955	STRAWBERRY NO 3	259	07207
43	358ALXD	424026091321502	09106W22CDDA	1957	STRAWBERRY NO 4	240	08583
45	350SLRN	414921090450401	08102E17ACC	1937	CALAMUS NO 1	278	00549
45	355NIGR	414930090384901	08103E18ADA	1937	GRAND MOUND 1	253	
45	355NIGR	414926090385501	08103E18ADCA	1963	GRAND MOUND 2	251	14998
45	350SLRN	415752090485701	08301E26CBDD	1911	LOST NATION NO 1	125	
45	350SLRN	415753090490411	08301E26CBDC	1963	LOST NATION NO 2	205	
45	350SLRN	414806090212302	08105E22DDD	1923	LOW MOOR NO 1	256	
45	358ALXD	414806090212301	08105E22DDD	1959	LOW MOOR NO 2	322	10742
47	340DVNN	420804095202001	08539W36BCAA	1982	ULLRICH NO 1	1350	26684
55	358ALXD	422548091195001	08804W17DDB	1958	DELHI NO 1	278	10437
55	355NIGR	422852091161901	08804W36BCBB	1905	EARLVILLE NO 1	178	
55	350SLRN	422852091161701	08804W36BCBB	1960	EARLVILLE NO 2	200	
55	350SLRN	422925091270701	08905W29DAD	1948	MANCHESTER 4	235	03221

Table 4.—Silurian-Devonian monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
55	350SLRN	422925091275101	08905W29CAC	1963	MANCHESTER 5	298	14995
55	350SLRN	422834091281601	08905W31DAAB	1972	MANCHESTER 6	160	
55	350SLRN	422059091291401	08706W13DBA	1956	RYAN NO 2	410	02242
61	358ALXD	421812091004001	08701W31CBA	1958	CASCADE NO 2	180	09786
61	350SLRN	422910091072701	08902W30DCCC	1959	DYERSVILLE 1	120	
61	358KNKK	422852091064301	08902W32BCD		DYERSVILLE 3	195	22538
61	358ALXD	422654090561201	08801W11CBB	1964	EPWORTH NO 2	220	17109
61	350SLRN	423305091064901	08902W05CBBB	1898	NEW VIENNA NO 1	170	
65	350SLRN	424028091562701	09109W20DCBB	1969	OELWEIN NO 70	125	
65	355NIGR	425719091482401	09408W17DAAC	1957	WEST UNION 1 EAST	64	08614
65	355NIGR	425720091484201	09408W17DBAC	1957	WEST UNION 2 WEST	70	08615
65	344CDVL	424606091594201	09210W23BDBD	1906	WESTGATE NO 1	102	
67	344RPID	430458092403701	09516W01AAB	1950	CHARLES CITY NO 5	187	04869
67	344CDVL	430458092403703	09516W01AAB	1963	CHARLES CITY NO 7	185	15317
67	344CDVL	430919092351801	09615W11BBA	1968	COLWELL NO 1	286	
67	344RPID	430726092441501	09616W21ABDD	1948	FLOYD NO 1	193	03352
67	344CDVL	430725092442501	09616W21ABCD	1977	FLOYD NO 2	275	
67	344CDVL	425754092515201	09417W16BBAA	1926	MARBLE ROCK NO 1	202	
67	344CDVL	425754092515202	09417W16BBAA	1920	MARBLE ROCK NO 2	101	
67	344CDVL	430836093001701	09618W07DDAD	1958	NORA SPRINGS NO 1	289	
67	344CDVL	430843093002401	09618W07DACD	1927	NORA SPRINGS NO 2	385	
67	344CDVL	430840093002801	09618W07DACA	1978	NORA SPRINGS NO 3	300	
67	344CDVL	430319092565801	09518W10DDBB	1914	ROCKFORD NO 1	185	
67	344CDVL	430315092563401	09518W11CCBD	1978	ROCKFORD NO 2	214	
67	344CDVL	430741092540601	09617W18CCAD	1916	RUDD NO 1	200	
69	344CDVL	424413093220601	09221W31DBBD	1939	COULTER NO 1	628	
69	341APLG	424044093080101	09119W19DBB	1949	GENEVA NO 1	160	03918
69	344CDVL	424533093061201	09219W28BBB	1958	HANSELL NO 1	470	10584
75	344CDVL	422811092374901	08815W05BBB		DIKE 1	292	
75	344CLVL	422747092374901	08815W05CBB		DIKE 2	300	07401
75	344RPID	422148092461801	08717W12ADC	1944	GRUNDY CENTER 3	559	01897
75	344CLVL	422149092462601	08717W12ACAD	1961	GRUNDY CENTER 4	530	13152
75	344CDVL	422413092474601	08817W26DBC	1952	HOLLAND NO 1	463	
75	344CDVL	421928092354801	08715W28ABAD	1939	REINBECK NO 1	350	00210
75	344CDVL	421912092355702	08715W28ACD	1930	REINBECK NO 2	370	
75	344CLVL	423140092423001	08916W14BB	1956	STOUT NO 1	405	08098
81	344CDVL	430539093482201	09625W33BAAC	1937	BRITT NO 1	263	00554
81	340DVNN	430540093482001	09625W28CAC		BRITT NO 2	200	00371
81	340DVNN	430623093480001	09625W28ACDB	1967	BRITT NO 3	290	19659
81	344CDVL	431308093474201	09725W16DAA	1947	CRYSTAL LAKE NO 1	300	
81	344CDVL	430627093361301	09623W30ABD	1932	GARNER NO 1	225	00134
81	344CDVL	430546093360901	09623W31ABAD	1957	GARNER NO 2	325	08640
81	341LMCK	430015093360501	09523W31ACA	1959	KLEMME NO 2	185	11168
83	341APLG	423332093034301	09019W35CDC	1948	ACKLEY NO 1	175	03269
89	340DVNN	431303092052002	09711W13DBCB	1906	PROTIVIN NO 1	72	
89	344CDVL	432150092332401	09915W25DABA	1917	RICEVILLE NO 1	460	
91	341APLG	425208094171401	09329W17DAD	1948	BODE NO 2	259	03375

Table 4.—Silurian-Devonian monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
91	344CDVL	424314094121101	09128W06CCAA	1978	DAKOTA CITY NO 3	950	
95	340DVSL	414752091520201	08109W26BCDB	1950	AMANA SOC NO 3	555	04871
95	350SLRN	414755091521101	08109W26BCBC	1962	AMANA SOC NO 6	601	13780
95	350SLRN	414341091595501	08010W22BA	1971	CONROY NO 1	651	
95	340DVSL	414825091511201	08109W23DADA	1968	EAST AMANA SOC 2	550	21060
95	350SLRN	414536091523201	08009W03DDCB	1967	HOMESTEAD SOC NO 17	750	20011
97	358EDGD	420912090352101	08503E22DAA	1953	ANDREW NO 1	247	06141
97	355HPKN	420428090501901	08401E22BB	1912	BALDWIN 1	160	
97	358ALXD	421750090365001	08703E33DC	1940	LAMOTTE NO 2	170	01291
103	358KNKK	414324091473501	08008W21BCCC	1925	OXFORD NO 2	586	01699
103	358KNKK	414801091294501	08106W25BAA	1960	SOLON NO 2	482	12477
103	355NIGR	414213091394902	08007W28DCAB	1969	TIFFIN NO 2	305	21746
105	358KNKK	420747091105801	08503W34ACC	1948	AMBER NO 1	405	03334
105	358KNKK	420631091172001	08404W03DDD	1955	ANAMOSA NO 2	405	07306
105	350SLRN	420638091044401	08402W04CACC	1939	CENTER JUNCTION 1	300	00218
105	355GOWR	420120091213001	08304W06CD	1935	MARTELLE NO 1	121	00230
105	355NIGR	420102091214101	08304W07B	1969	MARTELLE NO 2	249	21792
105	350SLRN	421420091142001	08603W21CD	1955	MONTICELLO 3	603	07032
105	355HPKN	420009091084901	08303W13BA	1910	OLIN NO 1	180	
105	355GOWR	420331091000701	08401W30A	1933	WYOMING NO 1	260	
109	340DVNN	431151094131201	09729W24CDD	1916	BURT NO 1	514	
109	344CDVL	431306094192801	09729W18BCC	1946	LONE ROCK NO 1	167	02333
109	344CDVL	431407094022401	09727W09ACB	1936	TITONKA NO 1	300	
109	344DVNNM	430506093593201	09627W35DADD	1937	WESLEY NO 2	302	00602
113	358ALXD	420901091373501	08507W26AB	1961	ALBURNETT 1	400	13909
113	350SLRN	420859091371201	08507W26AAD	1914	ALBURNETT 2	400	
113	344SOLN	421138091471801	08508W09BAB	1966	CENTER POINT NO 1	49	18947
113	358KNKK	415509091461701	08208W16ABA	1959	FAIRFAX 1	410	11597
113	358ALXD	420200091363003	08307W01BADB	1941	MARION NO 1	437	01333
113	355NIGR	420200091363002	08307W01BAAA	1953	MARION NO 2	441	05741
113	358KNKK	415525091252601	08205W10CBC	1957	MT. VERNON NO 3	405	09254
113	358KNKK	415553091245101	08205W10ABC	1967	MT. VERNON NO 4	350	20008
127	350SLRN	415640093062101	08219W06ACCB	1939	MELBOURNE 1	1340	00908
131	344RPID	431337092461901	09716W07DDCD	1959	ORCHARD NO 1	220	11450
131	344CDVL	432241092550801	09918W24CABA	1903	ST. ANSGAR NO 1	240	
131	344CDVL	432241092550802	09918W24CABA	1960	ST. ANSGAR NO 2	240	
131	344CDVL	432610092465801	10016W31BDDC	1915	STACYVILLE NO 1	117	
139	350SLRN	413428091094601	07803W11DBBB	1938	ATALISSA NO 1	295	00856
139	358ALXD	413520091013701	07802W01ACCD	1968	WILTON NO 1	450	20270
139	358ALXD	413520091014701	07802W01BDDD	1968	WILTON NO 2	450	20329
155	344WPPC	411836095240001	07540W12CBA	1918	OAKLAND NO 3	1936	00213
163	355NIGR	413037090455501	07802E32CCC	1944	BLUE GRASS 1	500	03789
163	350SLRN	412728090431701	07702E22CAB	1958	BUFFALO NO 1	405	10563
163	355NIGR	414131090402601	08002E36ACC	1959	DONAHUE 1	407	10638
163	355NIGR	413933090351301	07903E11CBC	1955	ELDRIDGE 3	487	07460
163	350SLRN	413557090210001	07905E35CDB	1948	LECLAIRE 1	360	03421

Table 4.—Silurian-Devonian monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
163	355NIGR	413545090213501	07805E03AAA	1960	LECLAIRE 2	435	12493
163	355NIGR	413855090430701	07902E15BDC	1955	MAYSVILLE NO 1	160	07088
163	350SLRN	414251090523401	08001E20CC	1949	NEW LIBERTY 1	205	
163	350SLRN	413459090463502	07802E06CDD	1943	WALCOTT 2	90	
163	355NIGR	413500090462401	07802E06DCC	1966	WALCOTT 3	230	18000
169	344CDVL	420950093232701	08522W22ABA	1951	MCCALLSBURG NO 1	1130	04737
171	344CDVL	420504092240301	08413W18DAC	1955	CLUTIER NO 1	290	7402
171	350SLRN	420029092190101	08313W12CCC	1953	ELBERON NO 1	635	6017
171	341LMCK	420533092403801	08416W14ABA	1943	GARWIN 2	171	01663
171	344CDVL	421549092413801	08616W15ADA	1950	LINCOLN NO 2	528	4064
171	341LMCK	415938092345201	08315W15CDDA	1956	TOLEDO NO 5	145	08494
171	344CDVL	421135092275001	08514W10ABCD	1894	TRAER NO 1 NORTH	240	
171	344CDVL	421135092275002	08514W10ABCD	1923	TRAER NO 2 SOUTH	350	
185	341LMCK	403456093312701	06723W20DCA	1954	LINEVILLE	1285	06868
187	341LMCK	423019094214301	08930W23CBC	1964	BARNUM NO 1	850	14551
187	340DVNN	421550094041001	08628W14ADAB	1931	DAYTON NO 2	1240	
187	340DVNN	421600094042001	08628W14AB	1952	DAYTON NO 3	1250	05548
187	340DVNN	422803093591601	08827W03BBC	1945	DUNCOMBE NO 2	974	01931
187	340DVNN	423024094115501	08928W19CACA	1935	FT DODGE NO 14	980	00352
187	340DVNN	421552094103702	08629W13BACC	1955	HARCOURT NO 2	1245	07307
187	340DVNN	422132094030401	08728W12DACA	1937	LEHIGH NO 2	1005	00489
187	340DVNN	422507094092201	08828W19BD	1961	OTHO NO 2	1045	12698
187	340DVNN	423517094010401	09027W22DCC	1960	VINCENT NO 2	745	12537
189	344CDVL	431615093382601	09824W26DDCC	1932	FOREST CITY NO 1	142	
189	344CDVL	431556093375401	09824W36BBDD	1934	FOREST CITY NO 2	142	00304
191	344CDVL	431100091505401	09709W36AAB	1910	CALMAR NO 1	350	
195	344CDVL	431558093250401	09822W35BCBB	1980	FERTILE NO 1	242	
195	344CDVL	431943093041801	09819W03DCDC	1938	GRAFTON NO 1	172	00700
195	344CDVL	431944093041402	09819W03DCDB	1978	GRAFTON NO 2	295	
195	344CDVL	432110093123501	09920W33ACBC	1956	KENSETT NO 1	259	
195	344CDVL	432109093124501	09920W33BDAB	1966	KENSETT NO 2	303	19172
195	344CDVL	431713093121401	09820W21DDA	1911	MANLY NO 1 WEST	165	
195	344CDVL	431713093121402	09820W21DDAA	1920	MANLY NO 2 EAST	439	
195	344CDVL	431739093121901	09820W21ADBB	1939	MANLY NO 3 NORTH	306	
195	344CDVL	432642093132101	10020W29DDDC	1931	NORTHWOOD NO 1	162	
195	344CDVL	432642093132102	10020W29DDDC	1931	NORTHWOOD NO 2	162	
197	344CDVL	423923093300701	09123W36AAC	1948	DOWS NO 4	751	03121
197	344CDVL	423923093295601	09123W36AAD	1967	DOWS NO 5	752	19239

Table 5—Cretaceous monitoring wells

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
21	217DKOT	424027095180903	09138W26BACA	1950	ALTA NO 3	508	
21	210CRCS	424019095174601	09138W26ACA	1963	ALTA NO 4	530	14165
21	217DKOT	424935095095301	09337W36CABC	1935	REMBRANDT	439	
21	217DKOT	424330095111001	09137W02CBA	1955	TRUESDALE NO 1	442	08104
25	210CRCS	421626094242201	08631W12ACC	1947	FARNHAMVILLE	195	02975
27	217DKOT	421058094582701	08535W07CCC	1942	BREDA NO 2	349	01526
27	210CRCS	420331094543101	08435W27BDD	1953	CARROLL	141	06220
27	217DKOT	420332094440201	08433W30ACBD	1969	GLIDDEN NO 4	156	
27	217DKOT	420335094440801	08433W30ACBB	1971	GLIDDEN NO 5	156	
27	217DKOT	421114094412501	08533W09DAC	1941	LANESBORO NO 1	145	01406
27	217DKOT	421117094411901	08533W09DDAB	1954	LANESBORO NO 2	134	06860
27	217DKOT	420733094465301	08534W35CCC	1956	LIDDERDALE NO 2	240	08006
29	217DKOT	412715094460401	07735W21BDDD	1943	ANITA NO 2	220	
29	217DKOT	412650094460701	07734W21CDD	1949	ANITA NO 3	214	04088
29	217DKOT	412714094460701	07735W21BDDD	1960	ANITA NO 3	237	
29	217DKOT	412429094594301	07636W04CAD	1945	ATLANTIC NO 2	81	
29	217DKOT	412430094595001	07636W04CA	1942	ATLANTIC NO 7	83	01785
29	217DKOT	411637094520201	07535W22CAC	1961	CUMBERLAND NO 3	257	12969
29	217DKOT	411355095065201	07437W09BBAA	1955	GRISWOLD TOWN WELL	100	07441
29	217DKOT	412400094532001	07635W09BB	1940	WIOTA NO 1	156	01149
35	217DKOT	424252095253801	09139W10ADDA	1961	AURELIA NO 3	400	
35	217DKOT	424251095262101	09139W10BDDB	1972	AURELIA NO 4	375	
35	217DKOT	424455095323701	09240W35BBBB	1951	CHEROKEE NO 4	199	
35	217DKOT	424358095333001	09140W03BACB	1965	CHEROKEE NO 5	261	
35	217DKOT	424843095424801	09241W05CACD	1935	CLEGHORN NO 1	398	
35	217DKOT	424847095430001	09241W05CBDA	1976	CLEGHORN NO 2	430	
35	217DKOT	425135095323401	09340W23BCA	1960	LARRABEE NO 2	385	12276
35	217DKOT	424739095382501	09241W12CCD	1956	MERIDEN NO 1	380	08106
35	217DKOT	423744095383301	09041W11ADAD	1967	QUIMBY NO 1	225	
63	217DKOT	432404094504411	09934W10DCCB	1940	ESTHERVILLE NO 4	759	01243
85	217DKOT	414500095420002	08042W11DC	1936	WOODBINE NO 1	92	00455
85	217DKOT	414500095420001	08042W11DC	1949	WOODBINE NO 2-WEST	90	03751
93	210CRCS	422009095210101	08739W23ACBD	1967	ARTHUR NO 4	330	19840
93	217DKOT	422915095323503	08940W35BBBC	1937	HOLSTEIN NO 3	645	00567
93	217DKOT	422915095323501	08940W35BBB	1951	HOLSTEIN NO 4	430	05120
109	217DKOT	430417094142401	09529W02CABA	1936	ALGONA NO 5	163	00617
109	217DKOT	431255094253101	09730W18DACD	1937	FENTON NO 2	229	00533
119	217DKOT	431844096263501	09847W18BDB	1940	INWOOD NO 1	518	01344
119	217DKOT	431837096261401	09847W18ACDC	1966	INWOOD NO 2	510	
119	217DKOT	431848096260601	09847W18AAC	1963	INWOOD NO 3	509	15926

Table 5—Cretaceous monitoring wells—Continued

COUNTY CODE	AQUIFER CODE	SITE ID NUMBER	LOCAL WELL NUMBER	CONSTRUCTION DATE	LOCAL WELL NAME	WELL DEPTH (FEET)	"W" NO.
137	217DKOT	410902095092201	07338W01DADC	1962	ELLIOT NO 2	108	14603
137	217DKOT	410106095115501	07238W22DDBC	1921	RED OAK NO 1 LOWER E	48	
137	217DKOT	410116095114901	07238W22DDBA	1949	RED OAK NO 2 UPPER E	117	
137	217DKOT	410216095113401	07238W14CBBB	1955	RED OAK NO 4	160	07047
137	217DKOT	405850095061701	07137W04ACD	1953	STANTON NO 1	150	06207
141	217DKOT	431035095283201	09739W32ACC	1960	HARTLEY	590	12222
141	217DKOT	431035095283202	09739W32ACC	1938	HARTLEY	660	00817
141	217DKOT	430447095354501	09540W05ABC	1937	PRIMGHAR TOWN WELL	570	00517
141	217DKOT	430508095373901	09641W36DDCA	1969	PRIMGHAR TOWN WELL	630	
141	217DKOT	430514095373601	09641W36DAD	1956	PRIMGHAR TOWN WELL	672	07930
141	210CRCS	431140095505801	09742W30ACDB	1963	SHELDON	615	15818
141	210CRCS	425824095300901	09439W07CAB	1953	SUTHERLAND 3	471	06045
143	217DKOT	432353095450401	09942W13ACCB	1946	SIBLEY NO 2	400	
143	217DKOT	432340095450001	09942W13DB	1960	SIBLEY NO 3	740	12223
143	217DKOT	432345095443701	09942W13DAAC	1979	SIBLEY NO 4	750	
147	210CRCS	425611094410501	09433W25ABA	1947	MALLARD NO 2	205	02863
147	217DKOT	430747094535711	09634W18DDBB	1944	RUTHVEN NO 4	468	01960
147	217DKOT	430745094541101	09634W18DCAC	1957	RUTHVEN NO 5	511	08630
147	217DKOT	425731094270801	09431W13ACCC	1949	WEST BEND	115	03595
149	210CRCS	424414096261001	09247W31DCDC	1978	AKRON	490	
149	217DKOT	423650096175701	09046W17ACAC	1974	HINTON NO 4	270	
149	217DKOT	424619096111001	09245W20BDDD	1969	LE MARS NO 7	351	
149	217DKOT	424756096095501	09245W09CAAD	1972	LE MARS NO 8	360	
149	217DKOT	424911096033001	09244W05AA	1953	OYENS NO 1	215	
151	217DKOT	425018094415701	09333W26DDA	1938	HAVELOCK NO 3	218	
151	217DKOT	424408094400701	09232W31CDAA	1941	POCAHONTAS NO 1	214	01549
155	217DKOT	412653095370901	07742W25ABB	1966	NEOLA NO 4	134	18833
161	217DKOT	421507094522801	08635W24BBA	1942	AUBURN NO 2	292	01584
161	217DKOT	423013095173701	408938W26ABA	1939	SCHALLER NO 1	353	01076
161	217DKOT	422950095174301	08938W26ACDC	1957	SCHALLER NO 3	462	09380
167	217DKOT	431133096075902	09745W26CBAA	1959	HULL NO 4	665	10434
167	217DKOT	431133096075901	09745W26CBAA	1963	HULL NO 5	630	14647
167	217DKOT	425835096190901	09446W07ACC	1935	IRETON NO 2	538	00343
167	217DKOT	425815096185101	09446W07DDAB	1967	IRETON NO 4	573	
167	217DKOT	425749096104201	09445W17AACD	1962	MAURICE NO 3	252	14860
167	217DKOT	425755096104501	09445W17AACB	1975	MAURICE NO 4	520	
167	217DKOT	425942096033901	09444W05AACB	1968	ORANGE NO 6	597	
193	217DKOT	422833095463301	08942W34CDC	1957	CORRECTIONVILLE NO 2	187	08854
193	217DKOT	421834096171501	08747W35BCDB	1949	SALIX NO 1	170	
193	217DKOT	422848096210701	08947W35DADD	1956	SIOUX CITY NO 1	381	
193	217DKOT	423006096250401	08947W29ABDC	1969	SIOUX CITY NO 11	348	
193	217DKOT	423004096244501	08947W29ADAB	1926	SIOUX CITY NO 17	279	
193	217DKOT	422927096252201	08947W29CDCD	1971	SIOUX CITY NO 2	310	

Table 6—Field parameters for ground-water-quality sampling

Field parameter	WATSTORE Code
Water temperature, field, ° Celsius	00010
Air temperature, ° Celsius	00020
pH, units	00400
Specific conductance, µmhos at 25° Celsius	00095
Alkalinity, carbonate, as CaCO3, mg/L	99430
Flow rate, instantaneous, gal/min	00059
Pump or flow period prior to sampling, minutes	72004
Sample source code	72005
Water level, depth below land surface, feet	72019
Sampling method code	82398

Table 7—Common constituents and characteristics for laboratory measurement

Parameter name	WATSTORE Code
Calcium, dissolved, mg/L	00915
Magnesium, dissolved, mg/L	00925
Sodium, dissolved, mg/L	00930
Potassium, dissolved, mg/L	00935
Bicarbonate ion, as HCO3, mg/L	95440
Carbonate ion, as CO3, mg/L	95445
Alkalinity as CaCO3, mg/L,	90410
Hardness as CaCO3, mg/L	00900
Sulfate, dissolved, mg/L	00945
Chloride, dissolved, mg/L	00940
Fluoride, dissolved, mg/L	00950
Nitrogen, NO3+NO2, dissolved as N	00631
Nitrogen, ammonia, dissolved as N, mg/L	00608
Phosphorus, orthophospate, dissolved as P, mg/L	00671
Iron, dissolved, µg/L	01046
Iron, total, µg/L	01045
Manganese, dissolved, µg/L	01056
Manganese, total, µg/L	01055
Silica, dissolved, mg/L	00955
Solids, residue at 103° Celsius, dissolved, mg/L	00515
Solids, residue at 103° Celsius, total, mg/L	00500
Solids, dissolved, calculated sum, mg/L	70301
pH, units	00403
Specific conductance, lab, µmhos at 25° Celsius	90095

Table 8—Trace metal constituents for laboratory measurement

Parameter name	WATSTORE code	Detection level	reporting unit
Aluminum, dissolved	01106	100	µg/L
Arsenic, dissolved	01000	10	µg/L
Barium, dissolved	01005	100	µg/L
Cadmium, dissolved	01025	1	µg/L
Chromium, dissolved	01030	10	µg/L
Copper, dissolved	01040	10	µg/L
Lead, dissolved	01049	10	µg/L
Mercury, dissolved	71890	1	µg/L
Nickel, dissolved	01065	100	µg/L
Selenium, dissolved	01145	10	µg/L
Silver, dissolved	01075	10	µg/L
Strontium, dissolved	01080	10	µg/L
Zinc, dissolved	01090	10	µg/L

Table 9—Radiochemical constituents for laboratory measurement

Parameter name	WATSORE Code	Detection level	Reporting units
Alpha gross, dissolved as U natural	01515	.1	pCi/L
Beta gross, dissolved as Cs-137	03515	.1	pCi/L
Radium-226, dissolved as Ra-226	09503	.1	pCi/L
Radium-228, dissolved as Ra-228	81366	.1	pCi/L

Table 10—Priority pollutants and pesticides for laboratory measurement

PRIORITY POLLUTANTS

BASE/NEUTRAL COMPOUNDS

Compound	Concentration (ug/L)	Compound	Concentration (ug/L)
acenaphthene	<10	diethyl phthalate	<10
acenaphthylene	<10	dimethyl phthalate	<10
anthracene	<10	di-n-butyl phthalate	<10
benzidine	<10	2,4-dinitrotoluene	<10
benzo(a)anthracene	<10	2,6-dinitrotoluene	<10
benzo(a)pyrene	<10	di-n-octyl phthalate(1)	<10
3,4-benzofluoranthene	<10	1,2-diphenylhydrazine	<10
benzo(g,h,i)perylene	<25	fluoranthene	<10
benzo(k)fluoranthene	<10	fluorene	<10
bis-(2-chloroethoxy)methane	<10	hexachlorobenzene	<10
bis-(2-chloroethyl)ether	<10	hexachlorobutadiene	<10
bis-(2-chloroisopropyl)ether	<10	hexachlorocyclopentadiene	<10
bis-(2-ethylhexyl)phthalate	<10	hexachloroethane	<10
4-bromophenyl phenyl ether	<10	indeno(1,2,3-cd)pyrene	<25
butyl benzyl phthalate	<10	isophorone	<10
2-chloronaphthalene	<10	naphthalene	<10
4-chlorophenyl phenyl ether	<10	nitrobenzene	<10
chrysene	<10	N-nitrosodimethylamine	<10
dibenzo(a,h)anthracene	<25	N-nitrosodi-n-propylamine	<10
1,2-dichlorobenzene	<10	N-nitrosodiphenylamine	<10
1,3-dichlorobenzene	<10	phenanthrene	<10
1,4-dichlorobenzene	<10	pyrene	<10
3,3'-dichlorobenzidine	<10	1,2,4-trichlorobenzene	<10

(1) dioctylphthalate

VOLATILE COMPOUNDS

Compound	Concentration (ug/L)	Compound	Concentration (ug/L)
acrolein	<20	1,2-dichloropropane	<20
acrylonitrile	<20	1,3-dichloropropylene	<20
benzene	<20	ethylbenzene	<20
bis(chloromethyl)ether	<20	methyl bromide	<20
bromoform	<20	methyl chloride	<20
carbon tetrachloride	<20	methylene chloride	<20
chlorobenzene	<20	1,1,2,2-tetrachloroethane	<20
chlorodibromomethane	<20	tetrachloroethylene	<20
chloroethane	<20	toluene	<20
2-chloroethylvinyl ether	<20	1,2-trans dichloroethylene	<20
chloroform	<20	1,1,1-trichloroethane	<20
dichlorobromomethane	<20	1,1,2-trichloroethane	<20
dichlorodifluoromethane	<20	trichloroethylene	<20
1,1-dichloroethane	<20	trichlorofluoromethane	<20
1,2-dichloroethane	<20	vinyl chloride	<20
1,1-dichloroethylene	<20		

Table 10—Priority pollutants and pesticides for laboratory measurement—Continued

ACIDIC COMPOUNDS

Compound	Concentration (ug/L)
2-chlorophenol	< 25
2,4-dichlorophenol	< 25
2,4-dimethylphenol	< 25
4,6-dinitro-o-cresol(1)	<250
2,4-dinitrophenol	<250
2-nitrophenol	< 25
4-nitrophenol	< 25
p-chloro-m-cresol(2)	< 25
pentachlorophenol	< 25
phenol	< 25
2,4,6-trichlorophenol	< 25

(1) 2-methyl-4,6-dinitrophenol
(2) 4-chloro-3-methylphenol

PESTICIDE COMPOUNDS

Compound	Concentration (ug/L)	Compound	Concentration (ug/L)
Aldrin (HHDN)	<0.02	Toxaphene (polychlorocamphene)	<0.6
alpha-BHC (Benzene Hexachloride)	<0.01	Dyfonate (Fonofos)	<0.1
beta-BHC (Benzene Hexachloride)	<0.02	Counter (Terbufos)	<0.1
delta-BHC (Benzene Hexachloride)	<0.02	Lorsban (Chlorpyrifos)	<0.1
gamma-BHC (Lindane)	<0.01	Thimet (Phorate)	<0.1
Chlordane	<0.1	MoCap (Ethoprop)	<0.1
DDD (TDE)	<0.04	Atrazine (AAtrex)	<0.15
DDE	<0.02	Bladex (Cyanazine)	<0.08
DDT (Dichlorodiphenyltrichloroethane)	<0.04	Lasso (Alaclor)	<0.08
Dieldrin (HEOD)	<0.02	Treflan (Trifluralin)	<0.02
Endosulfan I (Thiodan I)	<0.02	Sencor (Metribuzin)	<0.01
Endosulfan II (Thiodan II)	<0.04	Dual (Metolachlor)	<0.1
Endosulfan sulfate	<0.02	Prowl (Pendimethalin)	<0.02
Endrin (Endrex)	<0.04	Amiben (Chloramben)	<0.07
Endrin aldehyde	<0.05	Banvel (Dicamba)	<0.07
Heptachlor	<0.01	2,4-D	<0.07
Heptachlor epoxide	<0.02	Silvex	<0.05