GROUND WATER
RESOURCES

IOWA GEOLOGICAL SURVEY
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Polk County

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GROUND-WATER RESOURCES OF POLK COUNTY

Introduction

Approximately 75% of the residents of Polk County rely on ground water as the source of their drinking water. It is estimated that the use of ground water in the county currently approaches 1.3 billion gallons per year. For comparison, this amount would provide each new resident with 116.36 gallons of water a day during the year. Actually, few if any households use this much water, and the rather large annual per capita use reflects the greater water requirements of the county's industries, agribusinesses and municipalities.

The users of ground water in the county draw their supplies from several different geologic sources. Several factors must be considered in determining the availability of ground water and the adequacy of a supply source:

distribution - having water where it is needed,

accessibility - affects the costs for drilling wells and pumping water,

yield - relates to the magnitude of the supply that can be sustained,

quality - determines for what purposes the water can be used.

In terms of these factors, there are few locations in Polk County where the availability of ground water is not limited to some degree. The most common limitation is poor water quality, that is, highly mineralized ground water. Secondary limitations are generally related to poor distribution, small yields from some sources, and poor accessibility due to the great depths to adequate sources.

Occurrence of Ground Water in Polk County

The occurrence of ground water is influenced by geology -- the position and thickness of the rock units, their ability to store and transmit water, and their physical and chemical make-up. Geologic units that store and transmit water and yield appreciable amounts to wells are called aquifers. The best aquifers are usually composed of unconsolidated sand and gravel, porous sandstone, and porous or fractured limestone and dolostone. Other units composed of materials such as clay and silt, shale, siltstone, and mudstone yield little or no water to wells. These impermeable units are called aquicludes or aquitards and commonly separate one aquifer unit from another.

In Polk County there are two principal sources from which users obtain water supplies: the loose, unconsolidated materials near the land surface that comprise the surficial aquifer, and several deep rock aquifers. Between the surficial aquifer and the deep Cambro-Ordovician aquifer are two other major water-bearing units, the Mississippian and the Devonian aquifer systems. However, throughout Polk County the water contained in these aquifers is highly mineralized and often of too poor quality for human or livestock use.

Figure 1 shows the geologic relations of these beneath the county. Each aquifer has its own set of geologic, hydrologic, and water quality characteristics which determine the amount and potability (suitability for drinking) of water it will yield.

Surficial Aquifers

Unconsolidated deposits at the land surface are comprised of mixtures of clay, silt, sand, gravel, and assorted boulders. The water-yielding potential of these deposits is greater in units composed mostly of sand and/or gravel. Three sub-types of surficial aquifers used in the county are alluvial aquifers, drift aquifers, and buried channel aquifers.

Alluvial aquifers consist mainly of sand and gravel transported and deposited by modern streams and make up the floodplains and terraces in major valleys. Alluvial deposits are near surface, generally less than 50-60 feet, and thus may be easily contaminated by infiltrating surface water.

The drift aquifer is the thick layer of clay to boulder size material (till) deposited over the bedrock by glacial ice which invaded the county at least twice in the last two million years. The composition of the glacial drift varies considerably and in many places does not yield much water. There may, however, be lenses or beds of sand and gravel in the drift that are thick and widespread enough to store and furnish dependable water. These may be difficult to locate because of their irregular shape and because they are buried within other drift materials. Usually one or two sand layers can be found in most places that will yield enough water to meet domestic needs.

Buried channels are pre-glacial valleys filled with alluvial sand and gravel. These valleys were overridden by glaciers and are now buried under the drift and may or may not coincide with present day alluvial valleys.

The distribution, yield, and water quality characteristics for the surficial aquifers are summarized in Figures 2 and 9 and Table 3. An indication of general thicknesses can be obtained by comparing the elevations of the top (the land surface) and the bottom (the bedrock surface) of the surficial deposits in Figure 4 and 5. The thickness of the glacial drift or the depth of buried channels can be determined by subtracting the elevation of the bedrock surface from the elevation of the land surface.

Rock Aquifers

Below the drift and other surficial materials is a thick sequence of layered rocks formed from deposits of rivers and shallow seas that alternately covered the state during the last 600 million years. The geologic map (Figure 3) shows the geologic units which form the surface of this rock sequence. These rocks are Pennsylvanian in age and are mainly shales. Although the Pennsylvanian rocks usually act as an aquiclude, sandstone layers within the Cherokee Group provide several wells in the southern half of the county with yields from 5-25 gpm. The thicknesses of these sandstone units are quite variable and the depth of wells drilled into them vary in depth between 75 and 100 feet. Water quality data extrapolated from Warren County indicates that in

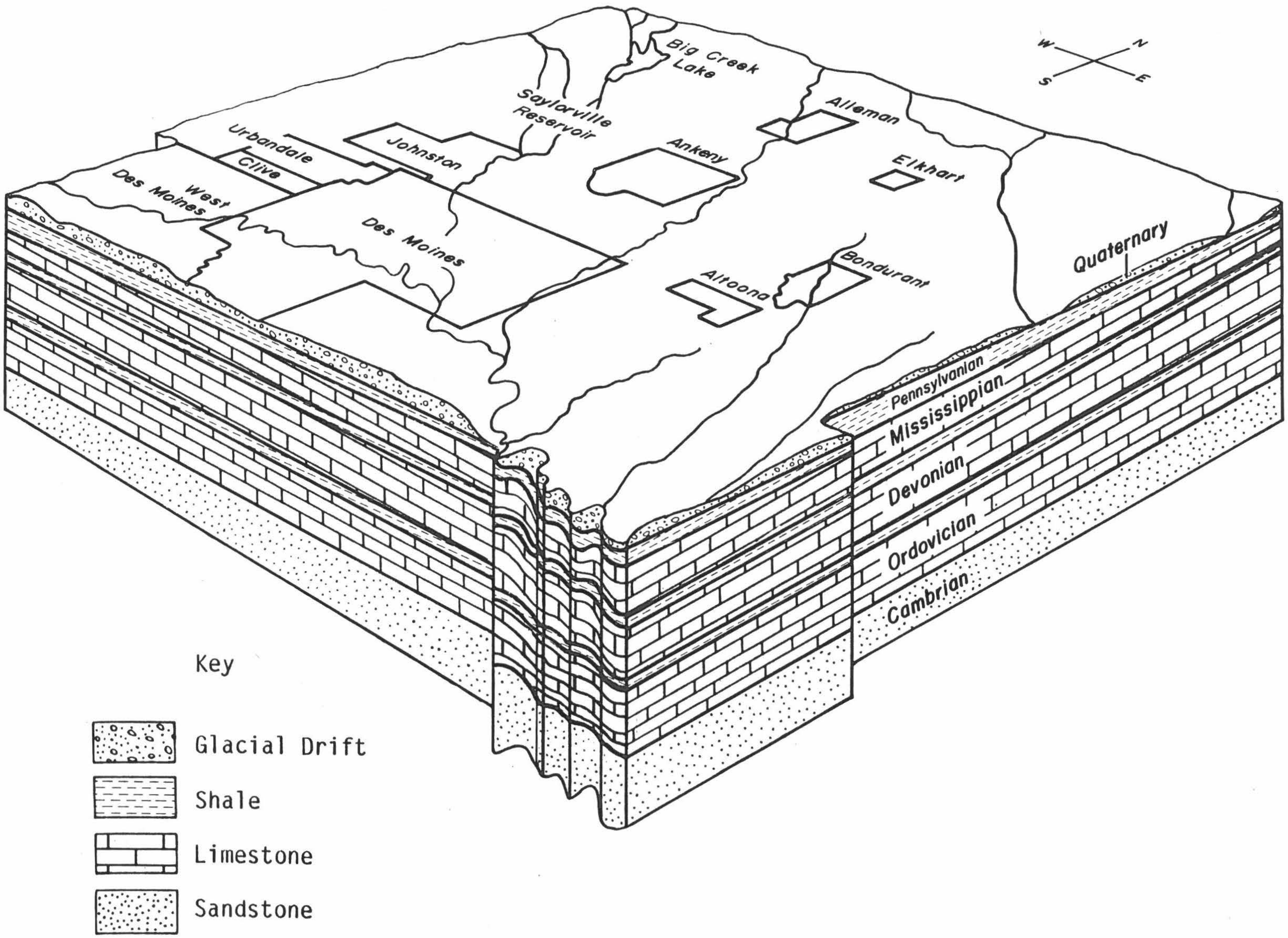


Figure 1

BLOCK DIAGRAM SHOWING THE GEOLOGY OF POLK COUNTY general, the water from the Pennsylvanian Cherokee is highly mineralized with high dissolved solids, sulphate and sodium concentrations. Nitrates are generally within acceptable limits.

Underlying the Pennsylvanin aquiclude is a sequence of older rocks, portions of which form the major rock aquifers beneath Polk County. This sequence and its water-bearing characteristics are shown in Table 1.

The Mississippian Aquifer is heavily used in Polk County by rural residents and consists of a series of limestones and dolostones. Yields range from 5-20 gpm. The Devonian aquifer contains extremely poor quality water and is little used in the county. The Cambro-Ordovician Aquifer is the major deep aquifer in the county and includes the St. Peter sandstone, the Prairie du Chien dolomite and the Jordan sandstone, the latter of which is the major water producer. The maps in Figure 12 do not include information on the St. Peter,, but refer instead to the Jordan Aquifer, the lower two units of the Cambro-Ordovician Aquifer. The St. Peter, being highly friable, is generally cased out in the deep wells.

Examples of the rock units encountered in several wells at various locations in Polk County are indexed and illustrated in Figures 7 and 8. The geologic unit that supplies ground water and the rate of yield are shown for each well.

The accessibility of ground water in rock aquifers depends on the depth to the aquifer. The deeper a well must be, the greater the cost for well construction and pumping. The depths to and thicknesses of units at specific sites will vary somewhat because of irregularities in the elevation of the land surface and in the elevation of the tops of the underlying rock units. Estimates of depths and thicknesses can be made by comparing Figure 4 with the maps of aquifer elevations in Figures 10, 11, and 12. The range in depth below land surface to the top of the county's principal bedrock aquifers is given for each township in Figure 6.

A second factor which affects ground water accessibility is the level to which the water will rise in a well (the static water level). Throughout the county water in the rock aquifers is under artesian pressure and rises in wells once the aquifer is penetrated. This can reduce the cost of pumping. Average static water levels for Polk County wells are shown in Figures 10, 11, and 12.

Average rates of yield and water quality characteristics for each of the aquifers are summarized in the maps in figures 10, 11, 12 and Table 4.

Table 1

GEOLOGIC AND HYDROGEOLOGIC UNITS IN POLK COUNTY

Age	Rock Unit	Description	Thickness Range	Hydrogeologic Unit	Water-Bearing Characteristics
Quaternary	Alluvium	Sand, gravel, silt and clay	0-295 (feet)	Surficial aquifer	Fair to large yields (10 to 500 gpm)
	Glacial drift (undifferentiated)	Predominantly till containing scattered irregualr bodies of sand and gravel			Low yields (less than 10 gpm)
	Buried channel	Sand, gravel, silt and clay			Small to large yields
Pennsylvanian	Marmaton Group	Alternating shale and limestone; thin coal and sandstone	0-500	Aquiclude	Low yields only from limestone and sandstone
	Cherokee Group	Shale, clay, siltstone, sandstone and coal beds; mostly thin			
Mississippian	Meramac Series	Sandy limestone	285-450	Mississippian aquifer	Fair to low yields
	Osage Series	Limestone and dolostone, cherty; shale			
	Kinderhook Series	Limestone, oolitic, and dolostone, cherty			
Devonian	Maple Mill Shale Sheffield Formation Lime Creek Formation	Shale, limestone in lower	150-250	Devonian aquiclude	Does not yield water
	Cedar Valley Limestone Wapsipinicon Formation	Limestone and dolostone contains evaporites (gypsum) in southern half of Iowa	500-550	Devonian aquifer*	Fair to low yields
Silurian	Undifferentiated	Chert and limestone	50-100	Silurian aquifer	Low yields from limestone
Ordovician	Maquoketa Formation	Shale and dolostone	950-1050	Maquoketa aquiclude	Does not yield water
	Galena Formation	Dolostone and chert		Minor aquifer	Low yields
	Decorah Formation Platteville Formation	Limestone, dolostone and thin shale, includes sandstone in SE Iowa		Aquiclude	Does not yield water
	St. Peter Sandstone	Sandstone		Cambro-Ordovician aquifer	Fair yields
	Prairie du Chien Formation	Dolostone, sandy and cherty			High yields (over 500 gpm)
Cambrian	Jordan Sandstone	Sandstone			
	St. Lawrence Formation	Dolostone		Aquitard	Low yields
	Franconia Sandstone	Sandstone and Shale			
	Dresbach Group	Sandstone		Dresbach aquifer*	High to low yields
Precambrian	Undifferentiated	Coarse sandstone: crystalline rocks		Base of ground water reservior	Not know to yield water

*not significant in Polk County owing to highly mineralized water contained.

Figure 2

SURFICIAL MATERIALS

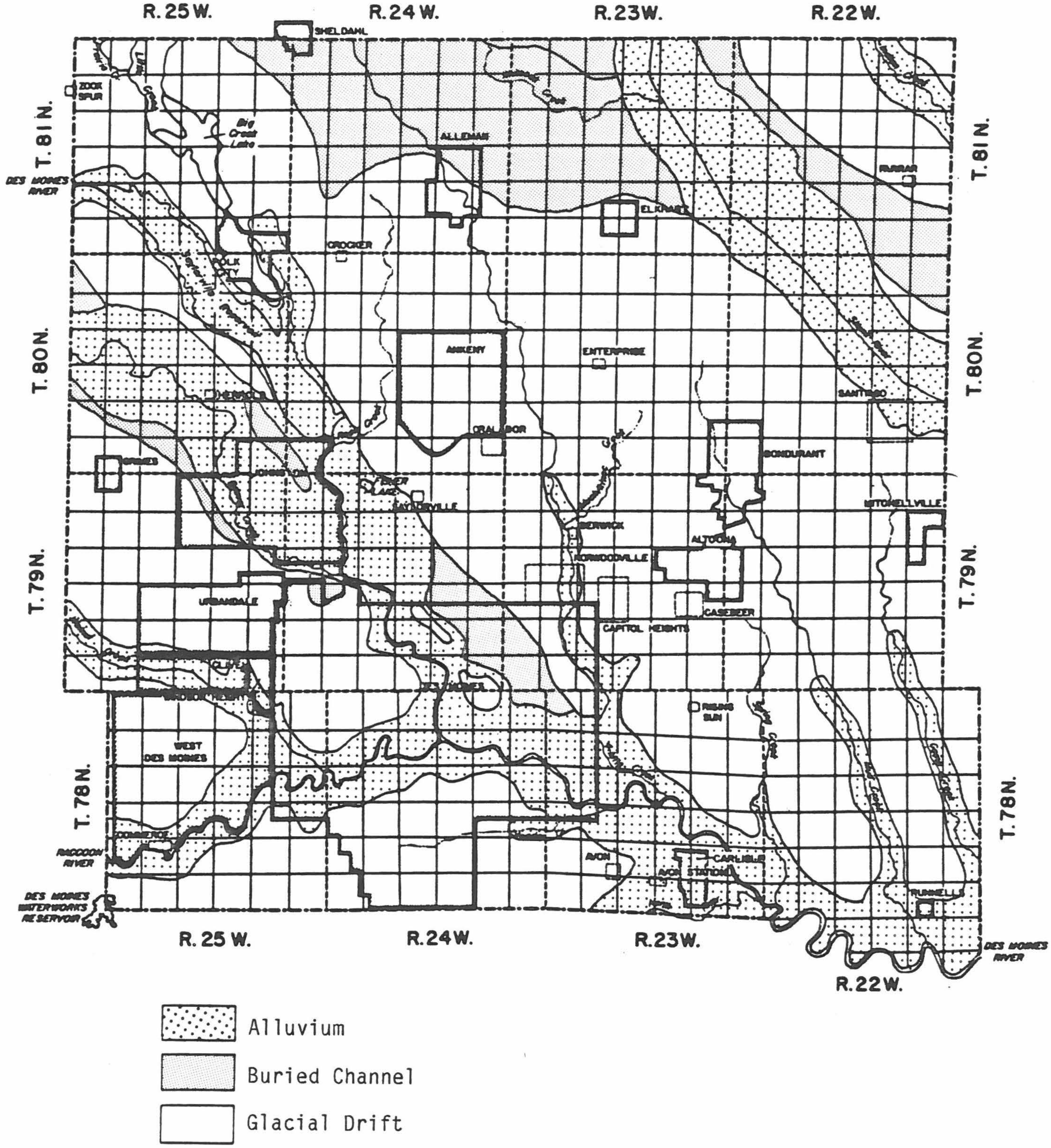


Figure 3

GEOLOGIC MAP

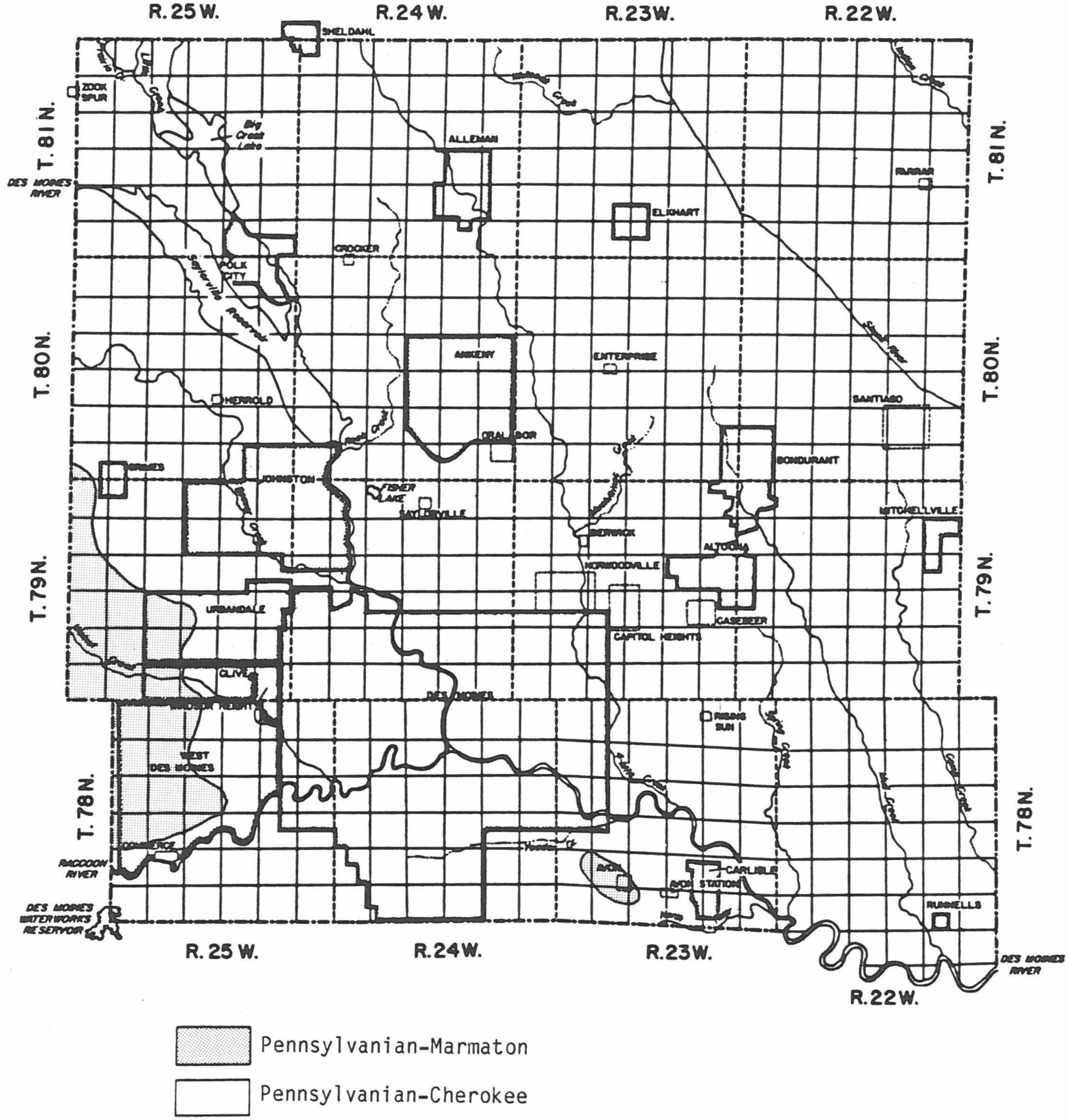


Figure 4

ELEVATION OF LAND SURFACE IN FEET ABOVE MEAN SEA LEVEL

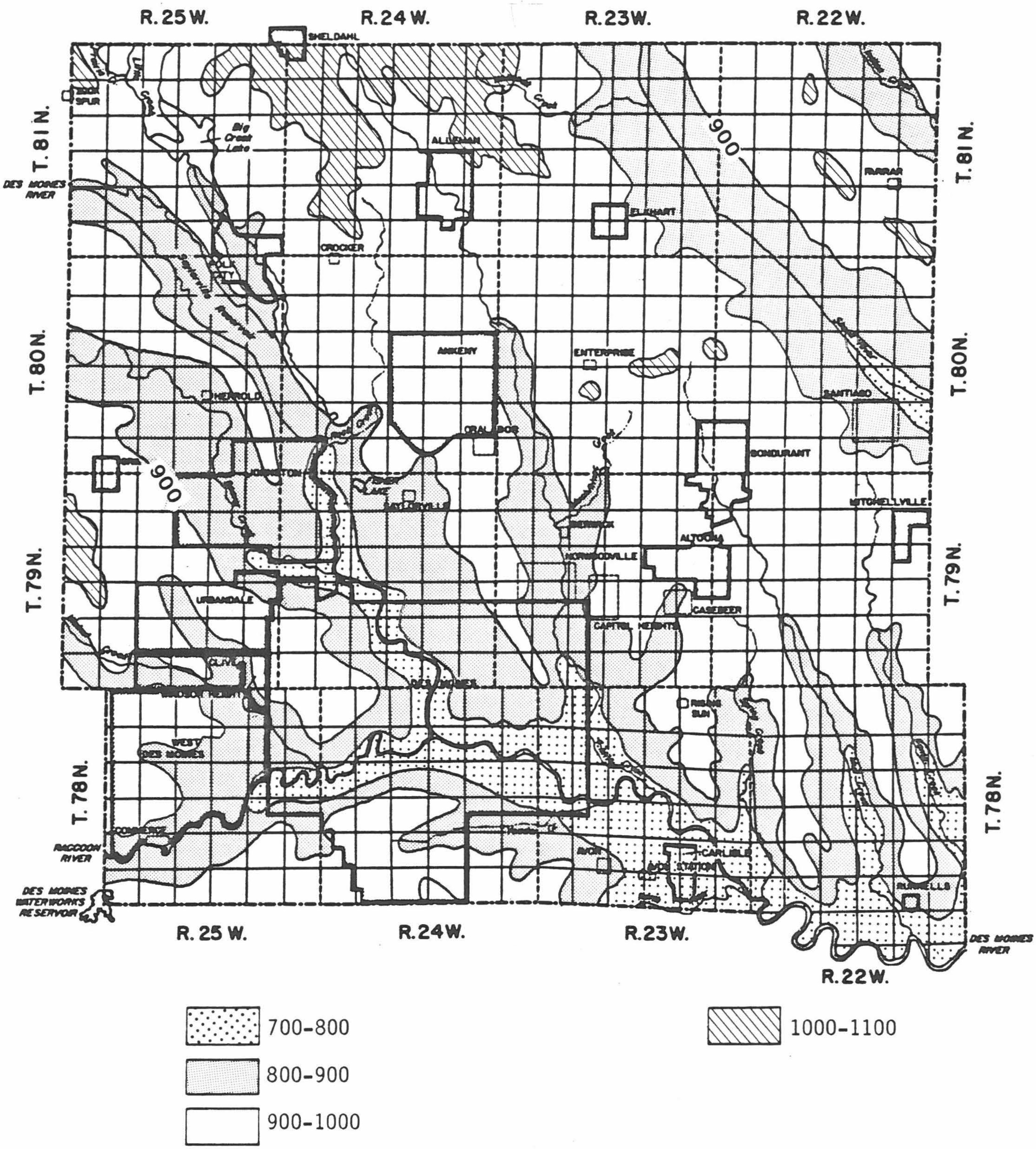


Figure 5

ELEVATION OF BEDROCK SURFACE IN FEET ABOVE MEAN SEA LEVEL

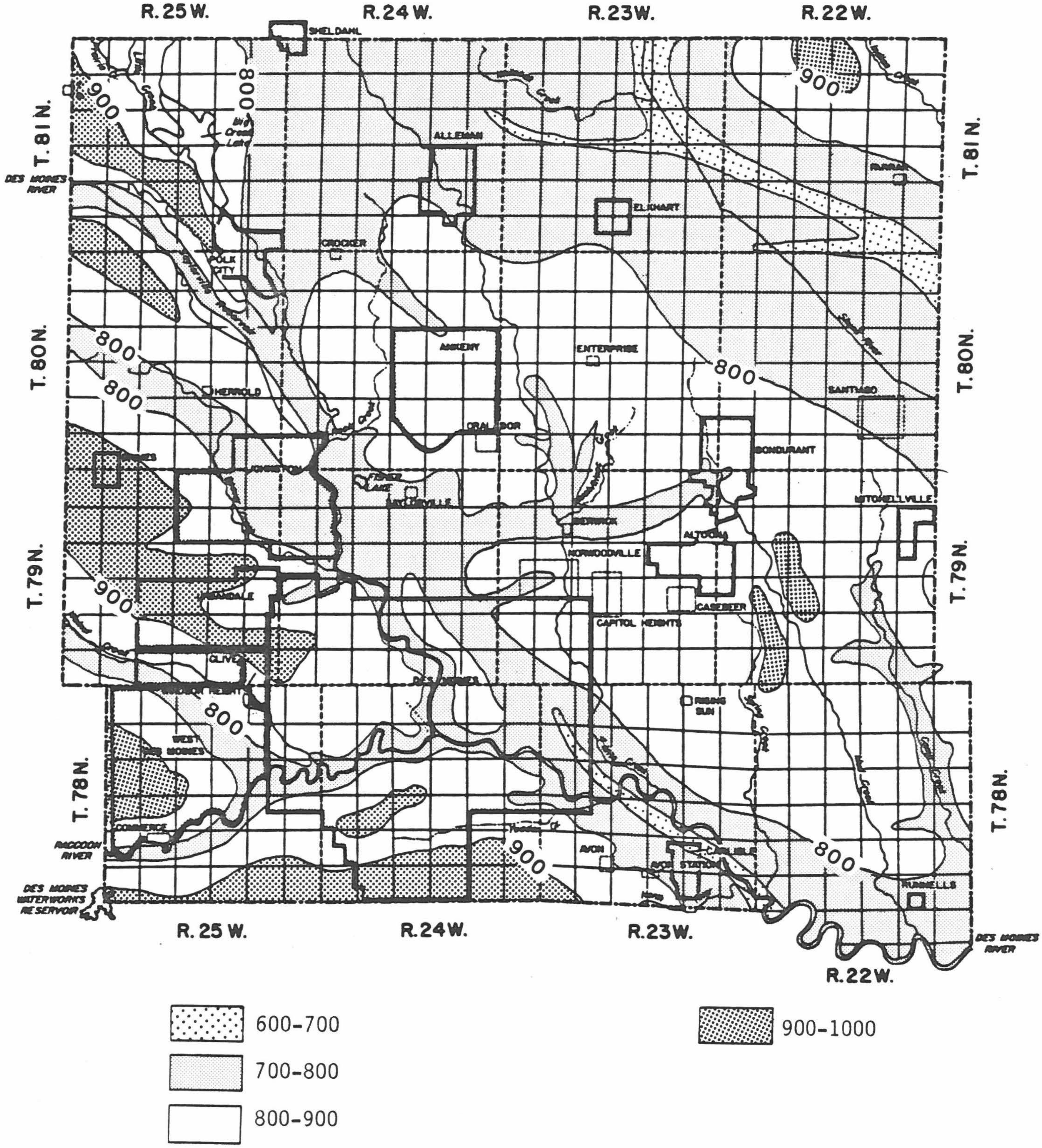


Figure 6

RANGE IN DEPTH TO POLK COUNTY'S PRINCIPAL ROCK AQUIFERS

	R. 25 W.	R. 24 W.	R. 23 W.	R. 22 W.
T. 81 N.	BEDROCK 0-180 MISSISSIPPIAN 350-400 DEVONIAN 800-900 CAMBRO-ORDOVICIAN 2450-2600	BEDROCK 0-300 MISSISSIPPIAN 350-400 DEVONIAN 700-800 CAMBRO-ORDOVICIAN 2500-2600	BEDROCK 0-250 MISSISSIPPIAN 220-300 DEVONIAN 600-750 CAMBRO-ORDOVICIAN 2350-2500	BEDROCK 0-200 MISSISSIPPIAN 200-250 DEVONIAN 575-675 CAMBRO-ORDOVICIAN 2275-2325
T. 80 N.	BEDROCK 0-100 MISSISSIPPIAN 325-375 DEVONIAN 700-800 CAMBRO-ORDOVICIAN 2500-2550	BEDROCK 0-200 MISSISSIPPIAN 350-425 DEVONIAN 650-750 CAMBRO-ORDOVICIAN 2400-2500	BEDROCK 0-200 MISSISSIPPIAN 300-400 DEVONIAN 550-650 CAMBRO-ORDOVICIAN 2250-2400	BEDROCK 0-275 MISSISSIPPIAN 275-325 DEVONIAN 550-650 CAMBRO-ORDOVICIAN 2300-2350
T. 79 N.	BEDROCK 0-125 MISSISSIPPIAN 250-500 DEVONIAN 700-800 CAMBRO-ORDOVICIAN 2500-2550	BEDROCK 0-140 MISSISSIPPIAN 275-375 DEVONIAN 650-750 CAMBRO-ORDOVICIAN 2400-2500	BEDROCK 0-125 MISSISSIPPIAN 300-375 DEVONIAN 625-700 CAMBRO-ORDOVICIAN 2350-2450	BEDROCK 0-200 MISSISSIPPIAN 275-325 DEVONIAN 600-700 CAMBRO-ORDOVICIAN 2300-2400
T. 78 N.	BEDROCK 0-90 MISSISSIPPIAN 250-450 DEVONIAN 700-800 CAMBRO-ORDOVICIAN 2375-2550	BEDROCK 0-80 MISSISSIPPIAN 350-450 DEVONIAN 700-800 CAMBRO-ORDOVICIAN 2300-2500	BEDROCK 0-160 MISSISSIPPIAN 260-325 DEVONIAN 575-750 CAMBRO-ORDOVICIAN 2250-2400	BEDROCK 0-125 MISSISSIPPIAN 200-325 DEVONIAN 600-700 CAMBRO-ORDOVICIAN 2250-2425

Figure 7

INDEX MAP FOR TYPICAL WELLS IN POLK COUNTY

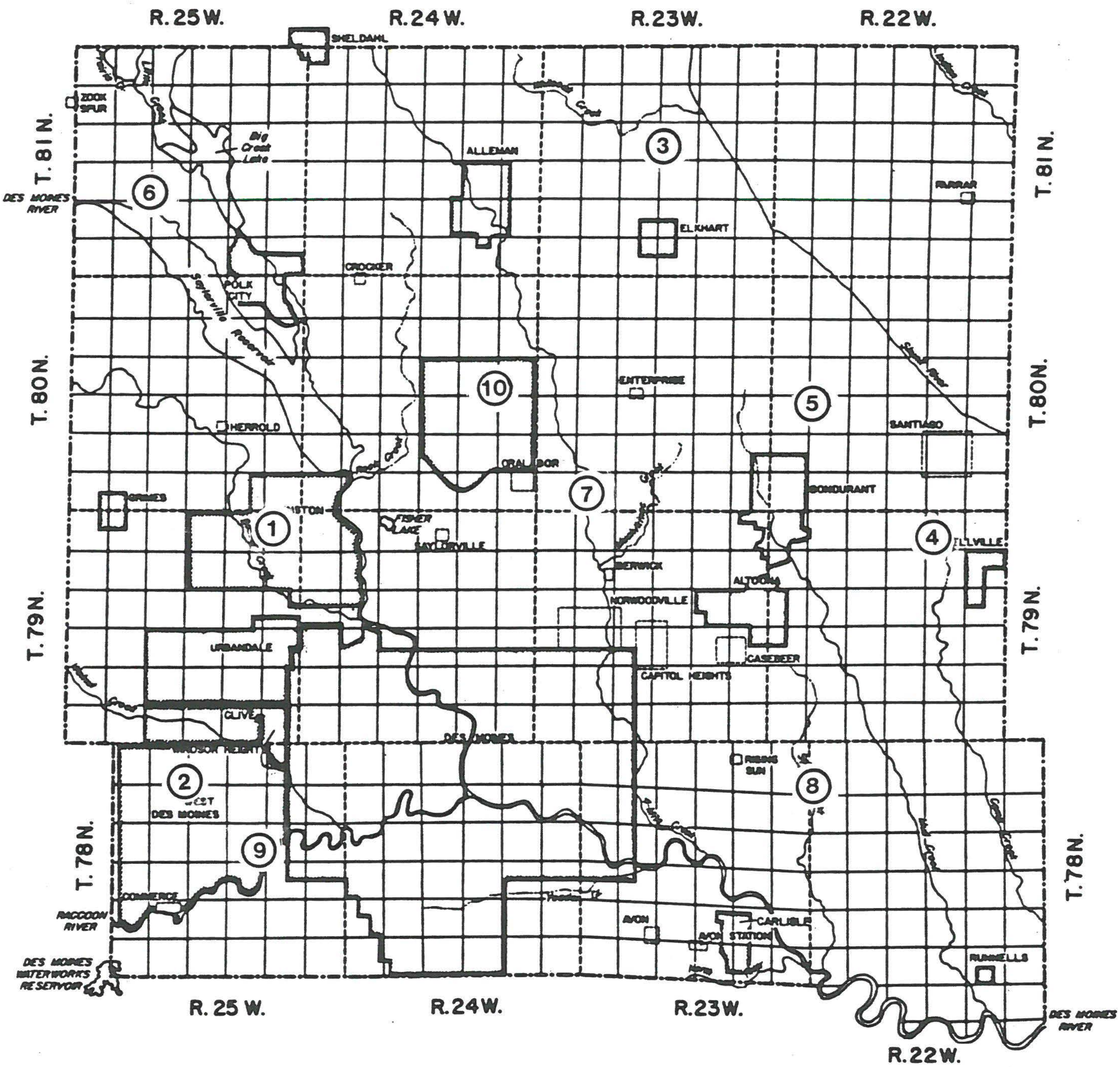


Figure 8

TYPICAL WELLS IN POLK COUNTY

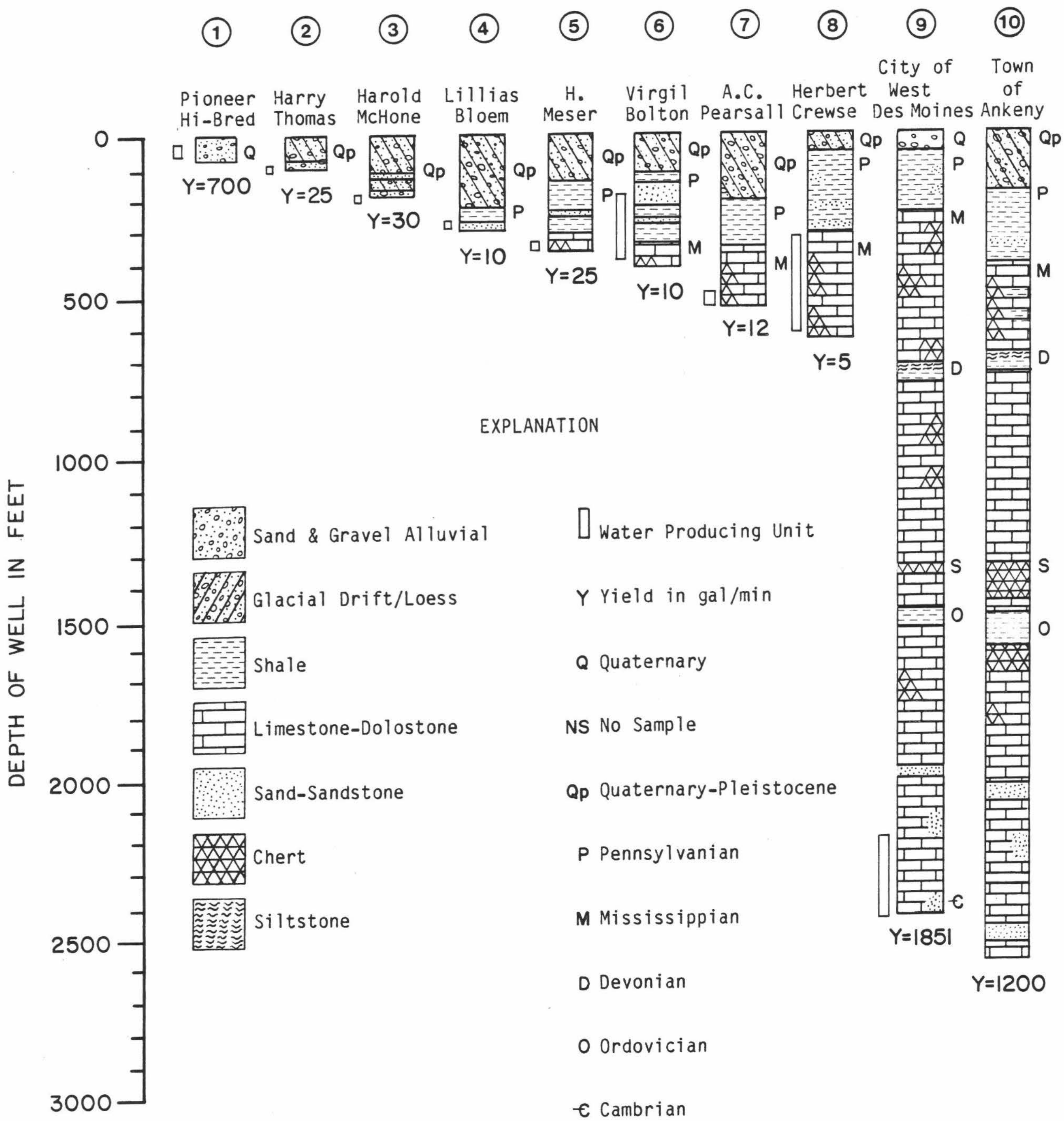


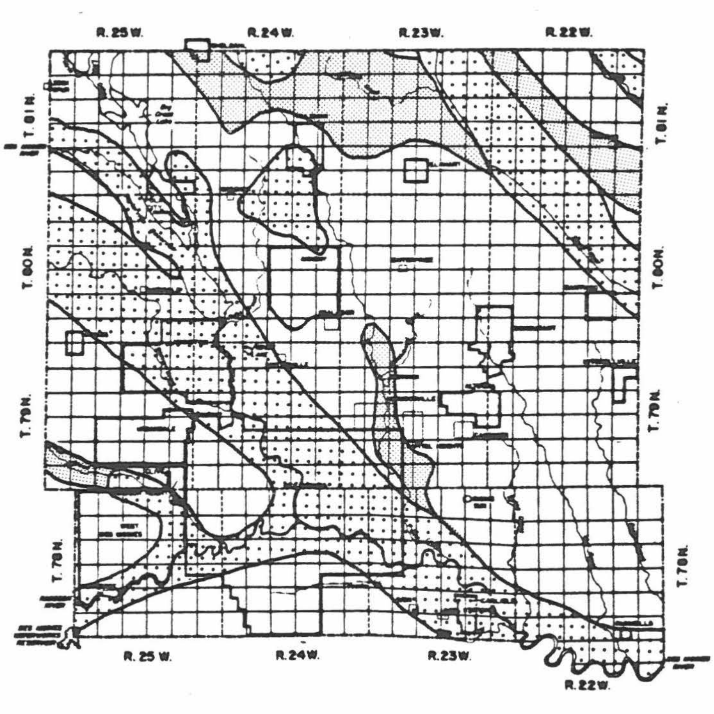
Figure 9

SURFICIAL AQUIFERS

Water Levels

Water levels in the surficial aquifers are difficult to analyze, because water rises to different levels in wells drilled into alluvial, buried-channel, and drift aquifers. The water table in the shallow drift aquifer generally slopes from high land areas toward the streams and, changes noticeably throughout the year in response to recharge from precipitation. Water levels in the alluvial aquifer fluctuate somewhat in the same way as those in the shallow drift aquifer; however, the main influence on the alluvial aquifer is the stage (level) of the associated streams. Water levels will be high during periods of high stream stage and low during the low-stage periods. The intermediate and deep drift and buried channel aquifers are under confined (artesian) condition and are generally unaffected by local recharge-discharge relationships.

Water levels in the drift aquifers commonly are from 10 to 50 feet below the land surface, and those in the buried-channel aquifers have been reported to be as low as 150 feet below the land surface. The water levels in alluvial wells are from 4 to 20 feet below the flood plain surface and the depth to the water surface will be accordingly deeper in wells located on terrace surfaces.



Water yields to wells in gallons per minute

Below 20

20-100

100-500

Figure 10

MISSISSIPPIAN AQUIFER

Elevation of Mississippian Aquifer in feet above mean sea level.

300-400

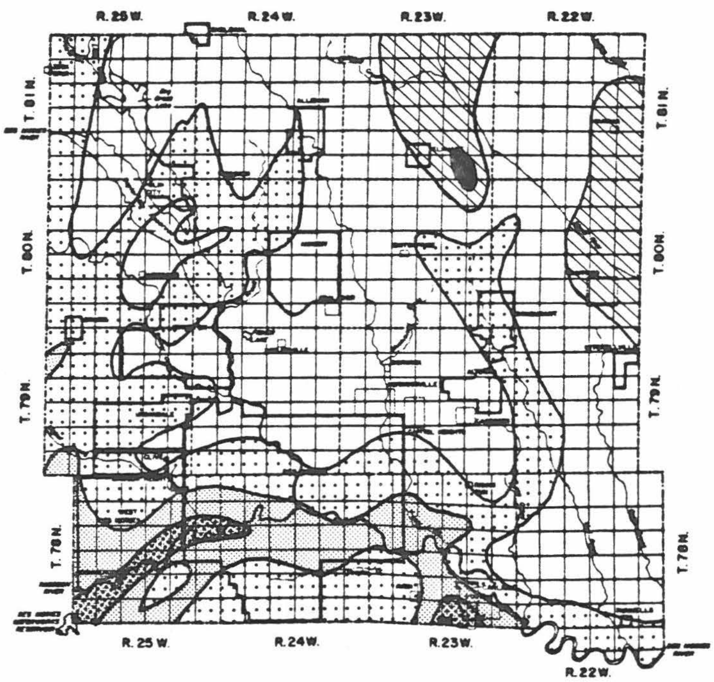
400-500

500-600

600-700

700-800

800-900



Water levels in wells in feet above mean sea level.

750-800

800-850

850-900

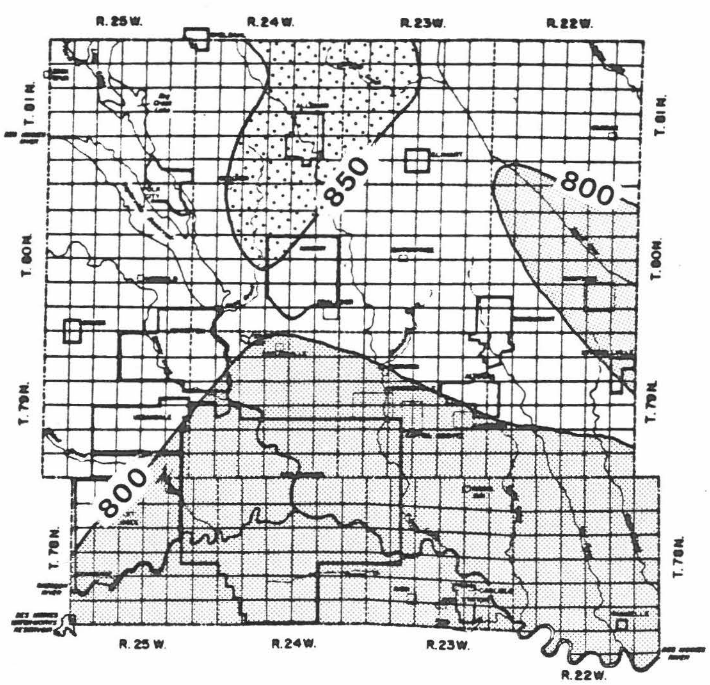


Figure 10 cont.

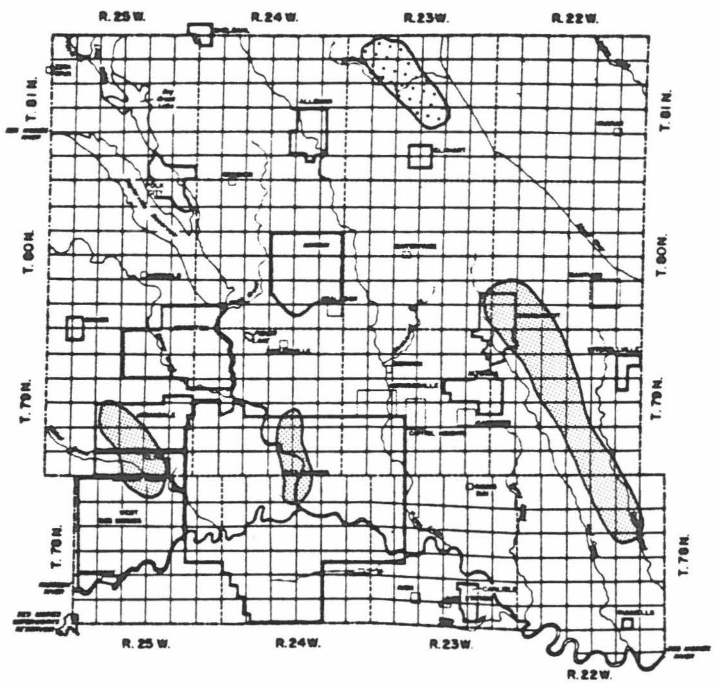
MISSISSIPPIAN AQUIFER

Water yields to wells in gallons per minute.

Below 20

20-50

50-100



Dissolved solids content in milligrams per liter (mg/l).

500-1000

1000-1500

1500-2000

2000-2500

2500-3000

3000+

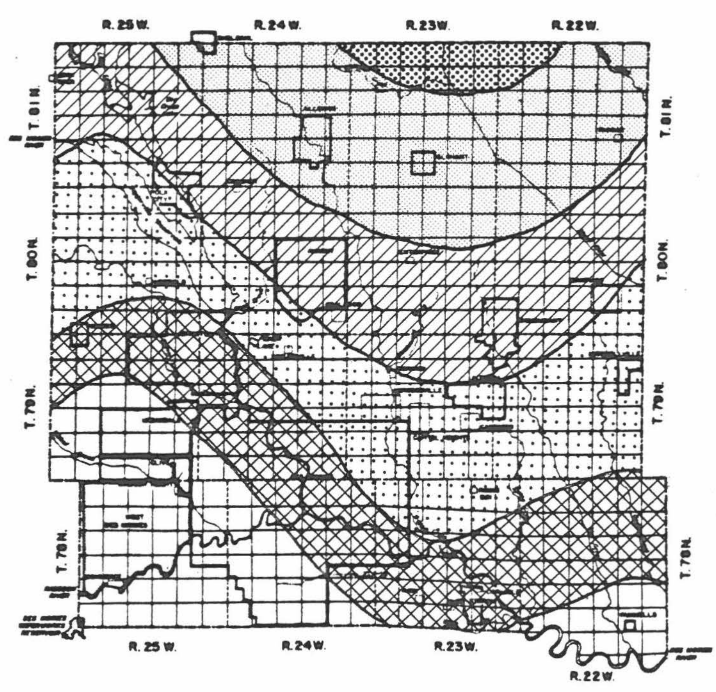
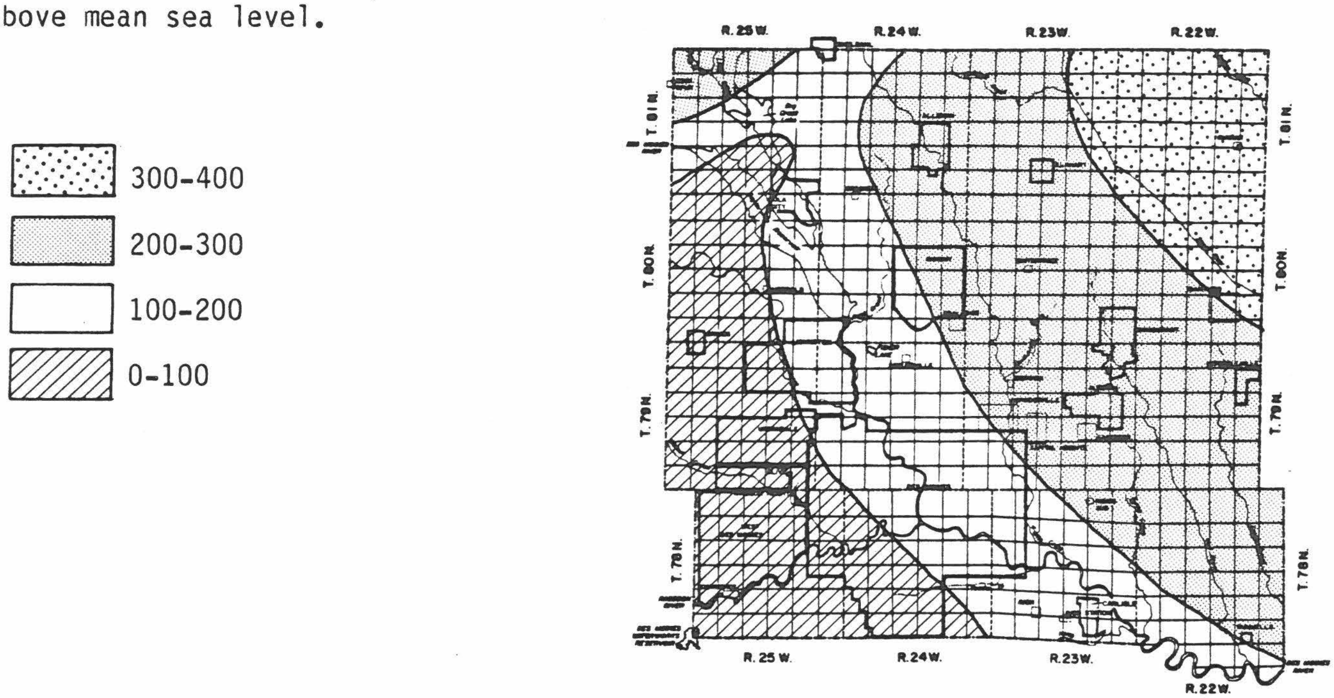


Figure 11

DEVONIAN AQUIFER

Elevation of Devonian Aquifer in feet above mean sea level.



Water levels in wells in feet above mean sea level.

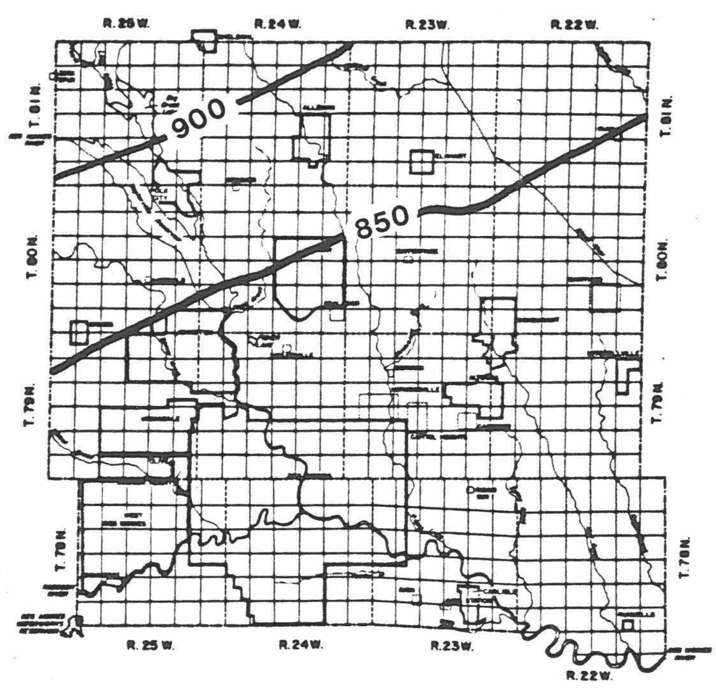


Figure 11 cont.

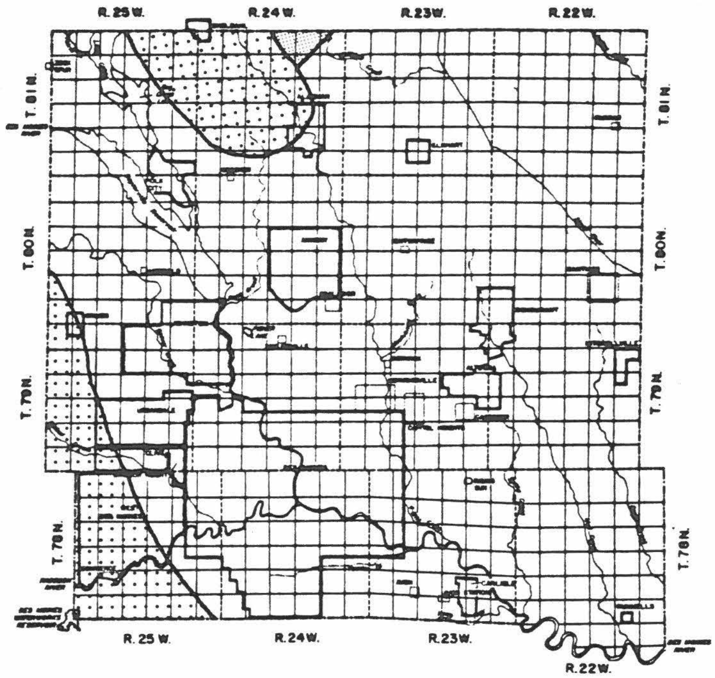
DEVONIAN AQUIFER

Water yields to wells in gallons per minute.

Below 20

20-50

50-100



Dissolved solids content in milligrams per liter (mg/l).

1000-1500

1500-2500

Above 2500

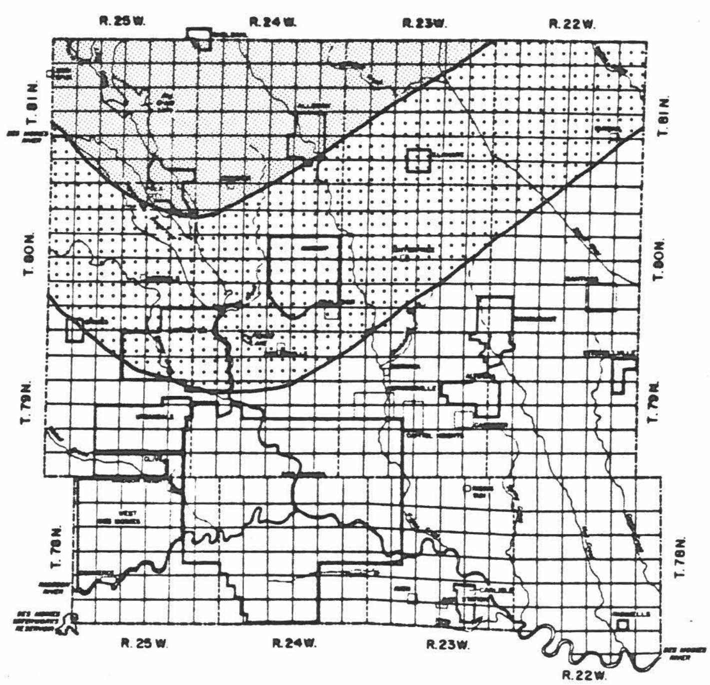


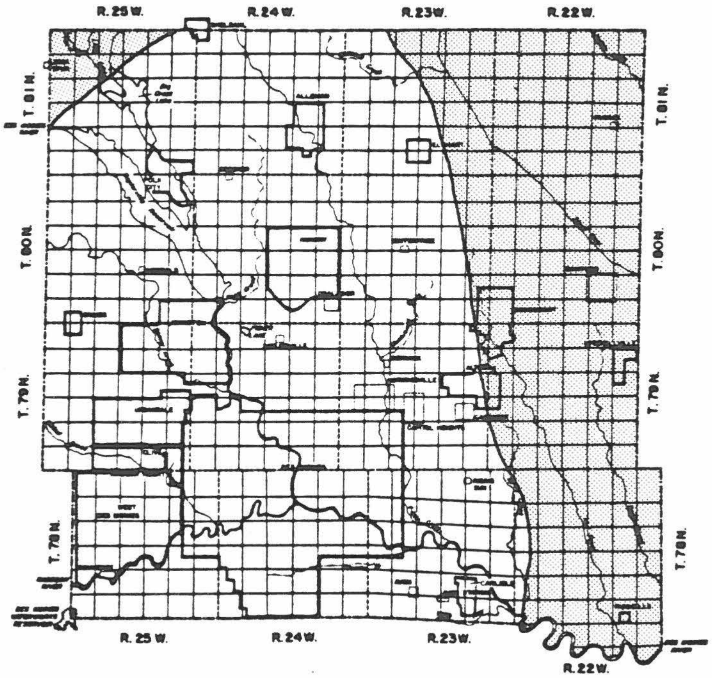
Figure 12

CAMBRO-ORDOVICIAN (JORDAN) AQUIFER

Elevation of Cambro-Ordovician (Jordan) Aquifer in feet below mean sea level.

(-)900-1000

(-)1000-1200



Water levels in wells in feet above mean sea level.

700-750

650-700

600-650

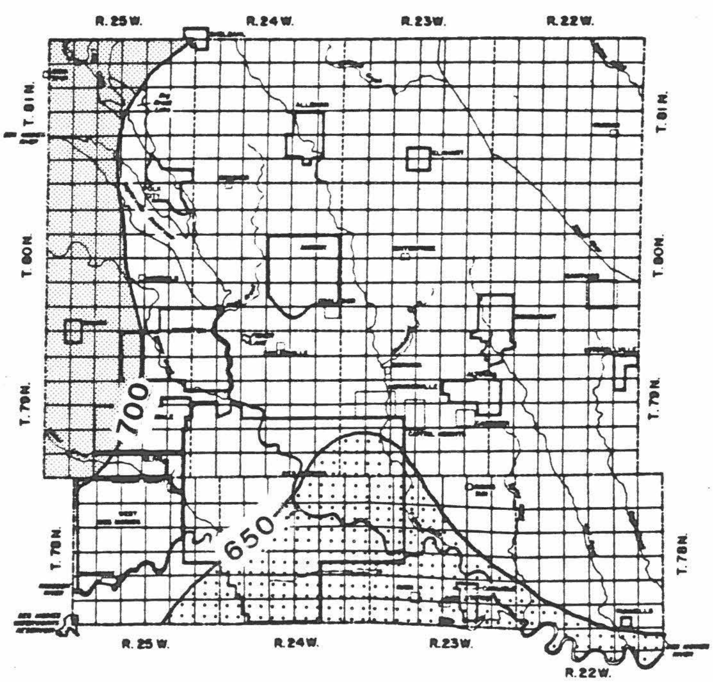


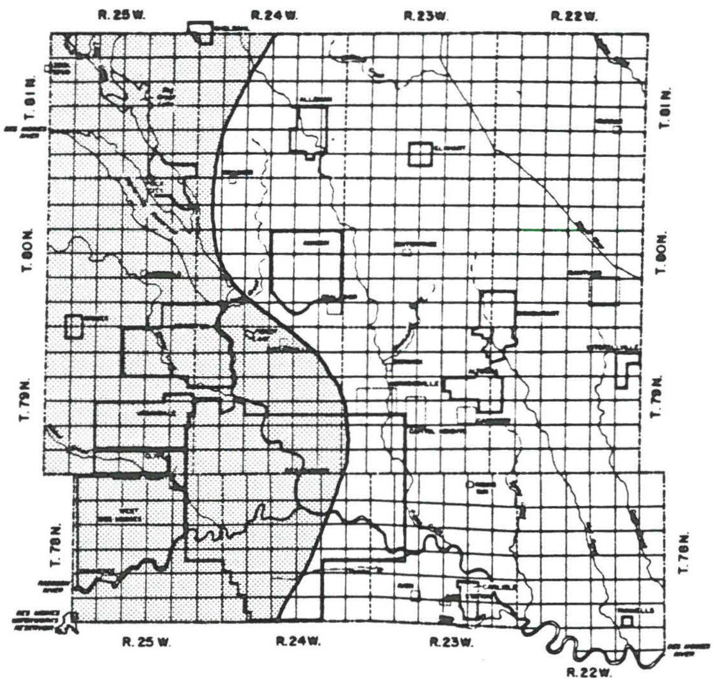
Figure 12 cont.

CAMBRO-ORDOVICIAN (JORDAN) AQUIFER

Water yields of wells in gallons per minute.

500-1000

Over 1000



Dissolved solids content in milligrams per liter (mg/l).

500-750

750-1000

1000-1250

1250-5000

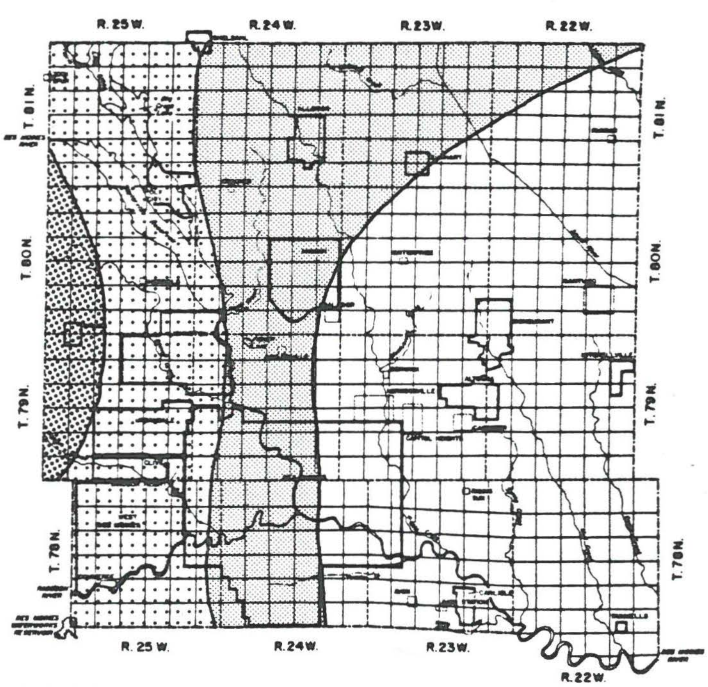


Table 2

SIGNIFICANCE OF MINERAL CONSTITUENTS AND PHYSICAL PROPERTIES OF WATER

Constituent or Property	Maximum Recommended Concentration	Significance
Iron (Fe)	0.3 mg/l	Objectionable as it causes red and brown staining of clothing and porcelain. High concentrations affect the color and taste of beverages. Iron is not listed in the following tables, as there are often major differences between reported and actual concentrations. It may be added to water from well casings, pumps, and pipes. The concentration also is affected by micro-organisms. Special sampling and analytical techniques are needed for accurate study.
Manganese (Mn)	0.05 mg/l	Objectional for the same reason as iron. When both iron and manganese are present, it is recommended that the total concentration not exceed 0.3 mg/l. Micro-organisms also affect the concentration. Special techniques are needed for an accurate study.
Calcium (Ca) and Magnesium (Mg)		Principal causes for hardness and scale-forming properties of water. They reduce the lathering ability of soap.
Sodium (Na) and Potassium (K)		Impart a salty or brackish taste when combined with chloride. Sodium salts cause foaming in boilers.
Sulfate (SO_4)	250 mg/l	Commonly has a laxitive effect when the concentration is 600 to 1,000 mg/l, particularly when combined with magnesium or sodium. The effect is much less when combined with calcium. This laxitive effect is commonly noted by newcomers, but they become acclimated to the water in a short time. The effect is noticeable in almost all persons when concentrations exceed 750 mg/l. Sulfate combined with calcium forms a hard scale in boilers and water heaters.
Chloride (Cl)	250 mg/l	Large amounts combined with sodium impart a salty taste.
Fluoride (F)	2.0 mg/l	Concentrations of 0.8 to 1.3 mg/l are considered to play a part in the reduction of tooth decay. However, concentrations over 2.0 mg/l will cause the mottling of the enamel of children's teeth.
Nitrate (NO_3)	45 mg/l	Waters with high nitrate content should not be used for infant feeding as it may cause methemoglobinemia or cyanosis. High concentrations suggest organic pollution from sewate, decayed organic matter, nitrate in the soil, or chemical fertilizer. High nitrates in the natural waters of central Iowa are limited to isolated occurrences, usually from shallow dug wells on farms. Since the high concentrations are characteristic of individual wells and not of any one aquifer, nitrate will not be discussed in this report.
Dissolved Solids	500 mg/l	This refers to all of the material in water that is in solution. If affects the chemical and physical properties of water for many uses. Amounts over 2,000 mg/l will have a laxitive effect on most persons. Amounts up to 1,000 mg/l are generally considered acceptable for drinking purposes if no other water is available.
Hardness (as $CaCO_3$)		This affects the lathering ability of soap. It is generally produced by calcium and magnesium. Hardness is expressed in parts per million equivalent to $CaCO_3$ as if all the hardness were caused by this compound. Water becomes objectionable for domestic use when the hardness is above 100 mg/l; however, it can be treated readily by softening.
Temperature		Affects the desirability and economy of water use, especially for industrial cooling and air conditioning. Most users want a water with a low and constant temperature.
Suspended Sediment		Causes water to have a cloudy or muddy appearance. It must be settled or filtered out before the water is used. It is the material that "silts-up" reservoirs, and it is the major cause of the reduction of reservoir life.

To the user, the quality of ground water is as important as the amount of water that an aquifer will yield. As ground water moves through soil and rock materials, it dissolves some of the minerals which, in turn, affect water quality. In addition to mineral content, bacterial and chemical contamination may be introduced through poorly constructed wells and seepage from other pollution sources.

Recommended standards for the common mineral constituents in water are described in the table above. These are accepted as guidelines for acceptable drinking water supplies. Limits for uses other than drinking often differ from these. For instance, water that is unacceptable for drinking and household use may be completely satisfactory for industrial cooling.

From past analyses of ground water, the averages (A) and ranges (R) of values in milligrams per liter (mg/l) for several constituents are summarized in Tables 3 and 4 for the surficial and bedrock aquifers in Polk County. Recommended concentrations for some constituents are often exceeded without obvious ill effects, although the water may be unpalatable. Water quality analyses for individual wells should be obtained to determine if concentrations of constituents that affect health are exceeded.

Table 3

CHEMICAL CHARACTER OF GROUND WATER

Surficial Aquifers

Average (A) and range (R)	Dissolved solids	Hardness (as $CaCO_3$)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Sodium (Na)	Iron (Fe)	Manganese (Mn)
				Alluvial aquifer					
A	586	451	129	27	.33	13	16.8	.77	.17
R	279-1260	200-900	26-380	5-95	.15-.6	<.1-80	8.1-35	.02-3.4	<.01-.62
				Shallow drift aquifer					
A	531	390	103	17.7	.5	15.5	18	2.65	.25
R	383-1270	296-653	2-620	1-83	.2-1.1	<.1-76	5.7-92	0.3-11	<.01-1.5
				Intermediate drift aquifer					
A	701	484	98	3.7	.21	.45	84	4.51	.05
R	485-796	401-540	5.6-210	<.5-5	.15-.3	<.1-1.1	74-120	.19-13	<.05-.08
				Deep drift and buried channel aquifer					
A	719	423	271	3	.41	5.6	91	1.29	0.3
R	473-950	306-547	52-499	1-8	.35-.5	1.2-8.3	66-118	.2-3.5	<.01-<.05

The alluvial aquifers yield the least mineralized water of all ground water sources in central Iowa. In the alluvial aquifers, manganese, iron and dissolved solids are slightly high, but all other constituents are well below recommended standards. Water temperatures average 55°F (13°C) and the range of these temperatures is from 46°F to 60°F (8°C to 16°C).

In the shallow drift aquifers, the water is hard and contains undesirable concentrations of iron and manganese. Locally sulfates, nitrates and bacteria exceed recommended limits but this is due to contamination of wells or the infiltration of agricultural waste water and runoff into shallow drift aquifers. The water from shallow drift aquifers is usually acceptable for most purposes if wells are constructed properly, and located a suitable distance from sources of contamination. Nitrate content should be checked carefully in these wells, and any water supply containing over 45 mg/l should not be used for infant feeding. Water temperatures average 54°F (12°C) and the range of these temperatures is from 50°F to 60°F (10°C to 16°C).

In the intermediate drift aquifer, water is more highly mineralized than the shallow drift aquifer, with iron concentrations high and nitrate low. The fluoride content, hardness and temperature are similar to the shallow drift aquifer.

In the deep drift and buried channel aquifers, the water is somewhat more mineralized, containing higher concentrations of dissolved solids, iron and sulfate. Water temperatures range between 54°F and 57°F (12°C to 14°C).

Table 4

CHEMICAL CHARACTER OF GROUND WATER

Bedrock Aquifers

Average (A) and range (R)	Dissolved solids	Hardness (as $CaCO_3$)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Sodium (Na)	Iron (Fe)	Manganese (Mn)
				Upper Bedrock Aquifer (Mississippian)					
A	1402	482	692	41	2.5	2.6	265	2.62	.07
R	440-3805	75-1680	42-2230	.3-96	.2-7.5	<.1-11	8.1-550	.07-12	<.01-.29
				Middle Bedrock Aquifer (Devonian)					
A	2344	955	1286	118	2.6				
R	1182-4786	309-2061	655-2850	5-331	9-6.5				
				Lower Bedrock Aquifer (Cambrian-Ordovician)					
A	872	362	359	42	1.9	1.1	148	1.5	.05
R	419-1796	252-750	95-910	10-100	1.5-3.0	<.1-5.0	54-300	.05-6.7	<.05-.-7

Water from the bedrock aquifers is generally highly mineralized in Polk County and thus is of limited use for many domestic purposes.

The Mississippian Aquifer although heavily used in Polk County is of poor quality. The dissolved solids content is highly variable and is highest in the southern part of the county. Sulfate concentrations are also high and this is related to the presence of the evaporite minerals gypsum ($CaSO_4 \cdot 2H_2O$) and anhydrite ($CaSO_4$). In the northern half of the county, water from the Mississippian is high in flouride (>5), but less than the rest of the county. The water temperatures average 53°F (12°C) ranging from 50-57°F (10-14°C).

The water from the Devonian Silurian Aquifer is unacceptable for human or livestock consumption and is rarely used in Polk County. The dissolved solids content of the water is a minimum of 1300 mg/l and averages greater than 2300 mg/l. The sulfate concentration is extremely high and the water is very hard.

Water from the Cambrian-Ordovician (Jordan) Aquifer is generally of better quality than that from the overlying bedrock aquifers, however, iron concentrations are typically high and sulfate concentrations are high in the northwest corner of the county. Increasing pumpage from the Cambrian-Ordovician (Jordan) Aquifer can potentially draw in poorer quality water from parts of the aquifer to the west. Temperatures range from 70-80°F (21-27°C).

RECOMMENDATIONS FOR PRIVATE WATER WELLS

Contracting for Well Construction

To protect your investment and guarantee satisfactory well completion, it is a good idea to have a written agreement with the well driller. The agreement should specify in detail:

size of well, casing specifications, and types of screen and well seal

methods of eliminating surface and subsurface contamination

disinfection procedures to be used

type of well development if necessary

test pumping procedure to be used

date for completion

itemized cost list including charges for drilling per foot, for materials per unit, and for other operations such as developing and test pumping

guarantee of materials, workmanship, and that all work will comply with current recommended methods

liability insurance for owner and driller

Well Location

A well should be located where it will be least subject to contamination from nearby sources of pollution. The Iowa State Department of Health recommends minimum distances between a new well and pollution sources, such as cesspools (150 ft.), septic tanks (50 ft.), and barnyards (50-100 ft. and downslope from well). Greater distances should be provided where possible.

The well location should not be subject to flooding or surface water contamination. Select a well-drained site, extend the well casing a few feet above the ground, and mound earth around it. Diversion terraces or ditches may be necessary on slopes above a well to divert surface runoff around the well site.

In the construction of all wells, care should be taken to seal or grout the area between the well bore and the well casing (the annulus), as appropriate, so that the surface water and other pollutants cannot seep into the well and contaminate the aquifer.

Locate a well where it will be accessible for maintenance, inspection, and repairs. If a pump house is located some distance from major buildings and wired separately for power, continued use of the water supply will not be jeopardized by fire in major buildings.

Water Treatment

Water taken from a private well should ideally be tested every six months. The University Hygienic Laboratory will do tests for coliform bacteria, nitrate, iron, hardness, and iron bacteria in drinking water for private individuals. Special bottles must be used for collecting and sending water samples to the laboratory. A sample kit can be obtained by writing to the University Hygienic Laboratory, University of Iowa, Oakdale Campus, Iowa City, Iowa 52242. Indicate whether your water has been treated with chlorine, iodine, or bromine; as different sample bottles must be used for treated and untreated water. The charge for the bacterial test is $4; for iron hardness and nitrate, it is $5; and the iron bacteria, $10. If your well is determined to be unsafe, advice for correcting the problem can be obtained from your county or state Department of Health. Several certified private laboratories also run water analyses.

Shock chlorination is recommended following the construction and installation of a well and distribution system and anytime these are opened for repairs or remodeling. A strong chlorine solution is placed in the well and complete distribution system to kill nuisance and disease-causing organisms. If the first shock chlorination does not rid the water supply of bacteria it should be repeated. If this does not solve the problem, the well should be abandoned or the water should be continuously disinfected with proper chlorination equipment.

Since most of the ground water in Polk County is mineralized, water softening and iron removal equipment may make water more palatable and pleasant to use. Softened water contains increased sodium; contact your physician before using a softener if you are on a sodium-restricted diet. Chlorination followed by filtration will remove most forms of iron and iron bacteria. Iron bacteria has no adverse effect on health but it will plug wells, water lines, and equipment and cause tastes and odors. Iron removal equipment can be used if problems persist.

Well Abandonment

Wells taken out of service provide easy access for pollution to enter aquifers supplying water to other wells in the vicinity. Unprotected wells may also cause personal injury. Proper abandonment procedures should be followed to restore the natural conditions that existed before well construction and prevent any future contamination. Permanent abandonment requires careful sealing. The well should be filled with concrete, cement grout, or sealing clays throughout its entire length. Before dug or bored wells are filled at least the top 10 feet of lining should be removed so surface waters will not penetrate the subsurface through a porous lining or follow cracks in or around the lining. The site should be completely filled and mounded with compacted earth.

ABANDONED WELLS SHOULD NEVER BE USED FOR DISPOSAL OR SEWAGE OR OTHER WASTES.

SOURCES OF ADDITIONAL INFORMATION

In planning the development of a ground water supply or contracting for the drilling of a new well, additional or more specific information is often required. This report section lists several sources and types of additional information.

State Agencies That May Be Consulted

Iowa Geological Survey[1]	123 North Capitol Iowa City 52242	(319) 338-1173
State Health Department[2,6]	Lucas Building Des Moines 50319	(515) 281-5787
Iowa Natural Resources Council[3]	Wallace Building Des Moines 50319	(515) 281-5914
Iowa Dept. of Environ. Quality[4]	Wallace Building Des Moines 50319	(515) 281-8854
University Hygienic Laboratory[5]	U. of IA, Oakdale Campus Iowa City 52242	(319) 353-5990
Cooperative Extension Service in[6] Agriculture and Home Economics	110 Curtis Hall, ISU Ames 50011	(515) 294-4569

Functions:

[1] Geologic and ground-water data repository, consultant on well problems, water development and related services

[2] Drinking water quality, public and private water supplies

[3] Water withdrawal regulation and Water Permits for wells withdrawing more than 5000 gpd

[4] Municipal supply regulation and well construction permits

[5] Water quality analysis

[6] Advice on water systems design and maintenance

Well Drillers and Contractors

The listing provided here was drawn from an Iowa Geological Survey mailing list and yellow pages of major towns in phone books. Those selected are within an approximate radius of 50 miles of Polk County. For a state-wide listing contact either the Iowa Water Well Driller's Association, 4350 Hopewell Avenue, Bettendorf, Iowa 51712, (319) 355-7528 or the Iowa Geological Survey, (319) 338-1173.

Dwayne Bruinekool
Bruinekool Well Co.
Oskaloosa, IA 52577

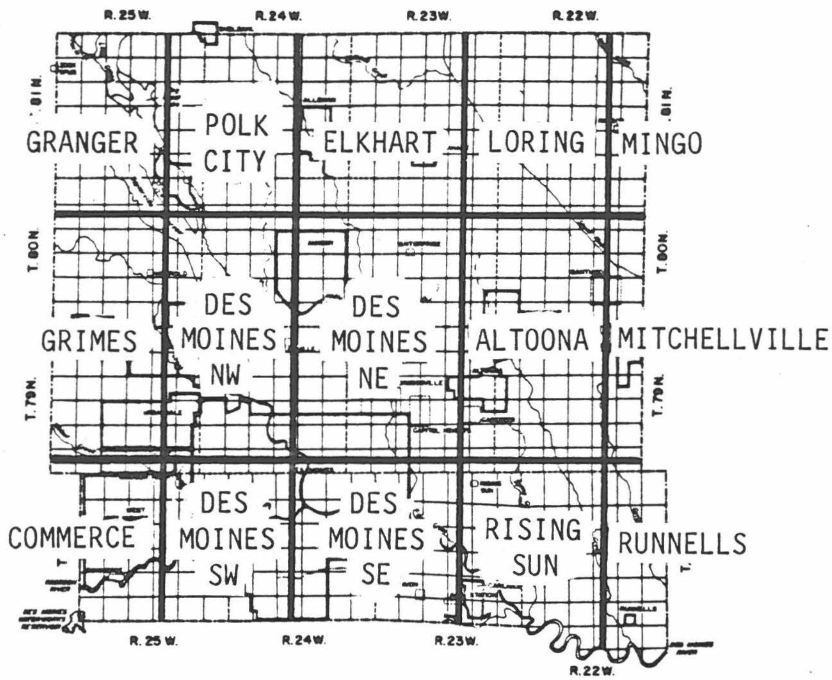
Hughes Well Co.
4120 73rd
Des Moines, IA 50322

Thorpe Well Co.
1903 SE Hulsizer Ave.
Ankeny, IA 50021

Anderson Well Boring
1035 SE 60
Des Moines, IA 50322

Frank Leopold Well Boring
RR 2
Madrid, IA 50156

Topographic Maps (Available from the Iowa Geological Survey)



Map Title	Date (Published)	Scale	Contour Interval
Altoona	1972	1:24,000	10'
Commerce	1965 (PR 1976)	1:24,000	10'
Des Moines NW	1956 (PR 1976)	1:24,000	10'
Des Moines NE	1956 (PR 1976)	1:24,000	10'
Des Moines SW	1956 (PR 1976)	1:24,000	10'
Des Moines SE	1956 (PR 1976)	1:24,000	10'
Elkhart	1972	1:24,000	10'
Granger	1965 (PR 1976)	1:24,000	10'
Grimes	1965 (PR 1976)	1:24,000	10'
Loring	1976	1:24,000	10'
Mingo	1975	1:24,000	10'
Mitchellville	1972	1:24,000	10'
Polk City	1972	1:24,000	10'
Rising Sun	1972	1:24,000	10'
Runnells	1972	1:24,000	10'

Useful Reference Materials

Horick, P. J., and Steinhilber, W. L., 1973, Mississippian aquifer of Iowa, Iowa Geological Survey, Misc. Map Series No. 3.

Horick, P. J., and Steinhilber, W. L., 1978, Jordan aquifer of Iowa, Iowa Geological Survey, Misc. Map Series No. 6.

Iowa State Department of Health, 1971 Sanitary standards for water wells, State Department of Health, Environmental Engineering Service.

Twenter, F. R., and Coble, R. W., 1965, The water story in central Iowa, Iowa Geological Survey Water Atlas No. 1.

Van Eck, O. J, 1971, Optimal well plugging procedures, Iowa Geological Survey, Public Information Circular No. 1.

Van Eck, O. J, 1978, Plugging procedures for domestic wells, Iowa Geological Survey, Public Information Circular No. 11.