

Selected Hydrologic and Water-Quality Data, 1997 through 1999, for the Lake Traverse Reservation/Roberts County Water-Resources Investigation in South Dakota

By Ryan F. Thompson

Open-File Report 00-445

Prepared in cooperation with the South Dakota Geological Survey,
Sisseton-Wahpeton Sioux Tribe, and Roberts County

U.S. Department of the Interior

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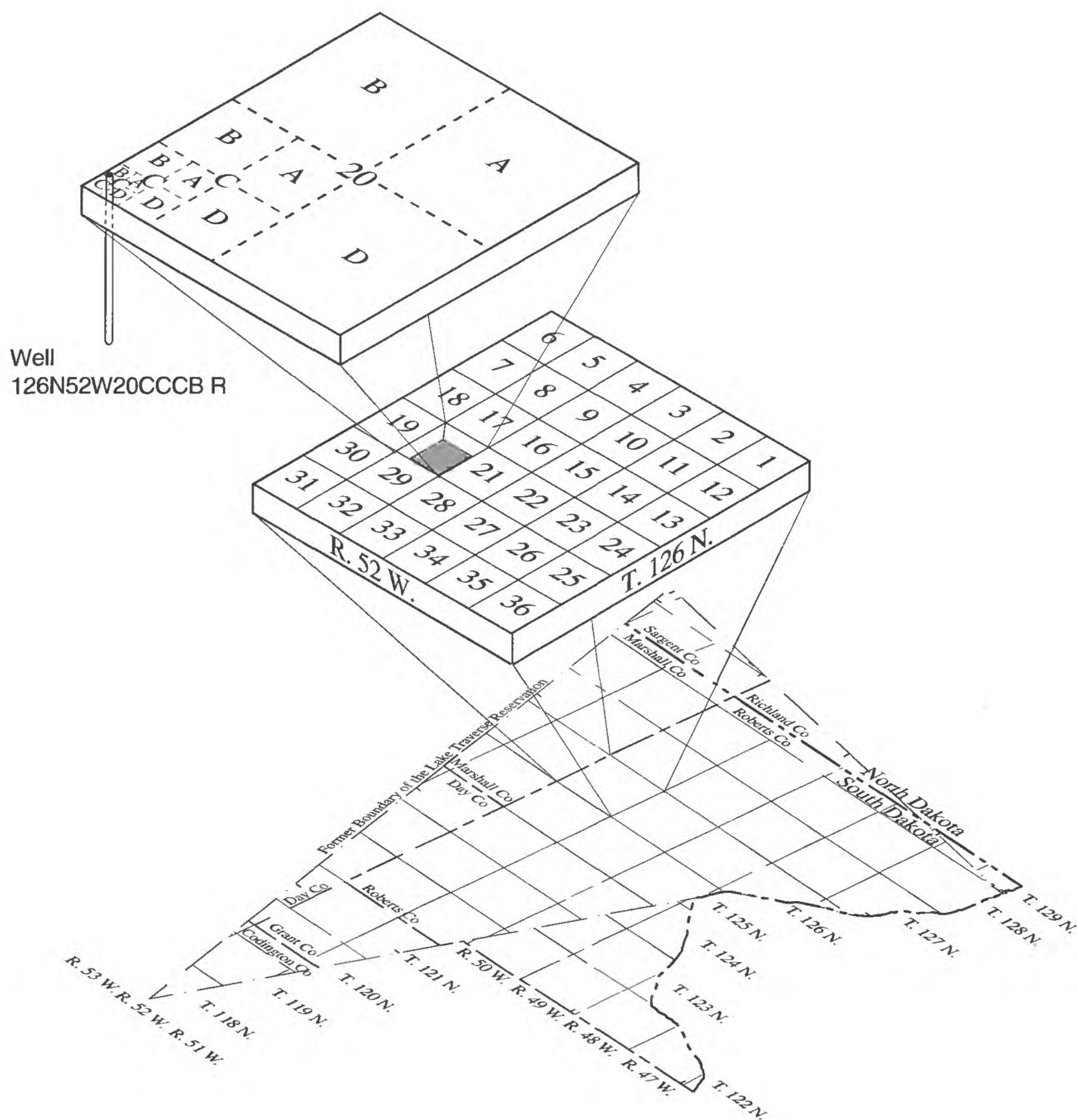
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WELL-NUMBERING SYSTEM

The Federal land-survey system is one method used to number observation wells and test holes. This system uses township, range, and section number. Number 126N52W20CCCB indicates a well in Township 126 North, Range 52 West, section 20. The last four letters show location within the section as shown below. When a nest of wells is drilled, sequential numbers identify each well in the nest and appear after the four-letter code. Wells located within the former boundary of the Lake Traverse Indian Reservation are given a suffix of "R."



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ABSTRACT

This report presents data on precipitation, geologic logs, water levels for ground water and lakes, stream discharge, and water quality for ground water that have been collected or compiled beginning in 1997 for the Lake Traverse Reservation/Roberts County Water Resources Investigation. The investigation was initiated in 1994 as a cooperative effort between the U.S. Geological Survey, the South Dakota Geological Survey, the Sisseton-Wahpeton Sioux Tribe, and Roberts County.

Prior to the water-resources investigation, a reconnaissance drilling program was accomplished from 1988 through 1990 by the U.S. Geological Survey and the Sisseton-Wahpeton Sioux Tribe. During the reconnaissance drilling, 19 test holes were drilled, and 9 observation wells were installed. After the water-resources investigation started in 1994, a comprehensive drilling program was initiated in cooperation with the South Dakota Geological Survey. This is the second of two data reports compiling data collected for the study. The first data report presented existing data within the study area, and data collected through 1996 specifically for the study. Since 1997, 59 additional test holes have been drilled and 23 observation wells have been installed. Geologic logs are presented for the test holes and wells completed during the 1997 and subsequent drilling seasons, as well as for selected

existing test holes and wells in which the bedrock was reached.

Precipitation data are presented for the eight National Weather Service stations within and near the study area. Water-level data for the new observation wells are presented, as well as water-level data collected since 1996 for observation wells included in the first data report. Water-quality data are presented for the samples collected from observation wells installed between 1997 and 1999. Updated peak-flow information is provided for all gaging stations included in the first data report that are still active. Summary statistics are presented for the two active streamflow-gaging stations that had less than a 10-year period of record when the first data report was prepared. Additional lake-level data compiled by the South Dakota Department of Environment and Natural Resources are presented to supplement the lake-level data included in the first data report. Miscellaneous streamflow measurements taken at the outlets of two lakes in the study area also are presented.

INTRODUCTION

The Lake Traverse Reservation/Roberts County Water Resources Investigation was initiated in 1994 as a cooperative effort between the U.S. Geological Survey (USGS), the South Dakota Geological Survey (SDGS), the Sisseton-Wahpeton Sioux Tribe, and Roberts County.

Prior to the water-resources investigation, a reconnaissance drilling program was accomplished from 1988 through 1990 by the USGS and the Sisseton-Wahpeton Sioux Tribe. During the reconnaissance drilling, 19 test holes were drilled, and 9 observation wells were installed. The reconnaissance drilling program identified the need for a more thorough knowledge of the area in order to map the thickness and extent of sand and gravel deposits and delineate aquifers. The present investigation was initiated to improve the knowledge of the area.

After the water-resources investigation was started in 1994, a comprehensive drilling program was initiated in cooperation with SDGS. Between 1994 and 1996, 41 test holes were drilled, and 19 observation wells were installed. Between 1997 and 1999, 59 additional test holes were drilled and 23 more observation wells were installed. Geologic logs for the test holes and wells completed during the reconnaissance and comprehensive drilling programs prior to 1997 are presented in Carter and Thompson (1999). Geologic logs for the test holes and wells completed during 1997-99 are presented in this report.

In addition to the observation wells installed during the reconnaissance and comprehensive drilling programs, 57 observation wells owned by the South Dakota Department of Environment and Natural Resources (SDDENR) and 18 observation wells owned by the North Dakota State Water Commission (NDSWC) were incorporated into the study for the purpose of water-level monitoring. The USGS began a water-level monitoring program in December 1996, and data collected from this effort are included in this data report.

Precipitation records from 1997 through 1999 at eight sites are compiled, as well as lake levels collected by SDDENR from 1997 through 1999 at 20 sites. In the previous data report (Carter and Thompson, 1999), two streamflow-gaging stations had only nine years of record. Both of these stations now have 12 years of record, and updated summary statistics are presented in this report for these two stations. Water-quality samples from 19 observation wells have been collected from 1997 through 1999. These samples were analyzed for field measurements, common and trace elements, nutrients, and radiometrics. The shallow wells also were tested for common pesticides and total coliform bacteria.

Specifically, this report contains (1) precipitation records for 1997-99 for eight sites; (2) geologic logs for 59 test holes and 23 observation wells completed for this study and selected other test holes and observation wells within the former boundary of the Lake Traverse Reservation that reached bedrock; (3) hydrographs for 163 wells; (4) water-quality data for 19 observation wells; (5) updated peak-flow frequency estimates for all active stations and updated summary statistics for the two active streamflow-gaging stations that had less than a 10-year period of record in Carter and Thompson (1999); (6) water-level elevation data for 1997-99 for 20 lakes; and (7) miscellaneous streamflow measurements at lake inlets or outlets.

Description of Study Area

Most of the Lake Traverse Reservation/Roberts County study area is located in northeastern South Dakota; a small part of the former boundary of the Lake Traverse Reservation extends into southeast North Dakota (fig. 1). Roberts County has an area of 1,135 square miles. The former boundary of the Lake Traverse Reservation included 1,595 square miles in South Dakota and North Dakota.

The study area, which is included in the Central Lowlands physiographic province, occupies the Coteau des Prairies and the Minnesota River-Red River lowland physiographic divisions (Flint, 1955). Present-day topography was formed by the advancement and recession of glaciers during the Wisconsin age of the Pleistocene epoch (Koch, 1975). The Coteau des Prairies, which is drained by the Big Sioux River, the James River, and the Minnesota River, is a massive plateau with rugged morainal topography (Koch, 1975). Much of the upper coteau consists of noncontributing, internal drainage except in times of high precipitation and low evaporation. The Minnesota River-Red River lowland is a broad depression that consists primarily of ground moraine (till) and isolated outwash and lake deposits formed by glacial meltwaters (Koch, 1975). This southern area of the lowland is drained by the Minnesota River and subsequently to the Mississippi River (Gulf of Mexico), and the northern area is drained by the Bois de Sioux River and subsequently to the Red River (Hudson Bay).

Glacial deposits (till and outwash) cover the majority of land surface. The drift is underlain by the Cretaceous-age Pierre Shale, Niobrara Formation, and Carlile Shale and by Precambrian-age granite (Flint, 1955). Isolated surface exposures of the Cretaceous-age formations are present in the study area, although they are relatively uncommon. Quaternary-age alluvial deposits also are present in the study area.

Acknowledgments

Many people have assisted with the development and implementation of the water-resources investigation. The SDGS drilled the test holes and installed the observation wells for the project. Dennis Tomhave (SDGS) provided insight and technical guidance throughout the study and assisted extensively during the interpretation of the geologic logs. The water-level measurements for 20 lakes and many observation wells were provided by SDDENR, Water Rights Program.

PRECIPITATION DATA

Precipitation data are collected by the National Weather Service at eight sites in and near the study area (fig. 2). Monthly precipitation data were compiled from annual summaries accessed on the internet, January 22, 2000, at <http://www.ncdc.noaa.gov/pub/data/coop-precip/south-dakota.txt>. Precipitation data for 1997-99 are presented for Big Stone City, S. Dak. (table 1), Sisseton, S. Dak. (table 2), Summit, S. Dak. (table 3), Victor, S. Dak. (table 4), Watertown, S. Dak. (table 5), Waubay National Wildlife Refuge, S. Dak. (table 6), Wilmot, S. Dak. (table 7), and Forman, N. Dak. (table 8).

WELL AND TEST-HOLE DATA

The Lake Traverse Reservation/Roberts County Water Resources Investigation included two drilling programs: a reconnaissance program from 1988 through 1990 and an ongoing comprehensive program that began in 1994. During the reconnaissance drilling program, 19 test holes were drilled, and 9 observation wells were installed. During the comprehensive drilling program, 41 test holes were drilled, and 19 observation wells were installed between 1994 and 1996. Another 59 test holes and 23 observation wells were installed between 1997 and 1999, and these geologic logs are presented in Section A of the

Supplemental Information section at the end of this report. All wells and test holes were drilled in Roberts County during both the reconnaissance and comprehensive drilling programs.

Three methods of station identification for the wells and test holes are used in this report. The first method is the station identification number, which is based on the international system of latitude and longitude. The number contains 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude north of the equator. The next seven digits denote the degrees, minutes, and second of longitude west of the prime (Greenwich) meridian. The last two digits are sequential numbers for sites within the same latitude and longitude. The latitude and longitude were determined using Global Positioning Satellite (GPS) equipment at the time of drilling and rounded to the nearest second.

The second identification method used is the local number, which is based on the Federal land-survey system of eastern South Dakota. The local number consists of the township number followed by "N," for north, the range number followed by "W," for west, and the section number, followed by a maximum of four uppercase letters that indicate, respectively, the 160-, 40-, 10-, and 2.5-acre tract in which the well or test hole is located. These letters are assigned in a counterclockwise direction beginning with "A" in the northeast quarter. A sequential number following the last letter is used to distinguish between wells in the same 2.5-acre tract. An "R" at the end of the local number distinguishes sites that are located within the former boundary of the Lake Traverse Reservation. Thus, well 125N50W12ABCC R is located within the former boundary of the Lake Traverse Reservation in the SW $\frac{1}{4}$ of the SW $\frac{1}{4}$ of the NW $\frac{1}{4}$ of the NE $\frac{1}{4}$ of section 12 in township 125 north and range 50 west.

The third identification method is the "other identifier," which was assigned by the SDGS. This name denotes the drilling rig number, the year, and sequence in which the well or test hole was drilled.

All observation wells have 2-inch diameter, flush-threaded PVC casing and screen. The wells were gravel packed with washed sand (0.65- to 0.75-millimeter diameter), and were sealed with bentonite to approximately 20 feet below land surface and with neat cement from the top of the bentonite to the land surface. Well development was accomplished using compressed air, and locking metal protectors were installed over the top of each well.

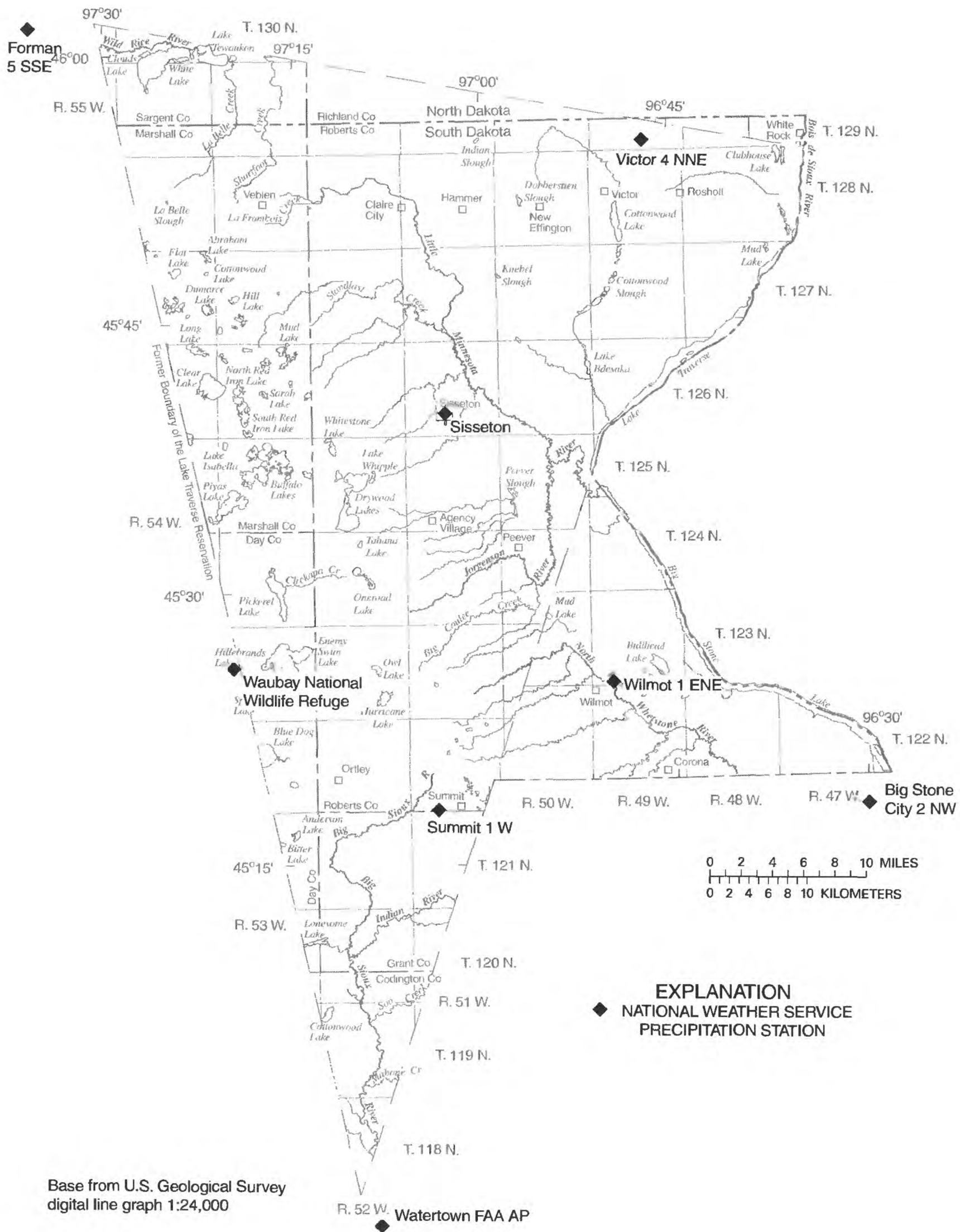


Figure 2. Location of precipitation stations within and near study area.

Table 1. Precipitation, in inches, for the Big Stone City, S. Dak., National Weather Service station, 1997-99

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1997	1.71	0.43	1.55	3.07	1.73	1.16	3.84	4.89	1.20	2.13	0.4	0.21	22.32
1998	.96	1.91	1.14	2.87	1.99	4.02	2.40	3.69	.15	5.59	1.64	.12	26.48
1999	.94	.12	.77	1.45	3.06	3.63	5.52	1.92	3.66	.25	.08	.15	21.55

Table 2. Precipitation, in inches, for the Sisseton, S. Dak., National Weather Service station, 1997-99

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1997	3.13	0.52	0.91	2.60	1.55	0.91	4.41	2.08	0.41	2.01	0.75	0.42	19.70
1998	1.30	2.03	2.06	2.91	5.51	3.59	1.88	2.77	0.00	7.95	1.81	.07	31.88
1999	1.20	.12	1.28	1.45	2.41	4.54	2.20	4.07	3.65	.57	.00	.20	21.69

Table 3. Precipitation, in inches, for the Summit, S. Dak., National Weather Service station, 1997-99

[---, no data; --, not computed]

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1997	---	0.61	1.31	2.23	1.22	0.59	5.22	3.99	1.64	2.88	0.46	0.51	--
1998	0.79	1.64	1.9	1.4	4.31	2.66	1.35	4.76	.05	6.8	1.21	.17	27.04
1999	1.41	.29	1.19	2.05	3.46	4.69	3.05	3.77	2.75	.43	.06	.16	23.31

Table 4. Precipitation, in inches, for the Victor, S. Dak., National Weather Service station, 1997-99

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1997	3.18	0.52	1.25	2.86	1.87	1.83	2.49	3.43	1.75	2.98	0.84	0.32	23.32
1998	.80	1.58	1.22	2.71	5.15	5.88	1.98	1.32	.33	5.74	1.54	.27	28.52
1999	1.13	.17	1.27	1.88	3.08	5.32	3.29	3.42	2.78	.81	.00	.43	23.58

Table 5. Precipitation, in inches, for the Watertown, S. Dak., National Weather Service station, 1997-99

[---, no data; --, not computed]

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1997	0.87	---	1.02	---	2.11	1.30	3.56	2.02	0.99	2.53	0.25	0.15	--
1998	.71	0.76	.40	2.17	2.91	1.62	2.69	4.06	.13	7.06	.51	.30	23.32
1999	---	.23	.57	1.55	2.41	5.44	1.65	1.39	2.21	.27	.08	.05	--

Table 6. Precipitation, in inches, for the Waubay National Wildlife Refuge, S. Dak., National Weather Service station, 1997-99

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1997	1.60	0.31	0.65	1.81	1.49	1.68	5.71	2.89	0.84	2.35	0.59	0.49	20.41
1998	1.24	1.10	1.10	4.16	5.42	3.00	1.97	2.66	.22	7.78	.80	.14	29.59
1999	.69	.07	.74	1.35	2.98	7.75	2.37	3.19	3.64	.54	.00	.17	23.49

Table 7. Precipitation, in inches, for the Wilmot, S. Dak., National Weather Service station, 1997-99

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1997	3.15	0.34	1.38	2.61	1.43	0.89	3.69	3.63	0.94	1.98	0.49	0.19	20.72
1998	1.03	1.54	1.18	3.34	3.54	3.28	2.50	3.14	.03	5.65	1.31	.08	26.62
1999	1.25	.10	1.01	1.39	1.82	3.40	2.90	3.22	2.01	.35	.02	.12	17.59

Table 8. Precipitation, in inches, for the Forman, N. Dak., National Weather Service station, 1997-99

[---, no data; --, not computed]

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1997	1.84	---	---	1.99	1.23	1.26	4.55	2.66	2.54	2.48	1.03	---	--
1998	.54	1.37	1.46	2.72	5.87	8.42	2.15	1.93	.69	---	2.03	0.18	--
1999	1.54	.06	1.20	.78	2.61	4.64	3.70	3.98	5.34	.79	---	.10	--

Selected information is presented in table 9 for the 59 test holes and 23 observation wells installed between 1997 and 1999 for the study. The last water level measured in the observation wells in calendar year 1999 is included in the table. The altitudes of all the wells installed for this study were determined using GPS software, and have vertical accuracies of approximately 0.10 foot. The location of the observation wells installed for the study are shown in figure 3, and the test holes are shown in figure 4.

The geologic logs in the first part of Supplemental Information Section A are presented in the order listed in table 9. Information regarding special construction details, site characteristics, and electric geophysical log (electric log) availability are indicated in the notes following the geologic logs. The electric logs may be obtained from the USGS office in Huron, South Dakota.

In addition to the wells specifically installed for this investigation, other observation wells have been incorporated into the study. Studies similar to the Lake Traverse Reservation/Roberts County Water Resources Investigation have been completed for Codington and Grant Counties (Hansen, 1990), Marshall County (Koch, 1975), and Day County (Leap, 1988) in South Dakota by the USGS and SDGS, and for Sargent County (Armstrong, 1979, 1982) and Richland County (Baker, 1966; Baker and Paulson, 1967) in North Dakota by the USGS and North Dakota Geological Survey. Comprehensive drilling programs were conducted as part of all of these investigations. The observation wells that were installed during these other county studies that are within or near the boundary of the former Lake Traverse Reservation are included in the second part of Supplemental Section A entitled "Selected Existing Test Holes and Observation Wells in Which the Bedrock was Reached."

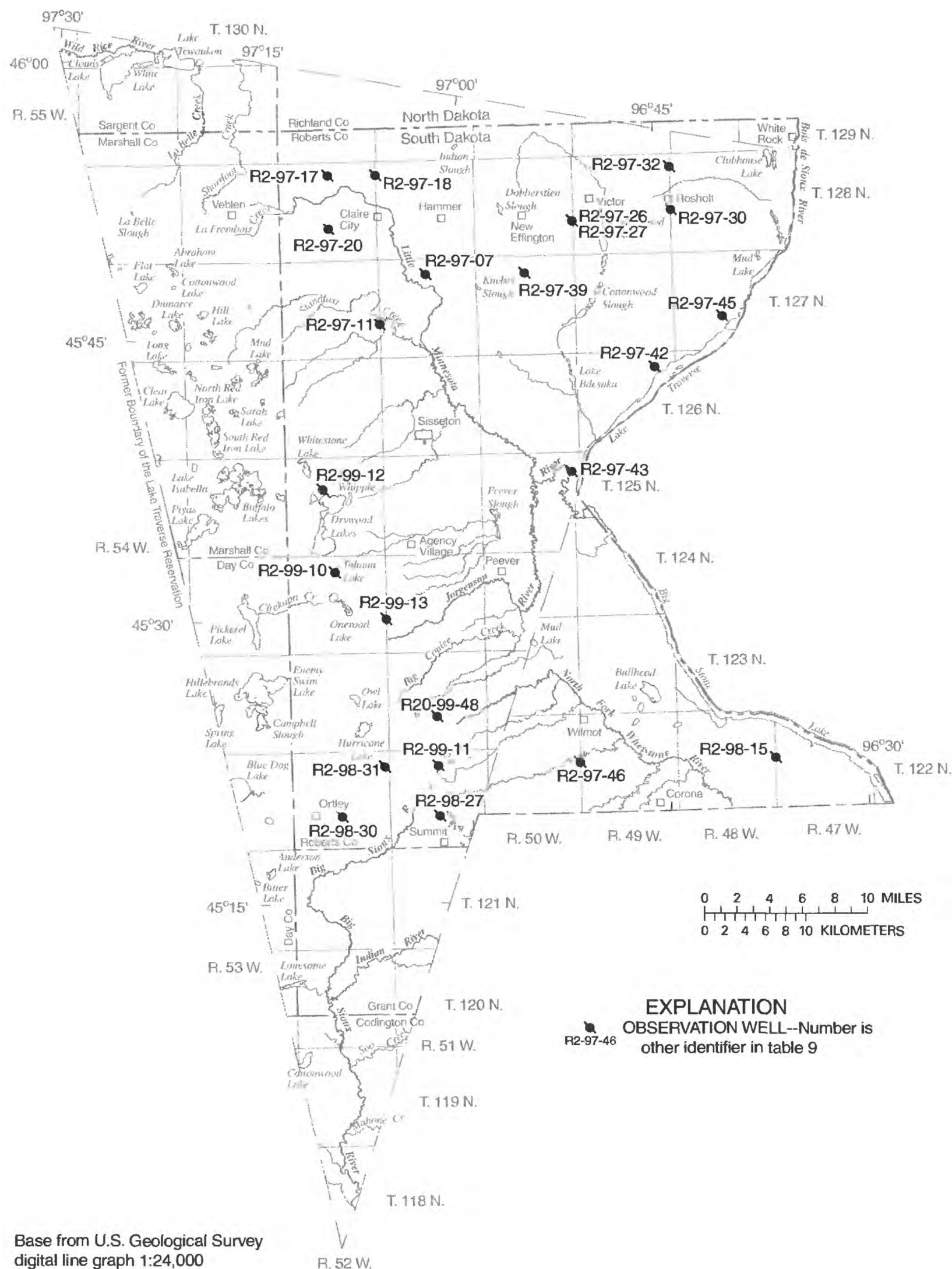


Figure 3. Location of observation wells installed between 1997 and 1999 for the study.

Table 9. Selected site information for observation wells and test holes completed from 1997 through 1999

[--, not applicable]

Site identification number	Local number	Other identifier	Aquifer	Depth drilled (feet)	Measuring point, in feet above surface	Date of water-level measurement	Water level, in feet below land surface	Land surface altitude (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
452218096331801	122N47W21AAAD	R2-98-13	--	122	--	--	--	990	--	--
452400096370401	122N48W 1DDDA	R2-98-19	--	82	--	--	--	1,000	--	--
452448096441701	122N48W 6BBBA	R2-98-18	--	402	--	--	--	1,153	--	--
452352096402301	122N48W10BABB	R2-98-20	--	142	--	--	--	1,090	--	--
452211096365901	122N48W13DDDD	R2-98-14	--	270	--	--	--	1,088	--	--
452211096365902	122N48W13DDDD2	R2-98-15	Undetermined	102	2.25	09-13-99	19.89	1,088	90	100
452210096404701	122N48W16DDDC	R2-98-16	--	162	--	--	--	1,118	--	--
452212096480801	122N49W16DDDC	R2-97-47	--	182	--	--	--	1,165	--	--
452144096442301	122N49W24DAAA	R2-98-17	--	142	--	--	--	1,130	--	--
452210096514701	122N50W13DDDC	R2-97-46	Wilmot ¹	82	1.5	08-25-99	20.47	1,224.6	54	74
452213096575001	122N50W17CCCC	R2-98-25	--	202	--	--	--	1,475	--	--
452213096564601	122N50W17DDDC	R2-99-14	--	364	--	--	--	1,390	--	--
452210097023101	122N51W 4DDDD R	R2-98-32	--	862	--	--	--	1,960	--	--
452212097022702	122N51W 4DDDD2 R	R2-99-11	Eden	452	2.0	12-08-99	208.73	1,962.2	426.5	446.5
451936097022601	122N51W27BBBBB R	R2-98-26	--	627	--	--	--	2,025	--	--
451936097022602	122N51W27BBBBB2 R	R2-98-27	Prairie Coteau ¹	302	2.25	09-14-99	221.01	2,025	282	302
452213097063101	122N52W 1DDCC R	R2-98-31	Eden	462	3.4	09-15-99	164.67	1,946	412	432
452218097095101	122N52W 9AAAAA3 R	R2-98-34	--	667	--	--	--	1,872	--	--
451936097061201	122N52W24DDDD R	R2-98-28	--	522	--	--	--	1,968	--	--
451934097095301	122N52W27BBBBB R	R2-98-29	--	477	--	--	--	1,875	--	--
451934097095302	122N52W27BBBBB2 R	R2-98-30	Lonesome Lake ¹	242	2.3	09-14-99	51.54	1,875	222	242

Table 9. Selected site information for observation wells and test holes completed from 1997 through 1999—Continued

[--, not applicable]

Site identification number	Local number	Other identifier	Aquifer	Depth drilled (feet)	Measuring point, in feet above land surface	Date of water-level measurement	Water level, in feet below land surface	Land surface altitude (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
452724096442201	123N49W24AAA	R2-98-21	--	102	--	--	--	1,045	--	--
452714096514501	123N50W24AAD	R2-98-24	--	182	--	--	--	1,170	--	--
452728097011401	123N51W 2CCCC R	R2-98-33	--	502	--	--	--	1,500	--	--
452507097061001	123N51W19CBCB R	R2-99-05	--	792	--	--	--	1,990	--	--
452448097023001	123N51W21DDDD R	R2-99-02	--	792	--	--	--	1,824	--	--
452218097022902	123N51W21DDDD2 R	R20-99-48	Undetermined	138	1.8	12-08-99	27.23	1,819.4	118	138
452727097095401	123N52W 3CCCC R	R2-99-01	--	507	--	--	--	1,900	--	--
452626097061201	123N52W13AADA R	R2-99-03	--	22	--	--	--	2,005	--	--
452450097095501	123N52W21DDDD R	R2-99-04	--	682	--	--	--	2,002	--	--
453234096514201	124N49W19BBBC	R2-98-22	--	122	--	--	--	1,130	--	--
453222096475701	124N49W21ADAD	R2-98-23	--	122	--	--	--	1,095	--	--
453002097022701	124N51W28AAAA R	R2-97-48	--	512	--	--	--	1,501	--	--
452958097060901	124N51W30BBBBB R	R2-99-06	--	847	--	--	--	2,060	--	--
453002097060902	124N51W30BBBBB2 R	R2-99-13	Marday	422	1.9	12-08-99	323.44	2,053.1	373	413
453234097095901	124N52W 9AAAC R	R2-99-09	--	807	--	--	--	2,005	--	--
453204097100202	124N52W 9AAAC2 R	R2-99-10	Undetermined	132	1.1	12-08-99	49.57	2,003.0	112	132
453003097110901	124N52W29AAAA	R2-98-35	--	720	--	--	--	1,965	--	--
453738096515401	125N50W12ABCC R	R2-97-23	--	142	--	--	--	1,120	--	--
453738096515402	125N50W12ABCC2 R	R2-97-43	Veblen ¹	62	2.1	08-25-99	59.85	1,120.8	52	62
453511096534301	125N50W23CCCD R	R2-97-22	--	142	--	--	--	1,160	--	--
453751097094901	125N52W10BBBBB R	R2-97-21	--	82	--	--	--	1,970	--	--

Table 9. Selected site information for observation wells and test holes completed from 1997 through 1999—Continued

[--, not applicable]

Site identification number	Local number	Other identifier	Aquifer	Depth drilled (feet)	Measuring point, in feet above land surface	Date of water-level measurement	Water level, in feet below land surface	Land surface altitude (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
453659097104601	125N52W16BABBB R	R2-99-07	--	942	--	--	--	1,990	--	--
453659097104502	125N52W16BABBB2 R	R2-99-12	Eden ¹	424	2.2	12-08-99	296.95	1,987.9	403	423
454303096451701	126N49W11AABBA R	R2-97-42	Fairmount ¹	262	2.3	04-06-99	78.11	1,109.7	242	262
454305096451901	126N49W11ABAAA R	R2-97-41	--	522	--	--	--	1,111	--	--
454157096462501	126N49W15ADDDA R	R2-97-24	--	222	--	--	--	990	--	--
454306096584301	126N50W 6CCCCC R	R2-97-36	--	202	--	--	--	1,164	--	--
454030097021901	126N51W27BBBBB R	R2-97-05	--	62	--	--	--	1,215	--	--
454305097060901	126N52W 1DDDD R	R2-97-09	--	82	--	--	--	1,252	--	--
454033097122101	126N52W20CCCCB R	R2-99-08	--	747	--	--	--	2,035	--	--
454541096400501	127N48W21DDDC R	R2-97-44	--	282	--	--	--	1,090	--	--
454541096400502	127N48W28AAAAA R	R2-97-45	Rosholt	72	2.0	08-25-99	45.93	1,090.8	62	72
454541096473901	127N49W21DDDC R	R2-97-40	--	282	--	--	--	1,092	--	--
454817096584601	127N50W 7BBBBB R	R2-97-37	--	222	--	--	--	1,168	--	--
454818096550601	127N50W 9AAAAA R	R2-97-38	--	162	--	--	--	1,119	--	--
454818096550602	127N50W 9AAAAA2 R	R2-97-39	Rosholt	82	2.0	08-06-99	29.39	1,119.2	72	82
454820097023601	127N51W 9AAAAA R	R2-97-06	--	242	--	--	--	1,188	--	--
454820097023602	127N51W 9AAAAA2 R	R2-97-07	Veblen	102	1.8	08-06-99	30.95	1,188.7	92	102
454543097022701	127N51W21DDDA R	R2-97-08	--	155	--	--	--	1,155	--	--
454819097102101	127N52W 4DCDC R	R2-97-19	--	102	--	--	--	1,231	--	--
454538097061101	127N52W25AAAAA R	R2-97-10	--	182	--	--	--	1,182	--	--
454538097061102	127N52W25AAAAA2 R	R2-97-11	Undetermined	42	1.9	08-06-99	3.97	1,182.4	23.1	33.1

Table 9. Selected site information for observation wells and test holes completed from 1997 through 1999—Continued

[--, not applicable]

Site identification number	Local number	Other identifier	Aquifer	Depth drilled (feet)	Measuring point, in feet above land surface	Date of water-level measurement	Water level, in feet below land surface	Land surface altitude (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
455123096434701	128N48W19BCCC R	R2-97-30	Fairmount ¹	234	1.7	08-06-99	15.90	1,078.6	207	227
455055096434801	128N48W30BBBB R	R2-97-29	--	252	--	--	--	1,092	--	--
455341096434701	128N49W 1DDAD R	R2-97-31	--	262	--	--	--	1,072	--	--
455341096435001	128N49W 1DDAD2 R	R2-97-32	Rosholt	142	2.2	08-06-99	8.64	1,071.7	132	142
455104096473501	128N49W21DDAD R	R2-97-35	--	322	--	--	--	1,076	--	--
455334096512001	128N50W 1DDDC R	R2-97-28	--	222	--	--	--	1,903	--	--
455058096511801	128N50W25AAAB R	R2-97-25	--	258	--	--	--	1,096	--	--
455058096511802	128N50W25AAAB2 R	R2-97-26	Rosholt	202	1.6	08-06-99	21.91	1,095.9	190	200
455058096511803	128N50W25AAAB3 R	R2-97-27	Rosholt	62	2.1	08-06-99	12.08	1,095.4	52	62
455054096550201	128N50W28AAAA R	R2-97-14	--	342	--	--	--	1,102	--	--
455054096582101	128N50W30BABB R	R2-97-13	--	242	--	--	--	1,172	--	--
455056097023101	128N51W27BBBB R	R2-97-12	--	282	--	--	--	1,222	--	--
455332097061301	128N52W 1DDDD R	R2-97-15	--	262	--	--	--	1,204	--	--
455335097061501	128N52W 1DDDD2 R	R2-97-18	Veblen ¹	162	2.2	08-06-99	25.43	1,204.2	152	162
455337097095501	128N52W 3CCCB R	R2-97-16	--	242	--	--	--	1,195	--	--
455337097095502	128N52W 3CCCB2 R	R2-97-17	Veblen ¹	142	2.3	08-06-99	12.42	1,194.8	132	142
455049097095501	128N52W27BBBC R	R2-97-20	Veblen ¹	152	2.5	08-06-99	35.78	1,213.7	120	130
455557096470201	129N49W27BACC R	R2-97-34	--	292	--	--	--	1,068	--	--
455543096510701	129N49W30CBBB R	R2-97-33	--	302	--	--	--	1,101	--	--

¹Preliminary selection of aquifer.

The SDDENR has installed observation wells throughout South Dakota and frequently measures the water levels in these wells. Fifty-seven SDDENR observation wells that are located within or near either Roberts County or the former boundary of the Lake Traverse Reservation also have been incorporated into the study. Selected information for the SDDENR observation wells is presented in table 10, and the locations are shown in figure 5. Hydrographs through 1996 are presented in Carter and Thompson (1999), and hydrographs for 1997 through 1999 are presented in Section B of the Supplemental Information section. The altitudes of most of these wells that are located in Roberts County have been determined using GPS software.

The NDSWC has installed observation wells throughout North Dakota. Eighteen of these NDSWC observation wells are located within or near the former boundary of the Lake Traverse Reservation. Selected site information for the 18 NDSWC observation wells is presented in table 10, and the locations are shown in figure 5. Water-level data collected through 1996 are published in Carter and Thompson (1999). Water-level data collected after 1996 are presented Section B.

The wells in table 10 are identified by the 15-digit station identification number based on their latitudes and longitudes, the USGS local number based on the Federal land-survey system, both assigned by the same methods previously described. The other identifier (table 10) for the South Dakota wells was designated by the SDDENR or SDGS. The SDDENR identifier denotes the county (CD, Codington; GT, Grant; DA, Day; ML, Marshall; RB, Roberts) followed by the year in which it was drilled and a sequence number or letter. For example, RB-77D denotes the fourth observation well installed in 1977 in Roberts County. The SDGS identifier denotes a well name from a previous study, or the rig number, followed by the year drilled, followed by a sequence number. For example R2-97-28 denotes the 28th hole drilled by rig 2 in 1997. The other identifier (table 10) for the North Dakota wells was designated by the NDSWC.

GROUND-WATER DATA

The major aquifers in the study area consist of unconsolidated glacial drift and alluvial deposits. The major glacial aquifers that are present in the study area in South Dakota include the Big Sioux, Coteau Lakes, Fairmount, Prairie Coteau, Revillo, Veblen, Rosholt, Roslyn, Lonesome Lake, Eden, Marday, Altamont, and

Wilmot aquifers. The major glacial aquifer present in the study area in North Dakota is the Spiritwood aquifer. Because several different studies have been conducted in the area and the aquifers in these studies were named for a localized area, it is possible that some of these aquifers are interconnected but named differently based on location. This issue will be addressed during the interpretive part of this study.

Hydrographs

Water levels have been compiled for a water-level network consisting of 57 SDDENR observation wells, 38 existing SDGS and SDDENR observation wells from miscellaneous local studies, 18 NDSWC observation wells, and 50 observation wells completed for this study. Data collected from 1997 through 1999, and data from some wells that were measured for the first time in December 1996, are presented in this report.

Site descriptions and hydrographs for observation wells that were part of the water-level network are presented in Section B. The water levels are given in feet above (+) or below (-) land surface. A dashed line is shown on the hydrographs when the interval between water-level measurements exceeds 1 year. The data used to generate the hydrographs are available in the USGS Ground Water Site Inventory (GWSI) data base.

Water-Quality Data

Water-quality data from samples collected during 1997-99 are published in this report. All water-quality samples were collected by USGS personnel. Field measurements (and total coliform bacteria and immunoassay for pesticides, where applicable) were completed by South Dakota District or North Dakota District USGS staff. All other parameters were analyzed by the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado. Analysis for bacteria and pesticides is generally only completed on wells with depths less than 100 feet. However, deeper wells were included when the 1997 observation wells were sampled. The locations of the sampling sites are shown in figure 6, and the analytical results are presented in table 11. Two additional wells (R2-96-56 and R2-96-58) are included in table 11 that do not appear in figure 6. These two wells were re-sampled for bacteria when the 1997 wells were sampled because they had not yet been sealed when sampled the first time.

Table 10. Selected site information for observation wells in water-level network

[--, no data]

Station identification number	Local number	Other identifier	Sequence number ¹	County	Land surface altitude (feet)	Aquifer	Depth drilled (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
450205097073302	118N52W18BBBB2	CD-77A	1	Codington	1,775	--	180	--	--
445930097070901	118N52W30CDCD	CD-76B	2	Codington	1,753.2	Big Sioux	50	24.9	29.9
450655097092301	119N52W 4ADDD R	CD-77B	3	Codington	1,770	Big Sioux	20	7.6	12.6
450538097083901	119N52W10DDDD R	CD-77C	4	Codington	1,770	Big Sioux	20	9.2	14.2
450208097101401	119N52W33DCDC R	CD-60A	5	Codington	1,745	Big Sioux	50	25	27
450904097145501	119N53W 6BBBB	R2-85-111	6	Codington	1,878	Altamont	590	520	535
450947097060901	120N51W19BBCC R	GT-77A	7	Grant	1,895	Prairie Coteau	190	172.1	177.1
451143097110501	120N52W 9BBBB R	GT-79C	8	Grant	1,834	Prairie Coteau	140	109	124
451141097061701	120N52W12AAAB R	GT-76C	9	Grant	1,873.1	Prairie Coteau	185	159.1	164.1
450956097083401	120N52W23BBBB R	GT-76B	10	Grant	1,820.9	Prairie Coteau	140	117.5	122.5
450814097091601	120N52W27CDDDD R	CD-76D	11	Codington	1,800	Prairie Coteau	129	112.6	128.6
450814097095301	120N52W28DDDD R	CD-56A	12	Codington	1,781.6	Big Sioux	19	--	--
451050097161601	120N54W23DDDDC	DA-78H	13	Day	1,830	Prairie Coteau	200	194	198
451936096294001	121N47W 1AAAA	CO-86-03	14	Grant	1,092	--	106	93	106
451844096305401	121N47W 2DDDD	CO-86-05	15	Grant	1,115	--	126	121	126
451848096363501	121N47W 6CCCC	GT-79E	16	Grant	1,104	--	132	123	128
451418097045501	121N51W29BBBB R	GT-77E	17	Grant	1,955	Prairie Coteau	245	221.3	226.3
451725097072101	121N52W 1CBBB R	GT-57A	18	Grant	1,885	Big Sioux	40	--	--
451606097072501	121N52W 2ADDD R	GT-82A	19	Grant	1,881.3	Big Sioux	35	16.8	21.8
451749097080601	121N52W 2BAAA R	R20-84-31	20	Grant	1,878.4	Big Sioux	23	5	19
451750097083001	121N52W 2BBBA R	CO-87-66	21	Grant	1,885	Prairie Coteau	153	140	150
451701097083701	121N52W 2CCCC R	R20-84-26	22	Grant	1,869	Big Sioux	18	8	17
451716097095901	121N52W 3CCBB R	R20-84-25	23	Grant	1,857.9	Big Sioux	25	5	15

Table 10. Selected site information for observation wells in water-level network—Continued

[--, no data]

Station identification number	Local number	Other identifier	Sequence number ¹	County	Land surface altitude (feet)	Aquifer	Depth drilled (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
451749097105501	121N52W 4BBAB R	R20-84-27	24	Grant	1,843.7	Big Sioux	53	40	54
451608097114101	121N52W 8DCCC R	GT-77B	25	Grant	1,831.2	Big Sioux	50	15.7	20.7
451608097110801	121N52W 8DDDD R	R20-84-30	26	Grant	1,839.2	Big Sioux	36	24	34
451605097071701	121N52W13BBBA R	GT-79A	27	Grant	1,916.9	Prairie Coteau	210	163	198.1
451423097095201	121N52W22CCCC R	GT-77C	28	Grant	1,837	Prairie Coteau	185	97.3	102.3
451328097072301	121N52W25CCCC R	GT-79B	29	Grant	1,880	Prairie Coteau	185	138.4	183.4
451340097121801	121N52W29CCBB R	GT-77D	30	Grant	1,860	Big Sioux	35	18.9	23.9
451506097170401	121N54W34AADA	DA-78E	31	Day	1,803	Prairie Coteau	90	77.8	82.8
451935096310001	122N47W35DDCD	R2-85-28	32	Roberts	1,100	Wilmot	200	74	79
452211096365902	122N48W13DDDD2	R2-98-15	33	Roberts	1,085.9	--	102	90	100
452352096513901	122N49W 7BBBB	RB-77N	34	Roberts	1,199.9	Revillo	200	179	184
452257096491801	122N49W17AAAD	RB-77P	35	Roberts	1,163.9	Wilmot	65	38	43
452302096503101	122N49W18AAA	RB-77O	36	Roberts	1,184.2	Wilmot	75	61	66
452117096514201	122N49W30BBBB	RB-77Q	37	Roberts	1,248.3	Revillo	165	146	151
452210096514701	122N50W13DDDC	R2-97-46	38	Roberts	1,228	Wilmot	82	54	74
452212097022702	122N51W 4DDDD2 R	R2-99-11	39	Roberts	1,962.2	Eden	452	426.5	446.5
451936097022602	122N51W27BBBB2 R	R2-98-27	40	Roberts	2,025.4	Prairie Coteau	302	282	302
452213097063101	122N52W 1DDCC R	R2-98-31	41	Roberts	1,946.1	Eden	462	412	432
452304097080201	122N52W 2ABBB R	CO-93-11	42	Roberts	1,905	Coteau Lakes	37	--	--
452304097083901	122N52W 2BBBB R	RB-77T	43	Roberts	1,910.9	Coteau Lakes	65	52.4	57.4
452304097091501	122N52W 3ABBB R	CO-93-36	44	Roberts	1,908	Coteau Lakes	34	16.5	26.5
452214097092701	122N52W 3CCDD R	CO-93-37	45	Roberts	1,890	Coteau Lakes	52	38	48
452238097084001	122N52W 3DAAA R	CO-93-35	46	Roberts	1,910	Coteau Lakes	37	23	33
452215097121801	122N52W 5CCCC R	RB-77R	47	Roberts	1,871.7	Coteau Lakes	35	24.9	29.9

Table 10. Selected site information for observation wells in water-level network—Continued

[--, no data]

Station identification number	Local number	Other identifier	Sequence number ¹	County	Land surface altitude (feet)	Aquifer	Depth drilled (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
452213097095602	122N52W 9AAAA2 R	CO-93-31	48	Roberts	1,872	Coteau Lakes	54	32	42
452212097083901	122N52W11BBBB R	RB-93C	49	Roberts	1,921	Prairie Coteau	162	151.5	156.5
452122097072301	122N52W12CCCC R	RB-76B	50	Roberts	1,904.9	Coteau Lakes	50	26.5	31.5
452119097083901	122N52W14BBBB R	RB-76A	51	Roberts	1,897.9	Coteau Lakes	50	28.1	33.1
452115097110601	122N52W16BBBC R	RB-82B	52	Roberts	1,855.5	Coteau Lakes	35	16.6	21.6
451934097095302	122N52W27BBBB2 R	R2-98-30	53	Roberts	1,878.4	Lonesome Lake	242	222	242
451841097110901	122N52W32AAAA R	RB-77S	54	Roberts	1,851.7	Coteau Lakes	110	18.1	23.1
451822097072401	122N52W36CCCB2 R	R20-84-34	55	Roberts	1,888	Big Sioux	28	9	28
452120097145001	122N53W11DDDD R	DA-78D	56	Day	1,830	Coteau Lakes	40	27.4	32.4
452633096453401	123N49W24CCCC	RB-81B	57	Roberts	1,148.6	--	140	97	107
452722096552301	123N50W22BBBB	R2-94-66	58	Roberts	1,240.3	Reville	242	202	212
452721096525701	123N50W23AAAA	RB-77L	59	Roberts	1,175.2	Reville	170	146	151
452537096525701	123N50W35AAAA	RB-77M	60	Roberts	1,216.1	Reville	200	178.1	183.1
452218097022902	123N51W21DDDD2 R	R20-99-48	61	Roberts	1,819.4	--	138	118	138
452728097122401	123N52W 6DDDA R	CO-93-28	62	Roberts	1,870	Coteau Lakes	40	23	33
452724097114701	123N52W 8BAAA R	CO-93-26	63	Roberts	1,895	Coteau Lakes	47	29	39
452540097130901	123N52W19BABA R	RB-81C	64	Roberts	1,918	Coteau Lakes	26	8.1	18.1
452357097072401	123N52W25CCCC R	RB-81D	65	Roberts	1,931.9	Coteau Lakes	32	19	29
452330097083801	123N52W35CBBB R	CO-93-33	66	Roberts	1,910	Coteau Lakes	64	41.5	51.5
452330097083802	123N52W35CBBB2 R	CO-93-34	67	Roberts	1,910	Coteau Lakes	20	8	18
452544097144802	123N53W13CCCC2 R	RO-7	68	Day	1,874	Prairie Coteau	81	--	--
452959096545901	124N50W27BBBB R	R2-94-54	69	Roberts	1,210.1	Reville	220	176.83	186.83
453001096584801	124N51W25AAAB R	R2-94-55	70	Roberts	1,274	Reville	282	256	266
453002097060902	124N51W30BBBB2 R	R2-99-13	71	Roberts	2,053.1	Marday	422	373	413

Table 10. Selected site information for observation wells in water-level network—Continued

[—, no data]

Station identification number	Local number	Other identifier	Sequence number ¹	County	Lsnd surface altitude (feet)	Aquifer	Depth drilled (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
453240097022701	124N51W4DDDD R	R2-95-01	72	Roberts	1,425	Revilla	423	397.5	407.5
453204097100202	124N52W 9AAAC2 R	R2-99-10	73	Roberts	2,003	--	132	112	132
453815096584001	125N50W 6CBBB R	R2-93-53	74	Roberts	1,225	--	88	78	83
453752096584001	125N50W 6CCCC R	RB-81-15	75	Roberts	1,200	--	90	37	40
453752096580301	125N50W 6DCCC R	RB-81-16	76	Roberts	1,230	--	155	97.4	201.4
453752096580302	125N50W 6DCCC2 R	RB-81-17	77	Roberts	1,231	--	50	41.8	47.8
453725096572801	125N50W 7ADDD R	R2-93-54	78	Roberts	1,205	--	83	78	83
453751096572401	125N50W 8BBBA R	RB-11	79	Roberts	1,216	--	140	105.1	110.1
453700096572702	125N50W 8CCCC2 R	RB-7W	80	Roberts	1,207	--	70	65	70
453700096572701	125N50W 8CCCC3 R	RB-7E	81	Roberts	1,207	--	23	19.8	22.8
453738096515402	125N50W12ABCC2 R	R2-97-43	82	Roberts	1,120	Veblen	62	52	62
453514096561402	125N50W20DDDD2 R	RB-5	83	Roberts	1,215	--	20	16.1	19.1
453752096591801	125N51W 1DCCC R	RB-12E	84	Roberts	1,215	--	68	52.7	63.7
453752096591802	125N51W 1DCCC2 R	RB-12W	85	Roberts	1,215	--	32	20.3	25.3
453658096591702	125N51W13ABBB2 R	RB-10	86	Roberts	1,222	--	16	10.6	15.6
453331097045301	125N51W32CCCC R	R2-96-01	87	Roberts	1,660.1	Revilla	657	605	645
453751097060702	125N51W7BBBB2 R	R2-95-05	88	Roberts	1,525	Roslyn	102	92	102
453659097104502	125N52W16BABB2 R	R2-99-12	89	Roberts	1,987.9	Eden	423	403	423
453515097083801	125N52W23CCCC R	CO-93-19	90	Roberts	1,972	Coteau Lakes	22	14	19
453700097144901	125N53W12CCCC R	CO-93-42	91	Marshall	1,875	Coteau Lakes	97	--	--
454304096511302	126N49W 7BBBB2 R	R2-96-56	92	Roberts	1,098.5	Rosholt	101	69.5	79.5
454303096451701	126N49W11AABA R	R2-97-42	93	Roberts	1,111	Fairmount	262	242	262
454028096550001	126N50W21DDDD R	R2-96-48	94	Roberts	1,165.1	Veblen	202	168	178
453819096572501	126N50W32CCCB R	RB-79D	95	Roberts	1,164.4	Veblen	112.1	97.1	112.1

Table 10. Selected site information for observation wells in water-level network—Continued

[--, no data]

Station identification number	Local number	Other identifier	Sequence number ¹	County	Land surface altitude (feet)	Aquifer	Depth drilled (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
453928096595601	126N51W35AADAR	RB-79C	96	Roberts	1,160.6	--	51	35.2	50.2
453844096591801	126N51W36DCCC R	RB-20	97	Roberts	1,200	--	64	57.7	63.7
454911096384601	127N48W 2BBBB R	RB-77F	98	Roberts	1,069	Rosholt	80	38.5	43.5
454818096434501	127N48W 7BBBB R	RB-77G	99	Roberts	1,079.9	Rosholt	50	38.4	43.4
454818096434502	127N48W 7BBBB2 R	RB-77H	100	Roberts	1,079.7	Fairmount	245	197.4	202.4
454737096424801	127N48W 7DDBB R	RB-77A	101	Roberts	1,100	Rosholt	77	59.4	64.4
454634096434501	127N48W18DDDD R	RB-77B	102	Roberts	1,097.7	Fairmount	240	208.7	213.7
454541096400502	127N48W28AAAA R	R2-97-45	103	Roberts	1,090	Rosholt	73	63	73
454818096473002	127N49W10BBBB2 R	R2-96-53	104	Roberts	1,089.2	Rosholt	62	52	62
454658096450301	127N49W14DAAA R	RB-77I	105	Roberts	1,109.3	Fairmount	170	158	163
454658096450402	127N49W14DAAA2 R	RB-77J	106	Roberts	1,109.9	Rosholt	80	75	80
454449096450201	127N49W26DDDD R	RB-77C	107	Roberts	1,124.5	Fairmount	270	265	270
454550096491302	127N49W29DCDC2 R	LTR-16	108	Roberts	1,111.4	Rosholt	90	80	90
454449096450101	127N49W36BBBB R	RB-77K	109	Roberts	1,129	Rosholt	125	118.5	123.5
454818096550602	127N50W 9BBBB2 R	R2-97-39	110	Roberts	1,120	Rosholt	82	72	82
454547096584301	127N50W19CCCB R	LTR-2	111	Roberts	1,175.4	Veblen	203	109	119
454541096550001	127N50W21DDDD R	R2-96-50	112	Roberts	1,139	Veblen	175	138	148
454523096511602	127N50W25ADAD2 R	R2-96-58	113	Roberts	1,099.5	Rosholt	80	66	76
454910097011501	127N51W 3AAAA R	RB-81A	114	Roberts	1,226.3	Veblen	275	185.88	197.88
454820097023602	127N51W 9AAAA2 R	R2-97-07	115	Roberts	1,192	Veblen	112	104	94
454838097061102	127N52W25AAAA2 R	R2-97-11	116	Roberts	1,188	--	42	23	33
454818097060401	127N52W7CCCD R	R2-95-08	117	Roberts	1,197	Veblen	147	128	138
455334096372102	128N48W 1CCDC2 R	R2-96-62	118	Roberts	1,021.8	Fairmount	222	198	203
455336096400301	128N48W 4DDDD R	R2-96-63	119	Roberts	1,046.6	Fairmount	252	218	238

Table 10. Selected site information for observation wells in water-level network—Continued

[--, no data]

Station identification number	Local number	Other identifier	Sequence number ¹	County	Land surface altitude (feet)	Aquifer	Depth drilled (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
455423096434501	128N48W 6BBBB R	LTR-10	120	Roberts	1,098.2	Fairmount	282	249	259
455123096434701	128N48W19BCCC R	R2-97-30	121	Roberts	1,080	Fairmount	234	207	227
455148096423101	128N48W20BBBB R	RB-77D	122	Roberts	1,070.7	Rosholt	95	38	43
455005096411801	128N48W29DDDD R	RB-77E	123	Roberts	1,081.5	Rosholt	110	58.4	63.4
455341096435001	128N49W 1DDAD2 R	R2-97-32	124	Roberts	1,074	Rosholt	142	132	142
455146096500001	128N49W20BBBB R	LTR-6	125	Roberts	1,082.6	Fairmount	223	190	200
455003096434701	128N49W36AAA R	LTR-21	126	Roberts	1,078.9	Fairmount	240	191	201
455333096550002	128N50W10BBBB2 R	R2-95-18	127	Roberts	1,092.3	Rosholt	57	47	57
455148096550001	128N50W21AAAA R	LTR-5	128	Roberts	1,093.7	Fairmount	283	210	220
455147096551301	128N50W21AABA R	RB-79A	129	Roberts	1,094.3	Rosholt	127	109.7	124.7
455057096561501	128N50W21CCCC R	RB-79B	130	Roberts	1,112.8	--	50	26.7	41.7
455058096511802	128N50W25AAAB2 R	R2-97-26	131	Roberts	1,095	Rosholt	202	190	200
455058096511803	128N50W25AAAB3 R	R2-97-27	132	Roberts	1,095	Rosholt	62	52	62
455148097001401	128N51W23AABA R	LTR-4	133	Roberts	1,210.0	Veblen	283	170	180
455608097010801	129N51W26BBBB2 R	12276B	134	Richland	1,198.7	Veblen	80	75	80
455335097061501	128N52W 1DDDD2 R	R2-97-18	135	Roberts	1,205	Veblen	162	152	162
455337097095502	128N52W 3CCCB2 R	R2-97-17	136	Roberts	1,201	Veblen	142	132	142
455053097061702	128N52W25AAAB2 R	R2-95-10	137	Roberts	1,188	Veblen	163	153	163
455053097061701	128N52W25AAAB R	R2-95-09	138	Roberts	1,188	Veblen	222	191	201
455049097095501	128N52W27BBBC R	R2-97-20	139	Roberts	1,212	Veblen	152	130	120
455329097172501	128N53W10BBBB R	ML-69A	140	Marshall	1,250	Veblen	215	120	--
455606097322901	128N56W 3BBBB	ML-70C	141	Marshall	1,352	--	230	--	--
455457096395201	129N48W33ADDA R	LTR-9	142	Roberts	1,051.7	Fairmount	253	222	232
455611096520101	129N50W24CCD R	12186A	143	Richland	1,089.5	Rosholt	215	198	203

Table 10. Selected site information for observation wells in water-level network—Continued

[--, no data]

Station identification number	Locsl number	Other identifier	Sequence number ¹	County	Land surface altitude (feet)	Aquifer	Depth drilled (feet)	Top of screen, in feet below land surface	Bottom of screen, in feet below land surface
455611096520102	129N50W24CCD2 R	12186B	144	Richland	1,089.5	Rosholt	143	137	142
455611096520103	129N50W24CCD3 R	12186C	145	Richland	1,089.5	Rosholt	90	82	87
455607096545002	129N50W27BBBB2 R	R2-95-21	146	Roberts	1,106	--	171	161	171
455755097045501	129N51W 8CCC R	13037	147	Richland	1,196.2	Veblen	240	148	153
455701097051501	129N51W19ABA R	13422	148	Richland	1,191.2	Veblen	240	128	133
455932097092401	129N52W14AAA	13494	149	Richland	1,220	Veblen	270	78	83
455610097110901	129N52W21CCC R	12277	150	Richland	1,221.2	Veblen	280	128	133
455608097061702	129N52W25AAAAB2 R	R2-95-13	151	Roberts	1,196	Veblen	178	168	178
455842097210301	129N53W 7BBA R	9248	152	Sargent	1,171	Spiritwood	220	178	184
455842097173701	129N53W 9AAA R	9249	153	Sargent	1,170	Spiritwood	240	198	201
455606097172501	129N53W27BBBB R	ML-70A	154	Marshall	1,255	Veblen	260	100	--
460118097230501	129N54W 1AAA	13452	155	Sargent	1,162	Spiritwood	231	195	200
460118097230502	129N54W 1AAA2	13453	156	Sargent	1,162	Spiritwood	80	65	70
455914097231801	129N54W 3ADD R	12263	157	Sargent	1,186	Spiritwood	200	125	128
455607097211501	129N54W25AAAAA R	ML-70B	158	Marshall	1,260	Veblen	230	120	140
460117097195801	130N53W 4BAA	13447	159	Sargent	1,163	Spiritwood	260	204	209
460117097195802	130N53W 4BAA2	13448	160	Sargent	1,163	Spiritwood	175	163	168
460033097245701	130N54W27CCC R	12261	161	Sargent	1,180	Spiritwood	190	158	163
455909097245901	130N54W33DDD R	12262	162	Sargent	1,158	Spiritwood	200	138	145
455941097234001	130N54W35CCC R	9247	163	Sargent	1,170	Spiritwood	240	188	191

¹Sequence number is used to identify the wells in figure 5.

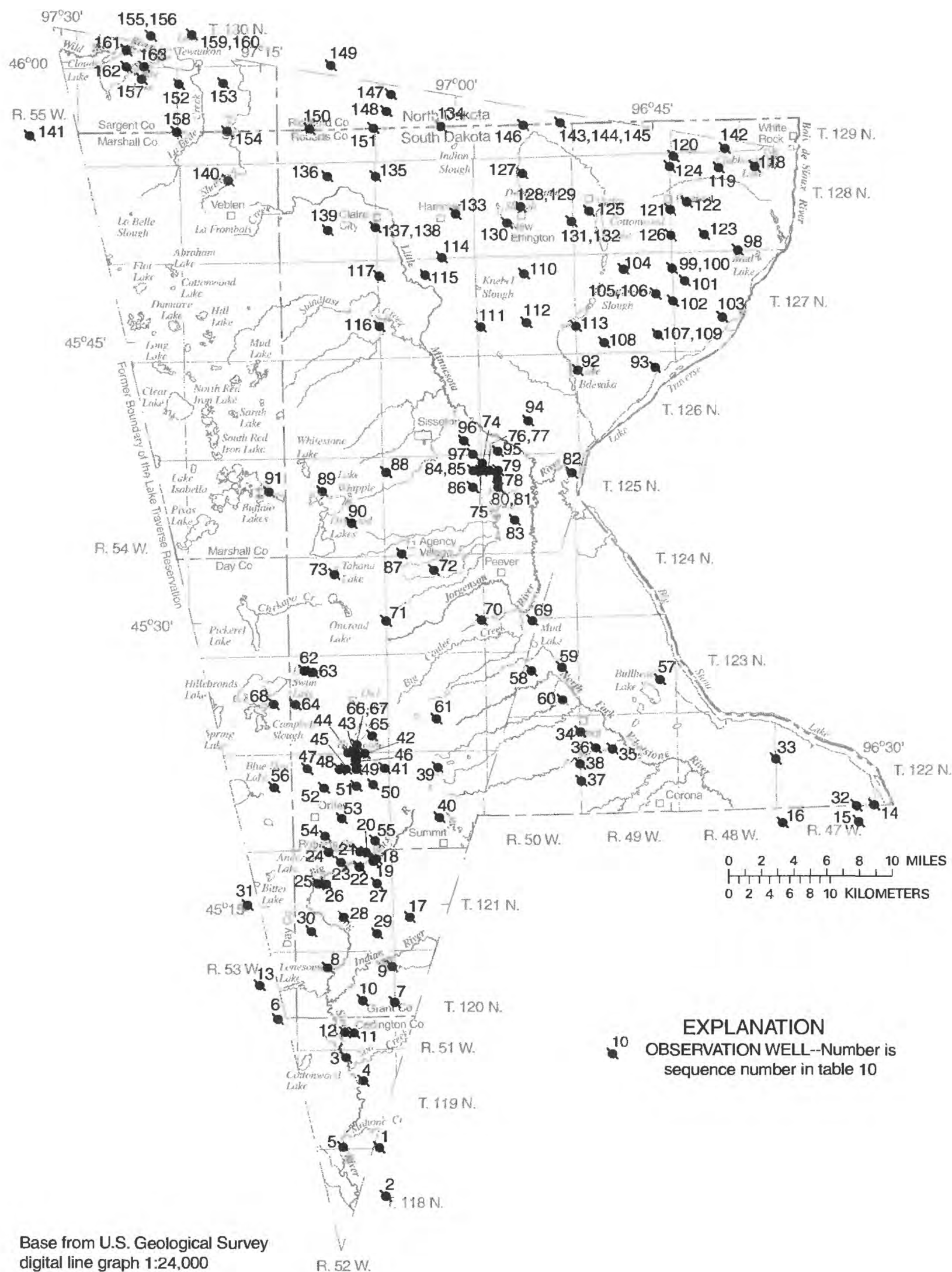


Figure 5. Location of selected observation wells in and near study area, which were part of the water-level monitoring program.

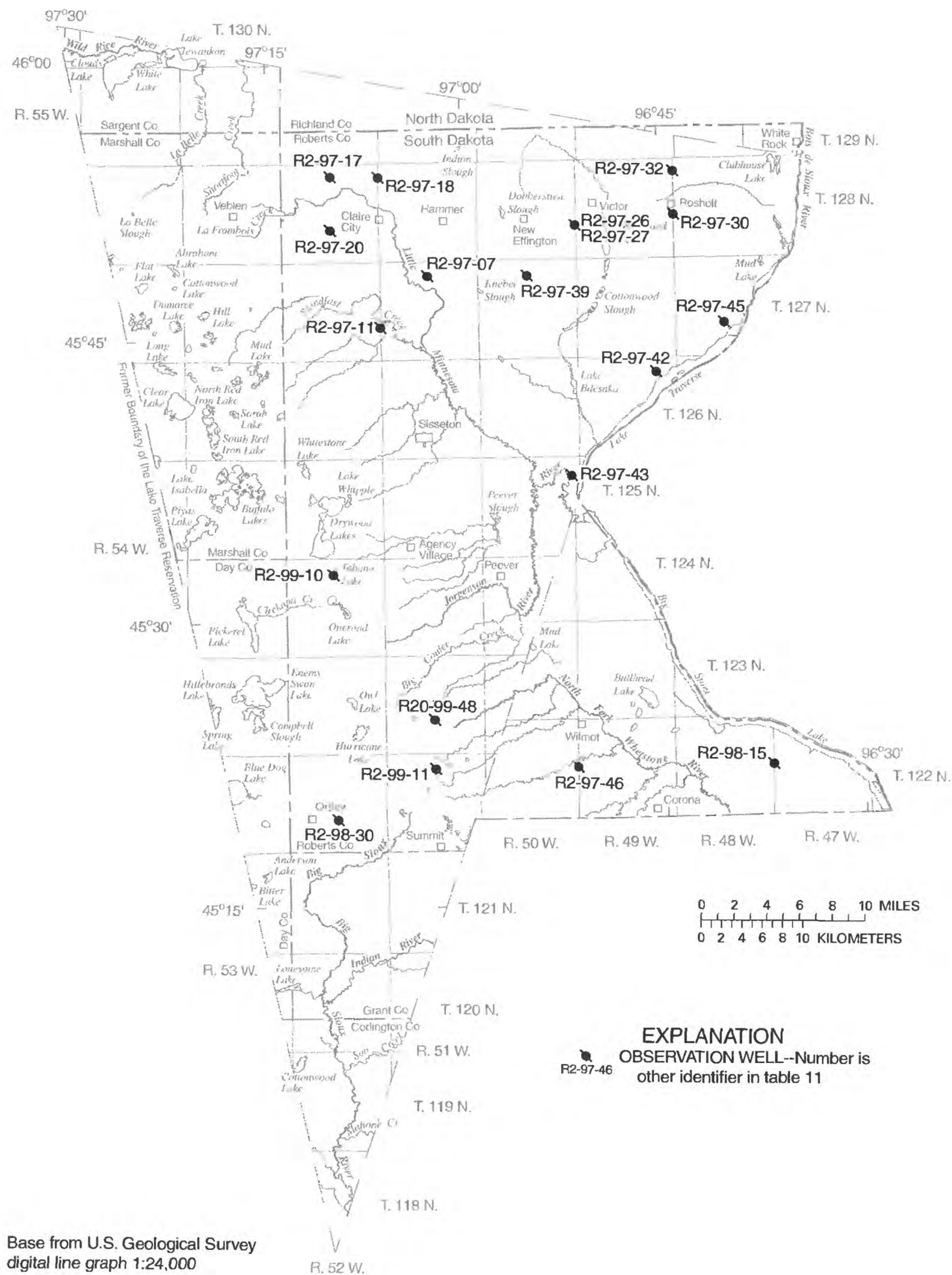


Figure 6. Location of ground-water sites sampled during 1997-99.

Table 11. Water-quality data from observation wells sampled by the U.S. Geological Survey from 1997-99

[Bold type indicates values above maximum contaminant level or SD Domestic Water Supply Criteria. $\mu\text{S}/\text{cm}$, microsiemens per centimeter; mg/L , milligrams per liter; $\mu\text{g}/\text{L}$, micrograms per liter; mm, millimeter; mV, millivolt; mL, milliliter; pCi/L, picocuries per liter; deg C, degrees Celsius; FET, fixed end point titration; IT, incremental titration; <, less than; --, no data]

Station identification number	Local number	Other identifier	Date	Specific conduct- ance, field ($\mu\text{S}/\text{cm}$) (00095)	pH, field (standard units) (00400)	Temper- ature water (deg C) (00010)	Oxygen, dissolved (mg/L) (00300)	Oxygen, dissolved (percent satura- tion) (00301)	Oxidation reduction potential (mV) (00090)	Alkalinity, field, dissolved, IT (mg/L as CaCO_3) (39086)	Alkalinity, field, dissolved, FET (mg/L ss CaCO_3) (00418)
452211096365902	122N48W13DDDD2	R2-98-15	09-13-99	1,415	6.6	9.9	0.2	1	-62	458	452
452210096514701	122N50W13DDDC	R2-97-46	05-15-98	2,390	7.2	10.5	.0	0	79	312	312
452212097022702	122N51W 4DDDD2 R	R2-99-11	09-14-99	1,910	6.8	10.4	.1	1	-87	387	383
451935097095201	122N52W27BBBB2 R	R2-98-30	09-14-99	700	7.0	9.6	.1	0	-127	391	387
			109-14-99	--	--	--	--	--	--	--	--
452218097022902	123N51W21DDDD2 R	R20-99-48	09-14-99	1,080	6.6	9.1	.2	1	-34	405	405
453204097100202	124N52W 9AAAC2 R	R2-99-10	09-13-99	2,160	6.5	9.6	.1	1	-3	486	482
453738096515402	125N50W12ABCC2 R	R2-97-43	05-15-98	2,370	6.9	10.3	³ 10.5	77	95	234	233
454304096511302	126N49W 7BBBB2 R	R2-96-56	05-11-98	--	--	--	--	--	--	--	--
454303096451701	126N49W11AABA2 R	R2-97-42	05-14-98	1,090	7.4	10.4	.0	0	-84	266	265
454541096400502	127N48W28AAAA R	R2-97-45	05-14-98	1,230	7.0	10.3	.0	0	-24	376	374
454818096550602	127N50W 9AAAA2 R	R2-97-39	05-14-98	1,330	7.0	10.3	.1	1	-61	368	368
454523096511602	127N50W25ADAD2 R	R2-96-58	05-11-98	--	--	--	--	--	--	--	--
454820097023602	127N51W 9AAAA2 R	R2-97-07	05-14-98	1,130	7.1	10.1	.1	1	-49	346	345
			105-14-98	--	--	--	--	--	--	350	349
454538097061102	127N52W25AAAA2 R	R2-97-11	05-13-98	1,400	7.1	9.9	.1	0	22	378	378
455123096434701	128N48W19BCCC R	R2-97-30	05-12-98	1,490	7.8	9.2	.0	0	-118	460	460
455341096435001	128N49W 1DDAD2 R	R2-97-32	05-12-98	920	6.8	8.9	.1	1	-75	294	293
455058096511802	128N50W25AAAB2 R	R2-97-26	05-12-98	3,700	7.2	8.9	.1	0	-121	301	300
455058096511803	128N50W25AAAB3 R	R2-97-27	05-12-98	1,410	6.9	8.8	.1	1	-82	309	309
455335097061501	128N52W 1DDDD2 R	R2-97-18	05-13-98	1,610	6.9	9.7	.1	0	-27	390	390
455337097095502	128N52W 3CCCB2 R	R2-97-17	05-13-98	1,170	7.0	9.5	.1	0	-18	364	363
455049097095501	128N52W27BBBC R	R2-97-20	05-13-98	1,180	7.1	9.7	.1	0	4	296	295
Maximum contaminant level or SD Domestic Water Supply Criteria				--	6.5-9.0	--	--	--	--	--	--

Table 11. Water-quality data from observation wells sampled by the U.S. Geological Survey from 1997-99—Continued

[Bold type indicates values above maximum contaminant level or SD Domestic Water Supply Criteria. μ S/cm, microsiemens per centimeter; mg/L, milligrams per liter; μ g/L, micrograms per liter; mm, millimeter; mV, millivolt; mL, milliliter; pCi/L, picocuries per liter; deg C, degrees Celsius; FET, fixed end point titration; IT, incremental titration; <, less than; --, no data]

Local number	Other identifier	Date	Calcium, dissolved	Magne- sium, dissolved	Sodium, dissolved	Potas- sium dissolved	Bicar- bonate, field, dissolved, IT	Carbon- ate, field, dissolved, IT	Sulfate, dissolved	Chloride, dissolved	Fluoride, dissolved	Silica, dissolved
			(mg/L as Ca) (00915)	(mg/L as Mg) (00925)	(mg/L as Na) (00930)	(mg/L as K) (00935)	(mg/L as HCO ₃) (00453)	(mg/L as CO ₃) (00452)	(mg/L as SO ₄) (00945)	(mg/L as Cl) (00940)	(mg/L as F) (00950)	(mg/L as SiO ₂) (00955)
122N48W13DDDD2	R2-98-15	09-13-99	190	67	36	6.6	552	0	380	2.9	0.2	37
122N50W13DDDC	R2-97-46	05-15-98	170	57	290	12	381	0	900	62	0.3	29
122N51W 4DDDD2 R	R2-99-11	09-14-99	240	89	55	9.0	466	0	760	2.0	.3	33
122N52W27BBBB2 R	R2-98-30	09-14-99	69	34	30	3.6	471	0	5.5	2.3	.4	35
		109-14-99	69	33	31	3.4	--	--	5.4	.47	.4	35
123N51W21DDDD2 R	R20-99-48	09-14-99	170	42	12	4.3	488	0	210	2.6	.3	31
124N52W 9AAAC2 R	R2-99-10	09-13-99	350	99	29	8.2	586	0	870	2.9	.2	32
125N50W12ABCC2 R	R2-97-43	05-15-98	350	190	24	8.5	286	0	1,400	14	.3	29
126N49W 7BBBB2 R	R2-96-56	05-11-98	--	--	--	--	--	--	--	--	--	--
126N49W11AABA2 R	R2-97-42	05-14-98	98	25	97	8.1	325	0	270	23	.4	29
127N48W28AAAA R	R2-97-45	05-14-98	210	70	19	8.5	459	0	470	1.3	.3	36
127N50W 9AAAA2 R	R2-97-39	05-14-98	150	35	140	10.7	449	0	430	34	.2	28
127N50W25ADAD2 R	R2-96-58	05-11-98	--	--	--	--	--	--	--	--	--	--
127N51W 9AAAA2 R	R2-97-07	05-14-98	140	45	29	9.7	422	0	290	3.4	.1	28
		105-14-98	150	46	30	9.7	427	0	290	3.4	.1	29
127N52W25AAAA2 R	R2-97-11	05-13-98	160	82	42	5.5	461	0	420	17	.5	27
128N48W19BCCC R	R2-97-30	05-12-98	12	6	310	4.8	562	0	220	43	1.4	18
128N49W 1DDAD2 R	R2-97-32	05-12-98	100	35	35	8.8	359	0	200	2.1	.3	28
128N50W25AAAB2 R	R2-97-26	05-12-98	110	35	610	9.0	367	0	600	650	.4	28
128N50W25AAAB3 R	R2-97-27	05-12-98	240	80	27	9.9	378	0	650	.96	.2	31
128N52W 1DDDD2 R	R2-97-18	05-13-98	200	55	89	13	476	0	510	12	.2	30
128N52W 3CCCB2 R	R2-97-17	05-13-98	180	42	30	8.3	444	0	280	6.1	.2	30
128N52W27BBBC R	R2-97-20	05-13-98	120	31	82	8.8	361	0	290	26	.3	29
Maximum contaminant level or SD Domestic Water Supply Criteria			--	--	--	--	--	--	875	438	4.0	--

Table 11. Water-quality data from observation wells sampled by the U.S. Geological Survey from 1997-99—Continued

[Bold type indicates values above maximum contaminant level or SD Domestic Water Supply Criteria. $\mu\text{S}/\text{cm}$, microsiemens per centimeter; mg/L , milligrams per liter; $\mu\text{g}/\text{L}$, micrograms per liter; mm, millimeter; mV, millivolt; mL, milliliter; pCi/L, picocuries per liter; deg C, degrees Celsius; FET, fixed end point titration; IT, incremental titration; <, less than; --, no data]

Local number	Other identifier	Date	Solids, residue at 180 deg C dissolved (mg/L) (70300)	Nitrogen, ammonia, dissolved (mg/L as N) (00608)	Nitrogen, nitrite, dissolved (mg/L as N) (00613)	Nitrogen, NO_2+NO_3 , dissolved (mg/L as N) (00631)	Phosphorus, ortho, dissolved (mg/L as P) (00671)	Aluminum, dissolved (mg/L as Al) (01106)	Arsenic, dissolved (mg/L as As) (01000)	Boron, dissolved (mg/L as B) (01020)	Iron, dissolved (mg/L as Fe) (01046)
122N48W13DDDD2	R2-98-15	09-13-99	958	2.2	0.01	0.05	0.04	15	1	235	2,800
122N50W13DDDC	R2-97-46	05-15-98	1,790	4.3	<.01	<.05	.07	<30	3	1,770	1,200
122N51W 4DDDD2 R	R2-99-11	09-14-99	1,460	6.0	.01	.05	.03	15	8	500	2,200
122N52W27BBBB2 R	R2-98-30	09-14-99	383	3.9	.01	.05	.23	15	9	275	1,700
		10-14-99	386	3.9	.01	.05	.20	15	8	268	1,700
123N51W21DDDD2 R	R20-99-48	09-14-99	690	.35	.01	.05	.01	15	9	116	990
124N52W 9AAAC2 R	R2-99-10	09-13-99	1,640	.72	.01	.05	.01	30	4	327	1,600
125N50W12ABCC2 R	R2-97-43	05-15-98	2,360	<.02	<.01	7.8	.07	<30	<1	138	<30
126N49W 7BBBB2 R	R2-96-56	05-11-98	--	--	--	--	--	--	--	--	--
126N49W11AABA2 R	R2-97-42	05-14-98	734	1.1	<.01	<.05	.06	<10	20	841	750
127N48W28AAAA R	R2-97-45	05-14-98	1,050	.43	<.01	<.05	.03	<10	41	130	1,300
127N50W 9AAAAA2 R	R2-97-39	05-14-98	1,060	.95	<.01	<.05	.02	<10	22	593	2,100
127N50W25ADAD2 R	R2-96-58	05-11-98	--	--	--	--	--	--	--	--	--
127N51W 9AAAAA2 R	R2-97-07	05-14-98	800	.22	<.01	<.05	.01	<10	10	198	2,400
		10-14-98	786	.57	<.01	<.05	.01	<10	10	205	2,500
127N52W25AAAA2 R	R2-97-11	05-13-98	1,040	.04	<.01	<.05	.02	<10	1	321	34
128N48W19BCCC R	R2-97-30	05-12-98	928	.02	<.01	<.05	.14	<10	<1	1,310	71
128N49W 1DDAD2 R	R2-97-32	05-12-98	581	1.1	<.01	<.05	.04	<10	39	303	440
128N50W25AAAB2 R	R2-97-26	05-12-98	2,260	.02	.01	<.05	.04	<30	3	1,570	2,000
128N50W25AAAB3 R	R2-97-27	05-12-98	1,330	.61	<.01	<.05	.03	<10	48	143	1,700
128N52W 1DDDD2 R	R2-97-18	05-13-98	1,220	.76	<.01	<.05	.02	<10	49	494	640
128N52W 3CCCB2 R	R2-97-17	05-13-98	822	.48	<.01	<.05	.09	<10	48	318	260
128N52W27BBBC R	R2-97-20	05-13-98	778	1.2	<.01	<.05	.04	<10	11	334	89
Maximum contaminant level or SD Domestic Water Supply Criteria			1,750	--	1	10	--	--	50	--	--

Table 11. Water-quality data from observation wells sampled by the U.S. Geological Survey from 1997-99—Continued

[Bold type indicates values above maximum contaminant level or SD Domestic Water Supply Criteria. $\mu\text{S}/\text{cm}$, microsiemens per centimeter; mg/L , milligrams per liter; $\mu\text{g}/\text{L}$, micrograms per liter; mm, millimeter; mV, millivolt; mL, milliliter; pCi/L, picocuries per liter; deg C, degrees Celsius; FET, fixed end point titration; IT, incremental titration; <, less than; --, no data]

Local number	Other identifier	Date	Manganese, dissolved (µg/L as Mn) (01056)	Selenium, dissolved (µg/L as Se) (01145)	Alpha, radio, dissolved as Th-230 (pCi/L) (04126)	Alpha, count, 2 sigma, dissolved as Th-230 (pCi/L) (75987)	Gross beta, dissolved (pCi/L as Cs-137) (03515)	Beta, 2 sigma, dissolved as Cs-137 (pCi/L) (75989)	Total coliform, (colonies/ 100 mL)	Atrazine, dissolved (µg/L)	Carbo-furan, dissolved (µg/L)	Cyanazine, dissolved (µg/L)	2,4-D, dissolved (µg/L)	
122N48W13DDDD2	R2-98-15	09-13-99	150	1	3.0	0.84	8.9	4.6	--	--	--	--	--	
122N50W13DDDC	R2-97-46	05-15-98	360	<1	3.0	.82	12	6.0	0	<0.05	<0.06	<0.04	<0.7	
122N51W 4DDDD2 R	R2-99-11	09-14-99	280	1	3.0	.93	12	6.4	--	--	--	--	--	
122N52W27BBBB2 R	R2-98-30	09-14-99	90	1	3.5	1.0	6.3	2.7	--	--	--	--	--	
		¹ 09-14-99	89	1	4.4	1.1	7.7	2.7	--	--	--	--	--	
123N51W21DDDD2 R	R20-99-48	09-14-99	1,200	1	3.7	1.1	14	5.7	--	--	--	--	--	
124N52W 9AAAC2 R	R2-99-10	09-13-99	3,000	1	18	2.2	23	9.2	--	--	--	--	--	
125N50W12ABCC2 R	R2-97-43	05-15-98	<12	210	9.9	1.4	20	7.3	2 ¹	<.05	<.06	<.04	<.7	
126N49W 7BBBB2 R	R2-96-56	05-11-98	--	--	--	--	--	--	0	--	--	--	--	
126N49W11AABA2 R	R2-97-42	05-14-98	240	<1	<3	.52	9.9	3.0	--	<.05	<.06	<.04	<.7	
127N48W28AAAA R	R2-97-45	05-14-98	1,100	<1	8.9	1.3	14	4.9	0	<.05	<.06	<.04	<.7	
127N50W 9AAAA2 R	R2-97-39	05-14-98	600	<1	<3	.69	13	4.7	0	<.05	<.06	<.04	<.7	
127N50W25ADAD2 R	R2-96-58	05-11-98	--	--	--	--	--	--	0	--	--	--	--	
127N51W 9AAAA2 R	R2-97-07	05-14-98	290	<1	<3	.59	12	3.8	0	<.05	<.06	<.04	<.7	
		¹ 05-14-98	300	<1	3	.66	11	3.5	--	<.05	<.06	<.04	<.7	
127N52W25AAAA2 R	R2-97-11	05-13-98	720	12	6.0	1.1	9.8	4.7	0	<.05	<.06	<.04	<.7	
128N48W19BCCC R	R2-97-30	05-12-98	40	<1	<3	.7	6.3	4.1	--	<.05	<.06	<.04	<.7	
128N49W 1DDAD2 R	R2-97-32	05-12-98	190	<1	<3	.69	9.1	3.0	--	<.05	<.06	<.04	.7	
128N50W25AAAB2 R	R2-97-26	05-12-98	170	<1	<3	.79	11	9.1	--	<.05	<.06	<.04	<.7	
128N50W25AAAB3 R	R2-97-27	05-12-98	1,100	<1	3.8	.9	11	4.8	2 ²	<.05	<.06	<.04	<.7	
128N52W 1DDDD2 R	R2-97-18	05-13-98	1,000	<1	5.9	1.1	20	4.9	--	<.05	<.06	<.04	<.7	
128N52W 3CCCB2 R	R2-97-17	05-13-98	1,100	<1	5.0	1.0	12	3.9	--	<.05	<.06	<.04	<.7	
128N52W27BBBC R	R2-97-20	05-13-98	950	<1	<3	.72	12	3.2	--	<.05	<.06	<.04	<.7	
Maximum contaminant level or SD Domestic Water Supply Criteria													70	
										20,000	3	40	--	

¹Indicates duplicate sample taken for quality-assurance purposes.

²Based on non-ideal colony count.

³Dissolved oxygen is high because of possible connection to surface water.

The collection of the ground-water samples followed methods presented in Wood (1976). All ground-water sampling equipment that came in contact with the sample water (submersible pump and tubing) was cleaned prior to the sampling trip with a phosphate-free detergent, dilute hydrochloric acid, and deionized water by procedures described by Horowitz and others (1994). After samples were collected from a well, the pump and tubing were rinsed with deionized water before sampling the next well.

In order to assure that a representative sample was collected from the aquifer at each well, the ground-water samples were collected after purging a minimum of three casing volumes from the well and after field measurements of specific conductance, pH, temperature, and dissolved oxygen had stabilized (Wood, 1976). Stability was reached when specific conductance differed less than 5 percent between readings, pH differed less than 0.1 standard unit between readings, and water temperature differed less than 0.2°C between readings. Samples were collected from the observation wells using a positive-displacement, stainless-steel submersible pump. A Keck pump was used for sampling the 1997 observation wells, and a Grundfos Rediflo2 was used for sampling the 1998 and 1999 wells. Water from the observation wells passed through a flow-through chamber without coming into contact with the atmosphere so that field measurements were measured in a closed system. The water-quality samples were collected in appropriate bottles directly from a Teflon collection tube.

Quality-Assurance Data

Quality-assurance procedures were performed to evaluate the precision and accuracy of the reported analytical results. The procedures were designed to verify that no significant biases were introduced to the data during either field sampling and processing, or during laboratory analysis of the samples. Quality-assurance procedures for the USGS NWQL included analyses of reference and calibration materials and internal analyses of blanks, replicates, and spiked samples. Quality-assurance procedures for the USGS NWQL are presented in Friedman and Erdmann (1982) and Pritt and Raese (1992). Field meters were calibrated daily for pH, dissolved oxygen, oxidation reduction potential, and specific conductance during sampling.

Quality-assurance samples collected during this study included duplicates, laboratory blanks, and field

blanks. Duplicate samples are two samples collected as close in time as possible and are considered to be essentially identical in composition. They are collected to evaluate variability in the data that may be attributed to either field-collection and processing procedures, or laboratory and analytical procedures.

Two duplicate sample sets were collected for this study during 1997-99. The two duplicates were for ground-water quality samples, the only water-quality samples taken after 1996. The data indicated that the analytical results for the duplicate pairs generally compared very well and were not substantially different (table 11).

Blank samples, which included both laboratory and field blanks, were collected and analyzed to identify the presence and magnitude of contamination that potentially could bias analytical results. Laboratory blanks are samples of ultrapure deionized water that are processed through the sampling equipment used in this study within a laboratory or other controlled environment; laboratory blanks are used to identify sample contamination introduced from the sampling equipment. Field blanks are samples of ultrapure deionized water that are processed through sampling equipment at the field collection site; field blanks are used to identify contamination introduced from the sampling equipment, and contamination introduced during collection and processing of samples in the field. Two laboratory blanks and two field blanks were collected for the ground-water-quality sampling during 1997-99.

Although some of the constituents in table 12 are at or near the concentrations found in table 11, this is due to the concentrations being at or near the reporting level for a particular constituent. One constituent does show an anomalous result that is unexpected for a blank sample. The analysis for lab alkalinity (parameter 90410) collected in a field blank on September 15, 1999, is higher than that of the other blanks. A possible source of contamination lies in the method used to collect field blanks. The volume of ultrapure deionized water required to fill all sample bottles is calculated, and an additional volume is used as a safety factor. Because the length of the tube on the Grundfos pump is great, the tube itself holds a substantial amount of water and is difficult to purge completely. The ultrapure water is run through the pump, and after a period of time has elapsed, the discharge from the sample collection tube is assumed to have purged out any water that may have remained in the tube. Bubbles can sometimes be seen at the interface between the ultrapure

water and the previous contents of the tube. After the required volume of ultrapure water is fed into the pump, additional deionized water is needed to "push" the ultrapure water through the tube and into the remaining sample bottles. Because of the length of the tube, it would be possible for the ultrapure water to become mixed with the "push" water, or the water present in the tube before the blank sample was collected. If the first or last sample bottle was filled with mixed water, it could cause contamination, which may result in an erroneous value such as noted for lab alkalinity in the 1999 field blank. Because none of the other constituents for the 1999 field blank appear to have been impacted, any possible contamination is apparently limited to the alkalinity sample.

SURFACE-WATER DATA

Numerous streams and lakes are present within the study area. Portions of four major basins drain the

study area: the Upper Red River, the Minnesota River, the Big Sioux River, and the James River (fig. 7). The portion of the study area that contains the majority of the lakes is drained by the James and Big Sioux River Basins, although much of the area is noncontributing under normal conditions. Drainage from the Minnesota, Big Sioux, and James River Basins is to the Gulf of Mexico, and drainage from the Upper Red River Basin is to the Hudson Bay.

Streams

The major streams in the study area include the Big Sioux River, Bois de Sioux River, Little Minnesota River, North Fork Whetstone River, LaBelle Creek, and Big Coulee Creek. Eight streamflow-gaging stations currently operated by the USGS are located within or near the study area (fig. 7).

Table 12. Constituent concentrations for quality-assurance laboratory and field blanks

[μ S/cm, microsiemens per centimeter; mg/L, milligrams per liter; μ g/L, micrograms per liter; mV, millivolt; pCi/L, picocuries per liter; deg C, degrees Celsius; FET, fixed end point titration; IT, incremental titration; --, no data]

Station number	Local number	Date	Calcium, dissolved (mg/L as Ca) (00915)	Magne- sium, dissolved (mg/L as Mg) (00925)	Sodium, dissolved (mg/L as Na) (00930)	Potassium, dissolved (mg/L as K) (00935)	Alkalinity, lab (mg/L as CaCO ₃) (90410)
442124098130700	Equipment blank	09-13-99	0.078	0.12	0.146	0.24	2.096
	Equipment blank	05-11-98	.021	.004	.1	.1	1.899
	Field blank	05-15-98	--	--	--	--	--
	Field blank	05-15-98	.323	.061	.1	.1	2.9
	Field blank	09-15-99	.534	.164	.085	.24	382.83

Local number	Date	Sulfate, dissolved (mg/L as SO ₄) (00945)	Chloride, dissolved (mg/L as Cl) (00940)	Fluoride, dissolved (mg/L as F) (00950)	Silica, dissolved (mg/L as SiO ₂) (00955)	Solids, residue at 180 deg C, dissolved (mg/L) (70300)	Nitrogen, ammonia, dissolved (mg/L as N) (00608)
Equipment blank	09-13-99	0.21	0.29	0.1	0.09	10	0.02
Equipment blank	05-11-98	.432	.163	.1	.1	10	.057
Field blank	05-15-98	--	--	--	--	--	--
Field blank	05-15-98	.285	.12	.1	.1	10	.06
Field blank	09-15-99	.8	.29	.1	.089	10	.02

Table 12. Constituent concentrations for quality-assurance laboratory and field blanks—Continued

[μS/cm, microsiemens per centimeter; mg/L, milligrams per liter; μg/L, micrograms per liter; mV, millivolt; pCi/L, picocuries per liter; deg C, degrees Celsius; FET, fixed end point titration; IT, incremental titration; --, no data]

Local number	Date	Nitrogen, nitrite, dissolved (mg/L as N) (00613)	Nitrogen, NO ₂ +NO ₃ , dissolved (mg/L as N) (00631)	Phosphorus, ortho, dissolved (mg/L as P) (00671)	Aluminum, dissolved (μg/L as Al) (01106)	Arsenic, dissolved (μg/L as As) (01000)	Boron, dissolved (μg/L as B) (01020)
Equipment blank	09-13-99	0.01	0.05	0.01	15	1	16
Equipment blank	09-13-99	.01	.05	.013	10	1	16
Field blank	05-15-98	--	--	--	--	--	--
Field blank	05-15-98	.01	.05	.043	10	1	16
Field blank	09-15-99	.01	.05	.01	15	1	8.718

Local number	Date	Iron, dissolved (μg/L as Fe) (01046)	Manganese, dissolved (μg/L as Mn) (01056)	Selenium, dissolved (μg/L as Se) (01145)	Alpha, radio, dissolved as Th-230 (pCi/L) (04126)	Alpha, count, 2 sigma, dissolved as Th-230 (pCi/L) (75987)	Gross beta, dissolved (pCi/L as Cs-137) (03515)
Equipment blank	09-13-99	10	4.262	1	3	0.51	4
Equipment blank	09-13-99	10	4	1	3	.35	4
Field blank	05-15-98	--	--	--	--	--	--
Field blank	05-15-98	10	4	1	3	.38	4
Field blank	09-15-99	10	1.672	1	3	.51	4

Local number	Date	Beta, 2 sigma, dissolved as Cs-137 (pCi/L) (75989)	Total coliform, (colonies/ 100 mL)	Atrazine, dissolved (μg/L) (34756)	Carbofuran, dissolved (μg/L)	Cyanazine, dissolved (μg/L)	2,4-D, dissolved (μg/L)
Equipment blank	09-13-99	0.72	--	--	--	--	--
Equipment blank	09-13-98	.68	--	--	--	--	--
Field blank	05-15-98	--	--	<0.05	<0.06	<0.04	<0.7
Field blank	09-15-98	.74	--	--	--	--	--
Field blank	09-15-99	.76	--	--	--	--	--

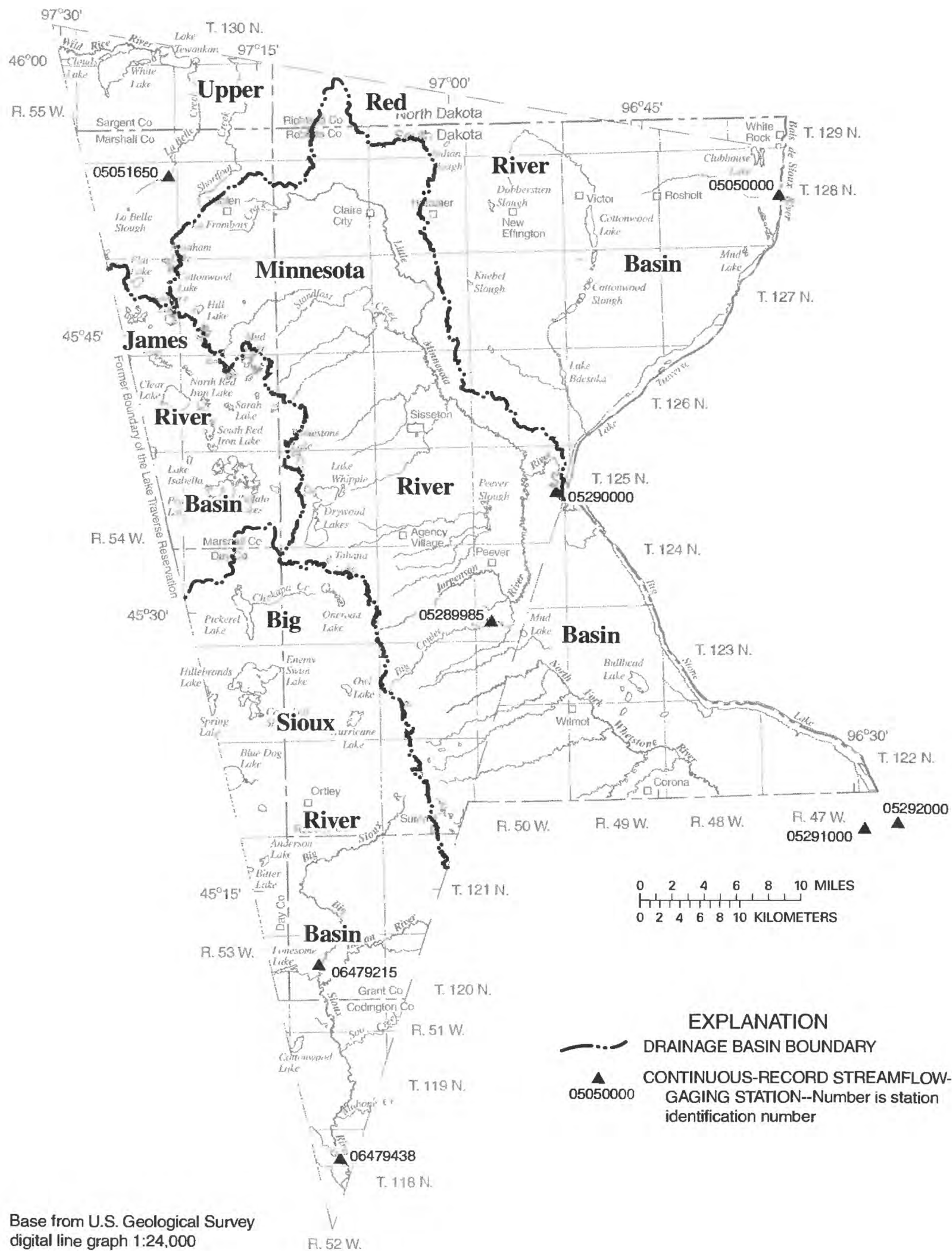


Figure 7. Drainage basins and location of active streamflow-gaging stations within and near the study area.

Peak-Flow Frequency Estimates

Peak-flow frequency estimates were determined for the continuous-record and crest-stage gaging stations that had 10 or more years of record and were published in Carter and Thompson (1999). Of the 15 gages included in this study, two did not have 10 years of record in 1996. Also, above-normal precipitation in 1997 and 1998 may have caused significantly higher peaks than normal. For these reasons, updated peak-flow frequency estimates were only determined for the eight currently operating continuous-record gaging stations. The estimates were determined using log-Pearson Type III procedures for recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years; the results are presented in table 13. The historic peak flows for the eight stations are presented in Section C of the Supplemental Information section.

Summary Statistics

The information presented in this section includes tabular data and graphical representation for

the two continuous-record gages that had less than 10 years of record in the previous data report (Carter and Thompson, 1999). Six tables and four graphs were produced for each of the two continuous-record gages for the period of record listed in table 13. The tables list monthly and annual mean flow, statistics on monthly and annual mean flow, correlation matrices, and lowest and highest mean flow and rankings. The graphs illustrate annual mean flow, distribution of monthly mean flow, duration curves, and duration hydrographs.

The summary statistics tables are presented in Section D of the Supplemental Information section. For each site, tables D1.1 and D2.1 contain monthly and annual mean flow values for the selected statistics period.

Tables D1.2 and D2.2 present selected statistics for monthly and annual mean flow. This table includes the total number of months used in the analysis, maximum, 75th percentile, 50th percentile, 25th percentile, minimum, mean, standard deviation, skewness, coefficient of variation, and the percent of annual flow.

Table 13. Peak-flow estimates for selected recurrence intervals for active gaging stations within and near the study area

Station number	Station name	Period of analysis (water year)	Peak flow, in cubic feet per second, for recurrence interval, in years, and annual exceedance probability, in percent						
			Years: 2	5	10	25	50	100	500
			Percent: 50	20	10	4	2	1	0.2
05050000	Bois de Sioux River near White Rock	1942-99	1,286	3,438	5,556	9,038	12,210	15,860	26,250
05051650	LaBelle Creek near Veblen	1988-99	83	298.5	501.9	789.5	1,006	1,213	1,636
05289985	Big Coulee Creek near Peever	1988-99	133.8	380.3	630.8	1,051	1,438	1,888	3,180
05290000	Little Minnesota River near Peever	1940-81, 1990-99	846.9	2,163	3,347	5,127	6,615	8,209	12,240
05291000	Whetstone River near Big Stone City	1931-99	1,299	3,289	4,980	7,369	9,246	11,150	15,560
05292000	Minnesota River at Ortonville, Minn.	1938-99	862.3	1,760	2,464	3,437	4,203	4,991	6,887
06479215	Big Sioux River near Florence	1984-99	407.7	1,114	1,686	2,429	2,960	3,454	4,441
06479438	Big Sioux River near Watertown	1973-99	856.1	2,235	3,425	5,120	6,456	7,815	10,960

Tables D1.3 and D2.3 present the serial auto correlation matrix for the 1-year lag for monthly mean flow. The correlation coefficient is a measure of the strength of the linear relation between two variables (Ott, 1993). The correlation coefficient ranges from -1 to +1; a correlation coefficient equal to zero indicates there is no relation between the two variables. A positive correlation indicates that both variables vary in the same direction, and a negative correlation indicates that one variable increases as the other decreases. The greater the correlation coefficient, the stronger the relation is between the two variables. For example, in table D1.3, the correlation coefficient for October of each year to October of the following year is 0.099. This indicates that streamflow in a given month is not strongly influenced by streamflow in the same month of the preceding year.

Tables D1.4 and D2.4 present a correlation matrix for monthly mean flow. This matrix contains a correlation coefficient for each month, relative to monthly flow for other months. For example, in table D1.4, the correlation coefficient between October and November is 0.596. This indicates that high (or low) streamflow in a given month is sometimes influenced by high (or low) streamflow in the previous month.

The lowest mean flow and ranking, by year, for 1, 3, 7, 14, 30, 60, 90, 120, and 183 consecutive-day periods is presented in tables D1.5 and D2.5. Similarly the highest mean flow and ranking, by year, for 1, 3, 7, 15, 30, 60, 90, 120, and 183 consecutive-day periods is presented in tables D1.6 and D2.6.

The graphical representations of the variations in the annual, monthly, and daily mean flow for each of the continuous-record gages that had less than a

10-year period of record in 1996 are presented in figures 8 and 9 with four graphs on each figure labeled A, B, C, and D as described previously. Graph A shows the annual mean flow values, and graph B shows a distribution of monthly mean flow. Graph C shows the duration curve for daily mean flows, and graph D shows the duration hydrographs for selected exceedances.

Lakes

Numerous lakes are present in the study area, and the majority of the lakes are located in the James and Big Sioux River Basins. Water-quality data from 17 lakes were presented in Carter and Thompson (1999). Lake-level data collected during 1997-99 are presented in this section.

Water Levels

Lake-level data subsequent to 1996 are presented in tables in Section E of the Supplemental Information section. The locations of the lakes within the study area with available water-level data are shown in figure 10. Water levels from 1997-99 for 19 of these lakes are shown in figures 11-25. Measurements at Clubhouse Lake in Roberts County were discontinued after May 13, 1997, so no hydrograph is presented for this lake. The extremes listed are for the period of record. Cottonwood Lake in Roberts County is referred to as Cottonwood North Lake to avoid confusion with Cottonwood Lake in Marshall County.

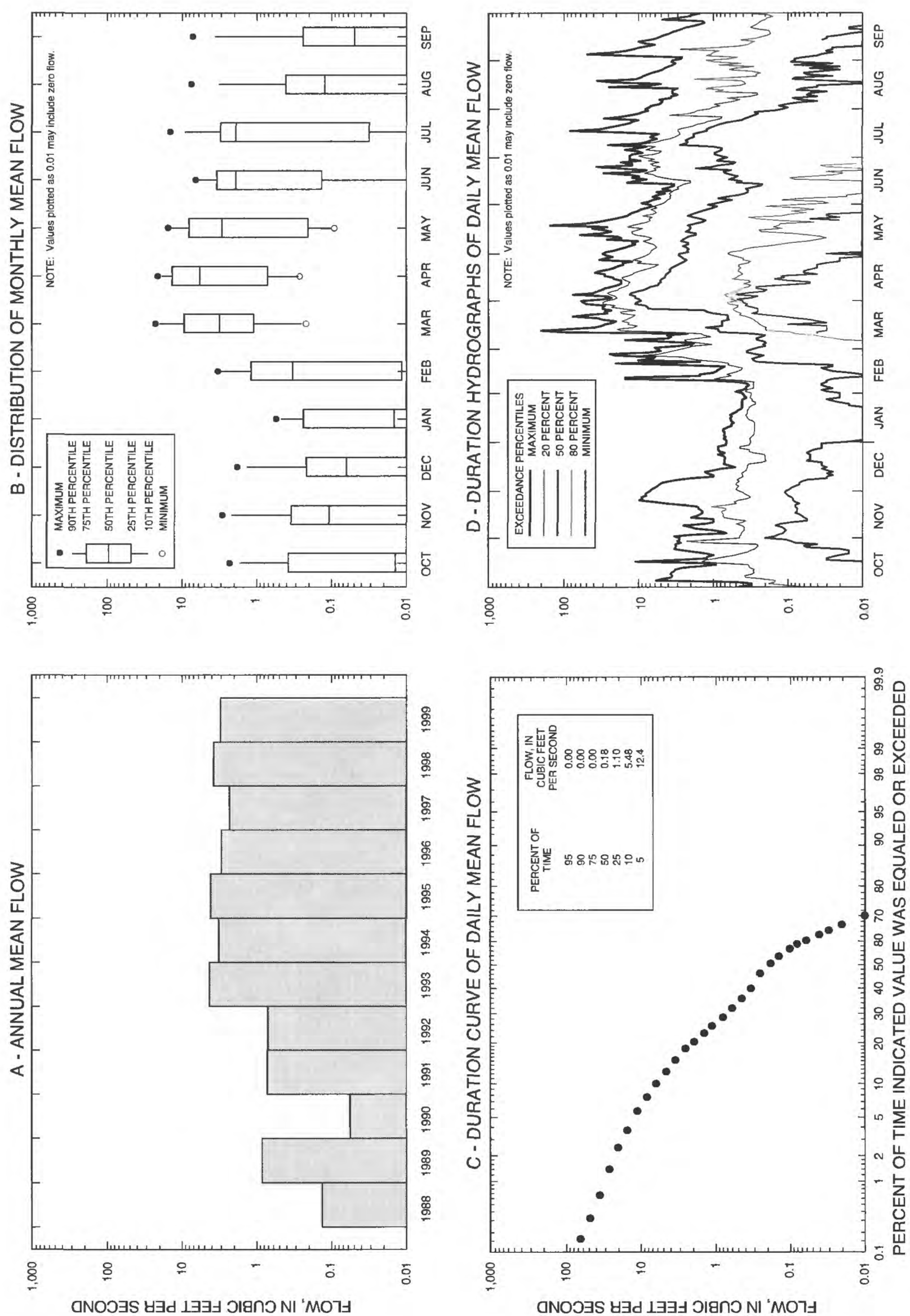


Figure 8. Variations in annual, monthly, and daily mean flow for station 05051650, LaBelle Creek near Veblen, S. Dak., water years 1988-99.

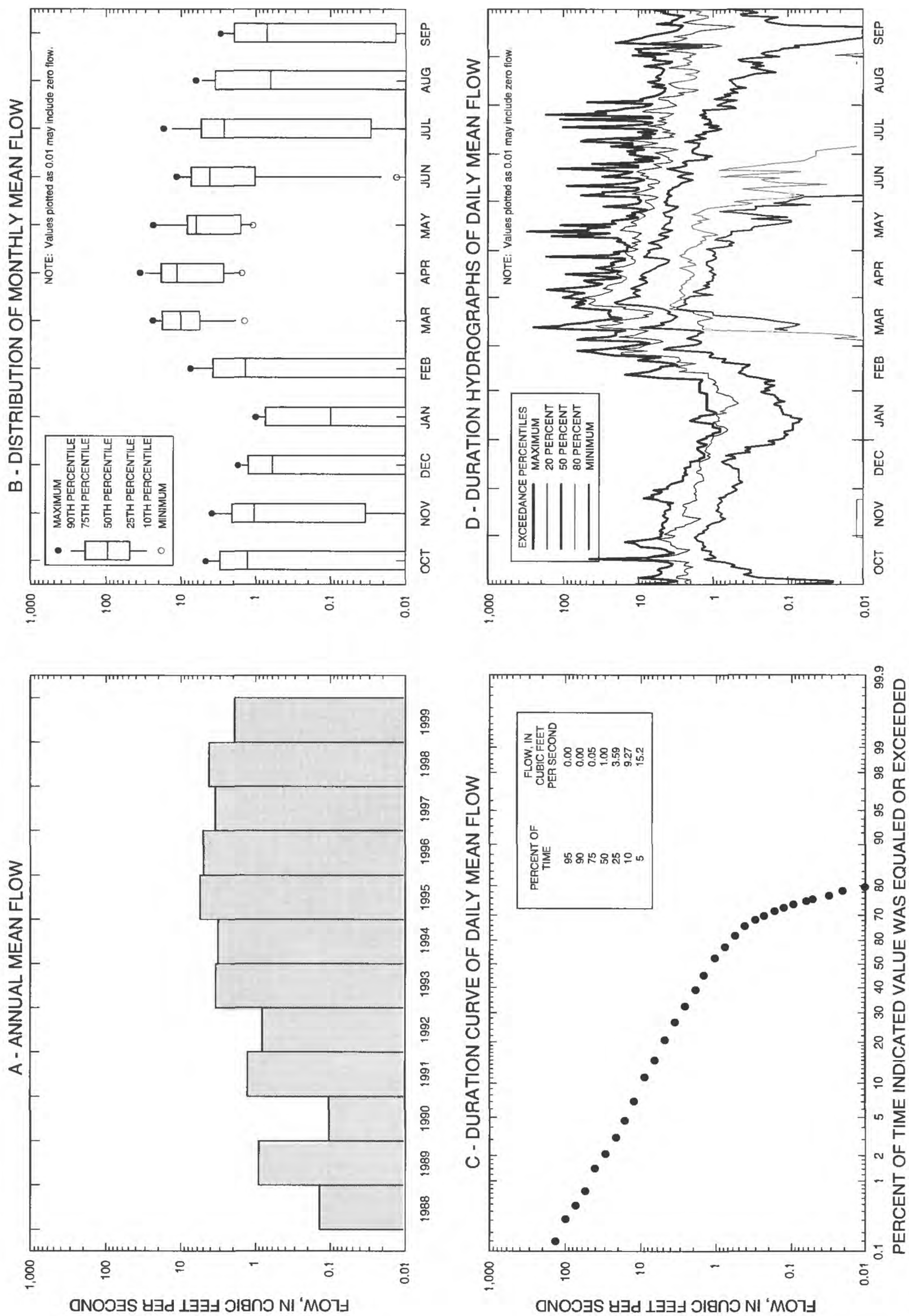


Figure 9. Variations in annual, monthly, and daily mean flow for station 05289985, Big Coulee Creek near Peever, S. Dak., water years 1988-99.

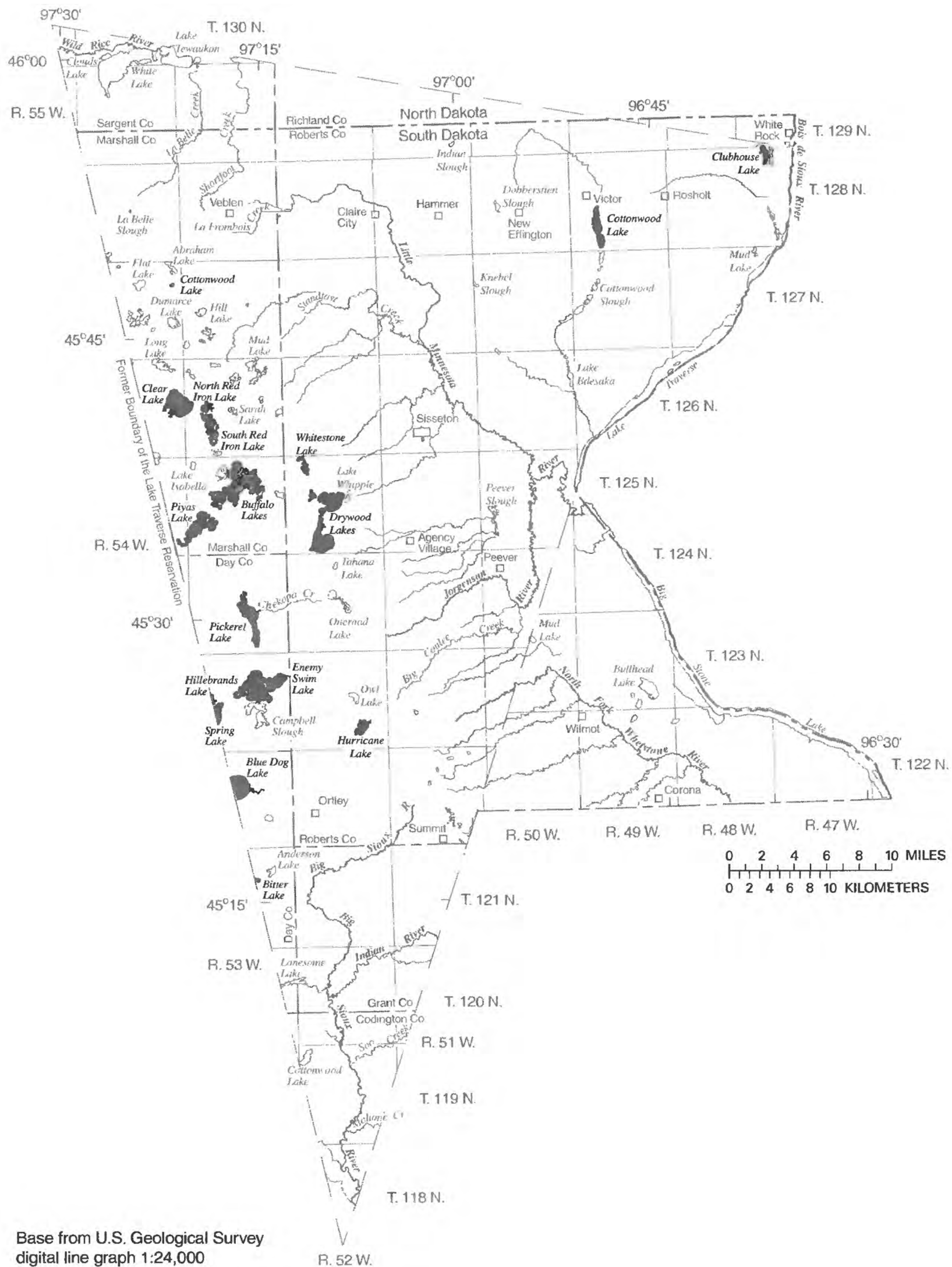


Figure 10. Location of lakes with recorded water-level elevations.

Lake name: Bitter Lake
County: Day
Extremes: June 8, 1984, to November 2, 1999: Highest, 1,792.15 feet, November 2, 1999; lowest, 1,770.3 feet, June 8, 1984.

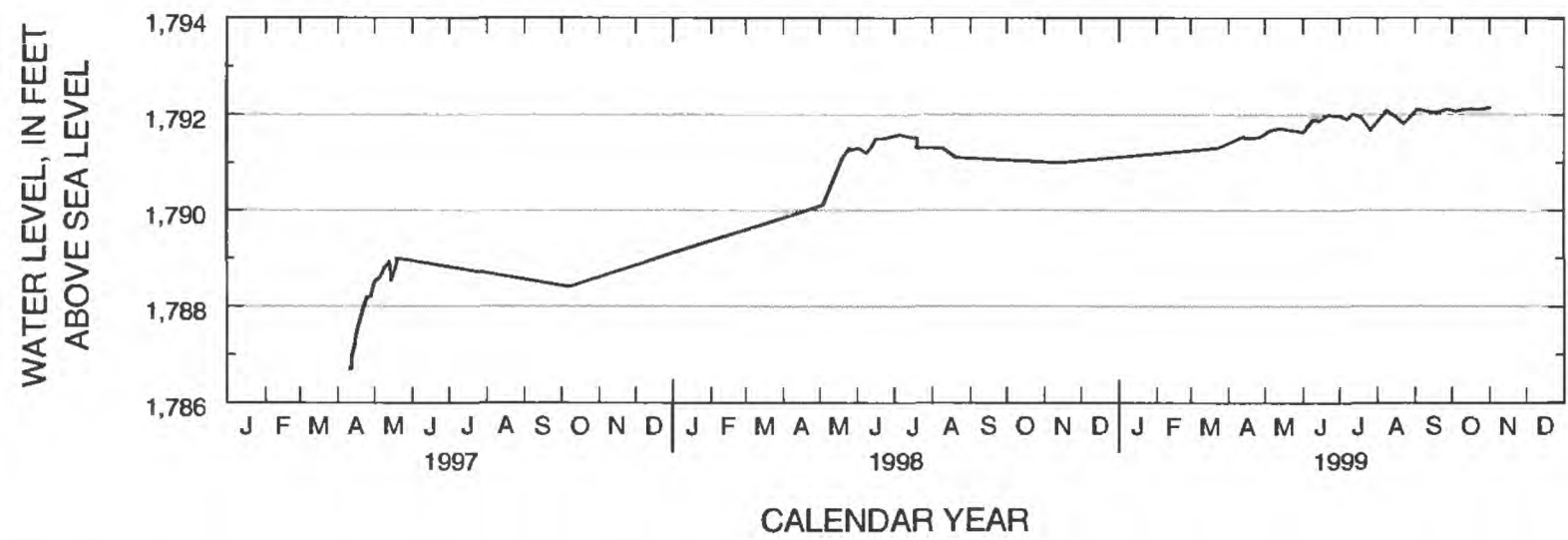


Figure 11. Hydrograph for Bitter Lake in Day County.

Lake name: Blue Dog Lake
County: Day
Extremes: February 21, 1980, to November 2, 1999: Highest, 1,804.29 feet, June 10, 1999; lowest, 1,799.5 feet, November 4, 1980, September 21, 1988.

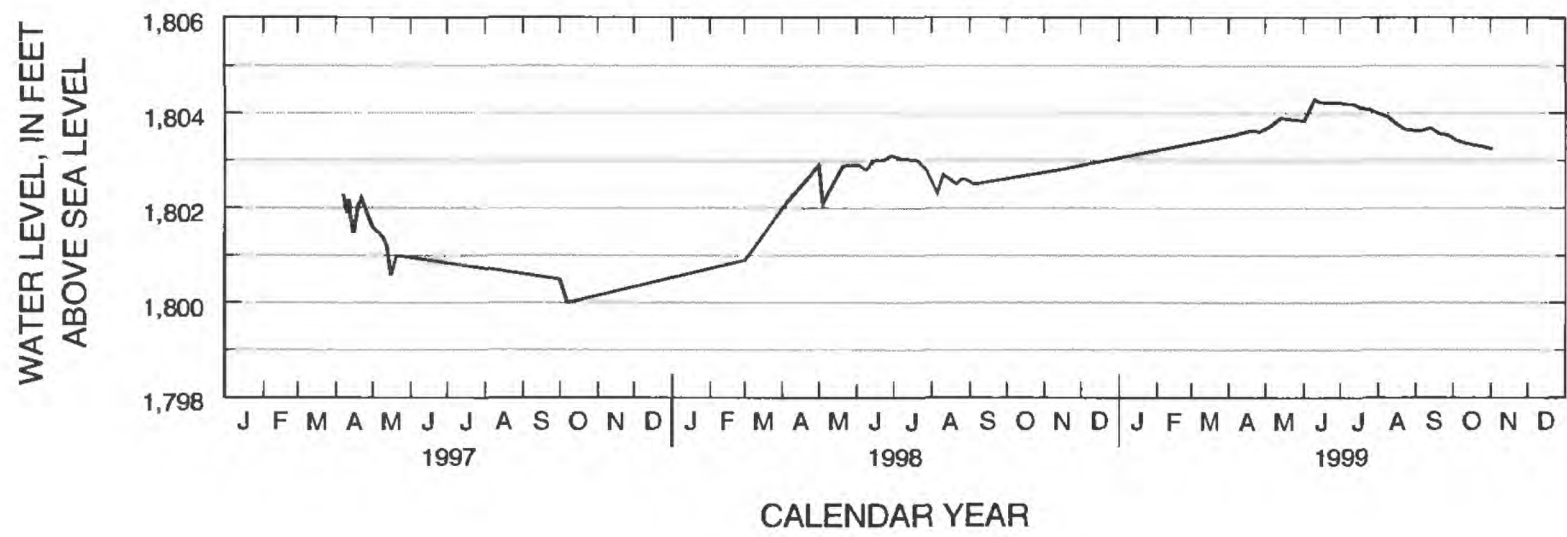


Figure 12. Hydrograph for Blue Dog Lake in Day County.

Lake name: Buffalo Lakes

County: Marshall

Extremes (North Buffalo Lake): June 24, 1982, to September 28, 1999: Highest, 1,837.7 feet, May 19, 1997; lowest, 1,830.3 feet, October 12, 1983.

Extremes (South Buffalo Lake): June 23, 1982, to September 28, 1999: Highest, 1,838.6 feet, May 19, 1997; lowest, 1,830.7 feet, October 12, 1983.

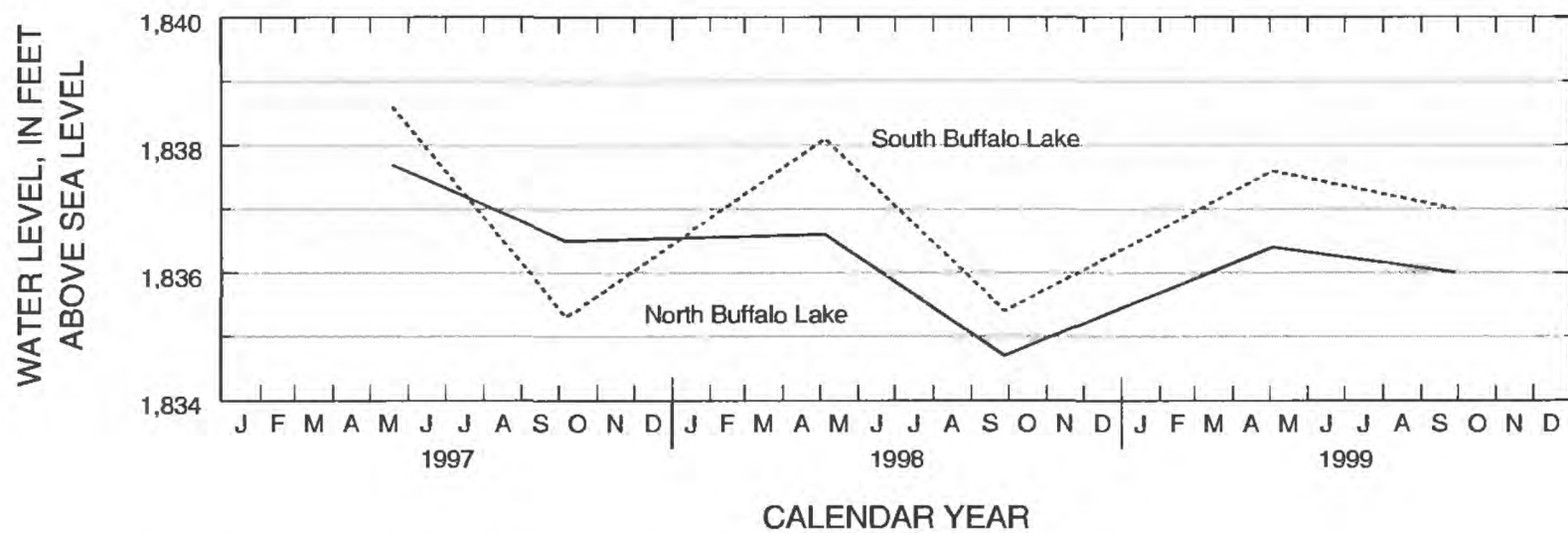


Figure 13. Hydrograph for Buffalo Lakes in Marshall County.

Lake name: Clear Lake

County: Marshall

Extremes: May 12, 1982, to September 28, 1999: Highest, 1,822.9 feet, May 5, 1994, and May 19, 1997; lowest, 1,816.4 feet, October 9, 1985.

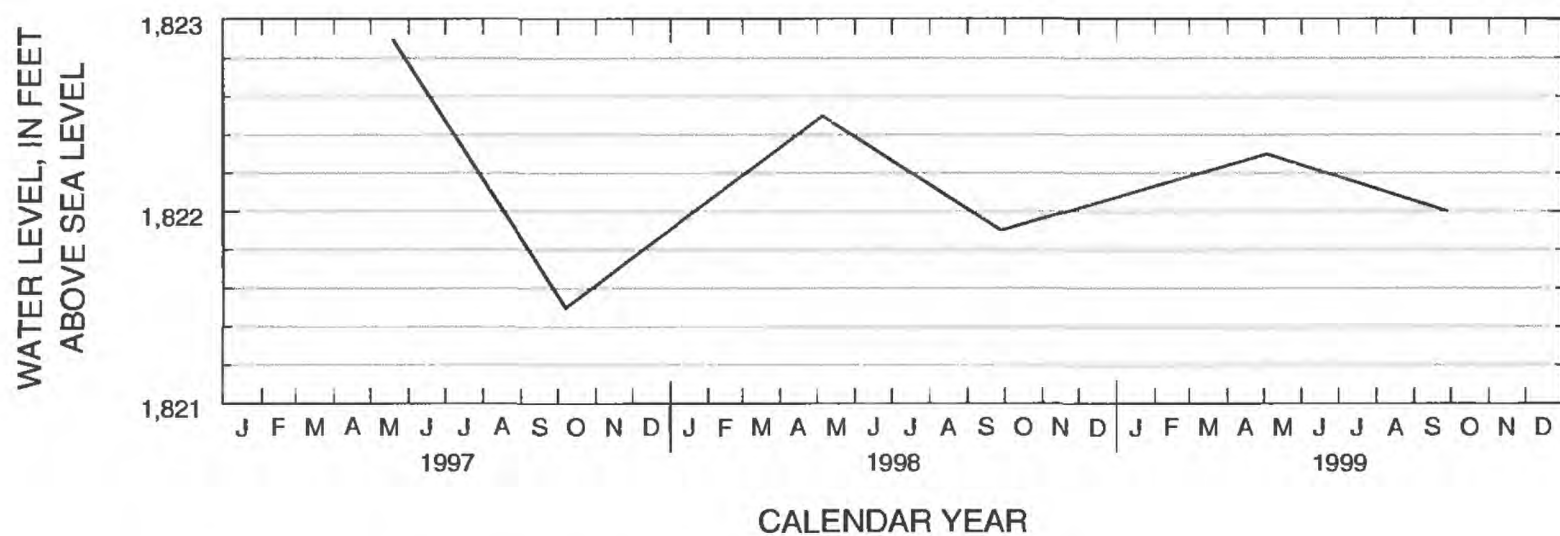


Figure 14. Hydrograph for Clear Lake in Marshall County.

Lake name: Clubhouse Lake

County: Roberts

Extremes: July 10, 1986, to May 13, 1997: Highest, 973.1 feet, May 5, 1994; lowest, 969.5 feet, September 20, 1988. (Note: Measurements have been discontinued at this lake.)

Lake name: Cottonwood (North) Lake

County: Roberts

Extremes: July 10, 1986, to September 28, 1999: Highest, 1,030.6 feet, May 13, 1999; lowest, 1,028.3 feet, September 20, 1988.

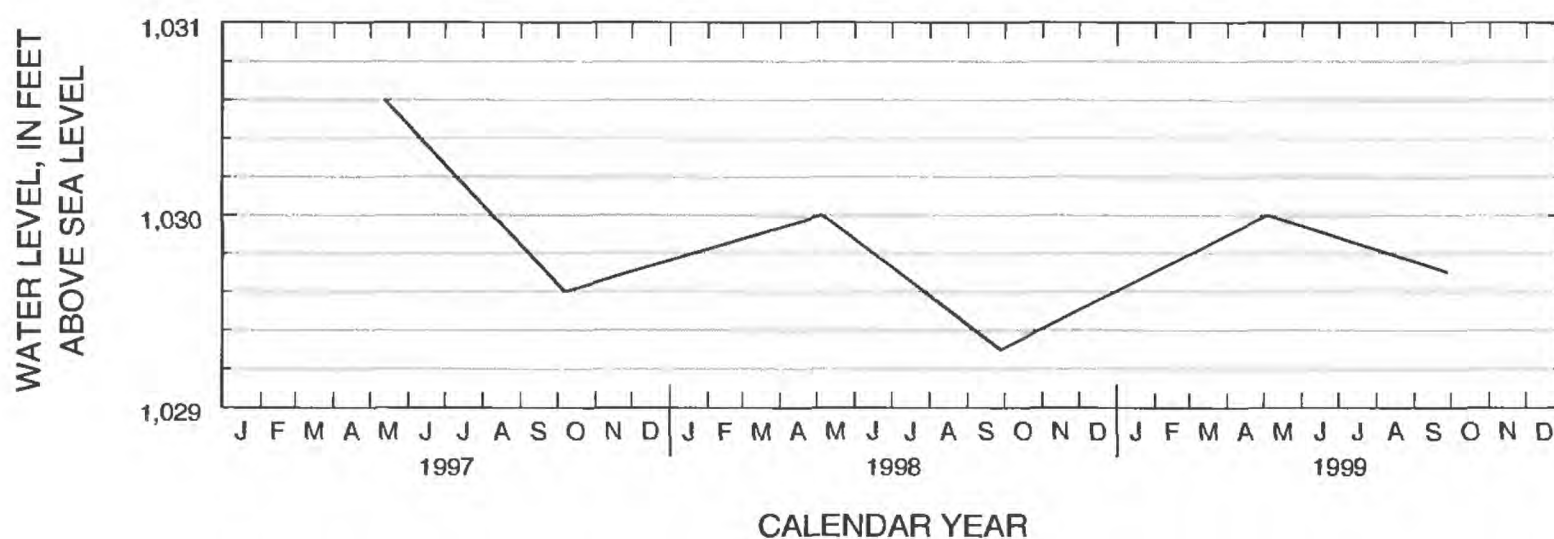


Figure 15. Hydrograph for Cottonwood Lake (North) in Roberts County.

Lake name: Cottonwood Lake

County: Marshall

Extremes: October 3, 1995, to September 28, 1999: Highest, 1,827.7 feet, May 19, 1997; lowest, 1,826.3 feet, October 7, 1997.

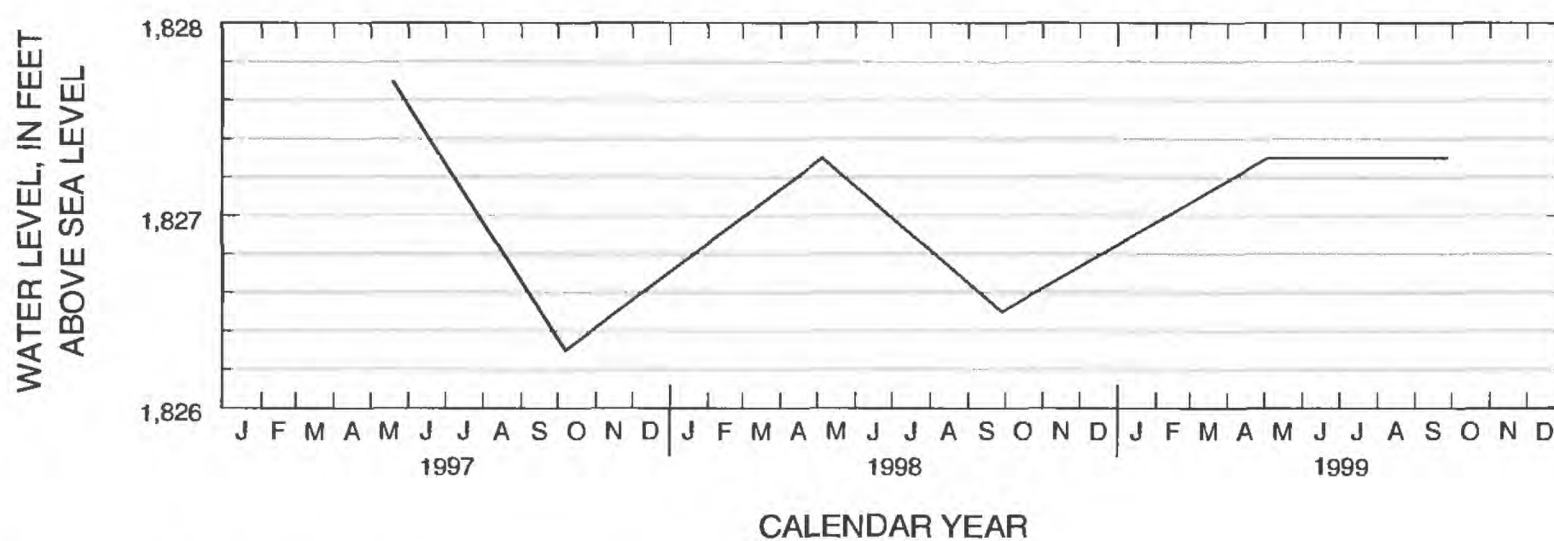


Figure 16. Hydrograph for Cottonwood Lake in Marshall County.

County: Roberts

Extremes (Drywood Lake North): November 3, 1983, to September 28, 1999: Highest, 1,950.0 feet, May 4, 1999; lowest, 1,940.9 feet, September 20, 1990.

Extremes (Drywood Lake South): November 3, 1983, to September 28, 1999: Highest, 1,950.0 feet, May 4, 1999; lowest, 1,942.0 feet, May 3, 1990.

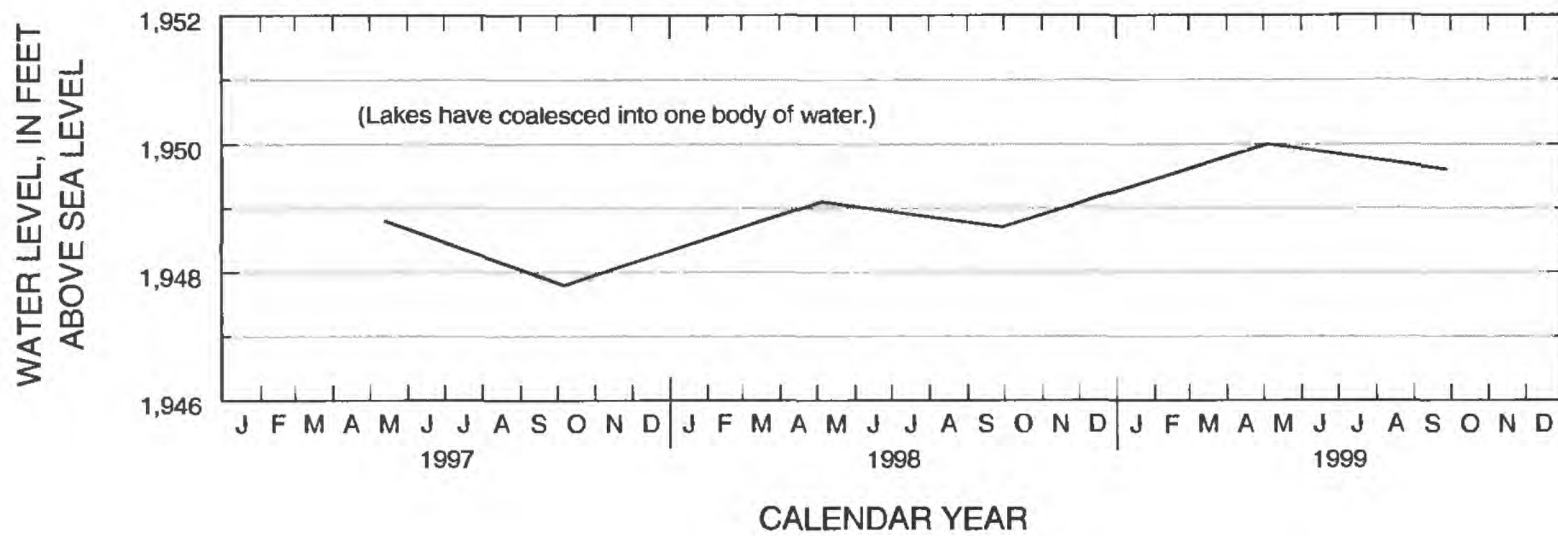


Figure 17. Hydrograph for North and South Drywood Lakes in Roberts County.

Lake name: Enemy Swim Lake

County: Day

Extremes: July 7, 1982, to November 2, 1999: Highest, 1,856.3 feet, April 15, 1997; lowest, 1,850.2 feet, October 12, 1983.

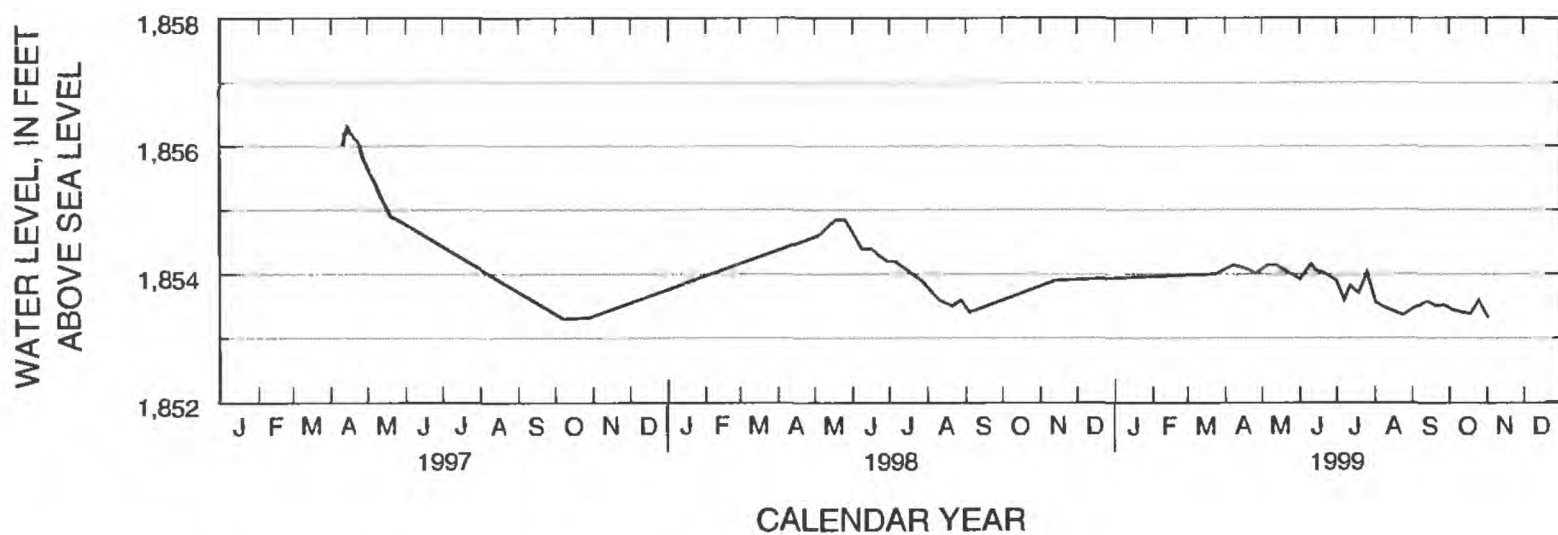


Figure 18. Hydrograph for Enemy Swim Lake in Day County.

Lake name: Hillebrands Lake
County: Day
Extremes: October 11, 1983, to November 2, 1999: Highest, 1,804.03 feet, July 26, 1999; lowest, 1,781.3 feet, October 11, 1983.

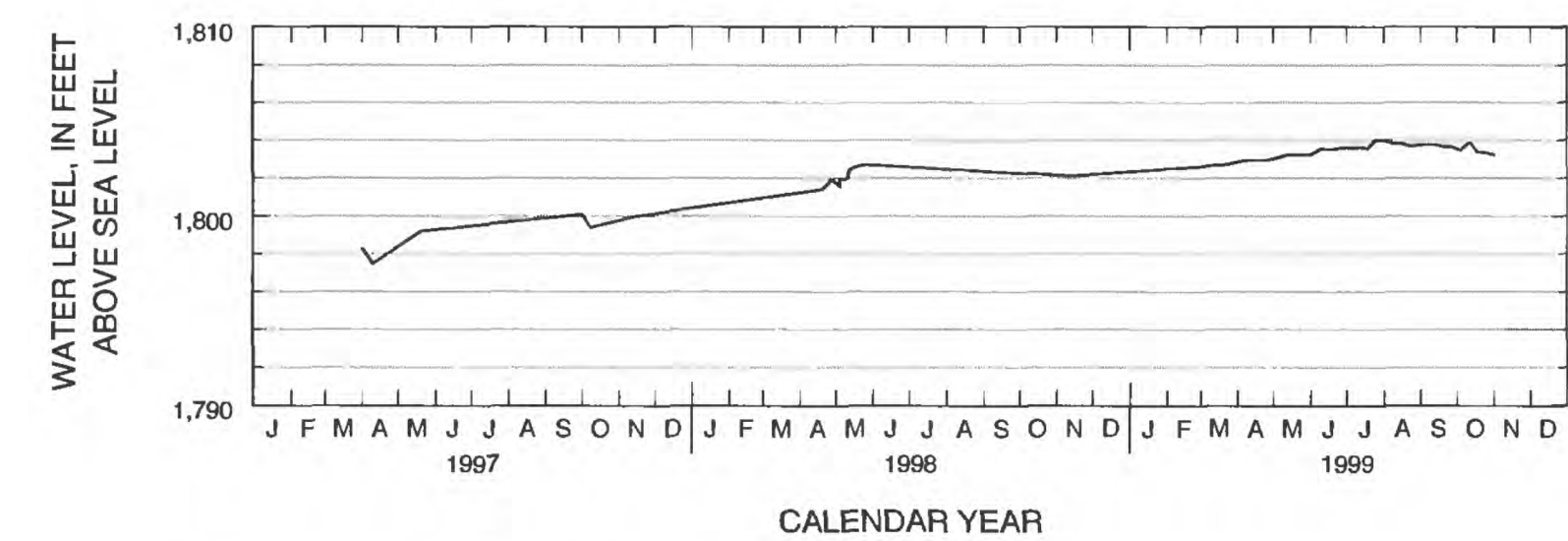


Figure 19. Hydrograph for Hillebrands Lake in Day County.

Lake name: Hurricane Lake
County: Roberts
Extremes: July 10, 1986, to September 28, 1999: Highest, 1,753.7 feet, May 10, 1995; lowest, 1,746.9 feet, May 1, 1991.

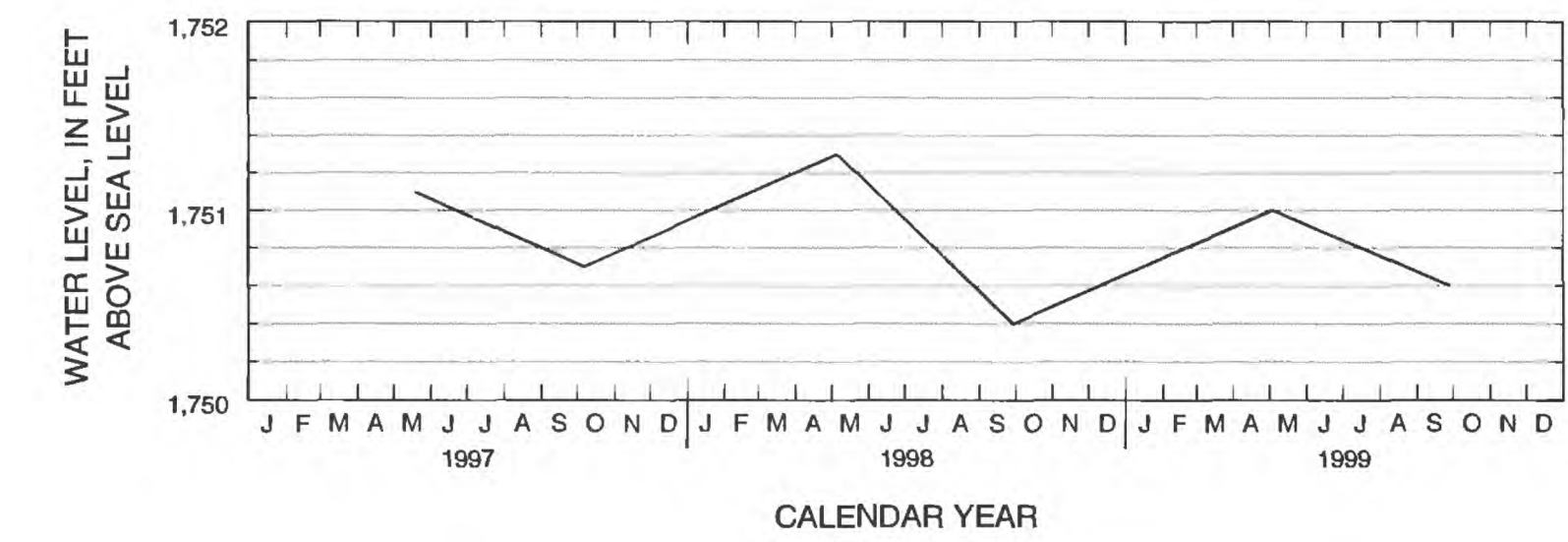


Figure 20. Hydrograph for Hurricane Lake in Roberts County.

Lake name: Pickerel Lake

County: Day

Extremes: June 22, 1982, to November 2, 1999: Highest, 1,846.7 feet, October 8, 1997; lowest, 1,843.5 feet, September 21, 1988.

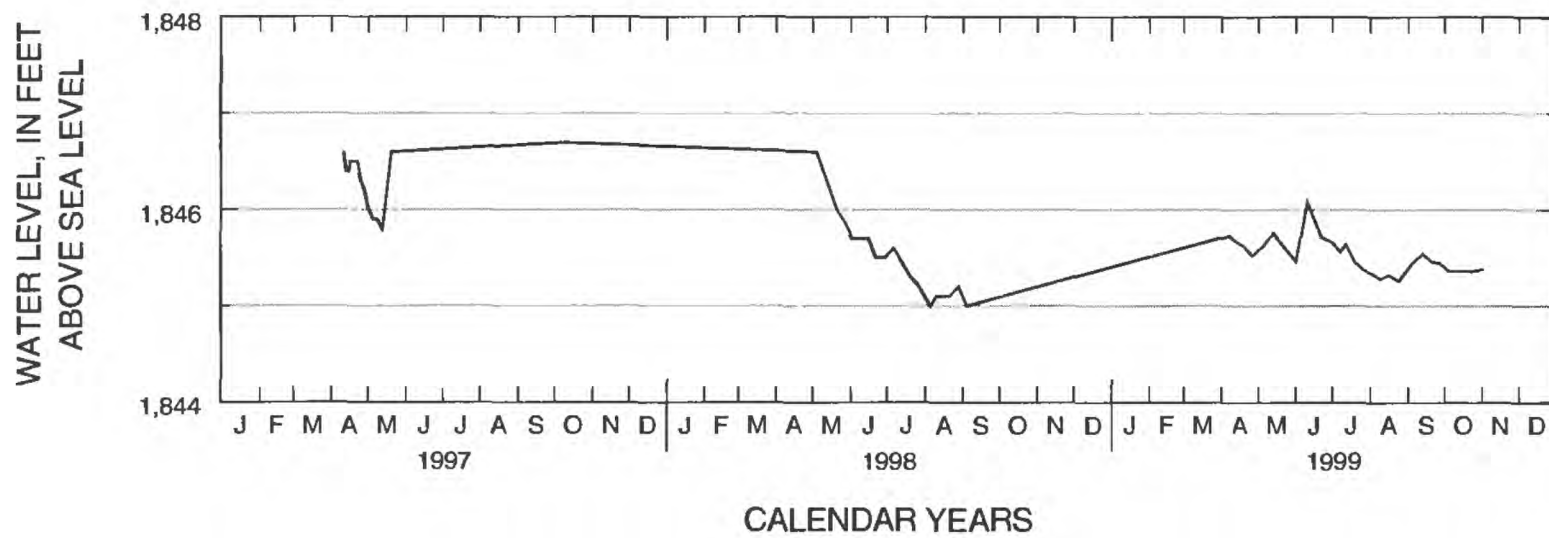


Figure 21. Hydrograph for Pickerel Lake in Day County.

Lake name: Piyas Lake

County: Marshall

Extremes: October 4, 1995, to September 28, 1999: Highest, 1,832.6 feet, September 28, 1999; lowest, 1,828.0 feet, October 4, 1995.

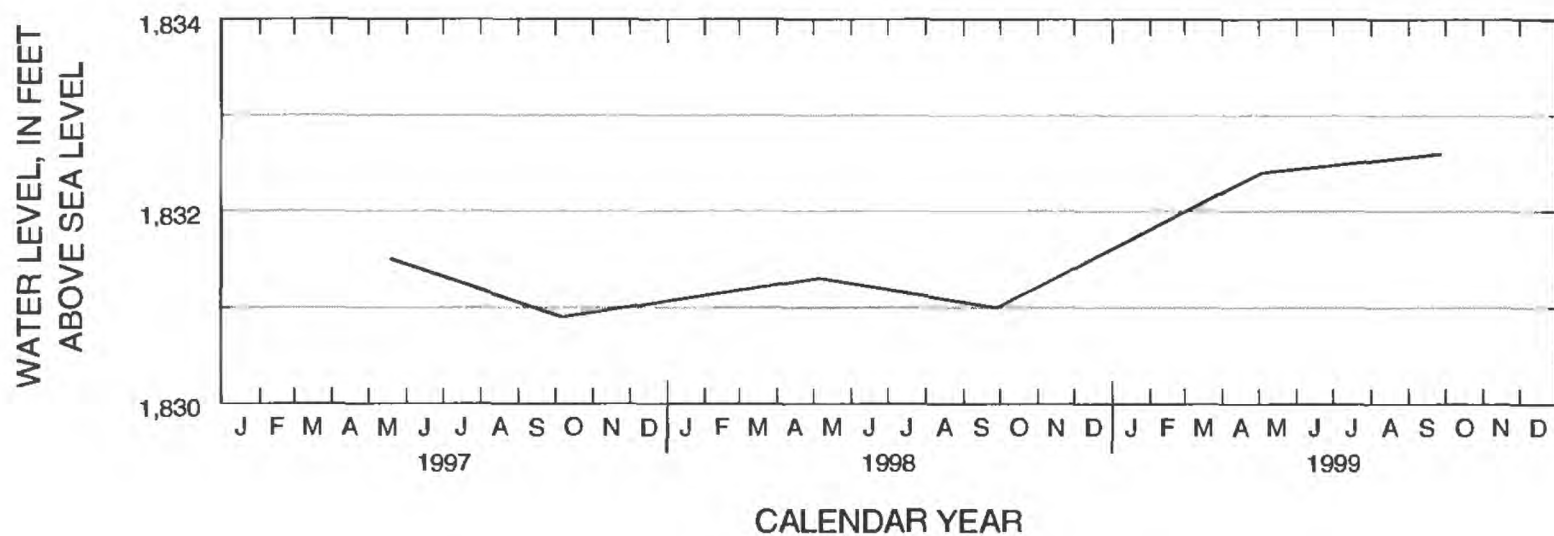


Figure 22. Hydrograph for Piyas Lake in Marshall County.

Lake name: Red Iron Lakes

County: Marshall

Extremes (Red Iron Lake North): September 28, 1984, to September 28, 1999: Highest, 1,830.6 feet, May 19, 1997, May 11, 1995; lowest, 1,825.0 feet, September 28, 1984.

Extremes (Red Iron Lake South): September 28, 1994, to September 28, 1999: Highest, 1,832.9 feet, May 19, 1997, May 11, 1995; lowest, 1,826.8 feet, October 9, 1985, September 20, 1988.

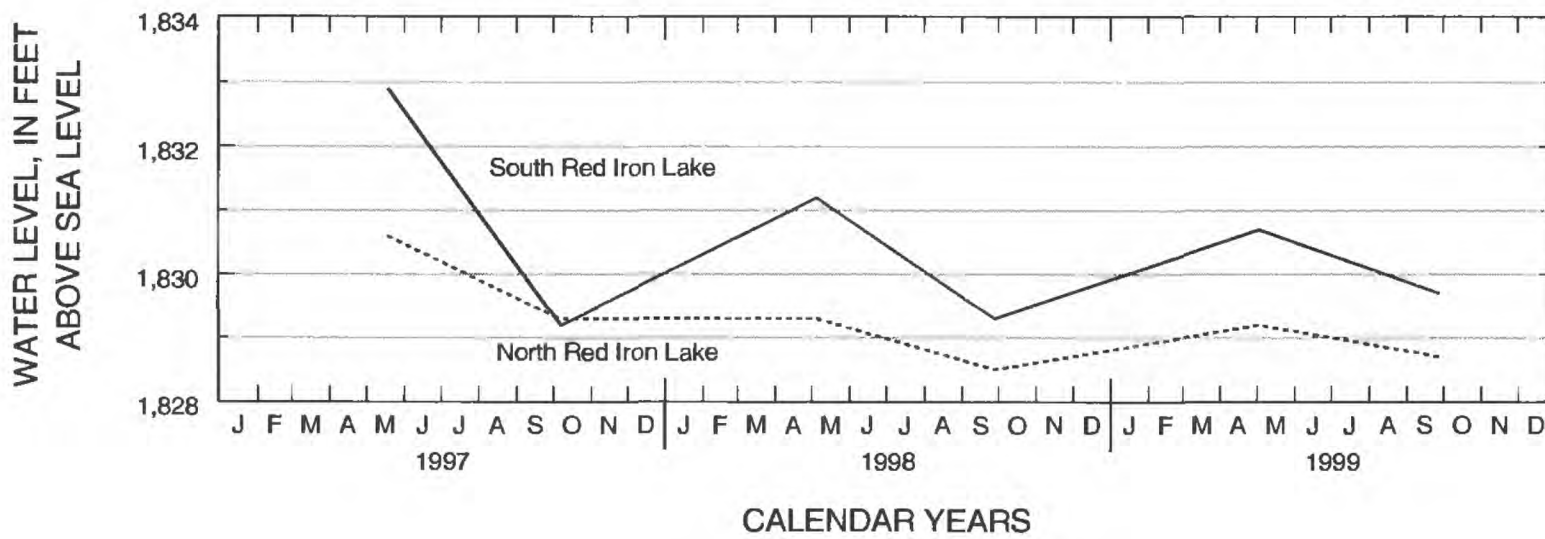


Figure 23. Hydrograph for North and South Red Iron Lakes in Marshall County.

Lake name: Spring Lake

County: Day

Extremes: October 11, 1983, to October 2, 1999: Highest, 1,804.03 feet, July 26, 1999; lowest, 1,785.0 feet, October 11, 1983.

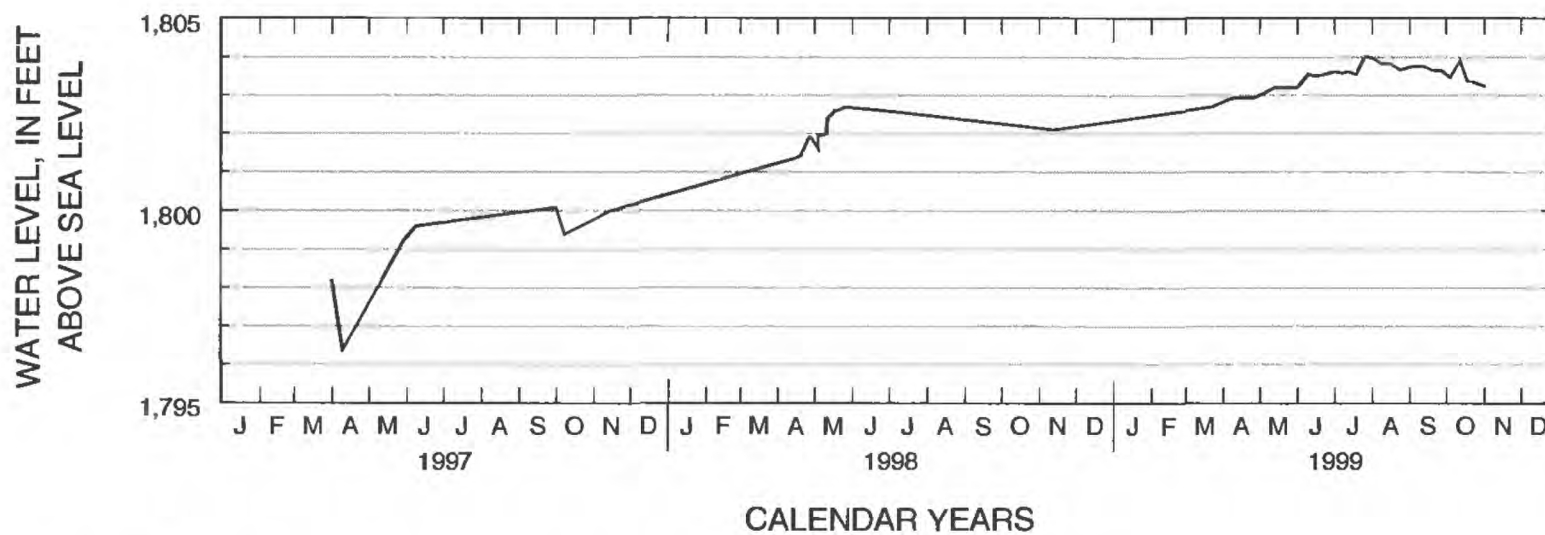


Figure 24. Hydrograph for Spring Lake in Day County.

Lake name: Whitestone Lakes

County: Roberts

Extremes (Whitestone Lake North): June 7, 1984, to September 28, 1999: Highest, 2,015.3 feet, May 5, 1998; lowest, 2,010.4 feet, September 20, 1990.

Extremes (Whitestone Lake South): June 7, 1984, to September 28, 1999: Highest, 2,015.3 feet, May 5, 1998; lowest, 2,009.0 feet, September 17, 1992.

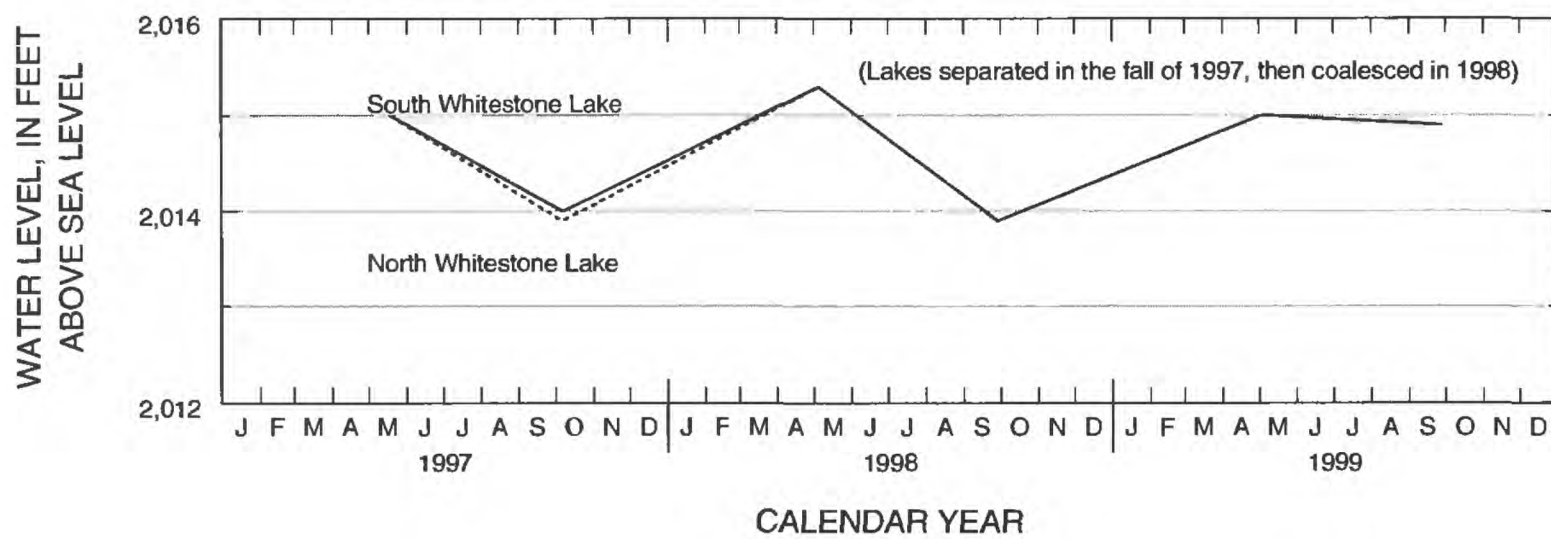


Figure 25. Hydrograph for North and South Whitestone Lakes in Roberts County.

Flows at Inlets/Outlets

Miscellaneous flow measurements have been made by the USGS on inlets and outlets of some of the lakes within the Waubay Lakes Chain (fig. 26). Beginning in the 1990's, the lakes began to rise and coalesce. Three of the four flow measurement sites are within the

study area. The fourth measurement site is outside the study area, but because of how the lakes have risen and coalesced, parts of the upstream (Rush) and downstream (Bitter) lakes are within the study area. Table 14 summarizes the streamflow measurements and associated data at the four lake inlet/outlet locations.

Table 14. Miscellaneous streamflow measurements at lake inlets or outlets

[ft³/s, cubic feet per second; deg C, degrees Celsius; μ S/cm, microsiemens per centimeter; --, no data]

Station	Date	Time	Discharge, instantaneous (ft ³ /s)	Water temperature (deg C)	Air temperature (deg C)	Specific conductance (μ S/cm)
453014097165900 Pickerel Lake outflow near Grenville, SD	11-16-98	1255	11	2.0	3.0	452
	07-29-99	1300	10	27.5	30.0	445
	08-11-99	1605	3.2	24.0	27.0	451
	08-25-99	1600	3.2	25.5	26.0	440
	09-08-99	1630	16	18.5	15.5	442
	09-22-99	1415	9.4	16.0	20.0	447
452357097165200 Campbell Slough outflow near Waubay, SD	11-16-98	1135	11	.5	3.0	429
	07-29-99	1150	7.9	27.0	29.5	402
	08-11-99	1425	3.2	27.0	31.0	330
	08-25-99	1415	.33	24.0	26.0	397
	09-08-99	1510	5.7	18.5	19.0	380
	09-22-99	1215	.02	--	--	--
06479159 Blue Dog Lake inflow (Owens Creek) near Waubay, SD	07-29-99	1040	5.8	25.0	28.0	566
	08-11-99	1100	4.7	22.0	25.0	538
	08-25-99	1250	3.9	23.0	24.0	546
	09-08-99	1355	15	15.5	14.5	552
	09-22-99	1140	6.7	12.0	19.0	542
451918097193700 Little Rush Lake outflow near Waubay, SD	07-21-99	1340	67	25.0	28.0	448
	07-29-99	1505	52	30.0	36.0	430
	08-11-99	1040	44	22.5	25.0	463
	08-25-99	1040	46	22.0	22.0	515
	09-08-99	1210	45	18.0	15.0	500
	09-22-99	1030	39	15.0	14.0	559

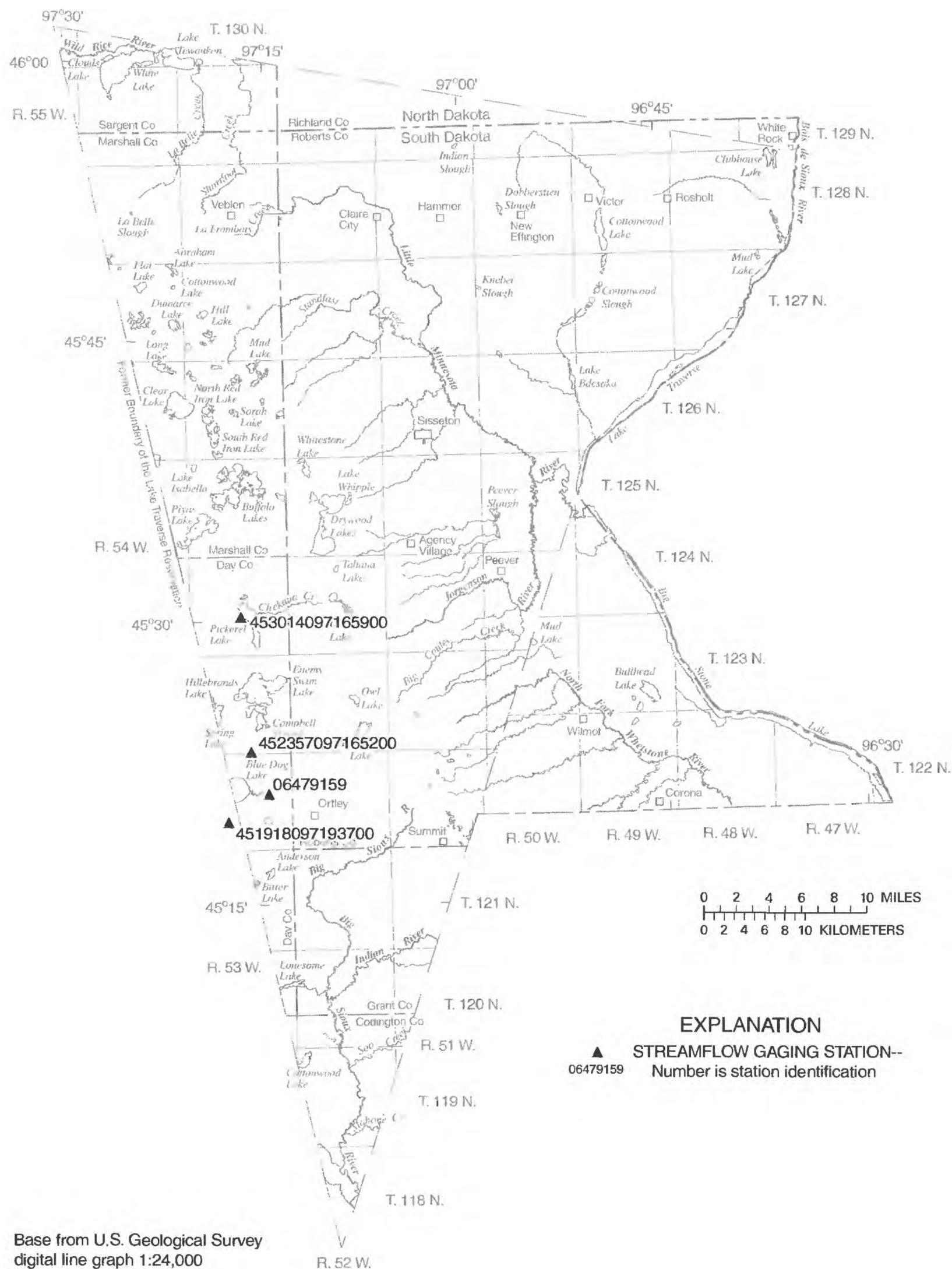


Figure 26. Location of miscellaneous streamflow measurements at lake inlets or outlets.

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SUPPLEMENTAL INFORMATION

Section A - Geologic logs

Test Holes Drilled and Observation Wells Installed, 1997-99

Local number: 122N47W21AAAD

Other identifier: R2-98-13

Site identification number: 452218096331801

Date of construction: 06-15-98

Land surface altitude: 990 feet

Total depth: 122 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	990-989	Clay, black, silty; some sand, top few inches roadfill (topsoil)
1-10	9	989-980	Clay, tan to yellowish-brown, silty, sandy, pebbly; some light-gray mottling, oxidized (till)
10-20	10	980-970	Clay, dark-grayish-black, very shaley, silty, pebbly; unoxidized (till)
20-25	5	970-965	Sand, grayish-brown, medium to coarse
25-32	7	965-958	Clay, gray, silty, sandy, pebbly; unoxidized (till)
32-84	52	958-906	Clay, dark-gray, shaley; hard, greasy (Blue Hill Shale Member - Carlile Shale)
84-117	33	906-873	Clay, dark-grayish-brown; some white specks, calcareous (Fairport Shale Member - Carlile Shale)
117-122	5	873-868	Siltstone, brown with some white; hard, cherty, very calcareous (Greenhorn Limestone)

Electric log available

Local number: 122N48W1DDDA

Other identifier: R2-98-19

Site identification number: 452400096370401

Date of construction: 06-23-98

Land surface altitude: 1,000 feet

Total depth: 82 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,000-998	Clay, yellowish-brown, silty, sandy; oxidized, many cobbles (topsoil)
2-10	8	998-990	Gravel, medium to coarse; highly oxidized
10-16	6	990-984	Clay, brown, silty, sandy, pebbly; oxidized (till)
16-28	12	984-972	Clay, gray, silty, sandy, pebbly; unoxidized, sand lens from 22 to 24 feet (till)
28-31	3	972-969	Sand, gray, fine to medium
31-42	11	969-958	Clay, gray, silty, sandy, pebbly; harder than till interval above, unoxidized (till)
42-82	40	958-918	Clay, dark-gray, shaley; hard, greasy (Carlile Shale)

Electric log available

Local number: 122N48W6BBBA
 Other identifier: R2-98-18
 Site identification number: 452448096441701
 Date of construction: 06-22-98
 Land surface altitude: 1,153 feet
 Total depth: 402 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-12	12	1,153-1,141	Clay, tan to yellowish-brown, silty, sandy, pebbly; oxidized (till)
12-19	7	1,141-1,134	Clay, gray, silty, sandy, pebbly; soft, unoxidized (till)
19-20	1	1,134-1,133	Clay, tan, silty; oxidized
20-27	7	1,133-1,126	Gravel, medium; some coarse, highly oxidized
27-53	26	1,126-1,100	Clay, gray, silty, sandy, pebbly; soft, drills fast, unoxidized (till)
53-58	5	1,100-1,095	Sand and gravel, coarse sand to fine gravel
58-100	42	1,095-1,053	Clay, dark-gray, silty, sandy, pebbly; harder than till interval above, unoxidized (till)
100-108	8	1,053-1,045	Sand, gray, medium to coarse
108-114	6	1,045-1,039	Clay, reddish-pink, silty, sandy, pebbly; oxidized (Hawk Creek Till)
114-136	22	1,039-1,017	Clay, dark-gray, silty, sandy, pebbly; hard, some silty, very calcareous clay, possibly Niobrara Formation inclusions, unoxidized (till)
136-268	132	1,017-885	Clay, dark-gray, shaley; hard, greasy, concretion at 194 feet, sandy zones from 249 to 255 feet and 263 to 268 feet (Blue Hill Shale Member - Carlile Shale)
268-342	74	885-811	Clay, dark-brownish-gray, shaley; gritty, hard, calcareous, few white specks (Fairport Shale Member - Carlile Shale)
342-367	25	811-786	Clay, brown with white layers; hard, some siltstone, some chert, very calcareous (Greenhorn Limestone)
367-402	35	786-751	Clay, dark-gray, shaley; hard, greasy, slightly calcareous (Graneros Shale)

Electric log available

Local number: 122N48W10BABB
 Other identifier: R2-98-20
 Site identification number: 452352096402301
 Date of construction: 6-23-98
 Land surface altitude: 1,090 feet
 Total depth: 142 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,090-1,088	Clay, black, silty (topsoil)
2-20	18	1,088-1,070	Clay, tan to yellowish-brown, silty, sandy, pebbly; oxidized (till)
20-35	15	1,070-1,055	Clay, gray, silty, sandy, pebbly; unoxidized (till)
35-42	7	1,055-1,048	Sand and gravel, coarse sand to fine gravel; many shale pebbles
42-52	10	1,048-1,038	Clay, gray, very silty; poor cuttings (lake sediment?)
52-70	18	1,038-1,020	Sand and gravel, brown, coarse sand to fine gravel, silty; some clay
70-75	5	1,020-1,015	Clay, gray, very silty; poor cuttings (lake sediment?)
75-83	8	1,015-1,007	Sand, fine to medium, silty; some clay
83-92	9	1,007-998	Clay, grayish-pink, silty, sandy, pebbly; oxidized (Hawk Creek Till)
92-102	10	998-988	Sand and gravel, coarse sand to fine gravel
102-113	11	988-977	Clay, gray, very silty, sandy, pebbly; unoxidized (till)
113-142	29	977-948	Clay, gray, shaley; hard, greasy (Carlile Shale)
Electric log available			

Local number: 122N48W13DDDD
 Other identifier: R2-98-14
 Site identification number: 452211096365901
 Date of construction: 6-16-98
 Land surface altitude: 1,086 feet
 Total depth: 270 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-19	19	1,086-1,067	Clay, yellowish-brown, silty, sandy, pebbly; hard, oxidized, turns dark brown with depth (till)
19-35	16	1,067-1,051	Clay, gray, silty, sandy, pebbly; unoxidized (till)
35-39	4	1,051-1,047	Sand, brown, medium to coarse
39-45	6	1,047-1,041	Clay, gray, silty, sandy, pebbly; unoxidized (till)
45-51	6	1,041-1,035	Sand, medium to coarse; some fine gravel
51-56	5	1,035-1,030	Clay, gray, silty, sandy, pebbly; unoxidized, darker than till intervals above (till)
56-84	28	1,030-1,002	Clay, reddish-brown, silty, very sandy, pebbly; hard, oxidized, turning grayish-pink with depth (Hawk Creek Till)
84-88	4	1,002-998	Clay, gray, silty; unoxidized (lake sediment)
88-102	14	998-984	Sand and gravel, medium to coarse sand to fine to medium gravel; various rock types, many shale pebbles
102-137	35	984-949	Clay, gray to dark-gray, silty, sandy, pebbly; unoxidized (till)
137-192	55	949-894	Clay, dark-gray, shaley; hard, greasy (Blue Hill Shale Member - Carlile Shale)
192-268	76	894-818	Clay, dark-brownish-gray; gritty, some white specks, calcareous (Fairport Shale Member - Carlile Shale)
268-270	2	818-816	Siltstone, brown; with white clay beds, some chert, very calcareous (Greenhorn Limestone)

Electric log available

Local number: 122N48W13DDDD2
 Other identifier: R2-98-15
 Site identification number: 452211096365902
 Date of construction: 06-16-98
 Land surface altitude: 1,086 feet
 Total depth: 102 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-18	18	1,086-1,068	Clay, yellowish-brown, silty, sandy, pebbly; hard, oxidized, turns dark-brown with depth (till)
18-36	18	1,068-1,050	Clay, gray, silty, sandy, pebbly; unoxidized (till)
36-42	6	1,050-1,044	Sand, brown, medium to coarse
42-57	15	1,044-1,029	Clay, gray, silty, sandy, pebbly; unoxidized (till)
57-60	3	1,029-1,026	Sand, reddish-brown, medium
60-84	24	1,026-1,002	Clay, reddish-pink, silty, very sandy, pebbly; oxidized (Hawk Creek Till)
84-100	16	1,002-986	Sand and gravel, medium to coarse sand to fine to medium gravel
100-102	2	986-984	Clay, gray, silty, sandy, pebbly; unoxidized (till)

Well screened from 90 to 100 feet; 2-inch PVC screen and casing

Local number: 122N48W16DDDC
 Other identifier: R2-98-16
 Site identification number: 452210096404701
 Date of construction: 06-17-98
 Land surface altitude: 1,118 feet
 Total depth: 162 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,118-1,117	Clay, black, silty (topsoil)
1-30	29	1,117-1,088	Clay, tan to yellowish-brown, silty, sandy, pebbly; oxidized, turns dark brown with depth (till)
30-33	3	1,088-1,085	Sand and gravel, coarse sand to fine gravel; some cobbles near base of interval
33-35	2	1,085-1,083	Clay, brown, silty, sandy, pebbly; oxidized (till)
35-49	14	1,083-1,069	Clay, gray, silty, sandy, pebbly; unoxidized (till)
49-76	27	1,069-1,042	Clay, gray, silty, sandy, pebbly; unoxidized, E-log signature differs from above interval (till)
76-80	14	1,042-1,038	Sand, gray, fine to medium
80-83	3	1,038-1,035	Clay, gray, silty, sandy, pebbly; unoxidized (till)
83-85	2	1,035-1,033	Sand, gray, fine to medium
85-98	13	1,033-1,020	Clay, brown, silty, sandy, pebbly; oxidized, rocks at 93, and 96 to 98 feet (till)
98-106	8	1,020-1,012	Clay, gray, shaley; hard, greasy, unoxidized (shale inclusion)
106-130	24	1,012-988	Clay, dark-gray, silty, sandy, pebbly; unoxidized, hard, shaley (till)
130-133	3	988-985	Sand and gravel, coarse sand to fine gravel
133-162	30	985-956	Clay, dark-gray, shaley; hard, greasy, noncalcareous (Blue Hill Shale Member - Carlile Shale)

Electric log available

Local number: 122N49W16DDDC
 Other identifier: R2-97-47
 Site identification number: 452212096480801
 Date of construction: 08-27-97
 Land surface altitude: 1,165 feet
 Total depth: 182 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,165-1,163	Clay, black, silty (topsoil)
2-12	10	1,163-1,153	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
12-26	14	1,153-1,139	Clay, dark-gray, silty, sandy, pebbly; some shale inclusions, unoxidized (till)
26-55	29	1,139-1,110	Sand, gray, fine to medium; grading to fine to medium gravel, contains abundant black shale pebbles
55-60	5	1,110-1,105	Clay, gray, silty, sandy (till?)
60-65	5	1,105-1,100	Sand and gravel
65-78	13	1,100-1,087	Clay, light-gray, shaley; hard, greasy (Pierre Shale)
78-148	70	1,087-1,017	Clay, dark-gray, shaley; hard, greasy
148-150	2	1,017-1,015	Claystone; very hard, no sample (Niobrara Formation?)
150-182	32	1,015-983	Clay, dark-gray, shaley; hard, greasy (Carlile Shale)

Electric log available

Local number: 122N49W24DAAA
 Other identifier: R2-98-17
 Site identification number: 452144096442301
 Date of construction: 06-17-98
 Land surface altitude: 1,130 feet
 Total depth: 142 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,130-1,128	Clay, black, silty (topsoil)
2-15	13	1,128-1,115	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
15-24	9	1,115-1,106	Clay, dark-gray, silty, sandy, pebbly; unoxidized (till)
24-29	5	1,106-1,101	Sand and gravel, coarse sand to fine gravel
29-41	12	1,101-1,089	Clay, reddish-brown to reddish-gray, silty, sandy, pebbly; oxidized (Hawk Creek Till)
41-50	9	1,089-1,080	Sand, brown, medium to coarse
50-62	12	1,080-1,068	Clay, dark-gray to black, shaley; some light-gray bentonite layers (Sharon Springs Member - Pierre Shale)
62-142	80	1,068-988	Clay, light-gray to gray, shaley; greasy, noncalcareous (Carlile Shale)

Electric log available

Local number: 122N50W13DDDC
 Other identifier: R2-97-46
 Site identification number: 452210096514701
 Date of construction: 08-26-97
 Land surface altitude: 1,224.6 feet
 Total depth: 82 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,224.6-1,223.6	Clay, black, silty (topsoil)
1-13	12	1,223.6-1,211.6	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
13-18	5	1,211.6-1,206.6	Sand, brown, coarse; some gravel
18-30	12	1,206.6-1,194.6	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 17 feet (till)
30-82	52	1,194.6-1,142.6	Sand and gravel, coarse sand to fine gravel; some coarse gravel with depth

Well screened from 54 to 74 feet; 2-inch PVC casing and screen used. For electric-log see R2-94-62

Local number: 122N50W17CCCC

Other identifier: R2-98-25

Site identification number: 452213096575001

Date of construction: 06-30-98

Land surface altitude: 1,475 feet

Total depth: 202 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-8	8	1,475-1,467	Gravel, medium to very coarse: some large boulders, some coarse sand
8-13	5	1,467-1,462	Clay, brown, silty, sandy, pebbly; oxidized (till)
13-36	8	1,462-1,439	Clay, gray, silty, sandy, pebbly; soft, unoxidized, rock from 28 to 30 feet (till)
36-58	22	1,439-1,417	Gravel, fine to medium
58-60	2	1,417-1,415	Clay, dark-brown, silty, sandy; some pebbles (soil horizon)
60-91	31	1,415-1,384	Clay, light-gray, silty, sandy, pebbly; unoxidized, sand lens from 72 to 75 feet, 77 to 79 feet, and 89 to 91 feet (till)
91-100	9	1,384-1,375	Clay, gray, shaley; greasy (shale inclusion)
100-118	18	1,375-1,357	Clay, gray, silty, sandy, pebbly; unoxidized, rocks from 100 to 101 feet, gravel lens from 105 to 108 feet (till)
118-126	8	1,357-1,349	Clay, dark-gray, shaley; hard, greasy, noncalcareous (shale inclusion)
126-130	4	1,349-1,345	Sand and gravel, coarse sand to fine to medium gravel
130-202	72	1,345-1,273	Clay, dark-gray, shaley; hard, greasy, noncalcareous (Pierre Shale? or till?)

Electric log available

Local number: 122N50W17DDDC
 Other identifier: R2-99-14
 Site identification number: 452213096564601
 Date of construction: 08-30-99
 Land surface altitude: 1,390 feet
 Total depth: 364 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,390-1,389	Clay, black, silty (topsoil)
1-2	1	1,389-1,388	Gravel, brown coarse; some sand, rock at 2 feet, oxidized
2-10	8	1,388-1,380	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
10-52	42	1,380-1,338	Clay, gray, very silty, sandy, pebbly; soft, greasy, unoxidized (till)
52-54	2	1,338-1,336	Sand, fine to medium
54-63	9	1,336-1,327	Clay, dark-gray, very silty; hard, calcareous (lake sediment)
63-68	5	1,327-1,322	Sand, fine to medium
68-70	2	1,322-1,320	Clay, gray; hard (lake sediment)
70-74	4	1,320-1,316	Gravel, fine
74-210	136	1,316-1,180	Clay, gray, silty, sandy, pebbly, very shaley; gravel lens from 82 to 84 feet, rock at 158 feet, E-log change at 113 feet. unoxidized (till)
210-300	90	1,180-1,090	Clay, gray, silty, sandy, pebbly; less shaley than above interval, many shale inclusions, unoxidized (till)
300-344	44	1,090-1,046	Sand, fine; hard, cemented, rig chatter, clay layer at 327 feet
344-356	12	1,046-1,034	Clay, light-gray, silty; gritty, very calcareous (Niobrara Formation)
356-364	8	1,034-1,026	Clay, gray, shaley; soft, greasy, noncalcareous, concretion at 363 feet (Carlile Shale)
Electric log available			

Local number: 122N51W4DDDD R
 Other identifier: R2-98-32
 Site identification number: 452210097023101
 Date of construction: 08-10-98
 Land surface altitude: 1,960 feet
 Total depth: 862 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,960-1,950	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
10-22	12	1,950-1,938	Sand and gravel, oxidized
22-50	18	1,938-1,910	Clay, gray, silty, sandy, pebbly; unoxidized (till)
50-65	15	1,910-1,895	Sand and gravel, coarse sand to fine gravel; some coarse gravel, some clay layers
65-69	4	1,895-1,891	Clay, tan, very silty; greasy (loess)
69-72	3	1,891-1,888	Clay, grayish-brown to black, very silty; greasy (loess)
72-77	5	1,888-1,883	Clay, yellowish-brown, silty, very sandy, pebbly; highly oxidized (till)
77-92	15	1,883-1,868	Clay, grayish-brown, silty, sandy, pebbly; rocks at 86, 89, and 90 feet, sand lens from 82 to 86 feet, partially oxidized (till)
92-98	6	1,868-1,862	Sand and gravel, coarse sand to fine gravel
98-110	12	1,862-1,850	Clay, gray, very silty; soft. unoxidized, some sand layers (lake sediment)
110-162	52	1,850-1,798	Clay, gray, silty, sandy, pebbly; rocks from 146 to 148 feet and from 161 to 162 feet, unoxidized (till)
162-196	34	1,798-1,764	Clay, yellowish-brown, silty, sandy, pebbly, cobbly; oxidized, very cobbly from 162 to 178 feet, rocks at 175 to 187 feet (till)
196-204	8	1,764-1,756	Clay, grayish-brown, silty, sandy, pebbly; greasy, partially oxidized (till)
204-244	40	1,756-1,716	Clay, dark-gray, silty, sandy, pebbly; some hints of oxidation, greasy (till)
244-256	12	1,716-1,704	Sand, coarse; cemented, rig chatter, poor sample
256-358	102	1,704-1,602	Clay, gray, silty, sandy, pebbly; many cobbles from 282 to 296 feet, gravel lens from 351 to 354 feet and 356 to 358 feet (till)
358-422	64	1,602-1,538	Clay, light-gray with some greenish-brown and gray, silty, sandy, pebbly, shaley; oxidized and unoxidized zones, rocks at 397 and 406 feet, many shale inclusions (till)
422-454	32	1,538-1,506	Sand and gravel, coarse sand to fine gravel; drills fast, rig chatter, cemented
454-506	12	1,506-1,454	Clay, gray, silty, sandy, pebbly, shaley; greasy, with shale inclusions, rocks at 472, 492, and 504 feet, unoxidized (till)
506-513	7	1,454-1,447	Clay, dark-gray, shaley; greasy (shale block)
513-842	329	1,447-1,118	Clay, gray, silty, sandy, pebbly, shaley; greasy, with shale inclusions, rocks at 617, 759, 765, and 767 feet, unoxidized, very poor cuttings (till)
842-862	20	1,118-1,098	Clay, dark-gray to black, shaley; very hard, greasy, very poor cuttings (Pierre Shale? or till?)

Electric log available

Local number: 122N51W4DDDD2 R
 Other identifier: R2-99-11
 Site identification number: 452212097022702
 Date of construction: 08-17-99
 Land surface altitude: 1,962.2 feet
 Total depth: 452 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-11	11	1,962.2-1,951.2	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
11-22	11	1,951.2-1,940.2	Sand and gravel; oxidized
22-53	31	1,940.2-1,909.2	Clay, gray, silty, sandy, pebbly; rocks at 32, 41, and 46 feet, unoxidized (till)
53-65	12	1,909.2-1,897.2	Sand and gravel, coarse sand to fine gravel; some coarse gravel, some clay layers
65-69	4	1,897.2-1,893.2	Clay, tan, very silty; greasy (loess)
69-72	3	1,893.2-1,890.2	Clay, grayish-brown to black, very silty; greasy (loess)
72-77	5	1,890.2-1,885.2	Clay, yellowish-brown, silty, very sandy, pebbly; highly oxidized (till)
77-93	26	1,885.2-1,869.2	Clay, grayish-brown, silty, sandy, pebbly; rocks at 86, 89, and 90 feet, sand lens from 82 to 86 feet, partially oxidized (till)
93-98	5	1,869.2-1,864.2	Sand and gravel, coarse sand to fine gravel
98-110	12	1,864.2-1,852.2	Clay, gray, very silty; soft, unoxidized, some sand layers (lake sediment)
110-164	54	1,852.2-1,798.2	Clay, gray, silty, sandy, pebbly; rocks from 146 to 148 feet and from 161 to 162 feet, unoxidized (till)
164-196	32	1,798.2-1,766.2	Clay, yellowish-brown, silty, sandy, pebbly, cobbly; oxidized, very cobbly from 162 to 178 feet, rocks at 175 and 187 feet (till)
196-204	8	1,766.2-1,758.2	Clay, grayish-brown, silty, sandy, pebbly; greasy, partially oxidized (till)
204-242	38	1,758.2-1,720.2	Clay, dark-gray, silty, sandy, pebbly; some hints of oxidation, greasy (till)
242-255	13	1,720.2-1,707.2	Sand, coarse; cemented, rig chatter, poor sample
255-349	16	1,707.2-1,613.2	Clay, gray, silty, sandy, pebbly; unoxidized (till)
349-353	4	1,613.2-1,609.2	Sand; hard, cemented
353-419	66	1,609.2-1,543.2	Clay, dark-gray, silty, sandy, pebbly, shaley; unoxidized, many shale inclusions (till)
419-451	32	1,543.2-1,511.2	Sand and gravel, coarse sand to fine gravel; drills fast, rig chatter, cemented
451-452	1	1,511.2-1,510.2	Clay, gray, silty, sandy, pebbly, shaley; greasy, with shale inclusions (till)

Well screened from 426.5 to 446.5 feet; 2-inch screen and PVC casing

Local number: 122N51W27BBBB R
 Other identifier: R2-98-26
 Site identification number: 451936097022601
 Date of construction: 07-14-98
 Land surface altitude: 2,025 feet
 Total depth: 627 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	2,025-2,023	Clay, black, silty (topsoil)
2-8	6	2,023-2,017	Clay, brown, silty, sandy, pebbly; oxidized (till)
8-11	3	2,017-2,014	Sand and gravel, cobbly
11-41	30	2,014-1,984	Clay, gray, silty, sandy, pebbly; soft, large cuttings, unoxidized (till)
41-70	29	1,984-1,955	Clay, brown, silty, sandy, pebbly; hard, turns grayish-brown with depth, some cobbles, rock at 66 feet, oxidized (till)
70-80	10	1,955-1,945	Sand and gravel, coarse sand to fine gravel, clayey; this interval is not encountered in second test hole at site
80-159	79	1,945-1,866	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 107 feet (till)
159-162	3	1,866-1,863	Gravel, fine to coarse, cobbly
162-243	81	1,863-1,782	Clay, gray, silty, sandy, pebbly; unoxidized, gravelly from 168 to 177 feet, gravel lens from 181 to 184 feet and 192 to 199 feet (till)
243-278	35	1,782-1,747	Clay, gray, very silty; unoxidized (lake sediment)
278-298	20	1,747-1,727	Gravel, coarse
298-426	128	1,727-1,599	Clay, gray, silty, sandy, pebbly; unoxidized, sand lens from 320 to 325 feet, some shale inclusions, hard spots at 314 and 316 feet (till)
426-470	44	1,599-1,555	Clay, gray, silty, sandy, pebbly; unoxidized, E-log signature differs from above interval, gravel lens at 442 and 454 feet, rocks at 427, 447, and 458 feet, very poor cuttings (till)
470-496	26	1,555-1,529	Sand(?), very hard, cemented(?), some oxidized till noticed, very poor cuttings
496-528	32	1,529-1,497	Clay, gray, silty, sandy, pebbly, shaley; unoxidized, rocks from 525 to 528 feet, very poor cuttings (till)
528-627	99	1,497-1,398	Clay, dark-gray, shaley; hard, greasy, noncalcareous, poor cuttings (Pierre Shale)
Electric log available; below 298 feet most of the descriptions were made using electric log data. Drill cuttings were very poor			

Local number: 122N51W27BBBB2 R
 Other identifier: R2-98-27
 Site identification number: 451936097022602
 Date of construction: 07-15-98
 Land surface altitude: 2,025 feet
 Total depth: 302 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	2,025-2,023	Clay, black, silty (topsoil)
2-7	5	2,023-2,018	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
7-11	4	2,018-2,014	Sand, brown, fine to coarse
11-14	3	2,014-2,011	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
14-40	26	2,011-1,985	Clay, gray, silty, sandy, pebbly; soft, large cuttings, unoxidized (till)
40-79	39	1,985-1,946	Clay, brown, silty, sandy, pebbly; hard, turns grayish-brown at 54 feet, rocks at 63, 77, and 79 feet, oxidized (till)
79-265	186	1,946-1,760	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 98 feet, maybe more than one till in this interval (till)
265-283	18	1,760-1,742	Clay, gray, very silty; unoxidized (lake sediment)
283-298	15	1,742-1,727	Sand and gravel, coarse sand to fine to medium gravel
298-302	19	1,727-1,723	Clay, gray, silty, sandy pebbly; unoxidized (till)

Well screened from 282-302 feet; 2-inch PVC screen and casing

Local number: 122N52W1DDCC R
 Other identifier: R2-98-31
 Site identification number: 452213097063101
 Date of construction: 07-29-98
 Land surface altitude: 1,946 feet
 Total depth: 462 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,946-1,943	Clay, black with some brown, silty (topsoil)
3-15	12	1,943-1,931	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
15-32	17	1,931-1,914	Clay, grayish-brown, silty, sandy
32-35	3	1,914-1,911	Clay, gray, silty, sandy, pebbly; unoxidized (till)
35-56	21	1,911-1,890	Clay, tan then brown then light-gray then tan then dark-brown, very silty; soft (loess)
56-85	29	1,890-1,861	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
85-95	10	1,861-1,851	Clay, grayish-brown, very silty; very soft, somewhat greasy, unoxidized (loess)
95-119	24	1,851-1,827	Clay, yellowish-brown, very silty
119-142	23	1,827-1,804	Clay, gray with brown oxidation zones, silty, sandy, pebbly; partially oxidized (till)
142-228	86	1,804-1,718	Clay, gray, silty, sandy, pebbly; unoxidized (till)
228-232	4	1,718-1,714	Sand and gravel, medium to coarse sand to fine gravel
232-316	84	1,714-1,630	Clay, gray and brown, silty, sandy, pebbly; rocks at 262, 271, 274, and 296 feet, oxidized and unoxidized (till)
316-320	4	1,630-1,626	Gravel, coarse; with cobbles
320-333	13	1,626-1,613	Clay, gray, silty, sandy, pebbly; unoxidized, very hard from 331 to 332 feet (till)
333-343	10	1,613-1,603	Sand, medium; cemented, rig chatter, poor sample
343-413	70	1,603-1,533	Clay, gray, silty, sandy, pebbly, shaley; unoxidized, many shale inclusions (till)
413-438	25	1,533-1,508	Sand and gravel, medium sand to fine gravel; cemented, rig chatter, taking water
438-462	24	1,508-1,484	Clay, dark-gray to black, shaley; very greasy (Pierre Shale)

Well screened from 412 to 432 feet; 2-inch PVC screen and casing. Electric log available

Local number: 122N52W9AAAA3 R
 Other identifier: R2-98-34
 Site identification number: 452218097095101
 Date of construction: 08-25-98
 Land surface altitude: 1,872 feet
 Total depth: 667 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-49	49	1,872-1,823	Sand and gravel, coarse sand to medium to coarse gravel; oxidized
49-58	9	1,823-1,814	Clay, gray, silty, sandy, pebbly; unoxidized (till)
58-65	7	1,814-1,807	Gravel, medium to coarse
65-74	9	1,807-1,798	Clay, brown to dark-brown, silty, very sandy, pebbly; oxidized (till)
74-85	11	1,798-1,787	Clay, gray, very silty, sandy, pebbly; unoxidized (till)
85-90	5	1,787-1,782	Sand and gravel, coarse sand to fine to medium gravel
90-102	12	1,782-1,770	Clay, dark-gray, silty, sandy, pebbly; unoxidized, harder than till interval above (till)
102-106	4	1,770-1,766	Gravel
106-160	54	1,766-1,712	Clay, light-gray, silty, sandy, pebbly; partially oxidized, turns gray by 115 feet, gravel lens at 156 and 159 feet (till)
160-170	10	1,712-1,702	Sand, medium; cemented, poor sample
170-177	7	1,702-1,695	Clay, brown, very silty; oxidized (loess)
177-207	30	1,695-1,665	Clay, yellowish-brown, silty, sandy, pebbly; some gray noticed by 190 feet, oxidized (till)
207-267	60	1,665-1,605	Clay, gray, silty, sandy, pebbly; rock at 259 feet, unoxidized (till)
267-282	15	1,605-1,590	Sand and gravel, coarse sand to fine to medium gravel; rock at 282 feet
282-447	165	1,590-1,425	Clay, gray, silty, sandy, pebbly, shaley; unoxidized (till)
447-492	45	1,425-1,380	Clay, dark-gray, silty, sandy, pebbly, shaley; rocks at 454, 485, and 490 feet, E-log signature differs slightly from above interval, unoxidized (till)
492-555	63	1,380-1,317	Clay, gray, silty, sandy, pebbly, shaley; E-log signature differs slightly from above interval (till)
555-633	78	1,317-1,239	Sand, gray, very fine to fine, very silty; some silty clay layers
633-654	21	1,239-1,218	Clay, dark-gray to black, shaley; greasy, possibly just a block of shale and not actual shale surface (Pierre Shale)
654-667	13	1,218-1,205	Clay, dark-gray; poor cuttings (shale? or till?)

Electric log available; electric log signature seems to indicate till may have been re-encountered below a block of shale

Local number: 122N52W24DDDD R
 Other identifier: R2-98-28
 Site identification number: 451936097061201
 Date of construction: 07-20-98
 Land surface altitude: 1,968 feet
 Total depth: 522

Depth	Thickness (feet)	Altitude (feet)	Description
0-5	5	1,968-1,963	Sand and gravel, medium to coarse sand to medium gravel
5-19	14	1,963-1,949	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
19-23	4	1,949-1,945	Clay, light-grayish-brown, very silty; soft (loess)
23-26	3	1,945-1,942	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
26-105	79	1,942-1,863	Clay, gray to dark-gray with oxidized zones, silty, sandy, pebbly; hard, partially oxidized to unoxidized, sand zones from 42 to 45 feet and 52 to 56 feet (till)
105-112	7	1,863-1,856	Clay, dark-gray, very silty; somewhat greasy (loess)
112-178	66	1,856-1,790	Clay, yellowish-brown, silty, sandy, pebbly; hard, some gray till noticed with depth (till)
178-271	93	1,790-1,697	Clay, gray, silty, sandy, pebbly; unoxidized, gravel lens from 265 to 267 feet and 268 to 271 feet, rock at 268 feet (till)
271-400	129	1,697-1,568	Clay, gray, silty, sandy, pebbly; unoxidized, E-log signature differs from above interval, rocks at 315, 381 and 400 feet, gravel lens from 319 to 322 feet, 325 to 330 feet, and 341 to 345 feet, some oxidized till noticed (till)
400-433	33	1,568-1,535	Clay, yellowish-brown and gray, silty, sandy, pebbly; oxidized zones and unoxidized zones, rock at 417 feet (till)
433-435	2	1,535-1,533	Gravel, medium to coarse
435-472	37	1,533-1,496	Clay, gray, silty, sandy, pebbly, shaley; unoxidized (till)
472-490	18	1,496-1,478	Sand, fine to medium; partially cemented, rock at 476 feet
490-522	32	1,478-1446	Clay, gray, shaley; hard, greasy (Pierre Shale)
Electric log available			

Local number: 122N52W27BBBB R
 Other identifier: R2-98-29
 Site identification number: 451934097095301
 Date of construction: 07-27-98
 Land surface altitude: 1,875 feet
 Total depth: 477 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,875-1,873	Clay, black, silty (topsoil)
2-7	5	1,873-1,868	Sand and gravel, medium sand to medium gravel; oxidized
7-30	23	1,868-1,851	Clay, tan, then dark-brown then yellowish-brown grading to grayish-brown, very silty; soft, a few small pebbles, oxidized (loess?)
30-40	10	1,851-1,841	Clay, gray, very silty; unoxidized (loess?)
40-42	2	1,841-1,839	Clay, yellowish-brown, silty, sandy, pebbly; highly oxidized (till)
42-84	42	1,839-1,797	Clay, dark-gray, very silty, sandy, pebbly; hard, unoxidized (till)
84-102	18	1,797-1,779	Clay, gray, very silty; very soft, somewhat greasy (loess)
102-115	13	1,779-1,766	Clay, light-greenish-gray with some dark-brown, silty, sandy, pebbly; hard, oxidized (till)
115-140	25	1,766-1,741	Clay, yellowish-brown grading to light-gray with brown, silty, sandy, pebbly; oxidized to partially oxidized (till)
140-190	50	1,741-1,691	Clay, gray, silty, sandy, pebbly; unoxidized (till)
190-194	4	1,691-1,687	Sand and gravel, medium to coarse sand to fine gravel
194-204	10	1,687-1,677	Clay, gray, very silty; unoxidized (lake sediment)
204-243	39	1,677-1,638	Sand and gravel, medium to coarse sand to fine gravel
243-256	13	1,638-1,625	Clay, gray, very silty; unoxidized, gravel lens from 250 feet (lake sediment?)
256-261	5	1,625-1,620	Gravel, fine to medium
261-371	110	1,620-1,510	Clay, dark-gray, silty, sandy, pebbly, shaley; unoxidized, occasional cobbles (till)
371-388	17	1,510-1,493	Gravel, fine to medium; hard layer from 376 to 378 feet, very clayey below 378 feet
388-437	49	1,493-1,444	Clay, gray, silty, sandy, pebbly, shaley; unoxidized, sand lens from 402 to 404 feet, rock at 390 feet (till)
437-443	6	1,444-1,438	Gravel, coarse; with cobbles
443-477	34	1,438-1,404	Clay, gray, shaley; hard, greasy (Pierre Shale)
Electric log available			

Local number: 122N52W27BBBB2 R
 Other identifier: R2-98-30
 Site identification number: 451934097095302
 Date of construction: 07-28-98
 Land surface altitude: 1,878.4 feet
 Total depth: 242 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,878.4-1,876.4	Clay, black, silty (topsoil)
2-7	5	1,876.4-1,871.4	Sand and gravel, medium to coarse sand to medium gravel; highly oxidized
7-16	9	1,871.4-1,862.4	Clay, tan to yellowish-brown, very silty; soft, greasy, a few small pebbles, oxidized (loess?)
16-22	6	1,862.4-1,856.4	Clay, gray, very silty; soft, greasy, a few pebbles, unoxidized (loess?)
22-36	14	1,856.4-1,842.4	Clay, yellowish-brown, very silty; soft, greasy, oxidized (loess?)
36-43	7	1,842.4-1,835.4	Clay, yellowish-brown to brown, silty, sandy, pebbly; highly oxidized, gravel lens from 38 to 40 feet (till)
43-52	9	1,835.4-1,826.4	Clay, tan to grayish-brown, very silty; oxidized (loess)
52-58	6	1,826.4-1,820.4	Clay, gray, very silty; greasy, unoxidized (loess)
58-86	28	1,820.4-1,792.4	Clay, gray, very silty, sandy, pebbly; greasy, unoxidized (till)
86-100	14	1,792.4-1,778.4	Clay, gray, very silty; very soft, somewhat greasy, unoxidized (loess)
100-115	15	1,778.4-1,763.4	Clay, light-greenish-gray with some dark brown, silty, sandy, pebbly; hard, oxidized (till)
115-142	27	1,763.4-1,736.4	Clay, yellowish-brown grading to light-gray with brown, silty, sandy, pebbly; oxidized to partially oxidized (till)
142-188	46	1,736.4-1,690.4	Clay, gray, silty, sandy, pebbly; unoxidized (till)
188-192	4	1,690.4-1,686.4	Sand and gravel, medium to coarse sand to fine gravel
192-198	6	1,686.4-1,680.4	Clay, gray, very silty; unoxidized (lake sediment)
198-242	44	1,680.4-1,636.4	Sand and gravel, medium to coarse sand to fine gravel; clay layers common from 200 to 208 feet, clay layer from 235 to 236 feet

Well screened from 222 to 242 feet; 2-inch PVC screen and casing. Electric log available

Local number: 123N49W24AAAA
 Other identifier: R2-98-21
 Site identification number: 452724096442201
 Date of construction: 06-23-98
 Land surface altitude: 1,045 feet
 Total depth: 102 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,045-1,043	Sand, brown, coarse (roadfill)
2-20	18	1,043-1,025	Clay, brown, silty, sandy, pebbly; oxidized (till)
20-23	3	1,025-1,022	Clay, gray, silty, sandy, pebbly; unoxidized (till)
23-24	1	1,022-1,021	Sand, reddish-brown; oxidized
24-39	15	1,021-1,006	Clay, reddish-brown, silty, very sandy, pebbly; turns grayish-pink after 32 feet (Hawk Creek Till)
39-42	3	1,006-1,003	Sand and gravel, coarse sand to fine gravel
42-67	25	1,003-978	Clay, dark-gray, silty, sandy, pebbly; hard, unoxidized, many sand lens (till)
67-75	8	978-970	Clay, very light-gray, silty, sandy, pebbly; hard, gravelly, some boulders (till)
75-102	27	970-943	Clay, gray, shaley; hard, greasy (Carlile Shale)

Electric log available

Local number: 123N50W24AAAD
 Other identifier: R2-98-24
 Site identification number: 452714096514501
 Date of construction: 06-29-98
 Land surface altitude: 1,170 feet
 Total depth: 182 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,170-1,169	Clay, black, silty (topsoil)
1-12	11	1,169-1,158	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
12-42	30	1,158-1,128	Sand and gravel, coarse sand to fine to medium gravel; some coarse gravel with depth
42-47	5	1,128-1,123	Clay, gray, silty, sandy, pebbly; unoxidized (till)
47-50	3	1,123-1,120	Gravel, coarse to very coarse; some cobbles
50-102	52	1,120-1,068	Clay, dark-gray, shaley; hard, greasy, noncalcareous (Pierre Shale)
102-123	21	1,068-1,047	Clay, black, shaley; greasy, oily (Sharon Springs Member - Pierre Shale)
123-138	15	1,047-1,032	Clay, light-gray to white, silty; hard, gritty, chalky, very calcareous (Niobrara Formation)
138-182	42	1,032-988	Clay, gray, shaley; hard, greasy, noncalcareous (Blue Hill Shale Member - Carlile Shale)

Electric log available

Local number: 123N51W2CCCC R
 Other identifier: R2-98-33
 Site identification number: 452728097011401
 Date of construction: 08-19-98
 Land surface altitude: 1,500 feet
 Total depth: 502 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,500-1,499	Clay, black, silty (topsoil)
1-3	2	1,499-1,497	Sand and gravel; oxidized (roadfill)
3-6	3	1,497-1,494	Clay, brown, silty, sandy
6-15	9	1,494-1,485	Sand and gravel, coarse sand to fine gravel
15-70	55	1,485-1,430	Clay, gray, silty, sandy, pebbly; soft, large cuttings, sand lens from 28 to 31 feet and 52 to 54 feet, unoxidized (till)
70-94	24	1,430-1,406	Clay, gray, very silty; greasy (lake sediment)
94-115	21	1,406-1,385	Sand and gravel, coarse sand to coarse gravel; some cobbles at base of interval
115-122	7	1,385-1,378	Clay, gray, silty, sandy, pebbly; unoxidized (till)
122-134	12	1,378-1,366	Sand; some clay layers
134-471	337	1,366-1,029	Clay, gray, silty, sandy, pebbly, shaley; rocks at 279, 284, 342, 379, and 388 feet, very cobbly from 342 to 358 feet, many shale inclusions, not much change in the E-log signature (till)
471-482	11	1,029-1,018	Clay, dark-gray to black; greasy, very calcareous (Sharon Springs Member - Pierre Shale?)
482-496	14	1,018-1,004	Clay, gray, very silty; hard, very calcareous (Niobrara Formation)
496-502	6	1,004-998	Clay, gray, shaley; hard, greasy, noncalcareous (Carlile Shale)
Electric log available			

Local number: 123N51W19CBCB R
 Other identifier: R2-99-05
 Site identification number: 452507097061001
 Date of construction: 06-16-99
 Land surface altitude: 1,990 feet
 Total depth: 792 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,990-1,989	Clay, black, silty (topsoil)
1-7	6	1,989-1,983	Sand, brown, medium; oxidized
7-23	16	1,983-1,967	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
23-27	4	1,967-1,963	Gravel, coarse; with cobbles
27-112	85	1,963-1,878	Clay, gray, silty, sandy, pebbly; hard, unoxidized (till)
112-194	82	1,878-1,796	Clay, yellowish-brown, silty, sandy, pebbly; rock at 114 feet, oxidized (till)
194-302	108	1,796-1,688	Clay, brown and gray, silty, sandy, pebbly; granite boulder from 194 to 195 feet (till)
302-324	22	1,688-1,666	Clay, gray and dark-brown, silty; greasy (lake clay or loess?)
324-376	52	1,666-1,614	Clay, yellowish-brown, silty, sandy, pebbly; rocks at 325, 343, 359, and 367 feet, oxidized (till)
376-402	26	1,614-1,588	Sand and gravel, coarse sand to fine gravel; cemented, some very hard spots
402-456	54	1,588-1,534	Clay, dark-gray, silty, sandy, pebbly; shaley; greasy, some shale inclusions, unoxidized (till)
456-460	4	1,534-1,530	Sand; cemented, rig chatter
460-702	42	1,530-1,288	Clay, gray, silty, sandy, pebbly, shaley; greasy, some shale inclusions, rocks at 533 and 622 feet, unoxidized (till)
702-792	90	1,288-1,198	Clay, dark-gray to black, shaley; greasy, hard, noncalcareous (Pierre Shale)

Electric log available

Local number: 123N51W21DDDD R
 Other identifier: R2-99-02
 Site identification number: 452448097023001
 Date of construction: 06-02-99
 Land surface altitude: 1,824 feet
 Total depth: 792 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,824-1,823	Clay, black, silty (topsoil)
1-13	12	1,823-1,811	Clay, dark-brown, silty, sandy, pebbly; greasy, some gray 15 to 18 feet, oxidized (till)
13-110	97	1,811-1,714	Clay, gray, silty, sandy, pebbly; greasy, gravel lens at 63 feet, rocks 84 to 86 feet and 97 feet, unoxidized (till)
110-138	28	1,714-1,686	Sand and gravel, brown, medium sand to fine gravel; clay layer 118 to 120 feet, oxidized
138-215	77	1,686-1,609	Clay, gray to dark-gray, silty, sandy, pebbly; hard, rocks at 145, 159, and 169 to 171 feet, unoxidized (till)
215-229	14	1,609-1,595	Sand, medium to coarse; some fine gravel
229-336	7	1,595-1,488	Clay, light-gray then brown, silty, sandy, pebbly; rocks at 234 and 266 feet, oxidized (till)
336-340	4	1,488-1,484	Sand and gravel
340-769	129	1,484-1,055	Clay, gray, very silty, sandy, pebbly, shaley; very hard, some shale inclusions, rocks at 614, 633, 657, 703, and 724 feet, unoxidized (till)
769-780	11	1,055-1,044	Gravel, coarse; with cobbles
780-792	12	1,044-1,032	Clay, gray, silty; calcareous (Niobrara Formation)

Electric log available

Local number: 123N51W21DDDD2 R
 Other identifier: R20-99-48
 Site identification number: 452218097022902
 Date of construction: 08-18-99
 Land surface altitude: 1,819.4 feet
 Total depth: 138 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,819.4-1,818.4	Clay, black, silty (topsoil)
1-17	16	1,818.4-1,802.4	Clay, brown to yellowish-brown, silty, sandy, pebbly; greasy, some gray with reddish-brown fracture zones from 15 to 17 feet, rock at 17 feet, oxidized (till)
17-107	90	1,802.4-1,712.4	Clay, gray, silty, sandy, pebbly; greasy, gravel lens at 23 feet, rocks at 44, 73, 82, 83 to 85, 86, 87, 95, 97, 100, and 107 feet, unoxidized (till)
107-138	31	1,712.4-1,681.4	Sand and gravel, brown, medium sand to fine gravel; oxidized

Well screened from 118 to 138 feet; 2-inch PVC screen and casing

Local number: 123N52W3CCCC R
 Other identifier: R2-99-01
 Site identification number: 452727097095401
 Date of construction: 04-28-99
 Land surface altitude: 1,900 feet
 Total depth: 507 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,900-1,897	Clay, black, silty (topsoil)
3-13	10	1,897-1,887	Clay, tan to yellowish-brown, silty, sandy, pebbly; rock at 7 feet, sand lens from 7 to 9 feet, oxidized (till)
13-46	33	1,887-1,854	Clay, gray, silty, sandy, pebbly; greasy, unoxidized (till)
46-59	13	1,854-1,841	Sand and gravel, brown, medium; rock at 54 feet, clayey with rocks and coarse gravel 54 to 59 feet
59-64	5	1,841-1,836	Clay, brown, silty; oxidized
64-67	3	1,836-1,833	Gravel, medium to coarse
67-193	126	1,833-1,707	Clay, brown, silty, sandy, pebbly; some gray noticed with depth, oxidized (till)
193-349	336	1,707-1,551	Clay, brown grading to gray with depth, silty, sandy, pebbly; E-log signature differs from above interval, rocks at 283 and 338 feet, oxidized (till)
349-356	7	1,551-1,544	Sand and gravel, coarse; rock at 352 feet
356-404	48	1,544-1,496	Clay, dark-gray, silty, sandy, pebbly, shaley; some shale inclusions, rocks at 372 and 410 feet, unoxidized (till)
404-443	39	1,496-1,457	Sand and gravel, coarse sand to fine gravel; partially cemented, rock at 435 feet
443-467	24	1,457-1,433	Clay, gray, silty, sandy, pebbly; unoxidized (till)
467-498	38	1,433-1,402	Sand(?); very hard, rig chatter, E-log signature indicates possible sand, poor sample, wore out the drill bit
498-501	3	1,402-1,399	Granite boulder
501-507	6	1,399-1,393	Clay, black, shaley; greasy, noncalcareous (Pierre Shale)

Electric log available

Local number: 123N52W13AADA R
 Other identifier: R2-99-03
 Site identification number: 452626097061201
 Date of construction: 06-02-99
 Land surface altitude: 2,005 feet
 Total depth: 22 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-22	22	2,005-1,983	Sand and gravel, reddish-brown, coarse sand to fine gravel; highly oxidized

Local number: 123N52W21DDDD R
 Other identifier: R2-99-04
 Site identification number: 452450097095501
 Date of construction: 06-09-99
 Land surface altitude: 2,002 feet
 Total depth: 682 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	2,002-2,000	Clay, black, silty (topsoil)
2-4	2	2,000-1,998	Sand, brown, medium; oxidized
4-39	35	1,998-1,963	Clay, tan to yellowish-brown, silty, sandy, pebbly; turns dark-brown then grayish-brown with depth, hard, oxidized (till)
39-55	16	1,963-1,947	Clay, gray, silty, sandy, pebbly; hard, unoxidized (till)
55-94	39	1,947-1,908	Clay, gray, very silty; soft, layered (lake sediment)
94-148	54	1,908-1,854	Clay, yellowish-brown with a greenish tinge, silty, sandy, pebbly; grades to grayish-brown with depth, oxidized (till)
148-188	40	1,854-1,814	Clay, light-gray, silty, sandy, pebbly; hard (till)
188-217	29	1,814-1,785	Clay, dark-gray to black, very silty; greasy, some dark-brown soil-like material noticed (lake sediment?)
217-222	5	1,785-1,780	Gravel
222-460	238	1,780-1,542	Clay, brown and gray, silty, sandy, pebbly; sand lens at 253, 283, 295, 297, 299, and 332 feet, rocks at 357 and 372 feet, poor sample cuttings (till)
460-508	48	1,542-1,494	Clay, gray, silty, sandy, pebbly, shaley; greasy, some shale inclusions, poor sample cuttings, unoxidized (till)
508-524	34	1,494-1,478	Sand and gravel, coarse sand to fine gravel; cemented
524-574	50	1,478-1,428	Clay, gray, silty, sandy, pebbly, shaley; greasy, some shale inclusions, unoxidized (till)
574-625	51	1,428-1,377	Clay(?); very poor cuttings, drilled like clay but has questionable E-log signature (till?)
625-682	57	1,377-1,320	Clay, dark-gray to black, shaley; greasy, hard, noncalcareous (Pierre Shale)
Electric log available			

Local number: 124N49W19BBBC
 Other identifier: R2-98-22
 Site identification number: 453234096514201
 Date of construction: 06-24-98
 Land surface altitude: 1,130 feet
 Total depth: 122 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,130-1,128	Clay, black, silty (topsoil)
2-24	22	1,128-1,106	Clay, tan to yellowish-brown, silty, sandy, pebbly; oxidized, some dark-brown with depth (till)
24-27	3	1,106-1,103	Sand, brown, silty, medium to coarse
27-85	58	1,103-1,045	Clay, gray, silty, sandy, pebbly; unoxidized, sand lens from 33 to 35 feet, 70 to 73 feet (till)
85-88	3	1,045-1,042	Sand, gray, medium; unoxidized
88-98	10	1,042-1,032	Clay, gray, silty; unoxidized, very hard from 92 to 94 feet, very calcareous (Niobrara Formation)
98-122	24	1,032-1,008	Clay, gray, shaley; hard, greasy (Carlile Shale)

Electric log available

Local number: 124N49W21ADAD
 Other identifier: R2-98-23
 Site identification number: 453222096475701
 Date of construction: 06-24-98
 Land surface altitude: 1,095 feet
 Total depth: 122 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,095-1,085	Clay, tan to yellowish-brown, silty, sandy, pebbly; oxidized (till)
10-44	34	1,085-1,051	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 19 feet, sand lens at 28 feet, gravel lens from 36 to 38 feet (till)
44-92	48	1,051-1,003	Clay, gray, silty, sandy, pebbly; unoxidized, harder than above interval (till)
92-122	30	1,003-973	Clay, gray, shaley; hard, greasy, noncalcareous (Blue Hill Shale Member - Carlile Shale)

Electric log available

Local number: 124N51W28AAAA R
 Other identifier: R2-97-48
 Site identification number: 453002097022701
 Date of construction: 09-08-97
 Land surface altitude: 1,501 feet
 Total depth: 512 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-19	19	1,501-1,482	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
19-24	5	1,482-1,477	Clay, grayish-brown, silty, sandy, pebbly; partially oxidized (till)
24-52	28	1,477-1,449	Clay, gray, very silty, sandy, pebbly; soft, large cuttings, unoxidized (till)
52-58	6	1,449-1,443	Sand and gravel, coarse sand to coarse gravel; with cobbles
58-176	118	1,443-1,325	Clay, dark-gray, silty, sandy, pebbly; hard, rock at 78 feet, unoxidized (till)
176-184	8	1,325-1,317	Sand and gravel, coarse sand to medium gravel
184-423	239	1,317-1,078	Clay, gray to dark-gray, silty, sandy, pebbly; some hard zones, occasional rocks, drill rig not drilling properly, unoxidized, E-log signature changes very little over the interval (till)
423-498	75	1,078-1,003	Sand and gravel, medium to coarse sand to fine gravel; rig chatter, drills fast, cemented
498-512	14	1,003-989	Clay, black, shaley; hard, greasy, calcareous (Carlisle Shale)
Electric log available			

Local number: 124N51W30BBBB R

Other identifier: R2-99-06

Site identification number: 452958097060901

Date of construction: 07-07-99

Land surface altitude: 2,060 feet

Total depth: 847 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-38	38	2,060-2,022	Sand and gravel, brown, fine sand to fine to medium gravel; some clay layers, oxidized
38-70	32	2,022-1,990	Clay, gray, silty, sandy, pebbly; hard, unoxidized (till)
70-81	11	1,990-1,979	Sand and gravel
81-132	51	1,979-1,928	Clay, brown, silty, sandy, pebbly; rocks at 87 and 88 feet, oxidized (till)
132-140	8	1,928-1,920	Gravel, medium; much limestone, oxidized
140-152	12	1,920-1,908	Clay, gray, silty; greasy (lake clay or loess?)
152-211	59	1,908-1,849	Clay, grayish-brown, silty, sandy, pebbly; oxidized (till)
211-275	64	1,849-1,785	Clay, yellowish-brown, silty, sandy, pebbly; rock at 224 feet, highly oxidized then turns grayish-brown with depth (till)
275-377	102	1,785-1,683	Clay, gray, silty, sandy, pebbly; unoxidized (till)
377-405	28	1,683-1,655	Sand, gray, fine to medium; cemented, rig chatter
405-417	12	1,655-1,643	Clay, gray, silty; hard, smooth
417-427	10	1,643-1,633	Sand, gray, fine; hard, cemented, with many clay layers
427-722	295	1,633-1,338	Clay, gray and brown, silty, sandy, pebbly; rocks at 440, 454, 459, and 654 feet, poor cuttings, possibly more than one till unit (till)
722-730	8	1,338-1,330	Gravel(?)
730-847	117	1,330-1,213	Clay, gray, silty, sandy, pebbly; hard, unoxidized, poor cuttings (till)

For electric log see R2-99-13

Local number: 124N51W30BBBB2 R
 Other identifier: R2-99-13
 Site identification number: 453002097060902
 Date of construction: 08-24-99
 Land surface altitude: 2,053.1 feet
 Total depth: 422 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	2,053.1-2,052.1	Clay, tan, silty (topsoil)
1-6	5	2,052.1-2,047.1	Sand and gravel, brown, fine sand to fine to medium gravel; rock at 6 feet, oxidized
6-30	24	2,047.1-2,023.1	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
30-32	2	2,023.1-2,021.1	Sand and gravel
32-40	8	2,021.1-2,013.1	Clay, gray, very silty; unoxidized (lake sediment)
40-44	4	2,013.1-2,009.1	Sand, gray, fine
44-72	28	2,009.1-1,981.1	Clay, gray, silty, sandy, pebbly; hard, rocks at 64 and 72 feet, unoxidized (till)
72-88	16	1,981.1-1,965.1	Sand and gravel; rock at 79 feet
88-162	74	1,965.1-1,891.1	Clay, yellowish-brown, silty, sandy, pebbly; rocks at 87, 88, and 92 feet, grades to a grayish-brown by 120 feet, oxidized (till)
162-199	37	1,891.1-1,854.1	Clay, gray, silty, sandy, pebbly; rock at 161 feet, unoxidized (till)
199-275	76	1,854.1-1,778.1	Clay, yellowish-brown, silty, sandy, pebbly; rock at 219 feet, highly oxidized then turns grayish-brown with depth, first few feet may have been loess (till)
275-374	99	1,778.1-1,679.1	Clay, gray, silty, sandy, pebbly; rocks at 244, 246, 279, and 300 feet, unoxidized (till)
374-388	14	1,679.1-1,665.1	Sand, grayish-brown, fine to medium; hard, cemented, rig chatter
388-401	13	1,665.1-1,652.1	Clay, gray, silty; hard, smooth
401-416	15	1,652.1-1,637.1	Sand, gray, fine; hard, cemented, with many clay layers
416-422	6	1,637.1-1,631.1	Clay, gray and brown, silty, sandy, pebbly (till)
Well screened from 373 to 413 feet; 2-inch PVC screen and casing. Electric log available			

Local number: 124N52W9AAAC R
 Other identifier: R2-99-09
 Site identification number: 453234097095901
 Date of construction: 08-10-99
 Land surface altitude: 2,005 feet
 Total depth: 807 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	2,005-2,004	Clay, black, silty (topsoil)
1-25	24	2,004-1,980	Clay, brown, silty, sandy, pebbly; oxidized (till)
25-50	25	1,980-1,955	Clay, grayish-brown, silty, sandy, pebbly; partially oxidized (till)
50-86	36	1,955-1,919	Clay, gray, silty, sandy, pebbly; hard, gravel lens at 69 and 74 feet, unoxidized (till)
86-94	8	1,919-1,911	Gravel, coarse
94-110	16	1,911-1,895	Sand, brown, fine to medium, clayey
110-117	7	1,895-1,888	Gravel, coarse
117-145	28	1,888-1,860	Clay, grayish-brown to gray, silty, sandy, pebbly; unoxidized (till)
145-175	30	1,860-1,830	Clay, light-gray, dark-gray, brown, green and white, silty; greasy, layered, some calcareous zones (lake sediment)
175-192	17	1,830-1,813	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
192-197	5	1,813-1,808	Sand and gravel, coarse sand to fine gravel; oxidized
197-218	21	1,808-1,787	Clay, gray, silty; hard, greasy (lake sediment)
218-248	30	1,787-1,757	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
248-280	32	1,757-1,725	Clay, gray, silty, sandy, pebbly; unoxidized (till)
280-317	37	1,725-1,688	Clay, yellowish-brown, silty, sandy, pebbly; gravel lens from 295 to 298 feet, oxidized (till)
317-346	29	1,688-1,659	Clay, dark-gray, silty; hard, greasy (lake sediment)
346-348	2	1,659-1,657	Gravel
348-472	24	1,657-1,533	Clay, gray, silty, sandy, pebbly; rocks at 434, 446, and 454 feet, unoxidized (till)
472-484	12	1,533-1,521	Sand; cemented, rig chatter
484-508	24	1,521-1,497	Sand; cemented, with clay layers
508-512	4	1,497-1,493	Sand and gravel
512-574	62	1,493-1,431	Clay, gray, silty, sandy, pebbly; E-log signature change at 540 feet, unoxidized (till)
574-577	3	1,431-1,428	Gravel, coarse
577-688	11	1,428-1,317	Clay, gray, silty, sandy, pebbly; E-log signature change at 624 feet, unoxidized (till)
688-694	6	1,317-1,311	Sand, cemented
694-807	113	1,311-1,198	Clay, dark-gray to black, shaley; greasy, hard, noncalcareous (Pierre Shale)

Electric log available

Local number: 124N52W9AAAC2 R
 Other identifier: R2-99-10
 Site identification number: 453204097100202
 Date of construction: 08-11-99
 Land surface altitude: 2,003 feet
 Total depth: 132 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	2,003-2,002	Clay, black, silty (topsoil)
1-11	10	2,002-1,992	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
11-18	7	1,992-1,985	Clay, grayish-brown, silty, sandy, pebbly; partially oxidized (till)
18-20	2	1,985-1,983	Clay, gray, silty, sandy, pebbly; unoxidized (till)
20-24	4	1,983-1,979	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
24-87	63	1,979-1,916	Clay, gray, silty, sandy, pebbly; rock at 32 feet, unoxidized (till)
87-98	11	1,916-1,905	Sand and gravel, coarse sand to fine to medium gravel; some coarse gravel
98-102	4	1,905-1,901	Clay, gray, silty
102-132	30	1,901-1,871	Sand and gravel, coarse sand to fine gravel; much black shale
Well screened from 112 to 132 feet; 2-inch PVC screen and casing			

Local number: 124N52W29AAAA
 Other identifier: R2-98-35
 Site identification number: 453003097110901
 Date of construction: 09-01-98
 Land surface altitude: 1,965 feet
 Total depth: 720 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,965-1,964	Clay, black, silty (topsoil)
1-14	13	1,964-1,951	Sand and gravel, coarse sand to coarse gravel; rock at 14 feet, oxidized
14-26	12	1,951-1,939	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
26-48	22	1,939-1,917	Clay, grayish-brown, silty, sandy, pebbly; partially oxidized (till)
48-62	14	1,917-1,903	Clay, light-gray, very silty; greasy (loess)
62-92	30	1,903-1,873	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
92-125	33	1,873-1,840	Clay, grayish-brown, silty, sandy, pebbly; partially oxidized (till)
125-136	11	1,840-1,829	Clay, gray, silty, sandy, pebbly; unoxidized (till)
136-146	10	1,829-1,819	Clay, dark-brown, very silty; somewhat greasy, oxidized (loess)
146-153	7	1,819-1,812	Clay, very light-gray, very silty; unoxidized (loess)
153-178	25	1,812-1,787	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
178-229	51	1,787-1,736	Clay, gray, silty, sandy, pebbly; unoxidized (till)
229-239	10	1,736-1,726	Sand and gravel, medium sand to medium gravel; rock at 234 feet
239-262	23	1,726-1,703	Clay, gray, silty, sandy, pebbly, shaley; unoxidized (till)
262-380	118	1,703-1,585	Clay, gray, silty, sandy, pebbly, shaley; E-log signature differs from above interval, unoxidized (till)
380-450	70	1,585-1,515	Clay, gray, silty, sandy, pebbly, shaley
450-454	4	1,515-1,511	Sand, medium to coarse
454-597	143	1,511-1,368	Clay, gray, silty, sandy, pebbly, shaley; E-log signature differs from above interval, unoxidized (till)
597-720	123	1,368-1,245	Clay, gray, shaley; greasy, poor cuttings, unoxidized (Pierre Shale?)

Electric log available

Local number: 125N50W12ABCC R
 Other identifier: R2-97-23
 Site identification number: 453738096515401
 Date of construction: 07-15-97
 Land surface altitude: 1,120 feet
 Total depth: 142 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-28	28	1,120-1,092	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
28-38	10	1,092-1,082	Sand and gravel, coarse sand to fine gravel; some medium gravel, oxidized
38-41	3	1,082-1,079	Clay, dark-brown, silty, sandy, pebbly; unoxidized (till)
41-53	12	1,079-1,067	Gravel, fine to coarse
53-76	23	1,067-1,044	Clay, gray, silty, sandy, pebbly; unoxidized (till)
76-81	5	1,044-1,039	Clay, gray, very silty; soft, drilled fast, unoxidized (lake sediment)
81-92	11	1,039-1,028	Clay, brown, silty, pebbly; oxidized (till)
92-102	10	1,028-1,018	Clay, dark-gray, silty, very sandy, pebbly; unoxidized, may be some oxidized fracture zones (till)
102-118	16	1,018-1,002	Sand, medium to coarse; clay lens from 113 to 116 feet, some gravel from 116 to 118 feet
118-142	24	1,002-978	Clay, gray, shaley; hard, greasy, noncalcareous (Carlisle Shale)

Electric log available

Local number: 125N50W12ABCC2 R
 Other identifier: R2-97-43
 Site identification number: 453738096515402
 Date of construction: 08-25-97
 Land surface altitude: 1,120.8 feet
 Total depth: 62 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-25	25	1,120.8-1,095.8	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
25-62	37	1,095.8-1,058.8	Sand and gravel, medium sand to medium gravel

Well screened from 52 to 62 feet; 2-inch PVC casing and screen. For electric log see R2-97-23

Local number: 125N50W23CCCD R
 Other identifier: R2-97-22
 Site identification number: 453511096534301
 Date of construction: 07-14-97
 Land surface altitude: 1,160 feet
 Total depth: 142 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,160-1,159	Topsoil, black
1-18	17	1,159-1,142	Clay, yellowish-brown, silty, sandy, pebbly; color change to dark-brown at 14 feet, oxidized (till)
18-100	82	1,142-1,060	Clay, gray, silty, sandy, pebbly; rock at 20 feet, unoxidized (till)
100-112	12	1,060-1,048	Sand and gravel, coarse sand to fine gravel, rock from 110 to 112 feet
112-117	5	1,048-1,043	Clay, gray, silty; gritty, unoxidized, highly calcareous (Niobrara Formation)
117-142	25	1,043-1,018	Clay, gray, shaley; hard, greasy, noncalcareous, concretions at 135 and 139 feet (Carlile Shale)

Electric log available

Local number: 125N52W10BBBB R
 Other identifier: R2-97-21
 Site identification number: 453751097094901
 Date of construction: 07-08-97
 Land surface altitude: 1,970 feet
 Total depth: 82 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-4	4	1,970-1,966	Clay, tan, silty
4-8	4	1,966-1,962	Clay, gray, silty
8-10	2	1,962-1,960	Sand and gravel, brown
10-49	39	1,960-1,921	Clay, gray, silty, sandy, pebbly; rock at 14 feet, unoxidized (till)
49-52	3	1,921-1,918	Clay, brown, silty, sandy, pebbly; many cobbles, oxidized (till)
52-68	16	1,918-1,902	Gravel, coarse to very coarse; many cobbles from 61 to 68 feet
68-82	14	1,902-1,888	Clay, brown, very cobbly; with large boulders, abandoned hole because of caving gravel and cobbles (till?)

Local number: 125N52W16BABB R
 Other identifier: R2-99-07
 Site identification number: 453659097104601
 Date of construction: 07-21-99
 Land surface altitude: 1,990 feet
 Total depth: 942 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,990-1,988	Clay, black, silty (topsoil)
2-6	4	1,988-1,984	Sand, brown, fine; oxidized
6-10	4	1,984-1,980	Clay, tan, very silty; oxidized (lake sediment)
10-62	52	1,980-1,928	Clay, gray, very silty; greasy, unoxidized (lake sediment)
62-222	160	1,928-1,768	Clay, gray, very silty, sandy, pebbly; soft, gravelly from 190 to 200 feet, unoxidized (till)
222-400	178	1,768-1,590	Clay, yellowish-brown, silty, sandy, pebbly; oxidized then grades to unoxidized with depth (till)
400-420	20	1,590-1,570	Sand and gravel, coarse sand to fine gravel; cemented
420-522	102	1,570-1,468	Clay, grayish-brown to gray, silty, sandy, pebbly; rocks at 471, 481, 485, and 501 feet, gravel lens at 490 feet, hard (till)
522-661	139	1,468-1,329	Clay, brown and gray, silty, sandy, pebbly; hard, very poor cuttings (till)
661-676	15	1,329-1,314	Sand; very hard, cemented
676-847	171	1,314-1,143	Clay, brown and gray, silty, sandy, pebbly; hard, very poor cuttings, rocks at 680, 696, 715, 813, 832, 840, and 847 feet (till)
847-942	95	1,143-1,048	Clay, dark-gray to black, shaley; very hard, greasy, some bentonite noticed (Pierre Shale)
Electric log available			

Local number: 125N52W16BABB2 R
 Other identifier: R2-99-12
 Site identification number: 45365909097104502
 Date of construction: 08-18-99
 Land surface altitude: 1,987.9 feet
 Total depth: 424 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,987.9-1,985.9	Clay, black, silty (topsoil)
2-6	4	1,985.9-1,981.9	Sand, brown, fine; oxidized
6-10	4	1,981.9-1,977.9	Clay, tan, very silty; oxidized (lake sediment)
10-62	52	1,977.9-1,925.9	Clay, gray, very silty; greasy, unoxidized (lake sediment)
62-224	162	1,925.9-1,763.9	Clay, gray, very silty, sandy, pebbly; soft, sand lens from 152 to 156 feet, unoxidized (till)
224-405	181	1,763.9-1,582.9	Clay, yellowish-brown, silty, sandy, pebbly; oxidized then grades to unoxidized with depth (till)
405-419	14	1,582.9-1,568.9	Sand and gravel, coarse sand to fine gravel; cemented
419-424	5	1,568.9-1,563.9	Clay, grayish-brown to gray, silty, sandy, pebbly; hard (till)

Well screened from 403 to 423 feet; 2-inch PVC screen and casing

Local number: 126N49W11AABA R
 Other identifier: R2-97-42
 Site identification number: 454303096451701
 Date of construction: 08-20-97
 Land surface altitude: 1,109.7 feet
 Total depth: 262 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,109.7-1,107.7	Clay, black, silty (topsoil)
2-6	4	1,107.7-1,103.7	Clay, tan, silty; oxidized (loess)
6-35	29	1,103.7-1,074.7	Clay, yellowish-brown, silty, sandy, pebbly; grades to dark-brown then to grayish-brown, oxidized (till)
35-44	19	1,074.7-1,065.7	Clay, gray, silty, sandy, pebbly; soft, large cuttings, unoxidized (till)
44-68	24	1,065.7-1,041.7	Clay, gray, silty; greasy, unoxidized (lake sediment)
68-84	16	1,041.7-1,025.7	Sand and gravel, coarse sand to fine gravel
84-120	36	1,025.7-989.7	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 120 feet (till)
120-199	79	989.7-910.7	Clay, gray, silty, sandy, pebbly; unoxidized, different E-log signature than above interval, rock at 164 feet (till)
199-203	4	910.7-906.7	Gravel, fine to medium
203-232	29	906.7-877.7	Clay, gray, silty, sandy, pebbly, very gravelly; unoxidized (till)
232-256	24	877.7-853.7	Sand and gravel, coarse sand grading to fine to medium gravel; some coarse gravel
256-262	6	853.7-847.7	Clay, gray, silty, sandy, pebbly; unoxidized (till)

Well screened from 242 to 262 feet; 2-inch PVC casing and screen. For electric log see R2-97-41

Local number: 126N49W11ABAA R
 Other identifier: R2-97-41
 Site identification number: 454305096451901
 Date of construction: 08-18-19-97
 Land surface altitude: 1,111 feet
 Total depth: 522 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,111-1,109	Clay, black, silty (topsoil)
2-6	4	1,109-1,105	Clay, tan, silty (loess)
6-10	4	1,105-1,101	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
10-18	8	1,101-1,093	Clay, yellowish-brown, silty; greasy (lake sediment)
18-30	12	1,093-1,081	Clay, yellowish-brown, silty, sandy, pebbly; oxidized, grades to dark-brown by 25 feet (till)
30-36	6	1,081-1,075	Clay, grayish-brown, silty, sandy, pebbly; partially oxidized (till)
36-55	19	1,075-1,056	Clay, gray, silty, sandy, pebbly; unoxidized, some lake sediment inclusions (till)
55-66	11	1,056-1,045	Clay, gray, silty; soft, greasy, unoxidized (lake sediment)
66-84	18	1,045-1,027	Sand and gravel, medium to coarse sand to fine gravel
84-110	26	1,027-1,001	Clay, gray, silty, sandy, pebbly; unoxidized (till)
110-120	10	1,001-991	Clay, gray, silty; soft, greasy, unoxidized (lake sediment)
120-136	16	991-975	Sand and gravel, coarse sand to fine gravel
136-143	7	975-968	Clay, gray, silty; soft, greasy, unoxidized (lake sediment)
143-148	5	968-963	Sand, gray, fine to medium; unoxidized
148-206	58	963-905	Clay, gray, silty, sandy, pebbly; unoxidized, gravel lens at 188 and 197 feet (till)
206-260	54	905-851	Sand and gravel, medium to coarse sand to fine gravel
260-310	50	851-801	Clay, gray, sandy, pebbly; unoxidized (till)
310-409	99	801-702	Clay, gray, silty, sandy, pebbly; unoxidized, different E-log signature than above interval (till)
409-476	67	702-635	Clay, gray, silty, sandy, pebbly
476-498	22	635-613	Sand, white, fine to medium; mostly quartz, some mica (granite wash)
498-522	24	613-589	Clay, black with a purplish tinge, silty; very greasy, oily, noncalcareous (Graneros Shale)

Electric log available

Local number: 126N49W15ADDA R
 Other identifier: R2-97-24
 Site identification number: 454157096462501
 Date of construction: 07-15-97
 Land surface altitude: 990 feet
 Total depth: 222 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-6	6	990-984	Clay, black, silty (alluvium)
6-10	4	984-980	Clay, brown, light-gray and black layered; some pebbles (lake sediment)
10-12	2	980-978	Clay, black, silty (lake sediment)
12-19	7	978-971	Clay, light-gray, silty; calcareous, some fine sand, rocks at 17 and 19 feet
19-39	20	971-951	Sand, gray, fine; unoxidized
39-52	13	951-938	Clay, silt and sand, gray; alternating layers (lake sediment)
52-118	66	938-872	Clay, gray, shaley; soft, greasy, noncalcareous (Blue Hill Shale Member - Carlile Shale)
118-187	69	872-803	Clay, dark-brownish-gray; hard, some silty zones, some greasy zones, calcareous (Fairport Shale Member - Carlile Shale)
187-218	31	803-772	Siltstone, brown; some hard cherty layers, some white chalky layers, very calcareous (Greenhorn Limestone)
218-222	4	772-768	Clay, gray; greasy (Graneros Shale)

Local number: 126N50W6CCCC R
 Other identifier: R2-97-36
 Site identification number: 454306096584301
 Date of construction: 08-11-97
 Land surface altitude: 1,164 feet
 Total depth: 202 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,164-1,161	Clay, black (topsoil)
3-32	29	1,161-1,132	Clay, yellowish-brown, silty, sandy, pebbly; covered by several feet of loess, oxidized (till)
32-38	6	1,132-1,126	Clay, reddish-brown, silty, sandy, pebbly; oxidized (till)
38-67	29	1,126-1,097	Clay, gray, silty, sandy, pebbly; soft, large cuttings, unoxidized (till)
67-96	29	1,097-1,068	Sand and gravel, coarse sand to fine gravel; mostly shale pebbles
96-104	8	1,068-1,060	Clay, gray, silty, sandy, pebbly; unoxidized (till)
104-165	61	1,060-999	Sand, gray, fine to medium; some silt and clay layers, unoxidized
165-202	37	999-962	Clay, gray, shaley; hard, greasy, noncalcareous, concretion from 187 to 188 feet (Carlisle Shale)

Electric log available

Local number: 126N51W27BBBB R
 Other identifier: R2-97-05
 Site identification number: 454030097021901
 Date of construction: 06-11-97
 Land surface altitude: 1,215 feet
 Total depth: 62 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,215-1,213	Topsoil, black
2-15	14	1,213-1,200	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
15-37	21	1,200-1,178	Clay, gray, silty, sandy, pebbly; unoxidized (till)
37-62	25	1,178-1,153	Clay, gray, shaley; hard, greasy (Pierre Shale)

Electric log available

Local number: 126N52W1DDDD R
 Other identifier: R2-97-09
 Site identification number: 454305097060901
 Date of construction: 06-17-97
 Land surface altitude: 1,252 feet
 Total depth: 82 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,252-1,250	Topsoil, black
2-24	22	1,250-1,228	Clay, tan to brown, silty, sandy; turns grayish-brown at 17 feet, very shaley with depth (till?)
24-27	3	1,228-1,225	Sand, fine
27-52	25	1,225-1,200	Clay, tan to white, shaley; hard, greasy, mottled, turns darker brown to grayish-brown with depth (weathered Pierre Shale)
52-82	30	1,200-1,170	Clay, gray, shaley; hard, greasy, good cuttings (Pierre Shale)
Electric log available			

Local number: 126N52W20CCCB R
 Other identifier: R2-99-08
 Site identification number: 454033097122101
 Date of construction: 07-28-99
 Land surface altitude: 2,035 feet
 Total depth: 747 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	2,035-2,033	Clay, brown, silty, gravelly (topsoil)
2-36	34	2,033-1,999	Sand and gravel, brown, medium sand grading to coarse gravel with depth; some cobbles, oxidized
36-75	34	1,999-1,960	Clay, gray, silty, sandy, pebbly; hard, unoxidized (till)
75-83	8	1,960-1,952	Clay, tan, silty; oxidized (loess)
83-108	85	1,952-1,927	Clay, yellowish-brown, silty, sandy, pebbly; dark-brown at 96 feet, oxidized (till)
108-124	16	1,927-1,911	Clay, dark-brown and gray, very silty; greasy, layered (lake sediment)
124-184	60	1,911-1,851	Clay, yellowish-brown, silty, sandy, pebbly; rock at 126 feet, oxidized (till)
184-282	98	1,851-1,753	Clay, light-gray to gray with brown oxidation zones, silty, sandy, pebbly; partially oxidized (till)
282-286	4	1,753-1,749	Gravel
286-466	180	1,749-1,569	Clay, gray, silty, sandy, pebbly; rock at 314 feet, unoxidized (till)
466-476	10	1,569-1,559	Sand and gravel, coarse sand to fine gravel
476-627	151	1,559-1,408	Clay, gray, silty, sandy, pebbly, shaley; hard, unoxidized (till)
627-637	10	1,408-1,398	Sand; hard
637-720	83	1,398-1,315	Clay, gray, silty, sandy, pebbly, shaley; hard rocks at 670, 677, 685, 686, 689, 696, 699 to 702, 703, 705, 707, 709, 710, 715, 717, and 719 feet, unoxidized, poor cuttings (till)
720-747	27	1,315-1,288	Clay, dark-gray, shaley; hard, greasy (Pierre Shale)
Electric log available			

Local number: 127N48W21DDDC R
 Other identifier: R2-97-44
 Site identification number: 454541096400501
 Date of construction: 08-25-97
 Land surface altitude: 1,090 feet
 Total depth: 282 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,090-1,088	Clay, black, silty (topsoil)
2-6	4	1,088-1,084	Clay, tan, silty; oxidized (loess)
6-10	4	1,084-1,080	Sand, brown, medium; dirty, oxidized
10-28	18	1,080-1,062	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
28-60	32	1,062-1,030	Sand, brown, fine to medium; oxidized
60-72	12	1,030-1,018	Sand, gray, fine to medium; unoxidized
72-85	13	1,018-1,005	Clay, gray, silty; greasy, unoxidized (lake sediment)
85-114	29	1,005-976	Clay, gray, silty, sandy, pebbly; unoxidized (till)
114-123	9	976-967	Sand and gravel, coarse sand to fine gravel; rock at 116 feet
123-192	69	967-898	Clay, gray, silty, sandy, pebbly; gravel lens from 138 to 142 feet, and 148 to 150 feet, very gravelly clay from 151 to 155 feet, unoxidized (till)
192-207	15	898-883	Clay, gray, very silty; hard, greasy, unoxidized (lake sediment)
207-226	19	883-864	Sand, gray, medium to coarse; rock at 220 feet
226-241	15	864-849	Clay, gray; oily, greasy, calcareous (Fairport Shale Member - Carlile Shale)
241-272	31	849-818	Siltstone, brown; with brown and white silty clay layers, hard, cherty, very calcareous (Greenhorn Limestone)
272-282	10	818-808	Clay, gray; hard, greasy, slightly calcareous (Graneros Shale)

Electric log available

Local number: 127N48W28AAAA R
 Other identifier: R2-97-45
 Site identification number: 454541096400502
 Date of construction: 08-26-97
 Land surface altitude: 1,090.8 feet
 Total depth: 72 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,090.8-1,088.8	Clay, black, silty (topsoil)
2-8	6	1,088.8-1,082.8	Clay, tan, silty; oxidized (loess)
8-28	20	1,082.8-1,062.8	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
28-60	22	1,062.8-1,030.8	Sand, brown, fine to medium; oxidized
60-72	12	1,030.8-1,018.8	Sand, gray, fine to medium; unoxidized
Well screened from 62 to 72 feet; 2-inch PVC casing and screen. For electric-log see R2-97-44			

Local number: 127N49W21DDDC R
 Other identifier: R2-97-40
 Site identification number: 454541096473901
 Date of construction: 08-12-97
 Land surface altitude: 1,092 feet
 Total depth: 282 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,092-1,090	Clay, black, silty (topsoil)
2-26	24	1,090-1,066	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
26-30	4	1,066-1,062	Clay, brown, silty; oxidized (lake sediment)
30-35	5	1,062-1,057	Clay, grayish-brown to gray, silty; hard, greasy (lake sediment)
35-60	25	1,057-1,032	Sand and gravel, fine to very fine sand grading to coarse sand to very fine gravel
60-92	32	1,032-1,000	Clay, gray, very silty; greasy, unoxidized, sand lens from 78 to 80 feet (lake sediment)
92-114	22	1,000-978	Clay, gray, silty, sandy, pebbly; hard, gravelly, unoxidized (till)
114-145	31	978-947	Clay, gray, silty, sandy; very hard, very few pebbles, many shale inclusions, rock at 138 feet, unoxidized (till)
145-148	3	947-944	Gravel, fine to medium
148-158	10	944-934	Clay, light-gray, silty, very sandy, pebbly (till)
158-190	32	934-902	Clay, greenish-brown, silty, sandy, pebbly; rocks at 164 and 175 feet. highly oxidized (till)
190-220	30	902-872	Clay, dark-gray, silty; hard, greasy, poor cuttings (till? or lake sediment?)
220-270	50	872-822	Clay, brownish-black, silty; oily, greasy, chalky, calcareous (Fairport Shale Member - Carlile Shale)
270-282	12	822-810	Siltstone, brown, hard; some brown and white clay layers, cherty, very calcareous, rig chatter (Greenhorn Limestone)
Electric log available			

Local number: 127N50W7BBBB R
 Other identifier: R2-97-37
 Site identification number: 454817096584601
 Date of construction: 08-11-97
 Land surface altitude: 1,168 feet
 Total depth: 222 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,168-1,165	Clay, black, silty (topsoil)
3-14	11	1,165-1,154	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
14-18	4	1,154-1,150	Clay, grayish-brown, silty, sandy, pebbly; partially oxidized (till)
18-82	64	1,150-1,086	Clay, gray, silty, sandy, pebbly; soft, greasy, large cuttings, sand lens from 65 to 67 feet, unoxidized (till)
82-88	6	1,086-1,080	Clay, gray, silty; greasy (lake sediment)
88-196	108	1,080-1,072	Sand, gray, fine, silty; unoxidized
96-104	8	1,072-1,064	Clay, gray, silty; greasy (lake sediment)
104-110	6	1,064-1,058	Sand, gray, fine, silty; unoxidized
110-119	9	1,058-1,049	Clay, gray, silty, sandy; unoxidized (till?)
119-126	7	1,049-1,042	Sand and gravel, coarse sand to fine to medium gravel; rock at 125 feet
126-177	51	1,042-991	Clay, gray, silty, sandy, pebbly; hard, softer from 163 to 172 feet, unoxidized (till)
177-183	6	991-985	Gravel, medium to coarse
183-222	39	985-946	Clay, dark-gray, shaley; hard, greasy (Carlisle Shale)

Electric log available

Local number: 127N50W9AAAA R
 Other identifier: R2-97-38
 Site identification number: 454818096550601
 Date of construction: 08-12-97
 Land surface altitude: 1,119 feet
 Total depth: 162 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,119-1,117	Clay, black, silty (topsoil)
2-25	23	1,117-1,094	Clay, yellowish-brown, silty, sandy, pebbly; gravel lens from 23 to 24 feet, oxidized (till)
25-58	33	1,094-1,061	Clay, gray, silty, sandy, pebbly; unoxidized (till)
58-85	27	1,061-1,034	Sand and gravel, gray, fine to medium sand grading to medium gravel, rock at 84 feet
85-135	50	1,034-984	Clay, gray, silty, sandy, pebbly; rocks at 98, 130, and 132 feet, gravel lens at 116 and 124 feet, unoxidized (till)
135-162	27	984-957	Clay, dark-gray, shaley; hard greasy, noncalcareous (Carlisle Shale)

Electric log available

Local number: 127N50W9AAAA2 R
 Other identifier: R2-97-39
 Site identification number: 454818096550602
 Date of construction: 08-12-97
 Land surface altitude: 1,119.2 feet
 Total depth: 82 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,119.2-1,117.2	Clay, black, silty (topsoil)
2-25	23	1,117.2-1,094.2	Clay, yellowish-brown, silty, sandy, pebbly; rock at 20 feet, oxidized (till)
25-62	37	1,094.2-1,057.2	Clay, gray, silty, sandy, pebbly; unoxidized (till)
62-82	20	1,057.2-1,037.2	Sand and gravel, coarse sand to fine gravel

Well screened from 72 to 82 feet; 2-inch PVC casing and screen. For electric log see R2-97-38

Local number: 127N51W9AAAA R
 Other identifier: R2-97-06
 Site identification number: 454820097023601
 Date of construction: 06-11-97
 Land surface altitude: 1,188 feet
 Total depth: 242 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,188-1,185	Topsoil, black
3-6	3	1,185-1,182	Clay, tan, very silty (loess)
6-18	12	1,182-1,170	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
18-21	3	1,170-1,167	Clay, gray, silty, sandy, pebbly; unoxidized (till)
21-24	3	1,167-1,164	Clay, dark-brown, silty, sandy, pebbly; oxidized, rock at 23 feet (till)
24-67	43	1,164-1,121	Clay, gray, silty, sandy, pebbly; large cuttings, unoxidized, gravel lens from 55 to 57 feet and 58 to 59 feet (till)
67-99	32	1,121-1,089	Sand and gravel, medium sand to fine gravel; some medium to coarse gravel, much shale
99-143	44	1,089-1,045	Clay, gray, silty, sandy, pebbly; unoxidized (till)
143-177	34	1,045-1,011	Clay, gray, very silty, sandy; some fine sand layers (lake sediment)
177-208	31	1,011-980	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 206 feet (till)
208-242	34	980-946	Clay, gray, shaley; greasy, noncalcareous (Carlile Shale)
Electric log available			

Local number: 127N51W9AAAA2 R
 Other identifier: R2-97-07
 Site identification number: 454820097023602
 Date of construction: 06-11-97
 Land surface altitude: 1,188.7 feet
 Total depth: 102 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,188.7-1,185.7	Topsoil, black
3-24	21	1,185.7-1,164.7	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
24-67	43	1,164.7-1,121.7	Clay, gray, silty, sandy, pebbly; oxidized (till)
67-102	35	1,121.7-1,086.7	Sand and gravel, medium sand to fine gravel; some medium to coarse gravel, much shale

Well screened from 92 to 102 feet; 2-inch PVC screen and casing. Electric log available

Local number: 127N51W21DDDA R
 Other identifier: R2-97-08
 Site identification number: 454543097022701
 Date of construction: 06-16-97
 Land surface altitude: 1,155 feet
 Total depth: 155 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,155-1,152	Topsoil, black
3-5	2	1,152-1,150	Gravel and cobbles
5-15	10	1,150-1,140	Clay, brown, silty, sandy, pebbly; oxidized (till)
15-90	75	1,140-1,065	Clay, gray, silty, sandy, pebbly; sand lens from 80 to 82 feet (till)
90-122	32	1,065-1,033	Sand, gray, fine; unoxidized
122-135	13	1,033-1,020	Clay, gray, silty; very silty to sandy from 127 to 135 feet (lake sediments)
135-155	20	1,020-1,000	Clay, gray; hard, greasy, noncalcareous, concretion at 147 feet (Carlile Shale)

Electric log available

Local number: 127N52W4DCDC R
 Other identifier: R2-97-19
 Site identification number: 454819097102101
 Date of construction: 07-07-97
 Land surface altitude: 1,231 feet
 Total depth: 102 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-5	5	1,231-1,226	Clay, tan, silty; oxidized (alluvium)
5-12	7	1,226-1,219	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
12-53	41	1,219-1,178	Clay, gray, silty, sandy, pebbly; large cuttings, unoxidized (till)
53-58	5	1,178-1,173	Clay, gray, very silty; unoxidized (lake clay)
58-66	8	1,173-1,165	Sand and gravel, coarse sand to fine gravel
66-74	8	1,165-1,157	Clay, gray, silty, sandy, pebbly; unoxidized (till)
74-102	28	1,157-1,129	Clay, gray; hard, greasy, noncalcareous (Pierre Shale)
Electric log available			

Local number: 127N52W25AAAA R
 Other identifier: R2-97-10
 Site identification number: 454538097061101
 Date of construction: 06-17-97
 Land surface altitude: 1,182 feet
 Total depth: 182 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,182-1,180	Topsoil, black
2-7	5	1,180-1,175	Clay, brown, very silty; oxidized
7-9	2	1,175-1,173	Clay, gray, very silty; unoxidized
9-39	30	1,173-1,143	Sand and gravel, medium sand to fine gravel
39-58	19	1,143-1,124	Clay, gray, silty, sandy, pebbly; unoxidized (till)
58-100	42	1,124-1,082	Clay, gray, shaley; hard, greasy, noncalcareous (Pierre Shale)
100-151	51	1,082-1,031	Clay, black, shaley; hard, gritty, oily, noncalcareous (Sharon Springs Member- Pierre Shale)
151-157	6	1,031-1,025	Clay, gray, silty; hard, calcareous (Niobrara Formation?)
157-182	25	1,025-1,000	Clay, gray, shaley; hard, greasy (Carlile Shale)
Electric log available			

Local number: 127N52W25AAAA2 R
 Other identifier: R2-97-11
 Site identification number: 454538097061102
 Date of construction: 06-17-97
 Land surface altitude: 1,182.4 feet
 Total depth: 42 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,182.4-1,180.4	Topsoil, black
2-9	7	1,180.4-1,173.4	Clay, brown, very silty, sandy; oxidized
9-12	3	1,173.4-1,170.4	Clay, gray, silty, sandy; unoxidized
12-36	24	1,170.4-1,146.4	Sand and gravel, fine sand grading to fine to medium gravel
36-42	6	1,146.4-1,140.4	Clay, gray, silty
Well screened from 23.1 to 33.1 feet; 2-inch PVC casing and screen. For electric log see R2-97-10			

Local number: 128N48W19BCCC R
 Other identifier: R2-97-30
 Site identification number: 455123096434701
 Date of construction: 07-28-97
 Land surface altitude: 1,078.6 feet
 Total depth: 234 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,078.6-1,077.6	Topsoil, black, sandy
1-8	7	1,077.6-1,070.6	Sand, brown, fine; oxidized
8-25	17	1,070.6-1,053.6	Clay, brown, silty, very, sandy, pebbly; oxidized (till)
25-76	51	1,053.6-1,002.6	Sand, gray, very fine to fine; grades into lake sediment with depth, some clay layers, unoxidized
76-102	26	1,002.6-976.6	Clay, gray, very silty, sandy; greasy, unoxidized (lake sediment)
102-108	6	976.6-970.6	Sand, gray, fine; unoxidized
108-135	27	970.6-943.6	Clay, gray, silty, sandy, pebbly; unoxidized (till)
135-151	16	943.6-927.6	Clay, dark-gray, silty, very sandy, pebbly; harder than above interval, unoxidized rock at 144 feet (till)
151-168	17	927.6-910.6	Gravel, fine to coarse; cobbly
168-185	17	910.6-893.6	Clay, brown and gray, silty, sandy; alternating layers (lake sediments)
185-229	44	893.6-849.6	Sand, coarse; rig chatter, possibly cemented
229-233	4	849.6-845.6	Clay, dark-grayish-brown, silty; hard calcareous (Fairport Shale Member - Carlile Shale)
233-234	1	845.6-844.6	Siltstone; hard, cherty, calcareous (Greenhorn Limestone)

Well screened from 207 to 227 feet; 2-inch PVC casing and screen. Rosholt has installed a city well very near this observation well

Local number: 128N48W30BBBB R
 Other identifier: R2-97-29
 Site identification number: 455055096434801
 Date of construction: 07-23-97
 Land surface altitude: 1,092 feet
 Total depth: 252 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,092-1,091	Topsoil, black
1-10	9	1,091-1,082	Sand, yellowish-brown, fine to medium, silty, clayey; dirty, oxidized
10-20	10	1,082-1,072	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
20-32	12	1,072-1,060	Sand, brown, fine to medium; oxidized
32-65	33	1,060-1,027	Sand, gray, fine to medium; unoxidized
65-70	5	1,027-1,022	Clay, gray, silty; greasy, unoxidized (lake sediment)
70-78	8	1,022-1,014	Sand, gray, fine to medium; unoxidized
78-113	35	1,014-979	Clay, gray, silty; greasy, unoxidized (lake sediments)
113-144	31	979-948	Clay, gray, silty, sandy, pebbly; rock at 132 feet, unoxidized (till)
144-185	41	948-907	Clay, gray, silty, sandy, pebbly; harder than above interval, with a differing E-log signature, unoxidized (till)
185-194	9	907-898	Clay, gray, green, and brown, silty, sandy; alternating layers (lake sediment)
194-248	54	898-844	Sand and gravel, coarse sand to fine gravel
248-252	4	844-840	Siltstone; hard, cherty, calcareous, fractured, lost all of the drilling fluid, drill stem stuck in hole, abandoned hole (Greenhorn Limestone)

Electric log available to 180 feet; abandoned hole when circulation could not be established

Local number: 128N49W1DDAD R
 Other identifier: R2-97-31
 Site identification number: 455341096434701
 Date of construction: 07-29-97
 Land surface altitude: 1,072 feet
 Total depth: 262 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-4	4	1,072-1,068	Clay, black, silty (topsoil and alluvium)
4-20	16	1,068-1,052	Sand, brown, coarse; oxidized
20-24	4	1,052-1,048	Clay, brown, silty, sandy, pebbly; oxidized (till)
24-54	30	1,048-1,018	Sand, gray, fine, unoxidized
54-71	17	1,018-1,001	Silt, sand and clay, gray; very clayey from 54 to 62 feet, alternating layers (lake sediment)
71-102	31	1,001-970	Clay, gray, silty; greasy, unoxidized (lake sediment)
102-117	15	970-955	Clay, gray, silty, sandy, pebbly; unoxidized (till)
117-138	21	955-934	Gravel, fine to medium
138-204	66	934-868	Clay, gray, silty, sandy, pebbly; unoxidized, many cobbles, gravel lens from 167 to 168 feet and 170 to 172 feet (till)
204-262	58	868-810	Clay, gray, silty; greasy, some calcareous zones (Graneros Shale?)

Electric log available

Local number: 128N49W1DDAD2 R
 Other identifier: R2-97-32
 Site identification number: 455341096435001
 Date of construction: 07-29-97
 Land surface altitude: 1,071.7 feet
 Total depth: 142 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-4	4	1,071.7-1,067.7	Clay, black, silty (topsoil and alluvium)
4-35	31	1,067.7-1,036.7	Sand, yellowish-brown, fine to coarse; some fine gravel, oxidized
35-57	22	1,036.7-1,014.7	Sand, gray, fine; some clay layers, unoxidized
57-100	43	1,014.7-971.7	Clay, gray, silty, sandy; greasy, unoxidized (lake sediment)
100-130	30	971.7-941.7	Clay, gray, silty, sandy, pebbly; sand lens at 117 feet, unoxidized (till)
130-142	12	941.7-929.7	Sand and gravel, coarse sand to fine to medium gravel

Well screened from 132 to 142 feet; 2-inch PVC casing and screen. For electric log see R2-97-31

Local number: 128N49W21DDAD R
 Other identifier: R2-97-35
 Site identification number: 455104096473501
 Date of construction: 08-05-97
 Land surface altitude: 1,076 feet
 Total depth: 322 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,076-1,075	Clay, black (topsoil)
1-16	15	1,075-1,060	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
16-26	10	1,060-1,050	Sand, brown, medium to coarse; oxidized
26-59	33	1,050-1,017	Sand, gray, fine; some very silty zones, unoxidized
59-70	11	1,017-1,006	Clay, gray, silty; greasy, unoxidized (lake sediment)
70-77	7	1,006-999	Sand, gray, fine, silty; unoxidized
77-94	17	999-982	Clay, gray, silty; greasy, unoxidized (lake sediment)
94-106	12	982-970	Clay, gray, silty, sandy, pebbly; unoxidized (till)
106-112	6	970-964	Gravel, medium to coarse; rock at 110 feet
112-118	6	964-958	Clay, gray, silty, sandy, pebbly; unoxidized (till)
118-138	20	958-938	Gravel, fine to coarse
138-160	22	938-916	Sand, medium to coarse
160-183	23	916-893	Clay, gray, silty, sandy, pebbly; unoxidized (till)
183-240	57	893-836	Sand and gravel, coarse sand to fine gravel
240-291	51	836-785	Sand, medium to coarse; hard, cemented
291-294	3	785-782	Gravel and boulders
294-322	28	782-754	Clay, dark-gray; greasy, calcareous (Graneros Shale)

Electric log available

Local number: 128N50W1DDDC R

Other identifier: R2-97-28

Site identification number: 455334096512001

Date of construction: 07-22-97

Land surface altitude: 1,093 feet

Total depth: 222 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,093-1,900	Clay, black (topsoil)
3-17	14	1,090-1,076	Clay, tan to yellowish-brown, silty, sandy; oxidized (loess or lake sediment?)
17-20	3	1,076-1,073	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
20-24	4	1,073-1,069	Clay, gray, silty, sandy, pebbly; unoxidized (till)
24-36	12	1,069-1,057	Sand, gray, fine, silty; unoxidized
36-64	28	1,057-1,029	Silt, sand, and clay, gray; alternating layers (lake sediment)
64-70	6	1,029-1,023	Sand, gray, fine; unoxidized
70-86	14	1,023-1,007	Clay, gray, silty; greasy, unoxidized (lake sediment)
86-120	34	1,007-973	Clay, gray, silty, sandy, pebbly; rocks and gravel from 91 to 95 feet, gravel lens from 108 feet, unoxidized (till)
120-125	5	973-968	Sand and gravel, coarse sand to medium gravel
125-163	38	968-930	Clay, gray, silty, sandy, pebbly; unoxidized (till)
163-168	5	930-925	Sand and gravel, medium sand to fine gravel
168-180	12	925-913	Clay, gray, silty; greasy, unoxidized, some sandy zones (lake sediment)
180-194	14	913-899	Clay, gray, silty, sandy, pebbly; unoxidized (till)
194-198	4	899-895	Sand and gravel, coarse sand to fine gravel
198-222	24	895-871	Clay, dark-gray to brownish-black; hard, greasy, calcareous (Carlisle Shale)

Electric log available

Local number: 128N50W25AAAB R
 Other identifier: R2-97-25
 Site identification number: 455058096511801
 Date of construction: 07-21-97
 Land surface altitude: 1,096 feet
 Total depth: 258 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,096-1,095	Clay, black (topsoil)
1-10	9	1,095-1,086	Clay, tan, silty (roadfill and loess)
10-19	9	1,086-1,077	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
19-22	3	1,077-1,074	Clay, gray, silty, sandy, pebbly; unoxidized (till)
22-62	40	1,074-1,034	Sand, gray, fine to medium; unoxidized clay layers from 42 to 50 feet
62-83	21	1,034-1,013	Clay, gray, very silty; unoxidized (lake sediment)
83-92	9	1,013-1,004	Sand, gray, fine to medium; unoxidized
92-122	30	1,004-974	Clay, gray, silty, sandy, pebbly; unoxidized, rocks at 90, 92, 105, and 122 feet, shale gravel lens at 105 feet (till)
122-210	88	974-886	Sand and gravel, coarse sand to fine to medium gravel; many clay layers and clayey zones
210-222	12	886-874	Clay, gray, silty, sandy, pebbly; unoxidized (till)
222-248	26	874-848	Gravel, coarse to very coarse; with cobbles
248-256	8	848-840	Clay, dark-gray; hard, greasy, calcareous (Fairport Shale Member - Carlile Shale)
256-258	2	840-838	Siltstone, brown; very hard, cherty, very calcareous (Greenhorn Limestone)

Electric log available

Local number: 128N50W25AAAB2 R
 Other identifier: R2-97-26
 Site identification number: 455058096511802
 Date of construction: 07-22-97
 Land surface altitude: 1,095.9 feet
 Total depth: 202 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-17	17	1,095.9-1,078.9	Clay, tan to yellowish-brown, silty (loess over oxidized till)
17-26	9	1,078.9-1,069.9	Clay, gray, silty, sandy, pebbly; unoxidized (till)
26-67	41	1,069.9-1,028.9	Sand, gray, very fine to fine, unoxidized
67-96	29	1,028.9-999.9	Clay, gray, very silty, sandy; unoxidized, gravel lens near bottom of interval (lake sediment)
96-130	34	999.9-965.9	Clay, gray, silty, sandy, pebbly; unoxidized, gravel lens at 107 feet (till)
130-202	72	965.9-893.9	Sand and gravel, coarse sand to fine to medium gravel; some clay layers

Well screened from 190 to 200 feet; 2-inch PVC casing and screen. For electric-log see R2-97-25. North of two wells

Local number: 128N50W25AAAB3 R
 Other identifier: R2-97-27
 Site identification number: 455058096511803
 Date of construction: 07-22-97
 Land surface altitude: 1,095.4 feet
 Total depth: 62 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-18	18	1,095.4-1,077.4	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
18-27	9	1,077.4-1,068.4	Clay, gray, silty, sandy, pebbly; unoxidized (till)
27-62	35	1,068.4-1,033.4	Sand, gray, very fine to fine; unoxidized

Well screened from 52 to 62 feet; 2-inch PVC casing and screen. For electric log see R2-97-25. South of two wells

Local number: 128N50W28AAAA R
 Other identifier: R2-97-14
 Site identification number: 455054096550201
 Date of construction: 06-24-97
 Land surface altitude: 1,102 feet
 Total depth: 342 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,102-1,092	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
10-17	7	1,092-1,085	Clay, gray, silty, sandy, pebbly; unoxidized (till)
17-20	3	1,085-1,082	Sand and gravel, medium sand to fine gravel
20-36	16	1,082-1,066	Clay, gray, very silty, sandy; unoxidized
36-62	26	1,066-1,040	Sand, gray, fine; unoxidized
62-114	52	1,040-988	Clay, gray, silty, very sandy, pebbly; sand lens 75 to 80 feet and 99 to 102 feet, unoxidized (till)
114-126	12	988-976	Sand, gray, fine; unoxidized
126-202	76	976-900	Clay, gray, silty, sandy, pebbly; rocks at 137 and 152 feet, unoxidized (till)
202-223	21	900-879	Sand and gravel, medium sand to fine gravel; clay layer from 218 to 222 feet
223-261	38	879-841	Clay, dark-gray, silty; gritty, calcareous (Fairport Shale Member - Carlile Shale)
261-296	35	841-806	Clay, brownish-gray to dark-gray, silty; some white calcareous layers, some hard calcareous limestone layers, very calcareous (Greenhorn Limestone)
296-342	46	806-760	Clay, dark-gray, shaley; hard, greasy (Graneros Shale)
Electric log available			

Local number: 128N50W30BABB R
 Other identifier: R2-97-13
 Site identification number: 455054096582101
 Date of construction: 06-23-97
 Land surface altitude: 1,172 feet
 Total depth: 242 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,172-1,171	Topsoil, black
1-21	20	1,171-1,151	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
21-86	65	1,151-1,086	Clay, gray, silty, sandy, pebbly; large cuttings, unoxidized, (till)
86-98	12	1,086-1,074	Sand and gravel; clay layer 89 to 92 feet
98-193	95	1,074-979	Clay, gray, silty, sandy, pebbly; rock at 107 feet, smaller cuttings than above till interval, hard, unoxidized, gravel lens 130 to 134 feet, 147 to 151 feet, 155 to 157 feet, 164 to 167 feet, 187 to 190 feet, and 191 to 193 feet (till)
193-242	49	979-930	Clay, dark-gray, shaley; hard, greasy (Carlile Shale)
Electric log available			

Local number: 128N51W27BBBB R
 Other identifier: R2-97-12
 Site identification number: 455056097023101
 Date of construction: 06-18-97
 Land surface altitude: 1,222 feet
 Total depth: 282 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,222-1,220	Topsoil, black
2-20	18	1,220-1,202	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
20-24	4	1,202-1,198	Clay, gray, very silty; greasy (lake clay inclusion)
24-112	88	1,198-1,110	Clay, gray, silty, sandy, pebbly; large cuttings, unoxidized (till)
112-144	32	1,110-1,078	Sand and gravel, coarse sand grading to fine gravel; some coarse gravel and cobbles near base of interval
144-172	28	1,078-1,050	Clay, gray, very silty; greasy (lake clay)
172-216	44	1,050-1,006	Sand, gray, very fine to fine; unoxidized
216-247	31	1,006-975	Clay, gray, silty, sandy, pebbly; some gravel lens, unoxidized (till)
247-282	35	975-940	Clay, dark-gray, shaley; very hard, greasy, noncalcareous (Carlile Shale)
Electric log available			

Local number: 128N52W1DDDD R
 Other identifier: R2-97-15
 Site identification number: 455332097061301
 Date of construction: 06-25-97
 Land surface altitude: 1,204 feet
 Total depth: 262 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,204-1,203	Topsoil, black
1-30	29	1,203-1,174	Clay, yellowish-brown, silty, sandy, pebbly; turns grayish-brown at 10 feet, some reddish-brown from 17 to 19 feet, oxidized (till)
30-74	44	1,174-1,130	Clay, gray, silty, sandy, pebbly; large cuttings, unoxidized, fine gravel lens from 34 to 37 feet (till)
74-100	26	1,130-1,104	Clay, gray, very silty; unoxidized, sand content increased with depth (lake sediment)
100-168	68	1,104-1,036	Sand, gray, fine; unoxidized
168-208	40	1,036-996	Clay, gray, very silty, sandy; layered, unoxidized (lake sediment)
208-235	27	996-969	Clay, gray, silty, sandy, pebbly; unoxidized (till)
235-262	27	969-942	Clay, dark-gray, shaley; hard, greasy, noncalcareous, concretion at 237 feet (Carlile Shale)

Electric log available

Local number: 128N52W1DDDD2 R
 Other identifier: R2-97-18
 Site identification number: 455335097061501
 Date of construction: 07-02-97
 Land surface altitude: 1,204.2 feet
 Total depth: 162 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,204.2-1,203.2	Topsoil, black
1-30	29	1,203.2-1,174.2	Clay, yellowish-brown, silty, sandy, pebbly; turns grayish-brown at 10 feet, some reddish-brown from 17 to 19 feet, oxidized (till)
30-74	44	1,174.2-1,130.2	Clay, gray, silty, sandy, pebbly; large soft cuttings, unoxidized (till)
74-100	26	1,130.2-1,104.2	Clay, gray, very silty, unoxidized (lake sediment)
100-162	62	1,104.2-1,042.2	Sand, gray, fine; unoxidized

Well screened from 152 to 162 feet; 2-inch PVC casing and screen. For electric log see R2-97-15

Local number: 128N52W3CCCB R
 Other identifier: R2-97-16
 Site identification number: 455337097095501
 Date of construction: 06-30-97
 Land surface altitude: 1,195 feet
 Total depth: 242 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,195-1,193	Topsoil, black
2-30	28	1,193-1,165	Clay, yellowish-brown, silty, sandy, pebbly; turns grayish-brown at 25 feet, oxidized (till)
30-48	18	1,165-1,147	Clay, gray, silty, sandy, pebbly; unoxidized, gravel lens from 34 to 38 feet and 44 to 48 feet (till)
48-70	22	1,147-1,125	Clay, gray, very silty; greasy, unoxidized (lake clay)
70-112	42	1,125-1,083	Clay, gray, very silty, sandy; sand layers common, unoxidized (lake sediment)
112-146	34	1,083-1,049	Sand, gray, fine; unoxidized
146-174	28	1,049-1,021	Silt and sand; alternating layers (lake sediment)
174-211	37	1,021-984	Clay, gray, silty, sandy, pebbly; contains many gravel lens, unoxidized (till)
211-242	31	984-953	Clay, dark-gray, shaley; hard, greasy, noncalcareous (Carlisle Shale)

Electric log available

Local number: 128N52W3CCCB2 R
 Other identifier: R2-97-17
 Site identification number: 455337097095502
 Date of construction: 07-01-97
 Land surface altitude: 1,194.8 feet
 Total depth: 142 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,194.8-1,192.8	Topsoil, black
2-30	28	1,192.8-1,164.8	Clay, yellowish-brown, silty, sandy, pebbly; gravel lens from 6 to 8 feet and 27 to 29 feet, oxidized (till)
30-44	14	1,164.8-1,150.8	Clay, gray, silty, sandy, pebbly; gravel lens from 34 to 38 feet, unoxidized (till)
44-52	8	1,150.8-1,142.8	Gravel, fine
52-70	18	1,142.8-1,124.8	Clay, gray, very silty; unoxidized (lake clay)
70-112	42	1,124.8-1,082.8	Clay, gray, very silty, sandy; numerous sand layers, unoxidized (lake sediment)
112-142	30	1,082.8-1,052.8	Sand, gray, fine; unoxidized

Well screened from 132 to 142 feet; 2-inch PVC screen and casing. For electric log see R2-97-16

Local number: 128N52W27BBBC R
 Other identifier: R2-97-20
 Site identification number: 455049097095501
 Date of construction: 07-08-97
 Land surface altitude: 1,213.7 feet
 Total depth: 152 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,213.7-1,211.7	Topsoil, black
2-22	20	1,211.7-1,191.7	Clay, yellowish-brown, silty, sandy, pebbly; color change to dark-brown at 14 feet, oxidized (till)
22-88	66	1,191.7-1,125.7	Clay, gray, silty, sandy, pebbly; unoxidized (till)
88-135	47	1,125.7-1,078.7	Sand and gravel, coarse sand to fine gravel; some coarse gravel, clay layers from 96 to 101 feet
135-152	17	1,078.7-1,061.7	Clay, gray, shaley; hard greasy (Pierre Shale)
Well screened from 120 to 130 feet; 2-inch PVC casing and screen; 20 feet blank casing below and open to screen			

Local number: 129N49W27BACC R
 Other identifier: R2-97-34
 Site identification number: 455557096470201
 Date of construction: 08-05-97
 Land surface altitude: 1,068 feet
 Total depth: 292 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,068-1,066	Clay, black (topsoil)
2-14	12	1,066-1,054	Clay, yellowish-brown, tan, and blackish-brown, very silty; some reddish-brown, with concretions, layered (lake sediment)
14-20	6	1,054-1,048	Clay, gray, very silty; greasy, unoxidized (lake sediment)
20-72	52	1,048-996	Clay, gray, silty, sandy, pebbly; soft, large cuttings, unoxidized (till)
72-103	31	996-965	Clay, gray, very silty, sandy, unoxidized (lake sediment)
103-142	39	965-926	Clay, gray, silty, very sandy, pebbly; hard, some cobbles, fine gravel lens from 128 to 133 feet, unoxidized (till)
142-148	6	926-920	Gravel, coarse; with many cobbles
148-159	11	920-909	Clay, gray; very hard, greasy, unoxidized (lake sediment)
159-214	55	909-854	Silt grading to fine sand, gray; drills very fast, poor cuttings, unoxidized (lake sediment)
214-217	3	854-851	Chert boulder; very hard
217-220	3	851-848	Granite boulder; hard
220-228	8	848-840	Clay, gray, silty, sandy, pebbly; unoxidized (till)
228-292	64	840-776	Clay, dark-gray, silty; greasy, calcareous (Graneros Shale)

Electric log available

Local number: 129N49W30CBBB R
 Other identifier: R2-97-33
 Site identification number: 455543096510701
 Date of construction: 08-04-97
 Land surface altitude: 1,101 feet
 Total depth: 302 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,101-1,098	Topsoil, black
3-24	21	1,098-1,077	Clay, yellowish-brown, silty, sandy, pebbly; oxidized (till)
24-62	38	1,077-1,039	Clay, gray, silty, sandy, pebbly; soft, large cuttings, unoxidized (till)
62-76	14	1,039-1,025	Sand, gray, fine, silty; unoxidized
76-85	9	1,025-1,016	Clay, gray, silty, sandy, pebbly; unoxidized (till)
85-142	57	1,016-959	Sand and gravel, coarse sand to fine gravel; grades to medium gravel with depth, some coarse
142-193	55	959-908	Clay, gray, silty, sandy, pebbly; chert boulder at 150 feet, unoxidized (till)
193-197	4	908-904	Gravel, fine to medium
197-219	22	904-882	Clay, gray, silty, sandy, pebbly; unoxidized, rock at 198 feet (till)
219-225	6	882-876	Gravel, fine
225-270	45	876-831	Clay, dark-gray to blackish-brown; hard, greasy, calcareous (Fairport Shale Member - Carlile Shale)
270-298	28	831-803	Siltstone, white and brown; hard, cherty, very calcareous (Greenhorn Limestone)
298-302	4	803-799	Clay, gray, shaley; greasy, hard (Graneros Shale)
Electric log available			

Selected Existing Test Holes and Observation Wells in Which the Bedrock was Reached

Local number: 118N52W8AAAD R

Other identifier: R2-85-69

Site identification number: 450250097051001

Date of construction: 7-23-85

Land surface altitude: 1,795 feet

Total depth: 530 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,795-1,794	Topsoil, black
1-56	55	1,794-1,739	Clay, tan to brown, sandy, silty, pebbly (till)
56-83	27	1,739-1,712	Clay, gray, sandy, silty, pebbly (till)
83-104	21	1,712-1,691	Clay, tan, sandy, silty, pebbly (till)
104-138	34	1,691-1,657	Clay, tan, sandy, silty, pebbly (till)
138-157	19	1,657-1,638	Clay, gray, sandy, silty, pebbly (till)
157-185	28	1,638-1,610	Clay, gray, very sandy, silty, pebbly, (till)
185-233	48	1,610-1,562	Clay, gray, sandy, silty, pebbly (till)
233-254	21	1,562-1,541	Clay, tan, silty, sandy, pebbly; some thin sand stringers (till)
254-337	83	1,541-1,458	Clay, gray, silty, sandy, pebbly (till)
337-341	4	1,458-1,454	Sand and gravel
341-359	18	1,454-1,436	Clay, gray, sandy, silty, pebbly (till)
359-368	9	1,436-1,427	Gravel, fine; coarse sand; oxidized
368-413	45	1,427-1,382	Clay, gray, silty, sandy, pebbly, very sandy from 395 to 404 feet (till)
413-465	52	1,382-1,330	Sand and gravel, gray, medium sand to fine gravel; clay stringer from 432 to 437 feet (Altamont aquifer?)
465-530	65	1,330-1,265	Shale, dark-gray; greasy; bentonite (Pierre Shale)

Electric log available

Local number: 118N52W21AAAA
 Other identifier: R1-85-61
 Site identification number: 450113097032401
 Date of construction: 7-22-85
 Land surface altitude: 1,810 feet
 Total depth: 560 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,810-1,809	Topsoil, black
1-3	2	1,809-1,807	Sand and gravel, brown, medium sand to fine gravel
3-19	16	1,807-1,791	Clay, tan to brown, silty, sandy, pebbly (till)
19-34	15	1,791-1,776	Clay, gray, very silty, sandy, pebbly (till)
34-47	13	1,776-1,763	Clay, light-gray, very silty; calcareous (lake sediments?)
47-91	44	1,763-1,719	Clay, brown, sandy, silty, pebbly (till)
91-142	51	1,719-1,668	Clay, brown and gray mixed, sandy, silty, pebbly (till)
142-152	10	1,668-1,658	Clay, gray, very sandy, silty, pebbly (till)
152-162	10	1,658-1,648	Sand and gravel, medium sand to fine gravel; possibly oxidized
162-175	13	1,648-1,635	Sand and gravel, medium sand to fine gravel, clayey
175-177	2	1,635-1,633	Clay, gray, silty, sandy, pebbly (till)
177-181	4	1,633-1,629	Sand and gravel
181-185	4	1,629-1,625	Clay, gray, silty, sandy, pebbly (till)
185-191	6	1,625-1,619	Sand and gravel
191-244	53	1,619-1,566	Clay, gray, silty, sandy, pebbly (till)
244-276	32	1,566-1,534	Clay, gray, silty, sandy, pebbly; many sand and gravel stringers (till)
276-278	2	1,534-1,532	Sand and gravel
278-314	36	1,532-1,496	Clay, gray, silty, sandy, pebbly; many sand and gravel stringers (till)
314-398	84	1,496-1,412	Clay, gray, silty, sandy, pebbly (till)
398-407	9	1,412-1,403	Sand, fine to coarse; some fine gravel
407-461	54	1,403-1,349	Clay, gray, very sandy, silty, pebbly; many sand stringers (till?)
461-471	10	1,349-1,339	Sand, clayey
471-560	89	1,339-1,250	Shale, dark-gray; greasy, brittle (Pierre Shale)

Electric log available. Clay interval from 407 to 461 feet may be a very clay rich sand (Altamont aquifer equivalent?)

Local number: 118N53W36DDDD
 Other identifier: R2-85-68
 Site identification number: 445837097073502
 Date of construction: 7-22-85
 Land surface altitude: 1,745 feet
 Total depth: 540 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,745-1,744	Topsoil, black
1-11	10	1,744-1,734	Sand and gravel, tan, medium sand to fine gravel
11-17	6	1,734-1,728	Clay, tan, sandy, silty, pebbly (till)
17-21	4	1,728-1,724	Clay, gray, sandy, silty, pebbly (till)
21-30	9	1,724-1,715	Sand and gravel
30-129	99	1,715-1,616	Clay, gray, very sandy, silty, pebbly; some stringers of sand (till)
129-139	10	1,616-1,606	Sand and gravel
139-224	85	1,606-1,521	Clay, gray, sandy, silty, pebbly (till)
224-244	20	1,521-1,501	Clay, tan(?), sandy, silty, pebbly (till)
244-269	25	1,501-1,476	Clay, gray, very sandy, silty, pebbly (till)
269-293	24	1,476-1,452	Clay, gray, sandy, silty, pebbly (till)
293-296	3	1,452-1,449	Sand and gravel
296-332	36	1,449-1,413	Clay, gray, silty, sandy, pebbly (till)
332-394	62	1,413-1,351	Sand and gravel, clay, clayey (Altamont aquifer?)
394-540	146	1,351-1,205	Shale, dark-gray; hard, brittle greasy (Pierre Shale)

Well screened from 357 to 372 feet; 2-inch PVC screen and casing. Electric log available

Local number: 119N52W8AAAA R
 Other identifier: R1-85-62
 Site identification number: 450627097110701
 Date of construction: 7-23-85
 Land surface altitude: 1,818 feet
 Total depth: 530 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,818-1,817	Topsoil, black
1-38	37	1,817-1,780	Clay, yellow brown, sandy, silty, pebbly; soft (till)
38-54	16	1,780-1,764	Clay, tan to brownish-gray, sandy, silty, pebbly; soft (till)
54-89	35	1,764-1,729	Silts, light-brown to light-gray, clayey; some fine sand; some greenish silts; upper portion appears oxidized (lake sediments)
89-118	29	1,729-1,700	Clay, tan to orangish-tan, very sandy, silty, pebbly; sand stringers(?) (till)
118-147	29	1,700-1,671	Clay, light-gray to gray, sandy, silty, pebbly; some brownish-clays (till)
147-160	13	1,671-1,658	Silt, medium-gray to black; greasy, noncalcareous (lake silts)
160-189	29	1,658-1,629	Clay, yellow brown, silty, sandy, pebbly (till)
189-228	39	1,629-1,590	Clay, gray, silty, sandy, pebbly (till)
228-275	47	1,590-1,543	Clay, gray, silty, sandy, pebbly; hard (till)
275-281	6	1,543-1,537	Clay, brown, silty, sandy, pebbly (till)
281-291	10	1,537-1,527	Sand and gravel, medium sand to fine gravel; oxidized(?)
291-298	7	1,527-1,520	Clay, yellow brown, silty, sandy, pebbly (till)
298-358	60	1,520-1,460	Clay, gray, silty, sandy, pebbly; many sand and gravel stringers (till)
358-386	28	1,460-1,432	Sand and gravel, fine sand to fine gravel; some yellow brown clay in upper portion
386-530	144	1,432-1,288	Claystone, dark-gray to black; brittle, greasy (Pierre Shale)
Well screened from 372 to 387 feet; 2-inch PVC screen and casing. Electric log available			

Local number: 120N51W9BBBC R
 Other identifier: RB-86-104
 Site identification number: 451140097034101
 Date of construction: 10-28-86
 Land surface altitude: 1,940 feet
 Total depth: 652 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,940-1,939	Topsoil, black
1-23	22	1,939-1,917	Clay, yellow brown, silty, sandy, pebbly (till)
23-69	46	1,917-1,871	Clay, gray, silty, sandy, pebbly (till)
69-78	9	1,871-1,862	Clay, dark-brown to medium gray, silty
78-135	57	1,862-1,805	Clay, yellow brown, silty, sandy, pebbly (till)
135-190	55	1,805-1,750	Clay, gray, silty, sandy, pebbly; sand content increases with depth (till)
190-286	96	1,750-1,654	Clay, gray, silty, sandy, pebbly; many sand and gravel stringers (till)
286-306	20	1,654-1,634	Clay, grayish-brown, silty, sandy, pebbly (till)
306-396	90	1,634-1,544	Clay, gray, silty, sandy, pebbly; many sand and gravel stringers (till)
396-408	12	1,544-1,532	Sand and gravel
408-470	62	1,532-1,470	Clay, gray, silty, sandy, pebbly, shaley (till)
470-486	16	1,470-1,454	Sand and gravel
486-606	120	1,454-1,334	Clay, dark-gray, silty, sandy, pebbly, shaley (till)
606-614	8	1,334-1,326	Sand and gravel
614-652	38	1,326-1,288	Shale, dark-gray; greasy (Pierre Shale)

Electric log available

Local number: 120N51W17DDDD
 Other identifier: R2-87-27
 Site identification number: 451140096575301
 Date of construction: 6-30-87
 Land surface altitude: 1,915 feet
 Total depth: 745 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,915-1,914	Topsoil, black
1-49	48	1,914-1,866	Sand and gravel, tan, medium sand to fine gravel, coarse gravel common below 30 feet
49-62	13	1,866-1,853	Clay, tannish-gray, silty, sandy, pebbly (till)
62-73	11	1,853-1,842	Clay, dark-gray, silty, sandy, pebbly(?); strong gamma-kick, possibly organic (lacustrine sediments?)
73-154	81	1,842-1,761	Clay, gray, silty, sandy, pebbly; sand content higher between 97 and 130 feet; some sand stringers (till)
154-179	25	1,761-1,736	Clay, yellow brown to tan, silty, sandy, pebbly (till)
179-230	51	1,736-1,685	Clay, gray, silty, sandy, pebbly; minor sand and gravel stringers; strong gamma-kick at base may indicate primary or incorporated ash(?) (till)
230-368	138	1,685-1,547	Clay, gray, silty, sandy, pebbly; many sand and gravel stringers, particularly between 230 and 252 feet and 352 and 368 feet (till)
368-378	10	1,547-1,537	Clay, light-gray, sandy (lacustrine)
378-386	8	1,537-1,529	Clay, light-tray (lacustrine)
386-454	68	1,529-1,461	Clay, gray, silty, sandy, pebbly, shaley (till)
454-528	74	1,461-1,387	Clay, dark-grayish-brown, silty, sandy, shaley; sand and gravel from 497 to 504 feet (till)
528-585	57	1,387-1,330	Clay, gray, silty, sandy, pebbly, shaley (till)
585-682	97	1,330-1,233	Clay, dark-gray, silty, sandy, pebbly, shaley; sand and gravel between 624 and 635 feet
682-693	11	1,233-1,222	Sand and gravel
693-745	52	1,222-1,170	Shale, dark-gray; greasy, noncalcareous (Pierre Shale)

Electric log available. Interval from 73 to 130 feet may be three separate drift units. Several of the lower drift units were separated based on the geophysical log

Local number: 120N52W8AAAB R

Other identifier: R2-86-107

Site identification number: 451138097111301

Date of construction: 11-4-86

Land surface altitude: 1,850 feet

Total depth: 516 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,850-1,848	Topsoil, black
2-31	29	1,848-1,819	Clay, yellow brown to brown, very silty, sandy pebbly (till)
31-57	26	1,819-1,793	Clay, gray, very silty, sandy, pebbly (till)
57-67	10	1,793-1,783	Clay, grayish-green to olive, silty; noncalcareous (lacustrine?)
67-115	48	1,783-1,735	Clay, yellow brown to tan, silty, sandy, pebbly; scattered sand stringers (till)
115-147	32	1,735-1,703	Sand and gravel, yellow brown to gray, medium sand to fine gravel; yellow brown clay layers in upper half, gray layers in lower portion
147-224	77	1,703-1,626	Clay, gray, silty, sandy, pebbly (till)
224-282	58	1,626-1,568	Sand and gravel, gray, medium to coarse sand, some fine gravel; scattered gray clay layers, mostly in lower half
282-293	11	1,568-1,557	Clay, light-gray to tan, silty
293-310	17	1,557-1,540	Clay, yellow brown, silty, sandy, pebbly; a few sand stringers (till)
310-424	114	1,540-1,426	Clay, gray, silty, sandy, pebbly (till)
424-482	58	1,426-1,368	Sand, gray
482-516	34	1,368-1,334	Shale, dark-gray; greasy (Pierre Shale)

Electric log available

Local number: 120N52W11AAAA R
 Other identifier: R2-88-19
 Site identification number: 451143097072501
 Date of construction: 7-26-88
 Land surface altitude: 1,835 feet
 Total depth: 527 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,835-1,834	Topsoil, yellow brown, silty
1-27	26	1,834-1,808	Sand and gravel, medium sand to medium gravel; oxidized
27-34	7	1,808-1,801	Clay, gray, silty, sandy, pebbly (till)
34-39	5	1,801-1,796	Sand and gravel, coarse sand and fine gravel
39-75	36	1,796-1,760	Clay, yellow brown silty, sandy, pebbly (till)
75-102	27	1,760-1,733	Clay, brownish-gray to gray, silty, sandy, pebbly (till)
102-143	41	1,733-1,692	Sand and gravel, medium sand to medium gravel; oxidized; some yellow brown till stringers
143-161	18	1,692-1,674	Clay, gray, silty, sandy, pebbly (till)
161-181	20	1,674-1,654	Gravel, medium to coarse; some sand
181-238	57	1,654-1,597	Clay, gray, very silty, sandy, pebbly; clayey sands from 213 to 219 feet and 225 to 238 feet (till?)
238-289	51	1,597-1,546	Clay, gray, silty, sandy, pebbly (till)
289-295	6	1,546-1,540	Sand and gravel
295-337	42	1,540-1,498	Clay, yellow brown to brown, silty, sandy, pebbly (till)
337-354	17	1,498-1,481	Clay, gray, silty, sandy, pebbly; sand stringers (till)
354-438	84	1,481-1,397	Clay, gray, silty, sandy, pebbly (till)
438-481	43	1,397-1,354	Sand, gray, medium; some fine gravel
481-527	46	1,354-1,308	Shale, dark-gray; greasy, noncalcareous (Pierre Shale)
Electric log available			

Local number: 121N47W4AAAA
 Other identifier: R2-88-25
 Site identification number: 451935096343201
 Date of construction: 9-7-88
 Land surface altitude: 1,110 feet
 Total depth: 270 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,110-1,107	Topsoil, black
3-18	15	1,107-1,092	Clay, tan to light-brown, silty, sandy, pebbly (till)
18-43	25	1,092-1,067	Clay, gray, silty, sandy, pebbly (till)
43-45	2	1,067-1,065	Gravel, coarse
45-67	22	1,065-1,043	Clay, gray, silty, sandy, pebbly (till)
67-73	6	1,043-1,037	Sand and gravel
73-115	42	1,037-995	Clay, reddish-brown, sandy, silty, pebbly (till)
115-120	5	995-990	Sand
120-145	25	990-965	Clay, dark-gray, silty, sandy, pebbly (till)
145-205	60	965-905	Sand, gray, fine to medium
205-250	45	905-860	Siltstone, dark-brown with tan specks; calcareous (Fairport Shale Member - Carlile Shale)
250-270	20	860-840	Siltstone, dark-brown with tan specks; calcareous; crystalline carbonate layers; fractured (Greenhorn Limestone)

Encountered standard till sequence (New Ulm through Whetstone). Greenhorn Limestone is apparently fractured as a result of movement along Morris Fault. Lost circulation at depth of 270 feet. Plugged and abandoned hole

Local number: 121N48W3BBCC
 Other identifier: R2-87-20
 Site identification number: 451928096404001
 Date of construction: 5-28-87
 Land surface altitude: 1,150 feet
 Total depth: 319 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,150-1,149	Topsoil black
1-12	11	1,149-1,138	Clay, yellow brown to tan, silty, sandy, pebbly; sand stringers (till - New Ulm?)
12-32	20	1,138-1,118	Clay, yellow brown, silty, sandy, pebbly; some carbonate gravels (till - Granite Falls?)
32-58	26	1,118-1,092	Clay, gray, silty, sandy, pebbly; some carbonate gravels (till - Granite Falls?)
58-89	31	1,092-1,061	Clay, reddish-brown to reddish-gray, sandy, silty, pebbly (till - Hawk Creek?)
89-124	35	1,061-1,026	Clay, dark-gray, silty, sandy, pebbly (till - Whetstone?)
124-261	137	1,026-889	Shale, dark-gray; greasy, noncalcareous; scattered mica rich sand intervals (Blue Hill Member - Carlile Shale)
261-318	57	889-832	Shale, dark-brown with tan specks; calcareous (Fairport Shale Member - Carlile Shale)
318-319	1	832-831	Limestone, gray; dirty (Greenhorn Limestone)

Electric log available

Local number: 121N48W6AAAA
 Other identifier: R2-86-83
 Site identification number: 451935096430901
 Date of construction: 9-11-86
 Land surface altitude: 1,140 feet
 Total depth: 360 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-7	7	1,140-1,133	Clay, yellow brown and gray, silty, sandy, pebbly (till - New Ulm or Granite Falls)
7-42	35	1,133-1,098	Clay, reddish-brown, sandy, silty, pebbly; many sand stringers (till - Hawk Creek)
42-46	4	1,098-1,094	Clay, gray, silty, sandy, pebbly (till - Whetstone)
46-54	8	1,094-1,086	Clay, dark-brownish-gray, silty; greasy, noncalcareous; organic looking (Carlile Shale?)
54-274	220	1,086-866	Shale, dark-gray; greasy, noncalcareous; scattered fine sand partings (Blue Hill Shale Member - Carlile Shale)
274-331	57	866-809	Shale, dark-brown with tan specks; calcareous (Fairport Shale Member - Carlile Shale)
331-360	29	809-780	Limestone, dark-brownish-gray; dirty; some dark-brown calcareous shale (Greenhorn Limestone)

Electric log available

Local number: 121N49W3BBBC

Other identifier: R1-82-47

Site identification number: 451927096480201

Date of construction: 5-18-82

Land surface altitude: 1,195 feet

Total depth: 155 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,195-1,193	Topsoil
2-13	11	1,193-1,182	Clay, brown, silty, pebbly (till)
13-21	8	1,182-1,174	Sand, medium to coarse
21-55	34	1,174-1,140	Clay, gray, silty, pebbly (till)
55-66	11	1,140-1,129	Clay, olive, silty, pebbly (till)
66-145	79	1,129-1,050	Clay, gray, silty, sandy, pebbly (till)
145-155	10	1,050-1,040	Clay, gray (shale)

Local number: 121N50W1BBBB

Other identifier: R2-86-77

Site identification number: 451944096525701

Date of construction: 8-29-86

Land surface altitude: 1,305 feet

Total depth: 500 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,305-1,303	Topsoil, black
2-17	15	1,303-1,288	Clay, yellow brown to tan, silty, sandy, pebbly (till)
17-22	5	1,288-1,283	Clay, dark-brown, silty; noncalcareous; brittle (lacustrine or shale block?)
22-43	21	1,283-1,262	Clay, yellow brown to brown, silty, sandy, pebbly (till)
43-65	22	1,262-1,240	Clay, gray, silty, sandy, pebbly (till)
65-83	18	1,240-1,222	Clay, yellow brown, silty, sandy, pebbly; several sand and gravel stringers (till)
83-116	33	1,222-1,189	Clay, gray, silty, sandy, pebbly (till)
116-152	36	1,189-1,153	Clay, gray, silty, sandy, pebbly; sand stringers (till)
152-190	38	1,153-1,115	Clay, gray, silty, sandy, pebbly (till)
190-290	100	1,115-1,015	Sand and gravel, gray; scattered clay layers (Revilla aquifer?)
290-464	174	1,015-841	Shale, dark-blue gray; greasy, noncalcareous; scattered fine sand partings (Blue Hill Shale Member - Carlile Shale)
464-500	36	841-805	Shale, dark-brown with tan specks; calcareous (Fairport Shale Member - Carlile Shale)

Electric log available

Local number: 121N50W5BBBB
 Other identifier: R2-87-44
 Site identification number: 451935096575101
 Date of construction: 7-30-87
 Land surface altitude: 1,700 feet
 Total depth: 785 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,700-1,698	Topsoil, black
2-24	22	1,698-1,676	Clay, yellow brown, silty, sandy, pebbly (till)
24-55	31	1,676-1,645	Clay, gray, silty, sandy, pebbly (till)
55-105	50	1,645-1,595	Clay, gray, sandy, silty, pebbly; many sand stringers (till)
105-142	37	1,595-1,558	Clay, gray, silty, sandy, pebbly (till)
142-159	17	1,558-1,541	Clay, gray, silty, sandy, pebbly; many sand and gravel stringers (till?)
159-187	28	1,541-1,513	Clay, grayish-brown, silty, sandy, pebbly (till)
187-214	27	1,513-1,486	Clay, brownish-gray to gray, silty, sandy, pebbly (till)
214-301	87	1,486-1,399	Clay, gray, silty, sandy, pebbly; sandier below 262 feet (till)
301-335	34	1,399-1,365	Sand and gravel, medium and to fine gravel; scattered clay layers
335-419	84	1,365-1,281	Clay, gray, silty, sandy, pebbly, several sand and gravel stringers between 410 and 419 feet (till)
419-488	69	1,281-1,212	Clay, gray, silty, sandy, pebbly, shaley; darker than previous interval (till)
488-574	86	1,212-1,126	Clay, gray, silty, sandy, pebbly, shaley; quite sandy from 517 to 532 feet and 566 to 574 feet (till)
574-661	87	1,126-1,039	Clay, gray, silty, sandy, pebbly, shaley (till)
661-673	12	1,039-1,027	Sand and gravel(?), clayey
673-692	19	1,027-1,008	Shale, gray; greasy, noncalcareous (Carlile Shale?)
692-785	93	1,008-915	Shale, gray; greasy, noncalcareous; a few fine sand partings (Blue Hill Shale Member - Carlile Shale)

Electric log available

Local number: 121N51W14DADB
 Other identifier: R2-86-85
 Site identification number: 451720097002801
 Date of construction: 9-18-86
 Land surface altitude: 1,990 feet
 Total depth: 585 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,990-1,989	Topsoil, black
1-33	32	1,989-1,957	Clay, yellow brown, sandy, silty, pebbly; many sand and gravel stringers (till)
33-85	52	1,957-1,905	Clay, gray, sandy, silty, pebbly; many sand and gravel stringers; sand and gravel between 42 and 49 feet (till)
85-125	40	1,905-1,865	Clay, yellow brown to tan, silty, sandy, pebbly; numerous sand and gravel stringers (till)
125-170	45	1,865-1,820	Clay, medium-gray, silty, sandy, pebbly; many sand and gravel stringers (till)
170-223	53	1,820-1,767	Clay, gray, silty, sandy, pebbly (till)
223-236	13	1,767-1,754	Clay, yellow brown, silty, sandy, pebbly (till)
236-255	19	1,754-1,735	Clay, gray, silty, sandy, pebbly; a few sand stringers (till)
255-269	14	1,735-1,721	Clay, yellow brown, sandy, silty, pebbly (till)
269-301	32	1,721-1,789	Clay, gray, sandy, silty, pebbly (till)
301-313	12	1,789-1,777	Sand and gravel, medium sand to medium gravel; a few clay layers
313-388	75	1,777-1,602	Clay, gray, silty, sandy, pebbly; may be partially oxidized from 313 to about 340 feet (till)
388-436	48	1,602-1,554	Clay, light-gray, silty, sandy, pebbly; soft, greasy; a few sand stringers (till)
436-493	57	1,554-1,497	Clay, gray, silty, sandy, pebbly (till)
493-515	22	1,497-1,475	Clay, olive gray, silty, sandy, pebbly; a few sand stringers (till)
515-562	47	1,475-1,428	Clay, gray, silty, sandy, pebbly; a few sand stringers (till)
562-574	12	1,428-1,416	Sand and gravel, clayey
574-585	11	1,416-1,405	Shale, dark-gray; greasy, noncalcareous; inoceramus fragments (Pierre Shale)

Electric log available

Local number: 121N51W17AAAA R
 Other identifier: R2-86-103
 Site identification number: 451603097034201
 Date of construction: 10-22-86
 Land surface altitude: 2,030 feet
 Total depth: 758 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	2,030-2,029	Topsoil, black
1-42	41	2,029-1,988	Clay, yellow brown, silty, sandy, pebbly; minor sand and gravel (till)
42-100	58	1,988-1,930	Clay, gray, silty, sandy, pebbly (till)
100-185	85	1,930-1,845	Clay, gray, very silty, sandy, pebbly (till)
185-239	54	1,845-1,791	Clay, yellow brown silty, sandy, pebbly (till)
239-295	56	1,791-1,735	Clay, gray, silty, sandy, pebbly; a few sand and gravel stringers below 270 feet (till)
295-347	52	1,735-1,683	Clay, gray, silty, sandy, pebbly (till)
347-364	17	1,683-1,666	Sand and gravel; minor clay layers
364-399	35	1,666-1,631	Clay, gray, silty, sandy, pebbly (till)
399-423	24	1,631-1,607	Sand and gravel, clayey
423-465	42	1,607-1,565	Clay, brown, silty, sandy, pebbly; shaley; scattered sand and gravel intervals (till)
465-503	38	1,565-1,527	Clay, gray, silty, sandy, pebbly, shaley; scattered sand and gravel intervals (till)
503-601	98	1,527-1,429	Clay, dark-gray, silty, sandy, pebbly, shaley; scattered sand intervals (till)
601-701	100	1,429-1,329	Clay, dark-gray, silty, sandy, pebbly, shaley (till)
701-739	38	1,329-1,291	Sand and gravel
739-758	19	1,291-1,272	Shale, dark-gray; greasy, noncalcareous (Pierre Shale)
Electric log available			

Local number: 121N51W35CDDD
 Other identifier: R1-87-53
 Site identification number: 451427097010101
 Date of construction: 7-24-87
 Land surface altitude: 1,955 feet
 Total depth: 860 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,955-1,954	Topsoil, tan, sandy
1-26	25	1,954-1,929	Sand and gravel, brown, medium sand to medium gravel; numerous clay stringers
26-48	22	1,929-1,907	Clay, yellow brown to brown, sandy, silty, pebbly (till)
48-65	17	1,907-1,890	Sand and gravel, lower portion clayey
65-113	48	1,890-1,842	Clay, dark-gray, silty, sandy, pebbly (till)
113-117	4	1,842-1,838	Sand and gravel
117-169	52	1,838-1,786	Clay, gray, silty, sandy, pebbly (till)
169-212	43	1,786-1,743	Clay, yellow brown to brown, silty, sandy, pebbly (till)
212-233	21	1,743-1,722	Sand and gravel, lower portion clayey
233-242	9	1,722-1,713	Clay, brown, silty, sandy, pebbly (till)
242-350	108	1,713-1,605	Clay, gray, silty, sandy, pebbly (till)
350-378	28	1,605-1,577	Sand and gravel, clayey
378-407	29	1,577-1,548	Clay, yellow brown(?), silty, sandy, pebbly (till)
407-453	46	1,548-1,502	Clay, gray, sandy, silty, pebbly (till)
453-537	84	1,502-1,418	Clay, gray, silty, sandy, pebbly (till)
537-542	5	1,418-1,413	Sand
542-610	68	1,413-1,345	Clay, gray, silty, sandy, pebbly (till)
610-614	4	1,345-1,341	Sand and gravel, medium sand to medium gravel
614-680	66	1,341-1,275	Clay, gray, silty, sandy, pebbly (till)
680-715	35	1,275-1,240	Clay, brownish-gray, silty, sandy pebbly (till)
715-722	7	1,240-1,233	Sand, brown
722-820	98	1,233-1,135	Clay, gray, silty, sandy, pebbly (till)
820-860	40	1,135-1,095	Shale(?)

Electric log available. Lithologic breaks to 551 feet were called using the geophysical log. Below 551 feet they are based on the driller's logs. Nature of the shale, Pierre Shale or Carlile Shale, is uncertain, but it is probably Carlile Shale

Local number: 121N52W2AAAA R
 Other identifier: R1-87-37
 Site identification number: 451748097072501
 Date of construction: 6-11-87
 Land surface altitude: 1,890 feet
 Total depth: 560 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,890-1,888	Topsoil, black, sandy
2-15	13	1,888-1,875	Gravel, brown, fine to medium; some sand
15-27	12	1,875-1,863	Clay, yellow brown, silty, sandy, pebbly (till)
27-63	36	1,863-1,827	Clay, gray, silty, sandy, pebbly (till)
63-81	18	1,827-1,809	Clay, olive green, silty; minor sand
81-94	13	1,809-1,796	Clay, yellow brown, silty, sandy, pebbly (till)
94-144	50	1,796-1,746	Clay, gray, silty, sandy, pebbly, sandy near base (till)
144-166	22	1,746-1,724	Sand and gravel, coarse sand to medium gravel
166-194	28	1,724-1,696	Clay, yellow brown, sandy, silty, pebbly; scattered sand stringers (till)
194-225	31	1,696-1,665	Clay, yellow brown, silty, sandy, pebbly (till)
225-280	55	1,665-1,610	Clay, gray, silty, sandy, pebbly; some sand stringers (till)
280-332	52	1,610-1,558	Clay, gray, silty, sandy, pebbly (till)
332-345	13	1,558-1,545	Clay, gray, silty, sandy, pebbly; grading to clayey sand
345-392	47	1,545-1,498	Clay, yellow brown to gray, silty, sandy, pebbly (till)
392-473	81	1,498-1,417	Clay, gray, silty, sandy, pebbly; sand and gravel abundant between 423 and 435 feet (till)
473-528	55	1,417-1,362	Sand and gravel, gray, medium sand to fine gravel; several clayey zones; grades to medium gravel at base
528-560	32	1,362-1,330	Shale, dark-gray; greasy, noncalcareous (Pierre Shale)

Electric log available

Local number: 121N52W9CDDD R

Other identifier: R2-86-106

Site identification number: 451607097103001

Date of construction: 10-30-86

Land surface altitude: 1,852 feet

Total depth: 510 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,852-1,851	Topsoil, black
1-22	21	1,851-1,830	Clay, yellow brown, very silty, sandy, pebbly; soft (till)
22-52	30	1,830-1,800	Clay, dark-brown to gray, very silty, sandy, pebbly; soft (till)
52-65	13	1,800-1,787	Sand, gray, medium to coarse; some gravel
65-120	55	1,787-1,732	Silt, gray, clayey; only minor sand and pebbles; some interbedded sands
120-127	7	1,732-1,725	Silt, black to purplish-brown to green, clayey; a strong gamma kick in this segment suggests a possible ash layer
127-147	20	1,725-1,705	Clay, yellow brown, silty, sandy, pebbly (till)
147-212	65	1,705-1,640	Clay, gray, silty, sandy, pebbly (till)
212-280	68	1,640-1,572	Clay, gray, sandy, silty, pebbly; a few sand and gravel stringers below 259 feet (till)
280-297	17	1,572-1,555	Clay, yellow brown to brown, silty, sandy, pebbly (till)
297-349	52	1,555-1,503	Clay, gray, silty, sandy, pebbly; sandier interval or clayey sands from 336 to 349 feet (till)
349-369	20	1,503-1,483	Clay, dark-brown to gray, silty, sandy, pebbly, shaley(?) (till)
369-401	32	1,483-1,451	Clay, dark-gray, silty, sandy, pebbly, shaley(?) (till)
401-434	33	1,451-1,418	Clay, dark-gray, silty, sandy, pebbly, shaley(?) (till)
434-493	59	1,418-1,359	Sand, brown to gray, medium; minor clay intervals throughout
493-510	17	1,359-1,342	Shale, dark-gray; greasy, noncalcareous (Pierre Shale)

Well screened from 500 to 510 feet; 2-inch PVC screen and casing. Electric log available

Local number: 121N52W18BBBB R
 Other identifier: R-65
 Site identification number: 451605097133101
 Date of construction: 8-12-70
 Land surface altitude: 1,873 feet
 Total depth: 530 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-27	27	1,873-1,846	Till, brown
27-39	12	1,846-1,834	Till gray
39-63	24	1,834-1,810	Silt and sand, light-gray to light-brownish gray; possibly oxidized silt or till
63-65	2	1,810-1,808	Gravel
65-96	31	1,808-1,777	Till, yellowish-brown; iron staining
96-124	28	1,777-1,749	Gravel; and silty layers, yellowish-brown
124-128	4	1,749-1,745	Clay, light-gray, silty, sandy; fat, calcareous
128-245	117	1,745-1,628	Till, gray to brown; rocks from 227 to 229, 231 to 233, and 244 to 245 feet; rocky and gravelly from 233 to 235 feet
245-288	43	1,628-1,585	Till, light-brown
288-312	24	1,585-1,561	Sand and gravel; rocks
312-497	185	1,561-1,376	Till, brown and gray; some dark-clay in samples from 420 to 440 feet
497-505	8	1,376-1,368	Gravel
505-530	25	1,368-1,343	Shale
Electric log available			

Local number: 121N52W25BBBB R
 Other identifier: R1-87-35
 Site identification number: 451420097072301
 Date of construction: 6-9-87
 Land surface altitude: 1,915 feet
 Total depth: 725 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,915-1,913	Topsoil, black
2-41	39	1,913-1,874	Clay, yellow brown to tan, silty, sandy, pebbly (till)
41-87	46	1,874-1,828	Clay, gray, silty, sandy, pebbly; sand and gravel from 58 to 60 feet (till)
87-93	6	1,828-1,822	Sand and gravel
93-138	45	1,822-1,777	Clay, brown, silty, sandy, pebbly (till)
138-154	16	1,777-1,761	Clay, gray, silty, sandy, pebbly (till)
154-162	8	1,761-1,753	Sand and gravel, clayey
162-189	27	1,753-1,726	Clay, gray, silty, sandy, pebbly (till)
189-275	86	1,726-1,640	Clay, gray, sandy, silty, pebbly; many thin sand and gravel stringers (till)
275-306	31	1,640-1,609	Sand and gravel, coarse sand to medium gravel; possibly some oxidized till
306-358	52	1,609-1,557	Clay, gray, silty, sandy, pebbly, grading to very sandy below 346 feet (till)
358-413	55	1,557-1,502	Clay, gray, silty, sandy, pebbly, grades to very sandy below 399 feet; there is a gamma spike at the top of the interval, possibly indicating an ashy layer (till)
413-475	62	1,502-1,440	Clay, dark-brown, silty, sandy, pebbly; a few sand stringers (till)
475-564	89	1,440-1,351	Clay, dark-brown to gray, silty, sandy, pebbly; a few sand stringers below 535 feet (till)
564-696	132	1,351-1,219	Sand and gravel, gray, medium sand to fine gravel, generally clayey; possibly interbedded gray till units
696-725	29	1,219-1,190	Shale, dark-gray; greasy, noncalcareous, inoceramus fragments (Pierre Shale)
Electric log available			

Local number: 121N53W1AAAA R
 Other identifier: R2-87-25
 Site identification number: 451750097133501
 Date of construction: 6-9-87
 Land surface altitude: 1,915 feet
 Total depth: 545 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,915-1,912	Topsoil, black
3-26	23	1,912-1,889	Clay, yellow brown, silty, sandy, pebbly (till)
26-71	45	1,889-1,844	Clay, dark-yellow brown to gray, silty, sandy, pebbly
71-155	84	1,844-1,760	Clay, yellow brown, silty, sandy, pebbly; sand and gravel stringers common; sand content increases below 96 feet (till)
155-185	30	1,760-1,730	Clay, gray, silty, sandy, pebbly (till)
185-222	37	1,730-1,693	Clay, tan brown, silty, sandy, pebbly (till)
222-309	87	1,693-1,606	Clay, brown to gray(?), sandy, silty, pebbly; numerous sand and gravel intervals; very sandy below 259 feet (till)
309-373	64	1,606-1,542	Clay, tan, silty, sandy, pebbly (till)
373-416	43	1,542-1,499	Clay, gray, silty, sandy, pebbly (till)
416-449	33	1,499-1,466	Sand, gray, medium; scattered clay layers
449-479	30	1,466-1,436	Sand, gray, medium, shaley(?); some shale blocks included
479-545	66	1,436-1,370	Shale, dark-gray; greasy, noncalcareous (Pierre Shale)

Electric log available. Increase in general sand content at 96 feet in the 71- to 155-foot interval may mark a different drift unit. Very sandy till between 259 and 309 feet may be a clayey sand instead

Local number: 121N53W24DDDD R
 Other identifier: R1-87-36
 Site identification number: 451423097174501
 Date of construction: 6-10-87
 Land surface altitude: 1,855 feet
 Total depth: 515 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,855-1,853	Topsoil, black
2-9	7	1,853-1,846	Clay, yellow brown, sandy, silty, pebbly (till)
9-31	22	1,846-1,824	Sand, brown to gray, medium to coarse; some gravel; clay stringers
31-42	11	1,824-1,813	Clay, gray, silty, sandy, pebbly (till)
42-82	40	1,813-1,773	Clay, yellow brown to tan, silty, sandy, pebbly (till)
82-133	51	1,773-1,722	Clay, gray, silty, sandy, pebbly; possible increase in clay content at 113 feet (till)
133-190	57	1,722-1,665	Clay, medium-gray, silty, sandy, pebbly; some oxidized clay (till)
190-203	13	1,665-1,652	Sand and gravel, gray; interbedded clay
203-213	10	1,652-1,642	Clay, gray, silty; minor sand
213-245	32	1,642-1,610	Clay, yellow brown, silty, sandy, pebbly; scattered sand and gravel layers (till)
245-294	49	1,610-1,561	Clay, gray, silty, sandy, pebbly; a few sand and gravel stringers (till)
294-304	10	1,561-1,551	Sand and gravel
304-329	25	1,551-1,526	Clay, brown(?), silty, sandy, pebbly (till)
329-381	52	1,526-1,474	Clay, gray, silty, sandy, pebbly; scattered sand and gravel stringers (till)
381-420	39	1,474-1,435	Clay, gray, silty, sandy, pebbly (till)
420-480	60	1,435-1,375	Sand, gray, medium; several clay layers
480-515	35	1,375-1,340	Shale, dark-gray; greasy, noncalcareous (Pierre Shale)

Electric log available

Local number: 122N47W35DDCD
 Other identifier: R2-85-28
 Site identification number: 451935096310001
 Date of construction: 5-9-85
 Land surface altitude: 1,100 feet
 Total depth: 200 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-37	37	1,100-1,063	Clay, brown, silty, very sandy, pebbly (till)
37-51	14	1,063-1,049	Clay, gray, silty, very sandy, pebbly (till)
51-54	3	1,049-1,046	Sand, coarse
54-59	5	1,046-1,041	Clay, gray, very silty, sandy, pebbly, shaley (till)
59-86	27	1,041-1,014	Sand, medium; to medium gravel; clay layer from 80 to 82 feet
86-124	38	1,014-976	Clay, gray, silty, sandy, pebble; shale rich (till)
124-130	6	976-970	Sand, coarse; to fine gravel
130-161	31	970-939	Clay, gray, silty, sandy, pebbly; shale rich; lake deposits, clay and fine silt from 143 to 150 feet (till)
161-182	21	939-918	Mudstone, dark-brown, tan speckles; calcareous, hard (Fairport Shale Member? - Carlile Shale)
182-200	18	918-900	Mudstone, dark-brown, tan speckles, calcareous; crystalline carbonate fragments, soft, calcareous, white clays, drill chatter (Greenhorn Limestone)

Well screened from 74 to 79 feet; 2-inch PVC screen and casing. Electric log available

Local number: 122N48W35DDDD

Other identifier: R2-85-23

Site identification number: 451935096381501

Date of construction: 5-7-85

Land surface altitude: 1,110 feet

Total depth: 290 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,110-1,109	Topsoil, black
1-18	17	1,109-1,092	Clay, tan to brown, very silty, sandy, pebbly (till)
18-36	18	1,092-1,074	Clay, gray, very silty, sandy, pebbly (till)
36-48	12	1,074-1,062	Sand, medium to coarse; to fine travel in lower portion; upper parts look oxidized
48-78	30	1,062-1,032	Clay, pinkish- to brownish-gray, silty, very sandy, pebbly; some sand stringers
78-92	14	1,032-1,018	Sand, medium; to fine gravel; clay layers
92-118	26	1,018-992	Clay, dark-gray, silty, very sandy, pebbly (till)
118-122	4	992-988	Gravel, coarse
122-136	14	988-974	Clay, dark-gray to black, silty, sandy, pebbly(?); might be shale
136-205	69	974-905	Claystone, dark-brown to black; greasy, noncalcareous; fine sand partings with very soft clay (Blue Hill Member? - Carlile Shale)
205-240	35	905-870	Mudstone, dark-brown, tan speckles; calcareous; hard (Fairport Shale Member? - Carlile Shale)
240-290	50	870-820	Mudstone, dark-brown, tan speckles; calcareous; drill chatter; soft white calcareous clays, crystalline calcite fragments (Greenhorn Limestone)

Unit contacts in bedrock are from cuttings log, so they may both be exact. May have penetrated Graneros Shale below the Greenhorn Limestone

Local number: 122N49W33CCCB
 Other identifier: R20-88-47
 Site identification number: 451941096491701
 Date of construction: 9-14-88
 Land surface altitude: 1,214 feet
 Total depth: 458 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,214-1,212	Topsoil, black
2-21	19	1,212-1,193	Clay, yellow brown, silty, sandy, pebbly (till)
21-107	86	1,193-1,107	Clay, gray, silty, sandy, pebbly; sand intervals from 32 to 36, 50 to 57, and 60 to 62 feet (till)
107-116	9	1,107-1,098	Clay, olive gray, silty, sandy, pebbly (till)
116-257	141	1,098-957	Sand, medium to fine, clayey to 175 feet
257-362	105	957-852	Clay, gray, (Blue Hill Shale Member - Carlile Shale)
632-454	92	852-760	Clay, dark-brown; calcareous (Fairport Shale Member - Carlile Shale)
454-458	4	760-756	Limestone, dark-brown (Greenhorn Limestone)

Local number: 122N49W35BBBB
 Other identifier: R1-82-46
 Site identification number: 452026096464801
 Date of construction: 5-18-82
 Land surface altitude: 1,169 feet
 Total depth: 65 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,169-1,167	Topsoil, black
2-12	10	1,167-1,157	Clay, brown, silty, sandy, pebbly (till)
12-45	33	1,157-1,124	Clay, gray, silty
45-65	20	1,124-1,104	Shale

Local number: 122N49W35DDDD
 Other identifier: R2-86-80
 Site identification number: 451946096453701
 Date of construction: 9-9-86
 Land surface altitude: 1,165 feet
 Total depth: 372 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,165-1,163	Topsoil, black
2-10	8	1,163-1,155	Clay, yellow brown, silty, sandy, pebbly (till - New Ulm?)
10-22	12	1,155-1,143	Clay, gray, silty, sandy, pebbly (till - Granite Falls? or Whetstone?)
22-42	20	1,143-1,123	Silt, gray; calcareous; minor sand initially, increasing with depth
42-51	9	1,123-1,114	Sand and gravel, gray
51-79	28	1,114-1,086	Shale, dark-brownish-gray, silty; noncalcareous; organic looking (Carlile Shale?)
79-303	224	1,086-862	Shale, dark-blue-gray; greasy, noncalcareous; some fine sand partings between 240 and 280 feet (Blue Hill Shale Member - Carlile Shale)
303-360	57	862-805	Shale, dark-brown with tan specks, silty; calcareous (Fairport Shale Member - Carlile Shale)
360-372	12	805-793	Limestone, dark-brownish-gray; dirty, some dark-brown shale (Greenhorn Limestone)
Electric log available			

Local number: 122N52W19CCCC R
 Other identifier: R-70
 Site identification number: 451936097133301
 Date of construction: 8-20-70
 Land surface altitude: 1,870 feet
 Total depth: 515 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-14	14	1,870-1,856	Sand and gravel, coarse
14-80	66	1,856-1,790	Clay, yellowish-brown, pebbly
80-109	29	1,790-1,761	Clay, gray, pebbly
109-120	11	1,761-1,750	Gravel and clay stringers
120-170	50	1,750-1,700	Clay, gray, pebbly
170-220	50	1,700-1,650	Clay; partially oxidized (till)
220-289	69	1,650-1,581	Clay, gray, pebbly
289-311	22	1,581-1,559	Gravel and clay stringers
311-336	25	1,559-1,534	Clay, gray, pebbly
336-346	10	1,534-1,524	Sand and gravel, medium to coarse
346-416	70	1,524-1,454	Clay, gray, pebbly
416-437	21	1,545-1,433	Sand and gravel, clayey; with clay stringers
437-483	46	1,433-1,387	Clay, light-gray to white; some gravel (marl)
483-515	32	1,387-1,355	Shale
Electric log available			

Local number: 122N53W16DCCD R
 Other identifier: WA-6
 Site identification number: 454030097174501
 Date of construction: 6-66
 Land surface altitude: 1,812 feet
 Total depth: 445 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,812-1,810	Topsoil
2-15	13	1,810-1,797	Gravel
15-47	32	1,797-1,765	Clay, gray; several thin sand lenses
47-80	33	1,765-1,732	Gravel medium to coarse
80-124	44	1,732-1,688	Sand
124-195	71	1,688-1,617	Clay, gray; gravel stringers and 163 to 195 feet
195-210	15	1,617-1,602	Gravel; and clay stringers
210-385	175	1,602-1,427	Clay, gray; thin gravel lenses at 210 to 240 feet, rocky at 360 to 375 feet (till)
385-419	34	1,427-1,393	Gravel
419-445	26	1,393-1,367	Pierre Shale

Electric log available

Local number: 123N53W13CCCC R
 Other identifier: R-71
 Site identification number: 452544097144801
 Date of construction: 8-20-70
 Land surface altitude: 1,874 feet
 Total depth: 700 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-17	17	1,874-1,857	Clay, yellow brown, sandy, pebbly (till)
17-56	39	1,857-1,818	Clay, gray, sandy, pebbly (till)
56-72	16	1,818-1,802	Clay, yellow brown, silty, sandy (till)
72-98	26	1,802-1,776	Sand, yellow brown, clayey, gravelly
98-142	44	1,776-1,732	Clay, dark-gray, pebbly; very hard (till)
142-190	48	1,732-1,684	Clay, yellow (till)
190-684	494	1,684-1,190	Clay, gray, silty, sandy, pebbly (till)
684-700	16	1,190-1,174	Shale, dark-gray; thin bentonite layers

Electric log available

Local number: 123N53W27CCCC R
 Other identifier: R-69
 Site identification number: 452357097171601
 Date of construction: 8-18-70
 Land surface altitude: 1,882 feet
 Total depth: 840 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-17	17	1,882-1,865	Clay, yellow, silty, pebbly, gravelly in spots
17-60	43	1,865-1,822	Sand and gravel, medium to coarse
60-103	43	1,822-1,779	Clay, gray, silty, pebbly
103-106	3	1,779-1,776	Clay, yellow
106-123	17	1,776-1,759	Clay, light-gray, silty, sandy
123-137	14	1,759-1,745	Sand and gravel, medium to coarse; with some clay
137-152	15	1,745-1,730	Till, yellow to gray; gravel stringers
152-166	14	1,730-1,716	Clay, medium-gray to green; slightly oxidized, some black organic clay
166-185	19	1,716-1,697	Clay, gray, compact
185-200	15	1,697-1,682	Clay, gray, pebbly
200-207	7	1,682-1,675	Sand and gravel
207-217	10	1,675-1,665	Clay, gray
217-255	38	1,665-1,627	Clay, yellow, gravelly; sample contains gray and yellow oxidized clay, and some gravel
255-360	105	1,627-1,522	Clay, gray, silty, pebbly
360-425	65	1,522-1,457	Clay, dark-gray, very sandy; with gravelly layers and rocks
425-620	195	1,457-1,262	Clay, dark-gray, sandy, pebbly; some reworked shale present
620-645	25	1,262-1,237	Clay, gray (lacustrine)
645-685	40	1,237-1,197	Till(?), gray, silty, pebbly; some light-gray marl
685-700	15	1,197-1,182	Clay, gray; lots of marl, cuttings look like shale and yellow clay
700-710	10	1,182-1,172	Clay, medium to dark-gray, silty; some hard, dark-shale
710-785	75	1,172-1,097	Clay, medium to light-gray, silty, marly; calcareous
785-840	55	1,097-1,042	Shale, bluish-black; blocky, compact

Electric log available. E-log places bedrock surface at 672 feet

Local number: 124N49W8ADDC R
 Other identifier: RB-81-23
 Site identification number: 453354096491901
 Date of construction: 6-25-81
 Land surface altitude: 1,022 feet
 Total depth: 170 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,022-1,020	Clay, yellow brown, silty, sandy, pebbly (till)
2-20	18	1,020-1,002	Sand, brown, medium to fine, well sorted; estimate 85-90% of cuttings are quartz grains (Veblen aquifer)
20-26	6	1,002-996	Sand, gray, medium to fine; dominantly quartz grains (Veblen aquifer)
26-37	11	996-985	Shale; poor sample return
37-50	13	985-972	Shale, medium-gray; noncalcareous, samples are cut into "ribbons" (Carlile Shale)
50-111	61	972-911	Shale, medium-gray; very slightly calcareous, samples cut into "ribbons" (Carlile Shale)
111-116	5	911-906	Shale, light- to medium-brown, with orangish-brown mottling; very calcareous (Carlile Shale)
116-145	29	906-877	Shale, medium-gray; noncalcareous (Carlile Shale)
145-148	3	877-874	Sand(?); poor return but noticed slightly harder drilling (Codell Sandstone Member - Carlile Shale)
148-152	4	874-870	Shale, medium-gray (Carlile Shale)
152-156	4	870-866	Sand(?); poor sample return (Codell Sandstone Member - Carlile Shale)
156-161	5	866-861	Shale, medium-gray; samples are cut into "ribbons" (Carlile Shale)
161-163	2	861-859	Sand(?); poor sample return (Codell Sandstone Member? - Carlile Shale)
163-170	7	859-852	Shale, medium-gray; samples are cut into "ribbons" (Carlile Shale)

Electric log available

Local number: 124N50W5CADD R
 Other identifier: PEEVER 8
 Site identification number: 453250096565301
 Date of construction: 1973
 Land surface altitude: 1,185 feet
 Total depth: 140 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-4	4	1,185-1,181	Soil, dark-gray
4-13	9	1,181-1,172	Clay, yellowish-brown
13-126	113	1,172-1,059	Clay, gray (till)
126-140	14	1,059-1,045	Clay, dark-gray (shale)

Local number: 124N50W6BBCC R
 Other identifier: BARSE
 Site identification number: 453318096583201
 Date of construction: 12-22-76
 Land surface altitude: 1,218 feet
 Total depth: 800 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-154	154	1,218-1,064	Glacial drift
154-213	59	1,064-1,005	Pierre Shale
213-326	113	1,005-892	Niobrara Formation
326-331	5	892-887	Codell Sandstone Member - Carlile Shale
331-474	143	887-744	Carlile Shale
474-513	39	744-705	Greenhorn Limestone
513-600	87	705-618	Belle Fourche Shale Member - Graneros Shale
600-686	86	618-532	Mowry Shale Member - Graneros Shale
686-701	15	532-517	Dakota Formation
701-784	83	517-434	Wash?
784-800	16	434-418	Granite Wash

Private well screened from 780 to 800 feet. Yielded very little if any water. Electric log available

Local number: 124N53W1DDDD2 R

Other identifier: R-75

Site identification number: 453237097133802

Date of construction: 8-26-70

Land surface altitude: 2,027 feet

Total depth: 800 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-34	34	2,027-1,993	Till, brown
34-37	3	1,993-1,990	Till, gray
37-43	6	1,990-1,984	Sand and gravel, medium to coarse
43-80	37	1,984-1,947	Till, yellow
80-100	20	1,947-1,927	Clay, grayish-brown (lacustrine)
100-232	132	1,927-1,795	Till, yellow
232-264	32	1,795-1,763	Till, gray
264-270	6	1,763-1,757	Sand and gravel, clayey
270-290	20	1,757-1,737	Till, gray
290-308	18	1,737-1,719	Sand and gravel, well sorted
308-367	59	1,719-1,660	Till, gray
367-376	9	1,660-1,651	Gravel, fine, sandy
376-744	368	1,651-1,283	Clay, gray; possibly some water laid material (till)
744-800	56	1,283-1,227	Shale

Electric log available

Local number: 124N53W33DADD2 R
 Other identifier: R-72
 Site identification number: 452833097172002
 Date of construction: 8-24-70
 Land surface altitude: 1,929 feet
 Total depth: 560 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-17	17	1,929-1,912	Clay, yellow brown, silty; oxidized (till)
17-59	42	1,912-1,870	Clay, gray, silty; unoxidized (till)
59-76	17	1,870-1,853	Clay, yellow brown, silty, pebbly (till)
76-138	62	1,853-1,791	Gravel, red-brown, coarse, very sandy
138-154	16	1,791-1,775	Clay, yellow brown, silty, pebbly (till)
154-527	373	1,775-1,402	Clay, gray, sandy, very sandy at 480 to 527 feet, marly, pebbly (till)
527-560	33	1,402-1,369	Shale, gray

Electric log available

Local number: 125N50W6BCCB R
 Other identifier: RB-81-14
 Site identification number: 453822096584001
 Date of construction: 4-21-81
 Land surface altitude: 1,264 feet
 Total depth: 215 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,264-1,262	Topsoil, black
2-26	24	1,262-1,238	Clay, yellow brown, silty, pebbly (till)
26-29	3	1,238-1,235	Clay, light-gray
29-43	14	1,235-1,221	Clay, yellow brown, silty, sandy, pebbly (till)
43-60	17	1,221-1,204	Clay, medium-dark-gray, silty, sandy, pebbly (till)
60-67	7	1,204-1,197	Clay, medium-reddish-brown, silty; no sand (buried weathering horizon)
67-73	6	1,197-1,191	Clay, medium-dark-gray, silty; non sand (loess?/lake clay?)
73-91	18	1,191-1,173	Clay, medium-dark-gray, silty, sandy, pebbly (till)
91-93	2	1,173-1,171	Sand, gray, fine to coarse
93-99	6	1,171-1,165	Clay, medium-dark-gray
99-102	3	1,165-1,162	Sand, gray, fine to coarse
102-112	10	1,162-1,152	Clay, gray, sandy, gravelly (till)
112-128	16	1,152-1,136	Sand, gray, medium to coarse; with fine gravel
128-144	16	1,139-1,120	Clay, medium-dark-gray, silty, sandy, pebbly (till)
144-156	12	1,120-1,108	Gravel, gray, fine; with medium to very coarse sand
156-166	10	1,108-1,098	Clay, gray, gravelly (till)
166-204	38	1,098-1,060	Shale, very dark-gray (Pierre Shale)
204-210	6	1,060-1,054	Shale, very dark-gray; rig chatters through this interval (Pierre Shale)
210-215	5	1,054-1,049	Shale, very dark-gray (Pierre Shale)

Well screened from 118 to 123 feet; 2-inch PVC screen and casing. Electric log available

Local number: 125N50W6CCCC R
 Other identifier: RB-81-15
 Site identification number: 453752096584001
 Date of construction: 4-21-81
 Land surface altitude: 1,200 feet
 Total depth: 90 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,200-1,197	Topsoil, black
3-20	17	1,197-1,180	Sand, medium to coarse; clayey in spots
20-22	2	1,180-1,178	Sand, medium to coarse
22-36	14	1,178-1,164	Sand, gray, medium to coarse, clayey
36-40	4	1,164-1,160	Sand, gray, medium to coarse
40-56	16	1,160-1,144	Clay, medium-dark-gray; very sandy from 46 to 48 feet
56-61	5	1,144-1,139	Sand, gray, medium to coarse; with very fine gravel
61-90	29	1,139-1,110	Shale, dark-gray (Pierre Shale)

Well screened from 37 to 40 feet; 2-inch PVC screen and casing. Electric log available

Local number: 125N50W6DCCC R
 Other identifier: RB-81-16
 Site identification number: 453732096580301
 Date of construction: 4-22-81
 Land surface altitude: 1,230 feet
 Total depth: 155 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,230-1,229	Topsoil, black
1-21	20	1,229-1,209	Clay, yellow brown, silty, sandy, pebbly (till)
21-25	4	1,209-1,205	Gravel, coarse
25-42	17	1,205-1,188	Clay, gray, silty, sandy, pebbly (till)
42-50	8	1,188-1,180	Sand, gray, fine to coarse
50-56	6	1,180-1,174	Clay, gray, silty (loess? or lake clay?)
56-64	8	1,174-1,166	Sand, gray; with medium to coarse gravel
64-82	18	1,166-1,148	Clay, gray; very silty and sandy from 68 to 72 feet
82-107	25	1,148-1,123	Sand, medium to coarse; with thin clay stringers
107-118	11	1,123-1,112	Sand, medium to coarse; clayey
118-128	10	1,112-1,102	Clay, gray, silty, sandy, pebbly (till)
128-134	6	1,102-1,096	Sand, gray, medium to coarse; with gravel
134-155	21	1,096-1,075	Shale, gray (Pierre Shale)

Well screened from 97.4 to 102.4 feet; 2-inch PVC screen and casing. Electric log available

Local number: 125N50W8BBBA R
 Other identifier: RB-81-11
 Site identification number: 453751096572401
 Date of construction: 4-9-81
 Land surface altitude: 1,216 feet
 Total depth: 140 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-9	9	1,216-1,207	Silt, black, clayey (colluvium)
9-17	8	1,207-1,199	Clay, yellow brown, silty, sandy, pebbly (till)
17-43	26	1,199-1,173	Clay, medium-dark-gray, silty, sandy, pebbly (till)
43-44	1	1,173-1,172	Clay, light-gray; moderately calcareous
44-67	23	1,172-1,149	Clay, medium-dark-gray, silty, sandy, pebbly (till)
67-102	35	1,149-1,114	Clay, medium-dark-gray, silty, sandy, pebbly; interbedded with very coarse sand and gravel lenses (till)
102-114	12	1,114-1,102	Sand, gray, medium to very coarse; lots of shale grains which are very coarse sand to fine gravel size
114-140	26	1,102-1,076	Shale, dark-gray; soft on top but becoming harder with depth (Pierre Shale)
Well screened from 105 to 110 feet; 2-inch PVC screen and casing. Electric log available			

Local number: 125N50W8CCCC R
 Other identifier: RB-81-06
 Site identification number: 453700096572701
 Date of construction: 4-8-81
 Land surface altitude: 1,207 feet
 Total depth: 170 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,207-1,206	Topsoil, brown
1-6	5	1,206-1,201	Sand, brown, medium to coarse
6-12	6	1,201-1,195	Clay, yellow brown, silty, pebbly (till)
12-30	18	1,195-1,177	Sand, brown, medium to very coarse
30-38	8	1,177-1,169	Clay, gray, very silty (lake clay)
30-50	12	1,169-1,157	Sand, brownish-gray, medium to very coarse; with gravel and many dark-gray ½-inch shale fragments
50-58	8	1,157-1,149	Clay, gray (lake clay?)
58-73	15	1,149-1,134	Sand, gray, medium to very coarse; with gravel and clayey from 63 to 67 feet
73-100	27	1,134-1,107	Clay, medium-dark-gray, silty, sandy, pebbly; soft (till)
100-143	43	1,107-1,064	Clay, medium-dark-gray, sandy, gravelly (till)
143-170	27	1,064-1,037	Shale, dark-gray; hard (Pierre Shale)

Electric log available

Local number: 125N50W20DDDD R
 Other identifier: RB-81-04
 Site identification number: 453514096561401
 Date of construction: 4-7-81
 Land surface altitude: 1,214 feet
 Total depth: 200 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-15	15	1,214-1,199	Sand, brown, medium to very coarse
15-25	10	1,199-1,189	Clay, yellow brown, silty, pebbly (till)
25-139	114	1,189-1,075	Clay, medium-dark-gray, silty, sandy, pebbly (till)
139-154	15	1,075-1,060	Clay, medium-dark-gray, gravelly, sandy, (till)
154-179	25	1,060-1,035	Clay, medium-dark-gray, silty, sandy, pebbly (till)
179-181	2	1,035-1,033	Gravel; poor sample return
181-200	19	1,033-1,014	Clay, light- to medium-gray, silty; calcareous, samples turn brownish-gray upon being acidized, drill rig chatters through this interval (Niobrara Formation)

Electric log available. E-log suggests some change occurs from 108 to 139 feet, but it was not observed in drilling

Local number: 125N51W1DBBB R
 Other identifier: RB-81-19
 Site identification number: 453817096591801
 Date of construction: 4-22-81
 Land surface altitude: 1,261 feet
 Total depth: 155 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,261-1,260	Topsoil, black
1-42	41	1,260-1,219	Clay, yellow brown, silty, sandy, pebbly (till)
42-46	4	1,219-1,215	Sand, brown, coarse; with very fine gravel
46-58	12	1,215-1,203	Clay, yellow brown, silty, sandy, pebbly (till)
58-99	41	1,203-1,162	Clay, medium-dark-gray, silty, sandy, pebbly (till)
99-112	13	1,162-1,149	Sand, gray, coarse; with cream colored rock fragments, shale grains
112-120	8	1,149-1,141	Gravel, gray, very coarse; ½- to ¾-inch diameter, also with very coarse to coarse sand - excellent material!
120-126	6	1,141-1,135	Clay, gray; poor sample
126-135	9	1,135-1,126	Gravel, gray, very coarse; with very coarse sand
135-155	20	1,126-1,106	Shale, dark-gray (Pierre Shale)

Well screened from 117 to 123 feet; 2-inch PVC screen and casing. Electric log available

Local number: 125N51W13ABBB R
 Other identifier: RB-81-09
 Site identification number: 453658096591701
 Date of construction: 4-9-81
 Land surface altitude: 1,202 feet
 Total depth: 50 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-9	9	1,202-1,193	Sand, brown, medium to coarse
9-14	5	1,193-1,188	Clay, yellow brown, silty
14-17	3	1,188-1,185	Sand, grayish-brown, medium to coarse
17-21	4	1,185-1,181	Clay, gray, silty
21-50	29	1,181-1,152	Shale, dark-gray (Pierre Shale)

Electric log available

Local number: 125N51W25ABAB R
 Other identifier: RB-81-01
 Site identification number: 453514096591201
 Date of construction: 4-6-81
 Land surface altitude: 1,214 feet
 Total depth: 50 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,214-1,212	Topsoil, black
2-7	5	1,212-1,207	Clay, light-gray
7-17	10	1,207-1,197	Sand, brown, very coarse, poorly sorted; color becomes gray with fine gravel at the base
17-20	3	1,197-1,194	Clay, olive gray, very sandy (till)
20-26	6	1,194-1,188	Clay, medium-dark-gray, silty, sandy (till)
26-50	24	1,188-1,164	Shale, light-bluish-gray; color grades to dark-gray, hard

Electric log available

Local number: 125N55W36CDCD
 Other identifier: R-1
 Site identification number: 453517097222501
 Date of construction: 8-19-68
 Land surface altitude: 1,853 feet
 Total depth: 900 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-17	17	1,853-1,836	Clay, pebbly, sandy, silty, tan (till)
17-166	149	1,836-1,687	Clay, silty, very rocky, gray (till)
166-183	17	1,687-1,670	Gravel, brownish-gray
183-223	40	1,670-1,630	Clay, gray (till)
223-225	2	1,630-1,628	Gravel
225-245	20	1,628-1,608	Clay, pebbly, yellowish-brown (till)
245-323	78	1,608-1,530	Clay, pebbly, much gravel (till)
323-335	12	1,530-1,518	Gravel
335-395	60	1,518-1,458	Clay, sandy (till)
395-410	15	1,458-1,443	Gravel
410-440	30	1,443-1,413	Clay, gravelly, some very fine sand (till)
440-465	25	1,413-1,388	Clay, sandy, a lot of gravel (till)
465-560	95	1,388-1,293	Clay, sandy, dark-gray (till)
560-620	60	1,293-1,233	Clay, gravelly (till)
620-677	57	1,233-1,176	Clay, sandy, a lot of gravel (till)
677-740	63	1,176-1,113	Gravel
740-755	15	1,113-1,098	Clay, very gravelly and sandy (till)
755-770	15	1,098-1,083	Gravel, lots of lignite
770-800	30	1,083-1,053	Gravel
800-820	20	1,053-1,033	Clay, some sand, light-gray
820-900	80	1,033-953	Shale

Electric log available. Electric log shows shale at depth of 805 feet

Local number: 126N49W32BBBB R
 Other identifier: RB-81-25
 Site identification number: 453934096495701
 Date of construction: 6-30-81
 Land surface altitude: 995 feet
 Total depth: 230 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	995-994	Topsoil, black
1-7	6	994-988	Sand, brown; with fine gravel
7-24	17	988-971	Clay, medium-dark-gray, silty, sandy, pebbly; calcareous (till)
24-27	3	971-968	Sand, gray, medium to coarse
27-122	95	968-873	Shale, dark-gray; slightly calcareous, hard and cuts into "ribbons," uniform drilling (Carlile Shale)
122-130	8	873-865	Sand(?); based on electric log (Codell Sandstone Member - Carlile Shale)
130-185	55	865-810	Shale, dark-gray; slightly calcareous, hard and cuts into "ribbons," uniform drilling, concretions(?) at 140 feet (Carlile Shale)
185-199	14	810-796	Limestone, medium-brown to dark-brownish-gray; interbedded with shale, angular limestone chips are calcareous and occur in lumps of shale (Greenhorn Limestone)
199-222	23	796-773	Shale, dark-gray; interbedded with brown limestone and occasional bentonites (Greenhorn Limestone)
222-230	8	773-765	Shale, dark-gray to very dark-gray (Graneros Shale)
Electric log available			

Local number: 126N51W9AAAB R
 Other identifier: RB-79-18
 Site identification number: 454305097023501
 Date of construction: 9-19-79
 Land surface altitude: 1,160 feet
 Total depth: 80 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,160-1,159	Topsoil, black
1-14	13	1,159-1,146	Clay, yellow brown (till)
14-55	41	1,146-1,105	Clay, gray; a few sand stringers (till)
55-80	25	1,105-1,080	Clay, gray, black; shell fragments, good shale cuttings (shale)

Local number: 126N51W30CCCC R
 Other identifier: RB-81-24
 Site identification number: 453940097060701
 Date of construction: 6-30-81
 Land surface altitude: 1,410 feet
 Total depth: 735 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-24	24	1,410-1,386	Shale, medium-dark-gray; with orangish-iron stains, bentonitic (Pierre Shale)
24-115	91	1,386-1,295	Shale, black to very dark-gray, bentonite at 85 feet (Pierre Shale)
115-145	30	1,295-1,265	Shale, medium-dark-gray; bentonitic (Pierre Shale)
145-160	15	1,265-1,250	Shale, medium to light-gray (Pierre Shale)
160-185	25	1,250-1,225	Shale, medium-dark-gray (Pierre Shale)
185-245	60	1,225-1,165	Shale, light-gray; with bentonite (Pierre Shale)
245-280	35	1,165-1,130	Shale, medium-gray; easier drilling than interval from 185 to 245 feet, noncalcareous (Pierre Shale)
280-300	20	1,130-1,110	Shale, medium-gray; soft, easy drilling (Pierre Shale)
300-350	50	1,110-1,060	Shale, medium-dark-gray; hard, cuttings almost "snap" into pieces, noncalcareous (Pierre Shale)
350-377	27	1,060-1,033	Shale, very dark-gray; hard cuttings almost "snap" into pieces (Sharon Springs Member - Pierre Shale)
377-397	20	1,033-1,013	Clay, medium-olive-gray; very calcareous, cuttings turn olive brown color upon acidization, trace of cream colored rock chips (Niobrara Formation)
397-428	31	1,013-982	Shale, medium-dark-gray; with faint blue sheen; concretions, slightly calcareous (Carlile Shale)
428-505	77	982-905	Shale, medium-dark-gray; with faint blue sheen, quiet and uniform drilling
505-550	45	905-860	Shale, dark-gray; waxy, noncalcareous (Carlile Shale)
550-560	10	860-850	Shale, medium-dark-gray; with medium-gray calcareous fragments
560-580	20	850-830	Shale, medium-gray; calcareous, soft, uphole abrasion of cuttings seems to yield rounded or oblate shapes (Carlile Shale)
580-600	20	830-810	Shale, medium-dark-gray; noncalcareous (Carlile Shale)
600-653	53	810-757	Shale, dark-gray to very dark-gray; noncalcareous (Carlile Shale)
653-699	46	757-711	Clay, gray; interbedded shale and limestone, rig alternately drills very hard layers and then soft layers, trace of light-gray bentonite (Greenhorn Limestone)
699-735	36	711-675	Shale, gray (Graneros Shale)

Electric log available to depth of 550 feet. Below 550 feet, lithology is based on cuttings sampled at 10-foot increments and driller's log

Local number: 126N52W16DDC R
Other identifier: LONG HOLLOW
Site identification number: 454125097102601
Date of construction: 7-2-85
Land surface altitude: 1,730 feet
Total depth: 1,265 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-293	293	1,730-1,437	Glacial drift
293-635	342	1,437-1,095	Pierre Shale
635-711	76	1,095-1,019	Niobrara Formation
711-930	219	1,019-800	Carlile Shale
930-972	42	800-758	Greenhorn Limestone
972-1,176	204	758-554	Graneros Shale
1,176-1,265	89	554-465?	Dakota Formation
1,265		465?	Precambrian basement (granite)?
Electric log available			

Local number: 126N53W10DADA R
 Other identifier: R-59
 Site identification number: 454228097161501
 Date of construction: 8-24-71
 Land surface altitude: 1,950 feet
 Total depth: 523 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-12	12	1,950-1,938	Clay, gray
12-20	8	1,938-1,930	Clay, silty, dark-black
20-60	40	1,930-1,890	Clay, silty, gravelly, gray
60-76	16	1,890-1,874	Clay and gravel layers
76-82	6	1,874-1,868	Gravel
82-100	18	1,868-1,850	Clay, silty, gray
100-112	12	1,850-1,838	Gravel with large rocks
112-115	3	1,838-1,835	Clay, pebbly, gray (till)
115-123	8	1,835-1,827	Gravel with clay stringers
123-142	19	1,827-1,808	Clay, silty, pebbly, gravel stringers
142-156	14	1,808-1,794	Gravel, large rocks and clay stringers
156-193	37	1,794-1,757	Clay, gray, pebbly (till)
193-213	20	1,757-1,737	Gravel, clean
213-218	5	1,737-1,732	Clay, gray, pebbly (till)
218-258	40	1,732-1,692	Gravel, layers of clayey gravel
258-261	3	1,692-1,689	Clay
261-268	7	1,689-1,682	Gravel
268-306	38	1,682-1,644	Clay, gray, pebbly (till)
306-312	6	1,644-1,638	Gravel, clayey
312-368	56	1,638-1,582	Clay, pebbly, gray (till)
368-374	6	1,582-1,576	Gravel, clayey
374-488	114	1,576-1,462	Clay, gray, pebbly (till)
488-505	17	1,462-1,445	Gravel with clay layers
505-523	18	1,445-1,427	Clay, black (Pierre Shale)

Electric log available

Local number: 126N54W3CBDB R
 Other identifier: R-58
 Site identification number: 454327097243501
 Date of construction: 8-19-71
 Land surface altitude: 1,862 feet
 Total depth: 425 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,862-1,861	Topsoil, black
1-31	30	1,861-1,831	Clay, yellow brown, pebbly (till)
31-80	49	1,831-1,782	Clay, silty, pebbly, gray (till)
80-92	12	1,782-1,770	Gravel
92-124	32	1,770-1,738	Clay, gray
124-280	156	1,738-1,582	Clay, gray, pebbly (till)
280-287	7	1,582-1,575	Gravel
287-336	49	1,575-1,526	Clay, silty, gray, pebbly (till)
336-342	6	1,526-1,520	Gravel
342-346	4	1,520-1,516	Clay, gray
346-376	30	1,516-1,486	Sand and gravel
376-393	17	1,486-1,469	Clay, some sand layers
393-397	4	1,469-1,465	Sand, coarse
397-425	28	1,465-1,437	Shale, dark-gray (Pierre Shale)
Electric log available			

Local number: 126N54W25AAAA2 R
 Other identifier: R-61
 Site identification number: 454025097211502
 Date of construction: 8-26-71
 Land surface altitude: 1,845 feet
 Total depth: 485 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-8	8	1,845-1,837	Clay, silty, yellowish-brown, pebbly (till)
8-19	11	1,837-1,826	Clay, brownish-gray, pebbly (till)
19-23	4	1,826-1,822	Gravel
23-95	72	1,822-1,750	Clay, silty, gray, pebbly (till)
95-155	60	1,750-1,690	Clay, gray, gravelly in spots (till), some 3-inch to 1-foot gravel stringers
155-172	17	1,690-1,673	Gravel, some clay layers
172-215	43	1,673-1,630	Clay, yellow, some gravel stringers (till)
215-275	60	1,630-1,570	Clay, gray, pebbly, gravel stringers
275-292	17	1,570-1,553	Gravel
292-338	46	1,553-1,507	Clay, gray, gravelly, some gravel stringers
338-418	80	1,507-1,427	Clay, light-gray mixed with brown, pebbly (till)
418-422	4	1,427-1,423	Gravel
422-456	34	1,423-1,389	Clay, light-gray and brown, gravelly (till)
456-465	9	1,389-1,380	Gravel
465-485	20	1,380-1,360	Clay, dark-bluish-gray (Pierre Shale)

Electric log available

Local number: 126N55W31CCCD
 Other identifier: R-52
 Site identification number: 454030097285401
 Date of construction: 8-6-71
 Land surface altitude: 1,800 feet
 Total depth: 785 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,800-1,797	Topsoil
3-15	12	1,797-1,785	Clay, yellow, pebbly (till)
15-25	10	1,785-1,775	Clay, yellow turning gray at 25 feet (lake deposits)
25-28	3	1,775-1,772	Clay, gray, pebbly (till)
28-42	14	1,772-1,758	Sand, gray
42-63	21	1,758-1,737	Clay, gray, silty, pebbly (till)
63-65	2	1,737-1,735	Gravel
65-192	127	1,735-1,608	Clay, gray, silty, gravelly in spots (till)
192-212	20	1,608-1,588	Gravel, clay layer at 204 to 210 feet
212-239	27	1,588-1,561	Clay, gray, gravelly (till)
239-248	9	1,561-1,552	Gravel
248-290	42	1,552-1,510	Clay, gray, gravelly (till)
290-308	18	1,510-1,492	Gravel
308-352	44	1,492-1,448	Clay, dark-gray, pebbly (till)
352-380	28	1,448-1,420	Sand, fine to very coarse, clayey, gray
380-393	13	1,420-1,407	Clay, light-green to light-gray, light-green is clean clay, gray is pebbly
393-487	94	1,407-1,313	Clay, gray, pebbly (till)
487-505	18	1,313-1,295	Clay, gray, some very fine sand (lake deposits)
505-554	49	1,295-1,246	Clay, dark-gray, pebbly (till)
554-601	47	1,246-1,199	Sand, fine to very coarse; some pea size gravel, some clay
601-607	6	1,199-1,193	Clay, dark-gray, compact, pebbly
607-614	7	1,193-1,186	Sand
614-618	4	1,186-1,182	Clay, gray, pebbly
618-621	3	1,182-1,179	Sand
621-668	47	1,179-1,132	Clay, dark-gray, pebbly (till)
668-740	72	1,132-1,060	Sand and gravel, lots of coal from 692 to 725 feet
740-747	7	1,060-1,053	Clay, whitish-gray to light-gray, silty
747-785	38	1,053-1,015	Clay, bluish-black, compact (Pierre Shale)

Electric log available

Local number: 127N50W18AAAD R
 Other identifier: SATHER
 Site identification number: 454725096573301
 Date of construction: 1965?
 Land surface altitude: 1,150 feet
 Total depth: 753 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-85	85	1,150-1,065	Clay
85-99	14	1,065-1,051	Poor sand
99-132	33	1,051-1,018	Good sand
132-155	23	1,018-995	Clay
155-165	10	995-985	Good sand
165-358	193	985-792	Carlile Shale
358-390	32	792-760	Greenhorn Limestone
390-585	195	760-565	Graneros Shale
585-729	144	565-421	Dakota Formation
729-753	24	421-397	Granite Wash

Electric log available

Local number: 127N53W1AAAA R
 Other identifier: R-4
 Site identification number: 454907097134401
 Date of construction: 8-26-69
 Land surface altitude: 1,252 feet
 Total depth: 65 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,252-1,249	Topsoil, black
3-12	9	1,249-1,240	Clay, yellowish, some pebbles
12-18	6	1,240-1,234	Very large rocks (limestone?), gravel, some sand
18-40	22	1,234-1,212	Clay, gray, gravelly, pebbly
40-65	25	1,212-1,187	Shale

Local number: 127N54W3AAAA R
 Other identifier: R-60
 Site identification number: 454400097233301
 Date of construction: 8-24-71
 Land surface altitude: 1,847 feet
 Total depth: 380 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-7	7	1,847-1,840	Clay, yellowish-brown, pebbly (till)
7-11	4	1,840-1,836	Clay, gray, silty, pebbly (till)
11-13	2	1,836-1,834	Clay, brownish-gray (lake clay?)
13-18	5	1,834-1,829	Clay, gray, silty, clayey (lake clay?)
18-160	142	1,829-1,687	Clay, gray, silty, clayey, pebbly (till) some thin gravel stringers
160-164	4	1,687-1,683	Clay, gray, very tough, drilled like shale, had to use pulldown
164-285	121	1,683-1,562	Clay, gray, gravelly in spots (till)
285-295	10	1,562-1,552	Clay, same as above, some brown silty clay mixed in with it
295-320	25	1,552-1,527	Clay, gray, pebbly (till)
320-340	20	1,527-1,507	Clay, gray, pebbly, gravelly in spots (till)
340-364	24	1,507-1,483	Clay, gray, sandy and gravelly (till)
364-380	16	1,483-1,467	Clay, dark-bluish-gray (shale)

Electric log available

Local number: 127N56W36AABB
 Other identifier: R-51
 Site identification number: 454632097291701
 Date of construction: 8-4-71
 Land surface altitude: 1,840 feet
 Total depth: 545 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-5	5	1,840-1,835	Sand and gravel
5-12	7	1,835-1,828	Clay, yellowish-brown, pebbly (till)
12-20	8	1,828-1,820	Clay, gray, pebbly (till)
20-32	12	1,820-1,808	Clay, gray, sandy, gravelly (till)
32-76	44	1,808-1,764	Clay, gray, pebbly (till)
76-81	5	1,764-1,759	Gravel, some clay
81-140	59	1,759-1,700	Clay, gray, pebbly, some thin gravel stringers (till)
140-148	8	1,700-1,692	Sand and gravel
148-165	17	1,692-1,675	Clay, silty, gray, pebbly (till)
165-172	7	1,675-1,668	Sand and clay layers
172-185	13	1,668-1,655	Clay, gray (lake deposits)
185-235	50	1,655-1,605	Clay, silty, gray, pebbly (till)
235-336	101	1,605-1,504	Clay, gray, pebbly, some gravel layers
336-345	9	1,504-1,495	Gravel
345-355	10	1,495-1,485	Clay, gray, pebbly (till)
355-376	21	1,485-1,464	Clay, greenish-brown, pebbly, hard drilling
376-391	15	1,464-1,449	Clay, dark-gray to blackish-gray, pebbly (till)
391-394	3	1,449-1,446	Sand, coarse, some fine sand, marly
394-430	36	1,446-1,410	Sand, fine to coarse, clay layers
430-475	45	1,410-1,365	Clay, dark-gray, pebbly (till)
475-510	35	1,365-1,330	Clay, gray to brown, pebbly
510-545	35	1,330-1,295	Clay, bluish-black, compact (Pierre Shale)
Electric log available			

Local number: 128N53W10BBBB R
 Other identifier: R-1
 Site identification number: 455329097172501
 Date of construction: 8-25-69
 Land surface altitude: 1,250 feet
 Total depth: 215 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-21	21	1,250-1,229	Clay, yellowish-brown
21-27	6	1,229-1,223	Clay, yellowish-brown, gravelly
27-110	83	1,223-1,140	Clay, gray, gravelly
110-120	10	1,140-1,130	Sand, coarse, gray
120-130	10	1,130-1,120	Gravel
130-140	10	1,120-1,110	Gravel, coarse
140-160	20	1,110-1,090	Gravel, fine and very coarse sand
160-170	10	1,090-1,080	Sand, very coarse, some gravel
170-178	8	1,080-1,072	Gravel
178-215	37	1,072-1,035	Shale

Local number: 128N53W12AAAA R
 Other identifier: R-2
 Site identification number: 455329097134401
 Date of construction: 8-26-69
 Land surface altitude: 1,210 feet
 Total depth: 200 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-28	28	1,210-1,182	Clay, yellowish-brown, silty, sandy
28-45	17	1,182-1,165	Clay, yellowish-brown, silty, pebbly (till)
45-60	15	1,165-1,150	Clay, gray, very silty, slightly pebbly (till)
60-75	15	1,150-1,135	Clay, gray, silty, pebbly (till)
75-78	3	1,135-1,132	Clay, gray, shaley pebbly, gravelly
78-110	32	1,132-1,100	Clay, gray, silty, pebbly (till)
110-120	10	1,100-1,090	Sand, medium, some coarse
120-130	10	1,090-1,080	Sand, clayey
130-140	10	1,080-1,070	Sand, coarse, some very coarse
140-150	10	1,070-1,060	Sand, very coarse, clay layers
150-168	18	1,060-1,042	Sand, medium
168-200	32	1,042-1,010	Shale

Electric log available

Local number: 128N53W14CCCC R
 Other identifier: R-7
 Site identification number: 455148097161001
 Date of construction: 9-12-70
 Land surface altitude: 1,250 feet
 Total depth: 95 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,250-1,249	Topsoil
1-18	17	1,249-1,232	Clay, yellowish-brown, pebbly
18-78	60	1,232-1,172	Clay, silty, gray, pebbly
78-95	17	1,172-1,155	Shale (Pierre Shale)

Local number: 128N53W15BAAA R
 Other identifier: R-9
 Site identification number: 455337097165201
 Date of construction: 9-2-70
 Land surface altitude: 1,250 feet
 Total depth: 200 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,250-1,247	Topsoil, black
3-15	12	1,247-1,235	Silt (lake deposits)
15-120	105	1,235-1,130	Clay, silty, yellowish-brown to gray
120-170	50	1,130-1,080	Gravel
170-195	25	1,080-1,055	Clay, gray, pebbly (gravel layer on top of shale)
195-200	5	1,055-1,050	Shale (Pierre Shale)

Electric log available

Local number: 128N53W15CAAA R
 Other identifier: R-10
 Site identification number: 455211097165201
 Date of construction: 9-3-70
 Land surface altitude: 1,252 feet
 Total depth: 110 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-26	26	1,252-1,226	Clay, yellowish-brown, pebbly (till)
26-58	32	1,226-1,194	Clay, silty, some very fine sand, gray, some pebbles (till)
58-60	2	1,194-1,192	Sand and gravel
60-89	29	1,192-1,163	Clay, silty, some very fine sand, gray
89-110	21	1,163-1,142	Shale, bluish-black, compact (Pierre Shale)

Local number: 128N53W15CBCB R
 Other identifier: R-6
 Site identification number: 455204097172501
 Date of construction: 9-2-70
 Land surface altitude: 1,268 feet
 Total depth: 80 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-9	9	1,268-1,259	Sand, rocks, gravel, and clay (till)
9-16	7	1,259-1,252	Clay, yellowish-brown, gravelly
16-72	56	1,252-1,196	Clay, gray, pebbly (6-inch gravel stringer at 50 feet, 2-foot gravel stringer at 60 feet)
72-80	8	1,196-1,188	Shale (Pierre Shale)

Local number: 128N53W20BBBB R
 Other identifier: ATH-22
 Site identification number: 455144097195501
 Date of construction: 10-11-68
 Land surface altitude: 1,350 feet
 Total depth: 108 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-20	20	1,350-1,330	Clay, light-tan, with light-gray streaks and some red spots (rust)
20-40	20	1,330-1,310	Clay, light-gray, streaked with light-tan
40-95	55	1,310-1,255	Clay, light-gray
95-100	5	1,255-1,250	Weathered shale (about 95 feet)
100-108	8	1,250-1,242	Shale

Local number: 128N53W22CCCC R
 Other identifier: ATH-20
 Site identification number: 455055097172501
 Date of construction: 6-25-68
 Land surface altitude: 1,305 feet
 Total depth: 77 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,305-1,303	Topsoil
2-10	8	1,303-1,295	Clay, pebbly, light-brown
10-12	2	1,295-1,293	Clay, pebbly, yellow gray
12-15	3	1,293-1,290	Clay, pebbly, light-gray streaked with light-brown
15-19	4	1,290-1,286	Clay, pebbly, light-brown with some white streaks
19-45	26	1,286-1,260	Clay, light-tan with lighter and dark streaks
45-55	10	1,260-1,250	Clay, light-gray
55-77	22	1,250-1,228	Shale

Local number: 128N53W25AAAA R
 Other identifier: R-3
 Site identification number: 455052097134401
 Date of construction: 8-26-69
 Land surface altitude: 1,230 feet
 Total depth: 110 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-17	17	1,230-1,213	Clay, yellowish (till)
17-24	7	1,213-1,206	Clay, gray (till)
24-72	48	1,206-1,158	Clay, gray, pebbly (till)
72-80	8	1,158-1,150	Sand, coarse to very coarse, and gravel, gray
80-92	12	1,150-1,138	Gravel and very coarse sand, gray
92-110	18	1,138-1,120	Shale

Electric log available

Local number: 128N53W33DDDD R
 Other identifier: ATH-21
 Site identification number: 454911097173001
 Date of construction: 6-25-68
 Land surface altitude: 1,430 feet
 Total depth: 48 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-10	10	1,430-1,420	Sand, very coarse; gravel, very fine to medium
10-15	5	1,420-1,415	Sand, very coarse, silty, large cobbles; water level at 7.4 feet
15-25	10	1,415-1,405	Sand, coarse to very coarse, saturated, less cobbles and gravel
25-30	5	1,405-1,400	Sand, medium to very coarse
30-43	13	1,400-1,387	Clay, pebbles, gray; gravel
43-48	5	1,387-1,382	Shale?

Local number: 128N55W31CCBC R
 Other identifier: R-50
 Site identification number: 455102097284501
 Date of construction: 8-3-71
 Land surface altitude: 1,885 feet
 Total depth: 470 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-22	22	1,885-1,863	Clay, yellowish-brown with some gray, pebbly (till)
22-67	45	1,863-1,818	Clay, gray, pebbly (till)
67-185	118	1,818-1,700	Clay, gray, sandy, gravelly in spots (till)
185-208	23	1,700-1,677	Clay, gray, tough in spots, clayey (till)
208-235	27	1,677-1,650	Clay, gray gravelly in spots (till)
235-314	79	1,650-1,571	Clay, gray, pebbly (till)
314-386	72	1,571-1,499	Clay, gray, gravelly in spots, very tough drilling (cut mud at 327 feet, drills easier now); clay is very sticky, clayey, shaley at 360 feet
386-392	6	1,499-1,493	Gravel
392-395	3	1,493-1,490	Clay, shaley
395-405	10	1,490-1,480	Gravel
405-415	10	1,480-1,470	Clay, gray, sandy, pebbly, gravelly in spots
415-450	35	1,470-1,435	Clay, grayish-brown, tough, shaley. mud turned brown (another till?); some white marl in cuttings (lake deposit?); brown clay between 440 to 450 feet
450-453	3	1,435-1,432	Sand and gravel layer, not very good but took water
453-470	17	1,432-1,415	Clay, bluish-black, compact (shale)

Local number: 128N56W1AAAA
 Other identifier: R-48
 Site identification number: 455606097284901
 Date of construction: 8-2-71
 Land surface altitude: 1,720 feet
 Total depth: 260 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-31	31	1,720-1,689	Clay, yellowish-brown, pebbly (till)
31-46	15	1,689-1,674	Clay, light-brownish-gray, pebbly (till)
46-164	118	1,674-1,556	Clay, dark-gray, pebbly (till), becomes gravelly at 98 feet
164-167	3	1,556-1,553	Gravel
167-216	49	1,553-1,504	Clay, dark-gray, very gravelly (till)
216-230	14	1,504-1,490	Clay, yellow brown
230-260	30	1,490-1,460	Clay, dark-blue gray (shale), bentonite mixed in with shale
Electric log available			

Local number: 129N50W24CCD R
 Other identifier: 12186A
 Site identification number: 455755096520101
 Date of construction: 09-08-88
 Land surface altitude: 1,089.52 feet
 Total depth: 215 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,089.52-1,087.52	Topsoil
2-17	15	1,087.52-1,072.52	Silt, clayey to pebbly, soft, slightly plastic, oxidized; gravel from 14 to 15 feet (till)
17-47	30	1,072.52-1,042.52	Silt, clayey to pebbly, olive-gray, soft, slightly plastic (till)
47-92	45	1,042.52-997.52	Sand, fine, well sorted, subrounded and rounded quartz; contains detrital lignite below 60 feet
92-110	18	997.52-979.52	Silt, clayey, soft, nonplastic
110-117	7	979.52-972.52	Silt, clayey, soft, nonplastic; interbedded sand and gravel
117-123	6	972.52-966.52	Gravel, fine, granular, subangular to rounded; limestone and igneous
123-138	15	966.52-951.52	Sand, coarse and very coarse, pebbly, subangular to rounded; interbedded clay and gravel
138-145	7	951.52-944.52	Gravel, coarse, subrounded and rounded, igneous and limestone
145-157	12	944.52-932.52	Clay, silty to pebbly, olive-gray, firm, nonplastic (till)
157-177	20	932.52-912.52	Clay, olive-black, firm, slightly plastic; pebbly with depth; sand from 174 to 175 feet
177-180	3	912.52-909.52	Gravel, fine to coarse, granular
180-204	24	909.52-885.52	Sand, fine to very coarse, granular, subrounded and rounded
204-215	11	885.52-874.52	Shale, brownish-black, firm

Well screened from 198 to 203 feet; 2-inch PVC screen and casing

Local number: 129N51W8CCC R
 Other identifier: 13037
 Site identification number: 455755097045501
 Date of construction: 8-18-92
 Land surface altitude: 1,196.2 feet
 Total depth: 240 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,196.2-1,194.2	Topsoil, black
2-4	2	1,194.2-1,192.2	Clay, light-olive gray, soft, plastic, oxidized; mottled to 10 feet (till)
4-23	19	1,192.2-1,173.2	Clay, silty, sandy, pebbly, light-olive-gray, slightly firm, oxidized; mottled to 10 feet (till)
23-25	2	1,173.2-1,171.2	Sand, fine and medium, oxidized
25-33	8	1,171.2-1,166.2	Clay, silty, sandy, pebbly, light-olive-gray, slightly firm, unoxidized (till)
33-36	3	1,166.2-1,160.2	Clay, silty, sandy, pebbly, olive-gray, oxidized
36-40	4	1,160.2-1,156.2	Silt, clayey, light-olive-gray, oxidized
40-45	5	1,156.2-1,151.2	Silt, clayey, olive-gray, unoxidized
45-77	32	1,151.2-1,119.2	Sand, fine, slightly pebbly, fine, well sorted, quartz, igneous, shale
77-81	4	1,119.2-1,115.2	Silt, clayey, medium-dark-gray, soft, slightly stick, plastic
81-127	46	1,115.2-1,069.2	Sand, fine, slightly pebbly, fine, well sorted, quartz, igneous, shale; some lignite return
127-136	9	1,069.2-1,060.2	Silt, clayey, medium-dark-gray, soft, slightly sticky, plastic
136-155	19	1,060.2-1,041.2	Sand, fine and medium, pebbly, fine, medium sorted, quartz, igneous, shale; coarser with depth
155-163	8	1,041.2-1,033.2	Sand, medium and coarse, pebbly, fine to coarse, medium sorted, angular to sub-rounded, igneous, carbonate, shale
163-189	26	1,033.2-1,007.2	Silt, clayey, medium-dark-gray, soft, sticky, plastic
189-231	42	1,007.2-965.2	Clay, silty, sandy, pebbly, olive-gray, slightly firm; cobbles at 189 feet; firm from 209 to 231 feet (till)
231-240	9	965.2-956.2	Shale, grayish-black, hard; waxy appearance
Well screened from 148 to 153 feet; 2-inch PVC screen and casing			

Local number: 129N51W19ABA R
 Other identifier: 13422
 Site identification number: 455701097051501
 Date of construction: 9-21-94
 Land surface altitude: 1,191.23 feet
 Total depth: 240 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,191.23-1,189.23	Topsoil, clay loam black
2-7	5	1,189.23-1,184.23	Clay, light-olive-brown, slightly firm, slightly sticky, slightly plastic, oxidized
7-28	21	1,184.23-1,163.23	Clay, silty, sandy, pebbly, light-olive-brown, slightly firm, slightly sticky, slightly plastic, oxidized
28-34	6	1,163.23-1,157.23	Clay, slightly silty, light-olive-brown, soft, sticky, plastic, oxidized
34-53	19	1,157.23-1,138.23	Clay, slightly silty, olive gray
53-55	2	1,138.23-1,136.23	Interbedded clay, silt, and sand
55-65	10	1,136.23-1,126.23	Sand, fine to coarse, pebbly, fine, predominantly shale, subangular to rounded
65-87	22	1,126.23-1,104.23	Silt, clayey, sandy, olive gray; interbedded sand, silty from 74 to 75 feet
87-142	55	1,104.23-1,049.23	Sand, fine and medium, pebbly, fine, mixed mineralogy, subangular to rounded; detrital lignite; silt, sandy, olive gray from 103 to 108 feet, sand, fine to coarse, granular, pebbly, fine from 120 to 140 feet
142-203	61	1,049.23-988.23	Clay, silty, sandy, olive gray, soft, sticky, nonplastic; clay, slightly silty, plastic below 167 feet; clay, silty below 200 feet (lacustrine)
203-227	24	988.23-964.23	Clay, silty, sandy, pebbly, olive gray, slightly firm, slightly sticky, slightly plastic, occasional cobble (till)
227-240	13	964.23-951.23	Clay, olive black, slightly firm, sticky, plastic, noncalcareous; waxy appearance (shale)

Well screened from 128 to 133 feet; 2-inch PVC screen and casing

Local number: 129N52W14AAA R
 Other identifier: 13494
 Site identification number: 455932097092401
 Date of construction: 10-11-95
 Land surface altitude: 1,220 feet
 Total depth: 270 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,220-1,218	Loam, black
2-32	30	1,218-1,188	Clay, silty, sandy, pebbly, dusky yellow, firm slightly sticky, slightly plastic, oxidized; slightly reduced, light-olive-gray with depth
32-52	20	1,188-1,168	Clay, silty, sandy, pebbly, olive gray, firm, slightly sticky, slightly plastic, reduced
52-60	8	1,168-1,160	Clay, very silty, olive gray, soft, slightly sticky, nonplastic
60-124	64	1,160-1,096	Sand, very fine and fine; lignite return
124-218	94	1,096-1,002	Clay, silty, very sandy, olive gray; lignite return
218-264	46	1,002-956	Clay, silty, sandy, pebbly, olive gray, firm, slightly sticky, nonplastic, rock at 223 feet (till)
264-270	6	956-950	Clay, slightly silty, olive black, firm, sticky, plastic, noncalcareous; waxy appearance (shale)

Well screened from 78 to 83 feet; 2-inch PVC screen and casing

Local number: 129N52W19ABB R
 Other identifier: 13495
 Site identification number: 455658097130201
 Date of construction: 10-11-95
 Land surface altitude: 1,170 feet
 Total depth: 220 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,170-1,168	Clay loam, black
2-12	10	1,168-1,158	Clay, slightly silty, slightly sandy, slightly pebbly, dusky yellow, firm, slightly sticky, plastic, oxidized
12-15	3	1,158-1,155	Clay, slightly silty, slightly sandy, slightly pebbly, light-olive-gray, firm, slightly sticky, plastic, slightly reduced
15-35	20	1,155-1,135	Clay, slightly silty, slightly sandy, slightly pebbly, olive gray, firm, sticky, plastic, reduced
35-89	54	1,135-1,081	Clay, silty, sandy, pebbly, olive gray, slightly firm, sticky, plastic; occasional cobble; interbedded sand and gravel less than 1-foot beds, from 47 to 56 feet (till)
89-108	19	1,081-1,062	Sand, fine to coarse, predominantly coarse, gravel fine and medium, mixed minerology, subangular and subrounded
108-124	16	1,062-1,046	Sand, fine to coarse, predominantly coarse
124-132	8	1,046-1,038	Clay, olive gray
132-140	8	1,038-1,030	Clay, very sandy, olive gray
140-142	2	1,030-1,028	Sand and gravel
142-202	60	1,028-968	Clay, silty, sandy, pebbly, olive gray, slightly firm; occasional cobble; interbedded sand and gravel, less than 1-foot beds, from 142 to 166 feet; very sandy by 166 feet; firm by 183 feet (till)
202-220	18	968-950	Clay, slightly silty, olive black, firm, sticky, plastic, noncalcareous; waxy appearance (shale)

Well screened from 114 to 119 feet; 2-inch PVC screen and casing. Well flowed, less than 1 gallon per minute or about 3.3 feet above land surface. Well was plugged by NDSWC on 11-02-95

Local number: 129N52W21CCC R
 Other identifier: 12277
 Site identification number: 455610097110901
 Date of construction: 11-29-88
 Land surface altitude: 1,221.2 feet
 Total depth: 280 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,221.2-1,218.2	Topsoil
3-16	13	1,218.2-1,205.2	Clay, silty to pebbly, dark-yellowish-orange, soft, plastic, oxidized (till)
16-21	5	1,205.2-1,200.2	Clay, slightly silty, dark-yellowish-orange, soft, plastic, oxidized (lacustrine)
21-41	20	1,200.2-1,180.2	Sand, fine and medium, granular, subrounded and rounded limestone, shale and quartz; interbedded gravel
41-59	18	1,180.2-1,162.2	Silt, slightly clayey, oxidized
59-62	3	1,162.2-1,159.2	Silt, slightly clayey, olive gray
62-136	74	1,159.2-1,085.2	Sand, medium, subrounded and rounded, quartz and carbonate; interbedded sandy clay and gravel; contains detrital lignite
136-186	50	1,085.2-1,035.2	Clay, silty and very sandy, olive gray
186-189	3	1,035.2-1,032.2	Gravel, rounded, shale and limestone
189-204	15	1,032.2-1,017.2	Clay, very sandy, very pebbly, olive gray, nonplastic; interbedded gravel (till)
204-223	19	1017.2-998.2	Clay, very silty, to pebbly, olive gray, soft, slightly plastic (till)
223-263	40	998.2-958.2	Clay, very silty, very sandy, pebbly, olive gray firm; sand from 252 to 253 feet (till)
263-280	17	958.2-941.2	Shale, olive black, plastic

Well screened from 128 to 133 feet; 1¼-inch PVC screen and casing

Local number: 129N53W4BAA
 Other identifier: 13447
 Site identification number: 460117097195801
 Date of construction: 8-29-95
 Land surface altitude: 1,163 feet
 Total depth: 260 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-29	29	1,163-1,134	Clay, silty, sandy, pebbly pale yellow, gray, and brown, oxidized (till)
29-31	2	1,134-1,132	Sand and gravel, sand very fine to very coarse, gravel up to ½-inch diameter; yellow stained, oxidized; angular to rounded, quartz, shield silica, carbonate, shale
31-36	5	1,132-1,127	Sand and gravel, as above, interbedded with till as above
36-85	49	1,127-1,078	Clay, silty, sandy, pebbly, soft, olive gray (till)
85-91	6	1,078-1,072	Till interbedded with shale and carbonaceous sand and gravel
91-172	81	1,072-991	Sand (90%) very fine to very coarse, predominantly medium, and gravel (10%), predominantly very fine, up to ¼-inch diameter; occasional silty clay; clayey silt layers where bit slowed; lots of quartz, shale and carbonates, shield silicates, minor detrital shale, subangular to well rounded, light bit chatter; at 142 to 144 feet bit slowed, silty clay/clayey silt layer
172-192	20	991-971	Silty, clay, slightly sandy (very fine) greenish-gray, bit slowed, soft, drilled smooth, no chatter, good recovery
192-201	9	971-962	Clay silt, as 172- to 192-foot interval, with sand and gravel layers
201-229	28	962-934	Gravel (50-70%) up to 1-inch diameter, predominantly fine, and sand, very fine to very coarse, predominantly coarse (30-50%); lots of quartz, shield silica, carbonates, shale, some occasional silty clay/clayey silty layers where bit slowed, otherwise moderate bit chatter
229-235	6	934-928	Clay, silty, brownish-black, very calcareous, does not appear to be bedrock shale, soft, greasy
235-260	25	928-903	Clay, black, sticky, noncalcareous, does not effervesce in dilute HCl; ribbon-like sample returns (Carlile Shale)
Well screened from 204 to 209 feet; 2-inch PVC screen and casing Electric log available			

Local number: 129N53W7BBA R
 Other identifier: 9248
 Site identification number: 455842097210301
 Date of construction: 12-5-74
 Land surface altitude: 1,171 feet
 Total depth: 220 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,171-1,170	Topsoil, silty loam, dusky brown
1-4	3	1,170-1,167	Clay, silty, sandy, pebbly; grayish-orange; soft, sticky, oxidized (till)
4-12	8	1,167-1,159	Clay, silty, sandy, pebbly; dark-yellowish-brown; firm plastic, oxidized (till)
12-66	54	1,159-1,105	Clay, silty, sandy, predominantly very coarse sand grains, pebbly; dark-gray; moderately firm, plastic (till)
66-102	36	1,105-1,069	Clay, silty, sandy, pebbly; olive gray; moderately firm, plastic (till)
102-200	98	1,069-971	Sand, medium-dark-gray, medium to very coarse, angular to round, about 70% quartz, 10% gneiss, 10% carbonates, 8% shale, 2% detrital lignite (some fragments); at laminations taking some water
200-220	20	971-951	Pierre Shale, grayish-black; siliceous, plastic, slightly fissile, noncalcareous

Well screened from 178 to 184 feet; 1¼-inch PVC screen and casing. Electric log available

Local number: 129N53W9AAA R
 Other identifier: 9249
 Site identification number: 455842097173701
 Date of construction: 12-5-74
 Land surface altitude: 1,170 feet
 Total depth: 240 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,170-1,169	Topsoil, silty loam, dusky brown
1-6	5	1,169-1,164	Clay, silty, sandy, pebbly; grayish-orange, iron stained, moderately firm, plastic, oxidized (till)
6-62	56	1,164-1,108	Clay, silty, sandy, pebbly; dark-gray; moderately firm, plastic, tight; occasional gravel lens, boulders (till)
62-120	58	1,108-1,050	Clay, silty, sandy, pebbly; olive gray; moderately firm, plastic (till)
120-180	60	1,050-990	Silt, slightly sandy, dark-gray; tight, moderate plasticity, thin sand lenses; occasional light-gray laminae
180-217	37	990-953	Sand, about 5% gravel; fine to coarse; angular to subrounded; about 70% quartz, 10% shale, 10% carbonates, 10% gneiss; silt lenses
217-240	23	953-930	Pierre Shale, siliceous, dark-gray to grayish-black; noncalcareous, plastic, tight

Well screened from 198 to 201 feet; 1¼-inch PVC screen and casing. Electric log available

Local number: 129N53W11AAA R
 Other identifier: 9250
 Site identification number: 455844097145701
 Date of construction: 12-6-74
 Land surface altitude: 1,171 feet
 Total depth: 260 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,171-1,170	Topsoil, silty loam, dusky yellow brown
1-4	3	1,170-1,167	Clay, silty, sandy, pebbly; medium-yellow-brown; soft, sticky, oxidized (till)
4-26	22	1,167-1,145	Clay, silty, sandy, pebbly; medium-yellow-brown; firm, plastic, oxidized (till)
26-40	14	1,145-1,131	Clay, silty, sandy, pebbly; dark-gray; moderately firm, plastic, gravelly (till)
40-82	42	1,131-1,089	Clay, silty, sandy, pebbly; olive gray, moderately firm, plastic (till)
82-92	10	1,089-1,079	Sand, very fine to fine, medium-dark-gray; angular to subangular; about 80% quartz, 10% carbonates, 5% gneiss, 5% shale, trace detrital lignite; micaceous; till lenses
92-174	82	1,079-997	Sand, as above; clean, well sorted, little caving taking very little water (deltaic?)
174-230	56	997-941	Silt, olive gray, soft, poor recovery, washing out, sand-gravel lenses (deltaic?)
230-260	30	941-911	Pierre Shale; siliceous; grayish-black; tight, plastic; noncalcareous

Well screened from 138 to 141 feet; 1¼-inch PVC screen and casing. Electric log available

Local number: 129N53W25AADA R
 Other identifier: R-5
 Site identification number: 455559097134401
 Date of construction: 9-1-70
 Land surface altitude: 1,188 feet
 Total depth: 245 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-11	11	1,188-1,177	Clay, yellowish-brown, pebbly (till)
11-40	29	1,177-1,148	Sand, fine to coarse, brown
40-47	7	1,148-1,141	Sand, fine to coarse, light-gray
47-55	8	1,141-1,133	Clay, very silty, gray, with very fine sand
55-75	20	1,133-1,113	Sand, very fine to medium, gray
75-142	67	1,113-1,046	Clay, quite silty, gray, with very fine sand
142-151	9	1,046-1,037	Sand, medium to coarse, and gravel
151-177	26	1,037-1,011	Clay, very silty, gray, with very fine sand and gravel and sand stringers
177-218	41	1,011-970	Clay, calcareous, gray, pebbly, sandy (Niobrara Formation)
218-245	27	970-943	Shale, bluish-black (Carlisle Shale)

Electric log available

Local number: 129N53W27BBBB R
 Other identifier: R-11
 Site identification number: 455606097172501
 Date of construction: 9-3-70
 Land surface altitude: 1,255 feet
 Total depth: 260 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-12	12	1,255-1,243	Clay, yellowish-brown, pebbly (till)
12-20	8	1,243-1,235	Sand, medium, some gravel, brown
20-30	10	1,235-1,225	Sand, coarse some gravel, brown
30-50	20	1,225-1,205	Sand, medium to coarse, brown
50-60	10	1,205-1,195	Sand, coarse to very coarse, brown
60-80	20	1,195-1,175	Sand, medium to coarse, brown, some very coarse from 70 to 80 feet
80-90	10	1,175-1,165	Sand, coarse to very coarse, brown
90-110	20	1,165-1,145	Sand, medium to coarse, brown
110-130	20	1,145-1,125	Sand, coarse to very coarse, gray, some coal from 120 to 130 feet
130-140	10	1,125-1,115	Sand, fine to medium, gray, some coal
140-150	10	1,115-1,105	Sand, fine to medium, gray, some coal
150-160	10	1,105-1,095	Sand, medium, gray, some coal
160-170	10	1,095-1,085	Sand, medium to coarse, gray, some coal
170-180	10	1,085-1,075	Sand, fine to medium, gray, much coal
180-190	10	1,075-1,065	Sand, coarse, gray, some coal
190-203	13	1,065-1,052	Sand, coarse to very coarse, gray, some coal
203-218	15	1,052-1,037	Clay, sandy, gray, with pebbles
218-223	5	1,037-1,032	Sand and gravel, gray
223-242	19	1,032-1,013	Clay, gray, pebbly (till)
242-243	1	1,013-1,012	Rocks
243-260	17	1,012-995	Shale, bluish-black

Local number: 129N54W1AAA
 Other identifier: 13452
 Site identification number: 460118097230501
 Date of construction: 9-5-95
 Land surface altitude: 1,162 feet
 Total depth: 231 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-28	28	1,162-1,134	Clay, silty, sandy, pebbly, some cobbles; pale yellow; gray brown with red yellow stringers; oxidized, soft (till)
28-62	34	1,134-1,100	Clay, as above, olive gray, unoxidized (till)
62-218	156	1,100-944	Sand, very fine to very coarse, predominantly medium coarse (90%) and gravel (10%) up to about ½-inch diameter, mostly less than 0.2-inch diameter, lots of quartz, shield silica, carbonates, detrital shale and lignite, subangular to well rounded; takes water; some large pebbles sized weathered niobrara shale chunks; at 109 feet, finer section, (less than 1% very fine gravel; sand, predominantly fine to medium); At 135 to 140 feet, slight rig chatter numerous detrital lignite fragments; after about 160 feet, finer section, mostly very fine to fine sand, good recovery; at 180 feet mixed one bag bentonite
218-220	2	944-942	Silt, clayey, greenish-gray, good recovery, bit slowed, smooth
220-231	11	942-931	Clay, black, sticky, does not effervesce in dilute HCl, noncalcareous (Carlile Shale)
1¼-inch PVC casing and 2-inch PVC screen from 195 to 200 feet. Electric log available			

Local number: 129N54W3ADD R

Other identifier: 12263

Site identification number: 455914097231801

Date of construction: 10-25-82

Land surface altitude: 1,186 feet

Total depth: 200 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,186-1,185	Topsoil
1-43	42	1,185-1,143	Clay, yellow brown, iron stained, oxidized, silty, sandy, with pebbles (till)
43-120	77	1,143-1,066	Clay, olive gray, silty, sandy, with pebbles, unoxidized (till) poorly sorted
120-132	12	1,066-1,054	Sand, fine to coarse, some gravel, predominantly shale, well rounded to subrounded, fair sorting
132-138	6	1,054-1,048	Clay, olive gray, some layers of sand and gravel
138-140	2	1,048-1,046	Sand, very fine, poor return
140-156	16	1,046-1,030	Silt, poor return, drills fast, olive gray
156-188	32	1,030-998	Clay, olive gray, silty, sandy, with pebbles (till)
188-200	12	998-986	Clay, black, snaps when broken (bedrock)

Well screened from 125 to 128 feet; 1¼-inch PVC screen and casing

Local number: 129N54W10AAA R
 Other identifier: 12264
 Site identification number: 455846097231801
 Date of construction: 10-26-82
 Land surface altitude: 1,186 feet
 Total depth: 200 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1.5	1.5	1,186-1,184.5	Topsoil
1.5-18	16.5	1,184.5-1,168	Clay, yellow brown; iron stained, silty, sandy, pebbly, oxidized (till)
18-183	165	1,168-1003	Clay, olive gray, unoxidized, silty, sandy, pebbly (till), poorly sorted sand lens at 112 to 113 feet
183-200	17	1,003-986	Clay, black, greasy (bedrock)

Electric log available

Local number: 129N54W10ADD R
 Other identifier: 12265
 Site identification number: 455821097231801
 Date of construction: 10-26-82
 Land surface altitude: 1,232 feet
 Total depth: 200 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-2	2	1,232-1,230	Topsoil
2-13	11	1,230-1,219	Clay, yellow brown, oxidized, iron stained, silty, sandy, pebbly (till)
13-53	40	1,219-1,179	Clay, olive gray, silty, sandy, pebbly (till)
53-69	16	1,179-1,163	Sand, medium to coarse with some pebble gravel, well rounded to subrounded, fair sorting, predominantly shale with 10% carbonates and igneous; also a couple of clay seams
69-94	25	1,163-1,138	Till, as above
94-97	3	1,138-1,135	Sand, drills fast, poor return, predominantly shale, composition unknown due to upper sands
97-190	93	1,135-1,042	Till, as above
190-200	10	1,042-1,032	Clay, black, greasy, peels off like bacon (bedrock) some siltstone

Well screen from 58 to 63 feet; 1½-inch PVC screen and casing. Well was flowing so it was plugged with grout on 11-16-82. Electric log available

Local number: 129N54W25AAAA R
 Other identifier: R-12
 Site identification number: 455607097211501
 Date of construction: 9-4-70
 Land surface altitude: 1,260 feet
 Total depth: 230 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-3	3	1,260-1,257	Topsoil, black
3-33	30	1,257-1,227	Yellow brown clay, fatty
33-120	87	1,227-1,140	Clay, gray; 6- to 8-inch gravel stringer at 87 feet
120-160	40	1,140-1,100	Gravel
160-173	13	1,100-1,087	Silty (till), smooth cutting, gravel stringer at 173 feet
173-213	40	1,087-1,047	Silt; rock at 213 feet
213-230	17	1,047-1,030	Shale cuttings

Local number: 129N54W27BBBB R
 Other identifier: R-13
 Site identification number: 455607097245701
 Date of construction: 9-8-70
 Land surface altitude: 1,365 feet
 Total depth: 110 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-5	5	1,365-1,360	Mostly gravel, some clay
5-15	10	1,360-1,350	Clay, yellow, very gravelly
15-35	20	1,350-1,330	Clay, gray, very silty
35-100	65	1,330-1,265	Clay, whitish-gray (drills and looks like shale)
100-110	10	1,265-1,255	Shale, dark-gray

Local number: 129N54W29CCC
 Other identifier: 9244
 Site identification number: 455659097291601
 Date of construction: 12-3-74
 Land surface altitude: 1,520 feet
 Total depth: 40 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-4	4	1,520-1,516	Clay, very silty, sandy, pebbly; moderately yellow brown; soft, sticky, oxidized (till)
4-12	8	1,516-1,508	Clay, silty, sandy, pebbly; dark-yellow-brown; firm, moderately plastic, oxidized (till)
12-15	3	1,508-1,505	Clay, silty, sandy, pebbly; dark-gray, moderately plastic (till)
15-40	25	1,505-1,480	Pierre Shale; grayish-black; (brittle upper contact), tight, moderately plastic, noncalcareous, bentonitic

Local number: 130N54W27CCC R
 Other identifier: 12261
 Site identification number: 460033097245701
 Date of construction: 9-21-82
 Land surface altitude: 1,180 feet
 Total depth: 190 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,180-1,179	Topsoil
1-27	26	1,179-1,153	Clay, yellow brown, oxidized, iron stains, silty, sandy, pebbly (till)
27-101	74	1,153-1,079	Clay, olive gray, silty, sandy, pebbly (till); rock at 80 feet, put rock bit on
101-112	11	1,079-1,068	Sand and gravel, coarse sand to medium gravel, predominantly very coarse sand, angular to rounded, predominantly rounded, predominantly quartz, some very coarse detrital lignite
112-141	29	1,068-1,039	Till, olive gray clay, slightly pebbly, cohesive and plastic
141-170	29	1,039-1,010	Sand, fine to medium grain, predominantly medium, predominantly rounded, interbedded with sandy and/or silty clay and lenses of coarse detrital lignite; below 153 feet, appears to be strictly medium sand, no clay; below 164 feet, interbedded clay and detrital lignite
170-176	6	1,010-1,004	Till, brownish- to olive-gray, silty and pebbly, moderately cohesive
176-190	14	1,004-990	Bedrock shale, dark-gray to black, interbedded with dark-gray clayey siltstone

Well screened from 158 to 163 feet; 1¼-inch PVC screen and casing. Electric log available

Local number: 130N54W32CCC R
 Other identifier: 9246
 Site identification number: 455909097272801
 Date of construction: 12-4-74
 Land surface altitude: 1,187 feet
 Total depth: 180 feet

Depth	Thickness (feet)	Altitude (feet)	Description
2-0	2	1,187-1,185	Topsoil, silty, loam; dusky yellow brown
2-6	4	1,185-1,181	Clay, silty, sandy, pebbly; grayish-orange, soft, sticky, oxidized (till)
6-23	17	1,181-1,164	Clay, silty, sandy, pebbly; dark-yellow orange; firm, plastic, iron stained; oxidized (till)
23-70	47	1,164-1,117	Clay, very silty, sandy, few pebbles, very coarse sand grains; dark-gray; moderately soft, plastic, occasional thin gravel lenses (till)
70-151	81	1,117-1,036	Clay, silty, sandy, pebbly, olive gray; moderately firm, moderately plastic (till)
151-159	8	1,036-1,028	Clay, silty, very sandy, pebbly; dark-gray; firm, tight, slightly friable; gravel lenses (till)
159-180	21	1,028-1,007	Pierre Shale; gray, slightly black, plastic, tight, noncalcareous, very slightly fissile

Electric log available

Local number: 130N54W33DDD R
 Other identifier: 12262
 Site identification number: 455909097245901
 Date of construction: 9-22-82
 Land surface altitude: 1,158 feet
 Total depth: 200 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,158-1,157	Topsoil
1-10	9	1,157-1,148	Till, yellow brown, oxidized, silty, very pebbly; cohesive, plastic
10-27	17	1,148-1,131	Till, yellow brown, oxidized, slightly silty, slightly pebbly, very clayey; cohesive, slightly brittle; at 18 feet, color becomes dark-brown, still oxidized
27-120	93	1,131-1,038	Till, olive gray, silty, pebbly, moderately cohesive, moderately plastic, below 60 feet till seems softer, more pliable, same composition; at 116 to 120 feet, becomes gravelly
120-129	9	1,038-1,029	Till, olive gray, silty, pebbly, very cohesive, tight, plastic
129-172	43	1,029-986	Sand and gravel, coarse sand to medium gravel, predominantly very coarse sand and fine gravel, angular to rounded, predominantly subangular, equal proportions quartz, shale and carbonates; below 140 feet becomes more rounded and spherical
172-183	11	986-975	Till? no sample
183-200	17	975-958	Bedrock shale, dark-gray to black, slightly carbonaceous, silty

Well screened from 138 to 145 feet; 1¼-inch PVC screen and casing. Electric log available

Local number: 130N54W34DCC R
 Other identifier: 12267
 Site identification number: 455941097241701
 Date of construction: 10-26-82
 Land surface altitude: 1,155 feet
 Total depth: 180 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-1	1	1,155-1,154	Topsoil
1-11	10	1,154-1,144	Clay, yellow brown, iron stained, oxidized, silty, sandy with pebbles (till)
11-107	96	1,144-1,048	Clay, olive gray, unoxidized, silty, sandy with pebbles (till), layer of sand and gravel at 104 to 105 feet
107-118	11	1,048-1,037	Till with numerous layers of shale sand and gravel; drills slow then fast in 1- to 2-foot increments
118-136	18	1,037-1,019	Gray till as above, rocky
136-150	14	1,019-1005	Gravel, pebbly, subrounded, some medium to coarse sand, 30% shale, 40% carbonates, 30% igneous, drills choppy and fast
150-170	20	1005-985	Silt, olive gray, poor return, drills real smooth and fast, could be some very fine sands mixed in
170-180	10	985-975	Clay, blackish, greasy, bedrock?, lost circulation, put soap in and gained circulation; poor return?

Well screened from 145 to 150 feet; 1¼-inch PVC screen and casing. Electric log available

Local number: 130N54W35CCC R

Other identifier: 9247

Site identification number: 455941097234001

Date of construction: 12-4-74

Land surface altitude: 1,170 feet

Total depth: 240 feet

Depth	Thickness (feet)	Altitude (feet)	Description
0-4	4	1,170-1,166	Clay, silty, sandy, pebbly; dark-yellow-orange, soft, sticky, oxidized (till)
4-27	23	1,166-1,143	Clay, silty, sandy, pebbly; dark-yellow-brown; firm, plastic, tight, oxidized (till)
27-68	41	1,143-1,102	Clay, silty, sandy, pebbly; dark-gray; firm moderately plastic, tight (till); occasional thin gravel lens
68-96	28	1,102-1,074	Clay, silty, sandy, pebbly; olive gray; moderately soft, plastic; gravel lenses; larger pebbles (till)
96-118	22	1,074-1,052	Clay, silty, sandy, pebbly; dark-gray to grayish-black, moderately firm, plastic, numerous thin gravel lenses (till)
118-130	12	1,052-1,040	Sand and gravel; sand medium to very coarse, angular to subrounded, about 60% quartz, 30% carbonates, 5% shale, 5% gneiss; gravel, fine to coarse, angular to subrounded, about 70% gneiss, 10% quartz, 10% shale, 10% carbonates, clean sorted
130-134	4	1,040-1,036	Clay, very silty, sand, very coarse sand grains; dark-gray; soft, plastic (till)
134-150	16	1,036-1,020	Clay, dark-gray, noncalcareous; light-gray mottling (calcareous), tight, plastic; weak laminae (lacustrine)
150-174	24	1,020-996	Clay, as above with sand lenses
174-200	26	996-970	Sand and gravel, dark-gray sand, medium to very coarse, angular to round; gravel, fine to medium, angular to subround, about 60% quartz, 30% shale, 10% carbonates, igneous, and moderate lignite fragments
200-218	18	970-952	Clay, silty, slightly sandy, occasional coarse sand grains; grayish-black, calcareous, very plastic, soft (glaciofluvial - silt/till?)
218-240	22	952-930	Pierre Shale, grayish-black; noncalcareous, tight, plastic, stiff
Well screened from 188 to 191 feet; 1¼-inch PVC screen and casing. Electric log available			

Section B - Hydrographs

Site number from location map: 1
 Local well number: 118N52W18BBBB2
 Station identification number: 450205097073302
 Other identifier: CD-77A
 County: Codington, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,775 feet
 Measuring point: 0.0 foot
 Extremes: April 16, 1981, to November 6, 1996: Highest, -5.6 feet, August 20, 1990; lowest, 12.5 feet, June 19, 1986, July 1, 1986, July 16, 1986.

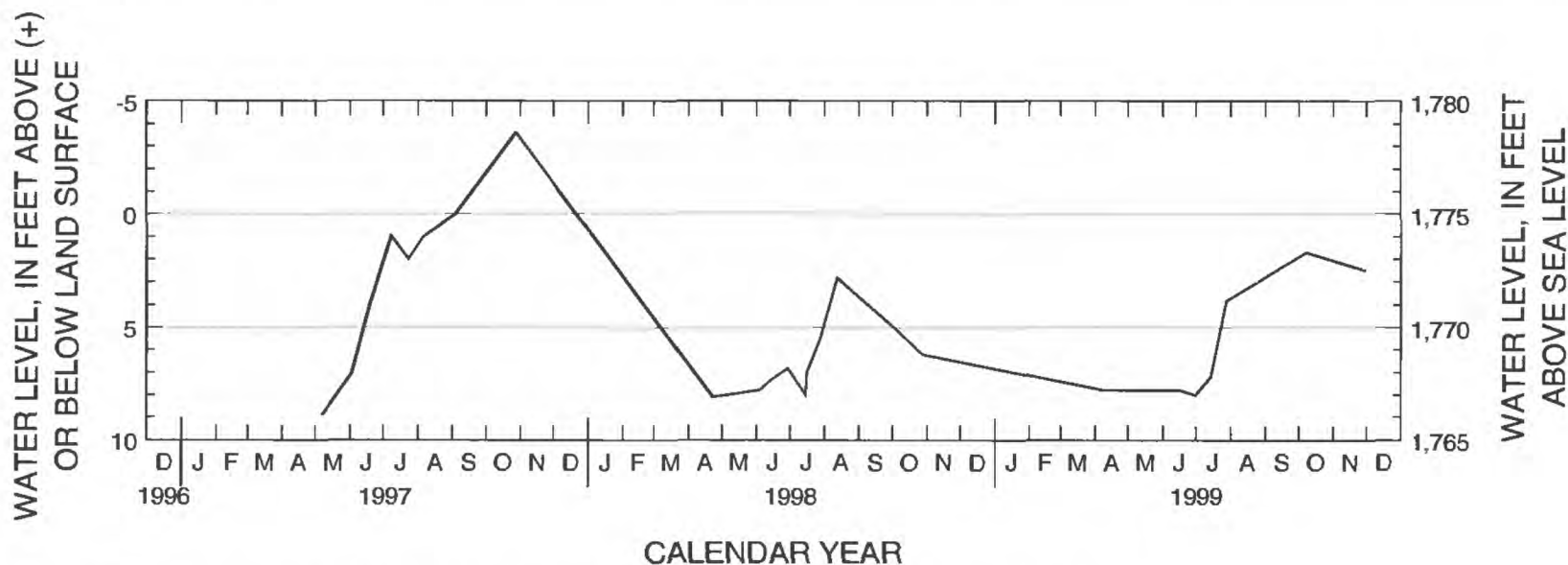


Figure B1. Hydrograph for observation well 118N52W18BBBB2 (site number 1).

Site number from location map: 2
 Local well number: 118N52W30CDCD
 Station identification number: 445930097070901
 Other identifier: CD-76B
 County: Codington, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,753.2 feet
 Measuring point: 0.0 foot
 Extremes: November 30, 1976, to October 9, 1996: Highest, 5.87 feet, March 21, 1985; lowest, 12.2 feet, July 25, 1984.

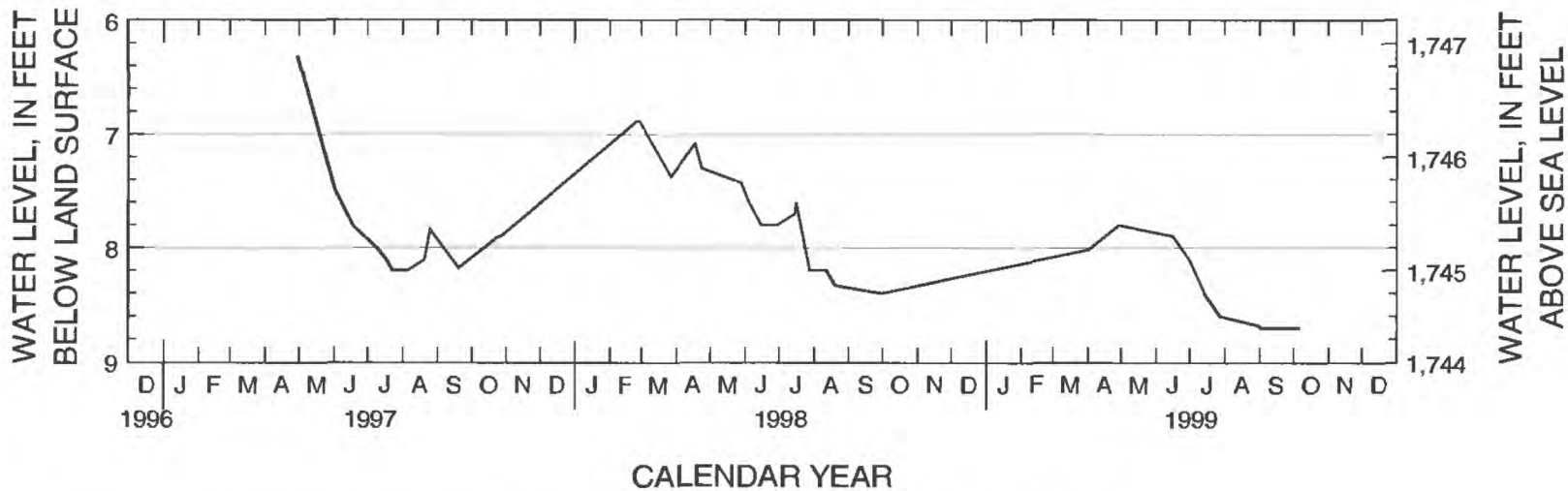


Figure B2. Hydrograph for observation well 118N52W30CDCD (site number 2).

Site number from location map: 3
 Local well number: 119N52W4ADDD R
 Station identification number: 450655097092301
 Other identifier: CD-77B
 County: Codington, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,770 feet
 Measuring point: 2.4 feet
 Extremes: December 1, 1977, to October 6, 1999: Highest, 1.9 feet, July 2, 1991; lowest, 7.67 feet, December 1, 1988.

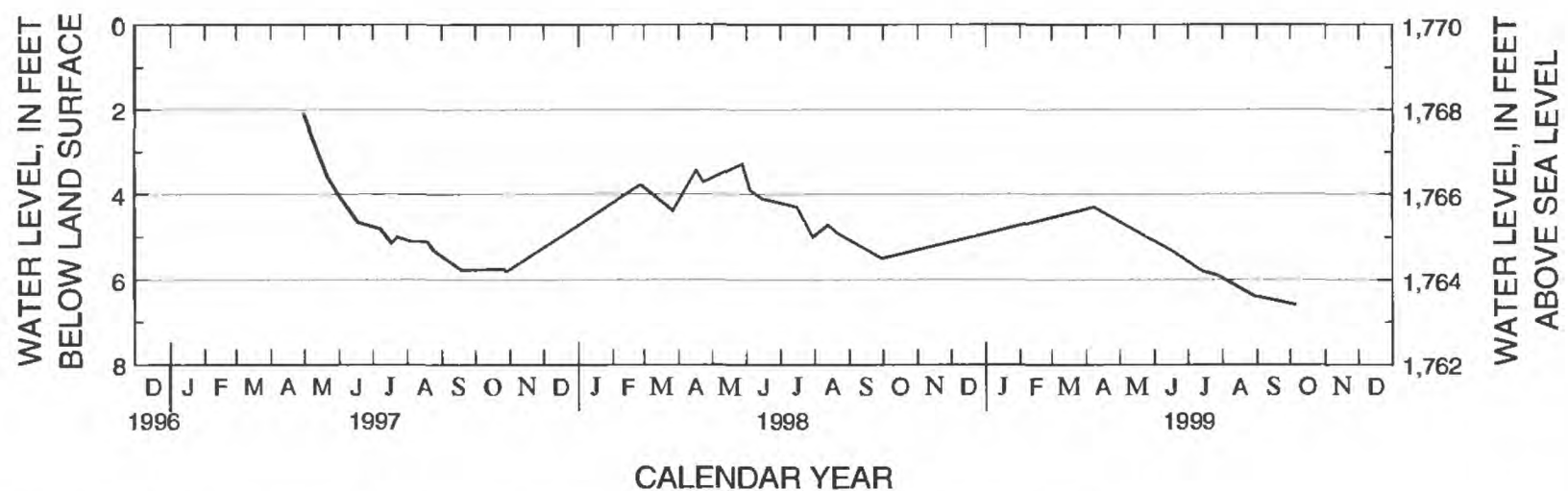


Figure B3. Hydrograph for observation well 119N52W4ADDD R (site number 3).

Site number from location map: 4
 Local well number: 119N52W10DDDD R
 Station identification number: 450538097083901
 Other identifier: CD-77C
 County: Codington, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,770 feet
 Measuring point: 3.6 feet
 Extremes: December 1, 1977, to October 6, 1999: Highest, 1.0 foot, June 23, 1994; lowest, 9.2 feet, December 29, 1981.

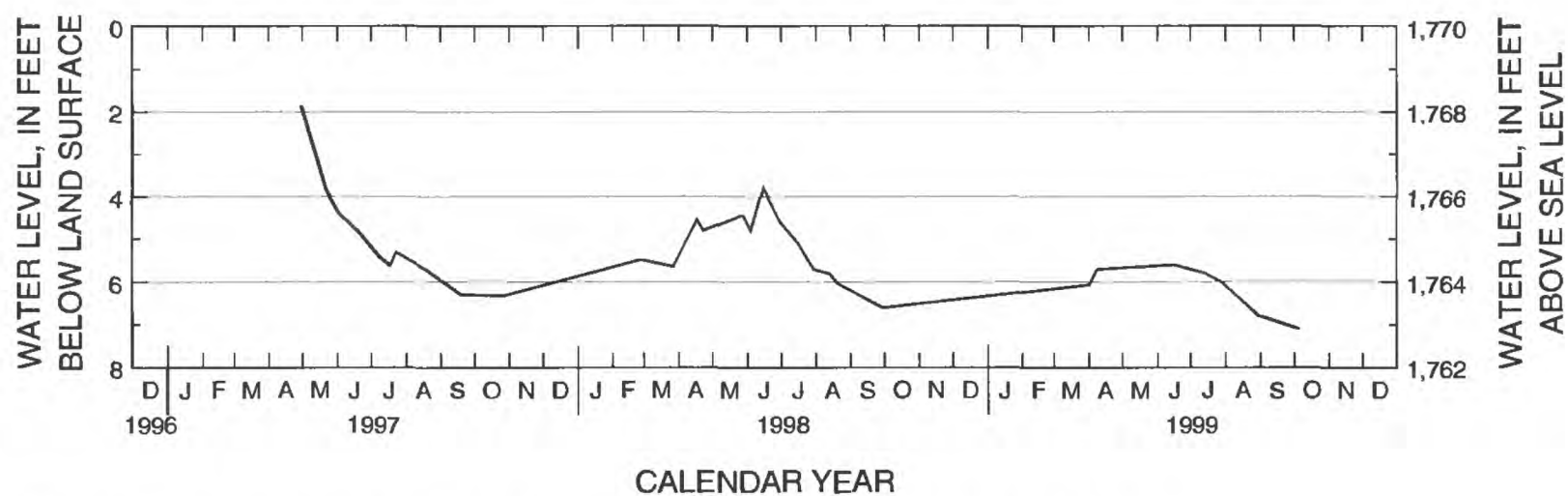


Figure B4. Hydrograph for observation well 119N52W10DDDD R (site number 4).

Site number from location map: 5
 Local well number: 119N52W33DCDC R
 Station identification number: 450208097101401
 Other identifier: CD-60A
 County: Codington, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,745 feet
 Measuring point: 1.9 feet
 Extremes: June 13, 1960, to October 7, 1999: Highest, 2.80 feet, Apr. 30, 1997; lowest, 10.6 feet, November 1, 1990.

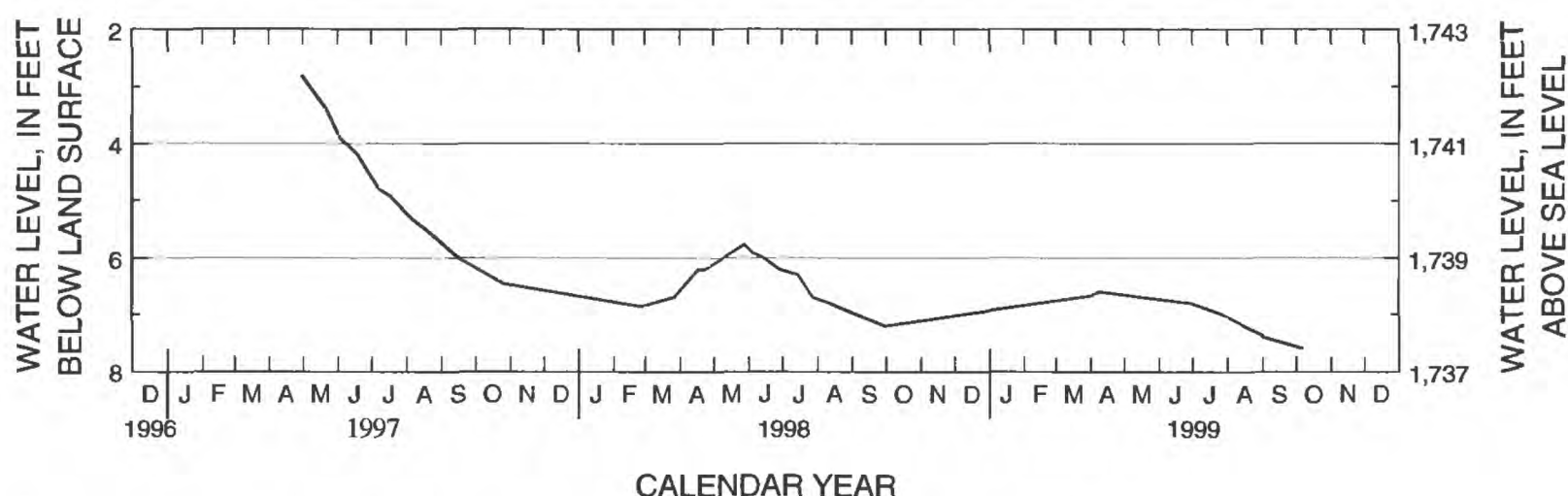


Figure B5. Hydrograph for observation well 119N52W33DCDC R (site number 5).

Site number from location map: 6
 Local well number: 119N53W6BBBB
 Station identification number: 450904097145501
 Other identifier: R2-85-111
 County: Codington, South Dakota
 Aquifer: Altamont
 Altitude of land surface: 1,878 feet
 Measuring point: 1.9 feet
 Extremes: April 30, 1997, to August 31, 1999: Highest, 118.71 feet, April 1, 1999; lowest, 120.14 feet, August 25, 1997.

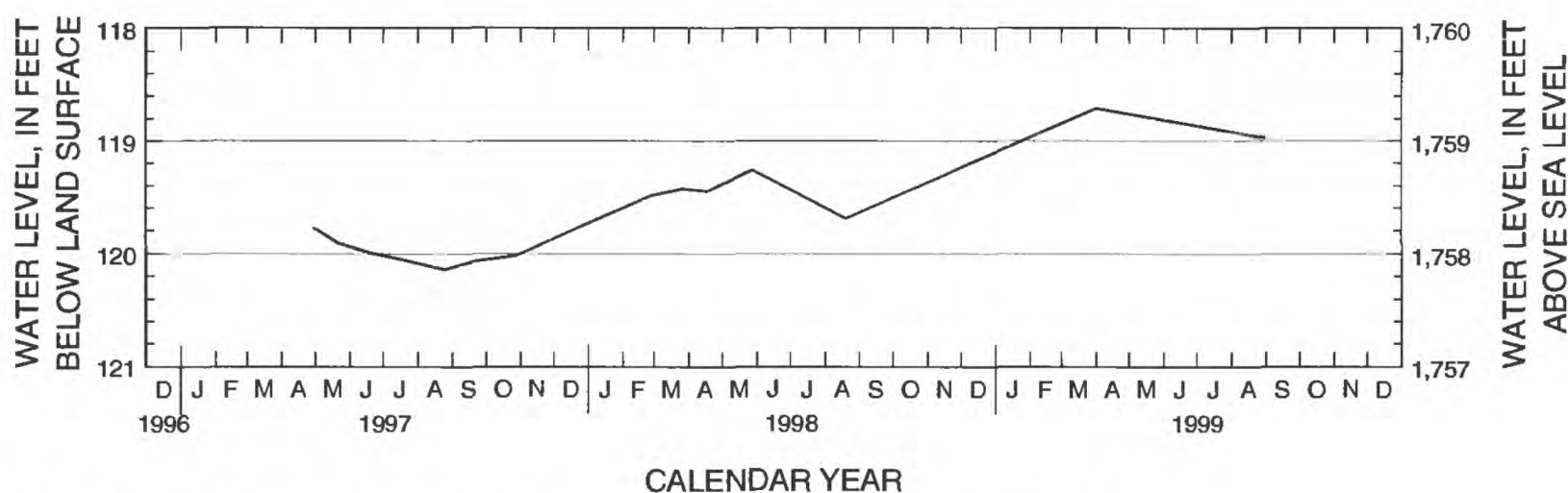
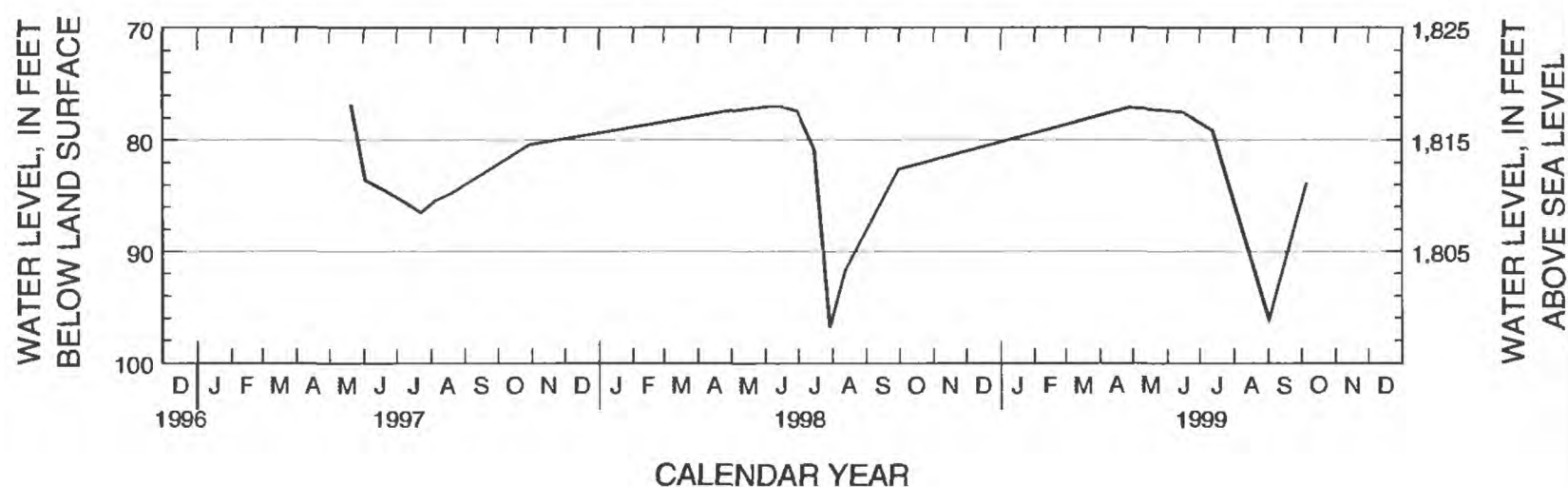


Figure B6. Hydrograph for observation well 119N53W6BBBB (site number 6).

Site number from location map: 7
 Local well number: 120N51W19BBCC R
 Station identification number: 450947097060901
 Other identifier: GT-77A
 County: Grant, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 1,894.99 feet
 Measuring point: 2.0 feet
 Extremes: July 20, 1977, to October 6, 1999: Highest, 75.5 feet, November 8, 1995; lowest, 121.5 feet, July 29, 1988.



Site number from location map: 8
 Local well number: 120N52W9BBBB R
 Station identification number: 451143097110501
 Other identifier: GT-79C
 County: Grant, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 1,834 feet
 Measuring point: 1.4 feet
 Extremes: October 25, 1979, to October 6, 1999: Highest, 14.5 feet, June 6, 1996; lowest, 26.2 feet, September 7, 1988.

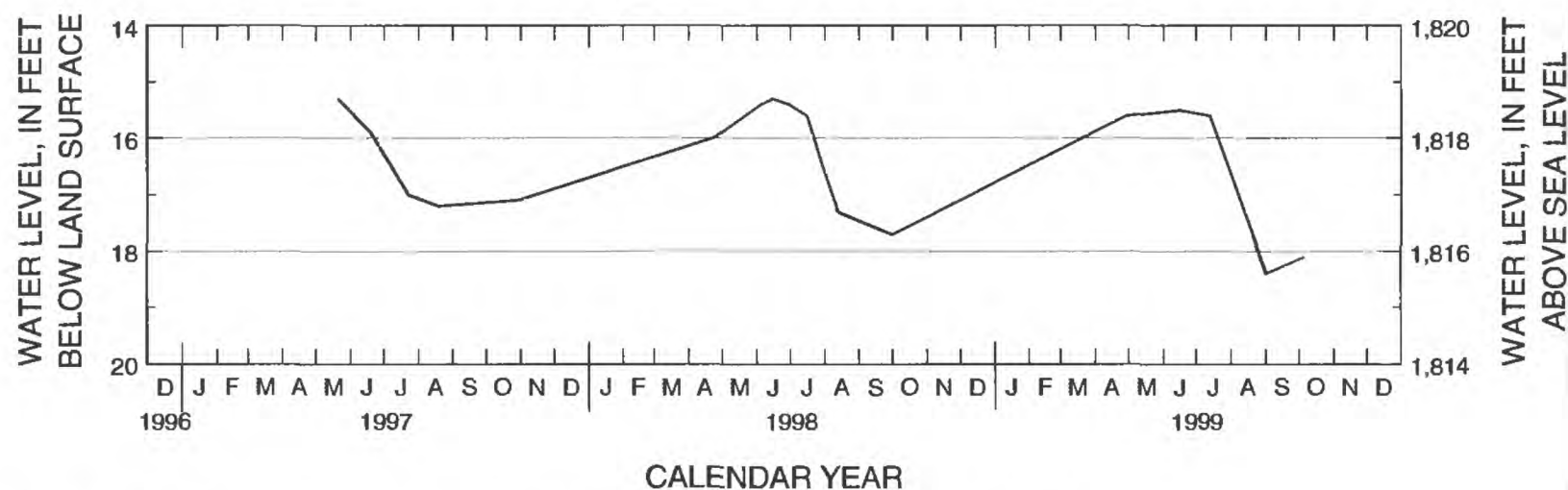


Figure B8. Hydrograph for observation well 120N52W9BBBB R (site number 8).

Site number from location map: 9
 Local well number: 120N52W12AAAB R
 Station identification number: 451141097061701
 Other identifier: GT-76C
 County: Grant, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 1,873.12 feet
 Measuring point: 2.1 feet
 Extremes: June 17, 1977, to October 6, 1999: Highest, 50.1 feet, June 6, 1996; lowest, 97.1 feet, August 25, 1988.

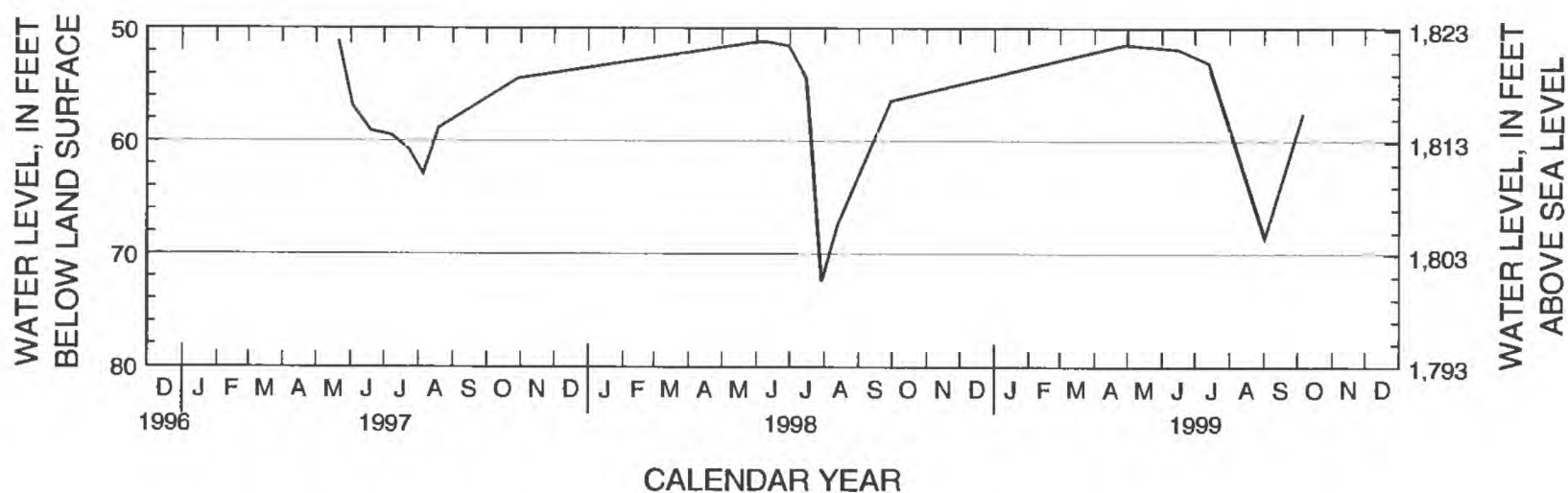


Figure B9. Hydrograph for observation well 120N52W12AAAB R (site number 9).

Site number from location map: 10
 Local well number: 120N52W23BBBBB R
 Station identification number: 450956097083401
 Other identifier: GT-76B
 County: Grant, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 1,820.87 feet
 Measuring point: 3.0 feet
 Extremes: June 16, 1977, to October 6, 1999: Highest, 6.3 feet, June 6, 1996; lowest, 65.0 feet, July 29, 1988.

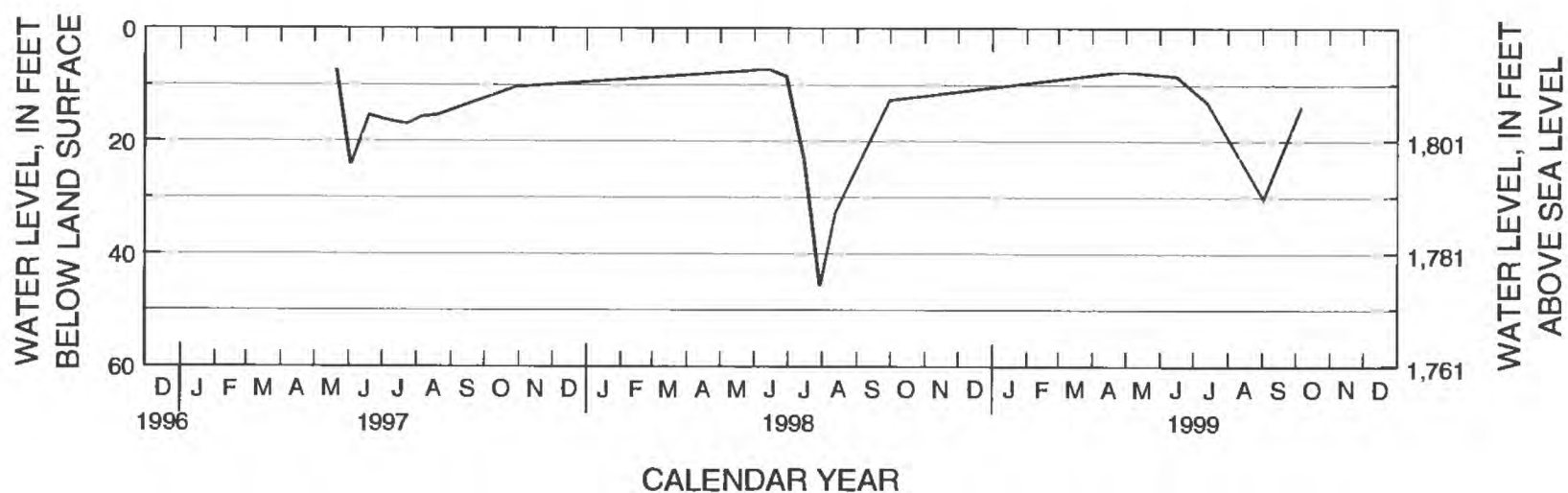


Figure B10. Hydrograph for observation well 120N52W23BBBBB R (site number 10).

Site number from location map: 11
 Local well number: 120N52W27CDDD R
 Station identification number: 450814097091601
 Other identifier: CD-76D
 County: Codington, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 1,800 feet
 Measuring point: 4.6 feet
 Extremes: June 16, 1976, to November 30, 1999: Highest, -4.7 feet, November 8, 1995; lowest, 52.1 feet, July 29, 1988.

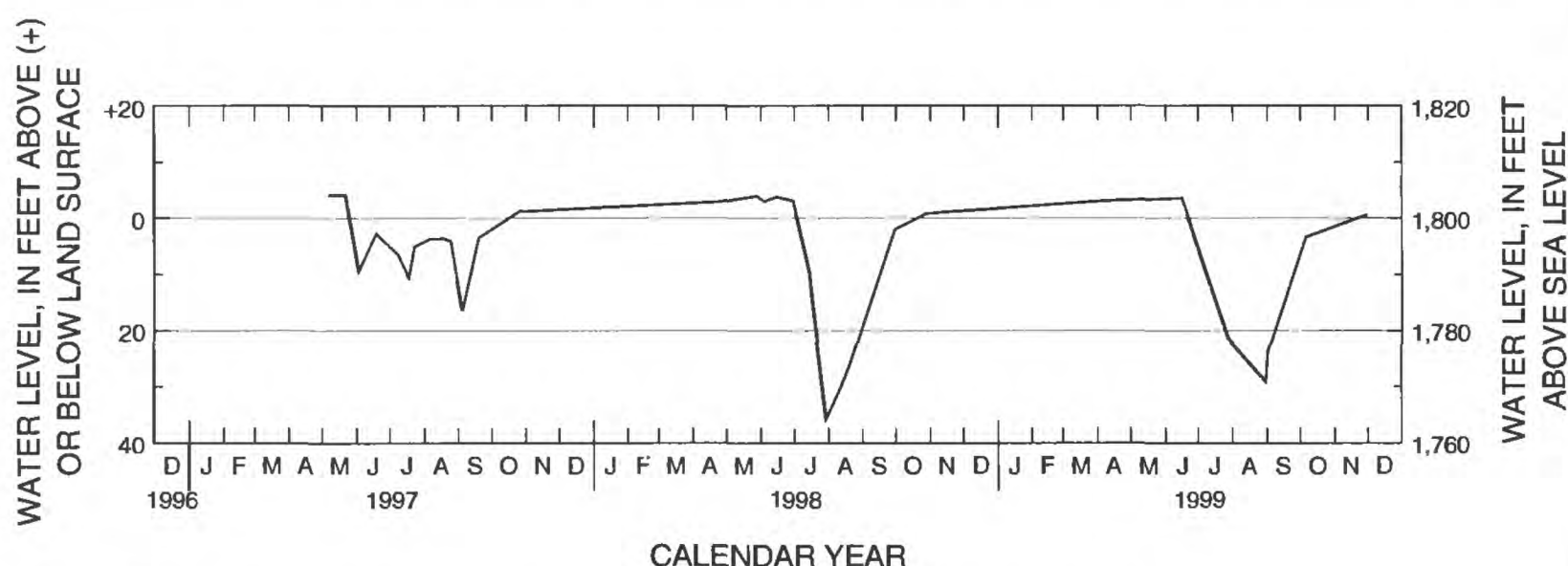


Figure B11. Hydrograph for observation well 120N52W27CDDD R (site number 11).

Site number from location map: 12
 Local well number: 120N52W28DDDD R
 Station identification number: 450814097095301
 Other identifier: CD-56A
 County: Codington, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,781.62 feet
 Measuring point: 1.6 feet
 Extremes: August 29, 1957, to October 6, 1999: Highest, 4.4 feet, July 2, 1991; lowest, 11.6 feet, December 7, 1966.

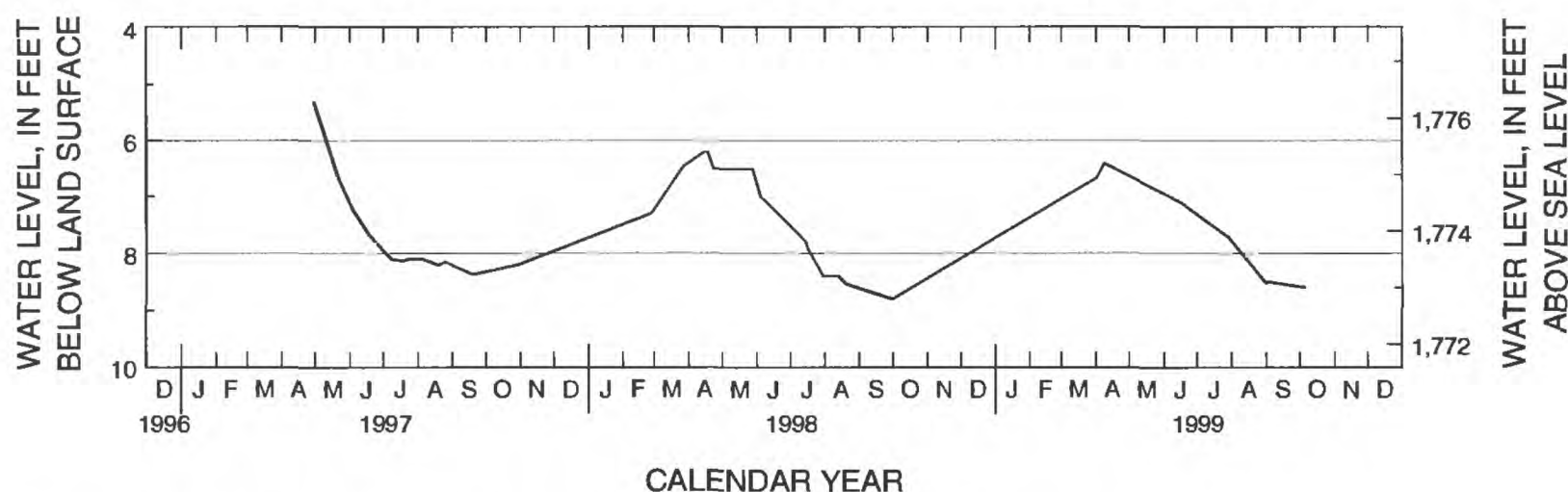


Figure B12. Hydrograph for observation well 120N52W28DDDD R (site number 12).

Site number from location map: 13
Local well number: 120N54W23DDDC
Station identification number: 451050097161601
Other identifier: DA-78H
County: Day, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,830 feet
Measuring point: 3.0 feet
Extremes: October 16, 1978, to October 6, 1999: Highest, 41.7 feet, October 6, 1999; lowest, 56.2 feet, August 4, 1982, October 3, 1983.

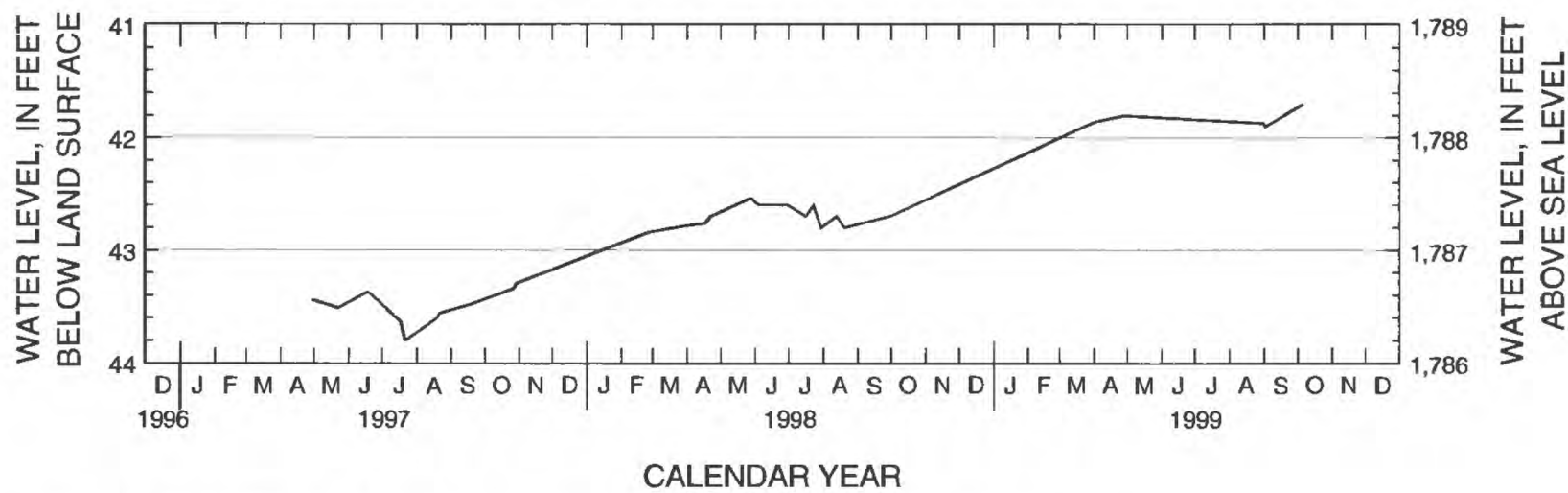


Figure B13. Hydrograph for observation well 120N54W23DDDC (site number 13).

Site number from location map: 14
Local well number: 121N47W1AAAA
Station identification number: 451936096294001
Other identifier: C0-86-03
County: Grant, South Dakota
Aquifer: Undetermined
Altitude of land surface: 1,092 feet
Measuring point: 3.0 feet
Extremes: December 11, 1996, to August 25, 1999: Highest, 50.8 feet, June 20, 1997; lowest, 54.77 feet, July 20, 1998.

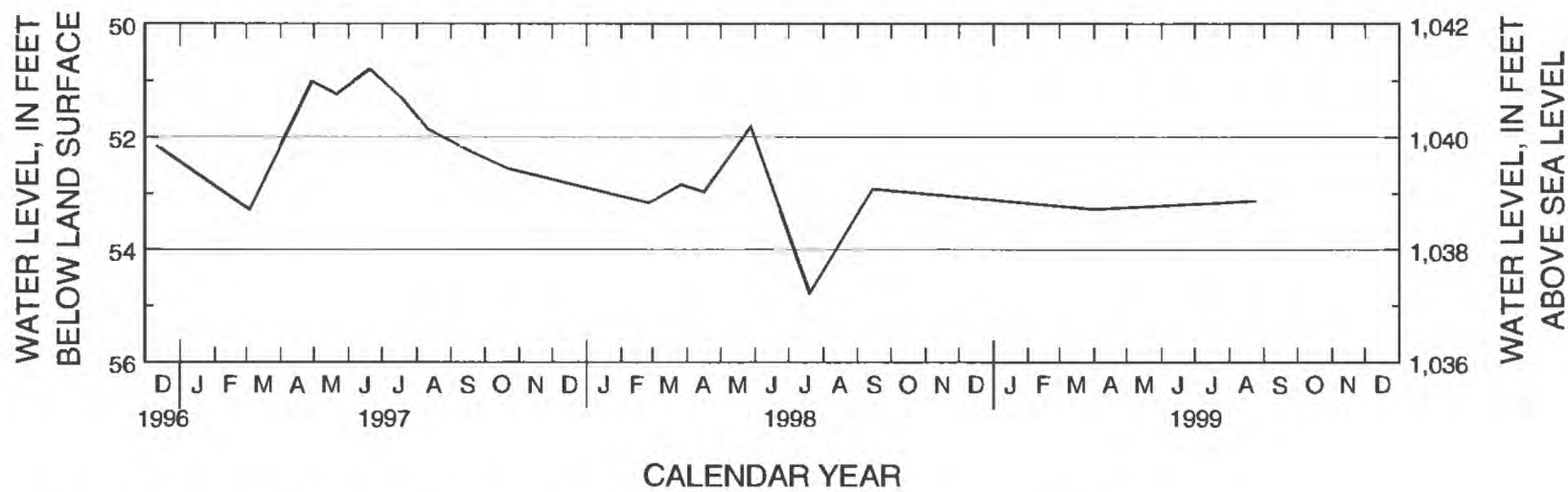


Figure B14. Hydrograph for observation well 121N47W1AAAA (site number 14).

Site number from location map: 15
 Local well number: 121N47W2DDDD
 Station identification number: 451844096305401
 Other identifier: CO-86-05
 County: Grant, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,115 feet
 Measuring point: 3.0 feet
 Extremes: April 29, 1997, to August 25, 1999: Highest, 45.13 feet, June 20, 1997; lowest, 48.03 feet, August 25, 1999.

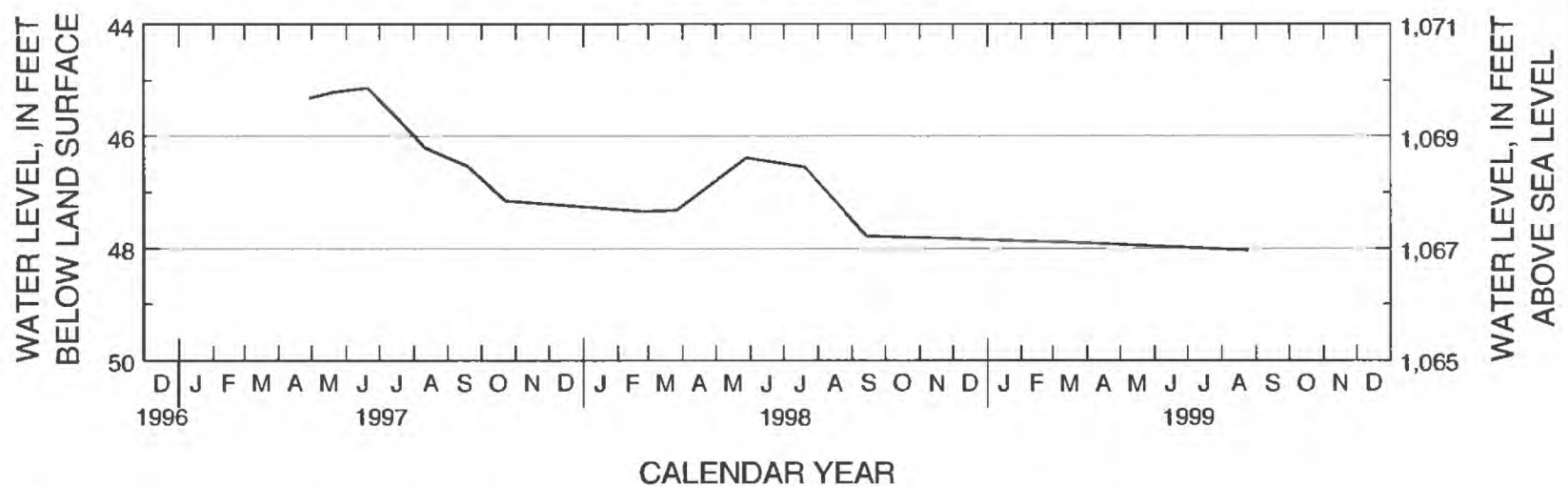


Figure B15. Hydrograph for observation well 121N47W2DDDD (site number 15).

Site number from location map: 16
 Local well number: 121N47W6CCCC
 Station identification number: 451848096363501
 Other identifier: GT-79E
 County: Grant, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,104.00 feet
 Measuring point: 2.8 feet
 Extremes: October 25, 1979, to October 5, 1999: Highest, 19.22 feet; Apr. 29, 1997; lowest, 38.4 feet, October 4, 1983, November 8, 1983.

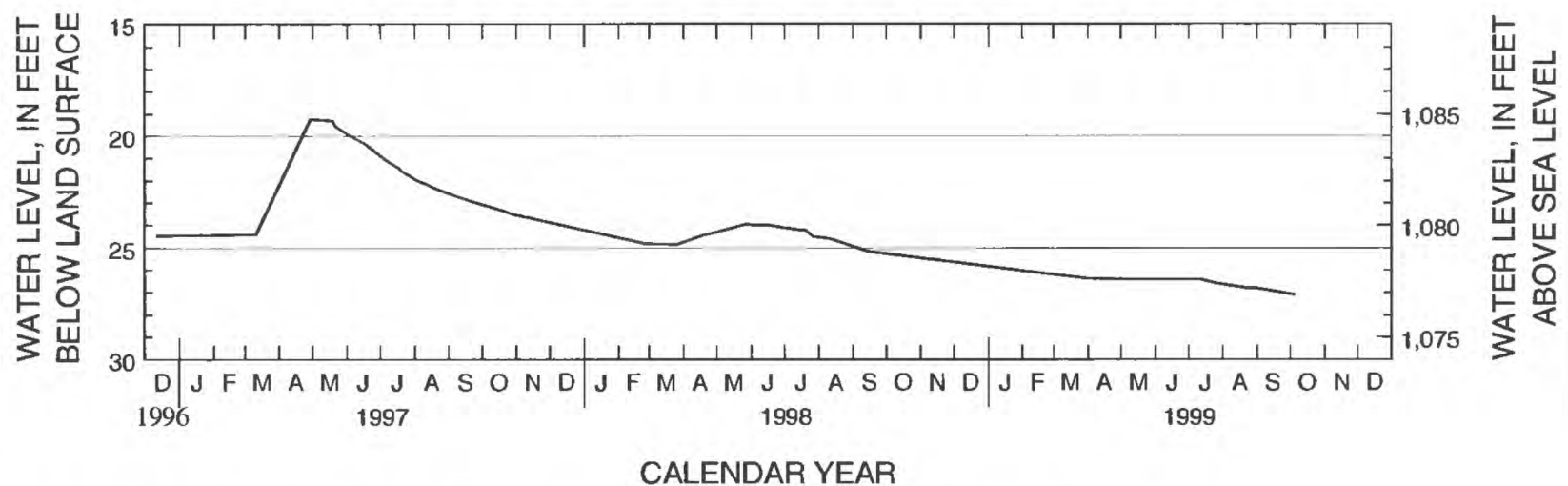


Figure B16. Hydrograph for observation well 121N47W6CCCC (site number 16).

Site number from location map: 17
 Local well number: 121N51W29BBBB R
 Station identification number: 451418097045501
 Other identifier: GT-77E
 County: Grant, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 1,955 feet
 Measuring point: 3.6 feet
 Extremes: May 2, 1978, to October 6, 1999: Highest, 73.5 feet, June 6, 1996; lowest, 84.72 feet, September 26, 1988.

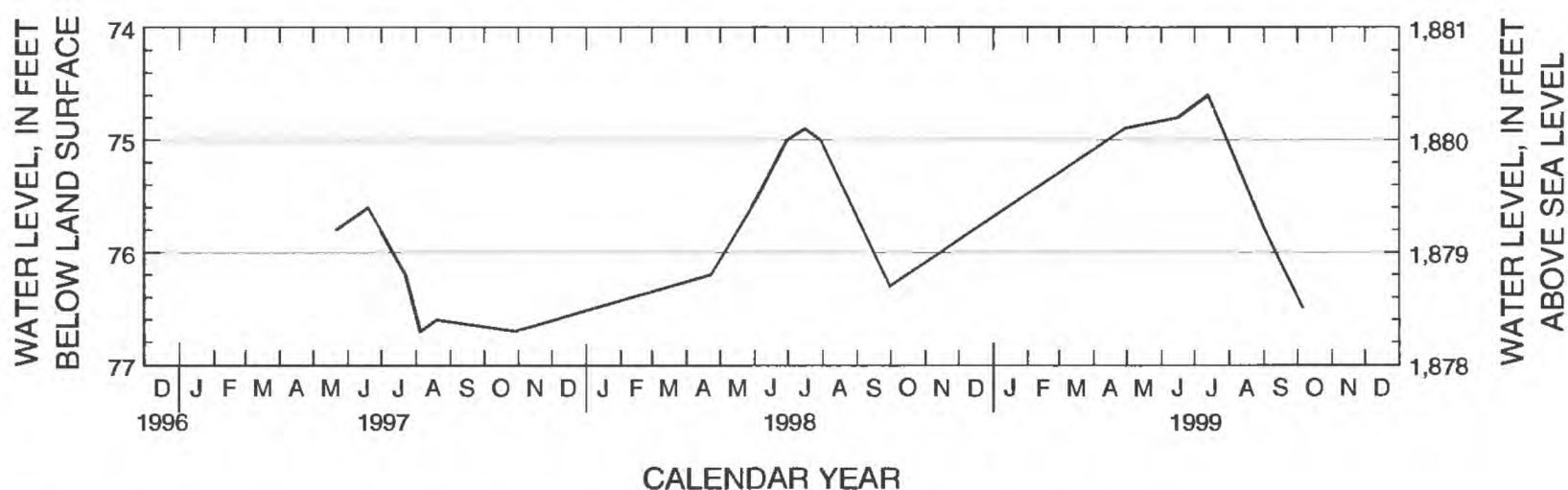


Figure B17. Hydrograph for observation well 121N51W29BBBB R (site number 17).

Site number from location map: 18
 Local well number: 121N52W1CBBB R
 Station identification number: 451725097072101
 Other identifier: GT-57A
 County: Grant, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,885 feet
 Measuring point: 1.75 feet
 Extremes: April 29, 1997, to October 6, 1999: Highest, 4.16 feet, April 29, 1997; lowest, 10.3 feet, October 6, 1999

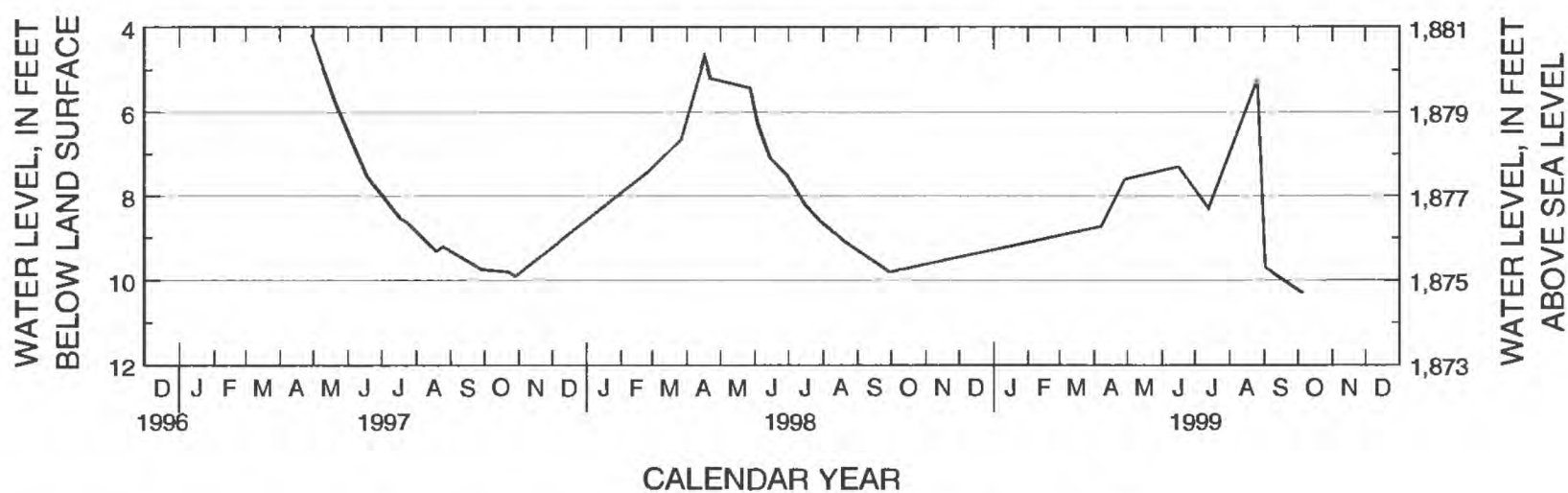


Figure B18. Hydrograph for observation well 121N52W1CBBB R (site number 18).

Site number from location map: 19
 Local well number: 121N52W2ADDD R
 Station identification number: 451606097072501
 Other identifier: GT-82A
 County: Grant, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,881.25 feet
 Measuring point: 3.2 feet
 Extremes: June 29, 1982, to October 6, 1999: Highest, 0.92 foot, April 29, 1997; lowest, 6.7 feet, July 30, 1998.

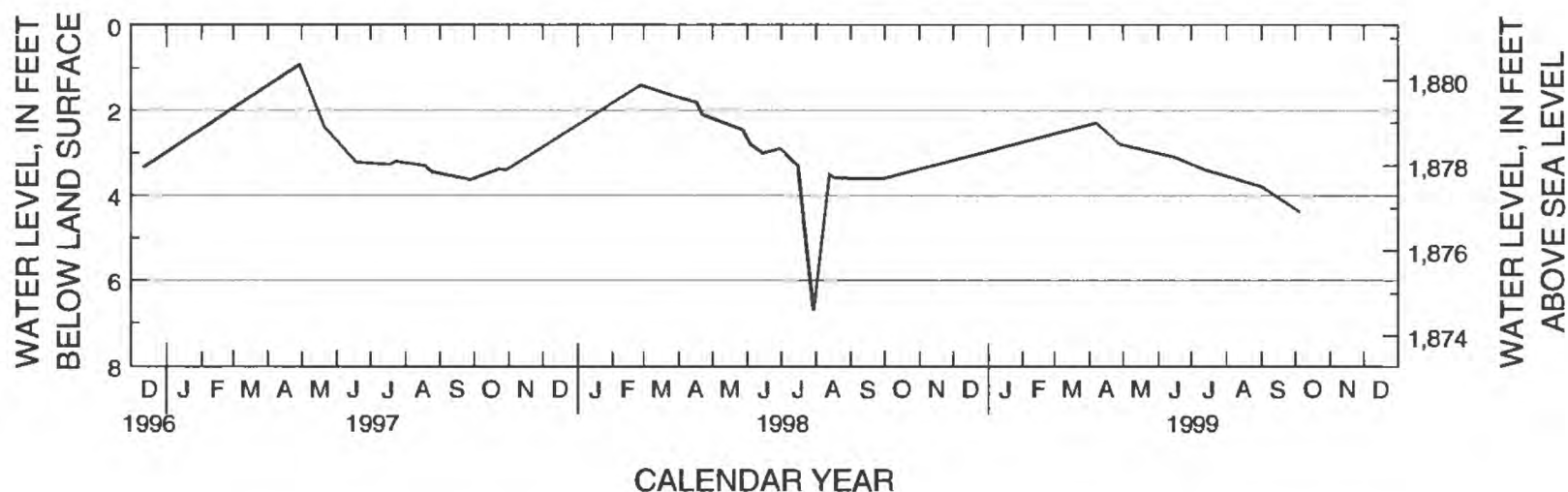


Figure B19. Hydrograph for observation well 121N52W2ADDD R (site number 19).

Site number from location map: 20
 Local well number: 121N52W2BAAA R
 Station identification number: 451749097080601
 Other identifier: R20-84-31
 County: Grant, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,878.4 feet
 Measuring point: 3.0 feet
 Extremes: April 29, 1997, to August 26, 1999: Highest, -0.49 foot, April 17, 1998; lowest, 2.07 feet, August 18, 1998.

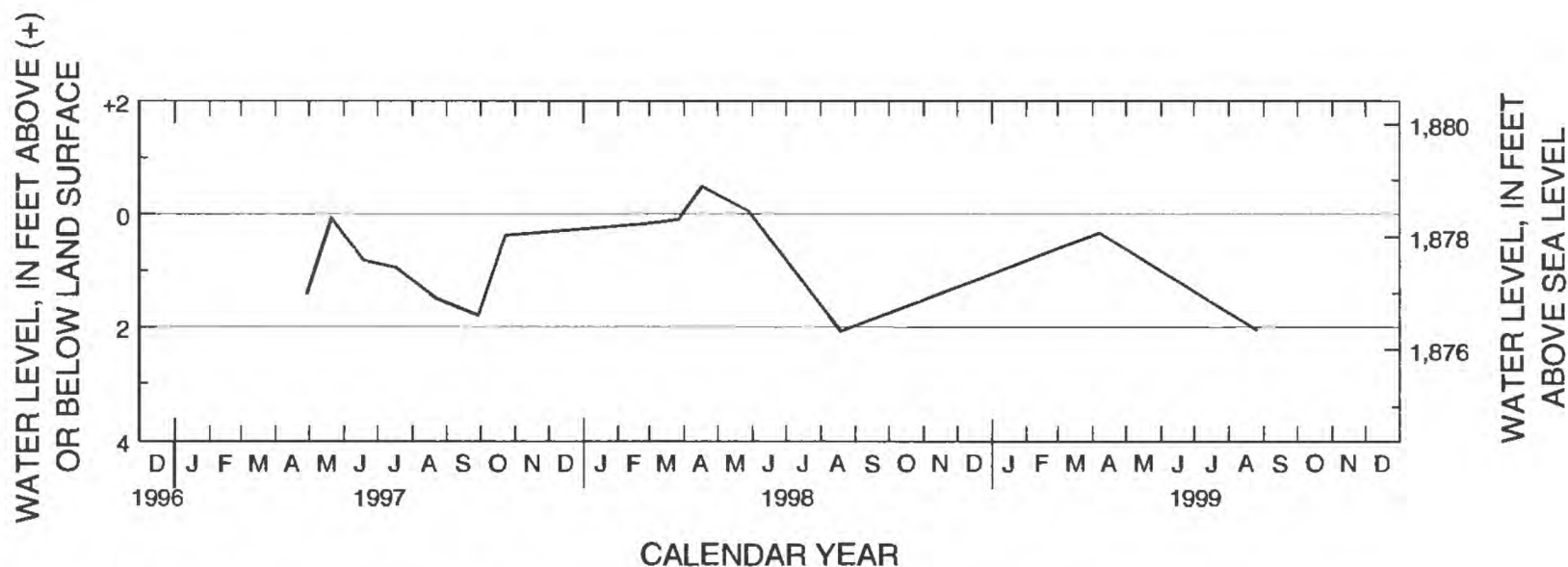


Figure B20. Hydrograph for observation well 121N52W2BAAA R (site number 20).

Site number from location map: 21
 Local well number: 121N52W2BBBA R
 Station identification number: 451750097083001
 Other identifier: CO-87-66
 County: Grant, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 1,885 feet
 Measuring point: 2.6 feet
 Extremes: April 29, 1997, to August 26, 1999: Highest, 23.03 feet, May 28, 1998; lowest 26.37 feet, August 26, 1999.

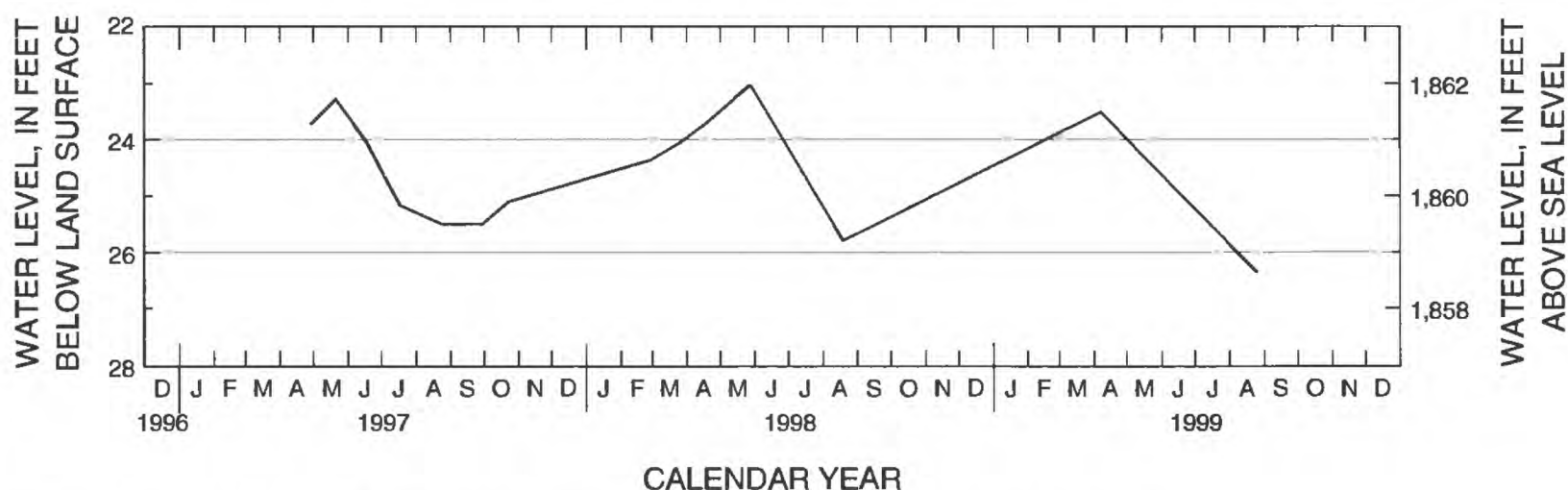


Figure B21. Hydrograph for observation well 121N52W2BBBA R (site number 21).

Site number from location map: 22
 Local well number: 121N52W2CCCC R
 Station identification number: 451701097083701
 Other identifier: R20-84-26
 County: Grant, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,869 feet
 Measuring point: 2.0 feet
 Extremes: April 29, 1997, to August 26, 1999: Highest, 0.21 foot, February 26, 1998; lowest, 8.64 feet, August 26, 1999.

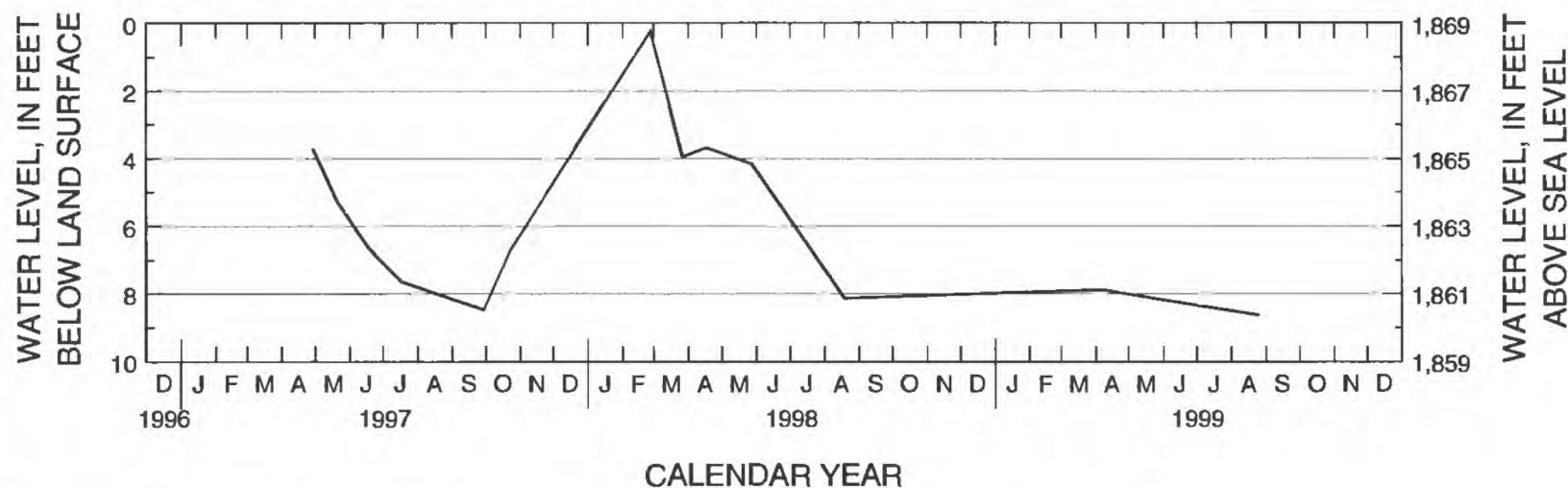


Figure B22. Hydrograph for observation well 121N52W2CCCC R (site number 22).

Site number from location map: 23
 Local well number: 121N52W3CCBB R
 Station identification number: 451716097095901
 Other identifier: R20-84-25
 County: Grant, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,857.9 feet
 Measuring point: 3.0 feet
 Extremes: April 29, 1997, to August 26, 1999: Highest, 6.74 feet, April 29, 1997; lowest, 12.8 feet, August 26, 1999.

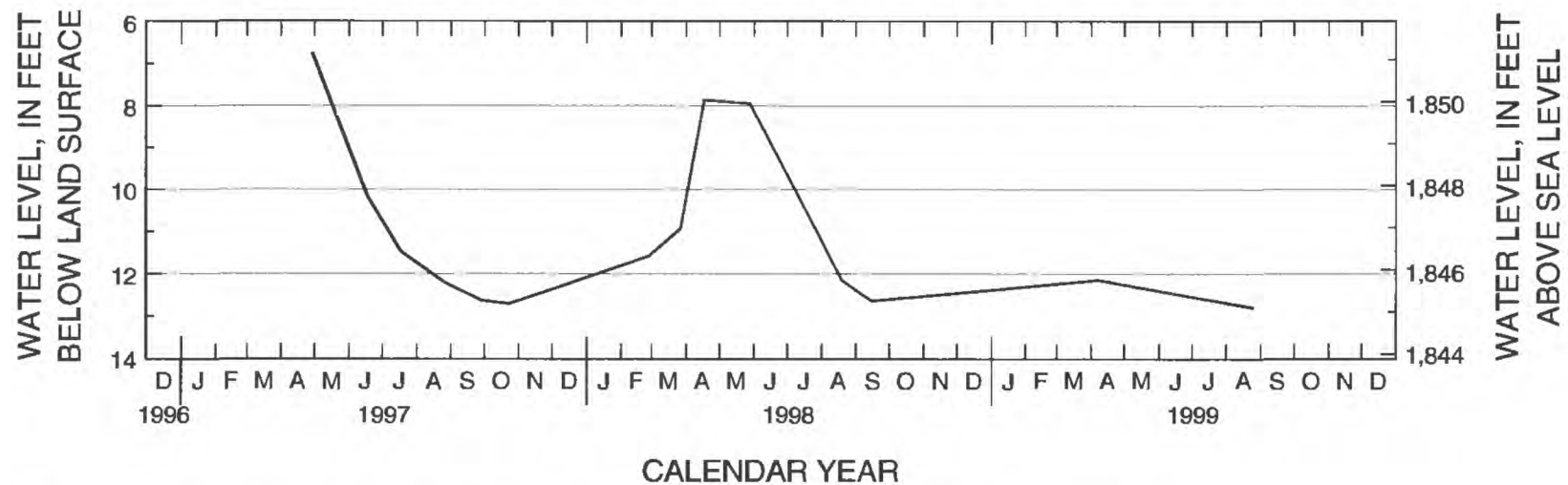


Figure B23. Hydrograph for observation well 121N52W3CCBB R (site number 23).

Site number from location map: 24
 Local well number: 121N52W4BBAB R
 Station identification number: 451749097105501
 Other identifier: R20-84-27
 County: Grant, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,843.7 feet
 Measuring point: 2.8 feet
 Extremes: December 11, 1996, to August 26, 1999: Highest, 3.1 feet, April 29, 1997; lowest 13.81 feet, December 11, 1996.

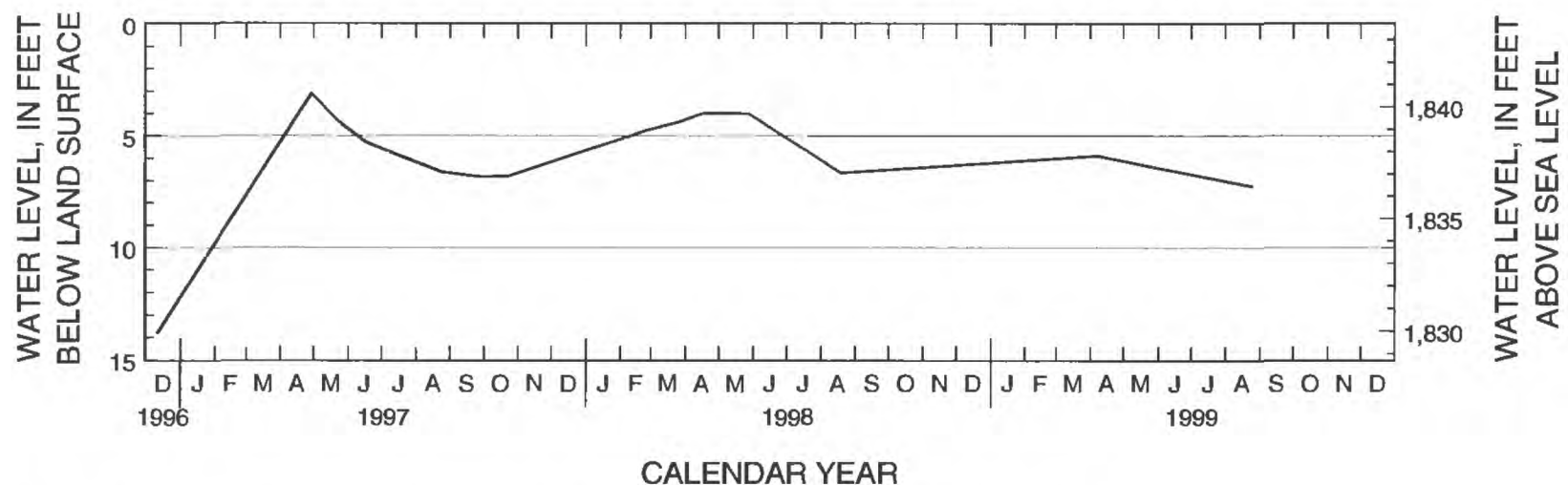


Figure B24. Hydrograph for observation well 121N52W4BBAB R (site number 24).

Site number from location map: 25
 Local well number: 121N52W8DCCC R
 Station identification number: 451608097114101
 Other identifier: GT-77B
 County: Grant, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,831.17 feet
 Measuring point: 2.6 feet
 Extremes: December 1, 1977, to October 6, 1999: Highest, 4.7 feet, April 29, 1997; lowest, 9.8 feet, October 20, 1981.

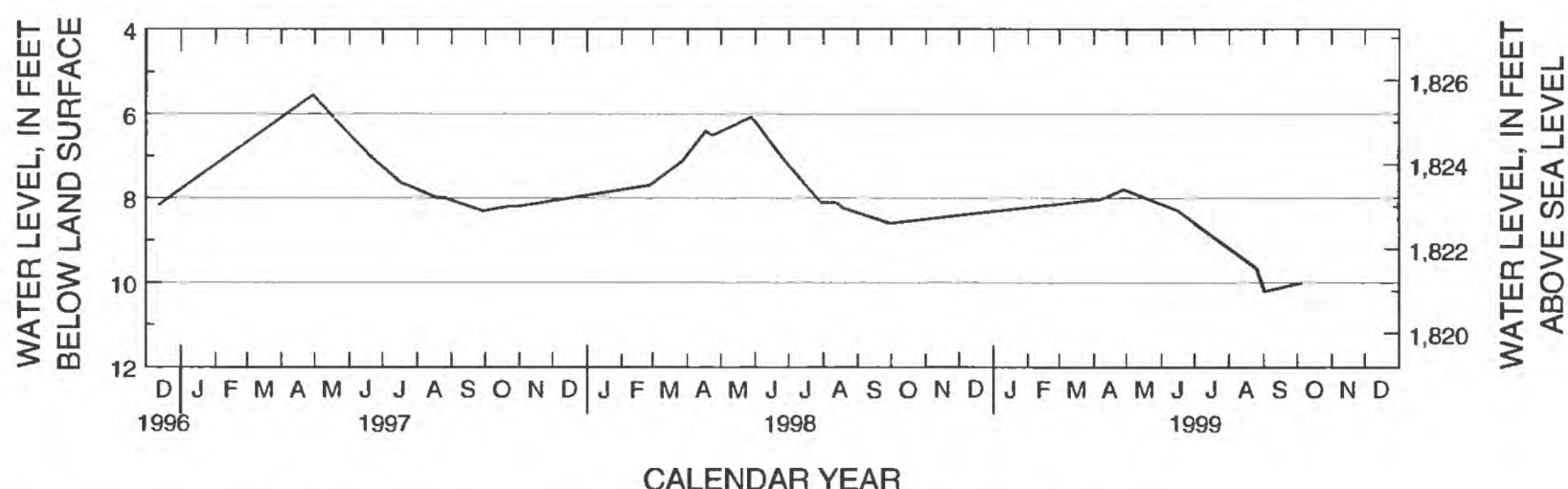


Figure B25. Hydrograph for observation well 121N52W8DCCC R (site number 25).

Site number from location map: 26
 Local well number: 121N52W8DDDD R
 Station identification number: 451608097110801
 Other identifier: R20-84-30
 County: Grant, South Dakota
 Aquifer: Big Sioux
 Altitude of land surface: 1,839.2 feet
 Measuring point: 3.0 feet
 Extremes: April 29, 1997, to August 20, 1999: Highest, 11.39 feet, April 29, 1997; lowest 15.08 feet, August 20, 1999.

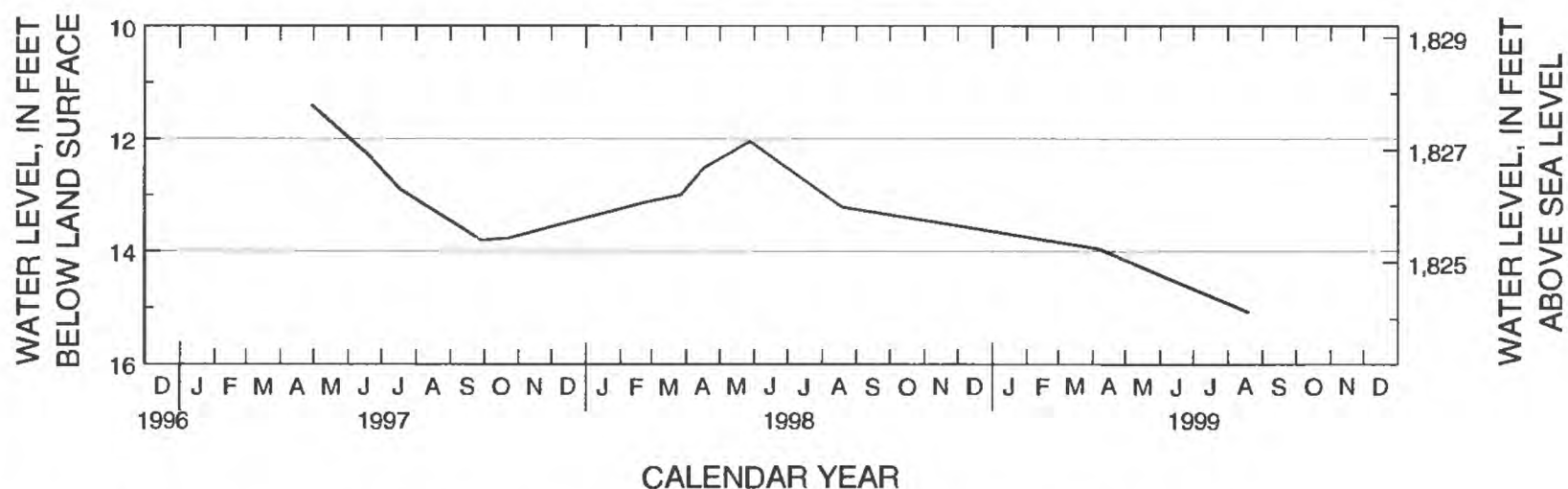


Figure B26. Hydrograph for observation well 121N52W8DDDD R (site number 26).

Site number from location map: 27
 Local well number: 121N52W13BBBA R
 Station identification number: 451605097071701
 Other identifier: GT-79A
 County: Grant, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 1,916.87 feet
 Measuring point: 2.2 feet
 Extremes: June 9, 1982, to October 6, 1999: Highest, 66.6 feet, September 8, 1992; lowest, 85.4 feet, August 25, 1988.

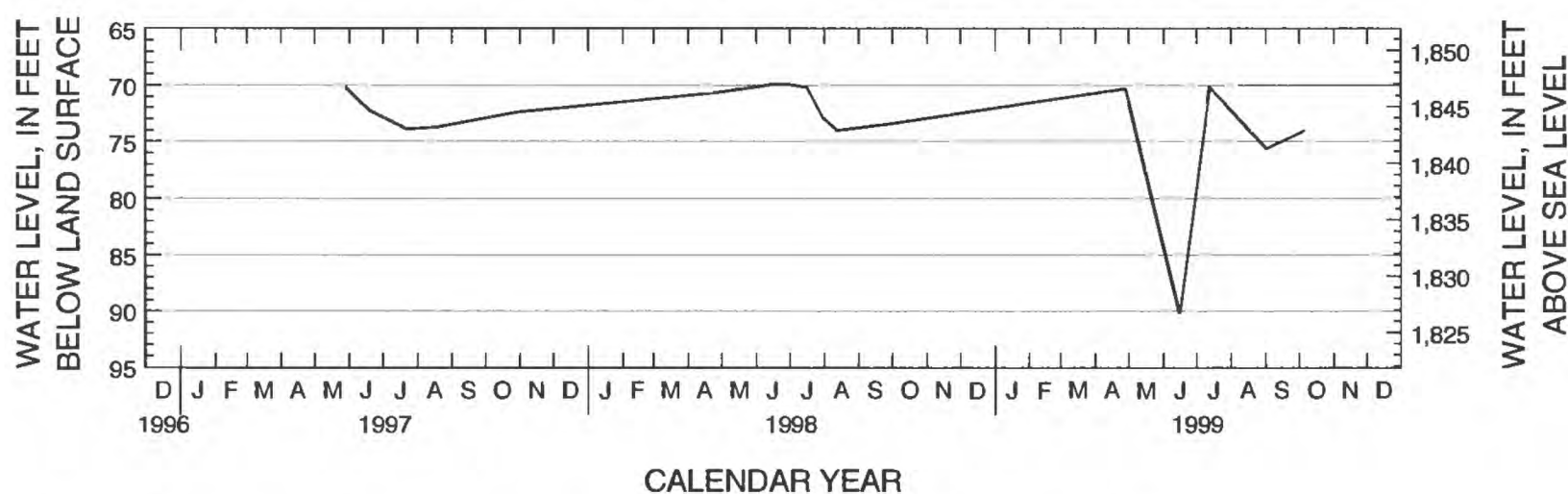


Figure B27. Hydrograph for observation well 121N52W13BBBA R (site number 27).

Site number from location map: 28
 Local well number: 121N52W22CCCC R
 Station identification number: 451423097095201
 Other identifier: GT-77C
 County: Grant, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 1,837 feet
 Measuring point: 3.0 feet
 Extremes: December 1, 1977, to October 6, 1999: Highest, 2.9 feet, June 5, 10, 15, 1996; lowest, 20.8 feet, August 25, 1988.

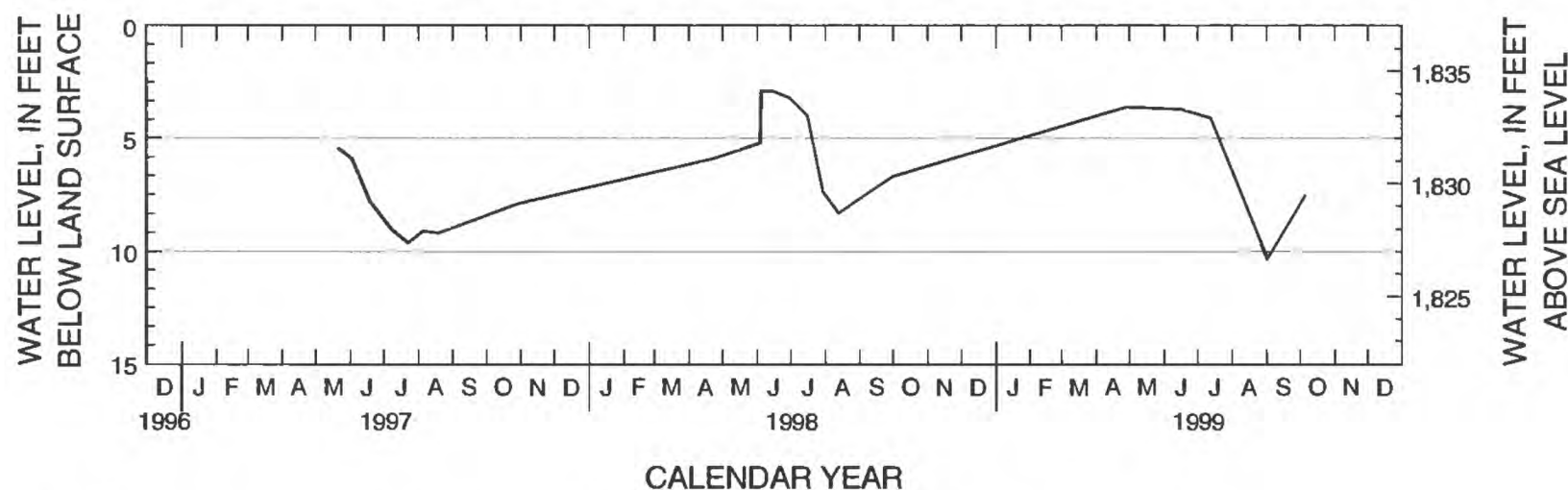


Figure B28. Hydrograph for observation well 121N52W22CCCC R (site number 28).

Site number from location map: 29
Local well number: 121N52W25CCCC R
Station identification number: 451328097072301
Other identifier: GT-79B
County: Grant, South Dakota
Aquifer: Prairie Coteau
Altitude of land surface: 1,880 feet
Measuring point: 2.2 feet
Extremes: October 25, 1979, to October 6, 1999: Highest, 51.6 feet, June 6, 1996; lowest, 84.2 feet, July 24, 1988.

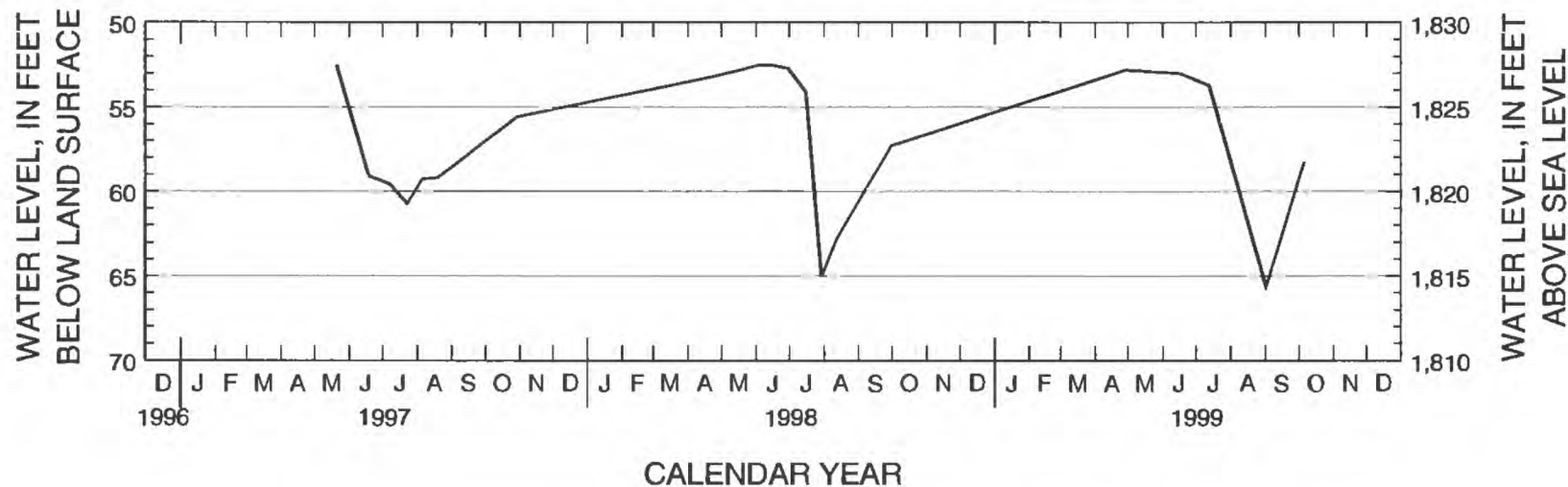


Figure B29. Hydrograph for observation well 121N52W25CCCC R (site number 29).

Site number from location map: 30
Local well number: 121N52W29CCBB R
Station identification number: 451340097121801
Other identifier: GT-77D
County: Grant, South Dakota
Aquifer: Big Sioux
Altitude of land surface: 1,860 feet
Measuring point: 1.6 feet
Extremes: December 1, 1977, to October 6, 1999: Highest, 1.4 feet, July 20, 1993; lowest, 12.1 feet, October 14, 1988.

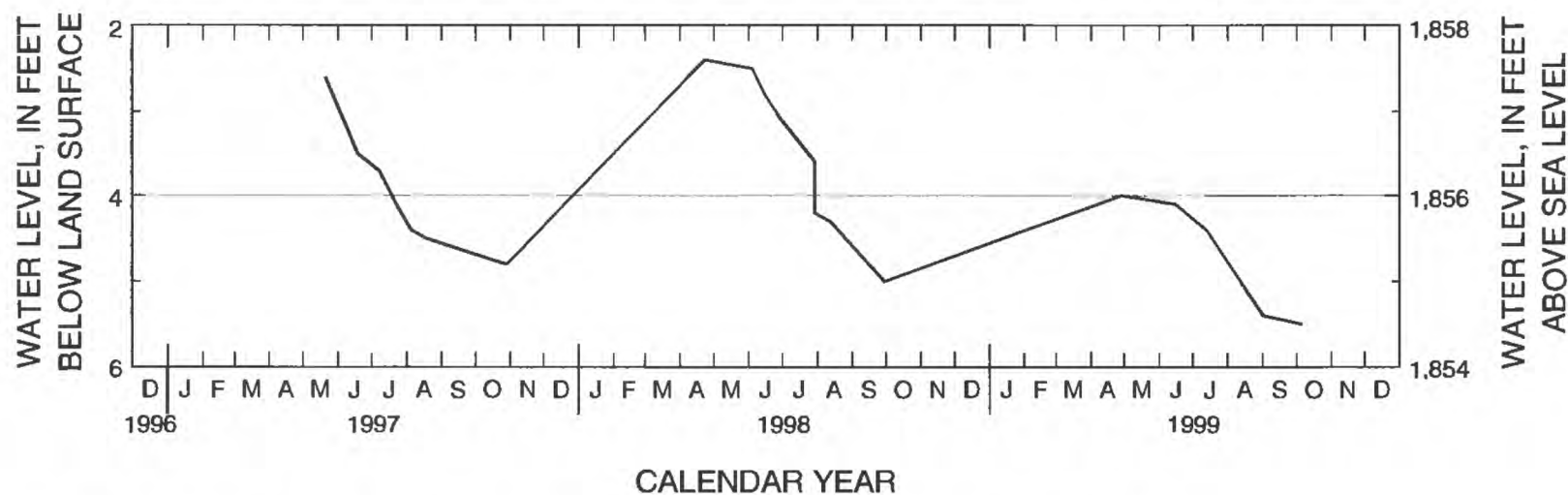


Figure B30. Hydrograph for observation well 121N52W29CCBB R (site number 30).

Site number from location map: 31

Local well number: 121N54W34AADA

Station identification number: 451506097170401

Other identifier: DA-78E

County: Day, South Dakota

Aquifer: Prairie Coteau

Altitude of land surface: 1,803 feet

Measuring point: 3.0 feet

Extremes: September 27, 1978, to October 6, 1999: Highest, 4.5 feet, June 4, 1998; lowest, 24.7 feet, August 19, 1982.

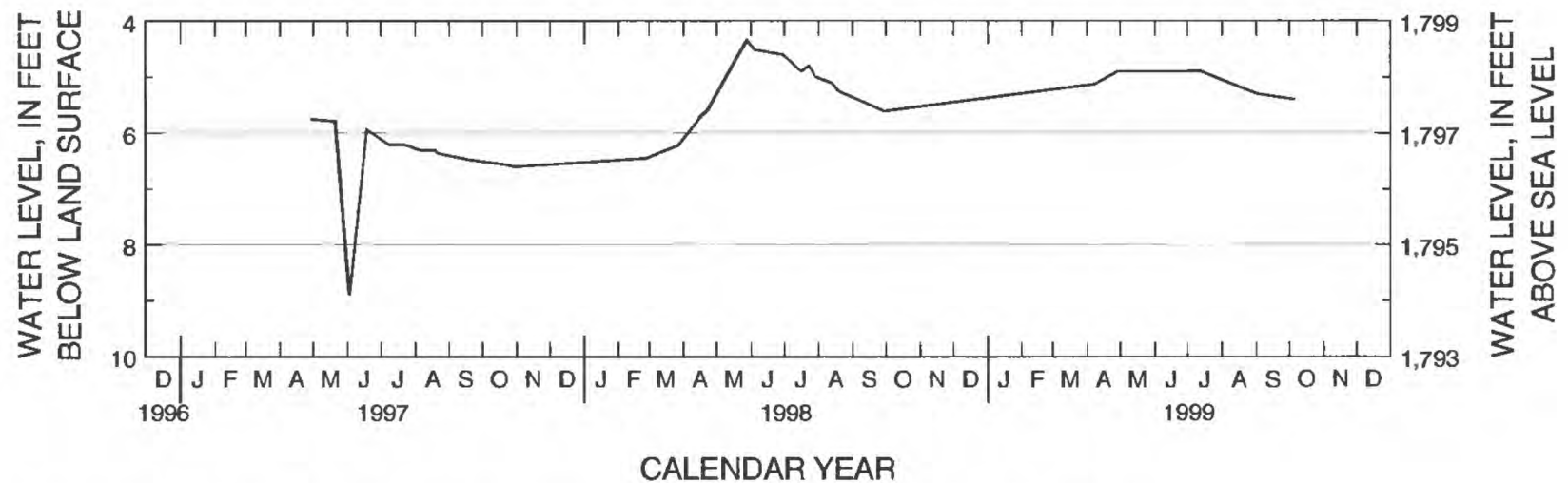


Figure B31. Hydrograph for observation well 121N54W34AADA (site number 31).

Site number from location map: 32

Local well number: 122N47W35DDCD

Station identification number: 451935096310001

Other identifier: R2-85-28

County: Roberts, South Dakota

Aquifer: Wilmot

Altitude of land surface: 1,100 feet

Measuring point: 3.0 feet

Extremes: December 11, 1996, to August 25, 1999: Highest, 23.53 feet, August 25, 1999; lowest, 26.82, April 1, 1999.

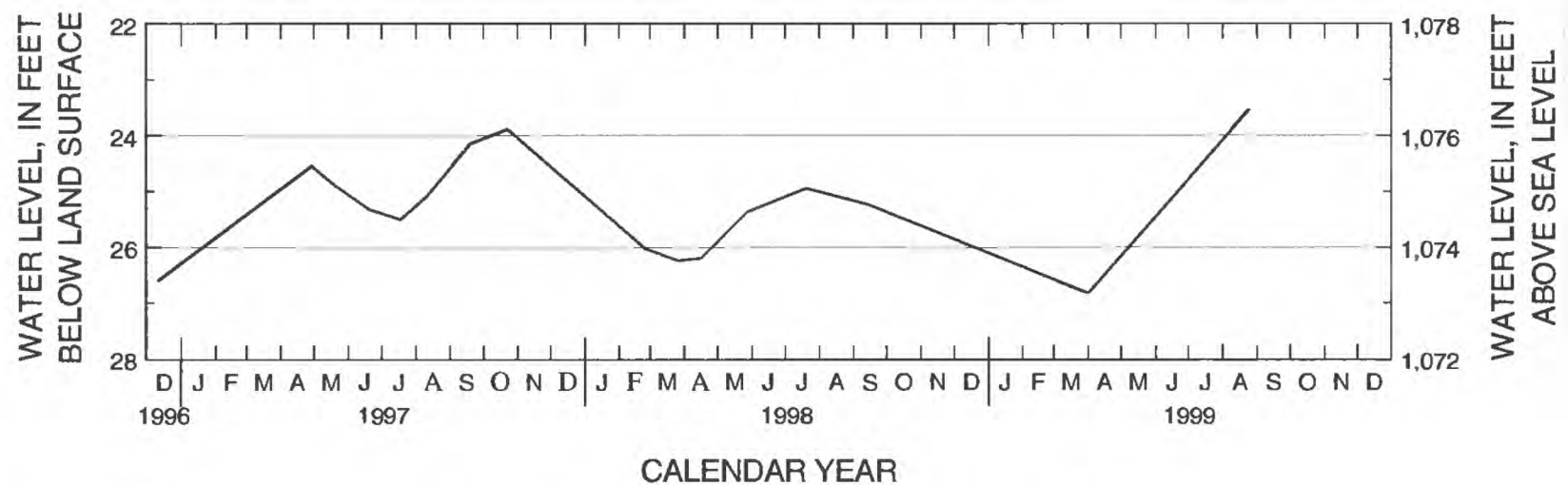


Figure B32. Hydrograph for observation well 122N47W35DDCD (site number 32).

Site number from location map: 33
 Local well number: 122N48W13DDDD2
 Station identification number: 452211096365902
 Other identifier: R2-98-15
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,085.9 feet
 Measuring point: 2.25 feet
 Extremes: April 1, 1999, to September 13, 1999: Highest, 18.96 feet, April 1, 1999; lowest, 19.89 feet, September 13, 1999.

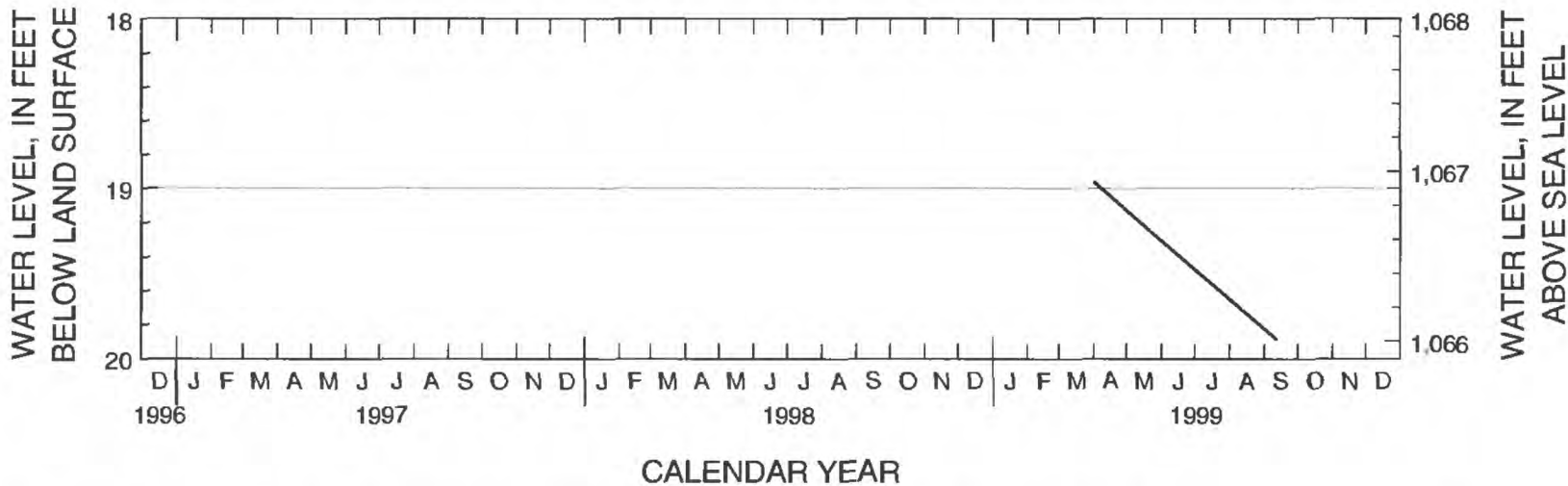


Figure B33. Hydrograph for observation well 122N48W13DDDD2 R (site number 33).

Site number from location map: 34
 Local well number: 122N49W7BBBB
 Station identification number: 452352096513901
 Other identifier: RB-77N
 County: Roberts, South Dakota
 Aquifer: Revillo
 Altitude of land surface: 1,199.9 feet
 Measuring point: 1.7 feet
 Extremes: November 30, 1977, to October 5, 1999: Highest, 23.74 feet, April 29, 1997; lowest, 43.2 feet, July 28, 1988.

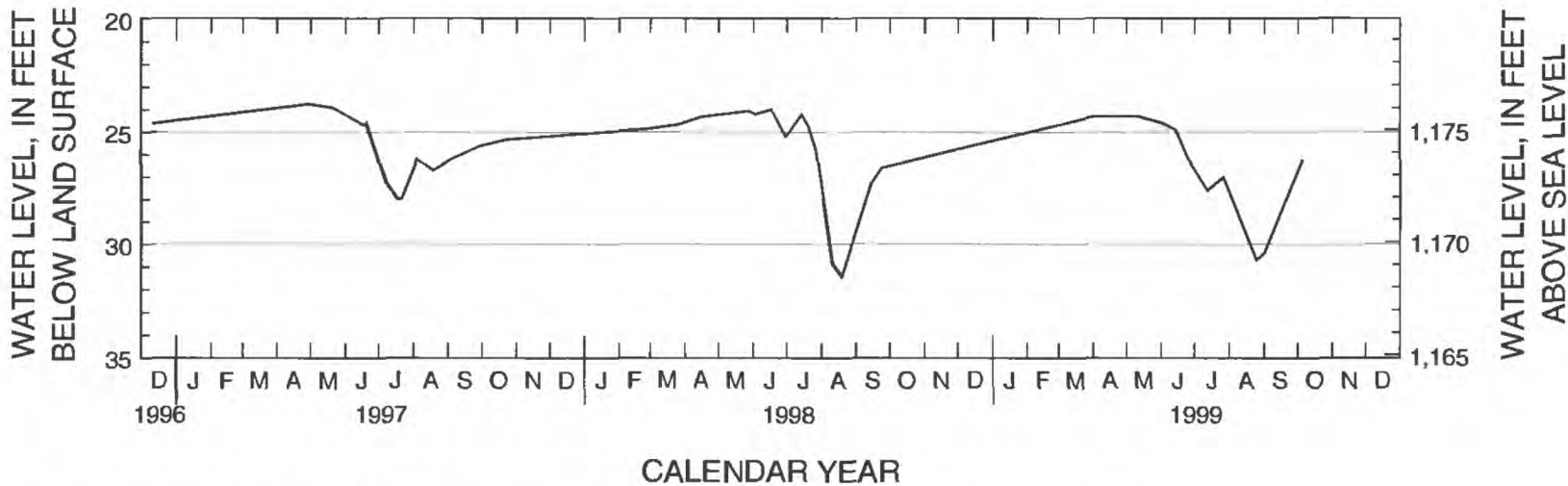


Figure B34. Hydrograph for observation well 122N49W7BBBB (site number 34).

Site number from location map: 35

Local well number: 122N49W17AAAD

Station identification number: 452257096491801

Other identifier: RB-77P

County: Roberts, South Dakota

Aquifer: Wilmot

Altitude of land surface: 1,163.9 feet

Measuring point: 2.4 feet

Extremes: November 30, 1977, to October 5, 1996: Highest, 6.7 feet, April 26, 1994; lowest, 12.1 feet, September 8, 1988.

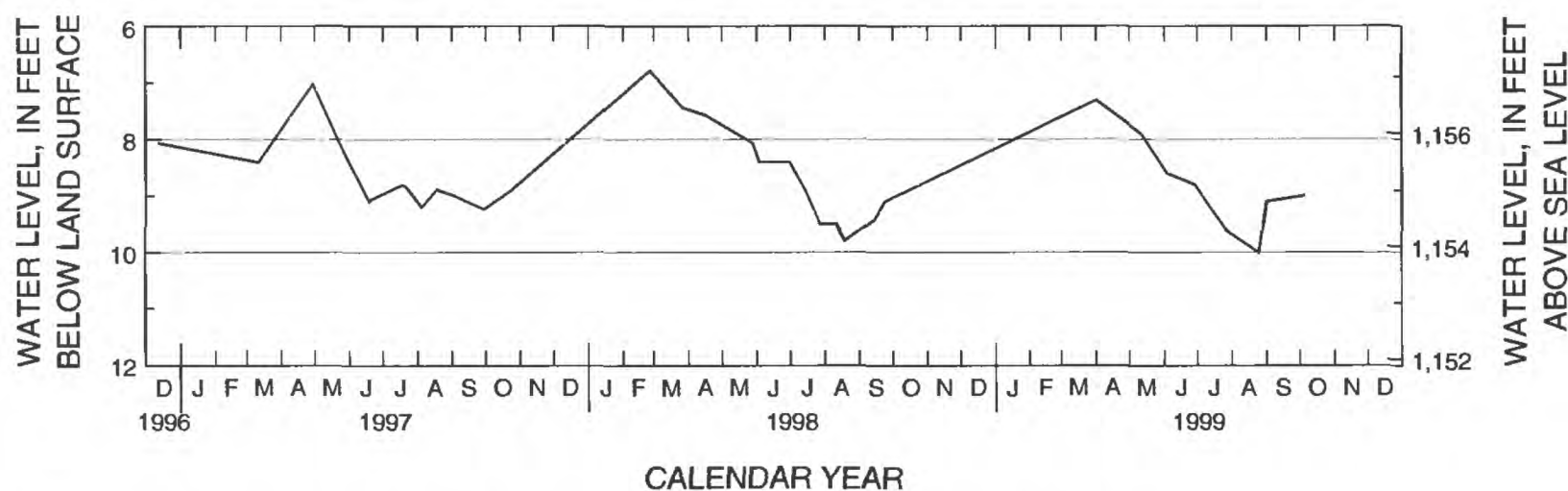


Figure B35. Hydrograph for observation well 122N49W17AAAD (site number 35).

Site number from location map: 36

Local well number: 122N49W18AAAA

Station identification number: 452302096503101

Other identifier: RB-77O

County: Roberts, South Dakota

Aquifer: Wilmot

Altitude of land surface: 1,184.2 feet

Measuring point: 1.5 feet

Extremes: November 30, 1977, to October 5, 1999: Highest, 8.16 feet, Apr. 29, 1997; lowest, 25.8 feet, July 28, 1988.

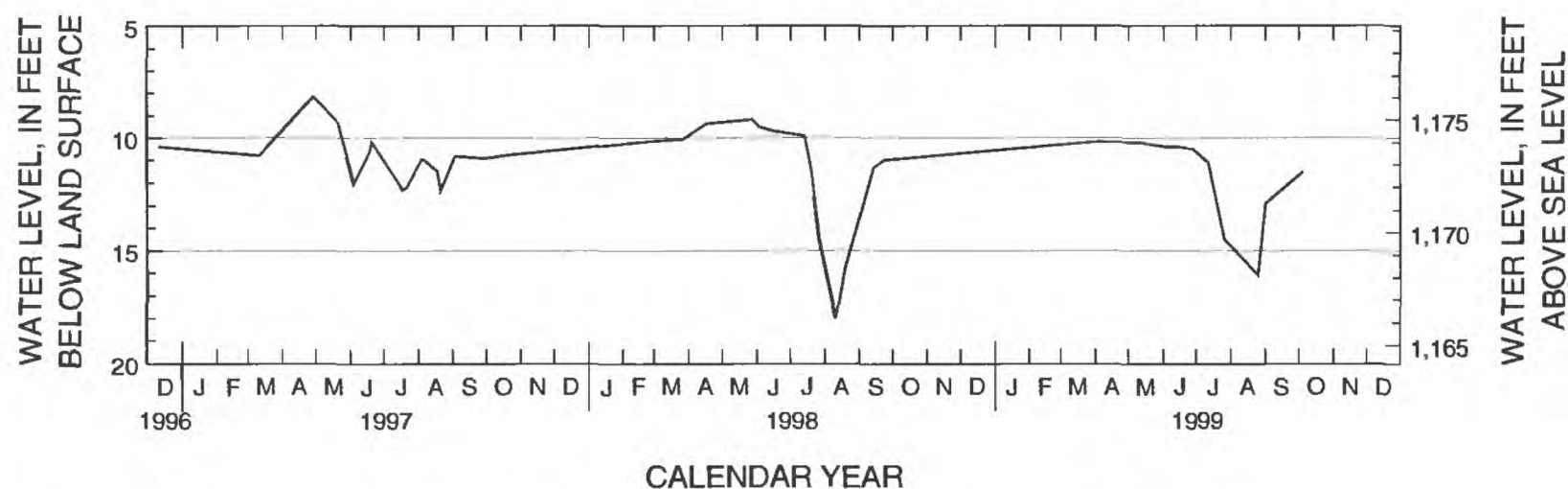


Figure B36. Hydrograph for observation well 122N49W18AAAA (site number 36).

Site number from location map: 37
Local well number: 122N49W30BBBB
Station identification number: 452117096514201
Other identifier: RB-77Q
County: Roberts, South Dakota
Aquifer: Reville
Altitude of land surface: 1,248.3 feet
Measuring point: 1.0 foot
Extremes: November 30, 1977, to October 5, 1999: Highest, 42.02 feet, May 21, 1997; lowest, 49.1 feet, August 18, 1982, September 1, 1982.

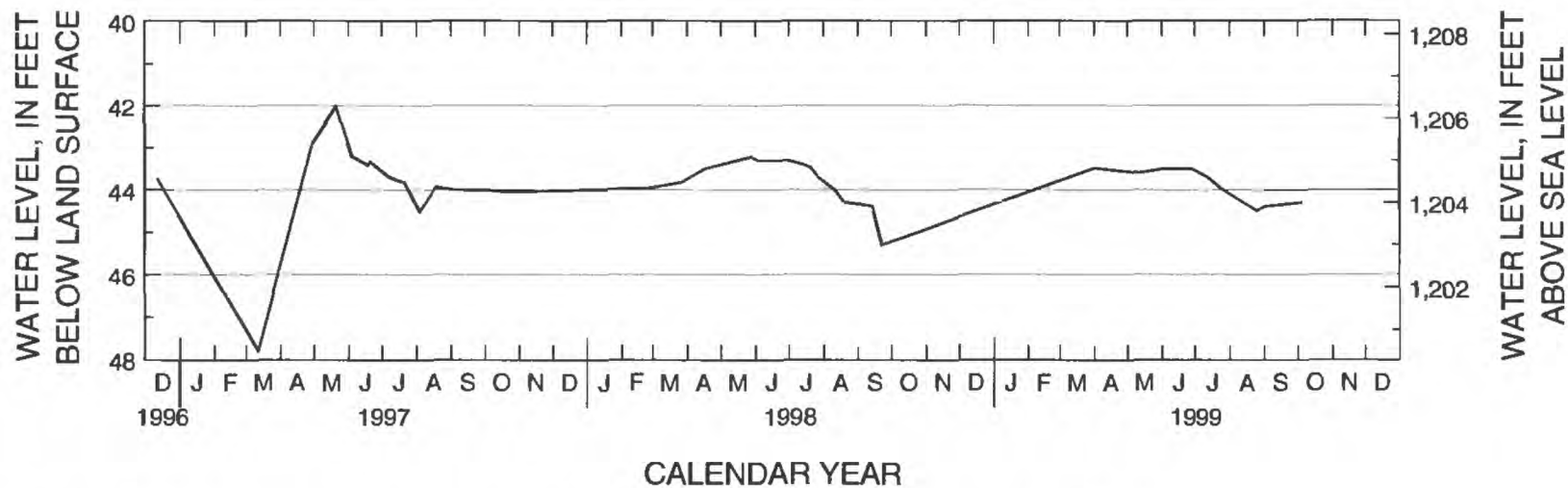


Figure B37. Hydrograph for observation well 122N49W30BBBB (site number 37).

Site number from location map: 38
Local well number: 122N50W13DDDC
Station identification number: 452210096514701
Other identifier: R2-97-46
County: Roberts, South Dakota
Aquifer: Wilmot
Altitude of land surface: 1,228 feet
Measuring point: 1.5 feet
Extremes: October 23, 1997, to August 25, 1999: Highest 19.52 feet, May 28, 1998; lowest 21.36 feet, October 23, 1997.

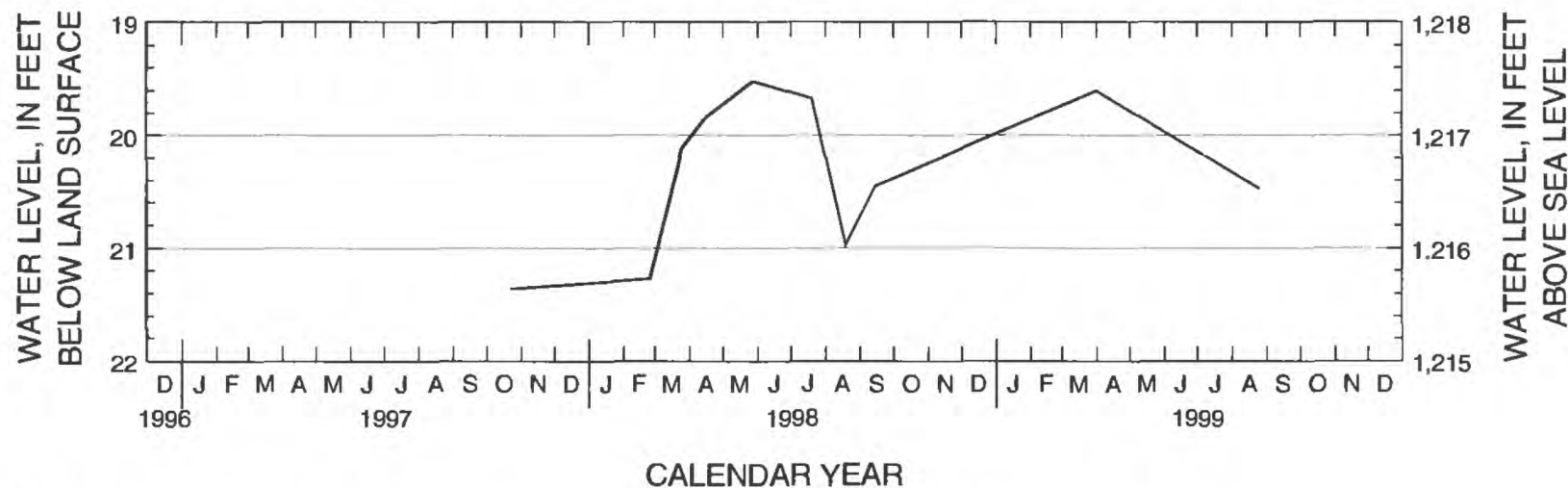


Figure B38. Hydrograph for observation well 122N50W13DDDC (site number 38).

Site number from location map: 39
 Local well number: 122N51W4DDDD2 R
 Station identification number: 452212097022702
 Other identifier: R2-99-11
 County: Roberts, South Dakota
 Aquifer: Eden
 Altitude of land surface: 1,962.2 feet
 Measuring point: 2.0 feet
 Extremes: September 14, 1999, to December 12, 1999: Highest, 208.35 feet, September 14, 1999; lowest, 208.73 feet, December 8, 1999.

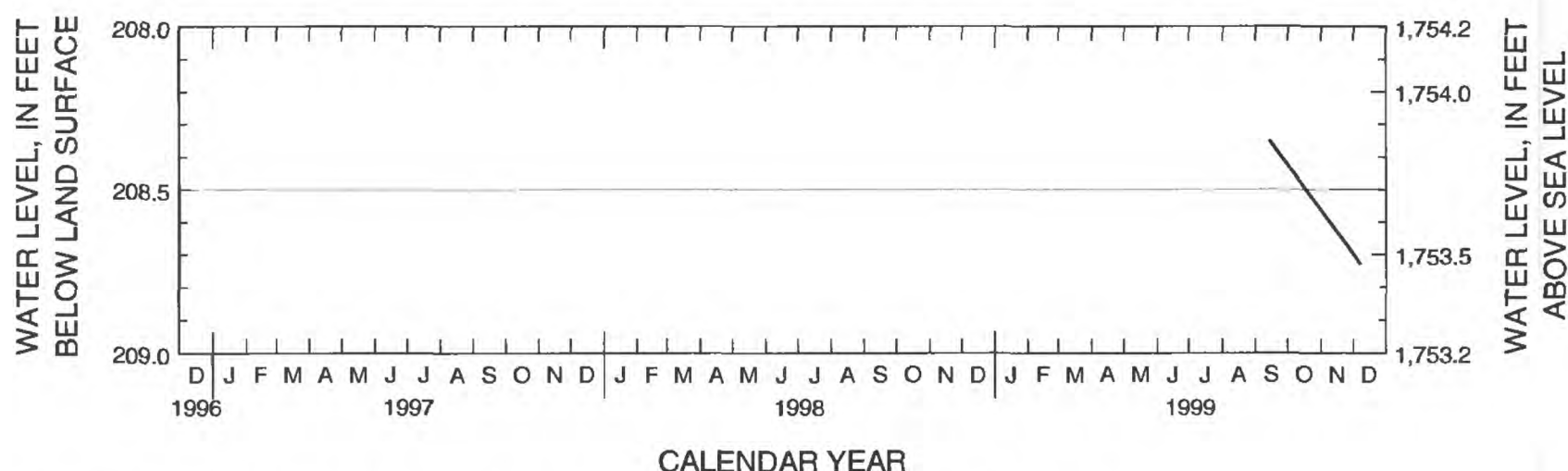


Figure B39. Hydrograph for observation well 122N51W4DDDD2 R (site number 39).

Site number from location map: 40
 Local well number: 122N51W27BBBB2 R
 Station identification number: 451936097022602
 Other identifier: R2-98-27
 County: Roberts, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 2,025.4 feet
 Measuring point: 2.25 feet
 Extremes: March 11, 1999, to September 14, 1999: Highest, 220.92 feet, March 11, 1999; lowest 221.01 feet, September 14, 1999.

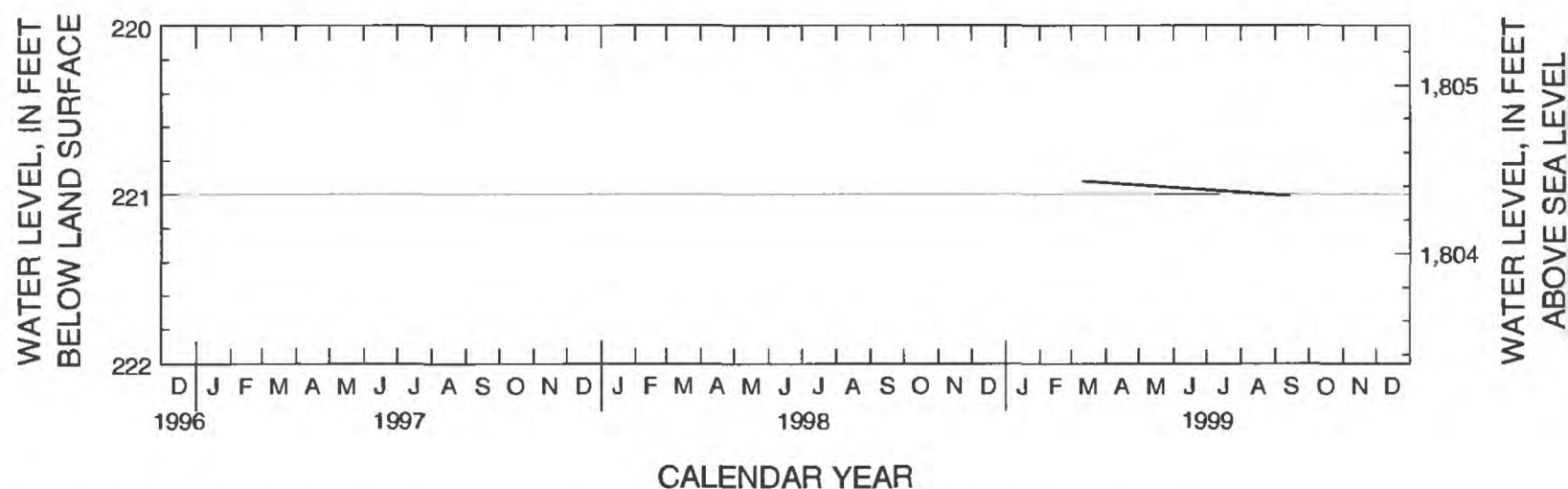


Figure B40. Hydrograph for observation well 122N51W27BBBB2 R (site number 40).

Site number from location map: 41

Local well number: 122N52W1DDCC R

Station identification number: 452213097063101

Other identifier: R2-98-31

County: Roberts, South Dakota

Aquifer: Eden

Altitude of land surface: 1,946.1 feet

Measuring point: 3.4 feet

Extremes: March 11, 1999, to September 15, 1999: Highest, 164.67 feet, September 15, 1999; lowest, 164.7 feet, March 11, 1999.

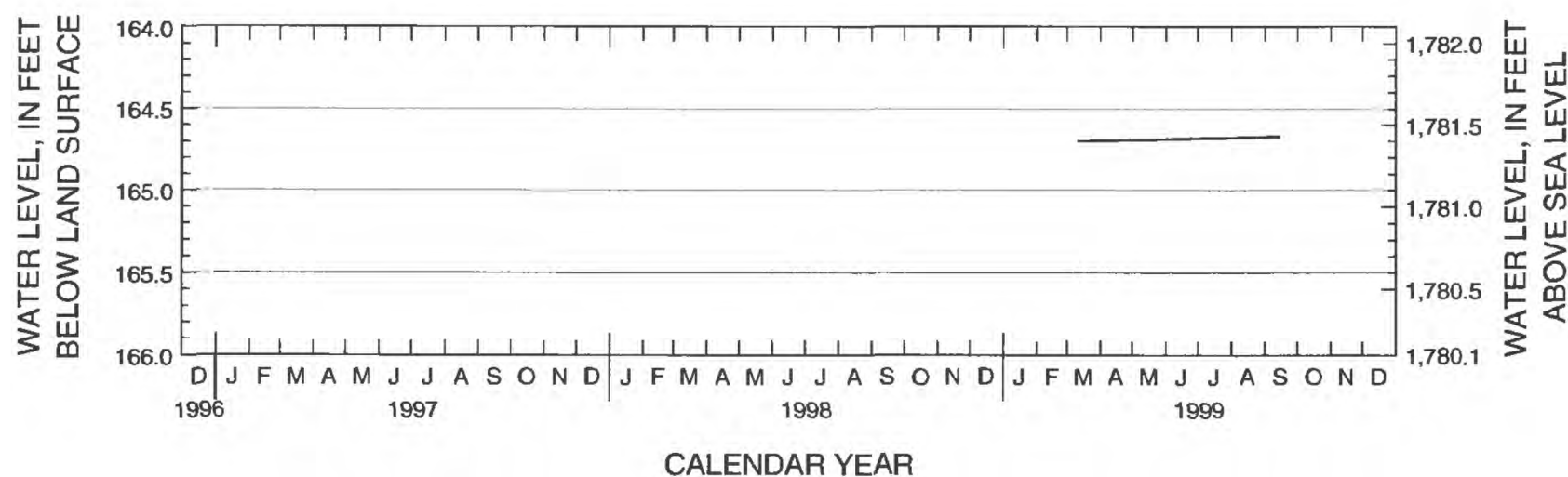


Figure B41. Hydrograph for observation well 122N52W1DDCC R (site number 41).

Site number from location map: 42

Local well number: 122N52W2ABBB R

Station identification number: 452304097080201

Other identifier: CO-93-11

County: Roberts, South Dakota

Aquifer: Coteau Lakes

Altitude of land surface: 1,905 feet

Measuring point: 2.4 feet

Extremes: December 12, 1996, to August 25, 1999: Highest, -0.12 foot, March 27, 1998; lowest, 2.11 feet, December 12, 1996.

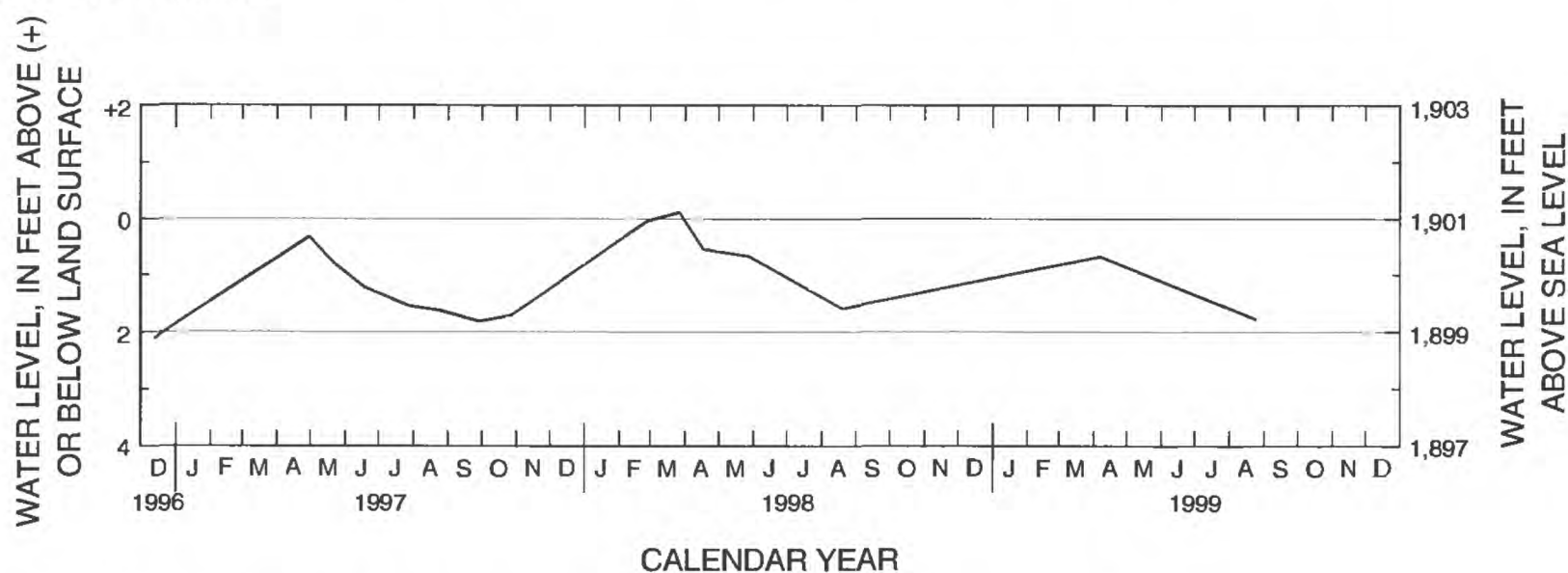


Figure B42. Hydrograph for observation well 122N52W2ABBB R (site number 42).

Site number from location map: 43

Local well number: 122N52W2BBBB R

Station identification number: 452304097083901

Other identifier: RB-77T

County: Roberts, South Dakota

Aquifer: Coteau Lakes

Altitude of land surface: 1,910.9 feet

Measuring point: 2.1 feet

Extremes: November 30, 1977, to October 5, 1999: Highest, 10.02 feet, April 30, 1997; lowest, 23.20 feet, November 30, 1977.

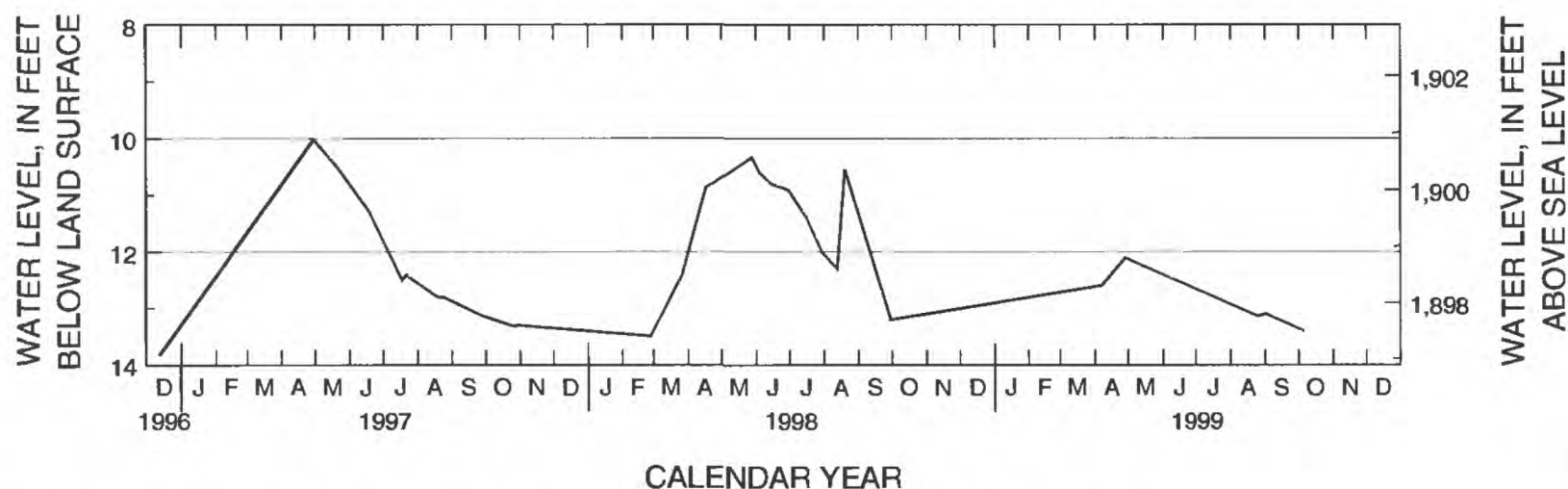


Figure B43. Hydrograph for observation well 122N52W2BBBB R (site number 43).

Site number from location map: 44

Local well number: 122N52W3ABBB R

Station identification number: 452304097091501

Other identifier: CO-93-36

County: Roberts, South Dakota

Aquifer: Coteau Lakes

Altitude of land surface: 1,908 feet

Measuring point: 2.3 feet

Extremes: December 12, 1996, to August 26, 1999: Highest, 12.0 feet, April 30, 1997; lowest 16.29 feet, February 26, 1998.

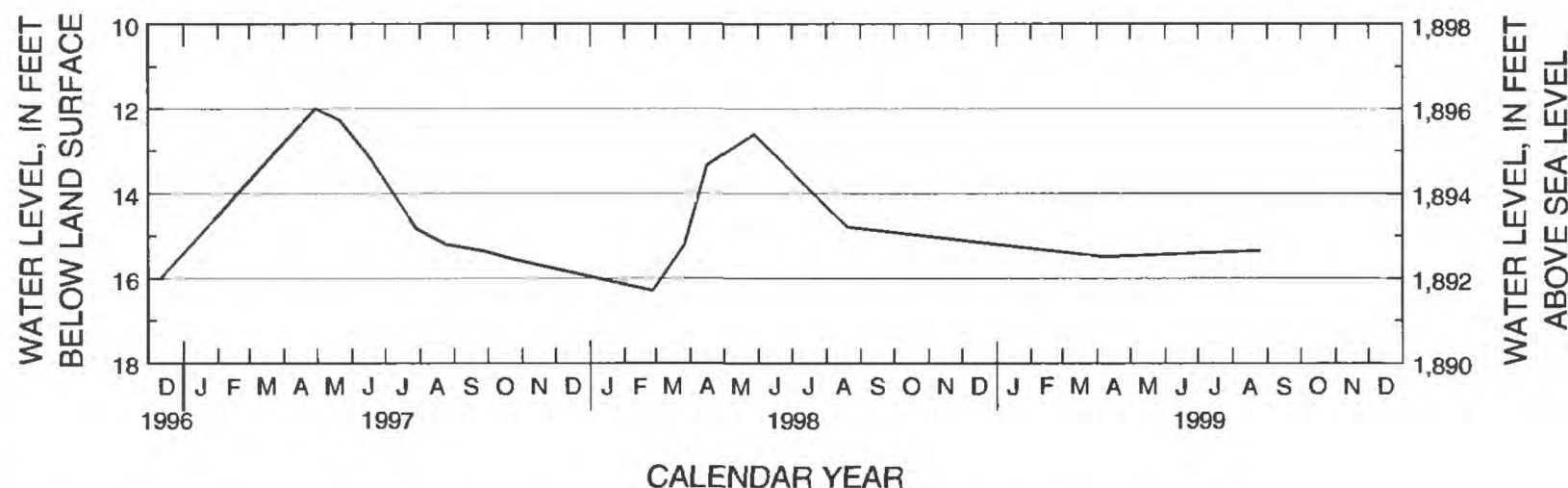


Figure B44. Hydrograph for observation well 122N52W3ABBB R (site number 44).

Site number from location map: 45
 Local well number: 122N52W3CCDD R
 Station identification number: 452214097092701
 Other identifier: CO-93-37
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,890 feet
 Measuring point: 2.2 feet
 Extremes: December 12, 1996, to August 26, 1999: Highest, 15.13 feet, April 30, 1997; lowest, 18.08 feet, August 26, 1999.

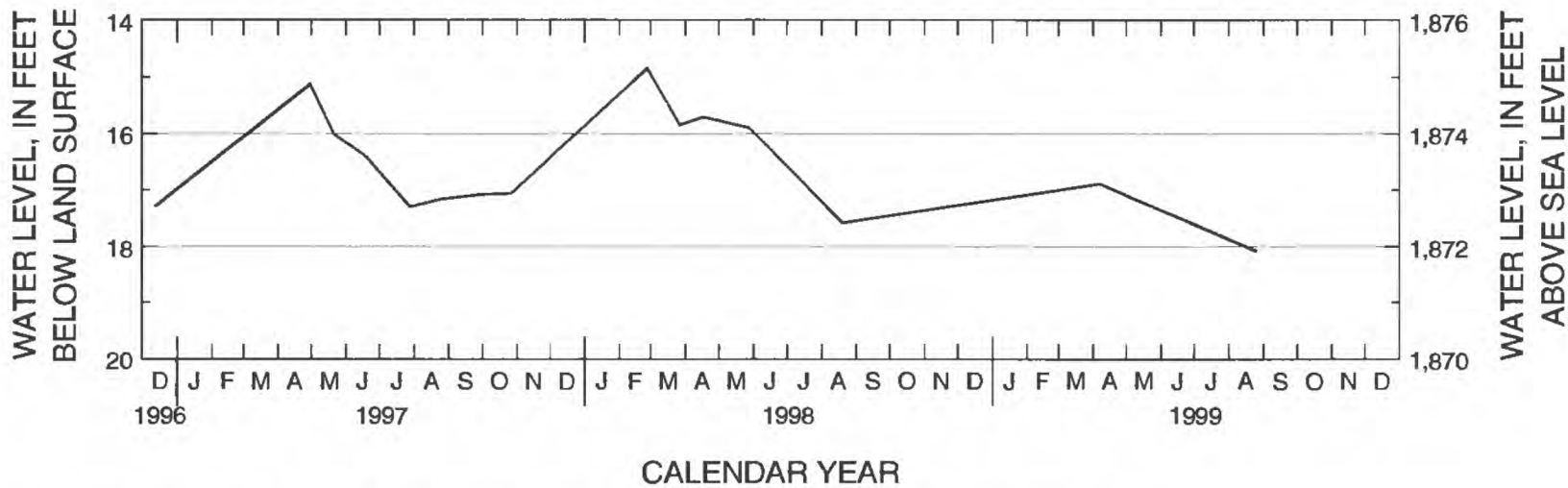


Figure B45. Hydrograph for observation well 122N52W3CCDD R (site number 45).

Site number from location map: 46
 Local well number: 122N52W3DAAA R
 Station identification number: 452238097084001
 Other identifier: CO-93-35
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,910 feet
 Measuring point: 2.0 feet
 Extremes: April 30, 1997, to August 26, 1999: Highest, 13.0 feet, April 30, 1997; lowest, 16.81 feet, February 26, 1998.

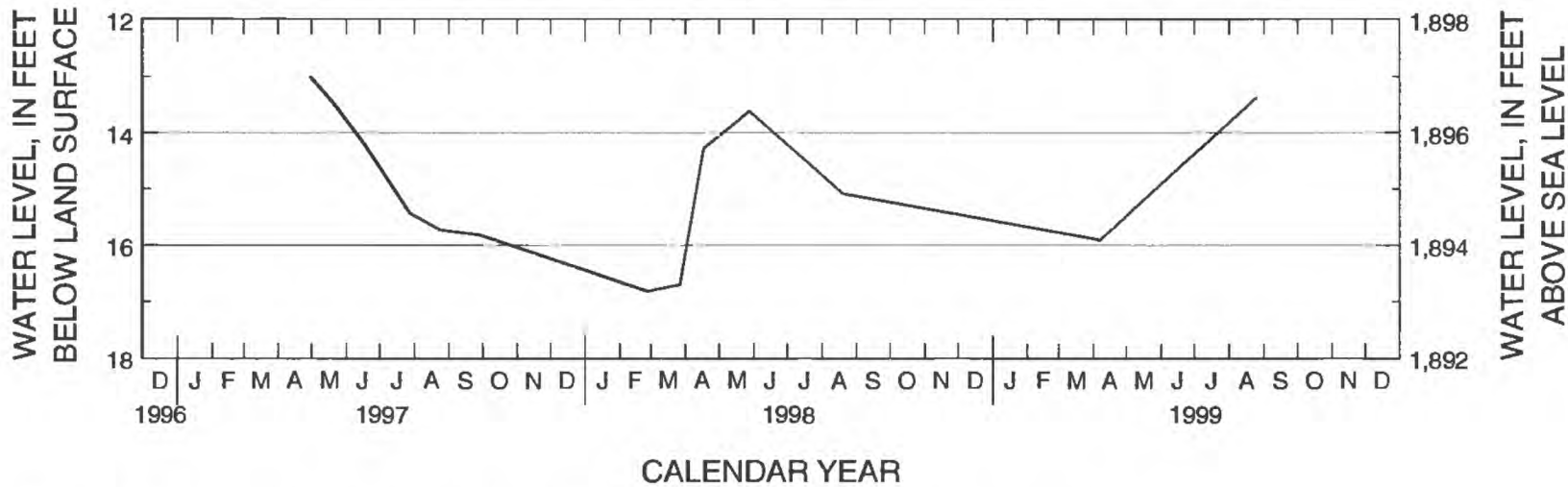


Figure B46. Hydrograph for observation well 122N52W3DAAA R (site number 46).

Site number from location map: 47
 Local well number: 122N52W5CCCC R
 Station identification number: 452215097121801
 Other identifier: RB-77R
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,871.7 feet
 Measuring point: 1.5 feet
 Extremes: November 30, 1977, to October 6, 1999: Highest, 7.85 feet, April 30, 1997; lowest, 16.4 feet, April 1, 1982.

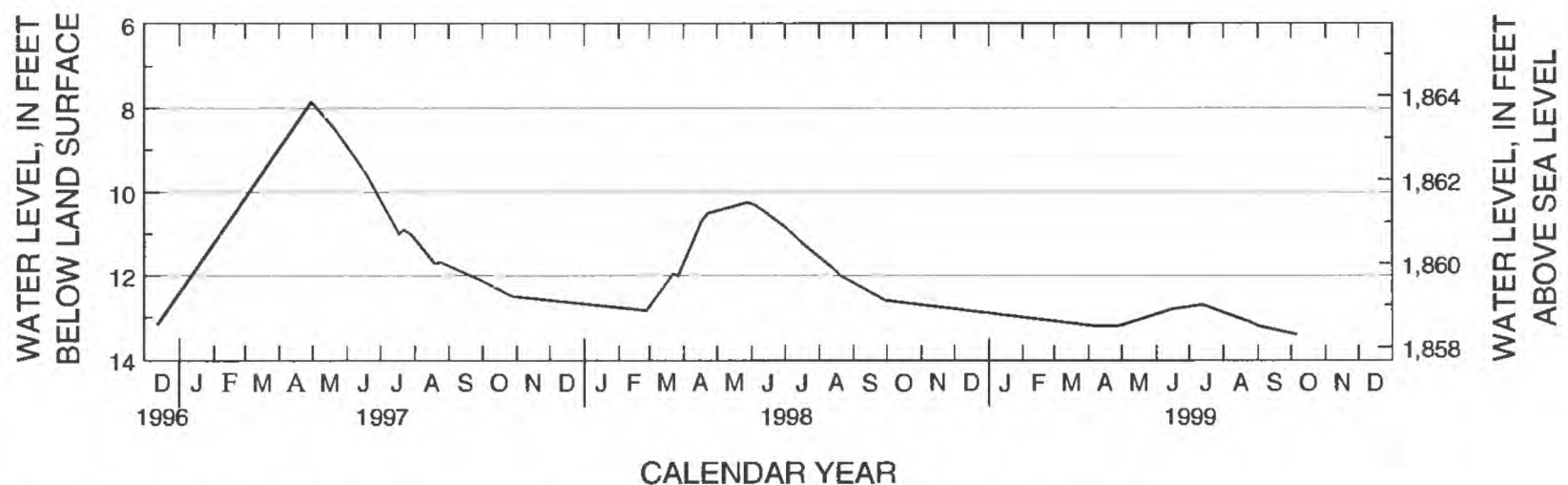


Figure B47. Hydrograph for observation well 122N52W5CCCC R (site number 47).

Site number from location map: 48
 Local well number: 122N52W9AAAA2 R
 Station identification number: 452213097095602
 Other identifier: CO-93-31
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,872 feet
 Measuring point: 2.1 feet
 Extremes: December 12, 1996, to August 26, 1999: Highest, 1.42 feet, February 26, 1998; lowest, 3.17 feet, August 26, 1999.

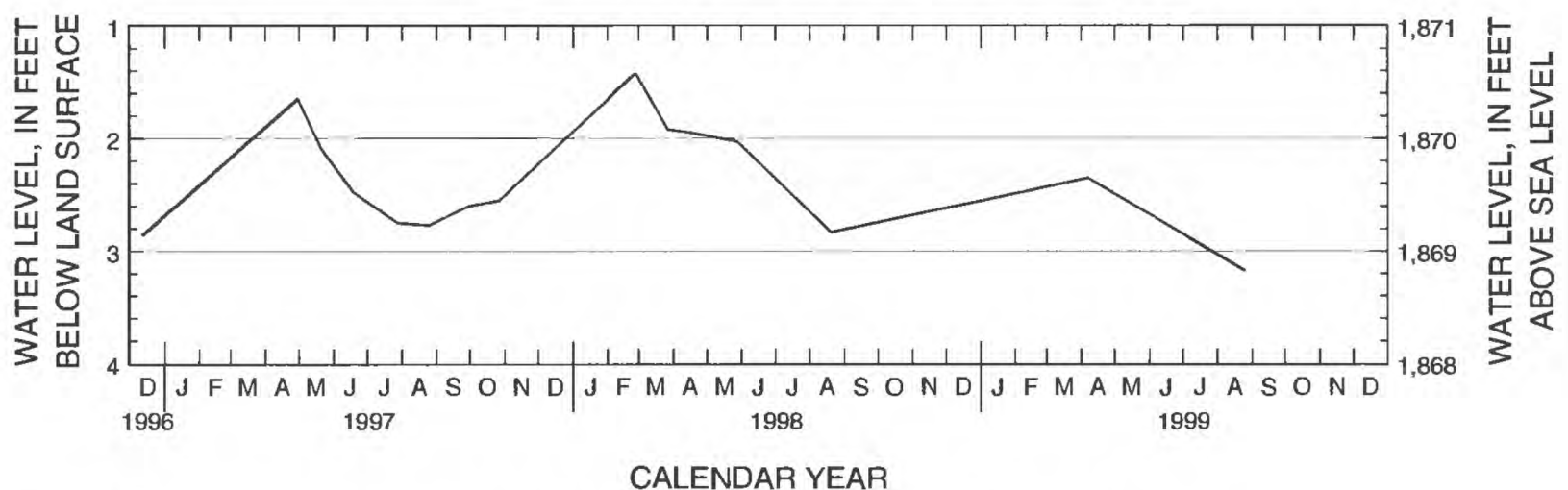


Figure B48. Hydrograph for observation well 122N52W9AAAA2 R (site number 48).

Site number from location map: 49
 Local well number: 122N52W11BBBB R
 Station identification number: 452212097083901
 Other identifier: RB-93C
 County: Roberts, South Dakota
 Aquifer: Prairie Coteau
 Altitude of land surface: 1,921 feet
 Measuring point: 2.3 feet
 Extremes: December 12, 1996, to October 6, 1999: Highest, 37.18 feet, May 21, 1997; lowest 39.82 feet, February 26, 1998.

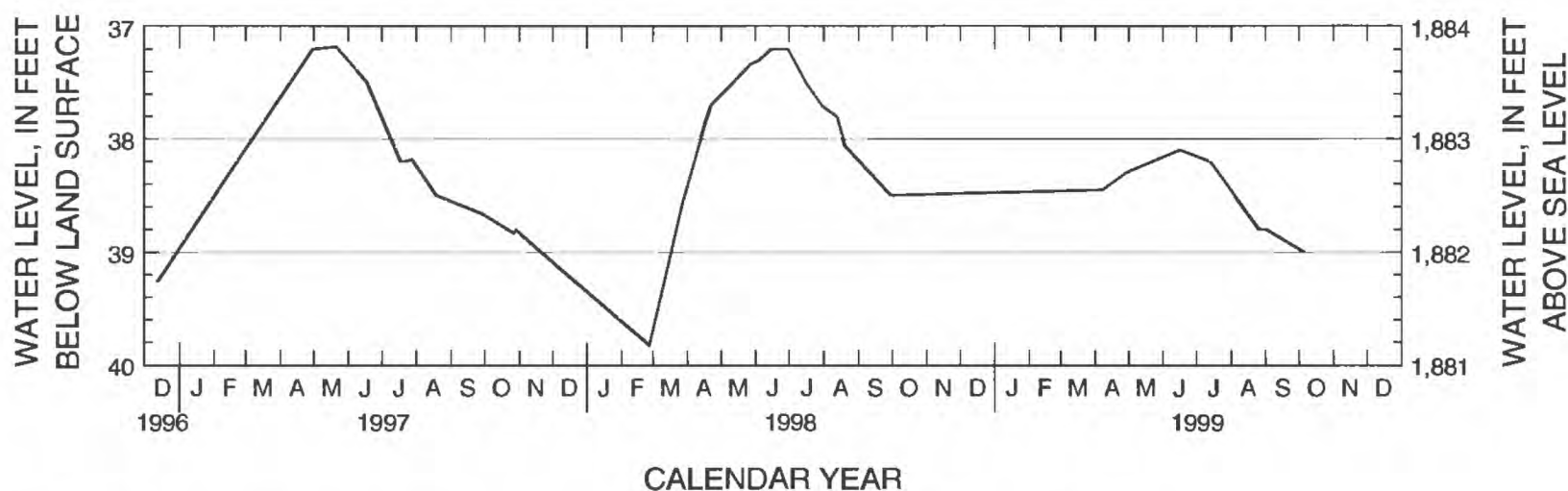


Figure B49. Hydrograph for observation well 122N52W11BBBB R (site number 49).

Site number from location map: 50
 Local well number: 122N52W12CCCC R
 Station identification number: 452122097072301
 Other identifier: RB-76B
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,904.9 feet
 Measuring point: 2.3 feet
 Extremes: December 1, 1976, to October 9, 1996: Highest, -1.08 feet, March 26, 1998; lowest, 13.0 feet, May 7, 1991.

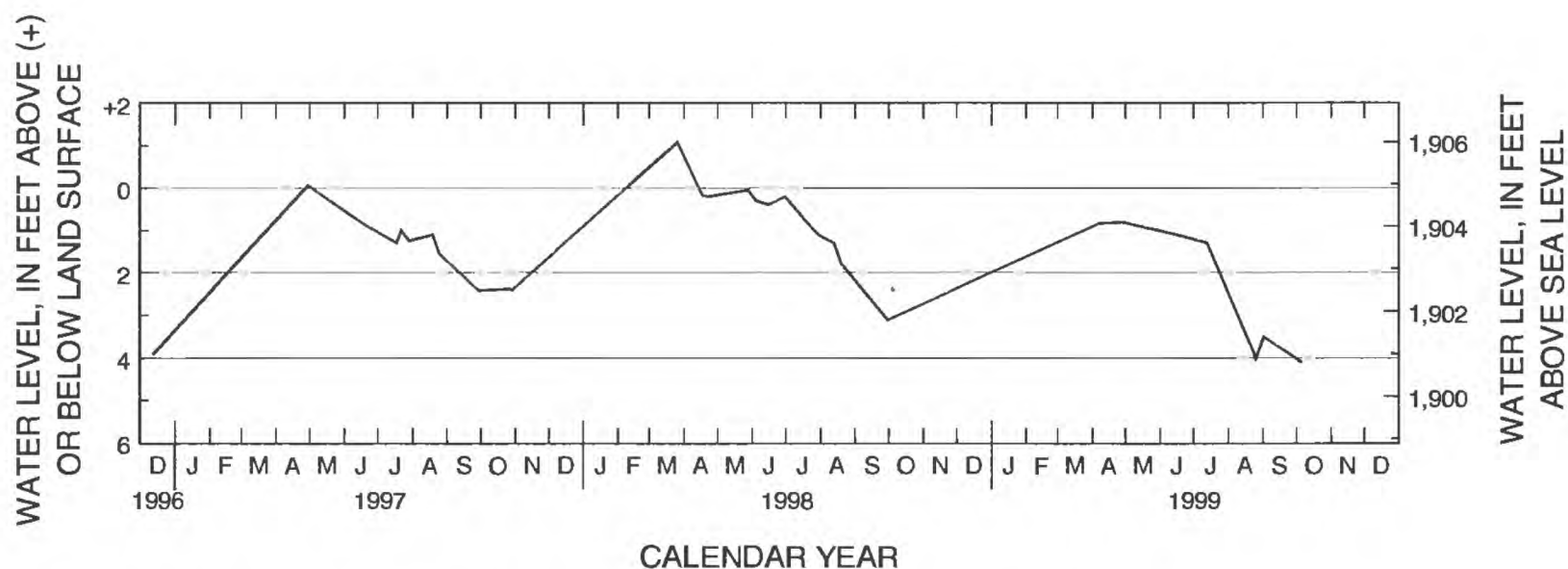


Figure B50. Hydrograph for observation well 122N52W12CCCC R (site number 50).

Site number from location map: 51
 Local well number: 122N52W14BBBB R
 Station identification number: 452119097083901
 Other identifier: RB-76A
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,897.9 feet
 Measuring point: 2.9 feet
 Extremes: December 1, 1976, to October 6, 1999: Highest, 10.1 feet, October 21, 1993; lowest, 22.8 feet, October 11, 1983, November 9, 1983.

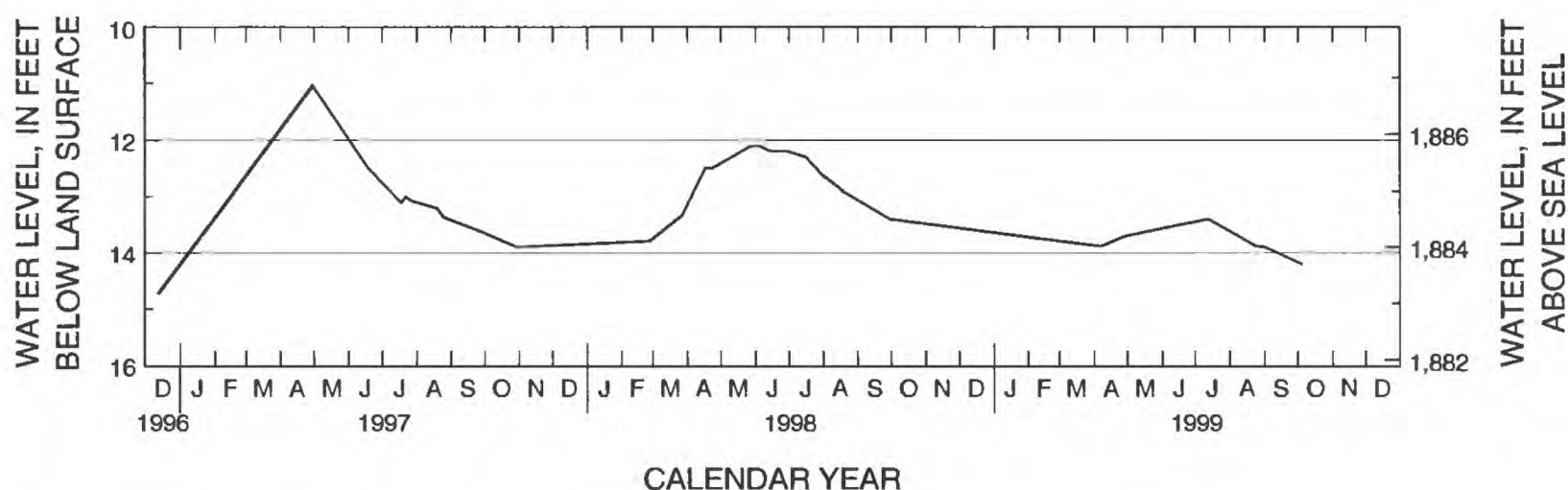


Figure B51. Hydrograph for observation well 122N52W14BBBB R (site number 51).

Site number from location map: 52
 Local well number: 122N52W16BBBC R
 Station identification number: 452115097110601
 Other identifier: RB-82B
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,855.5 feet
 Measuring point: 2.7 feet
 Extremes: June 29, 1982, to October 6, 1999: Highest, 12.1 feet, August 4, 1993; lowest, 14.8 feet, October 11, 1983.

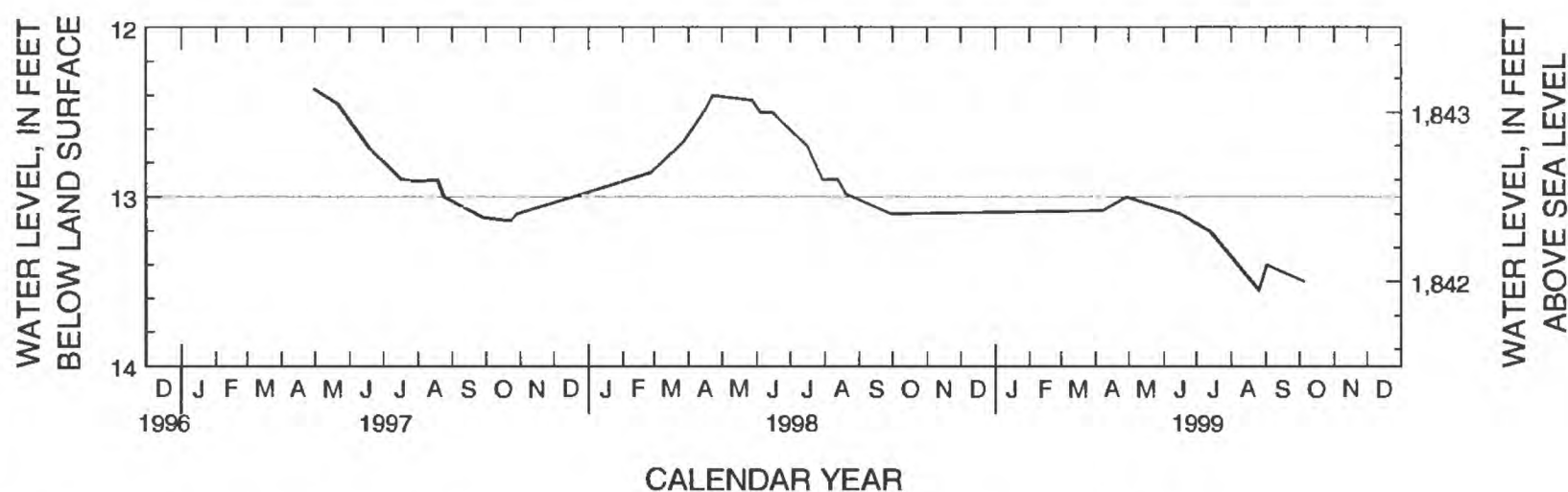


Figure B52. Hydrograph for observation well 122N52W16BBBC R (site number 52).

Site number from location map: 53
 Local well number: 122N52W27BBBB2 R
 Station identification number: 451934097095302
 Other identifier: R2-98-30
 County: Roberts, South Dakota
 Aquifer: Lonesome Lake
 Altitude of land surface: 1,878.4 feet
 Measuring point: 2.3 feet
 Extremes: March 11, 1999, to September 14, 1999: Highest, 51.14 feet, March 11, 1999; lowest, 51.54 feet, September 14, 1999.

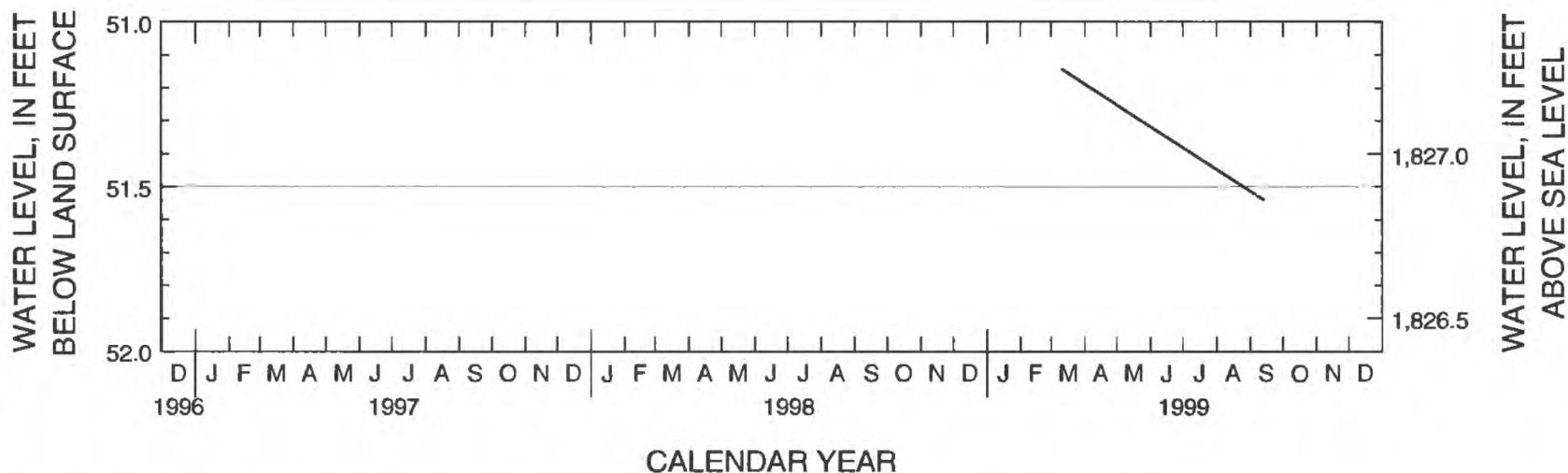


Figure B53. Hydrograph for observation well 122N52W27BBBB2 R (site number 53).

Site number from location map: 54
 Local well number: 122N52W32AAAA R
 Station identification number: 451841097110901
 Other identifier: RB-77S
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,851.7 feet
 Measuring point: 1.8 feet
 Extremes: May 23, 1978, to October 6, 1999: Highest, 7.6 feet, August 4, 1993; lowest, 12.0 feet, October 21, 1981.

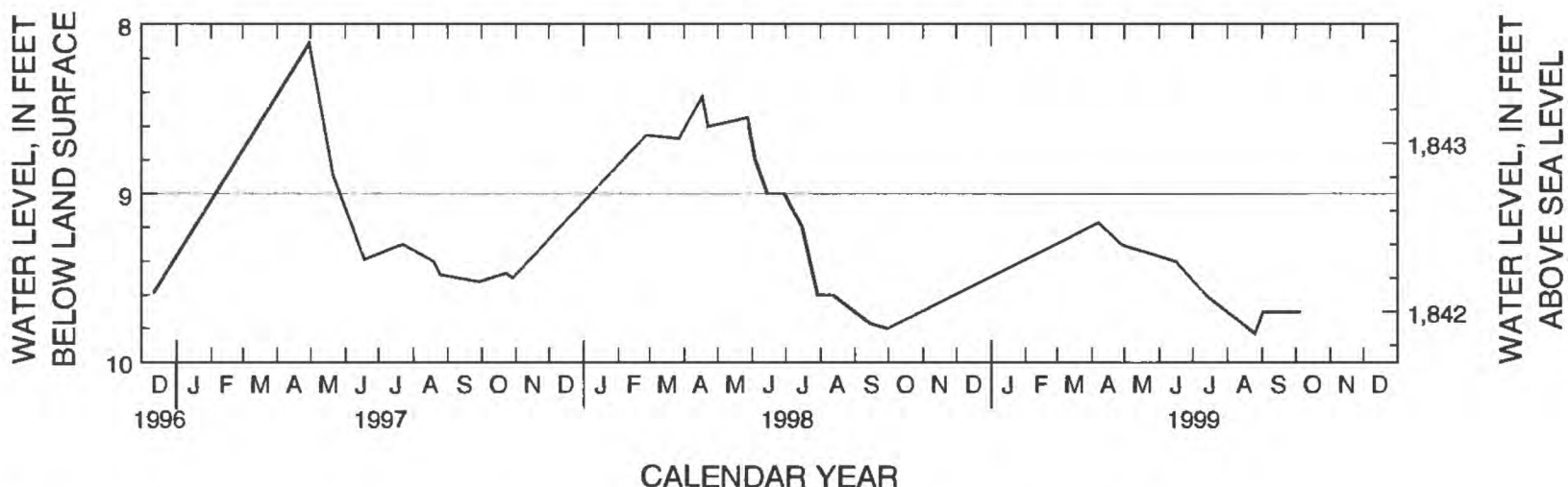


Figure B54. Hydrograph for observation well 122N52W32AAAA R (site number 54).

Site number from location map: 55

Local well number: 122N52W36BCCB2 R

Station identification number: 451822097072401

Other identifier: R20-84-34

County: Roberts, South Dakota

Aquifer: Big Sioux

Altitude of land surface: 1,888 feet

Measuring point: 3.0 feet

Extremes: April 29, 1997, to August 26, 1999: Highest, 0.76 feet, March 27, 1998; lowest, 4.33 feet, August 26, 1999.

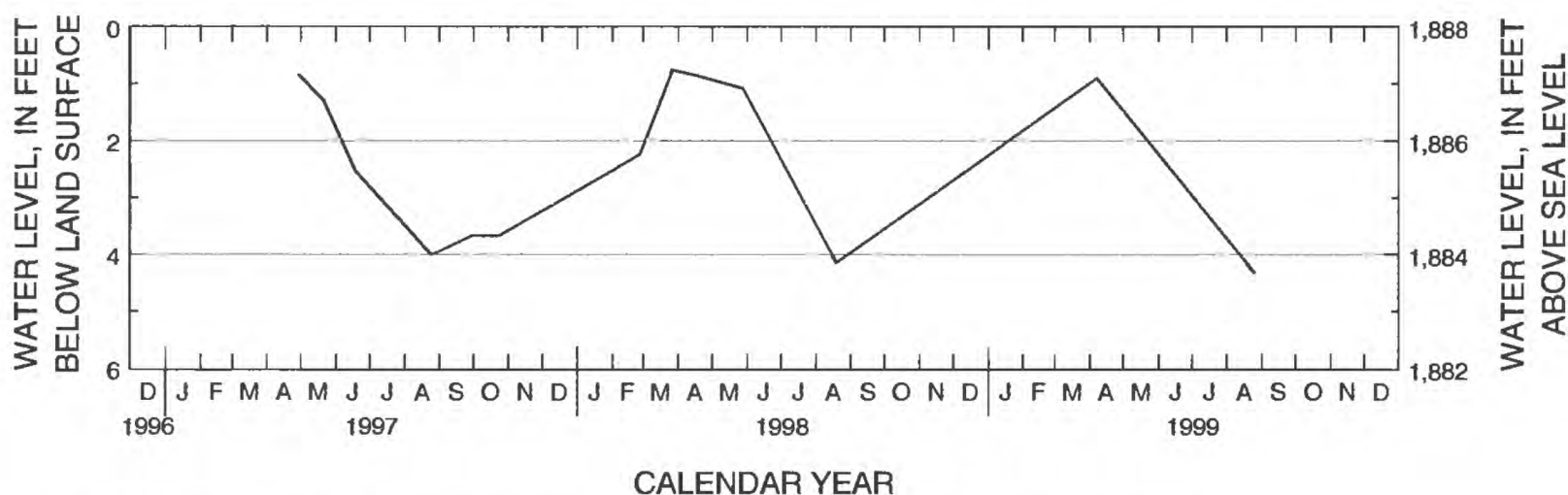


Figure B55. Hydrograph for observation well 122N52W36BCCB2 R (site number 55).

Site number from location map: 56

Local well number: 122N53W11DDDD R

Station identification number: 452120097145001

Other identifier: DA-78D

County: Day, South Dakota

Aquifer: Coteau Lakes

Altitude of land surface: 1,830 feet

Measuring point: 2.8 feet

Extremes: September 27, 1978, to October 6, 1999: Highest, 0.99 foot, February 26, 1998; lowest, 10.5 feet, September 1, 1982.

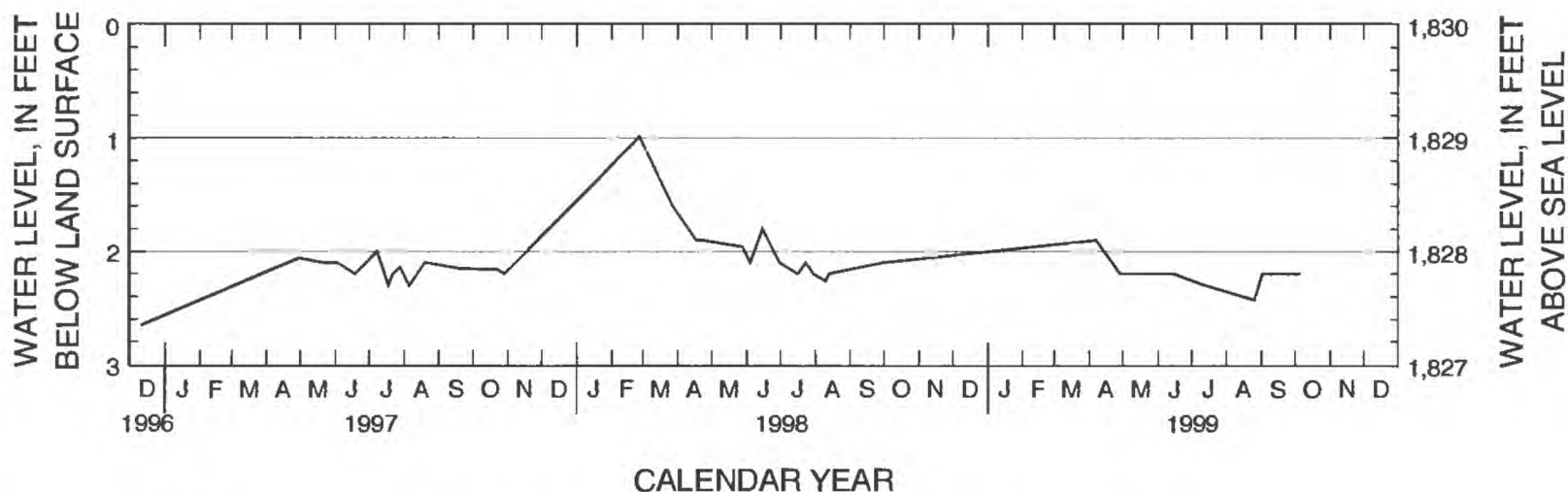


Figure B56. Hydrograph for observation well 122N53W11DDDD R (site number 56).

Site number from location map: 57
 Local well number: 123N49W24CCCC
 Station identification number: 452633096453401
 Other identifier: RB-81B
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,148.6 feet
 Measuring point: 2.5 feet
 Extremes: May 29, 1981, to October 5, 1999: Highest, 38.35 feet, June 20, 1997; lowest, 61.0 feet, November 9, 1983.

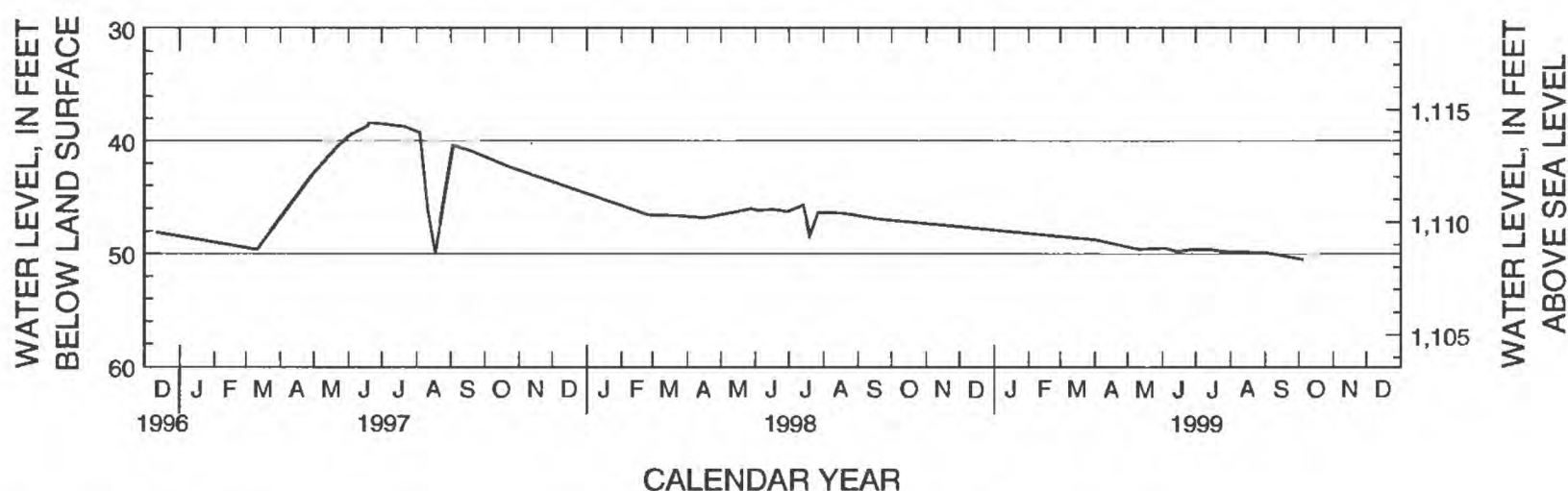


Figure B57. Hydrograph for observation well 123N49W24CCCC (site number 57).

Site number from location map: 58
 Local well number: 123N50W22BBBB
 Station identification number: 452722096552301
 Other identifier: R2-94-66
 County: Roberts, South Dakota
 Aquifer: Revillo
 Altitude of land surface: 1,240.3 feet
 Measuring point: 2.1 feet
 Extremes: December 12, 1996, to August 25, 1999: Highest, 58.59 feet, April 29, 1997; lowest 72.95 feet, August 25, 1999.

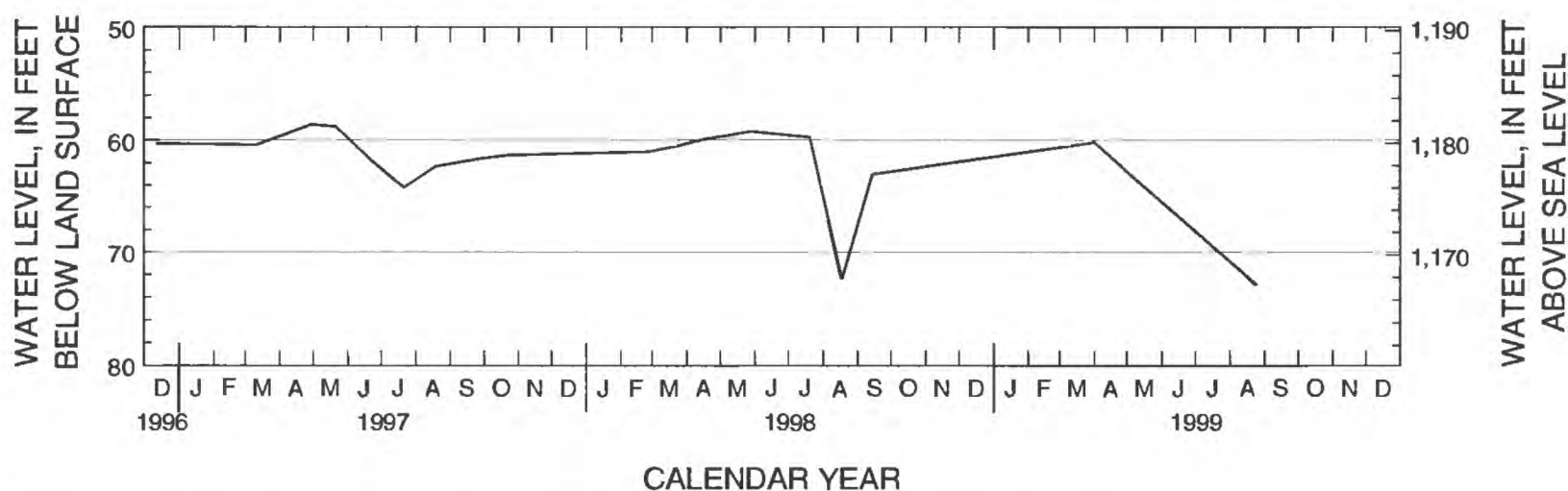


Figure B58. Hydrograph for observation well 123N50W22BBBB (site number 58).

Site number from location map: 59

Local well number: 123N50W23AAAA

Station identification number: 452721096525701

Other identifier: RB-77L

County: Roberts, South Dakota

Aquifer: Reville

Altitude of land surface: 1,175.2 feet

Measuring point: 3.5 feet

Extremes: November 30, 1977, to October 5, 1999: Highest, -3.5 feet, June 17, 1998; lowest, 16.0 feet, July 28, 1988.

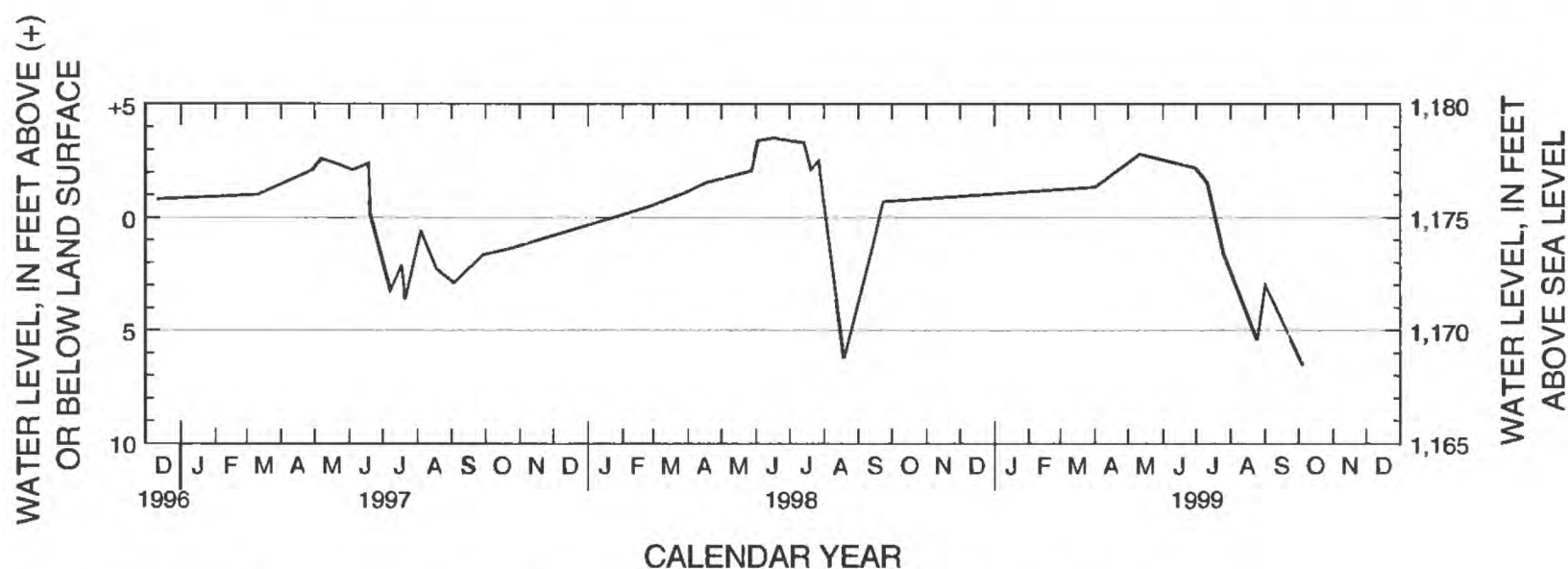


Figure B59. Hydrograph for observation well 123N50W23AAAA (site number 59).

Site number from location map: 60

Local well number: 123N50W35AAAA

Station identification number: 452537096525701

Other identifier: RB-77M

County: Roberts, South Dakota

Aquifer: Reville

Altitude of land surface: 1,216.1 feet

Measuring point: 2.3 feet

Extremes: November 30, 1977, to October 5, 1999: Highest, 39.91 feet, March 11, 1997; lowest, 59.1 feet, July 29, 1988.

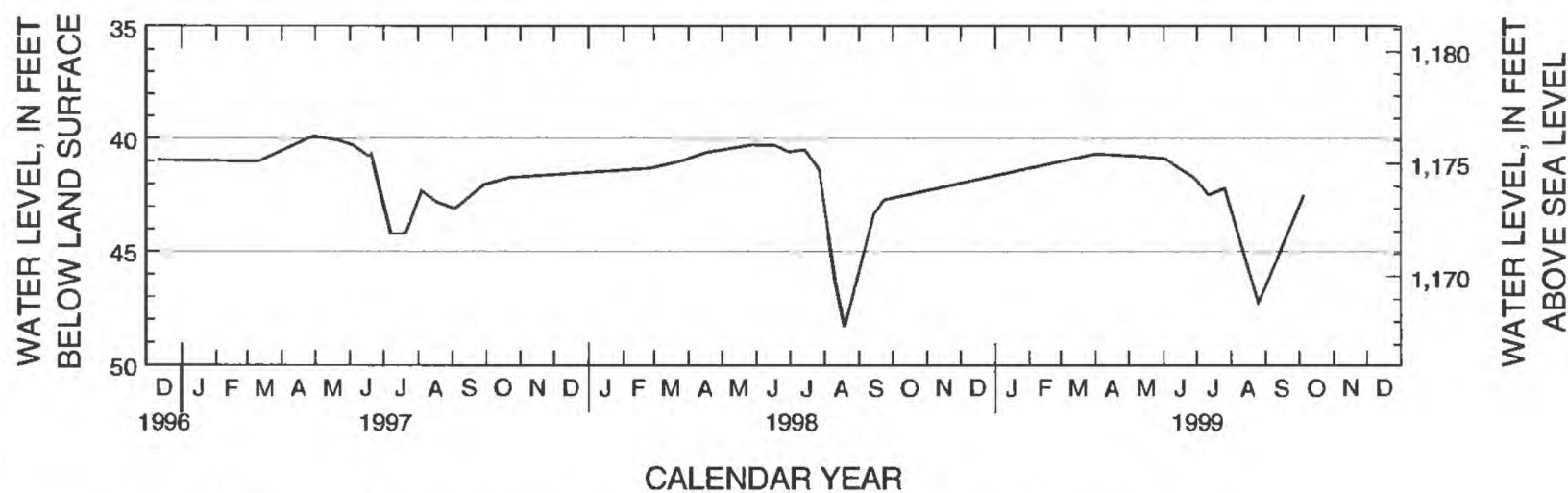


Figure B60. Hydrograph for observation well 123N50W35AAAA (site number 60).

Site number from location map: 61
 Local well number: 123N51W21DDDD2 R
 Station identification number: 452218097022902
 Other identifier: R20-99-48
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,819.4 feet
 Measuring point: 2.0 feet
 Extremes: September 14, 1999, to December 8, 1999: Highest 26.86 feet, September 14, 1999; lowest, 27.23 feet, December 8, 1999.

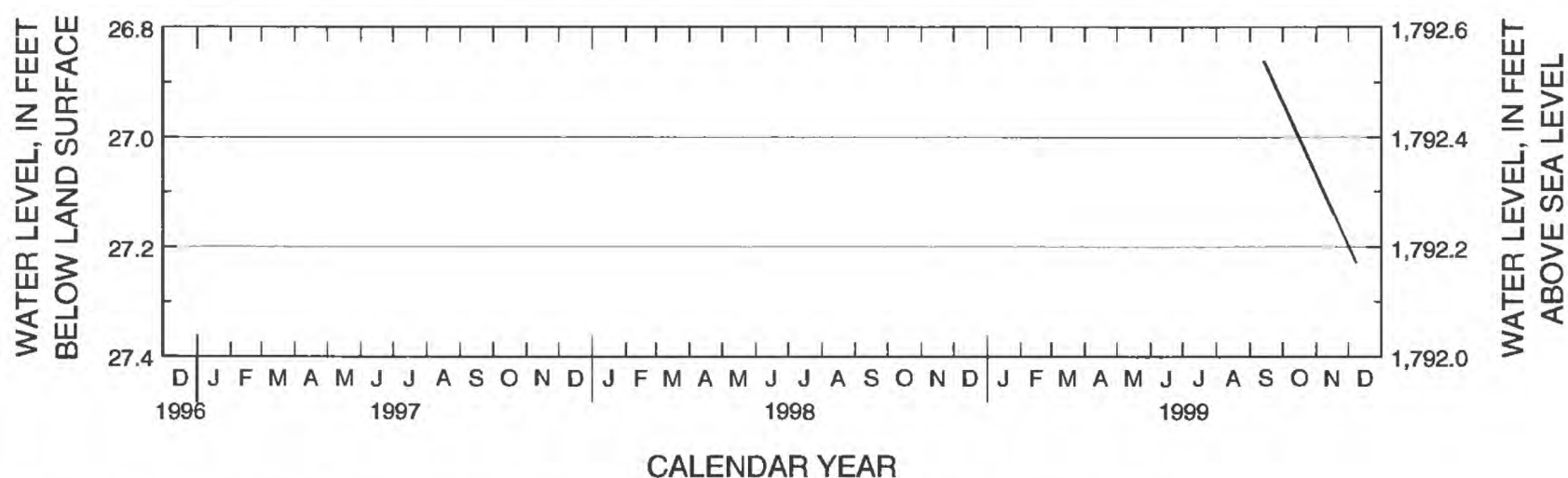


Figure B61. Hydrograph for observation well 123N51W21DDDD2 R (site number 61).

Site number from location map: 62
 Local well number: 123N52W6DDDA R
 Station identification number: 452728097122401
 Other identifier: CO-93-28
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,870 feet
 Measuring point: 2.0 feet
 Extremes: April 30, 1997, to August 26, 1999: Highest, 0.08 foot, February 26, 1998; lowest, 0.91 foot, September 18, 1997.

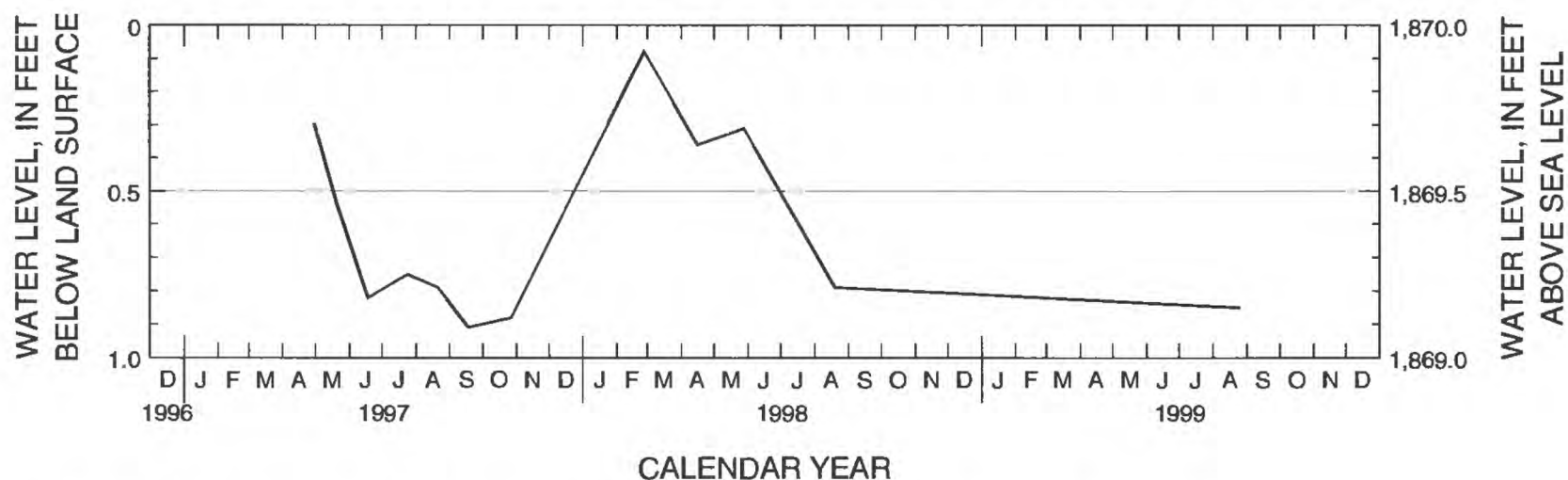


Figure B62. Hydrograph for observation well 123N52W6DDDA R (site number 62).

Site number from location map: 63
 Local well number: 123N52W8BAAA R
 Station identification number: 452724097114701
 Other identifier: CO-93-26

County: Roberts, South Dakota

Aquifer: Coteau Lakes

Altitude of land surface: 1,895 feet

Measuring point: 2.0 feet

Extremes: April 30, 1997, to August 26, 1999: Highest, 23.06 feet, April 30, 1997; lowest, 25.62 feet, February 26, 1998.

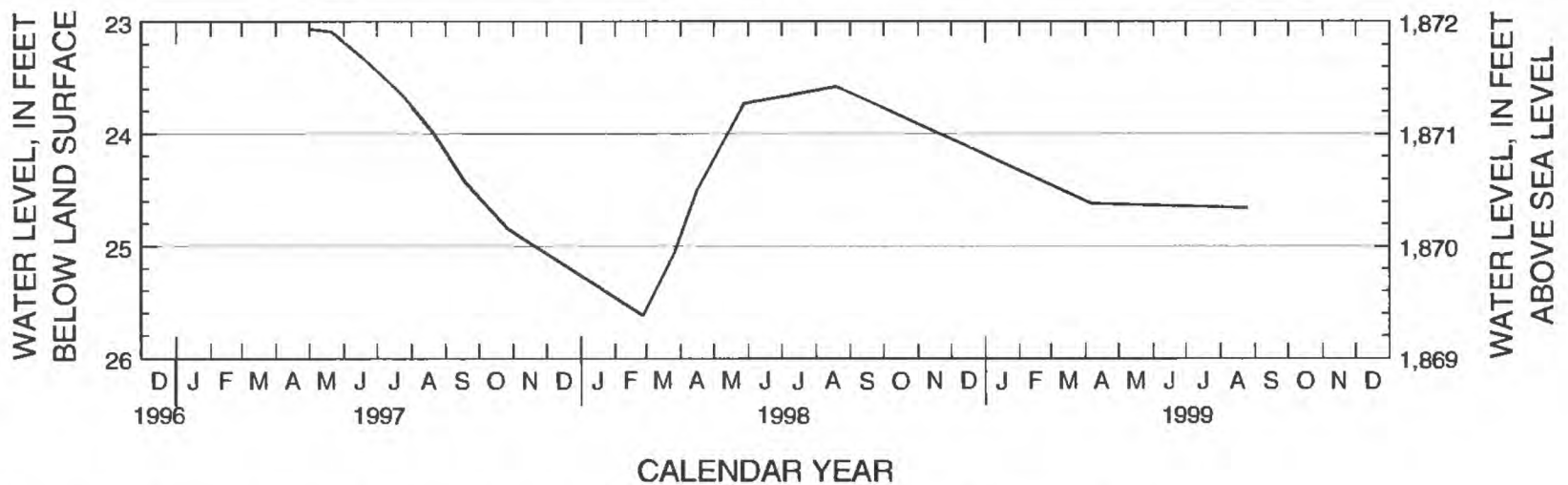


Figure B63. Hydrograph for observation well 123N52W8BAAA R (site number 63).

Site number from location map: 64
 Local well number: 123N52W19BABA R
 Station identification number: 452540097130901
 Other identifier: RB-81C

County: Roberts, South Dakota

Aquifer: Coteau Lakes

Altitude of land surface: 1,918.0 feet

Measuring point: 2.3 feet

Extremes: August 18, 1982, to October 6, 1999: Highest, 2.5 feet, July 22, 1997; lowest, 11.1 feet, September 8, 1988.

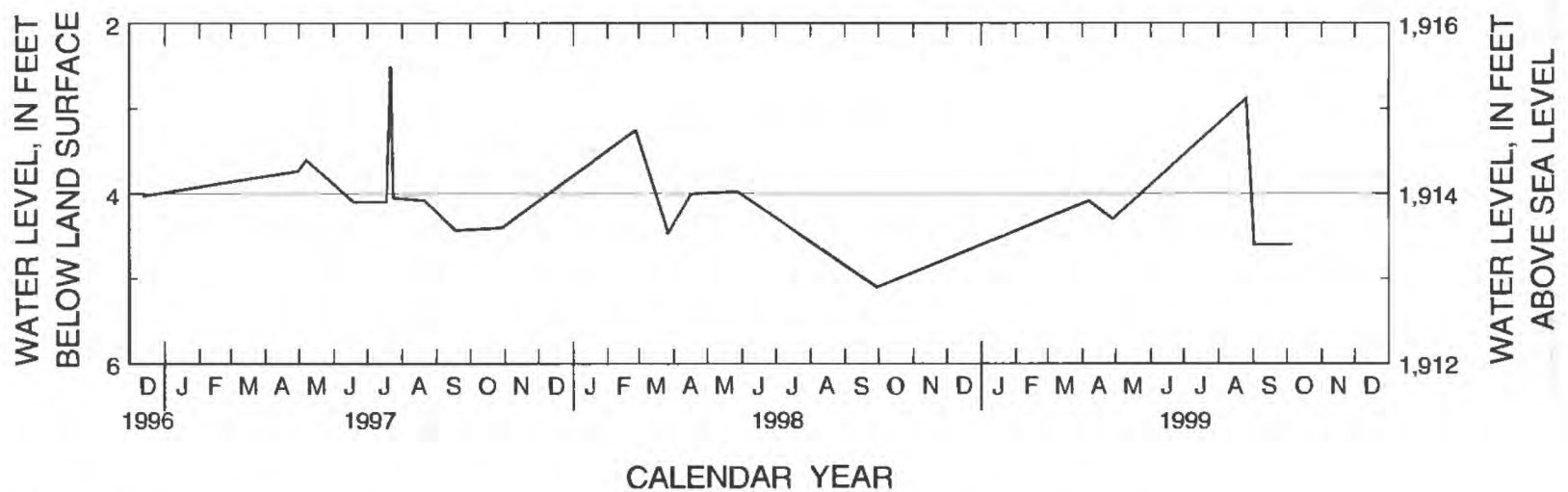


Figure B64. Hydrograph for observation well 123N52W19BABA R (site number 64).

Site number from location map: 65
 Local well number: 123N52W25CCCC R
 Station identification number: 452357097072401
 Other identifier: RB-81D
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,931.9 feet
 Measuring point: 2.5 feet
 Extremes: July 20, 1982, to October 6, 1999: Highest, 5.91 feet, April 30, 1997; lowest, 19.7 feet, March 21, 1991.

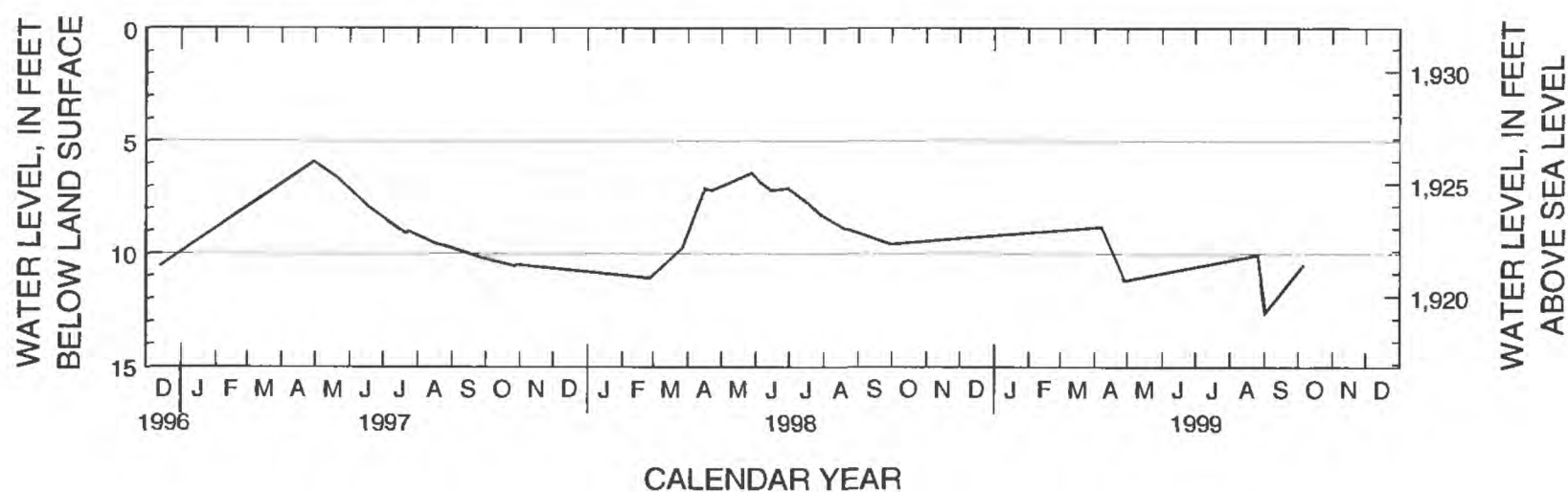


Figure B65. Hydrograph for observation well 123N52W25CCCC R (site number 65).

Site number from location map: 66
 Local well number: 123N52W35CBBB R
 Station identification number: 452330097083801
 Other identifier: CO-93-33
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,910 feet
 Measuring point: 2.0 feet
 Extremes: April 30, 1997, to August 26, 1999: Highest, -0.59 foot, April 30, 1997; lowest, 6.16 feet, February 26, 1998.

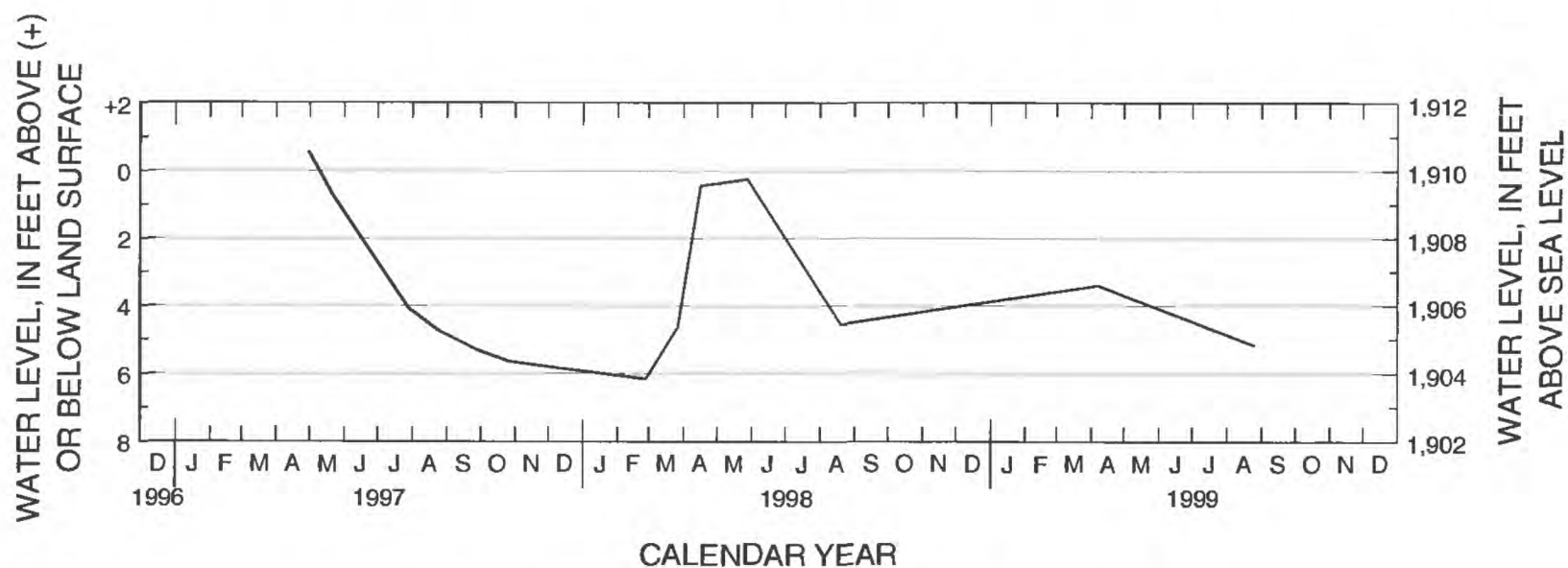


Figure B66. Hydrograph for observation well 123N52W35CBBB R (site number 66).

Site number from location map: 67

Local well number: 123N52W35CBBB2 R

Station identification number: 452330097083802

Other identifier: CO-93-34

County: Roberts, South Dakota

Aquifer: Coteau Lakes

Altitude of land surface: 1,910 feet

Measuring point: 2.0 feet

Extremes: April 30, 1997, to August 26, 1999: Highest, -0.95 foot, April 30, 1997; lowest, 5.83 feet, February 26, 1998.

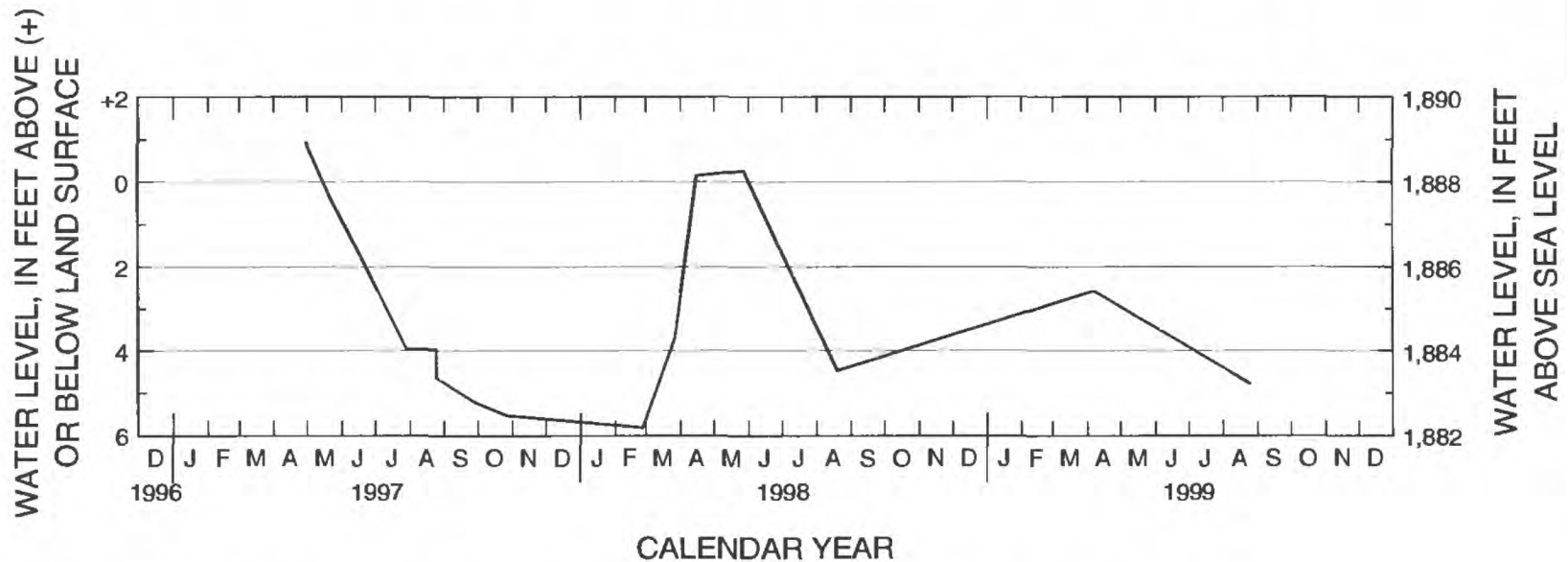


Figure B67. Hydrograph for observation well 123N52W35CBBB2 R (site number 67).

Site number from location map: 68

Local well number: 123N53W13CCCC2 R

Station identification number: 452544097144802

Other identifier: RO-7

County: Day, South Dakota

Aquifer: Prairie Coteau

Altitude of land surface: 1,874 feet

Measuring point: 1.6 feet

Extremes: April 30, 1997, to August 26, 1999: Highest, 17.72 feet, April 30, 1997; lowest, 18.8 feet, September 18, 1997, and October 27, 1997.

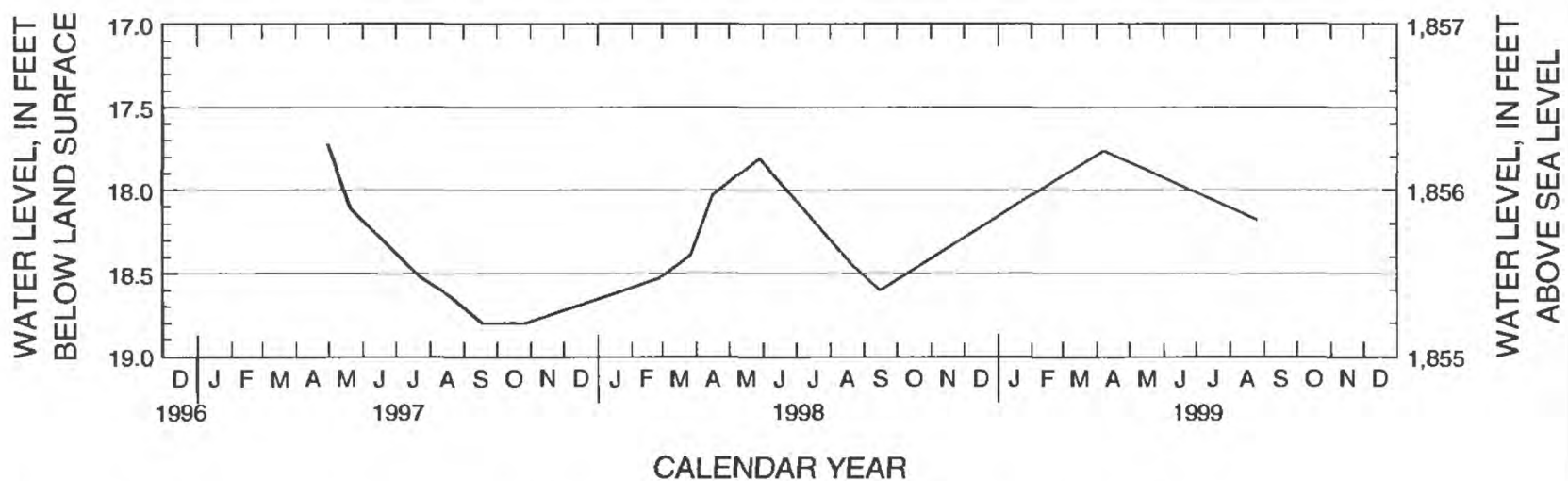


Figure B68. Hydrograph for observation well 123N53W13CCCC2 R (site number 68).

Site number from location map: 69
Local well number: 124N50W27BBBB R
Station identification number: 452959096545901
Other identifier: R2-94-54
County: Roberts, South Dakota
Aquifer: Renvillo
Altitude of land surface: 1,210.1 feet
Measuring point: 2.17 feet
Extremes: December 12, 1996, to August 25, 1999: Highest, 25.75 feet, April 29, 1997; lowest, 33.88 feet, August 19, 1998.

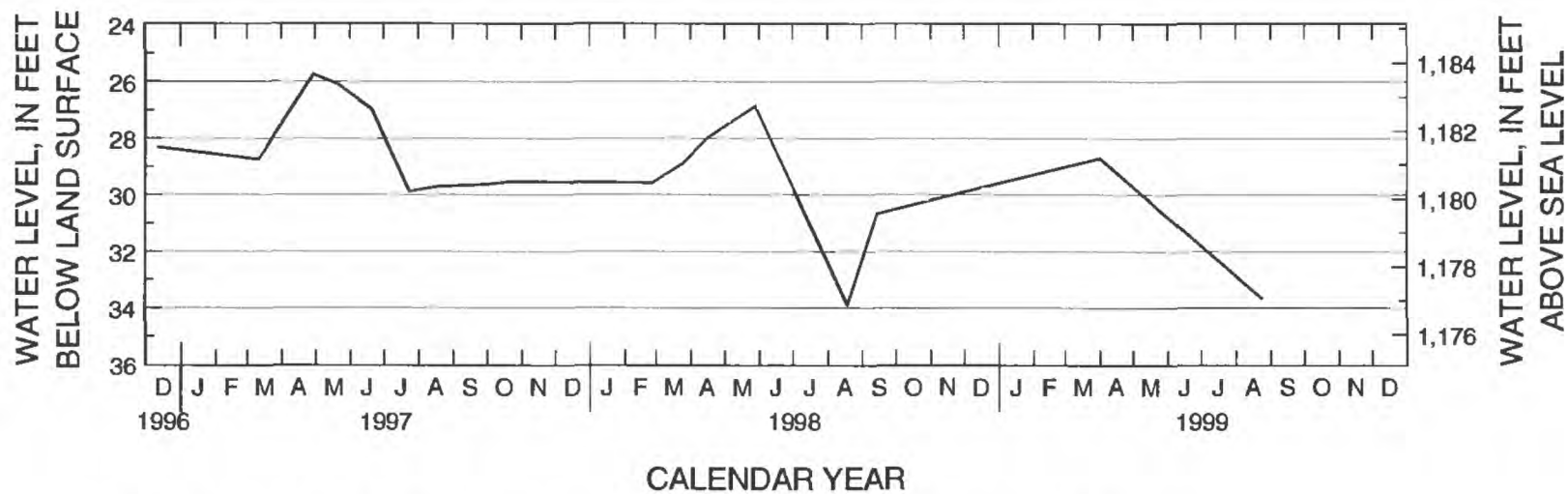


Figure B69. Hydrograph for observation well 124N50W27BBBB R (site number 69).

Site number from location map: 70
Local well number: 124N51W25AAAB R
Station identification number: 453001096584801
Other identifier: R2-94-55
County: Roberts, South Dakota
Aquifer: Renvillo
Altitude of land surface: 1,274 feet
Measuring point: 1.6 feet
Extremes: December 11, 1996, to August 25, 1999: Highest, 12.52 feet, April 29, 1997; lowest, 14.32 feet, February 5, 1998.

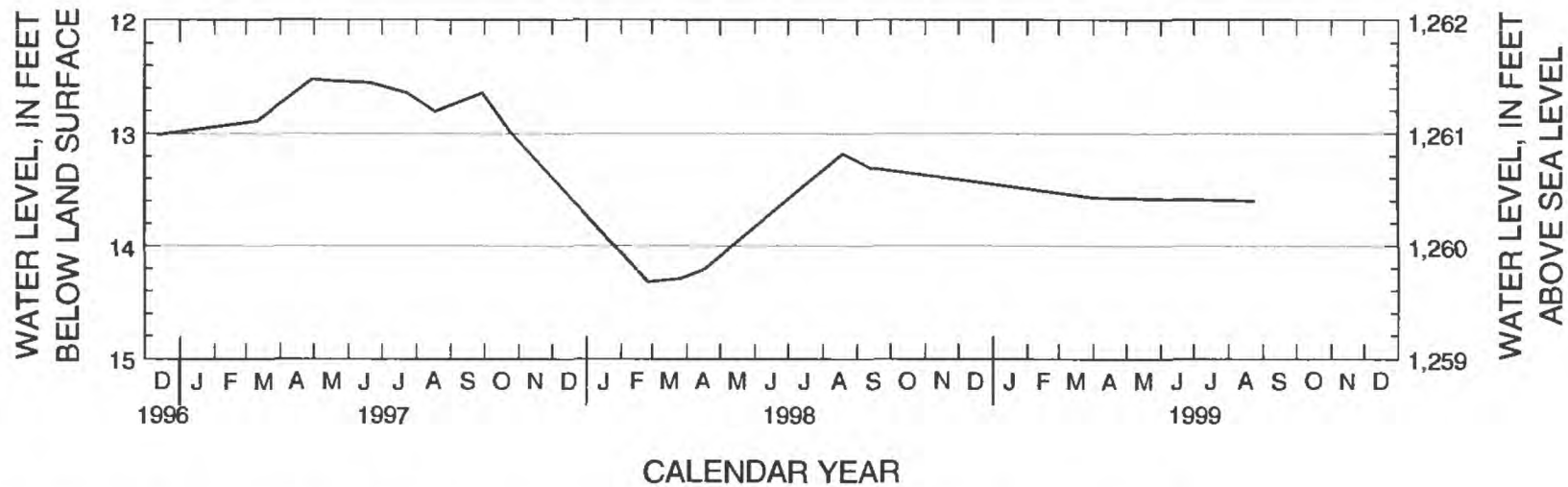


Figure B70. Hydrograph for observation well 124N51W25AAAB R (site number 70).

Site number from location map: 71
 Local well number: 124N51W30BBBB2 R
 Station identification number: 453002097060902
 Other identifier: R2-99-13
 County: Roberts, South Dakota
 Aquifer: Marday
 Altitude of land surface: 2,053.1 feet
 Measuring point: 1.9 feet
 Extremes: Single measurement of 323.44 feet on December 8, 1999.

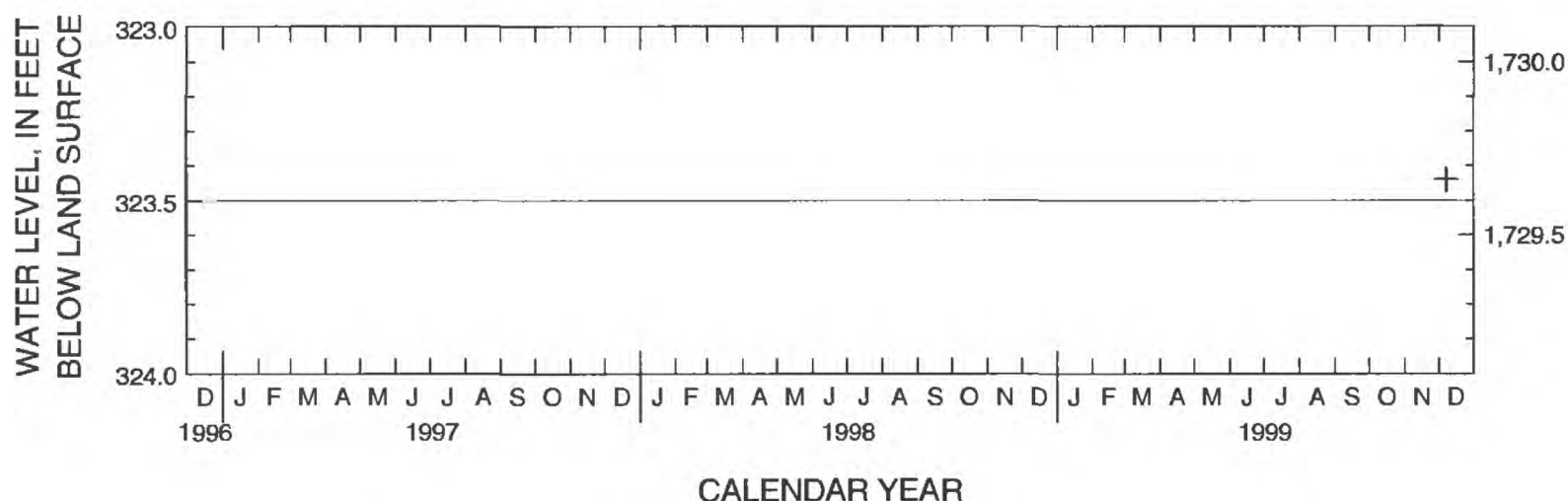


Figure B71. Hydrograph for observation well 124N51W30BBBB2 R (site number 71).

Site number from location map: 72
 Local well number: 124N51W4DDDD R
 Station identification number: 453240097022701
 Other identifier: R2-95-01
 County: Roberts, South Dakota
 Aquifer: Reville
 Altitude of land surface: 1,425 feet
 Measuring point: 2.5 feet
 Extremes: December 11, 1996, to August 26, 1999: Highest, 156.6 feet, December 11, 1996; lowest, 161.63 feet, September 14, 1998.

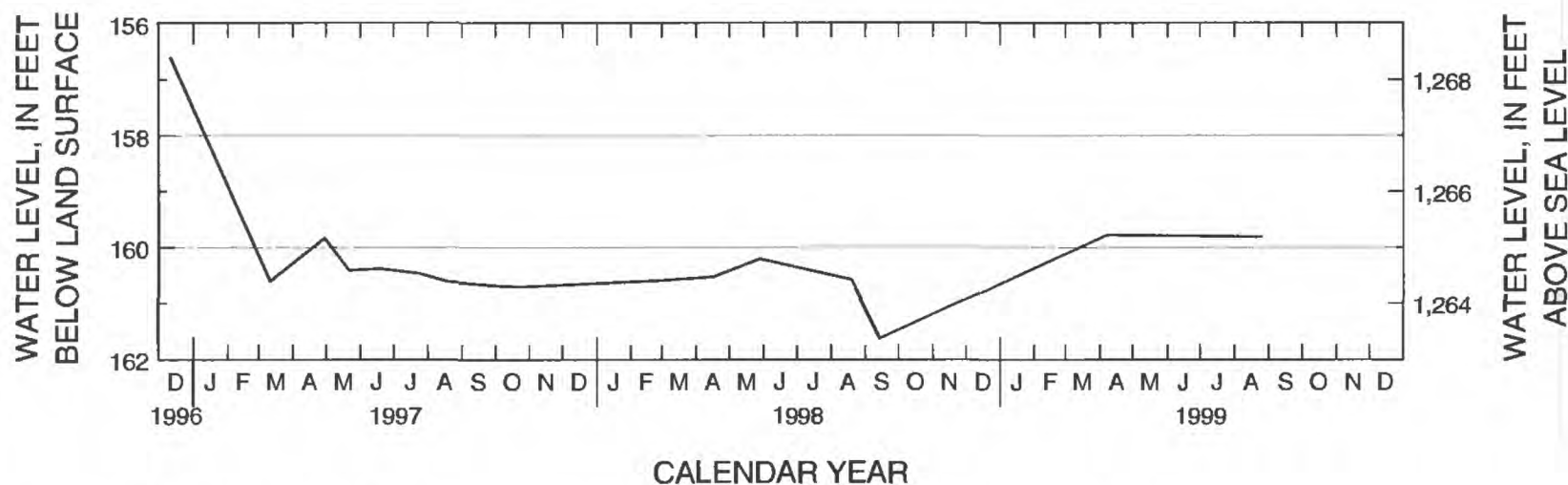


Figure B72. Hydrograph for observation well 124N51W4DDDD R (site number 72).

Site number from location map: 73
 Local well number: 124N52W9AAAC2 R
 Station identification number: 453204097100202
 Other identifier: R2-99-10
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 2,003 feet
 Measuring point: 1.1 feet
 Extremes: September 13, 1999, to December 8, 1999: Highest, 49.48 feet, September 13, 1999; lowest, 49.57 feet, December 13, 1999.

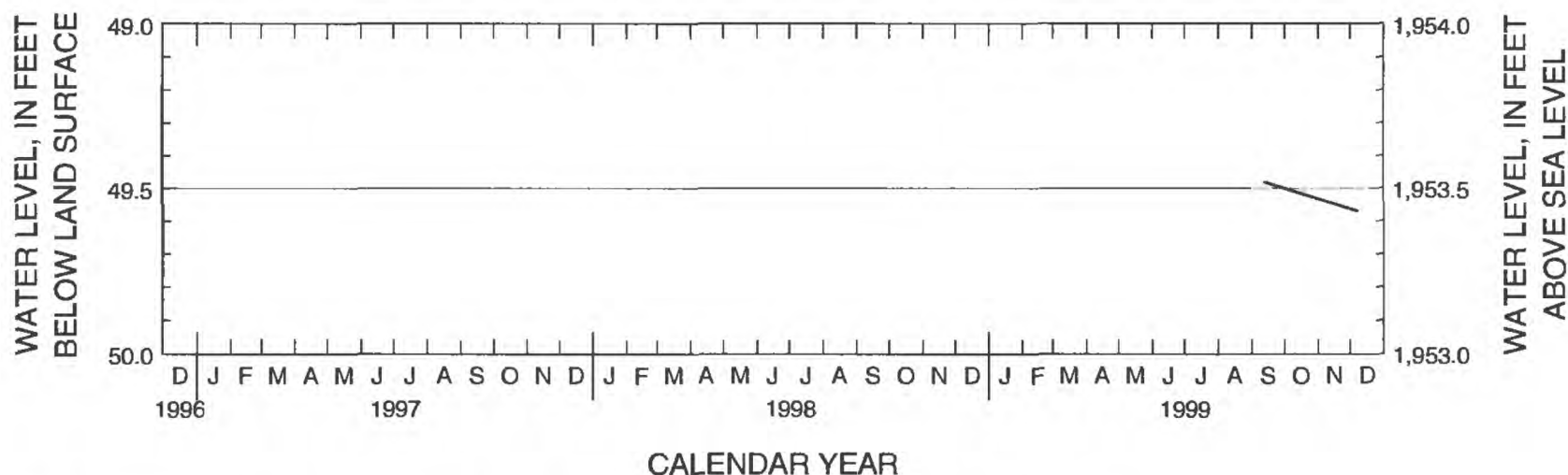


Figure B73. Hydrograph for observation well 124N52W9AAAC2 R (site number 73).

Site number from location map: 74
 Local well number: 125N50W6CBBB R
 Station identification number: 453815096584001
 Other identifier: R2-93-53
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,225 feet
 Measuring point: 1.9 feet
 Extremes: April 29, 1997, to August 25, 1999: Highest, 22.07 feet, April 29, 1997; lowest, 23.82 feet, August 25, 1999.

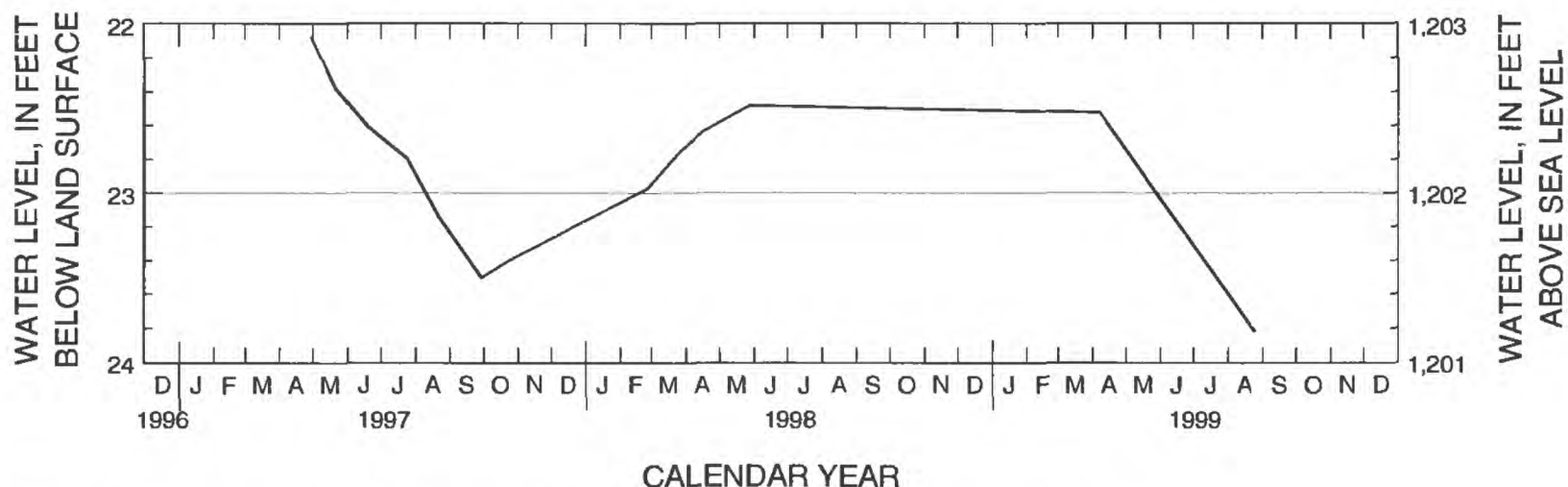


Figure B74. Hydrograph for observation well 125N50W6CBBB R (site number 74).

Site number from location map: 75
 Local well number: 125N50W6CCCC R
 Station identification number: 453752096584001
 Other identifier: RB-81-15
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,200 feet
 Measuring point: 2.5 feet
 Extremes: April 29, 1997, to August 25, 1999: Highest, 4.22 feet, April 29, 1997; lowest, 7.52 feet, September 14, 1998.

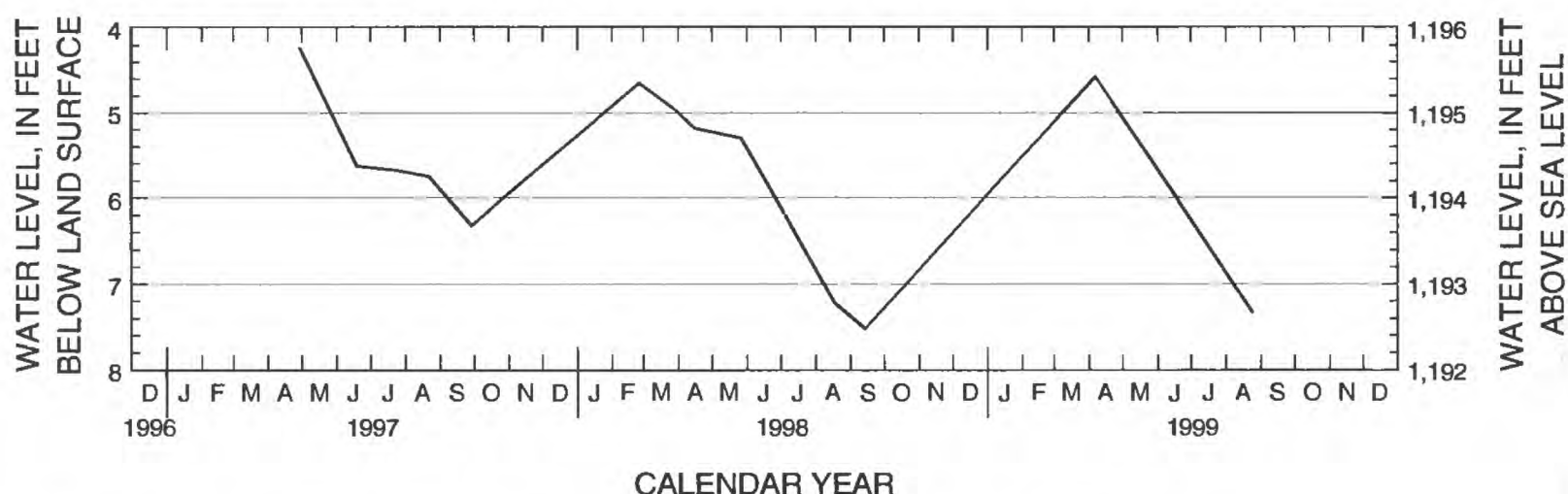


Figure B75. Hydrograph for observation well 125N50W6CCCC R (site number 75).

Site number from location map: 76
 Local well number: 125N50W6DCCC R
 Station identification number: 453752096580301
 Other identifier: RB-81-16
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,230 feet
 Measuring point: 1.6 feet
 Extremes: April 29, 1997, to August 25, 1999: Highest, 33.76 feet, April 29, 1997; lowest, 35.44 feet, August 25, 1999.

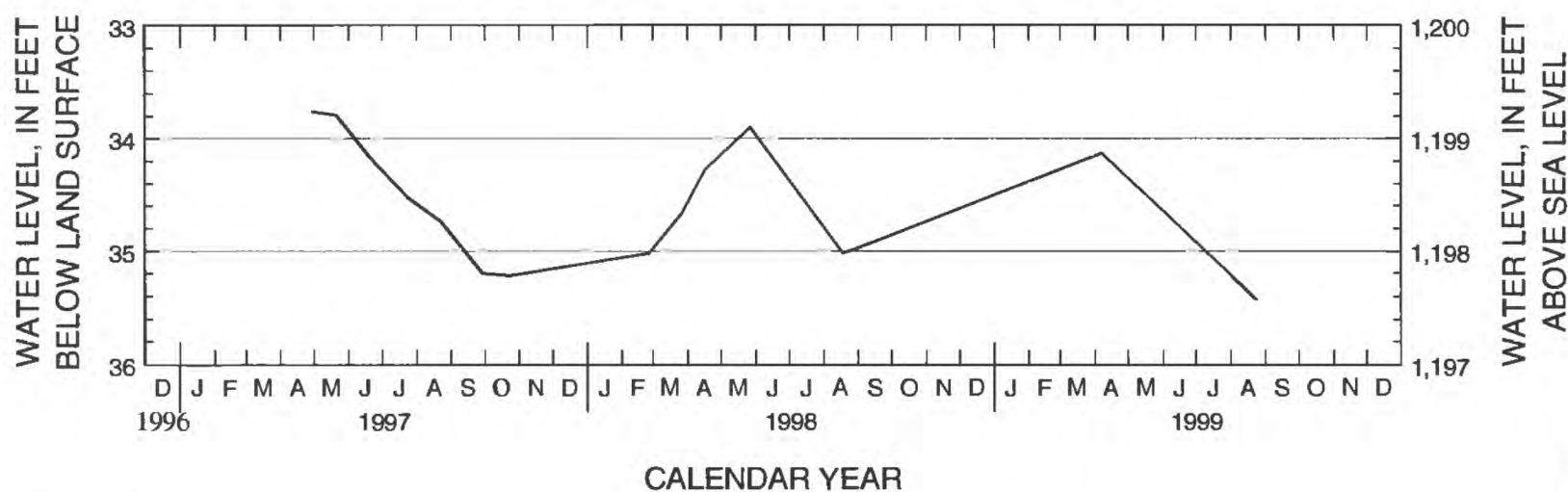


Figure B76. Hydrograph for observation well 125N50W6DCCC R (site number 76).

Site number from location map: 77
 Local well number: 125N50W6DCCC2 R
 Station identification number: 453752096580302
 Other identifier: RB-81-17
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,231 feet
 Measuring point: 1.1 feet
 Extremes: December 11, 1996, to October 5, 1999: Highest, 17.64 feet, May 27, 1998; lowest, 20.68 feet, March 11, 1997.

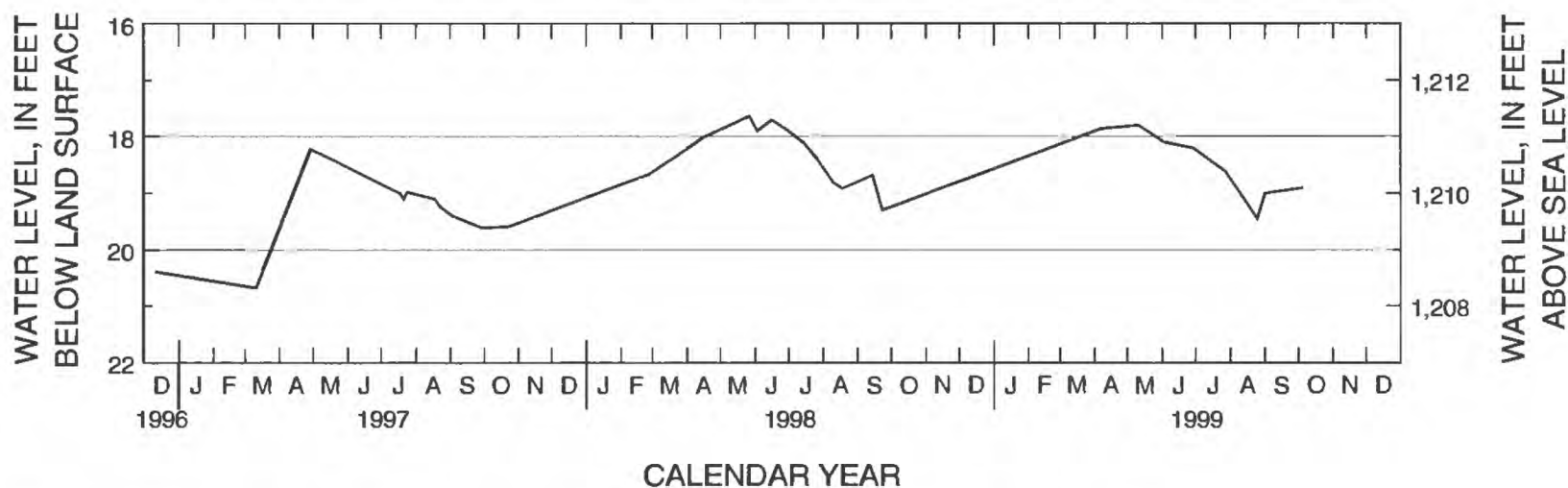


Figure B77. Hydrograph for observation well 125N50W6DCCC2 R (site number 77).

Site number from location map: 78
 Local well number: 125N50W7ADDD R
 Station identification number: 453725096572801
 Other identifier: R2-93-54
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,205 feet
 Measuring point: 2.0 feet
 Extremes: April 29, 1997, to August 25, 1999: Highest, 2.92 feet, April 29, 1997; lowest, 6.04 feet, September 14, 1999.

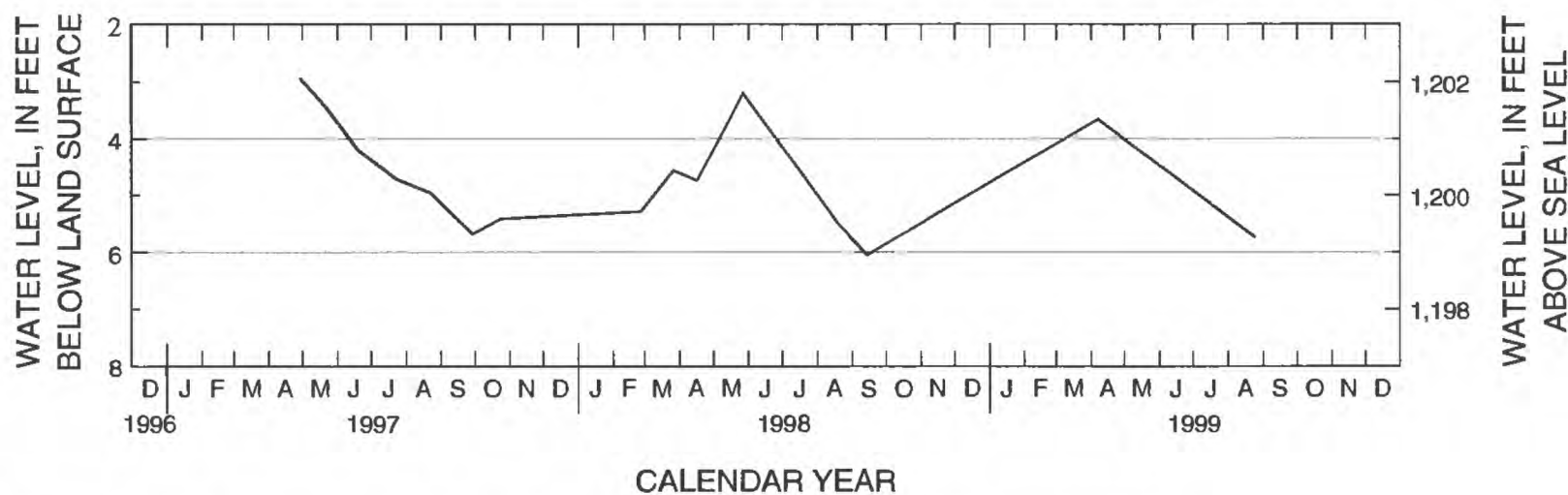


Figure B78. Hydrograph for observation well 125N50W7ADDD R (site number 78).

Site number from location map: 79
 Local well number: 125N50W8BBBA R
 Station identification number: 453751096572401
 Other identifier: RB-11
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,216 feet
 Measuring point: 3.5 feet
 Extremes: December 11, 1996, to October 5, 1999: Highest, 17.64 feet, May 27, 1998; lowest, 20.68 feet, March 11, 1997.

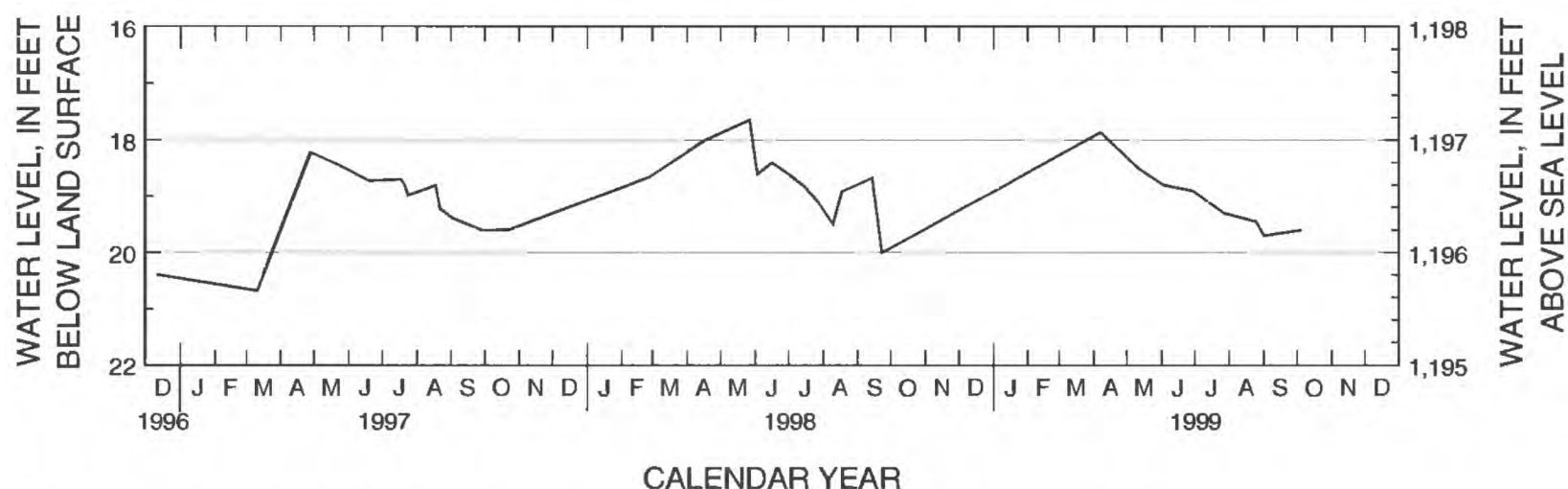


Figure B79. Hydrograph for observation well 125N50W8BBBA R (site number 79).

Site number from location map: 80
 Local well number: 125N50W8CCCC2 R
 Station identification number: 453700096572702
 Other identifier: RB-7W
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,207 feet
 Measuring point: 2.8 feet
 Extremes: December 10, 1996, to August 25, 1999: Highest, 0.25 foot, April 29, 1997; lowest, 5.98 feet, August 25, 1999.

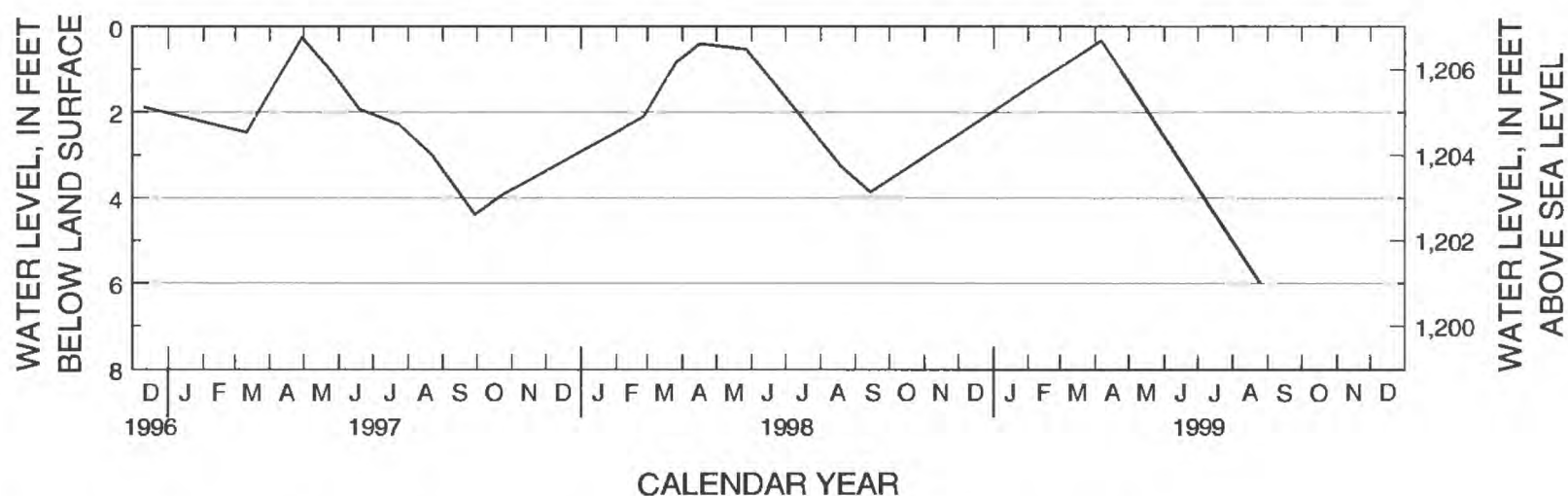


Figure B80. Hydrograph for observation well 125N50W8CCCC2 R (site number 80).

Site number from location map: 81
Local well number: 125N50W8CCCC3 R
Station identification number: 453700096572701
Other identifier: RB-7E
County: Roberts, South Dakota
Aquifer: Undetermined
Altitude of land surface: 1,207 feet
Measuring point: 3.0 feet
Extremes: December 10, 1996, to October 5, 1999: Highest, 0.52 foot, April 29, 1997; lowest, 4.71 feet, September 29, 1997.

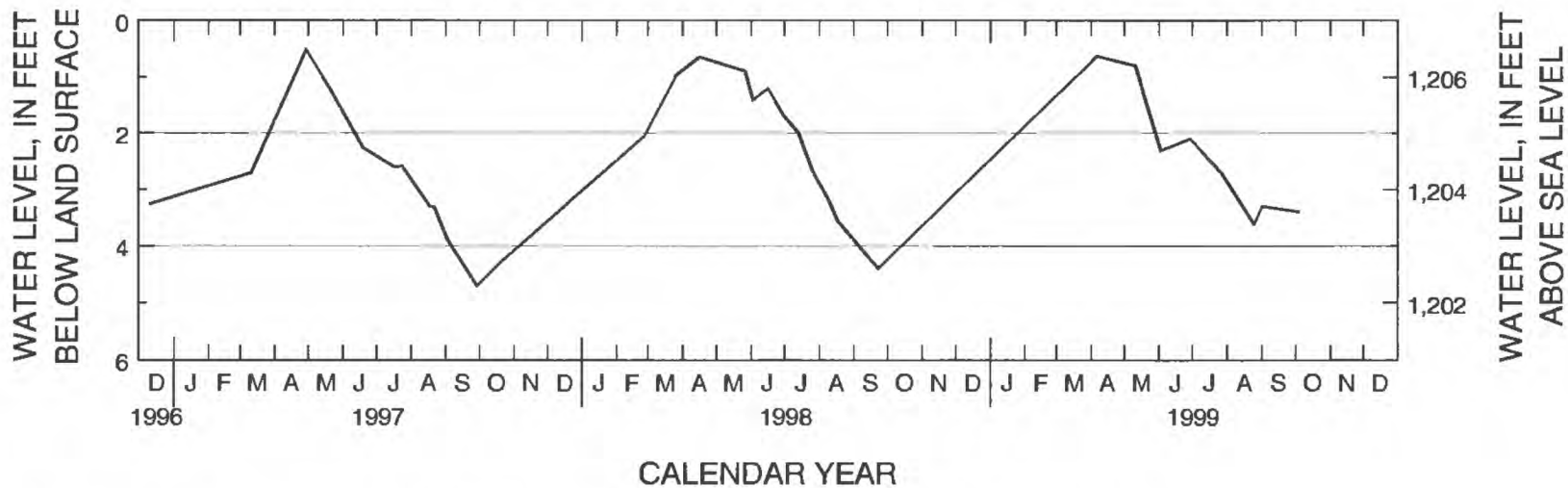


Figure B81. Hydrograph for observation well 125N50W8CCCC3 R (site number 81).

Site number from location map: 82
Local well number: 125N50W12ABCC2 R
Station identification number: 453738096515402
Other identifier: R2-97-43
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,120 feet
Measuring point: 2.1 feet
Extremes: October 23, 1997, to August 25, 1999: Highest, 56.98 feet, October 23, 1997; lowest, 59.85 feet, August, 25, 1999.

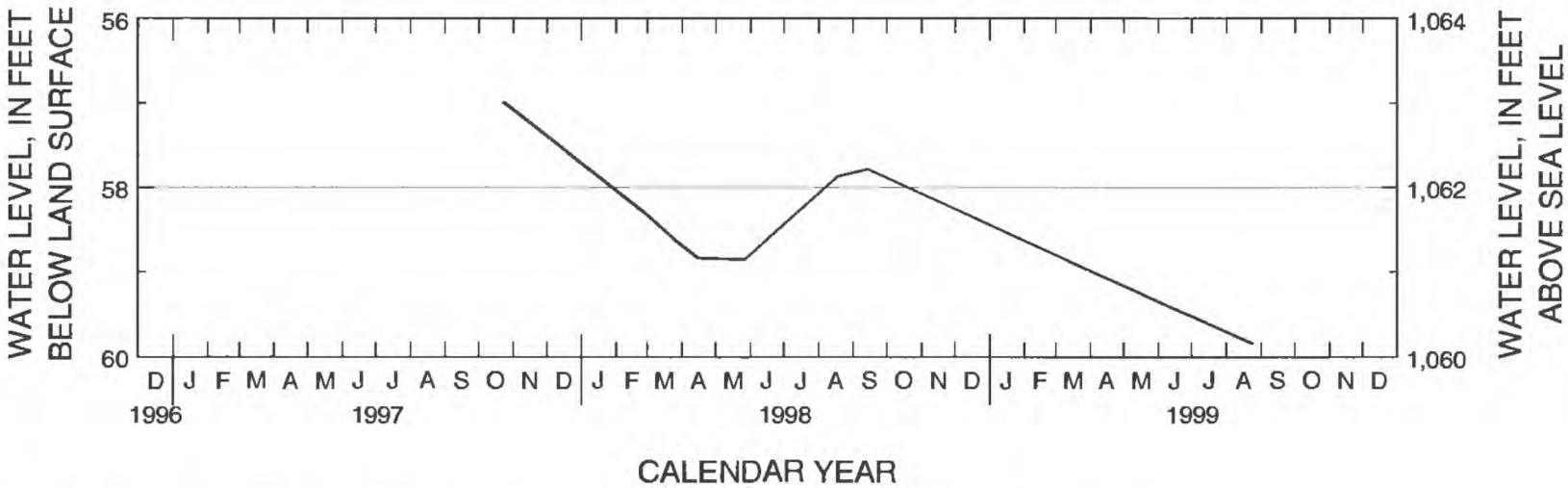


Figure B82. Hydrograph for observation well 125N50W12ABCC2 R (site number 82).

Site number from location map: 83
 Local well number: 125N50W20DDDD2 R
 Station identification number: 453514096561402
 Other identifier: RB-5
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,215 feet
 Measuring point: 3.3 feet
 Extremes: December 11, 1996, to October 5, 1999: Highest, 4.96 feet, April 29, 1997; lowest, 11.94 feet, February 25, 1998.

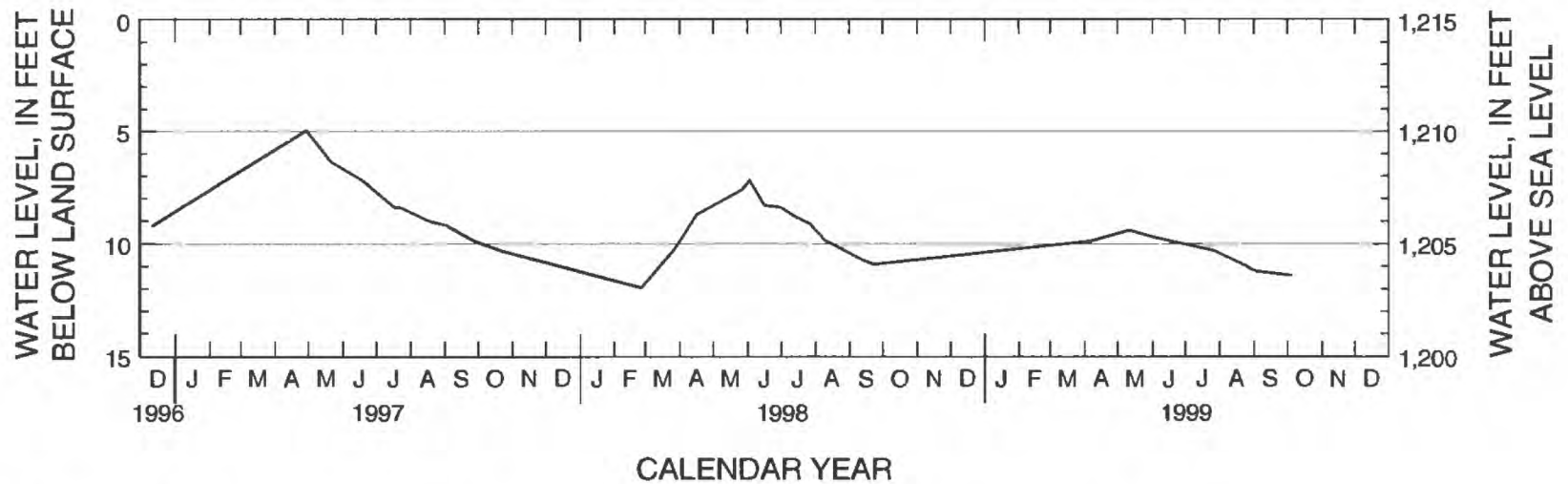


Figure B83. Hydrograph for observation well 125N50W20DDDD2 R (site number 83).

Site number from location map: 84
 Local well number: 125N51W1DCCC R
 Station identification number: 453752096591801
 Other identifier: RB-12E
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,215 feet
 Measuring point: 2.3 feet
 Extremes: April 29, 1997, to October 5, 1999: Highest, 19.02 feet, April 29, 1997; lowest, 20.86 feet, September 14, 1998.

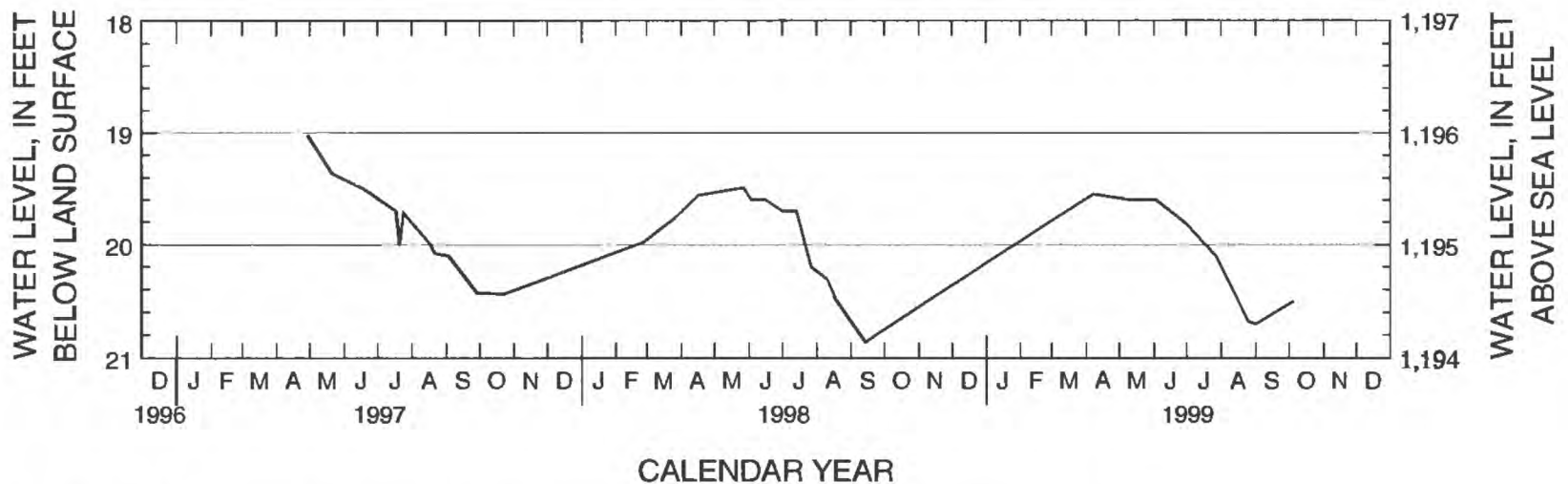


Figure B84. Hydrograph for observation well 125N51W1DCCC R (site number 84).

Site number from location map: 85
 Local well number: 125N51W1DCCC2 R
 Station identification number: 453752096591802
 Other identifier: RB-12W
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,215 feet
 Measuring point: 2.3 feet
 Extremes: April 29, 1997, to August 25, 1999: Highest, 18.91 feet, April 29, 1997; lowest, 21.05 feet, September 14, 1998.

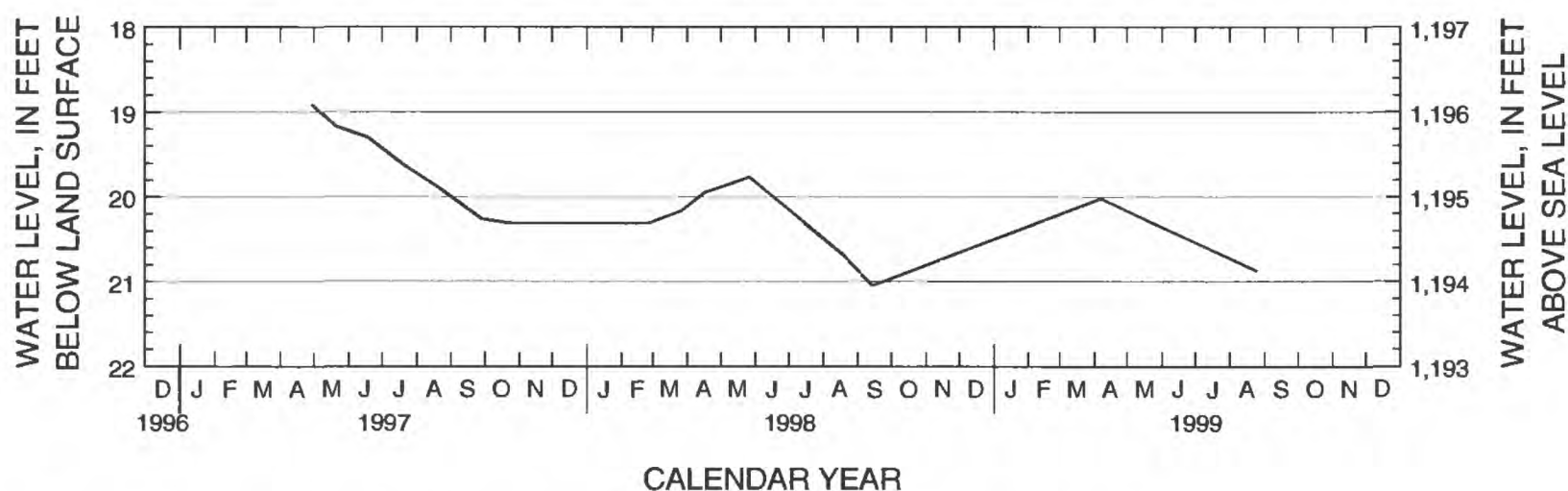


Figure B85. Hydrograph for observation well 125N51W1DCCC2 R (site number 85).

Site number from location map: 86
 Local well number: 125N51W13ABBB2 R
 Station identification number: 453658096591702
 Other identifier: RB-10
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,222 feet
 Measuring point: 4.3 feet
 Extremes: May 27, 1997, to October 5, 1999: Highest, 19.0 feet, May 20, 1997; lowest, 21.94 feet, February 25, 1998.

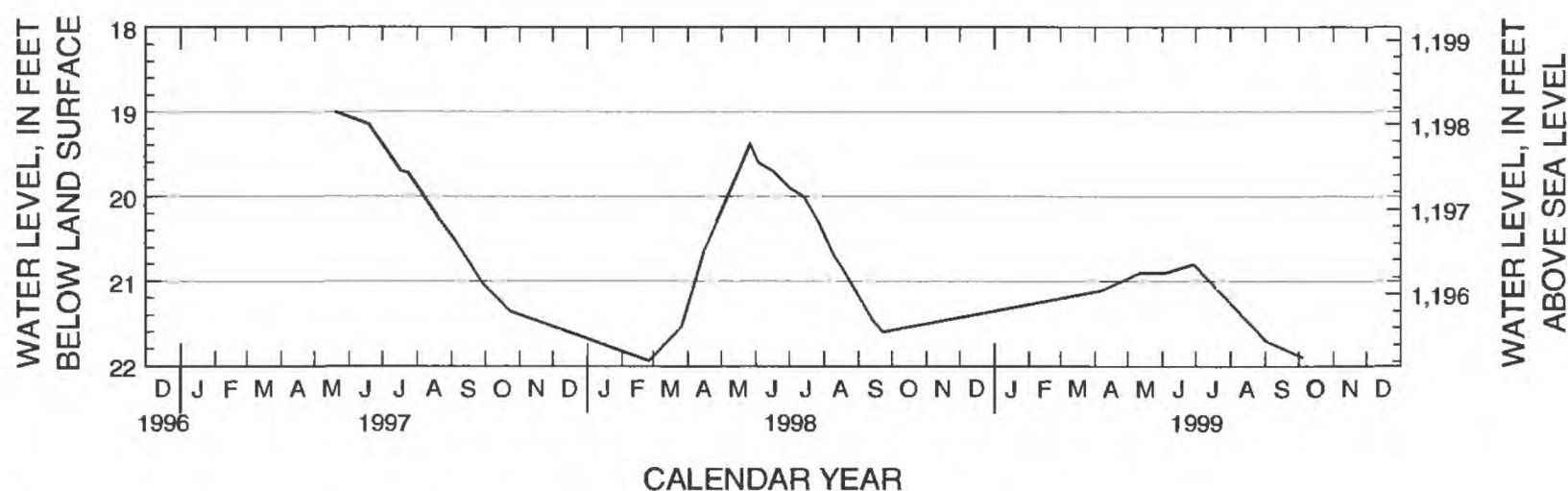


Figure B86. Hydrograph for observation well 125N51W13ABBB2 R (site number 86).

Site number from location map: 87
 Local well number: 125N51W32CCCC R
 Station identification number: 453331097045301
 Other identifier: R2-96-01
 County: Roberts, South Dakota
 Aquifer: Reville
 Altitude of land surface: 1,660.1 feet
 Measuring point: 2.0 feet
 Extremes: April 29, 1997, to August 26, 1999: Highest, 396.69, August 26, 1999; lowest, 397.66 feet, October 23, 1997.

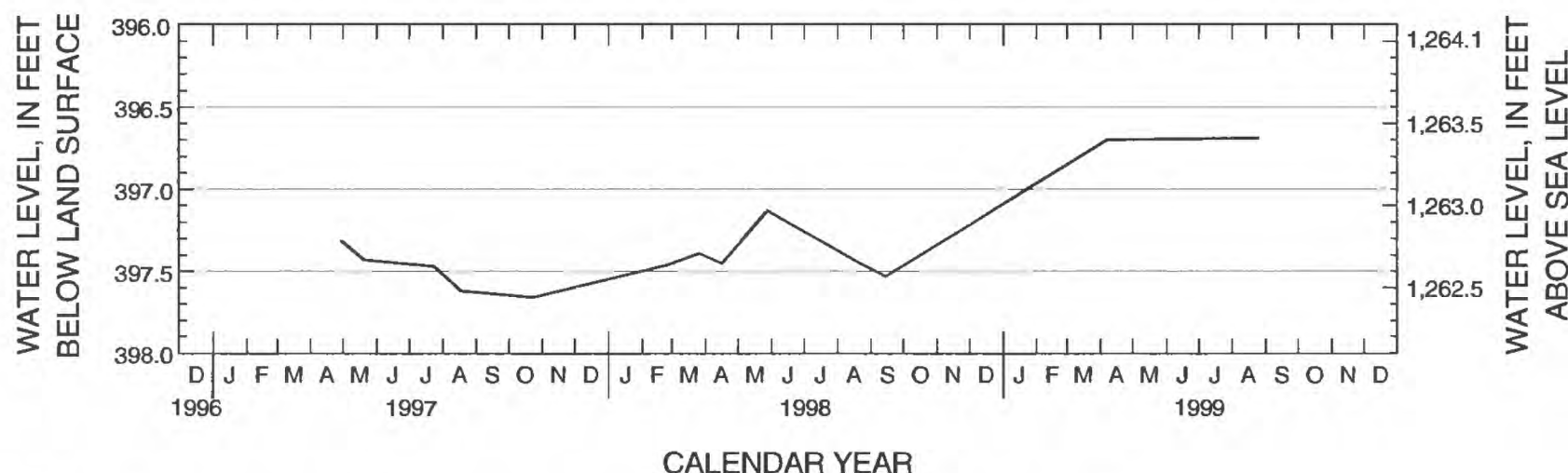


Figure B87. Hydrograph for observation well 125N51W32CCCC R (site number 87).

Site number from location map: 88
 Local well number: 125N51W7BBBB2 R
 Station identification number: 453751097060702
 Other identifier: R2-95-05
 County: Roberts, South Dakota
 Aquifer: Roslyn
 Altitude of land surface: 1,525 feet
 Measuring point: 1.75 feet
 Extremes: April 29, 1997, to August 26, 1999: Highest, 72.26 feet, August 26, 1999; lowest, 74.8 feet, April 16, 1998.

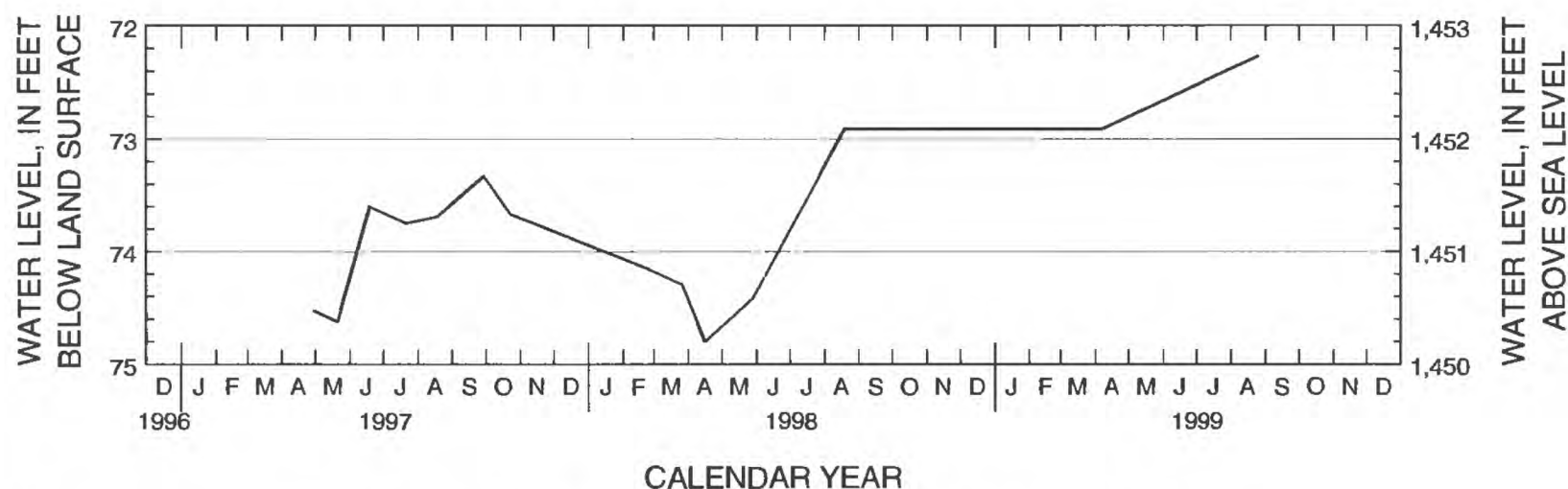


Figure B88. Hydrograph for observation well 125N51W7BBBB2 R (site number 88).

Site number from location map: 89
 Local well number: 125N52W16BABB2 R
 Station identification number: 453659097104502
 Other identifier: R2-99-12
 County: Roberts, South Dakota
 Aquifer: Eden
 Altitude of land surface: 1,987.9 feet
 Measuring point: 2.2 feet
 Extremes: September 13, 1999, to December 8, 1999: Highest, 296.57 feet, September 13, 1999; lowest, 296.95 feet, December 8, 1999.

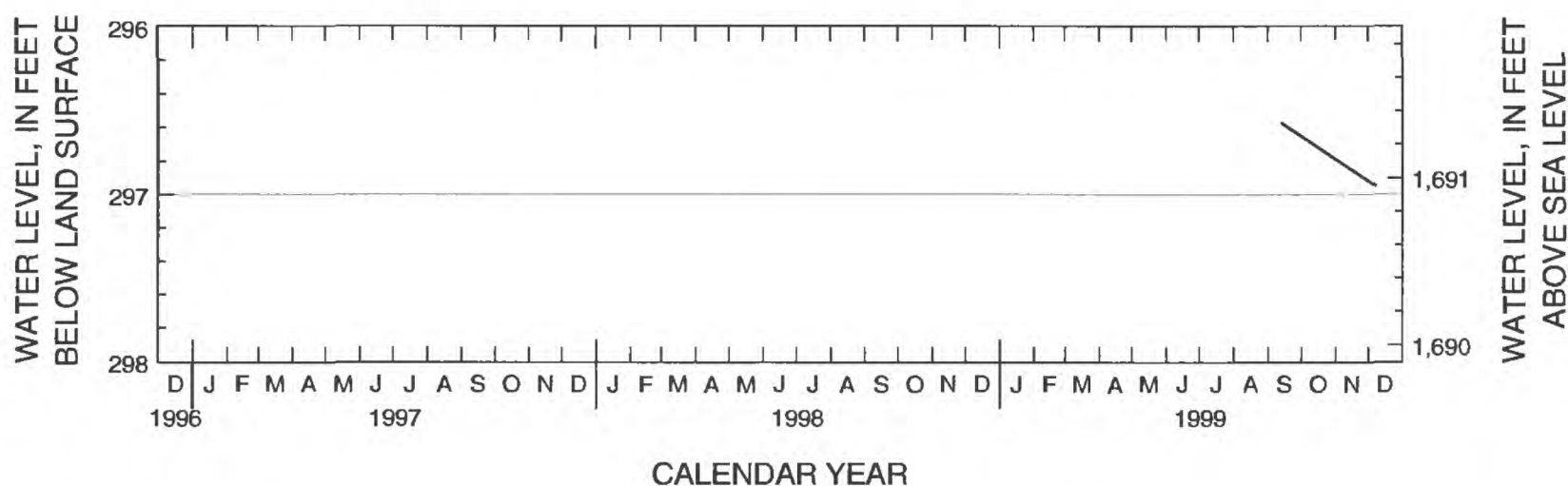


Figure B89. Hydrograph for observation well 125N52W16BABB2 R (site number 89).

Site number from location map: 90
 Local well number: 125N52W23CCCC R
 Station identification number: 453515097083801
 Other identifier: CO-93-19
 County: Roberts, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,972 feet
 Measuring point: 1.9 feet
 Extremes: April 29, 1997, to August 26, 1999: Highest, 2.35 feet, April 7, 1999; lowest, 7.09 feet, February 25, 1998.

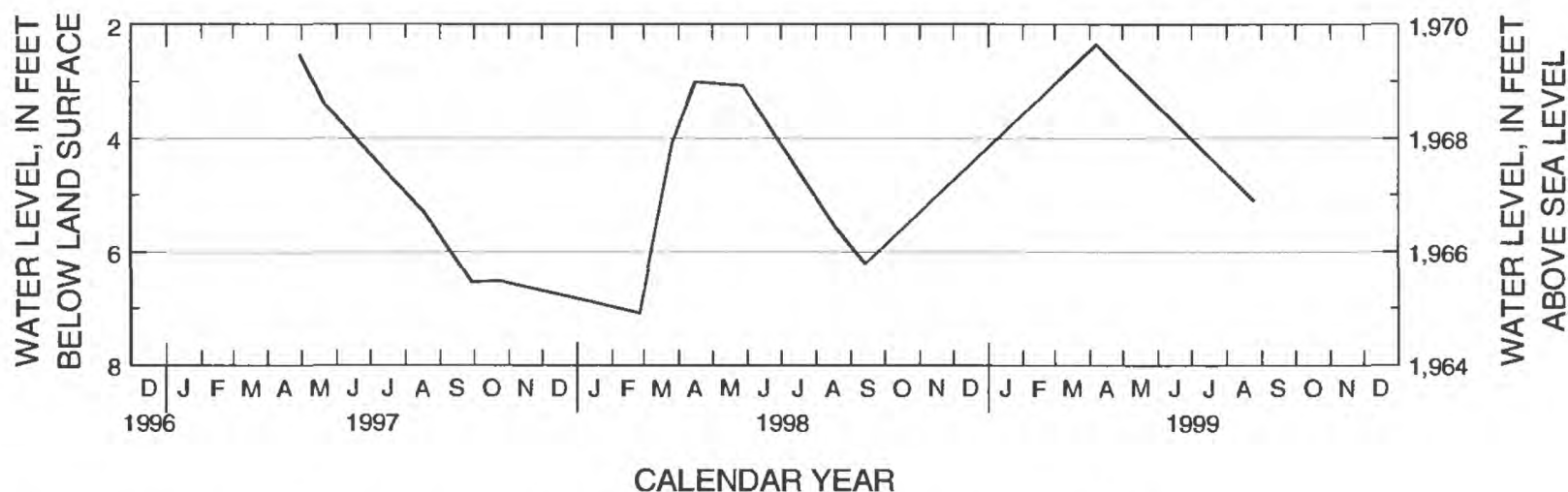


Figure B90. Hydrograph for observation well 125N52W23CCCC R (site number 90).

Site number from location map: 91
 Local well number: 125N53W12CCCC R
 Station identification number: 453700097144901
 Other identifier: CO-93-42
 County: Marshall, South Dakota
 Aquifer: Coteau Lakes
 Altitude of land surface: 1,875 feet
 Measuring point: 2.7 feet
 Extremes: March 11, 1997, to August 26, 1999: Highest, 9.43 feet, May 28, 1998; lowest, 13.52 feet, February 25, 1998.

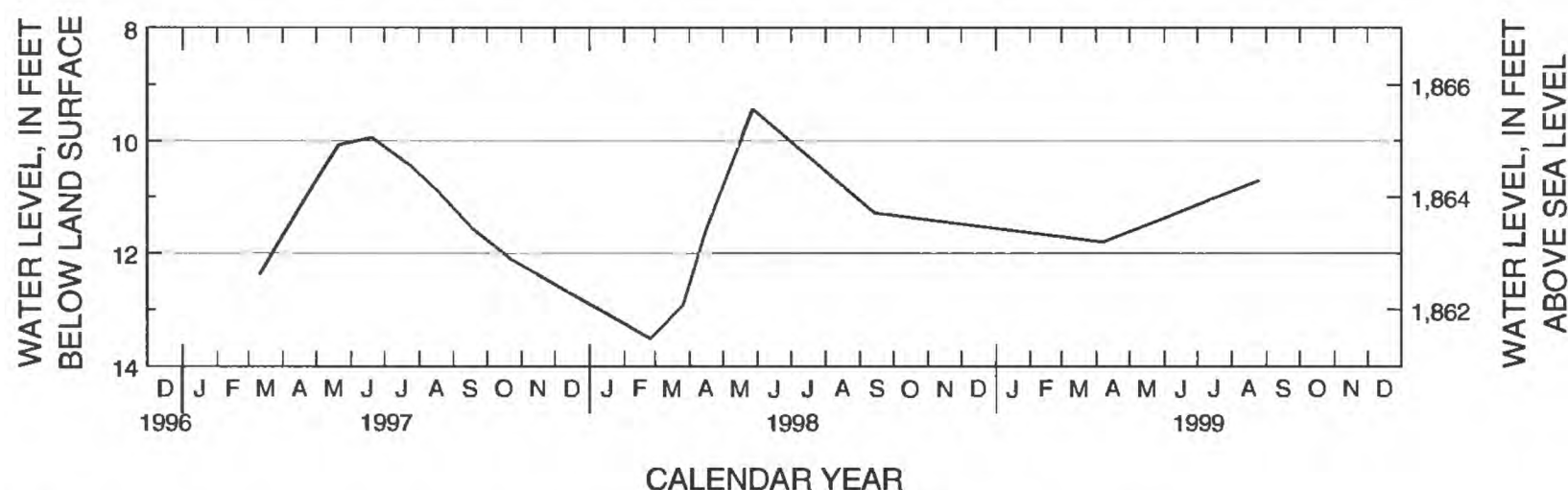


Figure B91. Hydrograph for observation well 125N53W12CCCC R (site number 91).

Site number from location map: 92
 Local well number: 126N49W7BBBBB2 R
 Station identification number: 454304096511302
 Other identifier: R2-96-56
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,098.5 feet
 Measuring point: 1.9 feet
 Extremes: April 29, 1997, to August 25, 1999: Highest, 47.7 feet, April 6, 1999; lowest, 48.66 feet, May 20, 1997.

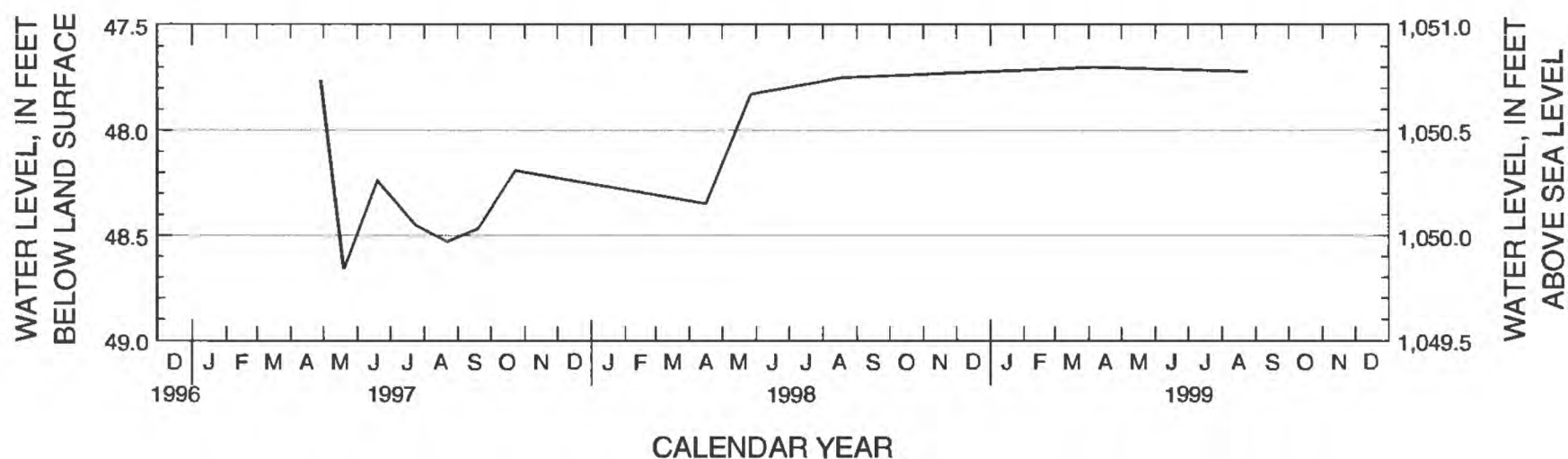


Figure B92. Hydrograph for observation well 126N49W7BBBBB2 R (site number 92).

Site number from location map: 93
 Local well number: 126N49W11AABA R
 Station identification number: 454303096451701
 Other identifier: R2-97-42
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,111 feet
 Measuring point: 2.3 feet
 Extremes: October 23, 1997, to April 6, 1999: Highest, 77.92 feet, February 25, 1998; lowest, 79.53 feet, October 23, 1997.

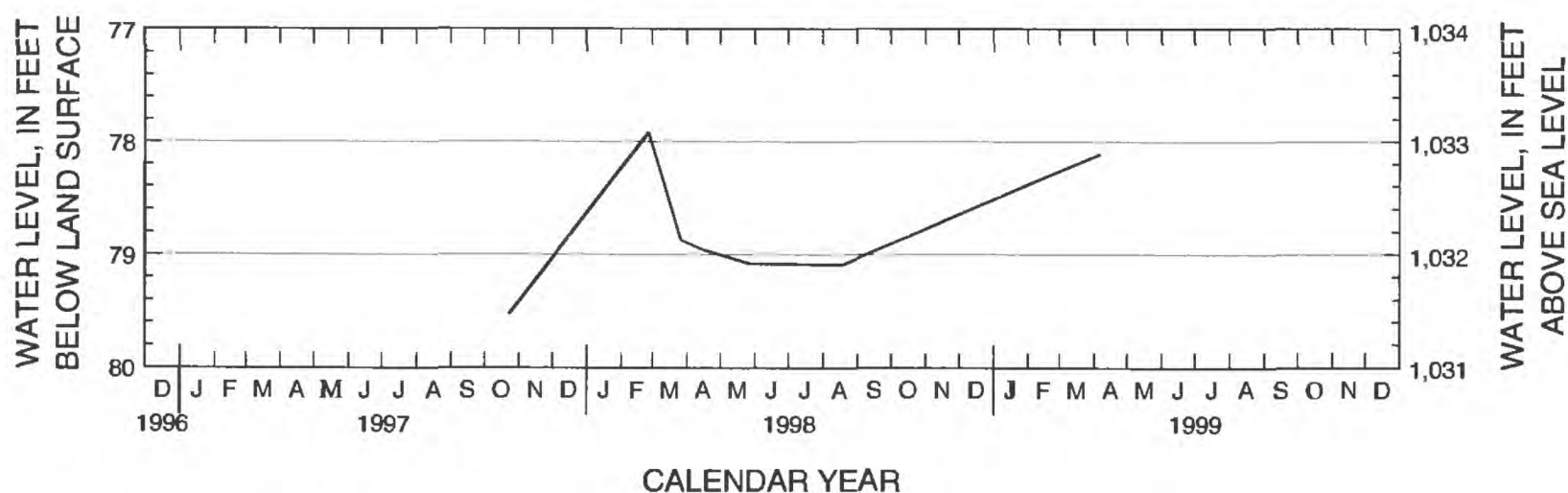


Figure B93. Hydrograph for observation well 126N49W11AABA R (site number 93).

Site number from location map: 94
 Local well number: 126N50W21DDDD R
 Station identification number: 454028096550001
 Other identifier: R2-96-48
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,165.1 feet
 Measuring point: 2.2 feet
 Extremes: December 10, 1996, to August 25, 1999: Highest, 65.61 feet, August 25, 1999; lowest, 68.83 feet, March 11, 1997.

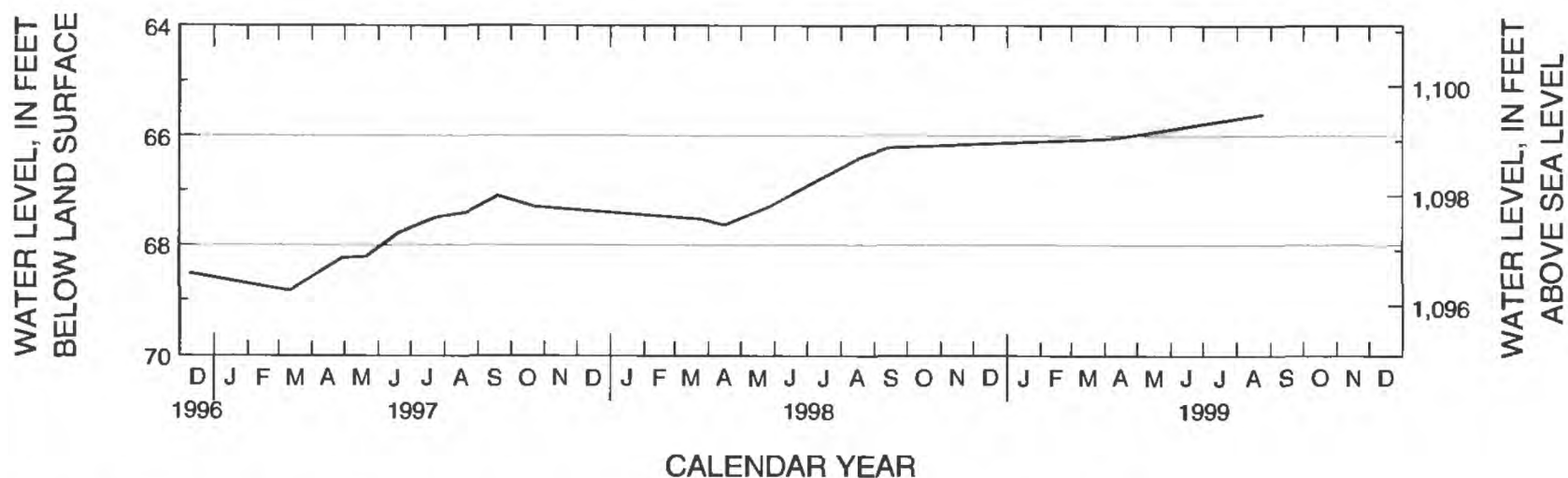


Figure B94. Hydrograph for observation well 126N50W21DDDD R (site number 94).

Site number from location map: 95
 Local well number: 126N50W32CCCB R
 Station identification number: 453819096572501
 Other identifier: RB-79D
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,164.4 feet
 Measuring point: 2.0 feet
 Extremes: October 26, 1979, to October 5, 1999: Highest, 52.71 feet, April 29, 1997; lowest, 60.4 feet, September 1, 1982.

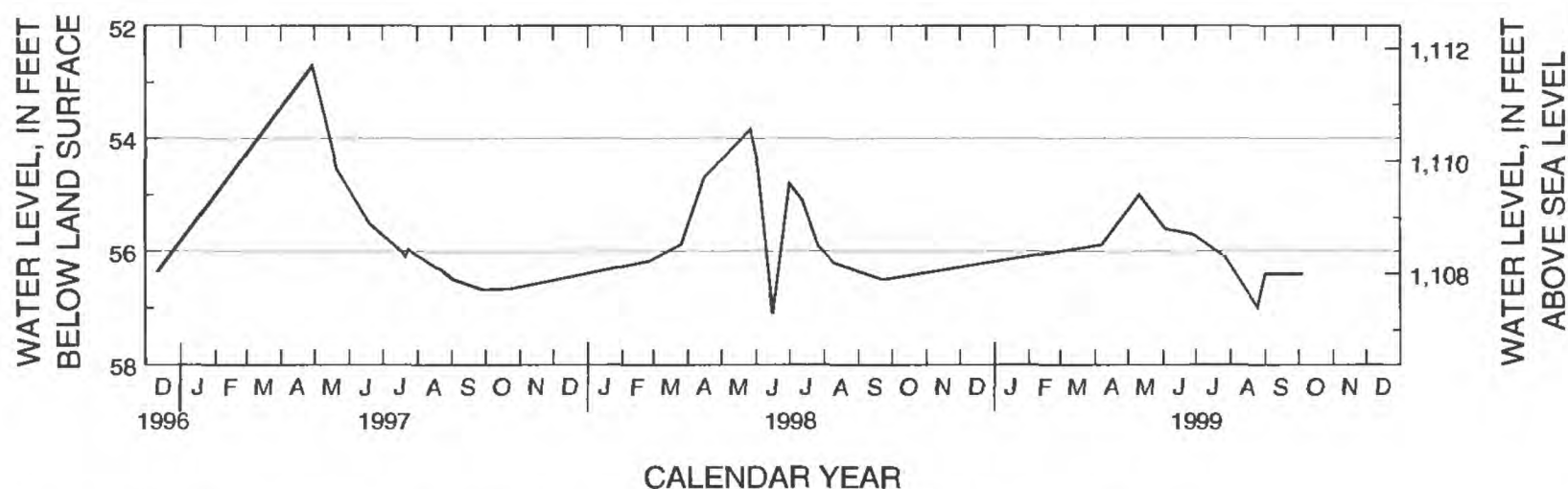


Figure B95. Hydrograph for observation well 126N50W32CCCB R (site number 95).

Site number from location map: 96
 Local well number: 126N51W35AADA R
 Station identification number: 453928096595601
 Other identifier: RB-79C
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,160.6 feet
 Measuring point: 2.5 feet
 Extremes: October 26, 1979, to October 5, 1999: Highest, 2.46 feet, May 27, 1998; lowest, 14.5 feet, October 21, 1981.

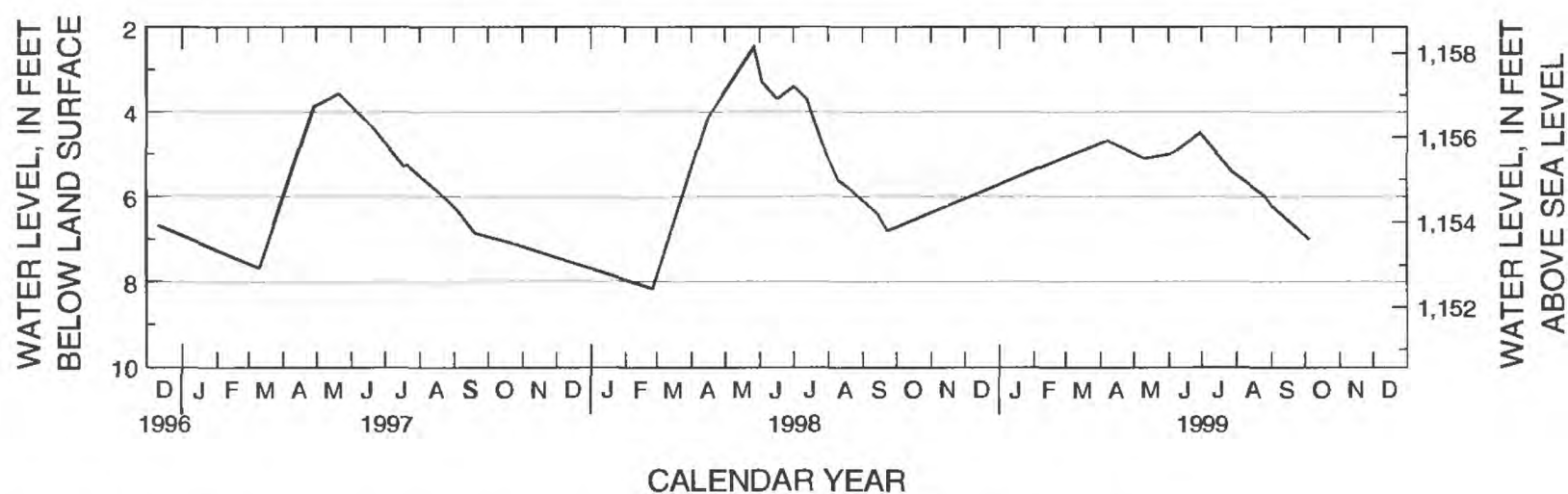


Figure B96. Hydrograph for observation well 126N51W35AADA R (site number 96).

Site number from location map: 97
 Local well number: 126N51W36DCCC R
 Station identification number: 453844096591801
 Other identifier: RB-20
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,200 feet
 Measuring point: 3.1 feet
 Extremes: December 11, 1996, to October 5, 1999: Highest, 5.97 feet, April 29, 1997; lowest, 7.79 feet, December 11, 1996.

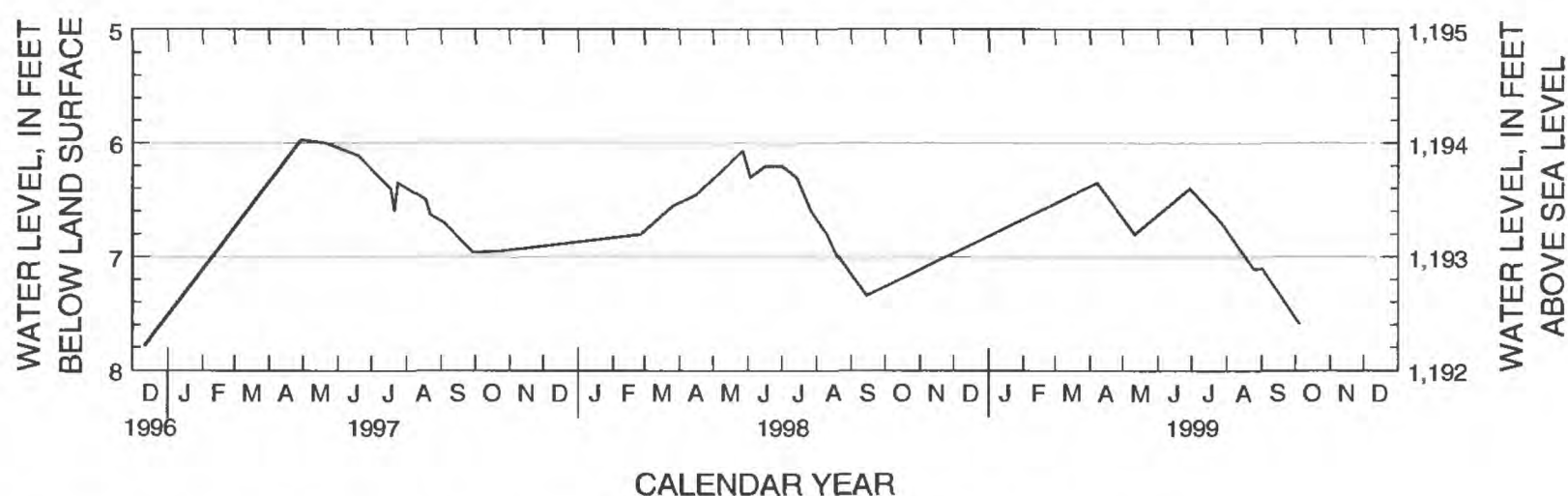


Figure B97. Hydrograph for observation well 126N51W36DCCC R (site number 97).

Site number from location map: 98
 Local well number: 127N48W2BBBBB R
 Station identification number: 454911096384601
 Other identifier: RB-77F
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,069 feet
 Measuring point: 1.0 foot
 Extremes: May 28, 1978, to October 5, 1999: Highest, 10.95 feet, April 28, 1997; lowest, 28.2 feet, July 20, 1982.

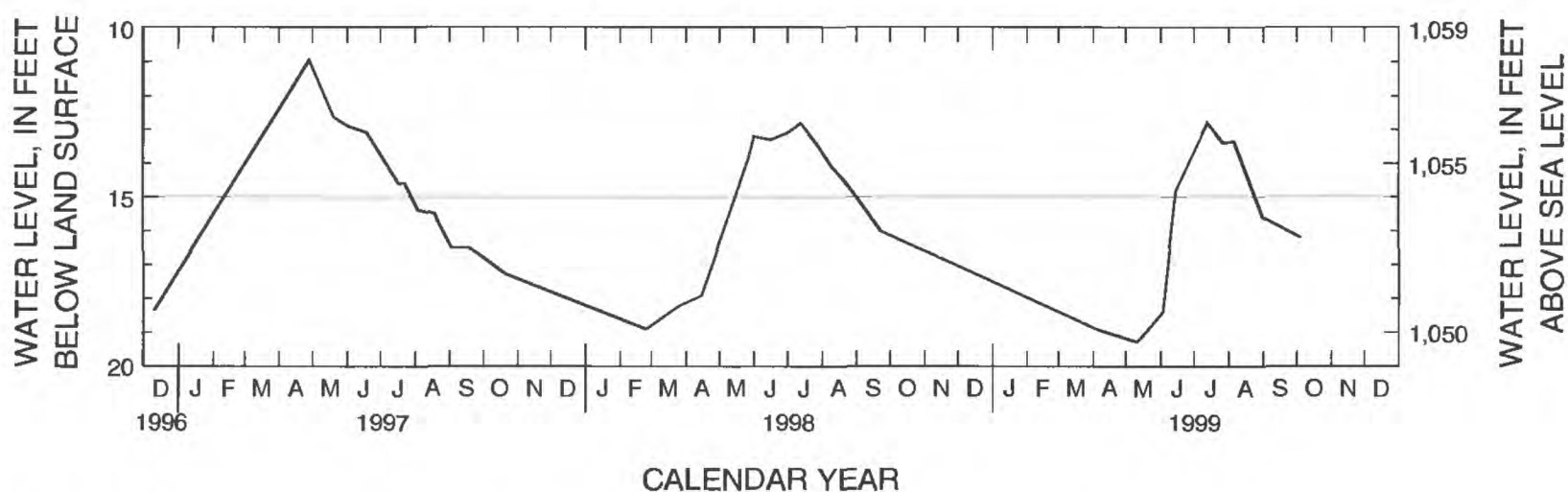


Figure B98. Hydrograph for observation well 127N48W2BBBBB R (site number 98).

Site number from location map: 99
 Local well number: 127N48W7BBBB R
 Station identification number: 454818096434501
 Other identifier: RB-77G
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,079.9 feet
 Measuring point: 1.9 feet
 Extremes: November 30, 1977, to October 5, 1999: Highest, 0.63 feet, April 6, 1999; lowest, 13.9 feet, October 4, 1983, November 9, 1983.

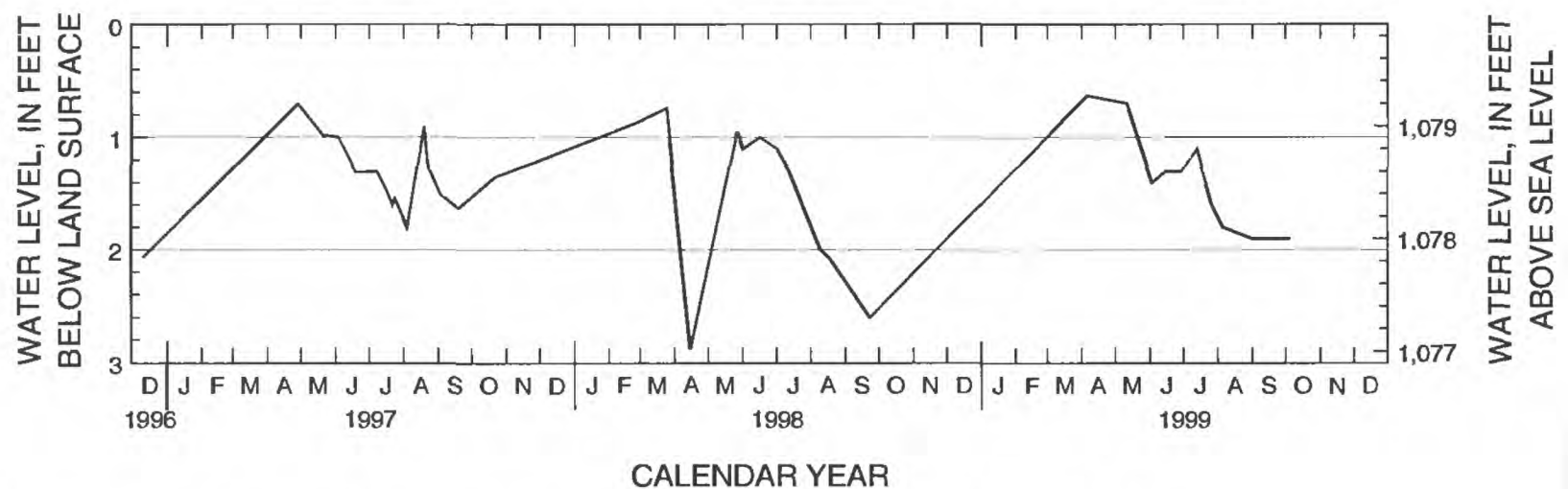


Figure B99. Hydrograph for observation well 127N48W7BBBB R (site number 99).

Site number from location map: 100
 Local well number: 127N48W7BBBB2 R
 Station identification number: 454818096434502
 Other identifier: RB-77H
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,079.7 feet
 Measuring point: 3.6 feet
 Extremes: November 30, 1977, to October 5, 1999: Highest, 8.2 feet, July 1, 13, 1998; lowest, 20.6 feet, October 4, 1983, November 9, 1983.

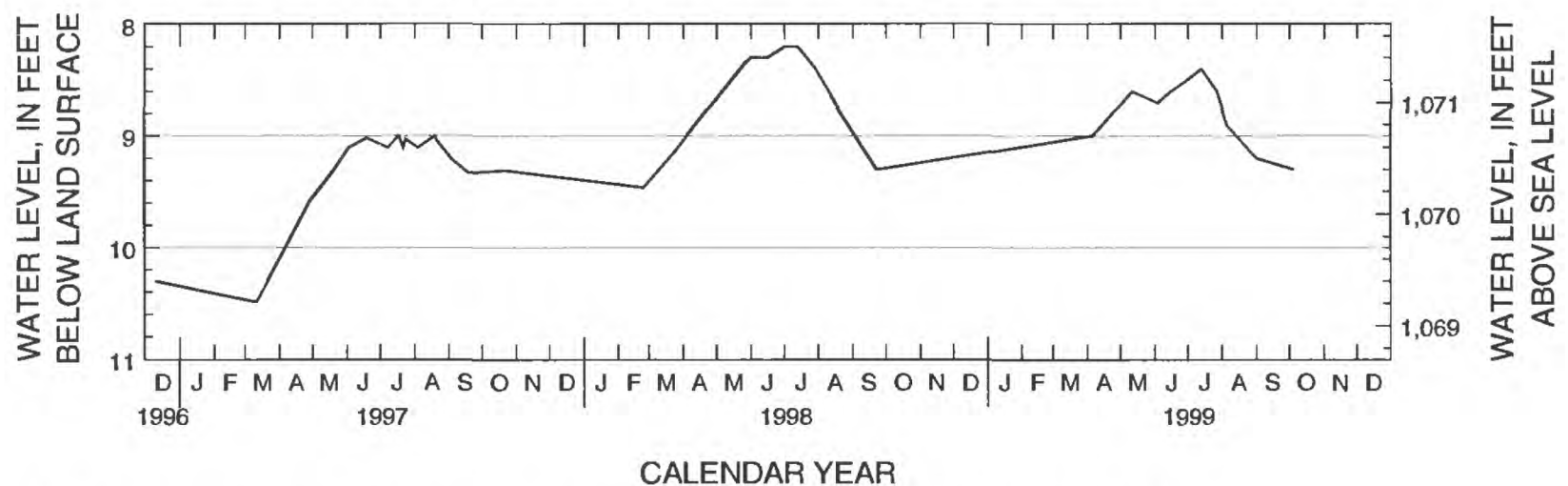


Figure B100. Hydrograph for observation well 127N48W7BBBB2 R (site number 100).

Site number from location map: 101
 Local well number: 127N48W7DDBB R
 Station identification number: 454737096424801
 Other identifier: RB-77A
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,100 feet
 Measuring point: 3.0 feet
 Extremes: June 6, 1977, to September 9, 1999: Highest, 12.5 feet, May 20, 1997; lowest, 32.6 feet, July 20, 1982.

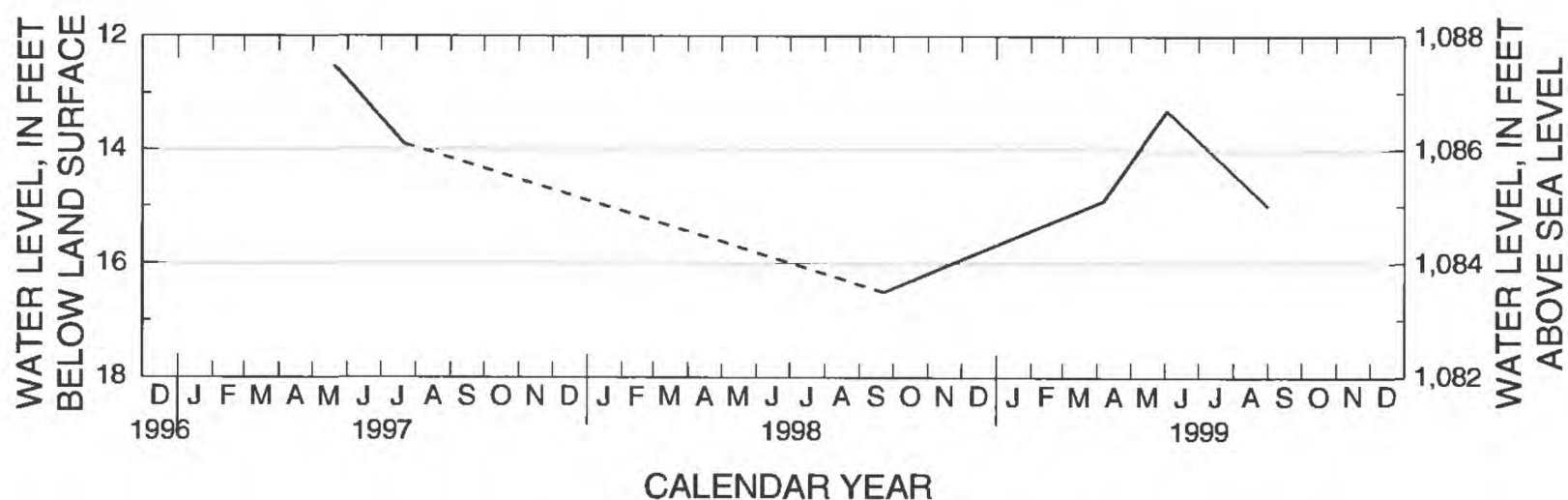


Figure B101. Hydrograph for observation well 127N48W7DDBB R (site number 101).

Site number from location map: 102
 Local well number: 127N48W18DDDD R
 Station identification number: 454634096434501
 Other identifier: RB-77B
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,097.7 feet
 Measuring point: 1.3 feet
 Extremes: June 6, 1977, to October 5, 1999: Highest, 32.3 feet, July 13, 1998; lowest, 44.2 feet, September 20, 1977.

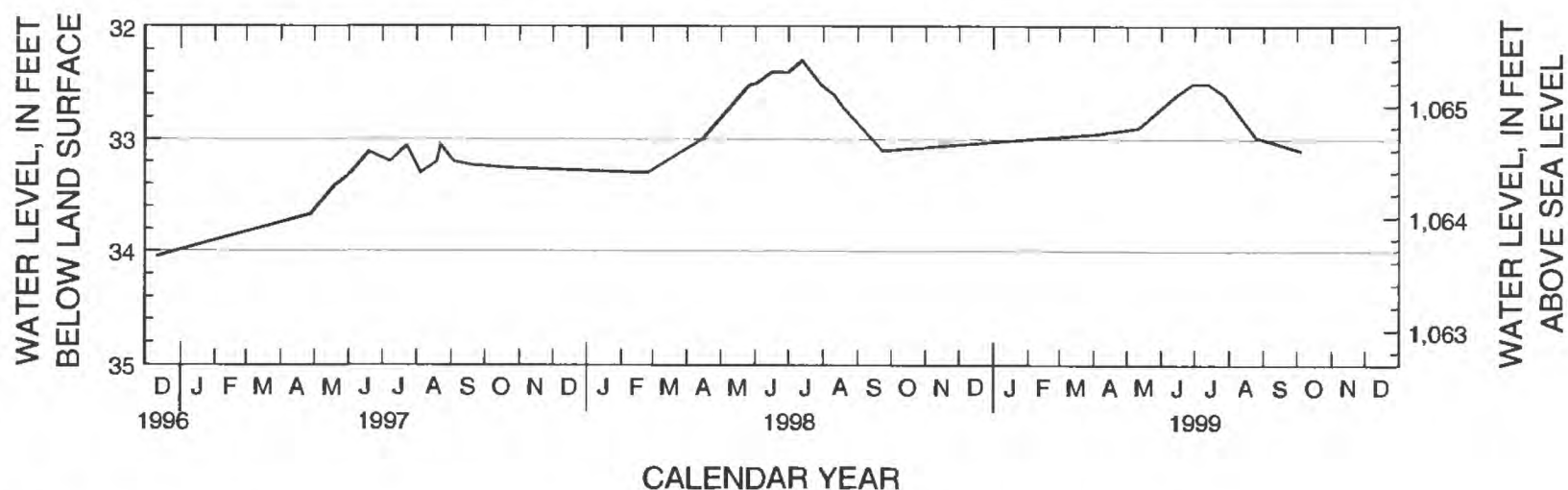


Figure B102. Hydrograph for observation well 127N48W18DDDD R (site number 102).

Site number from location map: 103
 Local well number: 127N48W28AAAA R
 Station identification number: 454541096400502
 Other identifier: R2-97-45
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,090 feet
 Measuring point: 2.0 feet
 Extremes: October 22, 1997, to August 25, 1999: Higher, 45.73 feet, April 6, 1999; lowest, 46.09 feet, September 14, 1998.

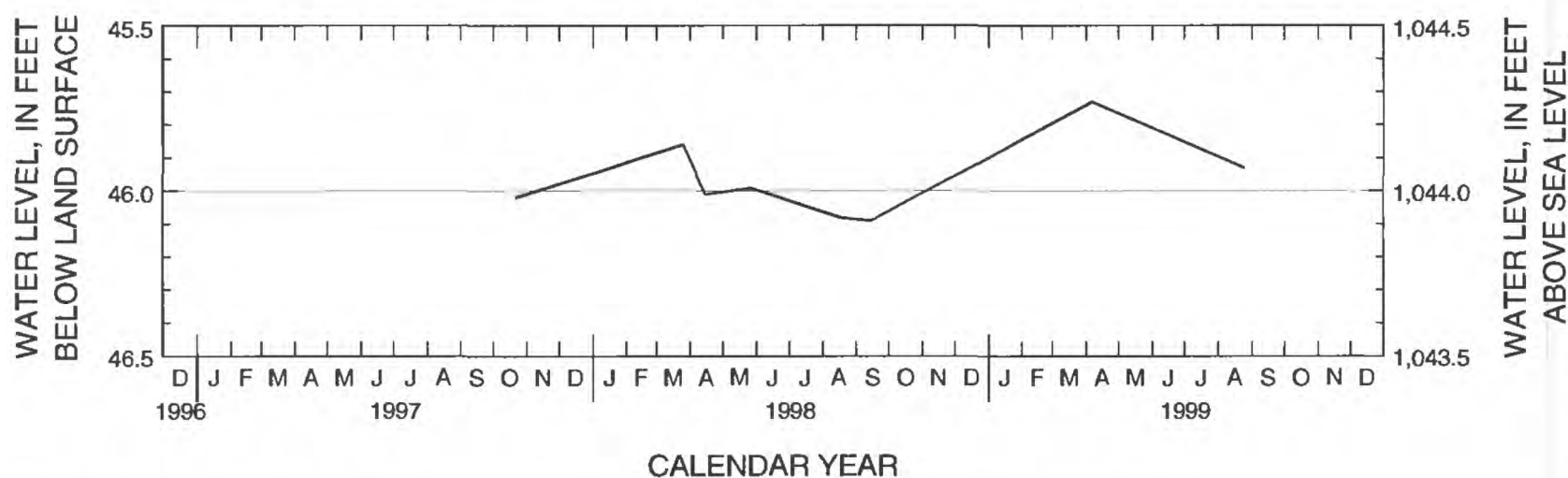


Figure B103. Hydrograph for observation well 127N48W28AAAA R (site number 103).

Site number from location map: 104
 Local well number: 127N49W10BBBBB2 R
 Station identification number: 454818096473002
 Other identifier: R2-96-53
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,089.2 feet
 Measuring point: 1.9 feet
 Extremes: December 10, 1996, to August 25, 1999: Highest, 11.57 feet, May 27, 1998; lowest, 18.88 feet, August 25, 1999.

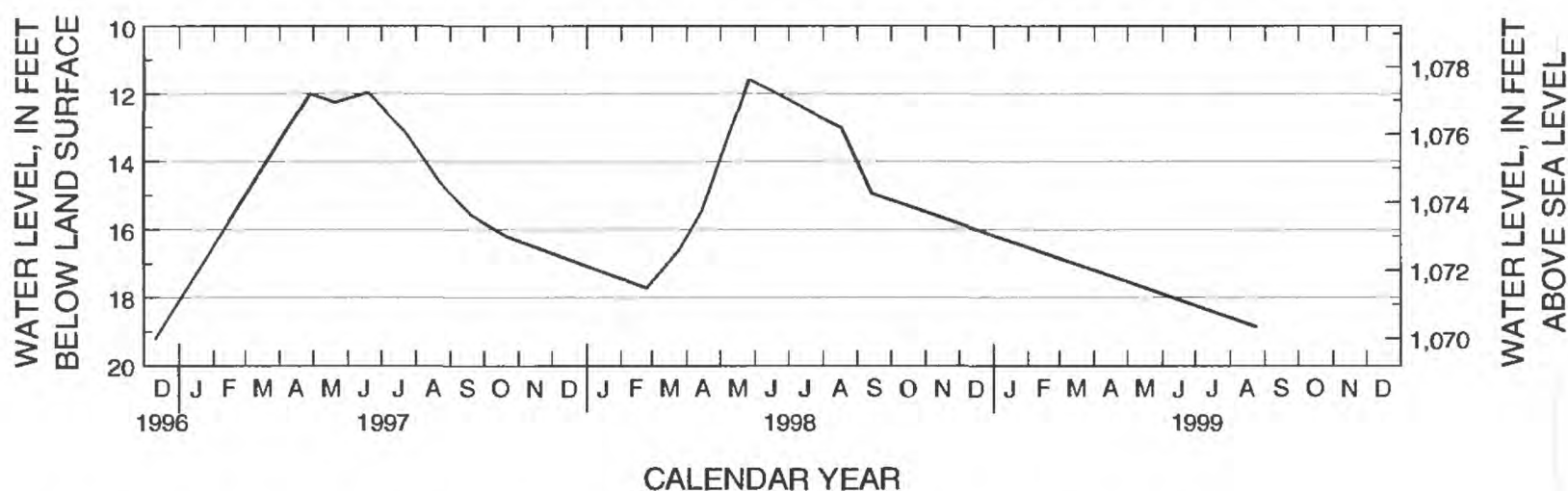


Figure B104. Hydrograph for observation well 127N49W10BBBBB2 R (site number 104).

Site number from location map: 105
 Local well number: 127N49W14DAAA R
 Station identification number: 454658096450301
 Other identifier: RB-77I
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,109.3 feet
 Measuring point: 2.2 feet
 Extremes: November 30, 1977, to October 5, 1999: Highest, 36.9 feet, July 13, 1998; lowest, 51.2 feet, October 4, 1983.

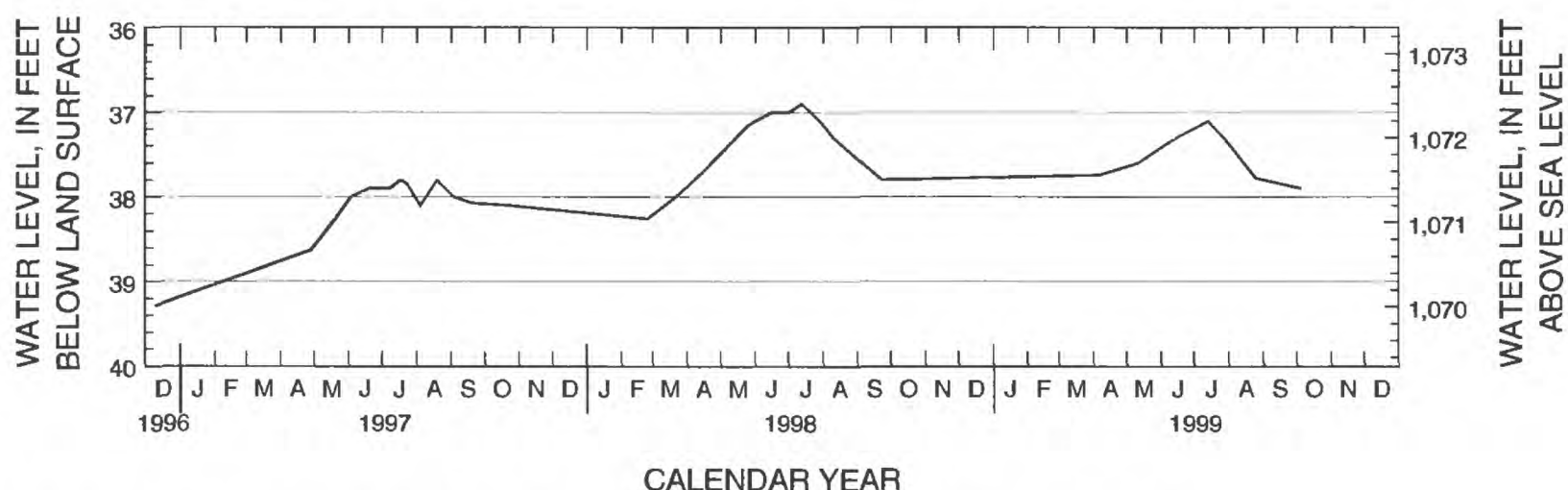


Figure B105. Hydrograph for observation well 127N49W14DAAA R (site number 105).

Site number from location map: 106
 Local well number: 127N49W14DAAA2 R
 Station identification number: 454658096450402
 Other identifier: RB-77J
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,109.9 feet
 Measuring point: 2.0 feet
 Extremes: November 30, 1977, to October 5, 1998: Highest, 19.8 feet, June 1, 1998; lowest, 42.5 feet, October 4, 1983.

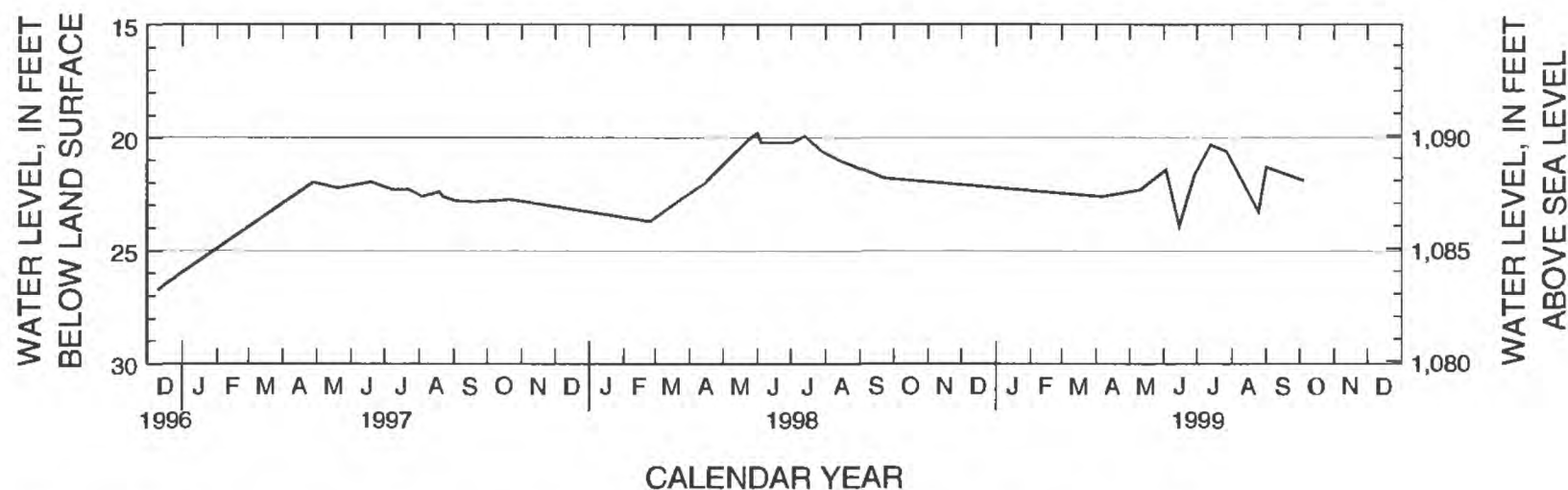


Figure B106. Hydrograph for observation well 127N49W14DAAA2 R (site number 106).

Site number from location map: 107
 Local well number: 127N49W26DDDD R
 Station identification number: 454449096450201
 Other identifier: RB-77C
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,124.5 feet
 Measuring point: 1.6 feet
 Extremes: June 6, 1977, to October 5, 1999: Highest, 54.0 feet, July 13, 1998; lowest, 70.0 feet, September 20, 1977.

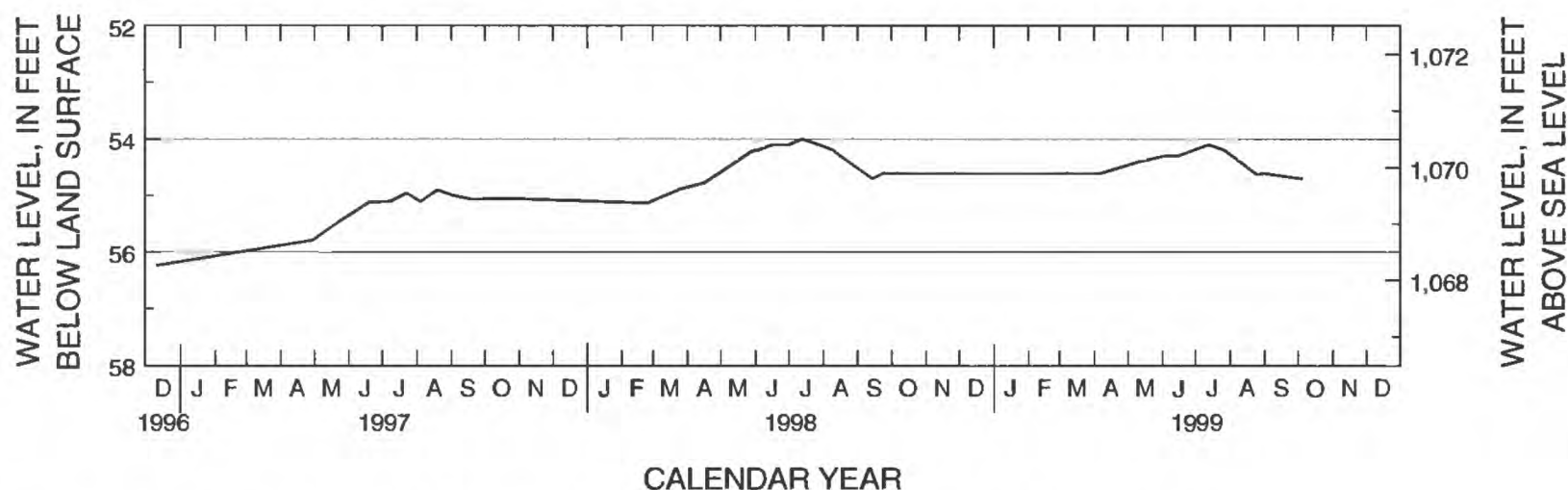


Figure B107. Hydrograph for observation well 127N49W26DDDD R (site number 107).

Site number from location map: 108
 Local well number: 127N49W29DCDC2 R
 Station identification number: 454550096491302
 Other identifier: LTR-16
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,111.4 feet
 Measuring point: 4.0 feet
 Extremes: December 10, 1996, to August 25, 1999: Highest, 54.68 feet, August 25, 1999; lowest, 58.78 feet, December 10, 1996.

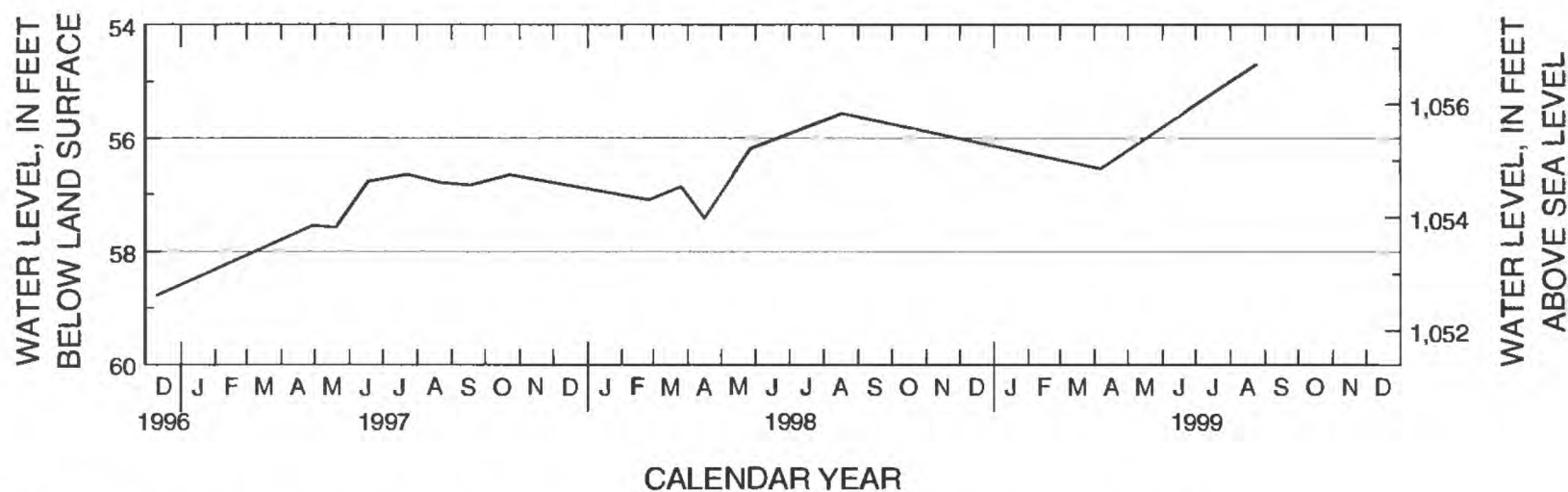


Figure B108. Hydrograph for observation well 127N49W29DCDC2 R (site number 108).

Site number from location map: 109
Local well number: 127N49W36BBBB R
Station identification number: 454449096450101
Other identifier: RB-77K
County: Roberts, South Dakota
Aquifer: Rosholt
Altitude of land surface: 1,129.0 feet
Measuring point: 2.8 feet
Extremes: November 30, 1977, to October 5, 1999: Highest, 56.46 feet, August 18, 1998; lowest, 77.4 feet, August 1, 1983.

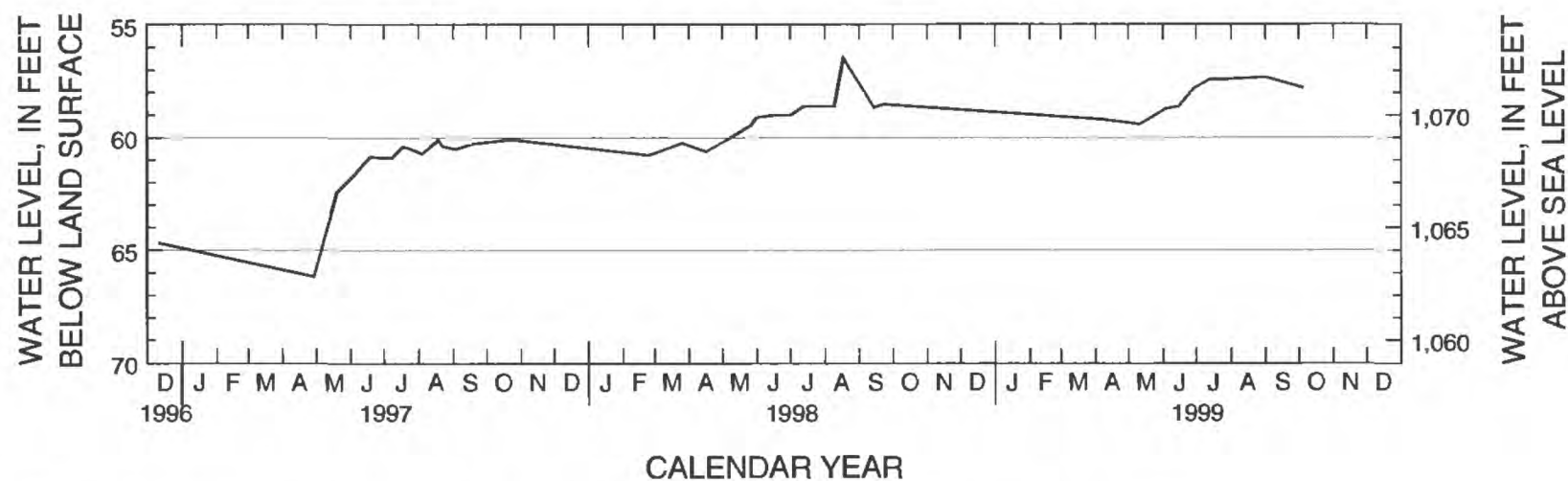


Figure B109. Hydrograph for observation well 127N49W36BBBB R (site number 109).

Site number from location map: 110
Local well number: 127N50W9BBBB2 R
Station identification number: 454818096550602
Other identifier: R2-97-39
County: Roberts, South Dakota
Aquifer: Rosholt
Altitude of land surface: 1,120 feet
Measuring point: 2.0 feet
Extremes: October 22, 1997, to August 6, 1999: Highest, 27.9 feet, April 6, 1999; lowest, 30.3 feet, September 15, 1998.

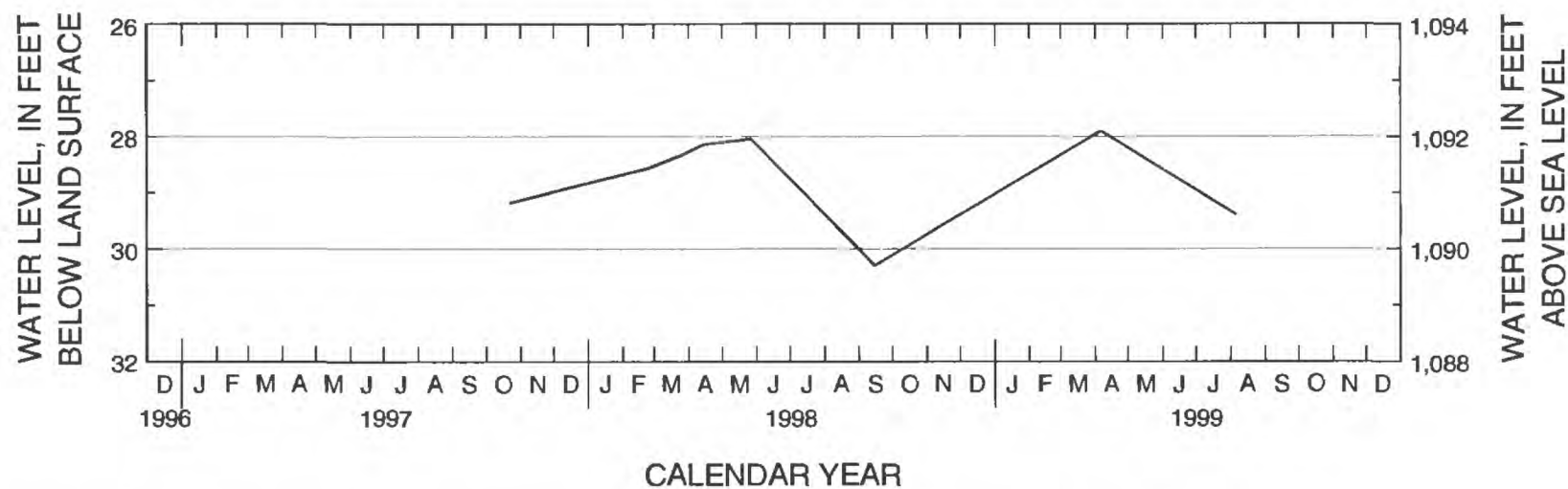


Figure B110. Hydrograph for observation well 127N50W9BBBB2 R (site number 110).

Site number from location map: 111
 Local well number: 127N50W19CCCB R
 Station identification number: 454547096584301
 Other identifier: LTR-2
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,175.4 feet
 Measuring point: 2.0 feet
 Extremes: February 24, 1998, to August 6, 1999: Highest, 40.09 feet, August 6, 1999; lowest, 42.45 feet, March 25, 1998.

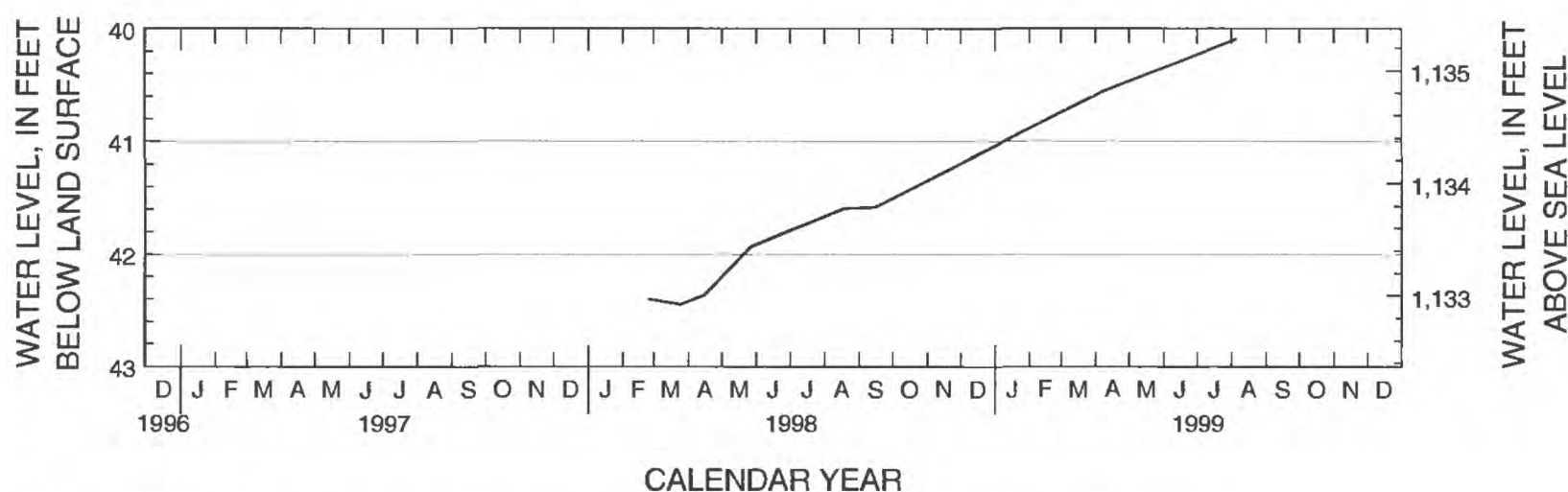


Figure B111. Hydrograph for observation well 127N50W19CCCB R (site number 111).

Site number from location map: 112
 Local well number: 127N50W21DDDD R
 Station identification number: 454541096550001
 Other identifier: R2-96-50
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,139 feet
 Measuring point: 2.3 feet
 Extremes: April 29, 1997, to August 25, 1999: Highest, 24.63 feet, April 6, 1999; lowest, 26.69 feet, February 25, 1998.

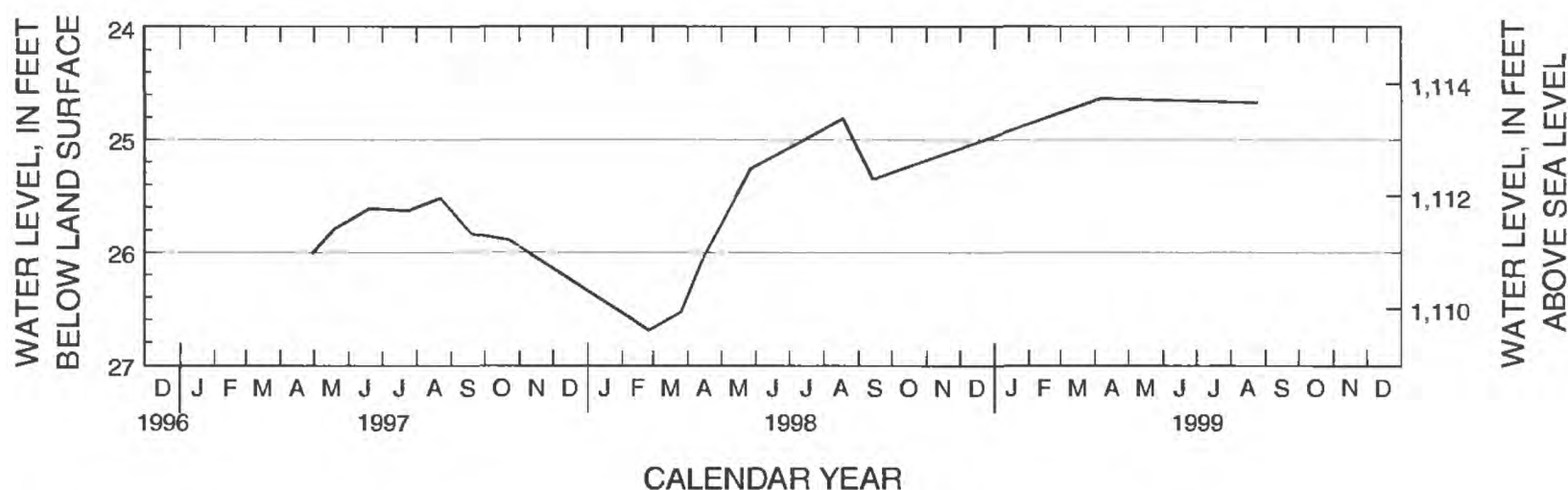


Figure B112. Hydrograph for observation well 127N50W21DDDD R (site number 112).

Site number from location map: 113
 Local well number: 127N50W25ADAD2 R
 Station identification number: 454523096511602
 Other identifier: R2-96-58
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,099.5 feet
 Measuring point: 1.6 feet
 Extremes: April 29, 1997, to August 25, 1999: Highest, 51.48 feet, August 18, 1998; lowest, 52.23 feet, April 16, 1998.

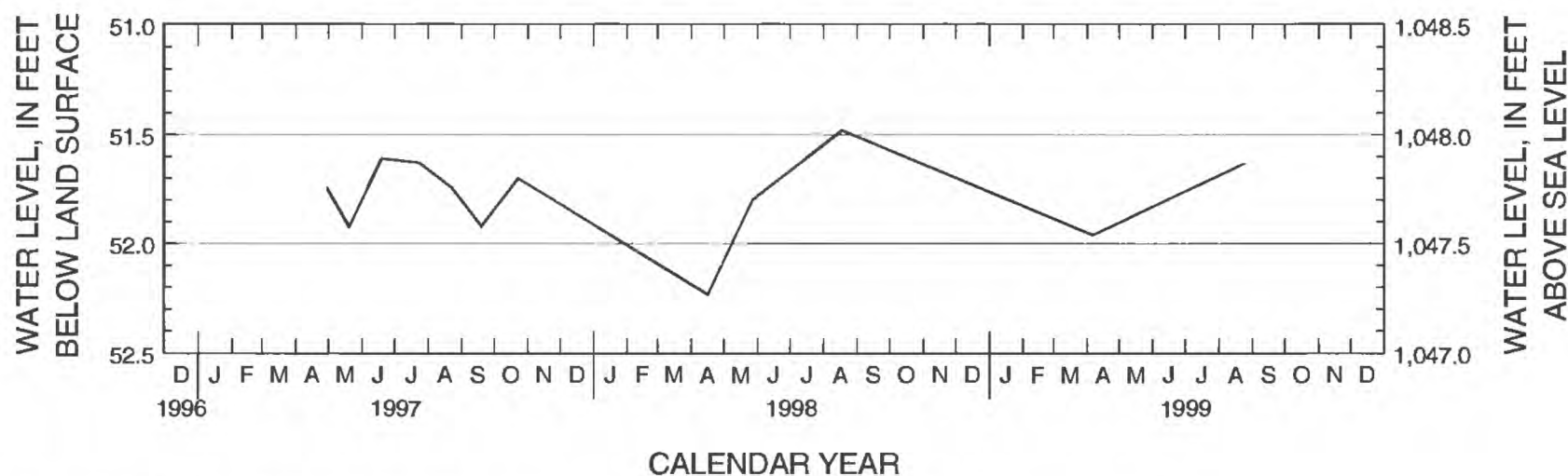


Figure B113. Hydrograph for observation well 127N50W25ADAD2 R (site number 113).

Site number from location map: 114
 Local well number: 127N51W3AAAA R
 Station identification number: 454910097011501
 Other identifier: RB-81A
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,226.3 feet
 Measuring point: 1.7 feet
 Extremes: May 29, 1981, to September 1, 1999: Highest, 69.4 feet, September 1, 1999; lowest, 84.8 feet, October 4, 1983.

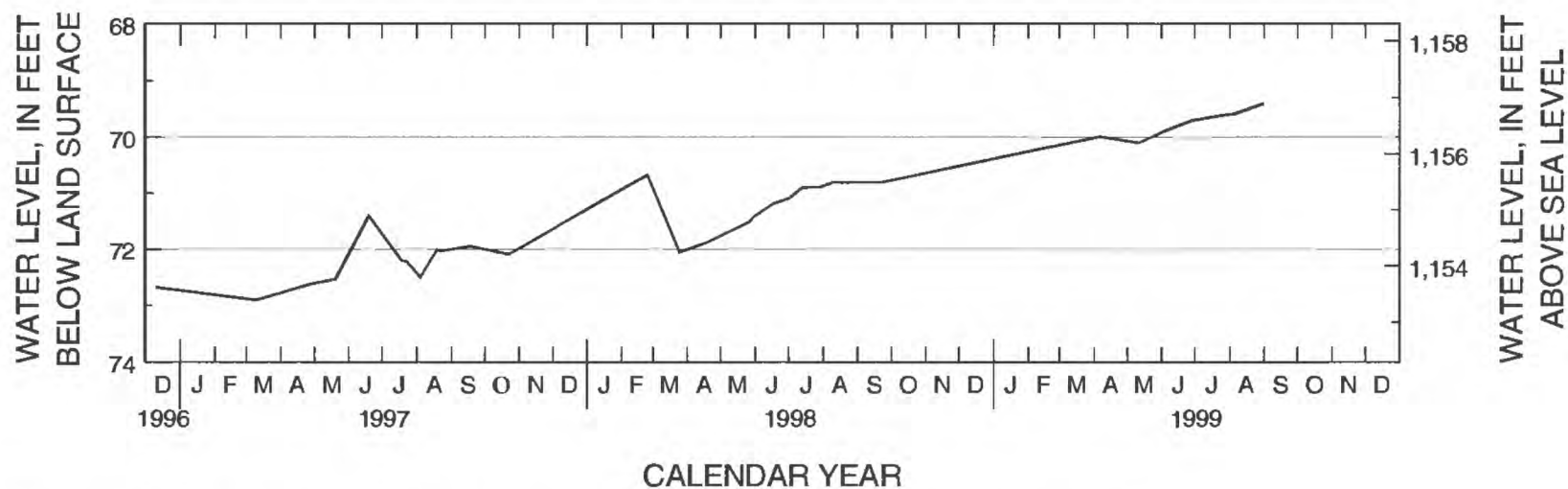


Figure B114. Hydrograph for observation well 127N51W3AAAA R (site number 114).

Site number from location map: 115
 Local well number: 127N51W9AAAA2 R
 Station identification number: 454820097023602
 Other identifier: R2-97-07
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,192 feet
 Measuring point: 1.7 feet
 Extremes: October 22, 1997, to August 6, 1999: Highest, 30.95 feet, August 6, 1999; lowest, 33.58 feet, February 24, 1998.

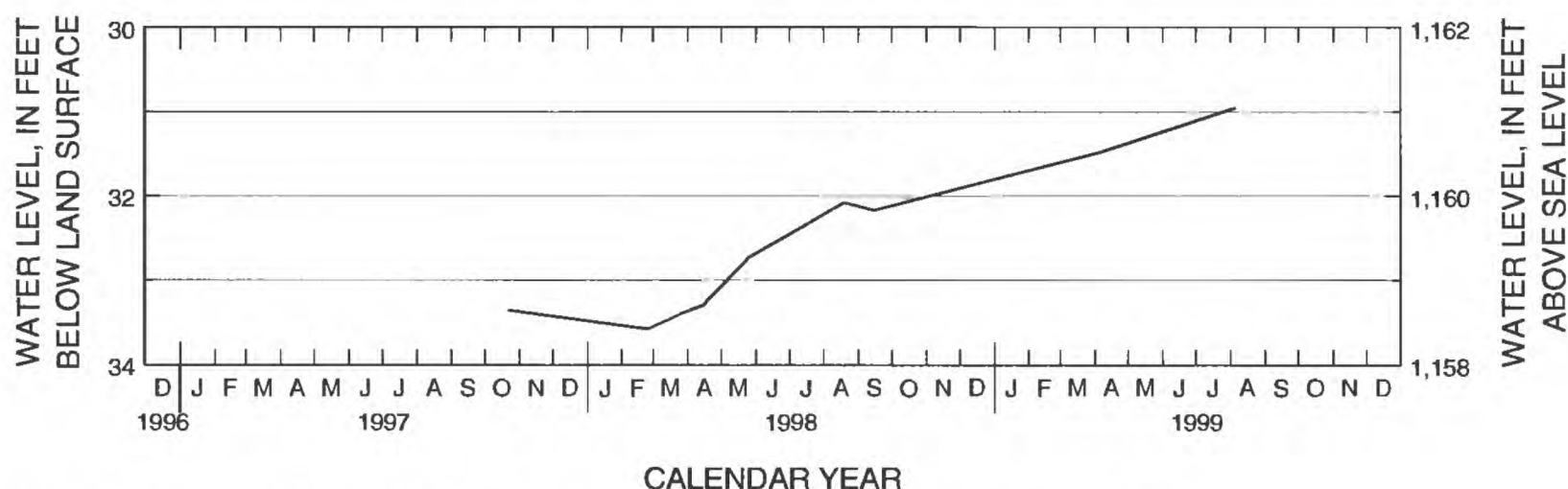


Figure B115. Hydrograph for observation well 127N51W9AAAA2 R (site number 115).

Site number from location map: 116
 Local well number: 127N52W25AAAA2 R
 Station identification number: 454838097061102
 Other identifier: R2-97-11
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,188 feet
 Measuring point: 1.9 feet
 Extremes: October 22, 1997, to August 6, 1999: Highest, 0.14 foot, April 6, 1999; lowest, 5.72 feet, October 22, 1997.

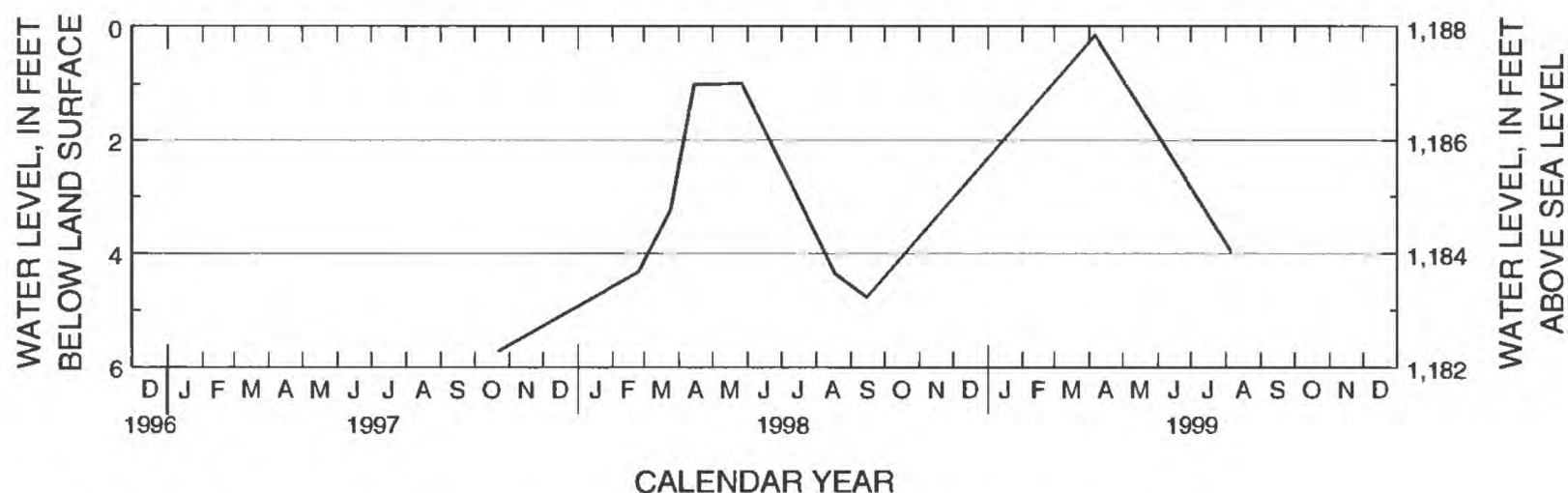


Figure B116. Hydrograph for observation well 127N52W25AAAA2 R (site number 116).

Site number from location map: 117
Local well number: 127N52W7CCCD R
Station identification number: 454818097060401
Other identifier: R2-95-08
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,197 feet
Measuring point: 2.4 feet
Extremes: December 10, 1996, to August 6, 1999: Highest, 27.21 feet, August 6, 1999; lowest, 30.82 feet, March 10, 1997.

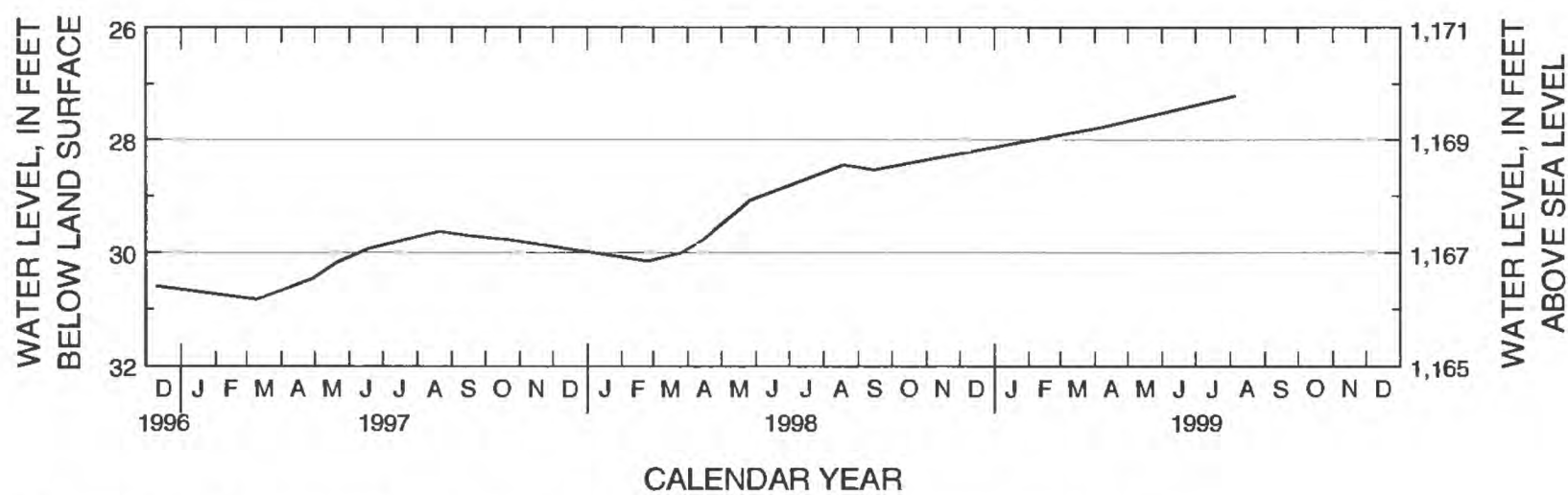


Figure B117. Hydrograph for observation well 127N52W7CCCD R (site number 117).

Site number from location map: 118
Local well number: 128N48W1CCDC2 R
Station identification number: 455334096372102
Other identifier: R2-96-62
County: Roberts, South Dakota
Aquifer: Fairmount
Altitude of land surface: 1,021.8 feet
Measuring point: 1.6 feet
Extremes: April 28, 1997, to August 6, 1999: Highest, 41.68 feet, April 28, 1997; lowest, 44.91 feet, July 23, 1997.

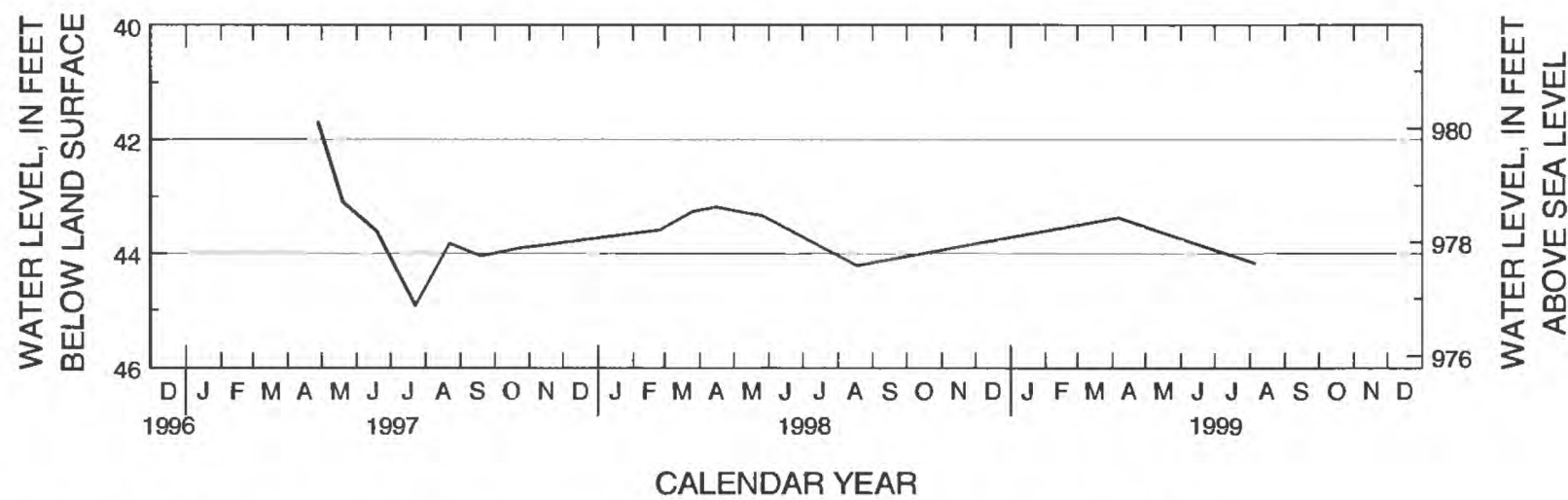


Figure B118. Hydrograph for observation well 128N48W1CCDC2 R (site number 118).

Site number from location map: 119
 Local well number: 128N48W4DDDD R
 Station identification number: 455336096400301
 Other identifier: R2-96-63
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,046.6 feet
 Measuring point: -0.2 foot
 Extremes: December 10, 1996, to April 6, 1999: Highest, 20.58 feet, December 10, 1996; lowest, 33.96 feet, March 11, 1997.

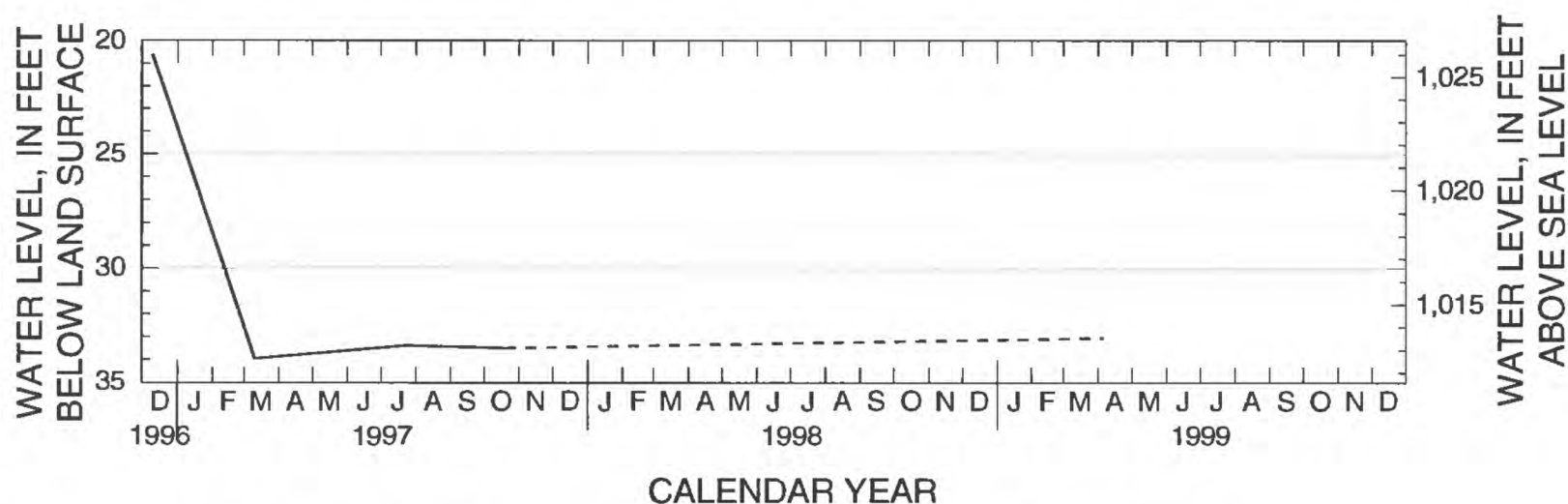


Figure B119. Hydrograph for observation well 128N48W4DDDD R (site number 119).

Site number from location map: 120
 Local well number: 128N48W6BBBB R
 Station identification number: 455423096434501
 Other identifier: LTR-10
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,098.2 feet
 Measuring point: 2.75 feet
 Extremes: April 28, 1997, to August 6, 1999: Highest, 41.33 feet, August 6, 1999; lowest, 43.85 feet, April 28, 1997.

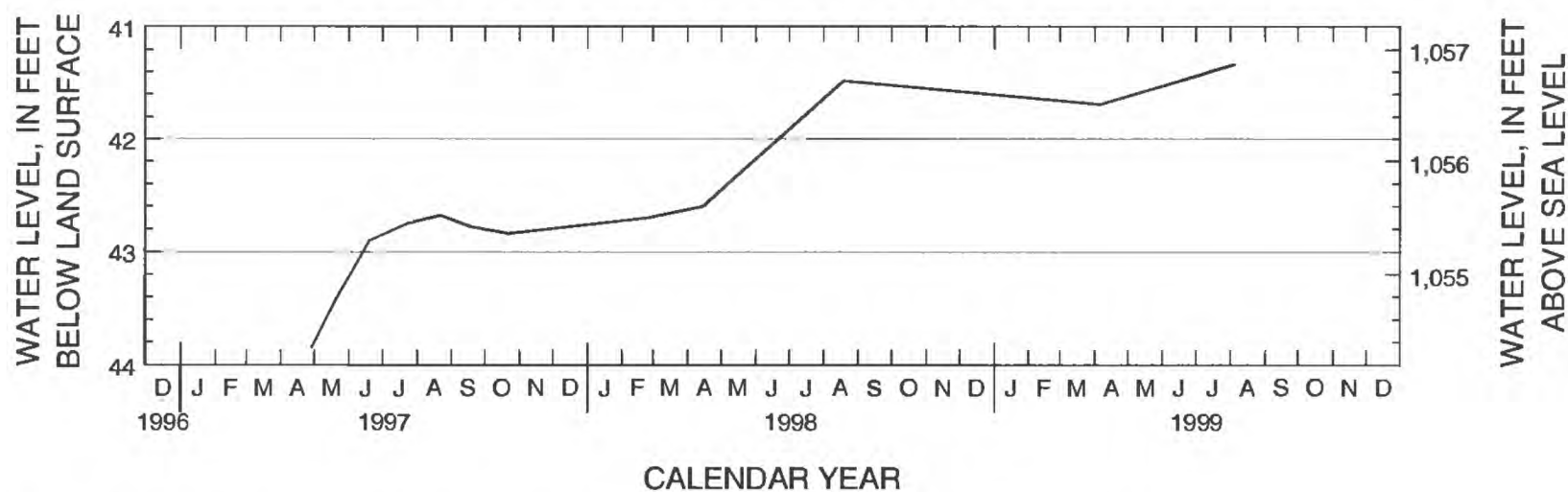


Figure B120. Hydrograph for observation well 128N48W6BBBB R (site number 120).

Site number from location map: 121
 Local well number: 128N48W19BCCC R
 Station identification number: 455123096434701
 Other identifier: R2-97-30
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,080 feet
 Measuring point: 1.7 feet
 Extremes: October 22, 1997, to October 5, 1999: Highest, 8.88 feet, October 22, 1997; lowest, 23.7 feet, July 27, 1999.

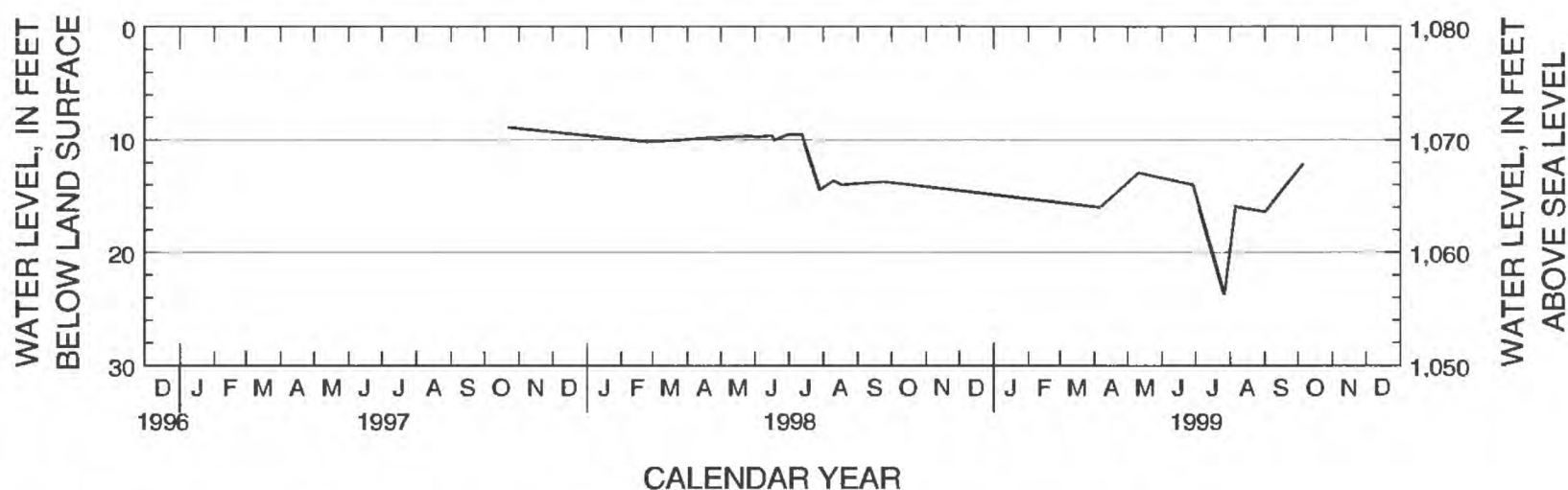


Figure B121. Hydrograph for observation well 128N48W19BCCC R (site number 121).

Site number from location map: 122
 Local well number: 128N48W20BBBBB R
 Station identification number: 455148096423101
 Other identifier: RB-77D
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,070.7 feet
 Measuring point: 2.1 feet
 Extremes: November 30, 1977, to October 5, 1999: Highest, 1.14 feet, April 28, 1997; lowest, 18.6 feet, October 4, 1983.

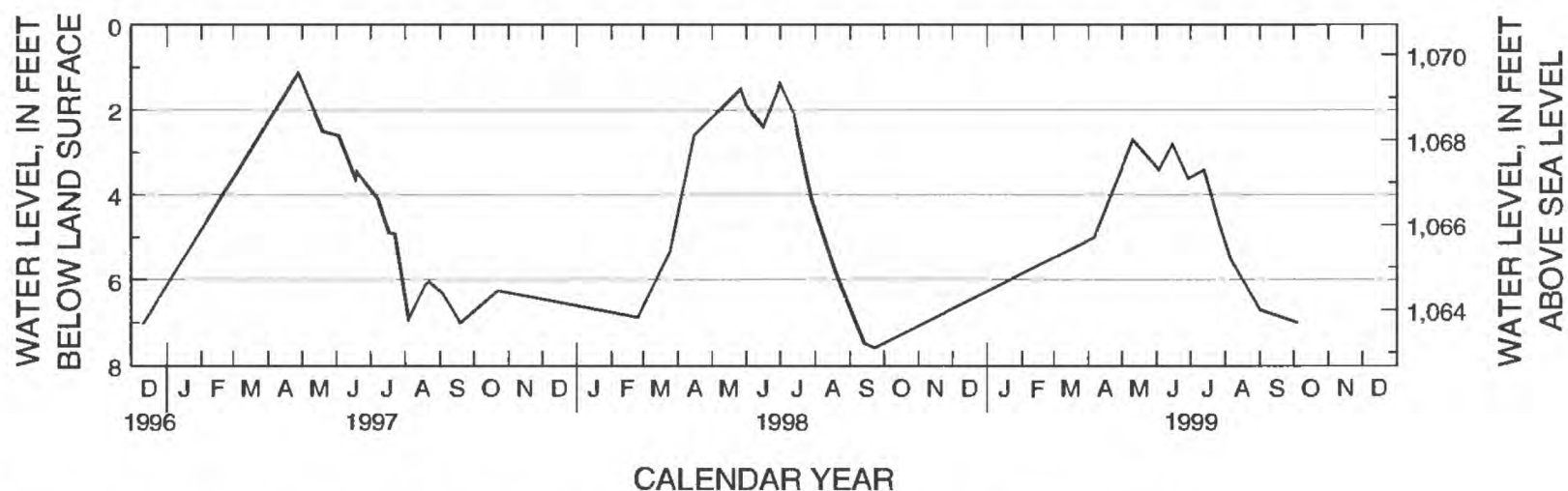


Figure B122. Hydrograph for observation well 128N48W20BBBBB R (site number 122).

Site number from location map: 123
 Local well number: 128N48W29DDDD R
 Station identification number: 455005096411801
 Other identifier: RB-77E
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,081.5 feet
 Measuring point: 1.2 feet
 Extremes: May 23, 1978, to October 5, 1999: Highest, 0.33 feet, April 28, 1997; lowest, 22.6 feet, October 4, 1983.

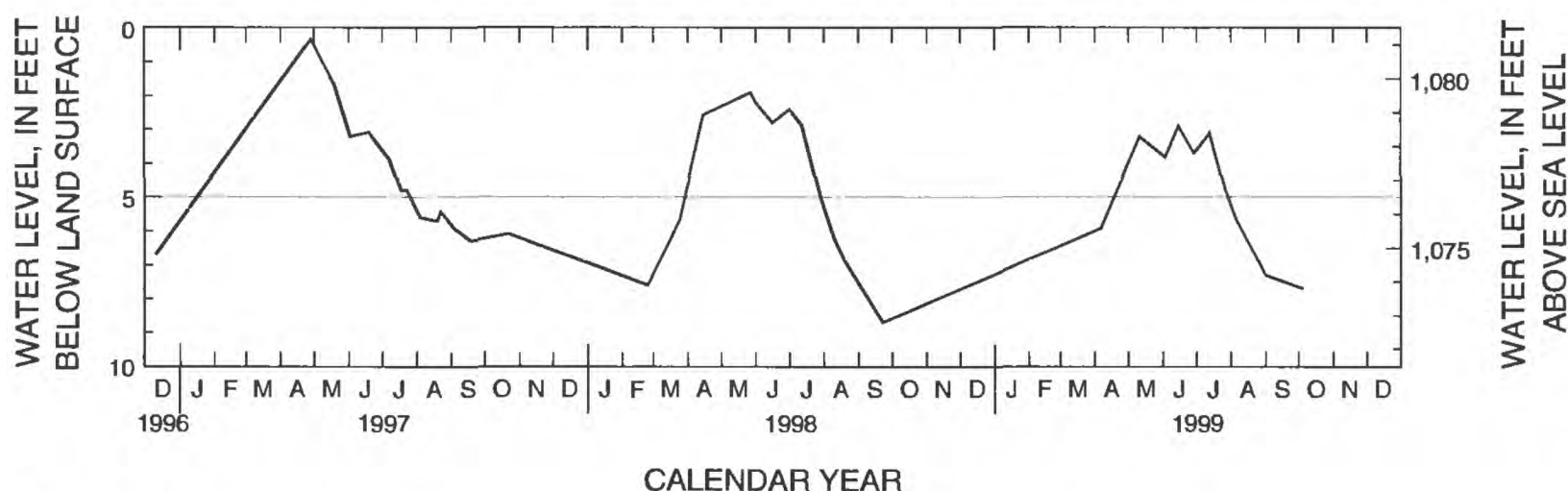


Figure B123. Hydrograph for observation well 128N48W29DDDD R (site number 123).

Site number from location map: 124
 Local well number: 128N49W1DDAD2 R
 Station identification number: 455341096435001
 Other identifier: R2-97-32
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,074 feet
 Measuring point: 2.2 feet
 Extremes: October 22, 1997, to August 6, 1999: Highest, 8.64 feet, August 6, 1999; lowest, 10.28 feet, February 24, 1998.

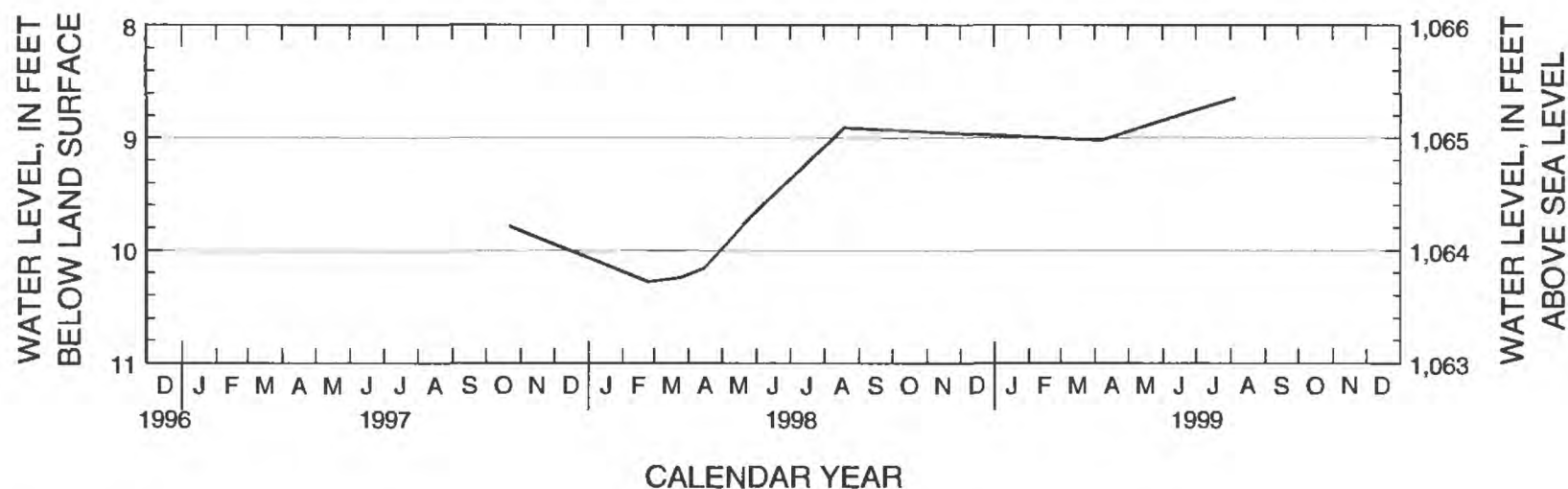


Figure B124. Hydrograph for observation well 128N49W1DDAD2 R (site number 124).

Site number from location map: 125
 Local well number: 128N49W20BBBB R
 Station identification number: 455146096500001
 Other identifier: LTR-6
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,082.6 feet
 Measuring point: 4.0 feet
 Extremes: December 10, 1996, to August 6, 1999: Highest, 8.9 feet, April 6, 1999; lowest, 9.62 feet, December 10, 1996.

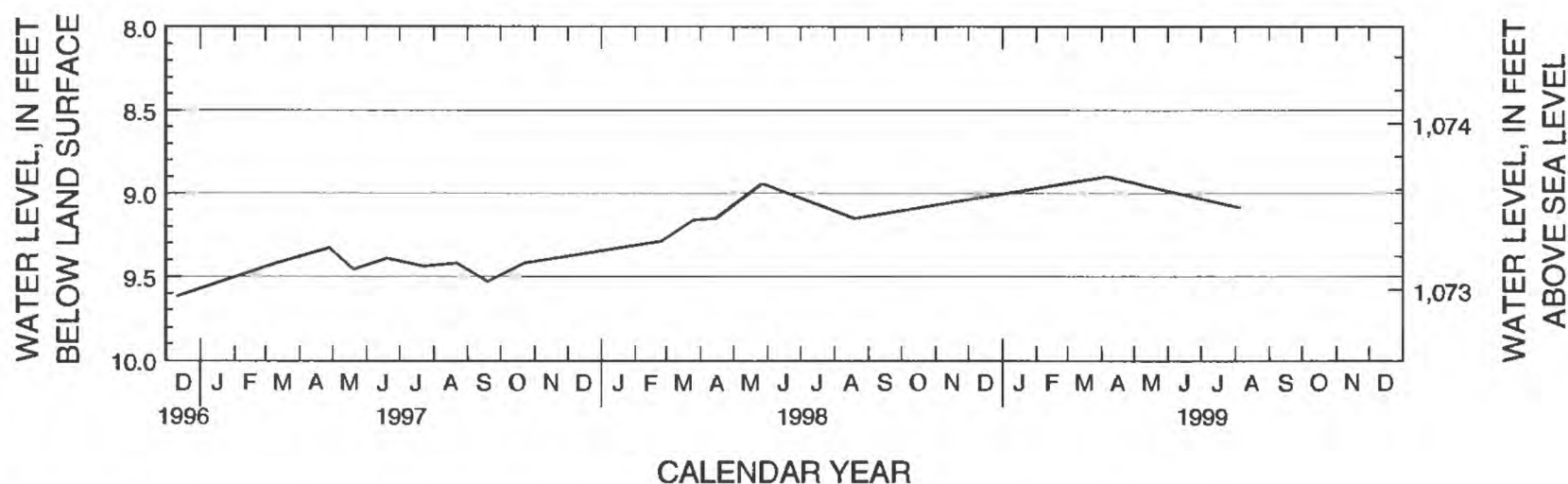


Figure B125. Hydrograph for observation well 128N49W20BBBB R (site number 125).

Site number from location map: 126
 Local well number: 128N49W36AAAA R
 Station identification number: 455003096434701
 Other identifier: LTR-21
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,078.9 feet
 Measuring point: 3.9 feet
 Extremes: December 10, 1996, to April 6, 1999: Highest, -1.48 feet, December 10, 1996; lowest, 1.36 feet, April 28, 1997.

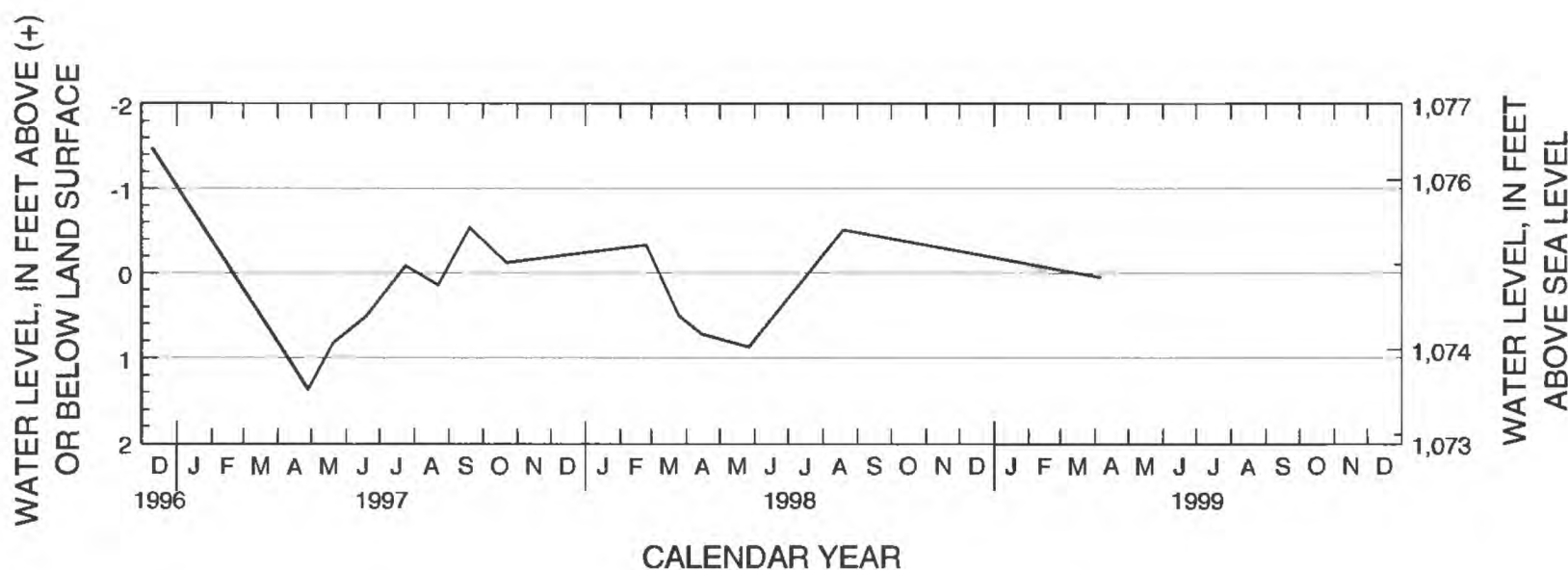


Figure B126. Hydrograph for observation well 128N49W36AAAA R (site number 126).

Site number from location map: 127
 Local well number: 128N50W10BBBB2 R
 Station identification number: 455333096550002
 Other identifier: R2-95-18
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,092.3 feet
 Measuring point: 3.7 feet
 Extremes: December 10, 1996, to August 5, 1999: Highest, 13.96 feet, April 28, 1997; lowest, 16.53, September 15, 1998.

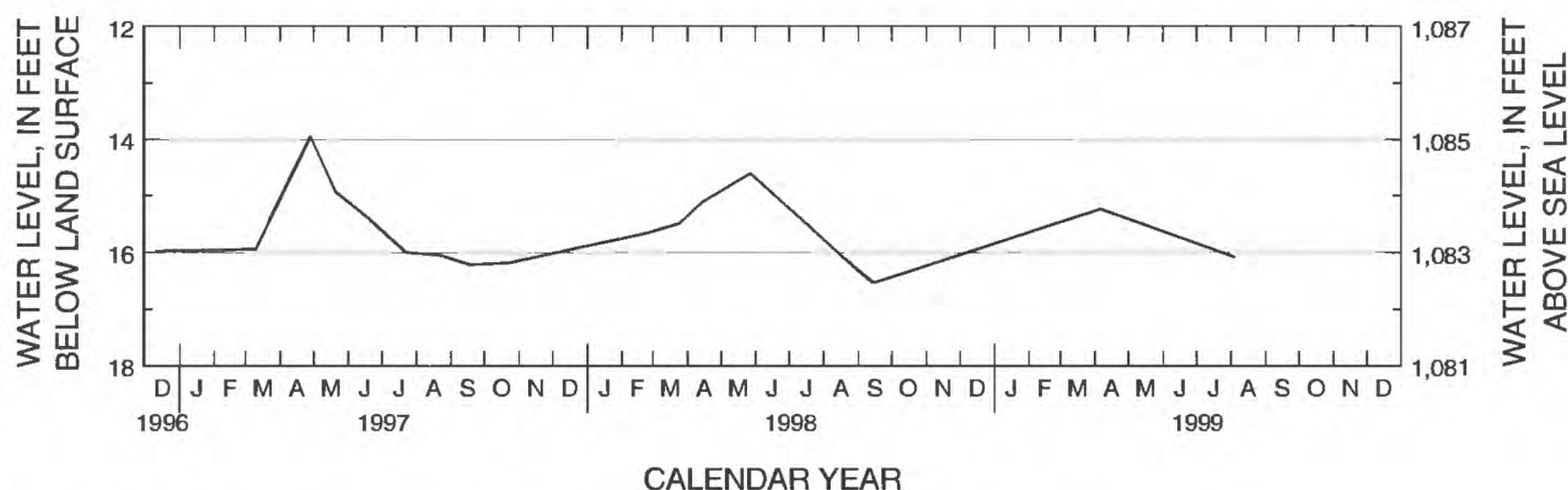


Figure B127. Hydrograph for observation well 128N50W10BBBB2 R (site number 127).

Site number from location map: 128
 Local well number: 128N50W21AAAA R
 Station identification number: 455148096550001
 Other identifier: LTR-5
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,093.7 feet
 Measuring point: 3.7 feet
 Extremes: December 10, 1996, to August 5, 1999: Highest, 3.02 feet, May 27, 1998; lowest, 3.79 feet, October 22, 1997.

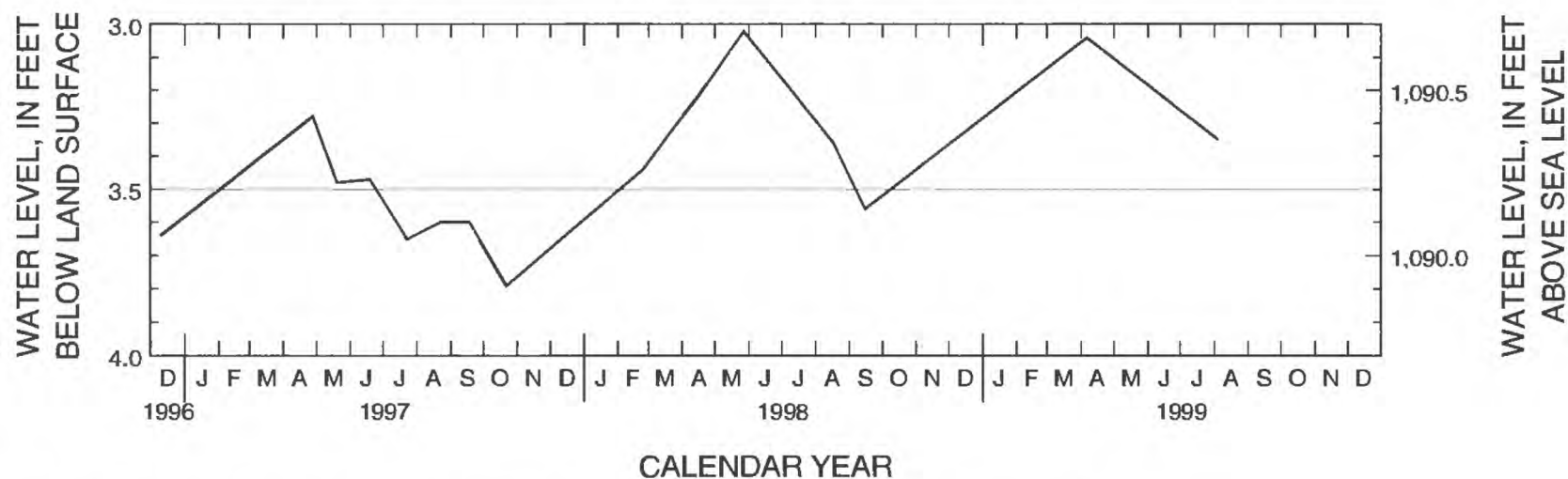


Figure B128. Hydrograph for observation well 128N50W21AAAA R (site number 128).

Site number from location map: 129
 Local well number: 128N50W21AABA R
 Station identification number: 455147096551301
 Other identifier: RB-79A
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,094.3 feet
 Measuring point: 2.5 feet
 Extremes: October 26, 1979, to October 5, 1999: Highest, 0.3 feet, June 4, 1996; lowest, 6.8 feet, September 8, 1981.

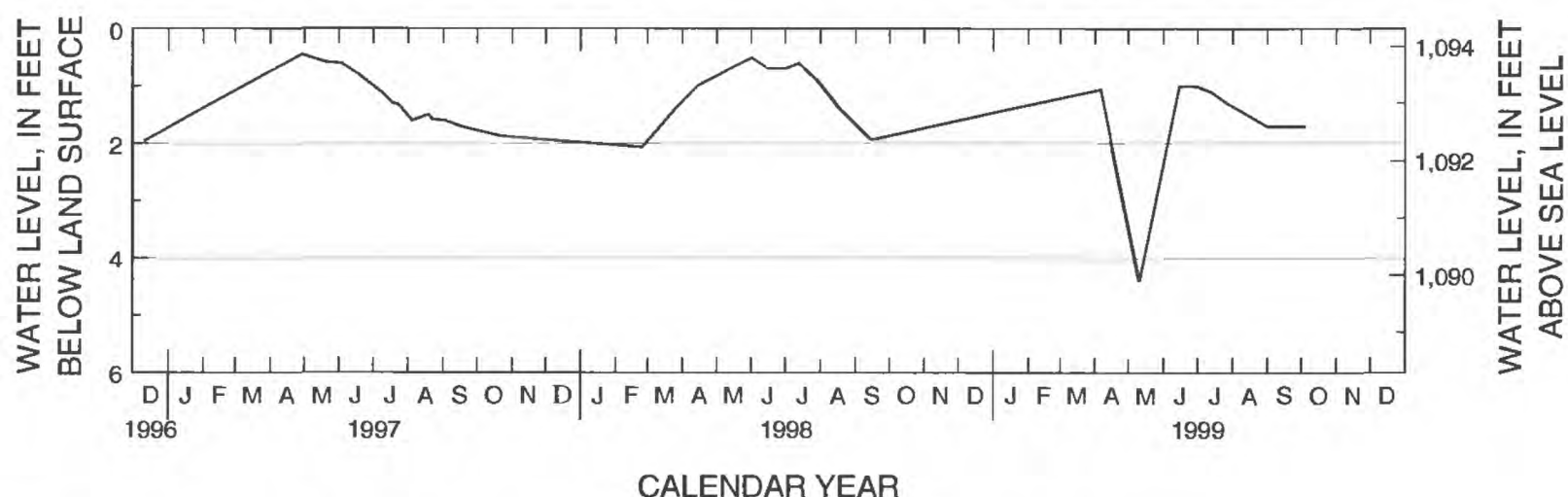


Figure B129. Hydrograph for observation well 128N50W21AABA R (site number 129).

Site number from location map: 130
 Local well number: 128N50W21CCCC R
 Station identification number: 455057096561501
 Other identifier: RB-79B
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,112.8 feet
 Measuring point: 4.25 feet
 Extremes: October 26, 1979, to December 1, 1999: Highest, -4.7 feet, June 30, 1999; lowest, 4.5 feet, August 14, 1990.

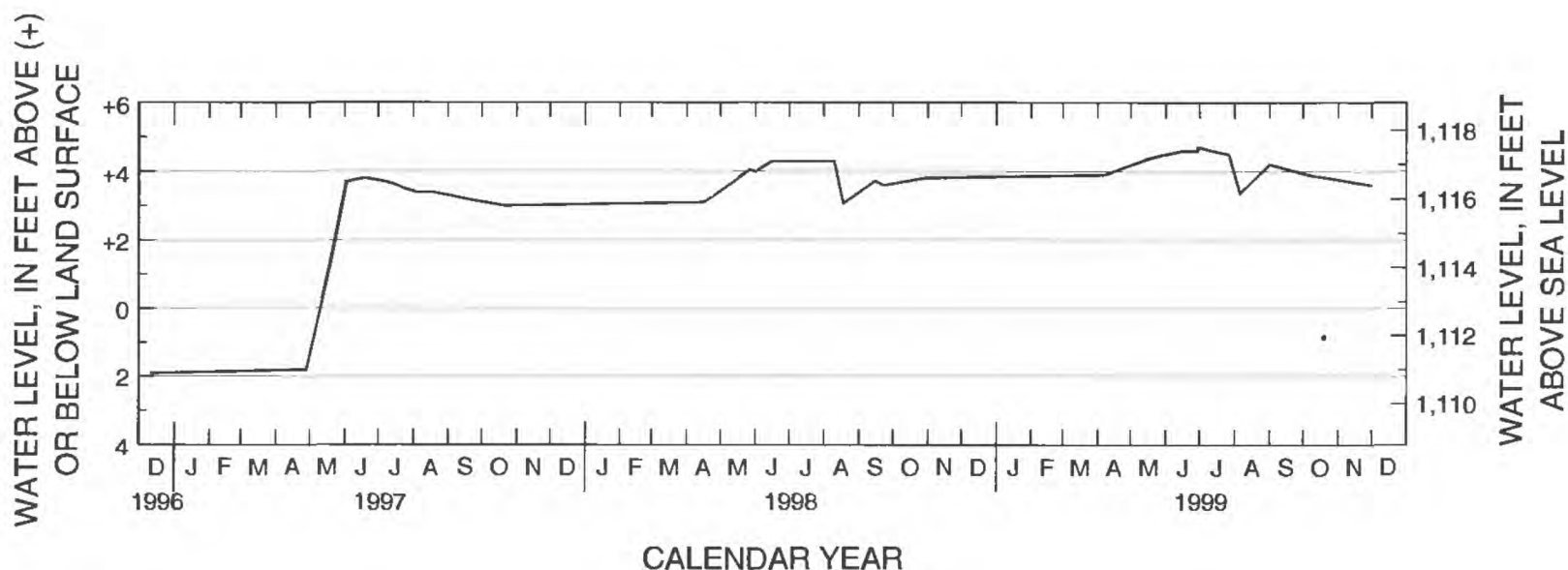


Figure B130. Hydrograph for observation well 128N50W21CCCC R (site number 130).

Site number from location map: 131
 Local well number: 128N50W25AAAB2 R
 Station identification number: 455058096511802
 Other identifier: R2-97-26
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,095 feet
 Measuring point: 1.6 feet
 Extremes: October 22, 1997, to August 6, 1999: Highest, 21.78 feet, May 27, 1988 and April 6, 1999; lowest, 22.21 feet, October 22, 1997.

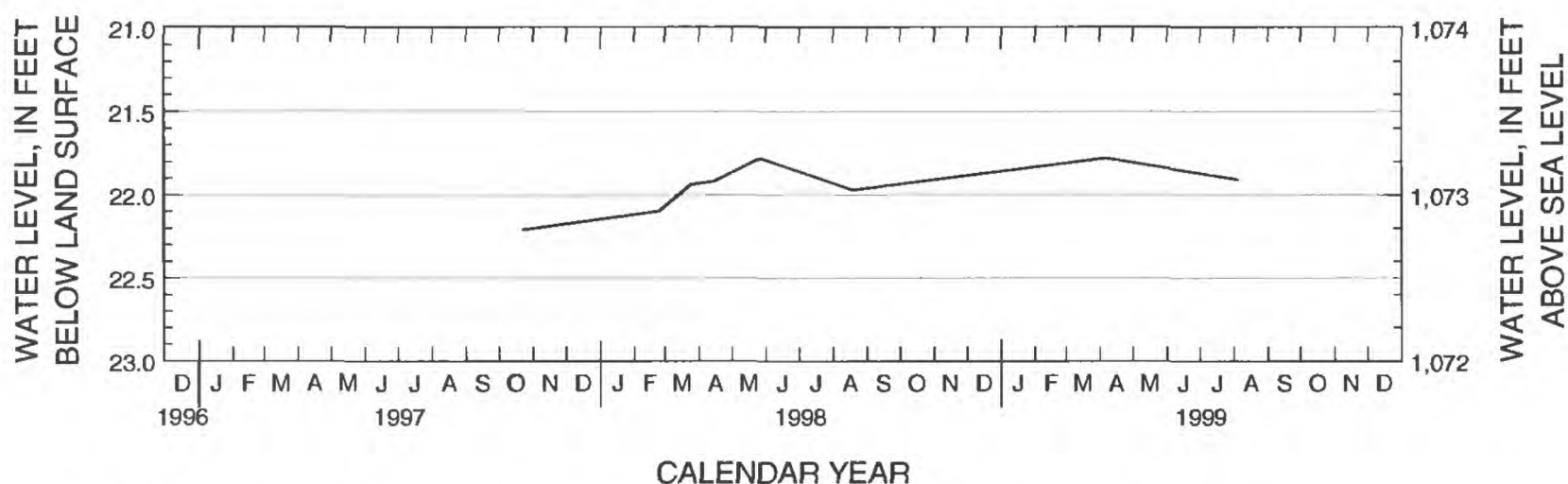


Figure B131. Hydrograph for observation well 128N50W25AAAB2 R (site number 131).

Site number from location map: 132
 Local well number: 128N50W25AAAB3 R
 Station identification number: 455058096511803
 Other identifier: R2-97-27
 County: Roberts, South Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,095 feet
 Measuring point: 2.1 feet
 Extremes: October 22, 1997, to August 6, 1999: Highest, 9.69 feet, May 27, 1998; lowest, 12.08 feet, August 6, 1999.

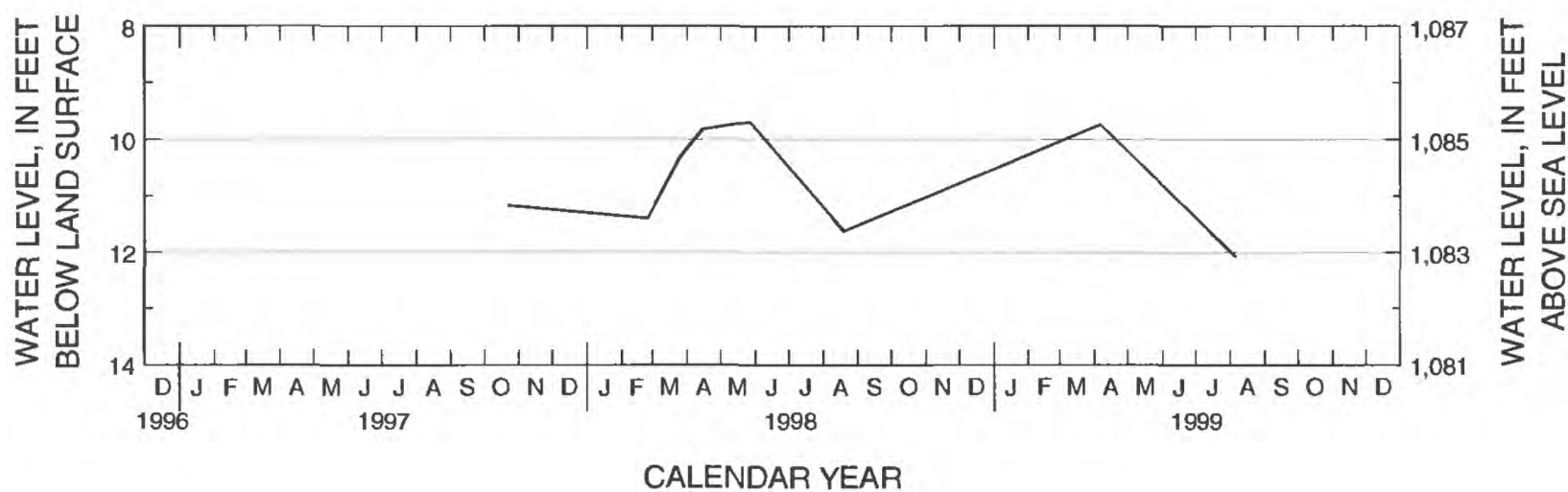


Figure B132. Hydrograph for observation well 128N50W25AAAB3 R (site number 132).

Site number from location map: 133
 Local well number: 128N51W23AABA R
 Station identification number: 455148097001401
 Other identifier: LTR-4
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,210.0 feet
 Measuring point: 2.25 feet
 Extremes: December 12, 1996, to August 6, 1999: Highest, 50.23 feet, August 6, 1999; lowest, 53.64 feet, December 10, 1996.

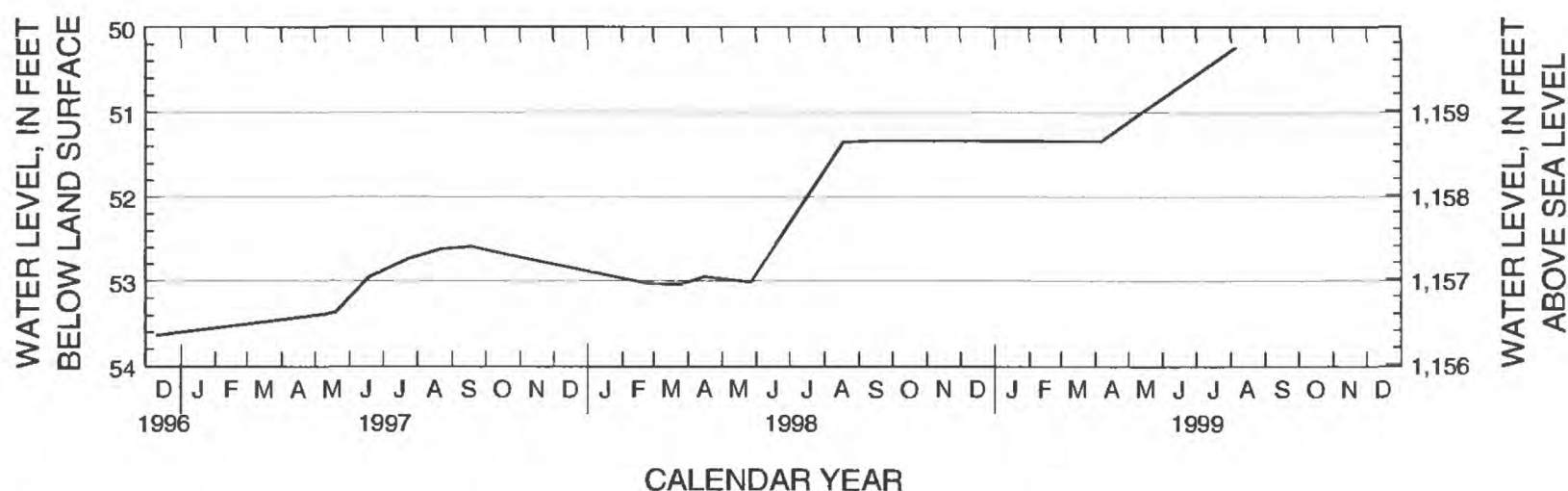


Figure B133. Hydrograph for observation well 128N51W23AABA R (site number 133).

Site number from location map: 134
 Local well number: 128N51W26BBB2 R
 Station identification number: 455608097010801
 Other identifier: 12276B
 County: Richland, North Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,198.7 feet
 Measuring point: 2.0 feet
 Extremes: March 10, 1997, to August 5, 1998: Highest, 30.24 feet, August 5, 1999; lowest, 37.39 feet, March 10, 1997.

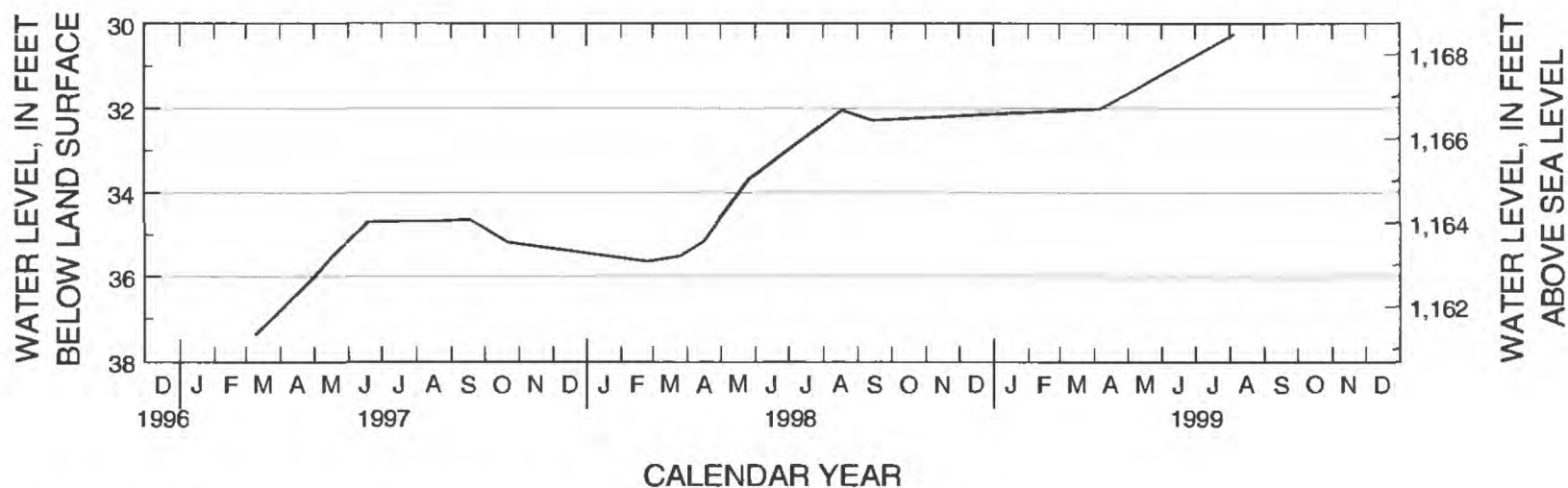


Figure B134. Hydrograph for observation well 128N51W26BBB2 R (site number 134).

Site number from location map: 135
 Local well number: 128N52W1DDDD2 R
 Station identification number: 455335097061501
 Other identifier: R2-97-18
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,205 feet
 Measuring point: 2.3 feet
 Extremes: October 22, 1997, to August 6, 1999: Highest, 25.43 feet, August 6, 1999; lowest, 29.84 feet, February 25 and March 25, 1998.

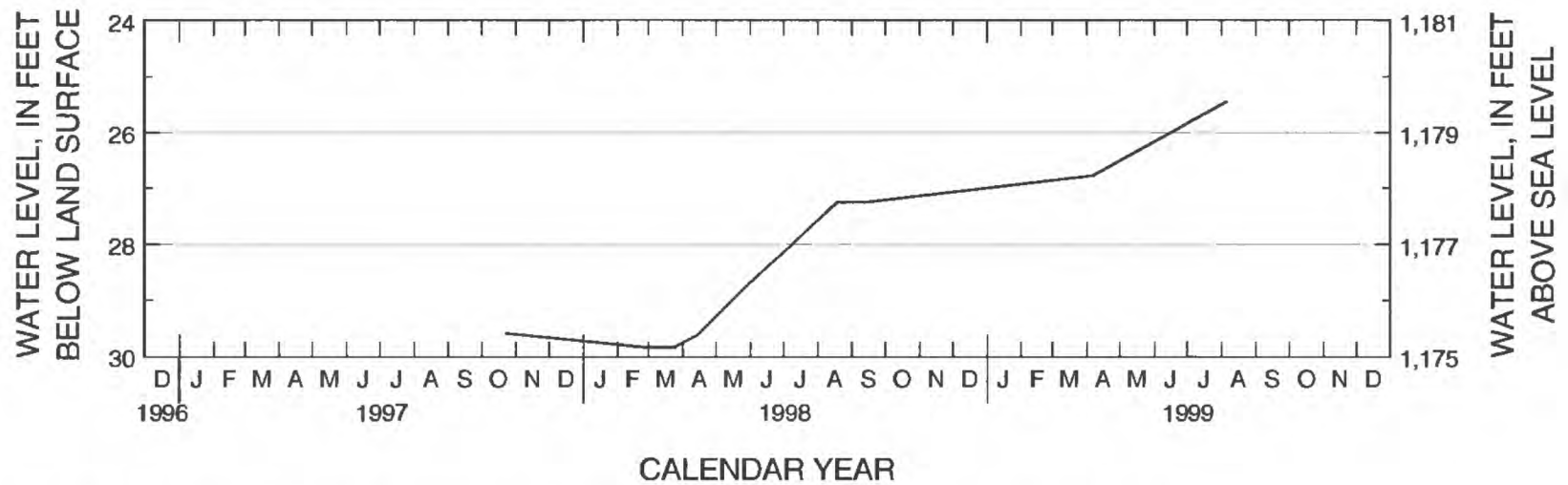


Figure B135. Hydrograph for observation well 128N52W1DDDD2 R (site number 135).

Site number from location map: 136
 Local well number: 128N52W3CCCB2 R
 Station identification number: 455337097095502
 Other identifier: R2-97-17
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,201 feet
 Measuring point: 2.3 feet
 Extremes: October 22, 1997, to August 6, 1999: Highest, 12.42 feet, August 6, 1999; lowest, 16.20 feet, August 18, 1998.

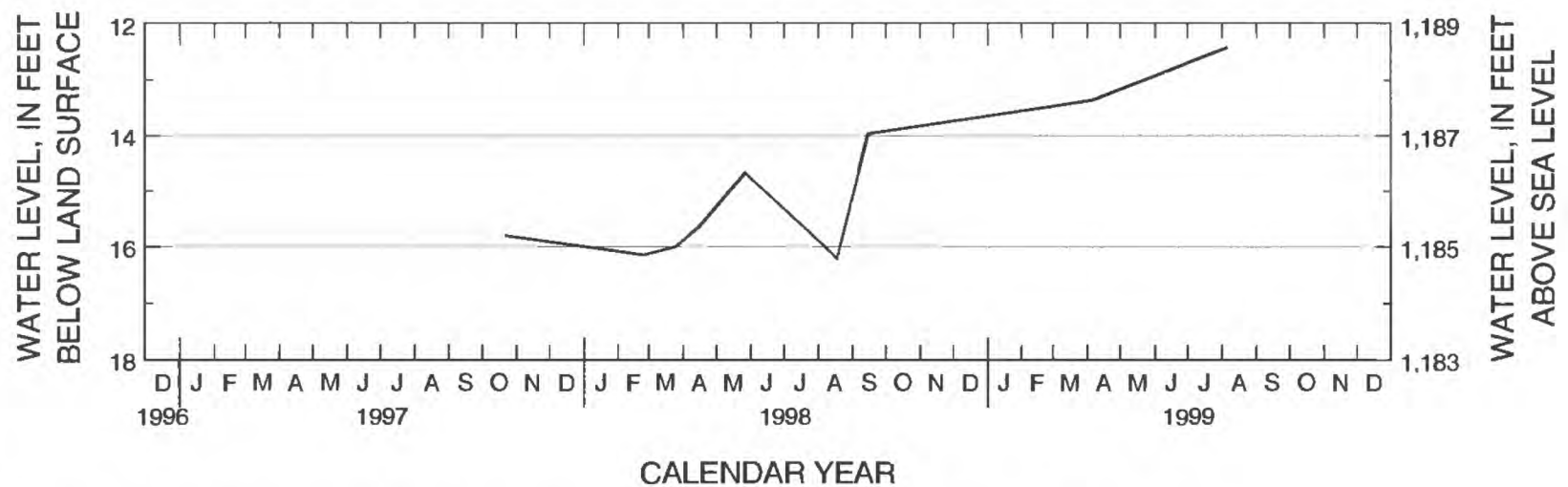


Figure B136. Hydrograph for observation well 128N52W3CCCB2 R (site number 136).

Site number from location map: 137
Local well number: 128N52W25AAAB2 R
Station identification number: 455053097061702
Other identifier: R2-95-10
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,188 feet
Measuring point: 2.0 feet
Extremes: April 28, 1997, to August 6, 1999: Highest, 13.62 feet, August 6, 1999; lowest, 17.9 feet, April 28, 1997.

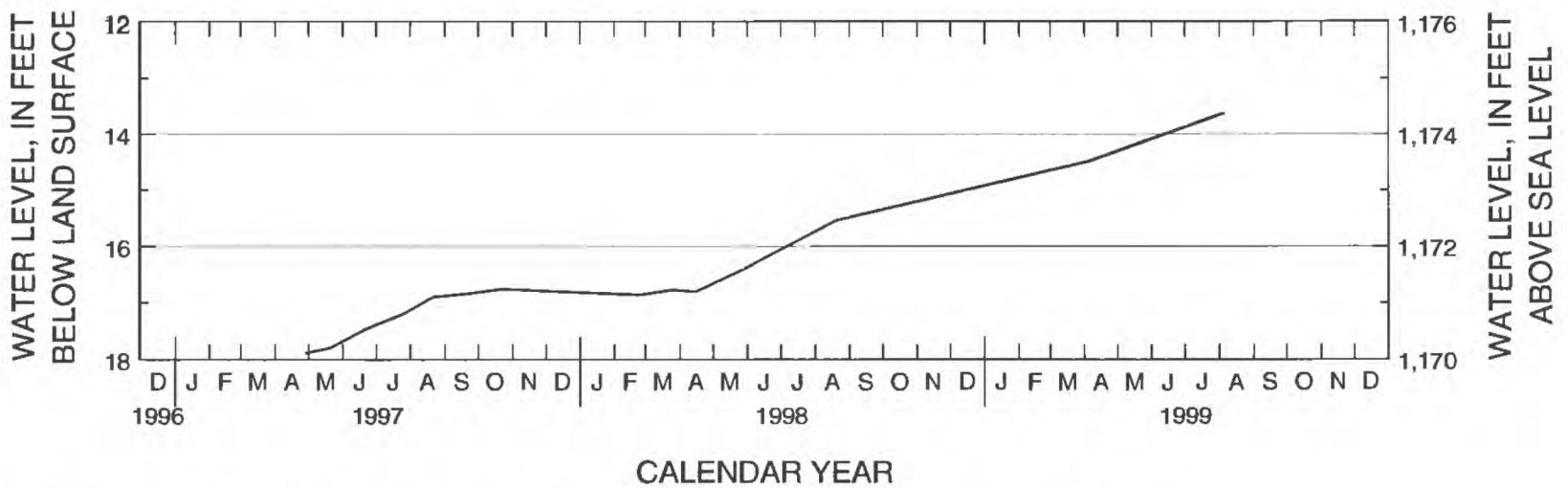


Figure B137. Hydrograph for observation well 128N52W25AAAB2 R (site number 137).

Site number from location map: 138
Local well number: 128N52W25AAAB R
Station identification number: 455053097061701
Other identifier: R2-95-09
County: Roberts, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,188 feet
Measuring point: 2.5 feet
Extremes: December 12, 1996, to August 6, 1999: Highest, 13.82 feet, August 6, 1999; lowest, 18.07 feet, December 12, 1996.

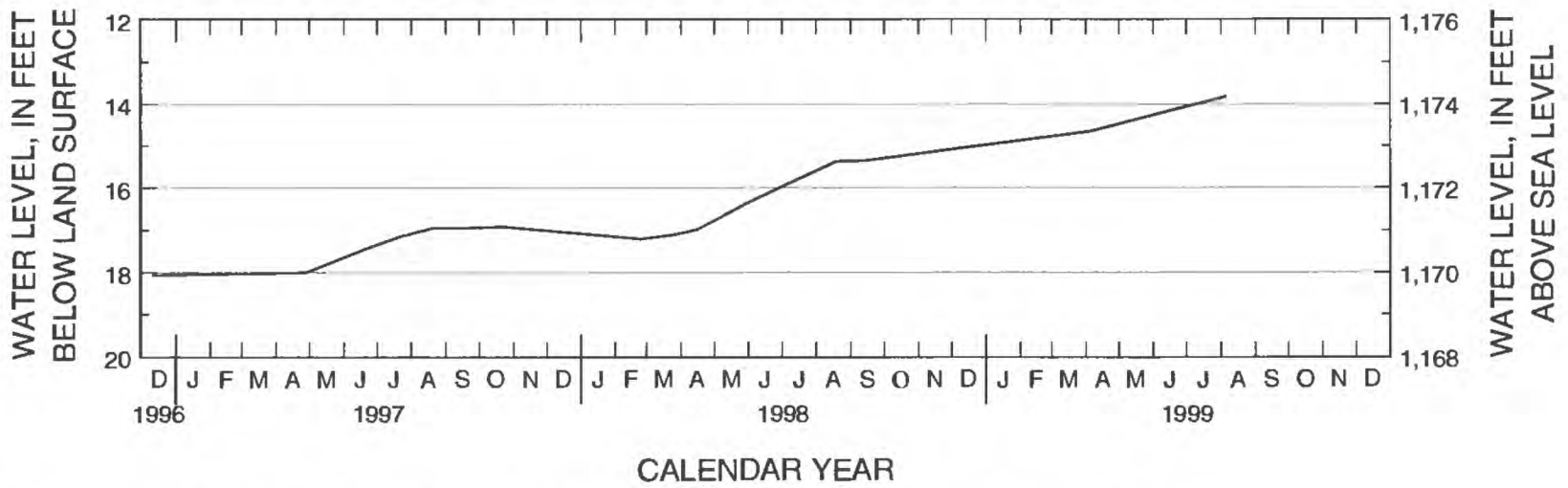


Figure B138. Hydrograph for observation well 128N52W25AAAB R (site number 138).

Site number from location map: 139
 Local well number: 128N52W27BBBC R
 Station identification number: 455049097095501
 Other identifier: R2-97-20
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,212 feet
 Measuring point: 2.5 feet
 Extremes: October 22, 1997, to August 6, 1999: Highest, 35.78 feet, August 6, 1999; lowest, 38.85 feet, March 25, 1998.

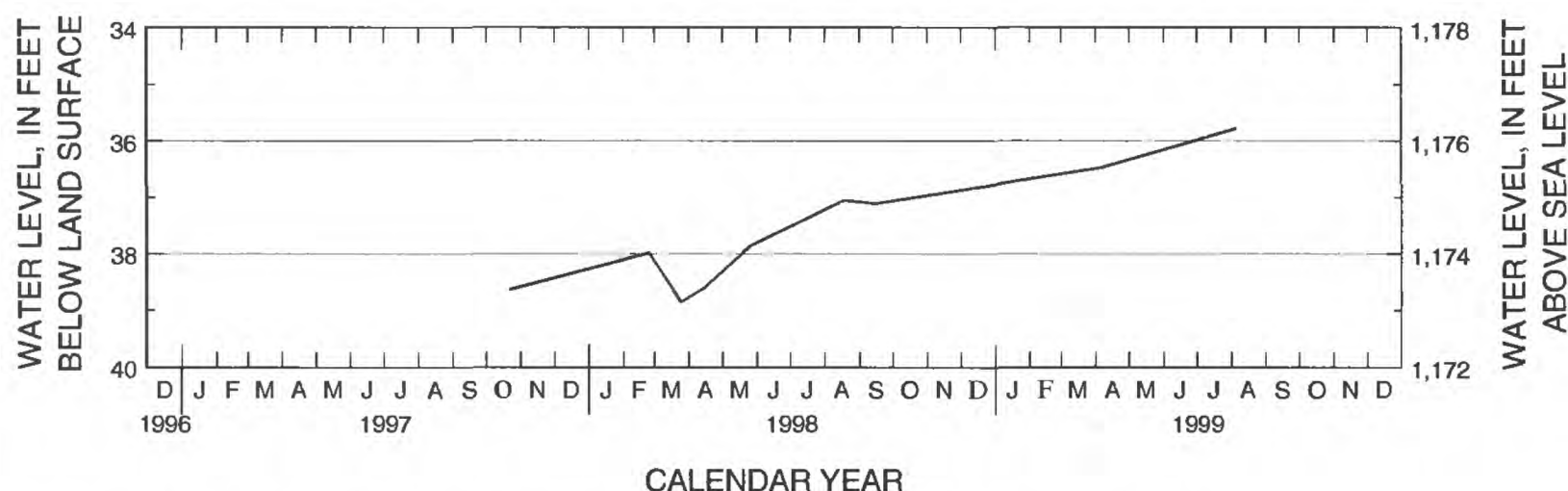


Figure B139. Hydrograph for observation well 128N52W27BBBC R (site number 139).

Site number from location map: 140
 Local well number: 128N53W10BBBBB R
 Station identification number: 455329097172501
 Other identifier: ML-69A
 County: Marshall, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,250 feet
 Measuring point: 2.3 feet
 Extremes: December 4, 1969, to October 6, 1999: Highest, 59.2 feet, October 6, 1999; lowest, 75.5 feet, August 2, 1977, September 7, 1977.

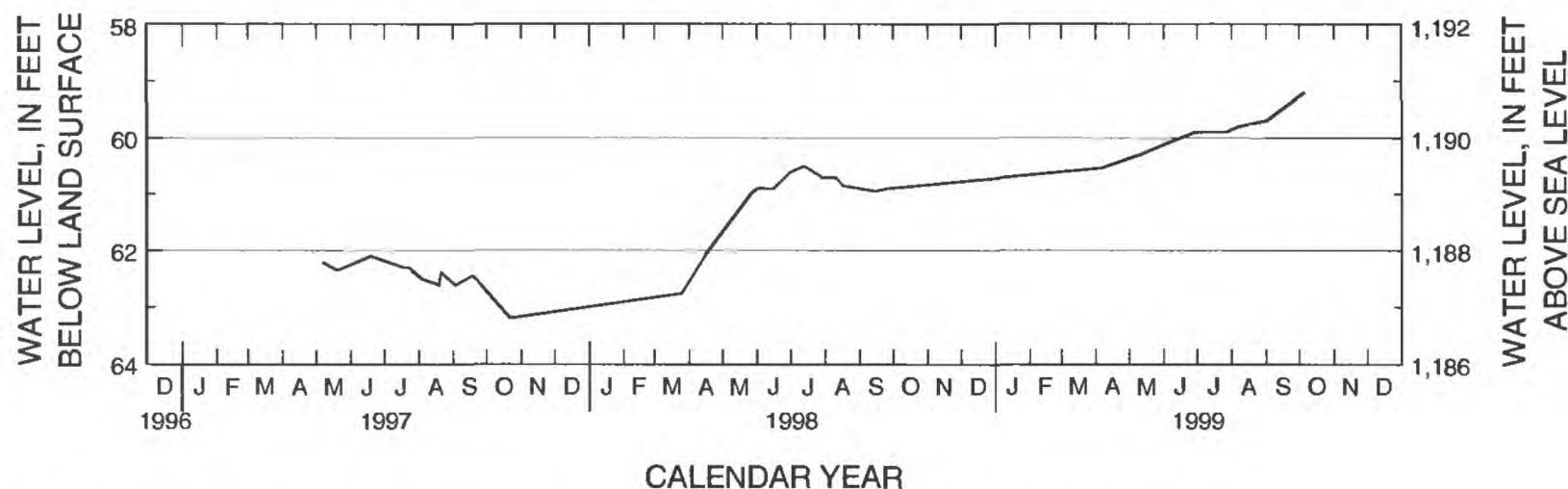


Figure B140. Hydrograph for observation well 128N53W10BBBBB R (site number 140).

Site number from location map: 141
 Local well number: 128N56W3BBBB
 Station identification number: 455606097322901
 Other identifier: ML-70C
 County: Marshall, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,352 feet
 Measuring point: 0.75 foot
 Extremes: June 7, 1977, to October 6, 1999: Highest, 35.49 feet, March 25, 1998; lowest, 42.9 feet, April 2, 1986.

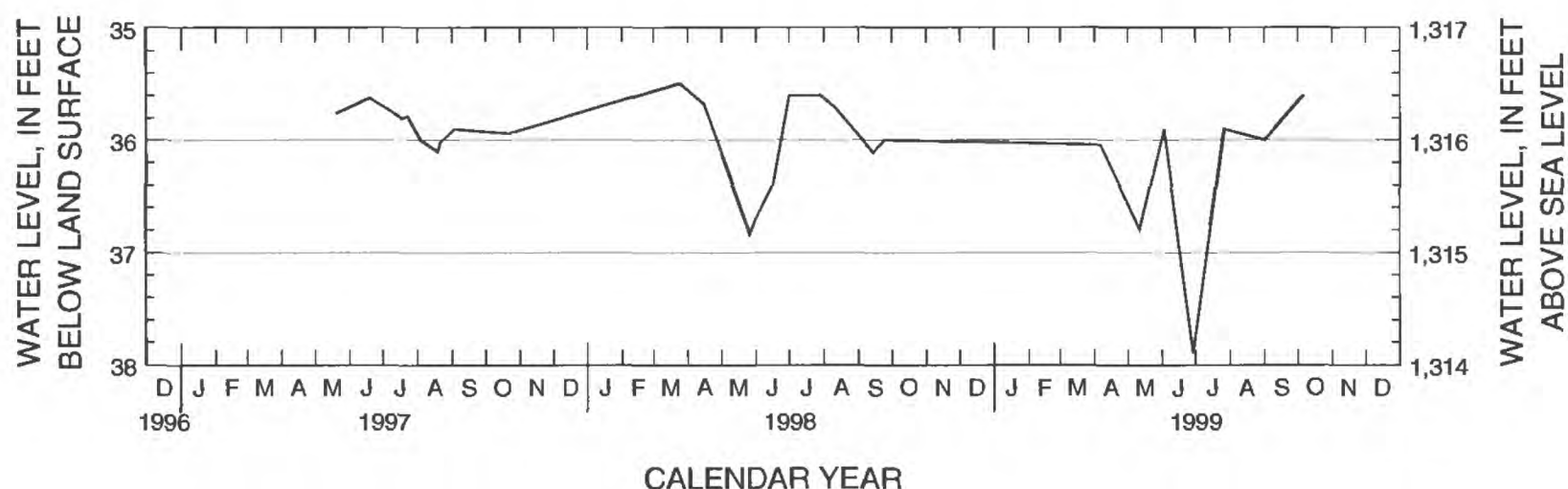


Figure B141. Hydrograph for observation well 128N56W3BBBB (site number 141).

Site number from location map: 142
 Local well number: 129N48W33ADDA R
 Station identification number: 455457096395201
 Other identifier: LTR-9
 County: Roberts, South Dakota
 Aquifer: Fairmount
 Altitude of land surface: 1,051.7 feet
 Measuring point: 1.9 feet
 Extremes: December 10, 1996, to August 6, 1999: Highest, 1.69 feet, April 6, 1999; lowest, 1.03 feet, February 24, 1998.

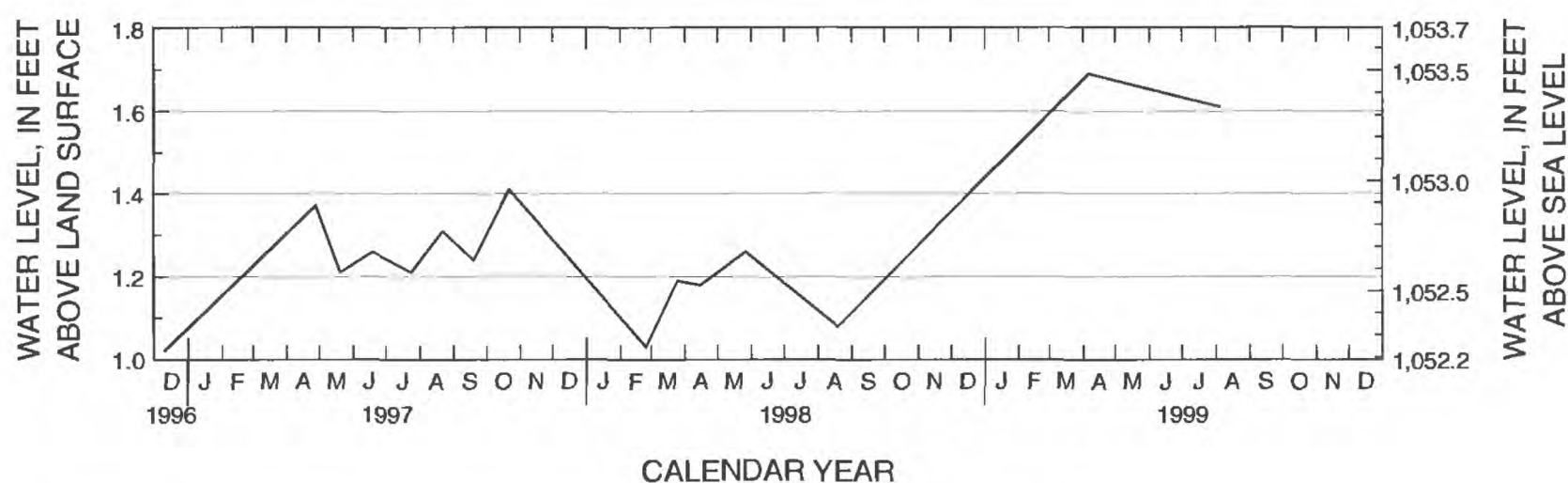


Figure B142. Hydrograph for observation well 129N48W33ADDA R (site number 142).

Site number from location map: 143
 Local well number: 129N50W24CCD R
 Station identification number: 455611096520101
 Other identifier: 12186A
 County: Richland, North Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,089.5 feet
 Measuring point: 1.1 feet
 Extremes: May 7, 1992, to April 6, 1999: Highest, 17.04 feet, June 6, 1996; lowest, 20.11 feet, November 10, 1992.

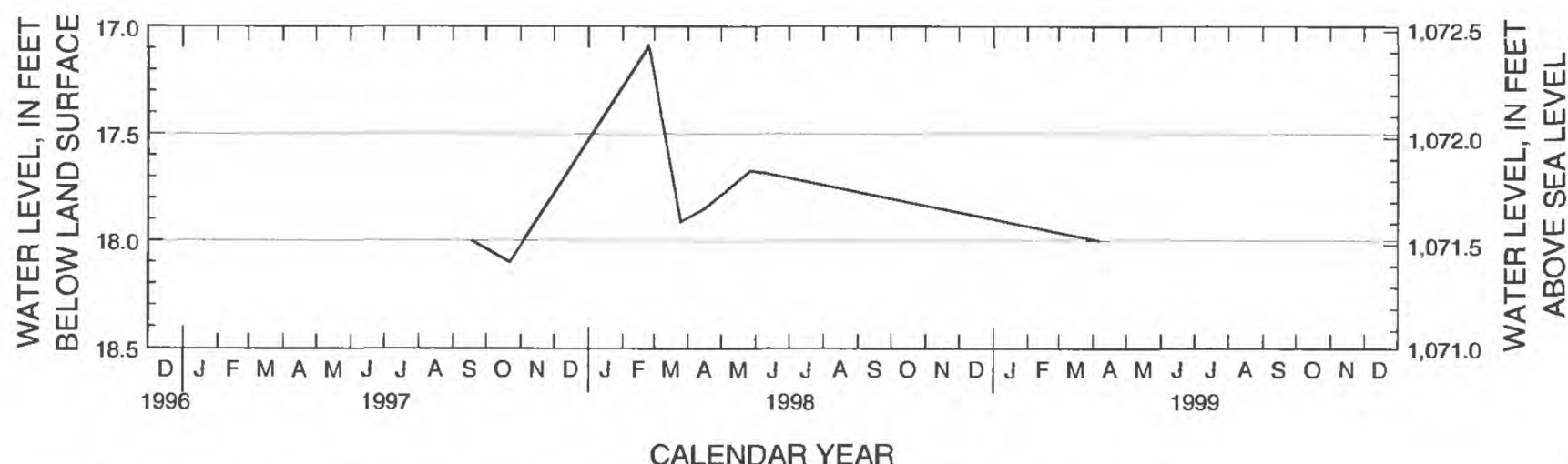


Figure B143. Hydrograph for observation well 129N50W24CCD1 R (site number 143).

Site number from location map: 144
 Local well number: 129N50W24CCD2 R
 Station identification number: 455611096520102
 Other identifier: 12186B
 County: Richland, North Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,089.5 feet
 Measuring point: 2.3 feet
 Extremes: May 7, 1992, to April 6, 1999: Highest, 16.91 feet, May 16, 1995, lowest; 21.66 feet, October 13, 1992.

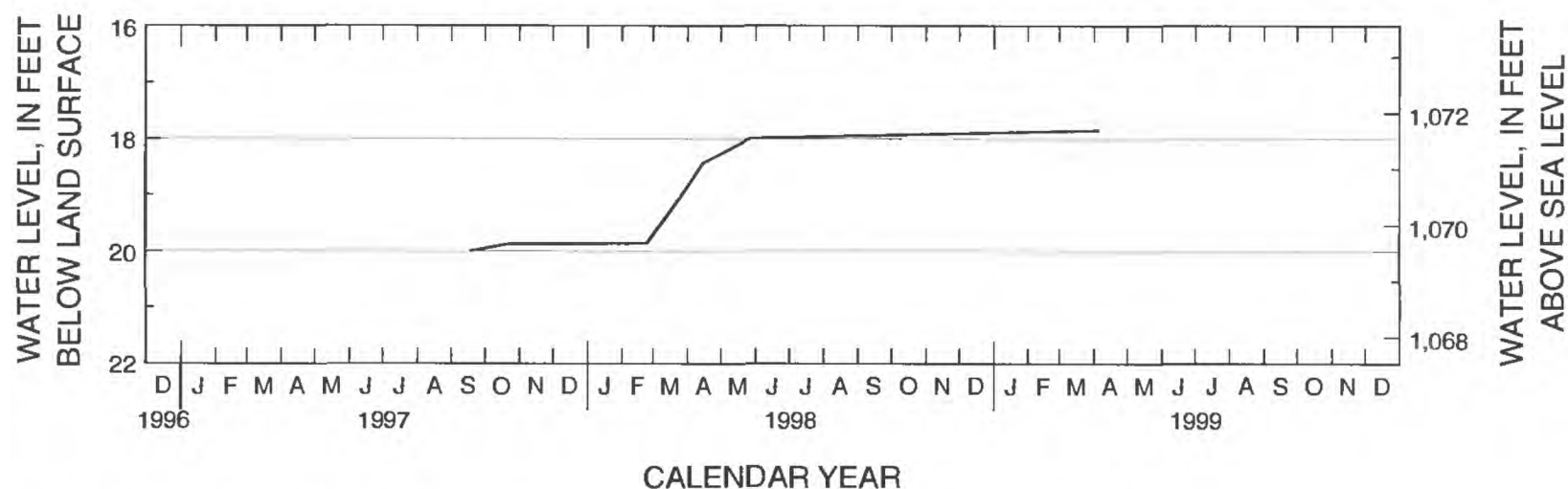


Figure B144. Hydrograph for observation well 129N50W24CCD2 R (site number 144).

Site number from location map: 145
 Local well number: 129N50W24CCD3 R
 Station identification number: 455611096520103
 Other identifier: 12186C
 County: Richland, North Dakota
 Aquifer: Rosholt
 Altitude of land surface: 1,089.5 feet
 Measuring point: 0.9 foot
 Extremes: May 7, 1992, to April 6, 1999: Highest, 15.39 feet, May 16, 1995; lowest, 20.42 feet, October 13, 1992.

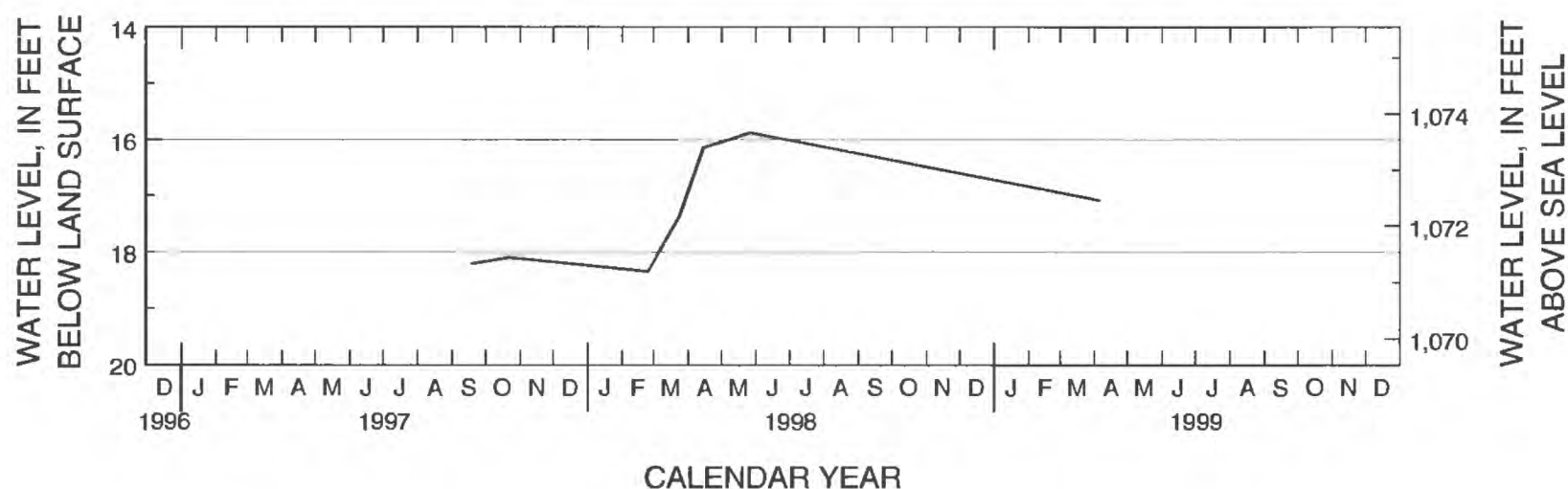


Figure B145. Hydrograph for observation well 129N50W24CCD3 R (site number 145).

Site number from location map: 146
 Local well number: 129N50W27BBBBB2 R
 Station identification number: 455607096545002
 Other identifier: R2-95-21
 County: Roberts, South Dakota
 Aquifer: Undetermined
 Altitude of land surface: 1,106 feet
 Measuring point: 2.19 feet
 Extremes: December 10, 1996, to April 6, 1999: Highest, 1.05 feet, April 6, 1999; lowest, 2.14 feet, December 10, 1996.

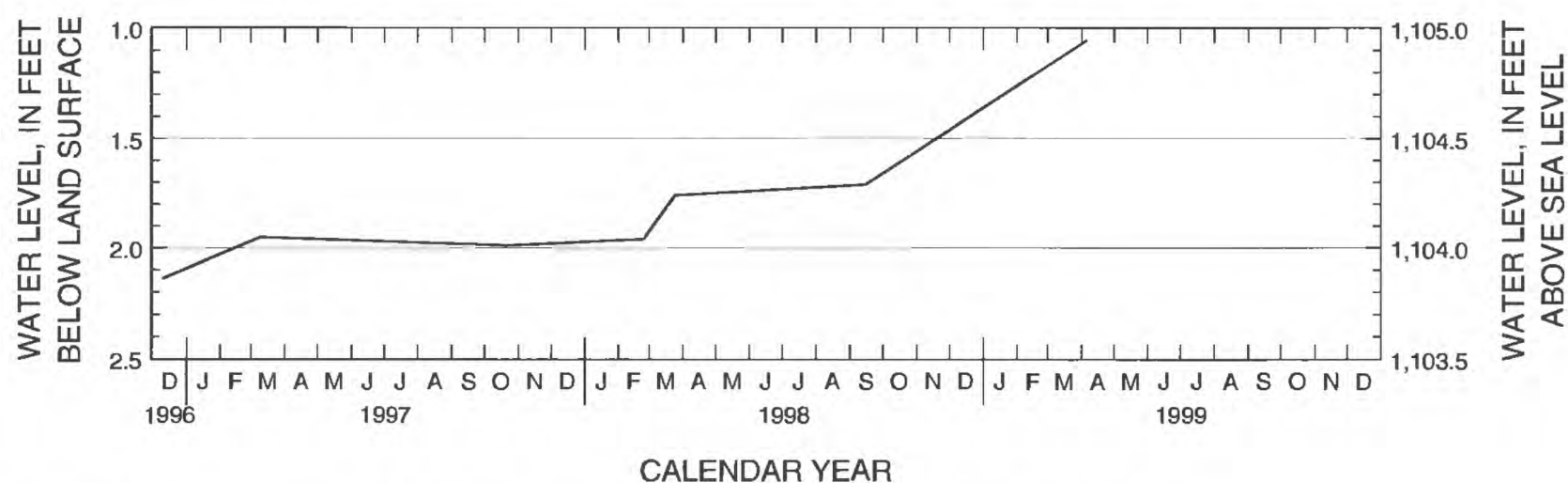


Figure B146. Hydrograph for observation well 129N50W27BBBBB2 R (site number 146).

Site number from location map: 147
 Local well number: 129N51W8CCC R
 Station identification number: 455755097045501
 Other identifier: 13037
 County: Richland, North Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,196.2 feet
 Measuring point: 1.5 feet
 Extremes: September 2, 1992, to August 5, 1999: Highest, 31.06 feet, August 5, 1999; lowest, 43.85 feet, November 10, 1992.

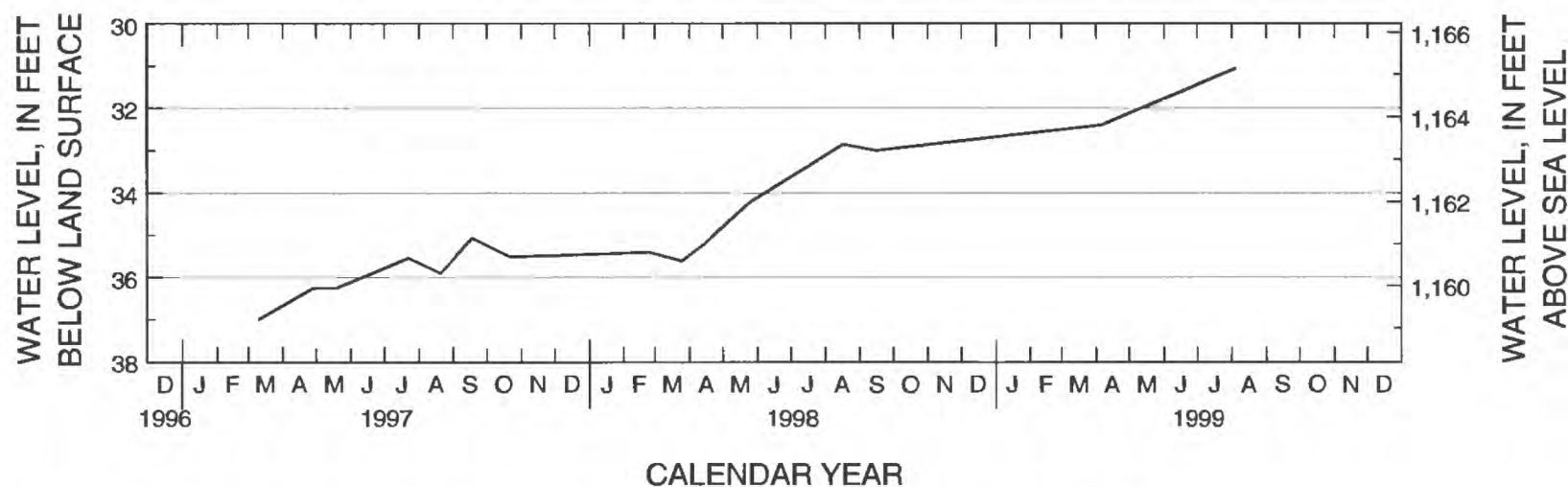


Figure B147. Hydrograph for observation well 129N51W8CCC R (site number 147).

Site number from location map: 148
 Local well number: 129N51W19ABA R
 Station identification number: 455701097051501
 Other identifier: 13422
 County: Richland, North Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,191.2 feet
 Measuring point: 1.7 feet
 Extremes: October 25, 1994, to August 5, 1999: Highest, 17.65 feet, August 5, 1999; lowest, 27.36 feet, December 14, 1994.

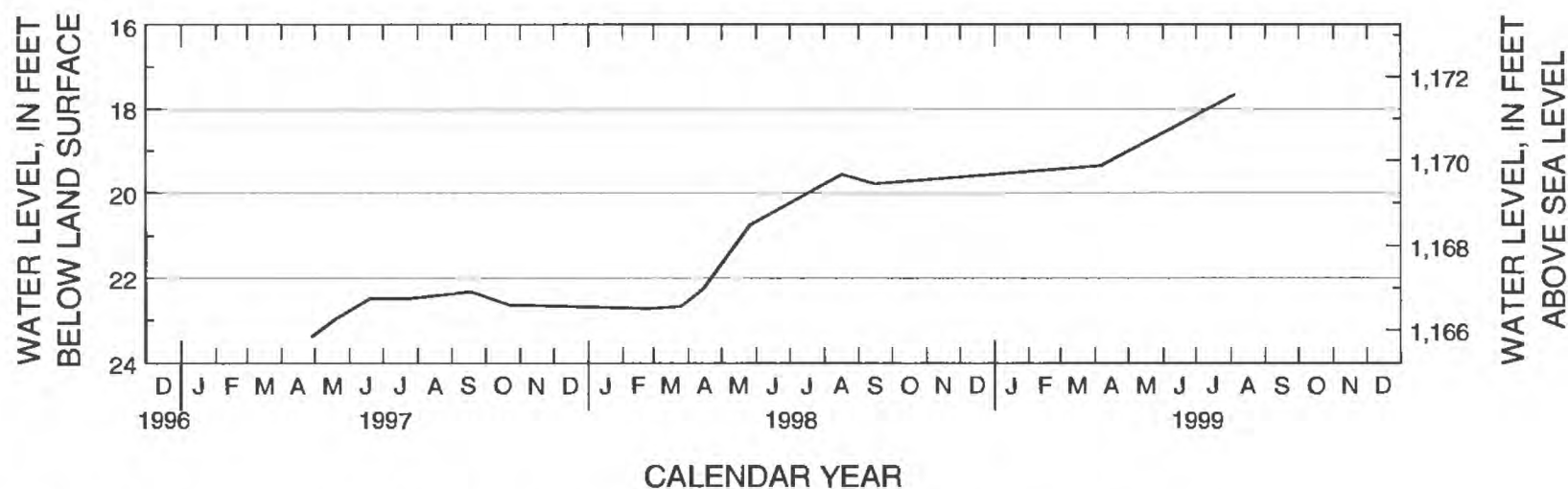


Figure B148. Hydrograph for observation well 129N51W19ABA R (site number 148).

Site number from location map: 149
 Local well number: 129N52W14AAA
 Station identification number: 455932097092401
 Other identifier: 13494
 County: Richland, North Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,220 feet
 Measuring point: 1.6 feet
 Extremes: November 21, 1995, to August 5, 1999: Highest, August 5, 1999; lowest 38.70 feet, November 21, 1995.

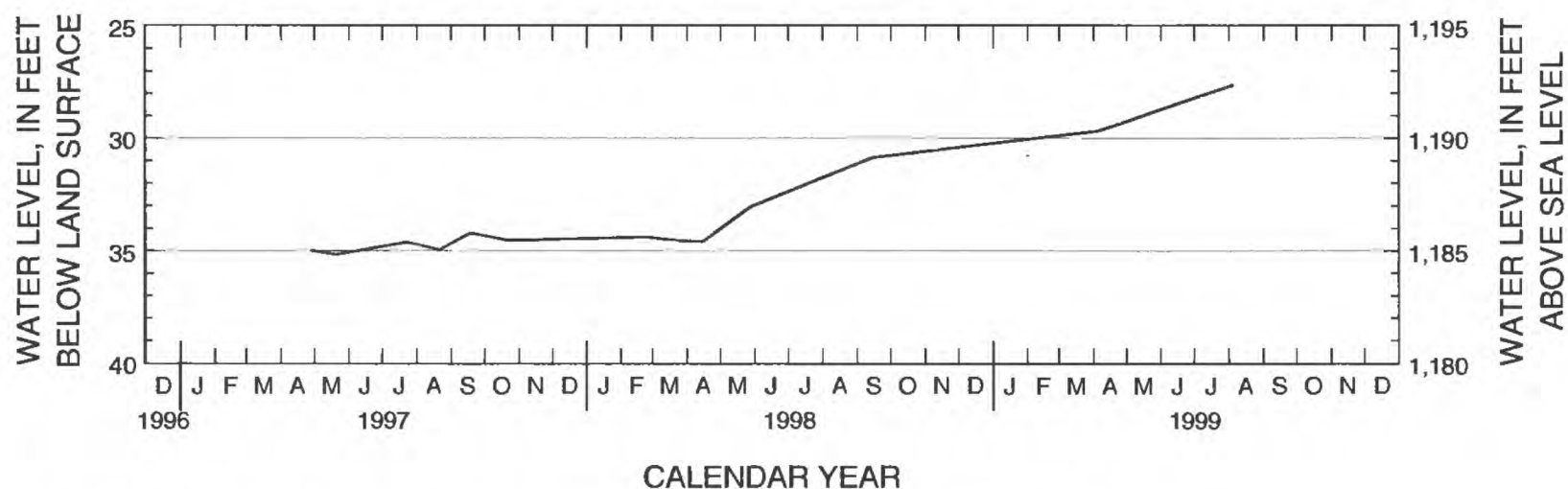


Figure B149. Hydrograph for observation well 129N52W14AAA (site number 149).

Site number from location map: 150
 Local well number: 129N52W21CCC R
 Station identification number: 455610097110901
 Other identifier: 12277
 County: Richland, North Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,221.2 feet
 Measuring point: 2.5 feet
 Extremes: July 17, 1991, to August 5, 1999: Highest, 35.86 feet, August 5, 1999; lowest, 42.97 feet, April 13, 1993.

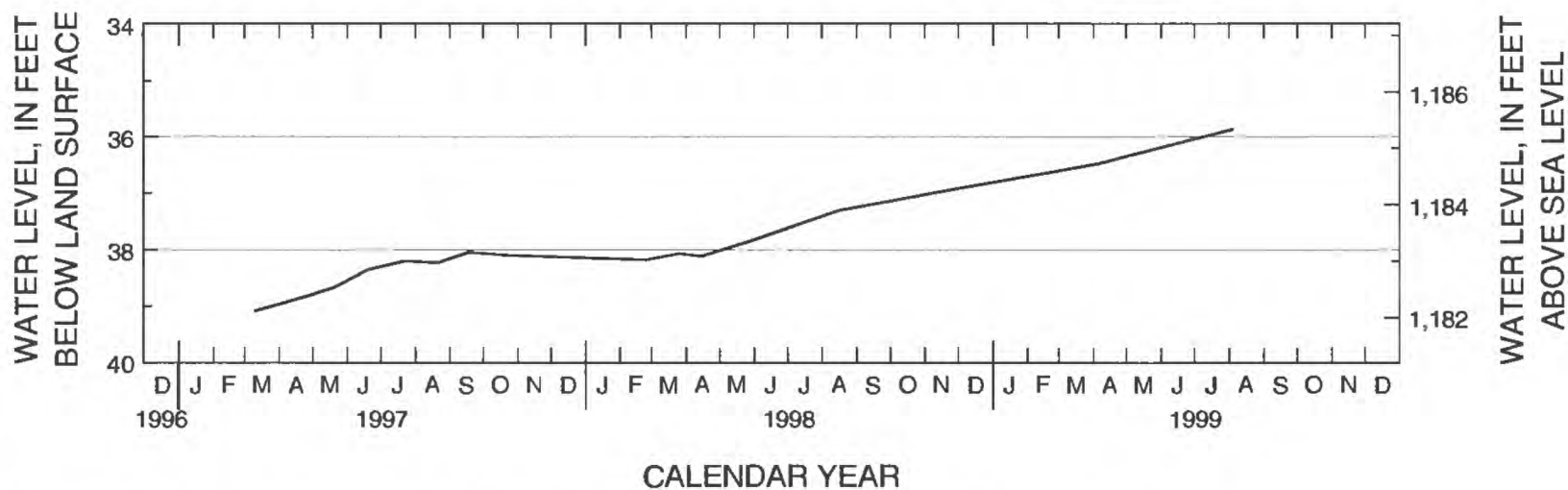


Figure B150. Hydrograph for observation well 129N52W21CCC R (site number 150).

Site number from location map: 151
 Local well number: 129N52W25AAAB2 R
 Station identification number: 455608097061702
 Other identifier: R2-95-13
 County: Roberts, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,196 feet
 Measuring point: 2.4 feet
 Extremes: December 10, 1996, to August 5, 1999: Highest, 17.54 feet, August 5, 1999: lowest, 24.24 feet, March 10, 1997.

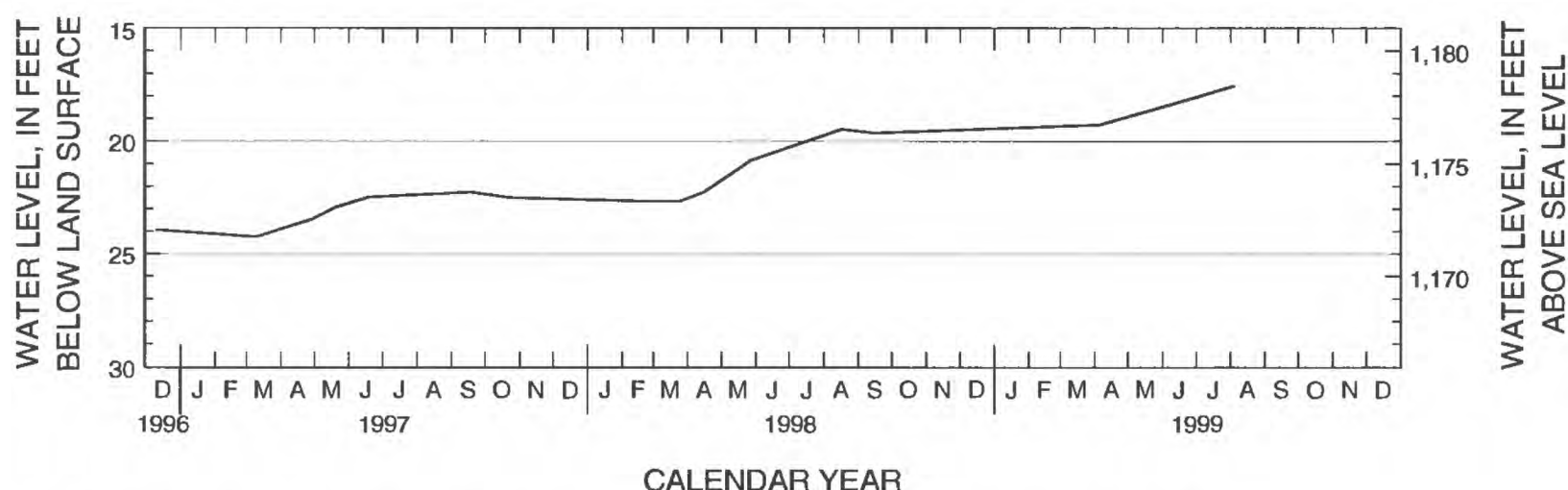


Figure B151. Hydrograph for observation well 129N52W25AAAB2 R (site number 151).

Site number from location map: 152
 Local well number: 129N53W7BBA R
 Station identification number: 455842097210301
 Other identifier: 9248
 County: Sargent, North Dakota
 Aquifer: Spiritwood
 Altitude of land surface: 1,171 feet
 Measuring point: 1.8 feet
 Extremes: March 10, 1997, to August 5, 1999: Highest, 32.54 feet, April 6, 1999; lowest, 34.46 feet, August 17, 1998.

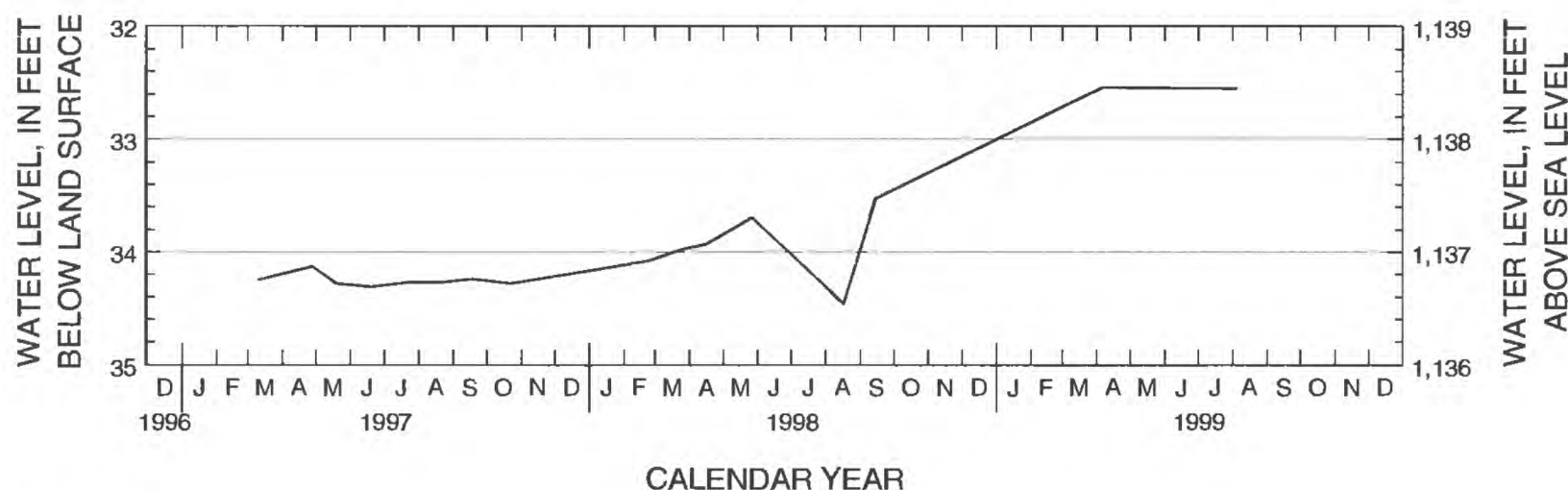


Figure B152. Hydrograph for observation well 129N53W7BBA R (site number 152).

Site number from location map: 153
Local well number: 129N53W9AAA R
Station identification number: 455842097173701
Other identifier: 9249
County: Sargent, North Dakota
Aquifer: Spiritwood
Altitude of land surface: 1,170 feet
Measuring point: 1.2 feet
Extremes: March 10, 1997, to August 5, 1999: Highest, 29.76 feet, August 5, 1999; lowest, 31.88 feet, June 19, 1997.

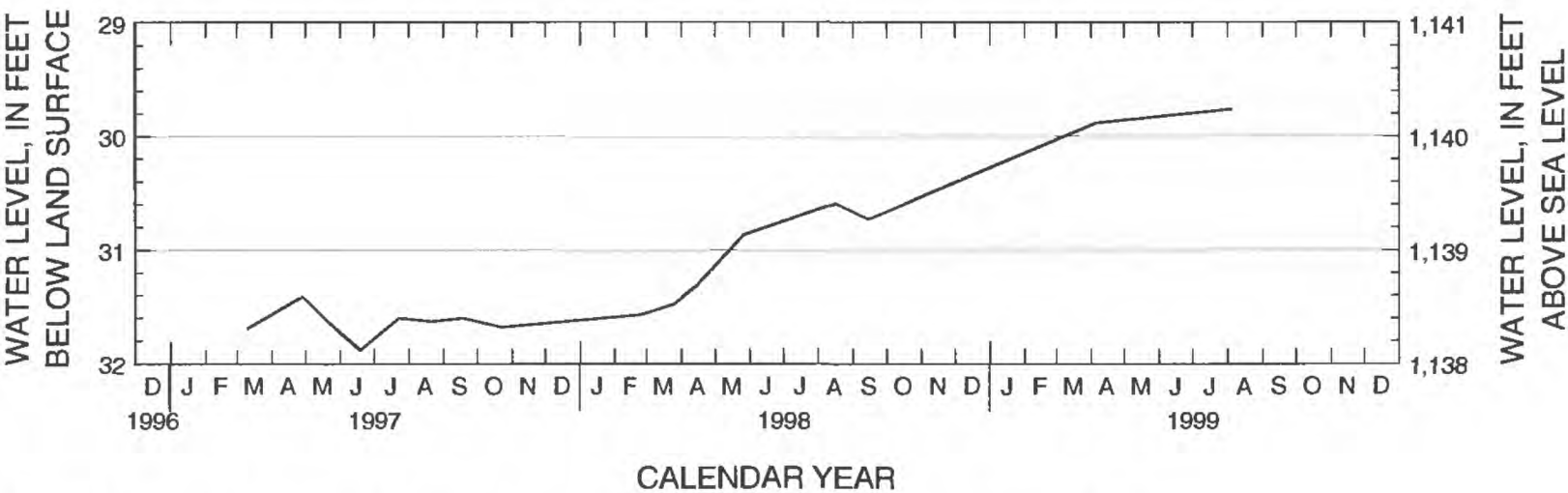


Figure B153. Hydrograph for observation well 129N53W9AAA R (site number 153).

Site number from location map: 154
Local well number: 129N53W27BBBBB R
Station identification number: 455606097172501
Other identifier: ML-70A
County: Marshall, South Dakota
Aquifer: Veblen
Altitude of land surface: 1,255 feet
Measuring point: 2.6 feet
Extremes: June 7, 1977, to October 6, 1999: Highest, 63.2 feet, October 6, 1999; lowest, 79.6 feet, August 19, 1983.

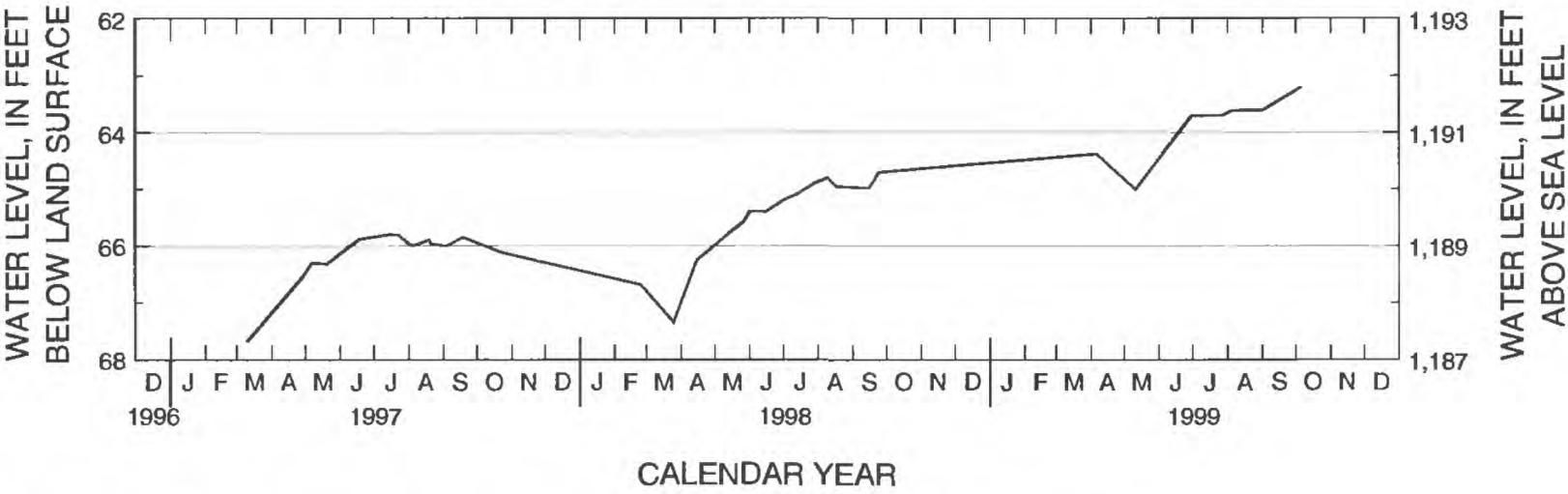


Figure B154. Hydrograph for observation well 129N53W27BBBBB R (site number 154).

Site number from location map: 155
 Local well number: 129N54W1AAA
 Station identification number: 460118097230501
 Other identifier: 13452
 County: Sargent, North Dakota
 Aquifer: Spiritwood
 Altitude of land surface: 1,162 feet
 Measuring point: 2.1 feet
 Extremes: April 28, 1997, to April 6, 1999: Highest, 13.78 feet, April 6, 1999; lowest, 15.62 feet, July 23, 1997.

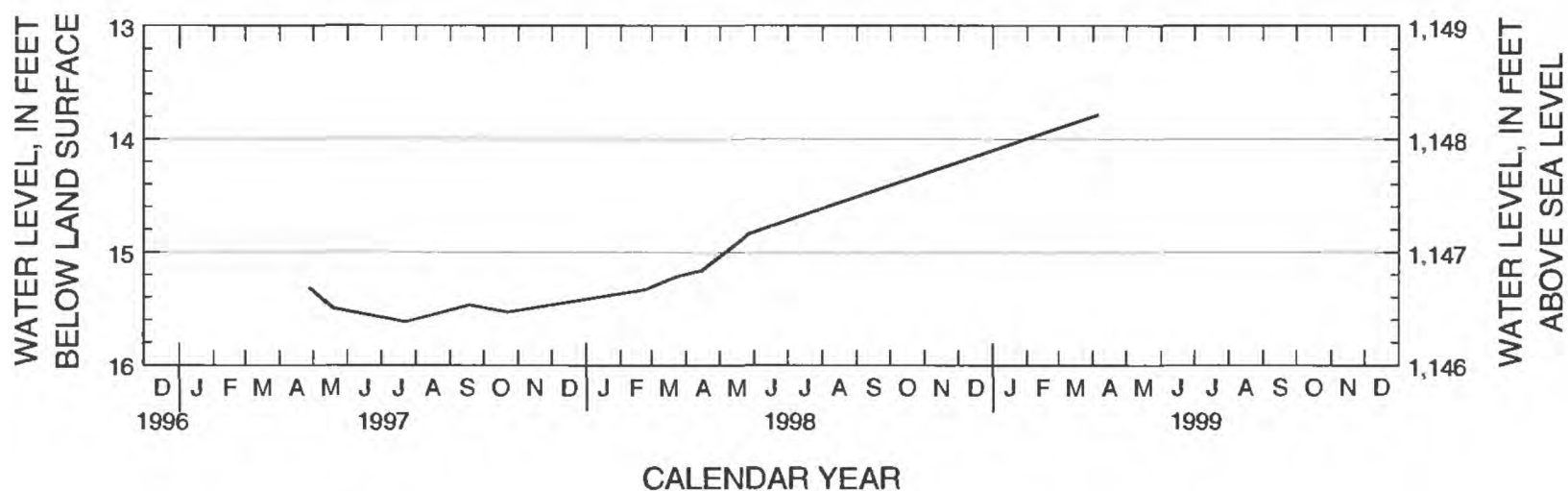


Figure B155. Hydrograph for observation well 129N54W1AAA (site number 155).

Site number from location map: 156
 Local well number: 129N54W1AAA2
 Station identification number: 460118097230502
 Other identifier: 13453
 County: Sargent, North Dakota
 Aquifer: Spiritwood
 Altitude of land surface: 1,162 feet
 Measuring point: 1.8 feet
 Extremes: April 28, 1997, to April 6, 1999: Highest, 13.58 feet, April 6, 1999; lowest, 15.34 feet, October 22, 1997.

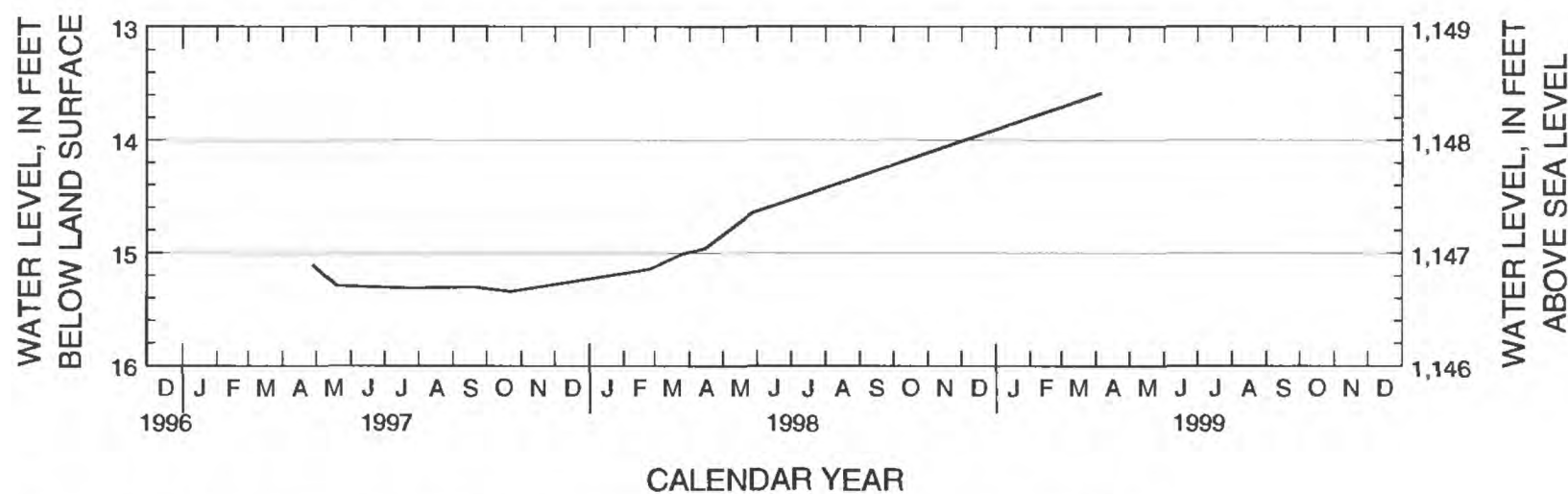


Figure B156. Hydrograph for observation well 129N54W1AAA2 (site number 156).

Site number from location map: 157
 Local well number: 129N54W3ADD R
 Station identification number: 455914097231801
 Other identifier: 12263
 County: Sargent, North Dakota
 Aquifer: Spiritwood
 Altitude of land surface: 1,186 feet
 Measuring point: 2.2 feet
 Extremes: March 10, 1997, to August 6, 1999: Highest, 47.15 feet, April 6, 1999: lowest, 49.65 feet, April 28, 1997.

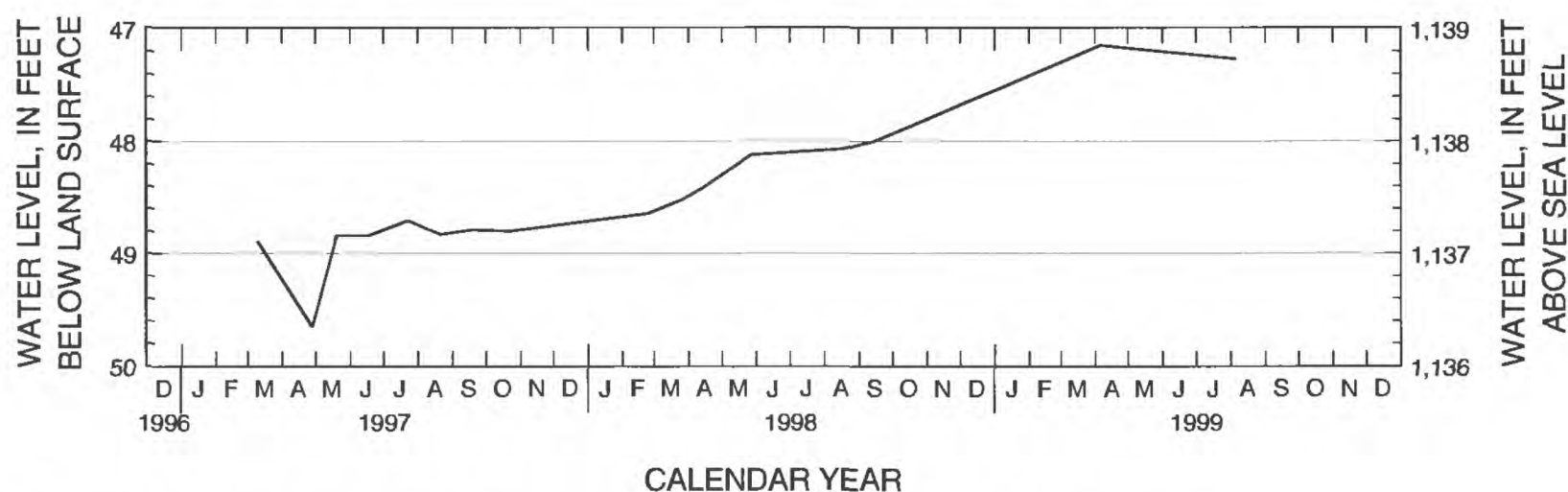


Figure B157. Hydrograph for observation well 129N54W3ADD R (site number 157).

Site number from location map: 158
 Local well number: 129N54W25AAAA R
 Station identification number: 455607097211501
 Other identifier: ML-70B
 County: Marshall, South Dakota
 Aquifer: Veblen
 Altitude of land surface: 1,260 feet
 Measuring point: 0.8 foot
 Extremes: June 7, 1977, to October 6, 1999: Highest, 70.4 feet, October 6, 1999; lowest, 88.3 feet, September 7, 1977.

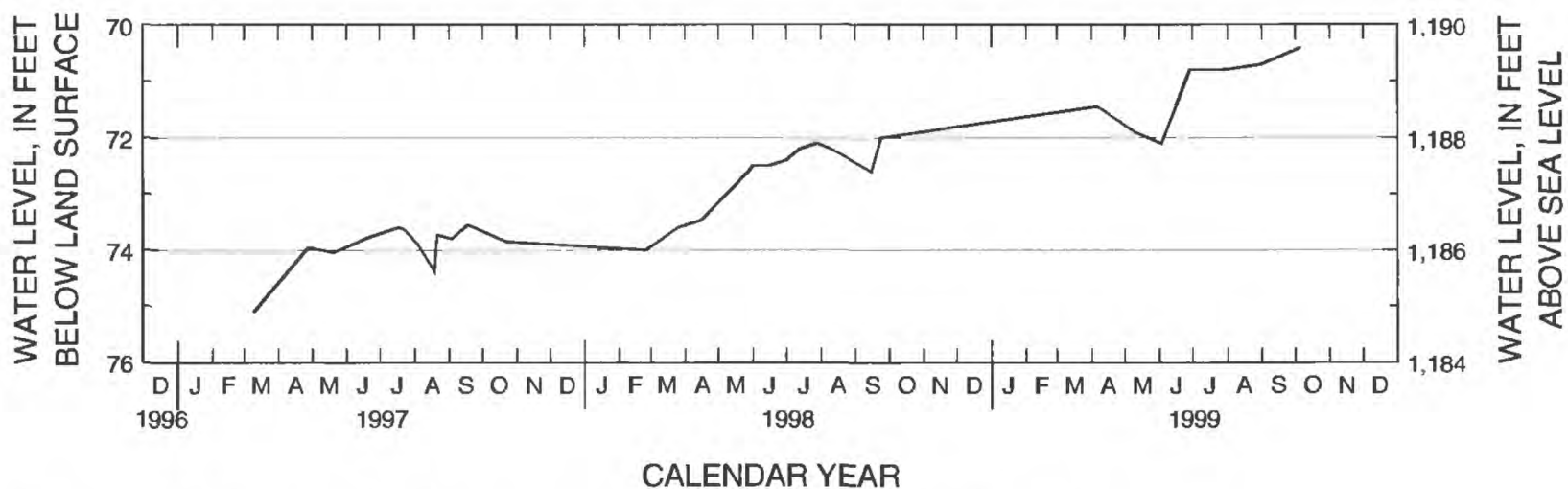


Figure B158. Hydrograph for observation well 129N54W25AAAA R (site number 158).

Site number from location map: 159
 Local well number: 130N53W4BAA
 Station identification number: 460117097195801
 Other identifier: 13447
 County: Sargent, North Dakota
 Aquifer: Spiritwood
 Altitude of land surface: 1,163 feet
 Measuring point: 1.5 feet
 Extremes: April 28, 1997, to April 6, 1999: Highest, 25.47 feet, April 6, 1999; lowest, 27.18 feet, September 18, 1997.

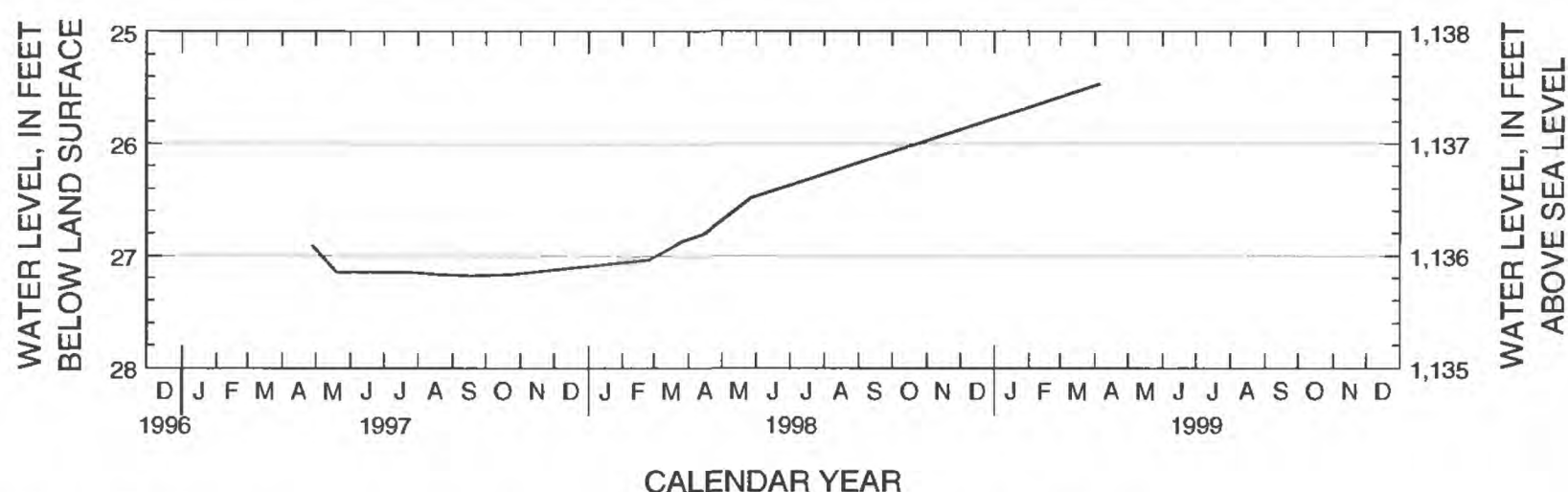


Figure B159. Hydrograph for observation well 130N53W4BAA (site number 159).

Site number from location map: 160
 Local well number: 130N53W4BAA2
 Station identification number: 460117097195802
 Other identifier: 13448
 County: Sargent, North Dakota
 Aquifer: Spiritwood
 Altitude of land surface: 1,163 feet
 Measuring point: 1.6 feet
 Extremes: April 28, 1997, to April 6, 1999: Highest, 25.06 feet, April 6, 1999; lowest, 26.78 feet, August 21, 1997.

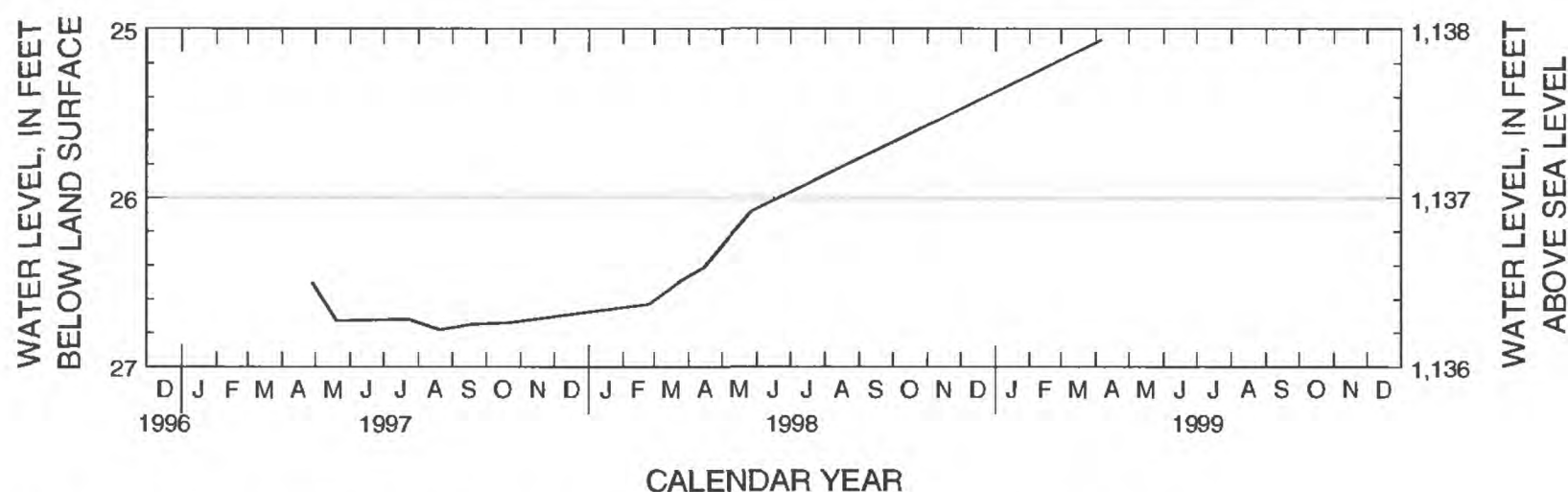


Figure B160. Hydrograph for observation well 130N53W4BAA2 (site number 160).

Site number from location map: 161
Local well number: 130N54W27CCC R
Station identification number: 460033097245701
Other identifier: 12261
County: Sargent, North Dakota
Aquifer: Spiritwood
Altitude of land surface: 1,180 feet
Measuring point: 2.1 feet
Extremes: March 10, 1997, to August 6, 1999: Highest, 34.69 feet, April 6, 1999; lowest, 36.64 feet, August 18, 1998.

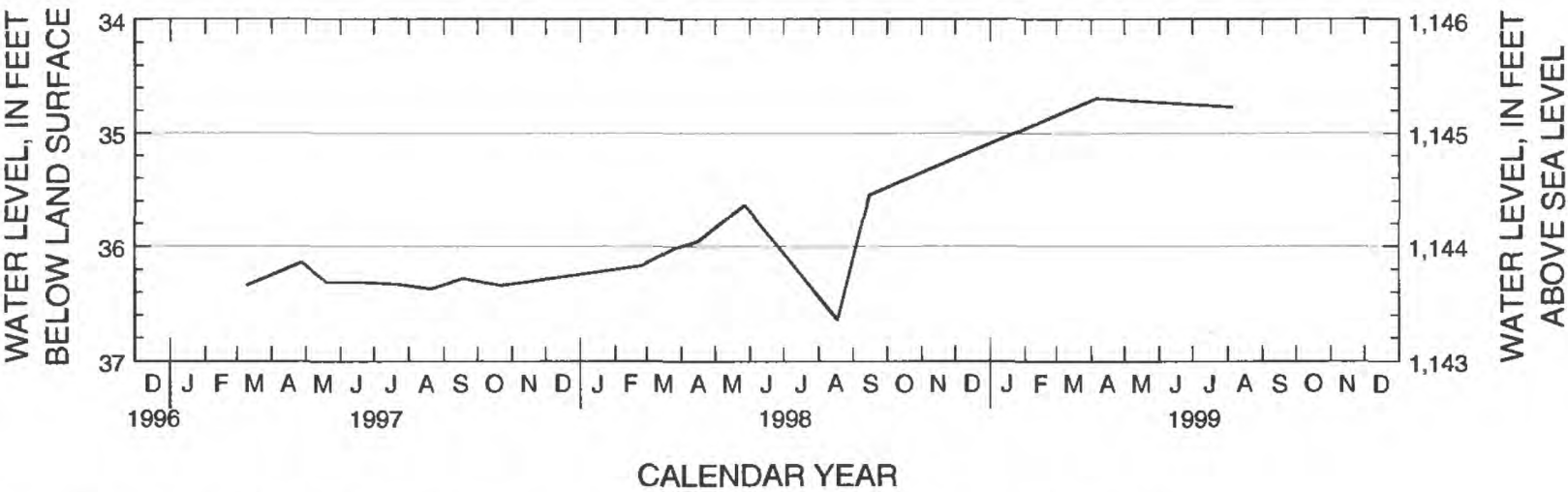


Figure B161. Hydrograph for observation well 130N54W27CCC R (site number 161).

Site number from location map: 162
Local well number: 130N54W33DDD R
Station identification number: 455909097245901
Other identifier: 12262
County: Sargent, North Dakota
Aquifer: Spiritwood
Altitude of land surface: 1,158 feet
Measuring point: 2.0 feet
Extremes: March 10, 1997, to August 6, 1999: Highest, 19.86 feet, April 6, 1999; lowest, 21.54 feet, June 19, 1997.

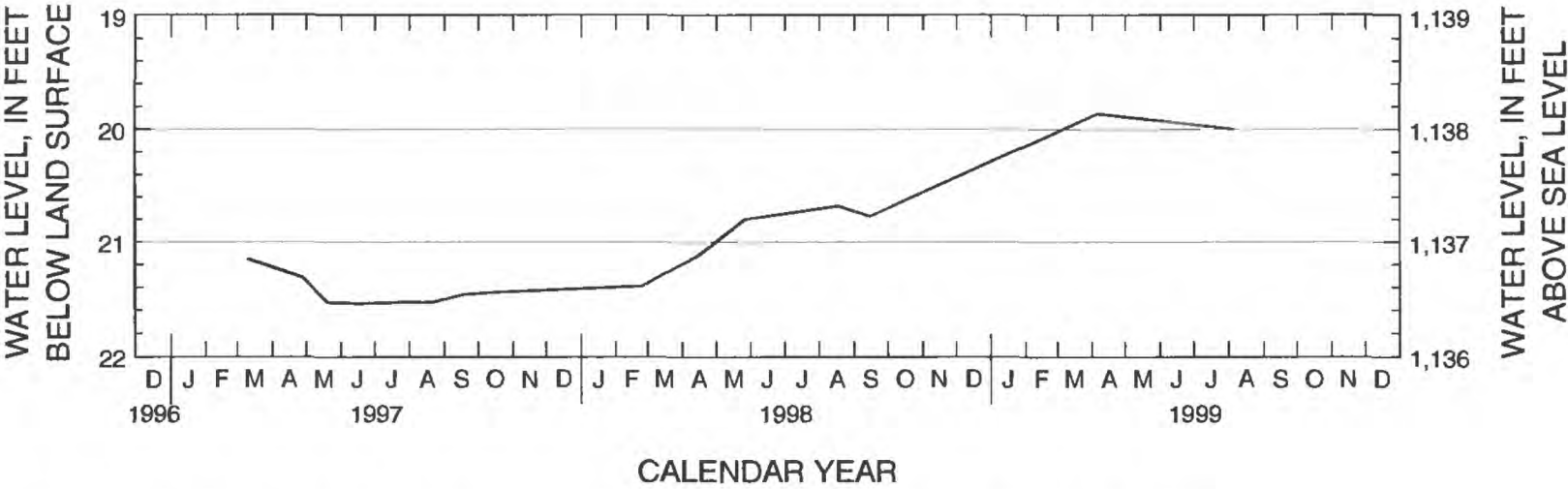


Figure B162. Hydrograph for observation well 130N54W33DDD R (site number 162).

Site number from location map: 163
Local well number: 130N54W35CCC R
Station identification number: 455941097234001
Other identifier: 9247

County: Sargent, North Dakota

Aquifer: Spiritwood

Altitude of land surface: 1,170 feet

Measuring point: 2.4 feet

Extremes: March 10, 1997, to August 5, 1999: Highest, 43.17 feet, August 5, 1999; lowest, 50.76 feet, March 10, 1997.

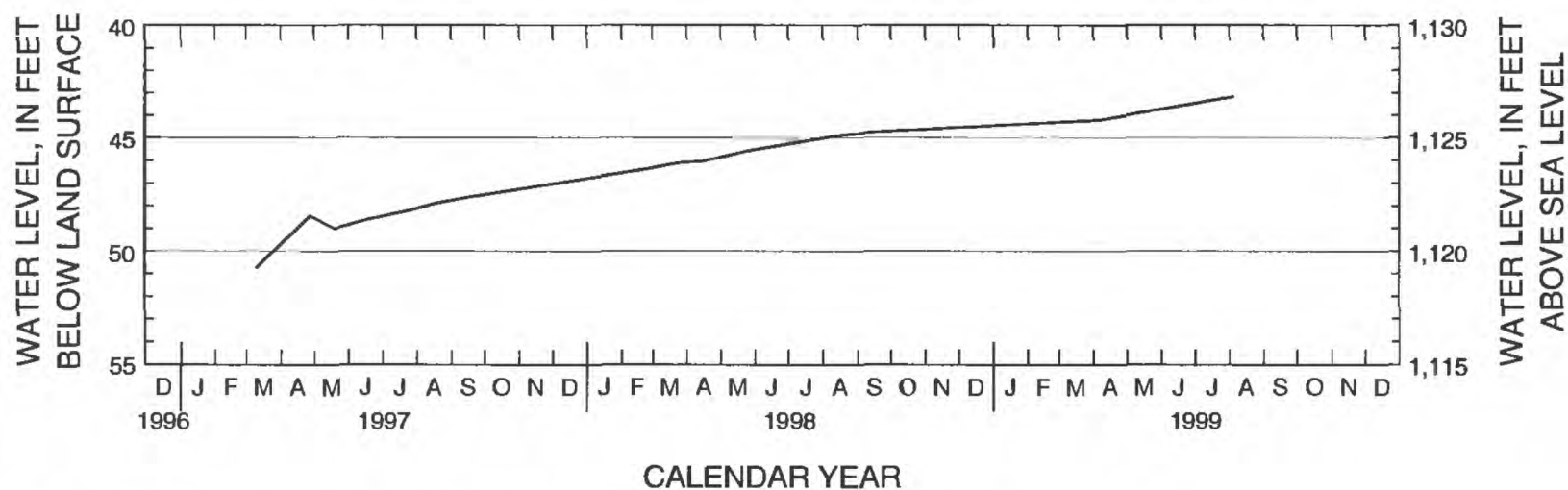


Figure B163. Hydrograph for observation well 130N54W35CCC R (site number 163).

Section C - Annual peak-flow information

Table C1. Annual peak-flow measurements for station 05050000, Bois de Sioux River near White Rock, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the maximum for the year. ft³/s, cubic feet per second]

Water year	Date	Peak discharge (ft ³ /s)	Discharge codes	Gage height (feet)	Gage-height codes	Highest since	Maximum gage height (feet)	Date	Gage-height codes
1997	04-20-97	8,750		16.90					
1998	03-08-98	1,070		10.32	2		11.81	03-10-98	1
1999	06-11-99	737		8.83					

Table C2. Annual peak-flow measurements for station 05051650, La Belle Creek near Veblen, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the maximum for the year. ft³/s, cubic feet per second]

Water year	Date	Peak discharge (ft ³ /s)	Discharge codes	Gage height (feet)	Gage-height codes	Highest since	Maximum gage height (feet)	Date	Gage-height codes
1997	04-04-97	100		10.60	1, 2		12.57	04-01-97	1
1998	05-12-98	133		5.41					
1999	07-08-99	97		5.15	2		5.30	02-26-99	1

Table C3. Annual peak-flow measurements for station 05289985, Big Coulee Creek near Peever, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the maximum for the year. ft³/s, cubic feet per second]

Water year	Date	Peak discharge (ft ³ /s)	Discharge codes	Gage height (feet)	Gage-height codes	Highest since	Maximum gage height (feet)	Date	Gage-height codes
1997	04-05-97	358		7.73	2		9.43	03-27-97	1
1998	05-12-98	614		7.42					
1999	10-17-98	136		5.18	2		5.59	06-06-99	1

Table C4. Annual peak-flow measurements for station 05290000, Little Minnesota River near Peever, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height not the maximum for the year. ft³/s, cubic feet per second]

Water year	Date	Peak discharge (ft ³ /s)	Discharge codes	Gage height (feet)	Gage-height codes	Highest since	Maximum gage height (feet)	Date	Gage-height codes
1997	03-28-97	3,590		14.40					
1998	05-17-98	1,340		6.31	2		6.58	02-29-98	1
1999	06-07-99	306		4.20					

Table C5. Annual peak-flow measurements for station 05291000, Whetstone River near Big Stone City, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year. ft³/s, cubic feet per second]

Water year	Date	Peak discharge (ft ³ /s)	Discharge codes	Gage height (feet)	Gage-height codes	Highest since	Maximum gage height (feet)	Date	Gage-height codes
1997	04-06-97	7,930		14.21					
1998	03-27-98	1,230		7.09					
1999	03-17-99	325		3.62					

Table C6. Annual peak-flow measurements for station 05292000, Minnesota River at Ortonville, Minn.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; 7, discharge is a historic peak. Gage height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year. ft³/s, cubic feet per second]

Water year	Date	Peak discharge (ft ³ /s)	Discharge codes	Gage height (feet)	Gage-height codes	Highest since	Maximum gage height (feet)	Date	Gage-height codes
1997	04-10-97	5,070	7	12.85		04-13-52			
1998	04-08-98	1,980		8.03					
1999	05-17-99	671		4.59					

Table C7. Annual peak-flow measurements for station 06479215, Big Sioux River near Florence, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value. Gage height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height is not the maximum for the year. ft³/s, cubic feet per second]

Water year	Date	Peak discharge (ft ³ /s)	Discharge codes	Gage height (feet)	Gage-height codes	Highest since	Maximum gage height (feet)	Date	Gage-height codes
1997	04-04-97	2,000		9.32	2		9.52	04-02-97	1
1998	05-16-98	528		8.12	2		8.23	02-26-98	1
1999	10-17-98	134		6.55					

Table C8. Annual peak-flow measurements for station 06479438, Big Sioux River near Watertown, S. Dak.

[Discharge codes: no code, peak flow or discharge is a maximum instantaneous value; 7, discharge is a historic peak. Gage height codes: no code, stage or gage height is the maximum, unaffected value for the station during the year; 1, gage height affected by backwater; 2, gage height is not the maximum for the year. ft³/s, cubic feet per second]

Water year	Date	Peak discharge (ft ³ /s)	Discharge codes	Gage height (feet)	Gage-height codes	Highest since	Maximum gage height (feet)	Date	Gage-height codes
1997	04-05-97	7,820	7	12.09		1881			
1998	05-17-98	1,140		8.87	2		9.91	02-26-98	1
1999	10-17-98	946		8.60					

Section D - Mean flow and summary statistics

Table D1.1. Mean flow, in cubic feet per second, for station 05051650, LaBelle Creek near Veblen, S. Dak.

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1988	0	0	0	0	0.293	0.932	0.281	0.091	0.001	0	0	0	0.133
1989	0	0	0	0	0	3.13	5.49	1.18	.115	.020	.281	.028	.854
1990	0	0	0	0	0	.217	.264	.151	.041	0	0	0	.056
1991	0	0	0	0	.078	.361	.669	.495	3.43	3.07	.389	.105	.718
1992	0	0	0	.005	.503	1.79	.858	.132	3.12	1.83	.072	.241	.710
1993	.002	.137	.036	.009	.006	7.03	12.7	2.50	6.46	14.1	7.42	.771	4.29
1994	.176	.269	.701	.548	.372	14.3	13.9	5.84	.206	1.93	.038	.086	3.21
1995	.486	.373	.140	.023	.761	22.4	11.4	8.67	2.41	2.78	.455	.235	4.21
1996	2.27	1.16	.154	.105	3.26	9.86	1.53	15.1	2.29	.111	.003	0	3.00
1997	.146	.084	.240	.326	.258	1.96	20.9	3.37	.409	.295	.117	.016	2.33
1998	.095	.171	.110	.048	2.41	7.75	13.6	11.9	6.25	3.14	.127	0	3.80
1999	.842	2.84	1.81	.303	1.36	6.59	5.99	5.53	1.51	2.74	.417	7.09	3.08

Table D1.2. Statistics on mean flow, in cubic feet per second, for station 05051650, LaBelle Creek near Veblen, S. Dak. (October 1988 through September 1999)

Statistic	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
Number	12	12	12	12	12	12	12	12	12	12	12	12	12
Maximum	2.27	2.84	1.81	.548	3.26	22.4	20.9	15.1	6.46	14.1	7.42	7.09	4.29
Percentile													
75th	.409	.347	.218	.254	1.21	9.33	13.4	7.96	3.35	3.00	.410	.240	3.65
50th	.049	.110	.073	.016	.333	4.86	5.74	2.93	1.90	1.88	.122	.057	2.66
25th	0	0	0	0	.024	1.15	.716	.237	.138	.043	.012	0	.712
Minimum	0	0	0	0	0	.217	.264	.091	.001	0	0	0	.056
Mean	.33	.42	.27	.11	.78	6.36	7.30	4.58	2.19	2.50	0.78	0.71	2.20
Standard deviation	.66	.83	.53	.18	1.05	6.67	6.99	5.02	2.31	3.88	2.10	2.02	1.61
Skewness	2.69	2.70	2.75	1.66	1.67	1.42	0.59	1.07	0.93	2.79	3.42	3.39	-0.11
Coefficient of variation	1.98	1.98	1.97	1.58	1.36	1.05	.96	1.10	1.05	1.55	2.70	2.83	0.73
Percent of annual flow	1.27	1.59	1.01	0.43	2.94	24.16	27.72	17.40	8.31	9.50	2.95	2.71	¹ 99.99

¹Less than 100 percent due to rounding.

Table D1.3. Serial correlation for 1-year lag for monthly and annual mean flows for station 05051650, LaBelle Creek near Veblen, S. Dak. (October 1988 through September 1999)

Month												Annual
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
0.099	0.055	0.006	-0.145	0.088	0.564	0.231	0.404	-0.139	-0.003	-0.138	-0.711	0.606

Table D1.4. Correlation matrix for monthly mean flow for station 05051650, LaBelle Creek near Veblen, S. Dak. (October 1988 through September 1999)

[--, not computed]

Month	Month											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Oct	1	0.596	0.273	0.149	0.800	0.347	-0.166	0.750	-0.026	-0.192	-0.163	0.220
Nov	--	1	.890	.366	.475	.210	-.065	.385	-.053	-.018	-.078	.909
Dec	--	--	1	.646	.195	.205	.151	.181	-.180	-.015	-.109	.915
Jan	--	--	--	1	.057	.286	.539	.211	-.354	-.140	-.109	.915
Feb	--	--	--	--	1	.320	-.026	.905	.304	-.166	-.240	.143
Mar	--	--	--	--	--	1	.403	.636	.144	.164	.057	.032
Apr	--	--	--	--	--	--	1	.275	.184	.294	.251	-.036
May	--	--	--	--	--	--	--	1	.306	-.046	-.131	.041
Jun	--	--	--	--	--	--	--	--	1	.742	.596	-.026
Jul	--	--	--	--	--	--	--	--	--	1	.956	.121
Aug	--	--	--	--	--	--	--	--	--	--	1	.047
Sep	--	--	--	--	--	--	--	--	--	--	--	1

Table D1.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05051650, LaBelle Creek near Veblen, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		14		30		60		90		120		183	
1988	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0.062	2
1989	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	.58	8
1990	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	.010	1
1991	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	.076	3
1992	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	.38	4
1993	0	6	0	6	0	6	0	6	0	6	.008	7	.013	6	.028	6	1.36	7
1994	0	7	0	7	0	7	.001	10	.024	11	.061	9	.38	11	.43	10	2.86	11
1995	0	8	.007	12	.010	12	.016	11	.018	10	.049	8	.090	8	.16	8	4.14	12
1996	0	9	0	8	0	8	0	7	0	7	.001	6	.029	7	.47	11	2.68	10
1997	0	10	0	9	0	9	0	8	.016	9	.068	11	.13	10	.20	9	.67	6
1998	0	11	0	10	0	10	1	9	0	8	.062	10	.10	9	.10	7	1.85	8
1999	0	12	0	11	.009	11	.036	12	.28	12	.28	12	.82	12	1.43	12	2.36	9

Table D1.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05051650, LaBelle Creek near Veblen, S. Dak.

Water year	Flow, In cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1988	3.50	11	2.83	11	1.96	11	1.58	11	1.17	11	0.76	11	0.53	11	0.41	11	0.27	11
1989	20.0	9	18.3	8	13.7	8	11.9	8	7.79	8	4.69	8	3.34	8	2.51	8	1.70	8
1990	.77	12	.50	12	.47	12	.40	12	.33	12	.27	12	.22	12	.17	12	.11	12
1991	29.0	8	15.1	9	9.59	9	8.43	9	5.45	9	3.37	9	2.35	9	1.96	9	1.41	9
1992	13.0	10	11.6	10	9.40	10	6.75	10	4.71	10	2.53	10	1.83	10	1.56	10	1.37	10
1993	81.0	3	51.0	4	35.9	4	27.0	5	18.9	5	12.3	5	9.54	4	9.99	3	8.51	1
1994	75.0	4	53.3	3	37.6	3	28.3	3	21.0	3	16.3	2	11.5	3	8.78	4	6.10	4
1995	200	1	130	1	72.9	1	41.7	1	26.5	1	18.5	1	14.8	1	11.9	1	8.16	2
1996	150	2	80.3	2	46.9	2	27.2	4	16.0	6	8.92	6	9.53	5	7.94	5	5.39	5
1997	75.0	5	48.3	5	32.1	6	25.4	6	21.5	2	12.9	4	8.84	6	6.74	6	4.51	7
1998	60.0	6	45.3	6	34.0	5	31.1	2	19.5	4	15.9	3	12.5	2	10.7	2	7.49	3
1999	49.0	7	28.7	7	18.5	7	21.1	7	10.2	7	7.74	7	6.30	7	5.29	7	4.60	6

Table D2.1. Mean flow, in cubic feet per second, for station 05289985, Big Coulee Creek near Peever, S. Dak.

Water year	Month												Annual
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1988	0	0	0	0	0.847	5.28	1.71	1.09	0.013	0	0	0	0.748
1989	0	0	0	0	0	11.8	12.0	2.76	.059	0	.003	1.19	2.32
1990	.193	.223	0	0	0	3.48	1.52	1.30	.789	.008	.002	0	.630
1991	.002	.018	.023	0	0	1.42	3.61	3.99	11.1	7.85	3.58	2.52	2.85
1992	1.64	.547	.488	.666	2.90	6.59	2.41	1.25	4.09	2.31	.370	2.91	2.17
1993	.340	1.61	.530	.059	.738	10.2	12.6	6.37	7.38	16.6	3.69	.825	5.11
1994	2.70	3.69	1.29	.026	1.36	20.1	10.4	6.55	6.84	2.84	.573	2.10	4.90
1995	3.76	1.18	.679	.750	1.53	23.4	16.2	19.0	8.78	2.85	3.24	.374	6.86
1996	4.48	2.24	1.24	.819	5.60	21.3	21.0	8.53	3.62	4.63	2.85	.593	6.41
1997	2.13	.906	.778	.957	1.39	10.6	34.0	6.85	2.21	1.34	.704	.013	5.14
1998	.996	1.25	1.24	.486	7.15	9.92	18.5	22.5	4.17	2.51	.523	.014	5.76
1999	3.08	3.26	1.66	.166	4.00	6.64	6.00	6.05	5.00	5.55	.617	1.47	3.62

Table D2.2. Statistics on mean flow, in cubic feet per second for station 05289985, Big Coulee Creek near Peever, S. Dak. (October 1988 through September 1999)

Statistic	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
Number	12	12	12	12	12	12	12	12	12	12	12	12	12
Maximum	4.48	3.69	1.66	.957	7.15	23.4	34.0	22.5	11.1	16.6	3.69	2.91	6.86
Percentile													
75th	2.98	2.08	1.24	.729	3.72	18.0	17.9	8.11	7.24	5.32	3.14	1.94	5.61
50th	1.32	1.04	.604	.112	1.38	10.1	11.2	6.21	4.13	2.67	.595	.709	4.26
25th	.050	.069	.006	0	.184	5.61	2.71	1.66	1.14	.341	.095	.013	2.21
Minimum	0	0	0	0	0	1.42	1.52	1.09	.013	0	0	0	.630
Mean	1.61	1.24	0.66	0.33	2.13	10.89	11.66	7.19	4.50	3.87	1.35	1.00	3.88
Standard deviation	1.60	1.26	0.59	0.38	2.34	7.16	9.73	6.84	3.51	4.66	1.51	1.04	2.13
Skewness	.54	.92	.27	.60	1.21	.67	1.05	1.52	.40	2.08	.78	.74	-.23
Coefficient of variation	1.00	1.01	.89	1.16	1.10	.66	.83	.95	.78	1.20	1.12	1.04	.55
Percent of annual flow	3.47	2.68	1.42	0.71	4.58	23.46	25.11	15.48	9.70	8.34	2.90	2.16	¹ 100.01

¹Greater than 100 percent due to rounding.

Table D2.3. Serial correlation for 1-year lag for monthly and annual mean flows for station 05289985, Big Coulee Creek near Peever, S. Dak. (October 1988 through September 1999)

Month												Annual
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	
0.572	0.367	0.703	0.440	0.207	0.633	0.510	0.164	0.192	-0.107	-0.178	0.088	0.675

Table D2.4. Correlation matrix for monthly mean flow for station 05289985, Big Coulee Creek near Peever, S.Dak. (October 1988 through September 1999)

[--, not computed]

Month	Month											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Oct.	1	0.681	0.750	0.657	0.506	0.753	0.441	0.403	0.231	-0.047	0.237	0.001
Nov.	--	1	.888	.077	.422	.518	.193	.251	.298	.263	.084	.164
Dec.	--	--	1	.383	.742	.474	.400	.501	.215	.135	.025	.022
Jan.	--	--	--	1	.500	.462	.708	.452	.011	-.169	.157	-.198
Feb.	--	--	--	--	1	.260	.321	.604	-.019	-.031	-.043	-.140
Mar.	--	--	--	--	--	1	.522	.512	.183	-.034	.287	-.146
Apr.	--	--	--	--	--	--	1	.504	-.037	-.002	.171	-.443
May.	--	--	--	--	--	--	--	1	.344	.049	.284	-.368
Jun.	--	--	--	--	--	--	--	--	1	.622	.777	.476
Jul.	--	--	--	--	--	--	--	--	--	1	.743	.218
Aug.	--	--	--	--	--	--	--	--	--	--	1	.116
Sep.	--	--	--	--	--	--	--	--	--	--	--	1

Table D2.5. Lowest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05289985, Big Coulee Creek near Peever, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		14		30		60		90		120		183	
1988	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0.47	2
1989	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	2.10	4
1990	0	3	0	3	0	3	0	3	0	3	0	3	0	3	.014	4	.60	3
1991	0	4	0	4	0	4	0	4	0	4	0	4	.007	4	.010	3	.26	1
1992	0	5	0	5	.001	9	.014	10	.11	10	.49	10	.54	6	.67	6	2.14	5
1993	.020	12	.027	12	.030	11	.032	11	.044	8	.26	6	.43	5	.64	5	2.38	6
1994	0	6	0	6	0	5	0	5	0	5	.096	5	.69	9	1.54	10	4.86	10
1995	0	7	0	7	0	6	0	6	.25	12	.66	11	.62	7	.83	7	5.33	11
1996	0	8	0	8	0	7	0	7	.091	9	.85	12	1.03	11	1.79	11	5.96	12
1997	.010	11	.010	11	.010	10	.011	9	.013	6	.36	8	.67	8	.97	8	3.25	8
1998	0	9	0	9	0	8	0	8	.014	7	.27	7	.92	10	1.00	9	3.48	9
1999	0	10	0	10	.10	12	.12	12	.16	11	.48	9	1.58	12	1.97	12	3.15	7

Table D2.6. Highest mean flow, in cubic feet per second, and ranking for the following number of consecutive days, for station 05289985, Big Coulee Creek near Peever, S. Dak.

Water year	Flow, in cubic feet per second, and ranking for number of consecutive days																	
	1		3		7		15		30		60		90		120		183	
1988	10.0	12	8.67	12	7.71	12	7.33	11	5.88	11	3.92	11	2.99	11	2.28	11	1.50	11
1989	75.0	7	58.3	6	43.6	5	31.1	5	19.4	6	12.9	6	9.01	7	6.76	9	4.55	9
1990	20.0	11	15.0	11	9.29	11	6.13	12	4.05	12	2.75	12	2.24	12	1.81	12	1.19	12
1991	118	5	53.3	7	25.9	8	18.2	8	11.5	8	10.2	8	8.05	8	7.14	7	5.56	7
1992	30.0	10	20.7	10	14.0	10	11.1	10	8.41	10	5.45	10	4.21	10	4.11	10	3.27	10
1993	170	3	69.7	5	33.7	6	25.3	6	17.8	7	12.7	7	10.5	6	12.0	5	9.55	4
1994	65.0	8	46.7	8	30.7	7	22.2	7	21.0	5	15.6	5	12.5	5	11.3	6	8.11	6
1995	250	2	140	1	70.9	3	38.3	4	27.4	4	23.7	3	20.5	1	17.5	1	12.3	1
1996	110	6	83.3	4	51.4	4	39.0	3	32.4	2	22.6	4	17.8	3	14.7	3	11.1	2
1997	163	4	113	3	86.7	1	62.1	1	40.9	1	24.8	1	17.7	4	13.6	4	9.36	5
1998	305	1	124	2	77.1	2	41.2	2	29.7	3	24.0	2	18.6	2	15.2	2	10.8	3
1999	59.0	9	43.0	9	19.8	9	11.5	9	9.19	9	7.77	9	6.88	9	7.02	8	5.52	8

Section E - Water-level measurements

Table E1. Water-level measurements for Bitter Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
04-10-97	1,786.7	10-07-97	1,788.4	04-19-99	1,791.51
04-11-97	1,786.7	05-04-98	1,790.1	04-26-99	1,791.53
04-12-97	1,786.7	05-20-98	1,791.1	05-05-99	1,791.67
04-13-97	1,787.0	05-25-98	1,791.3	05-13-99	1,791.71
04-14-97	1,787.1	05-26-98	1,791.26	06-01-99	1,791.63
04-15-97	1,787.2	06-02-98	1,791.3	06-10-99	1,791.91
04-16-97	1,787.4	06-08-98	1,791.2	06-14-99	1,791.87
04-17-97	1,787.5	06-12-98	1,791.3	06-21-99	1,791.99
04-18-97	1,787.6	06-16-98	1,791.5	07-01-99	1,791.97
04-19-97	1,787.7	06-22-98	1,791.5	07-07-99	1,791.91
04-20-97	1,787.8	07-06-98	1,791.58	07-12-99	1,792.01
04-21-97	1,787.9	07-20-98	1,791.5	07-19-99	1,791.93
04-22-97	1,788.0	07-20-98	1,791.3	07-26-99	1,791.68
04-25-97	1,788.2	07-27-98	1,791.3	08-02-99	1,791.89
04-28-97	1,788.2	08-05-98	1,791.3	08-09-99	1,792.09
05-01-97	1,788.5	08-10-98	1,791.3	08-16-99	1,791.95
05-05-97	1,788.6	08-21-98	1,791.1	08-23-99	1,791.81
05-09-97	1,788.8	11-13-98	1,791.0	09-03-99	1,792.11
05-13-97	1,788.9	03-23-99	1,791.3	09-13-99	1,792.05
05-14-97	1,788.5	04-07-99	1,791.47	09-20-99	1,792.05
05-20-97	1,789.0	04-12-99	1,791.53	09-27-99	1,792.11

Table E2. Water-level measurements for Blue Dog Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
04-07-97	1,802.3	05-04-98	1,802.1	04-26-99	1,803.61
04-10-97	1,801.9	05-01-98	1,802.9	05-05-99	1,803.73
04-11-97	1,802.2	05-20-98	1,802.87	05-13-99	1,803.89
04-12-97	1,802.1	05-25-98	1,802.9	06-01-99	1,803.83
04-13-97	1,801.8	05-26-98	1,802.88	06-10-99	1,804.29
04-14-97	1,801.7	05-29-98	1,802.9	06-14-99	1,804.23
04-15-97	1,801.5	06-02-98	1,802.9	06-21-99	1,804.21
04-16-97	1,801.5	06-08-98	1,802.8	07-01-99	1,804.21
04-17-97	1,801.7	06-15-98	1,803.0	07-07-99	1,804.19
04-18-97	1,801.8	06-16-98	1,803.0	07-12-99	1,804.19
04-19-97	1,802.0	06-22-98	1,803.0	07-19-99	1,804.09
04-20-97	1,802.1	06-29-98	1,803.1	07-26-99	1,804.06
04-21-97	1,802.1	07-06-98	1,803.04	08-02-99	1,803.98
04-22-97	1,802.2	07-20-98	1,803.0	08-09-99	1,803.92
04-25-97	1,802.0	07-27-98	1,802.8	08-16-99	1,803.76
04-28-97	1,801.8	08-05-98	1,802.3	08-23-99	1,803.66
05-01-97	1,801.6	08-10-98	1,802.7	09-03-99	1,803.62
05-09-97	1,801.4	08-21-98	1,802.5	09-13-99	1,803.68
05-13-97	1,801.2	08-25-98	1,802.6	09-20-99	1,803.56
05-16-97	1,800.58	08-28-98	1,802.6	09-27-99	1,803.54
05-20-97	1,801.0	09-04-98	1,802.5	10-04-99	1,803.42
10-01-97	1,800.5	11-13-98	1,802.8	10-12-99	1,803.36
10-07-97	1,800.0	04-07-99	1,803.55	10-18-99	1,803.32
03-01-98	1,800.9	04-12-99	1,803.59	10-25-99	1,803.3
04-01-98	1,802.0	04-19-99	1,803.63	11-02-99	1,803.24

Table E3. Water-level measurements for Buffalo Lake North in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-19-97	1,837.7	05-05-98	1,836.6	05-03-99	1,836.4
10-07-97	1,836.5	09-28-98	1,834.7	09-28-99	1,836.0

Table E4. Water-level measurements for Buffalo Lake South in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-19-97	1,838.6	05-05-98	1,838.1	05-03-99	1,837.6
10-07-97	1,835.3	09-28-98	1,835.4	09-28-99	1,837.0

Table E5. Water-level measurements for Clear Lake in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-19-97	1,822.9	05-05-98	1,822.5	05-03-99	1,822.3
10-07-97	1,821.5	09-28-98	1,821.9	09-28-99	1,822.0

Table E6. Water-level measurements for Clubhouse Lake in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-13-97 ¹	972.7				

¹Water-level measurements discontinued after this date.

Table E7. Water-level measurements for Cottonwood Lake (North) in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-13-97	1,030.6	05-05-98	1,030.0	05-03-99	1,030.0
10-07-97	1,029.6	09-28-98	1,029.3	09-28-99	1,029.7

Table E8. Water-level measurements for Cottonwood Lake in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-19-97	1,827.7	05-05-98	1,827.3	05-03-99	1,827.3
10-07-97	1,826.3	09-28-98	1,826.5	09-28-99	1,827.3

Table E9. Water-level measurements for Drywood Lakes in Roberts County

[Note: North and South Drywood Lakes have coalesced into one lake]

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-13-97	1,948.8	05-05-98	1,949.1	05-04-99	1,950.0
10-07-97	1,947.8	09-29-98	1,948.7	09-28-99	1,949.6

Table E10. Water-level measurements for Enemy Swim Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
04-10-97	1,856.0	06-02-98	1,854.6	06-01-99	1,853.92
04-11-97	1,856.0	06-08-98	1,854.4	06-10-99	1,854.16
04-12-97	1,856.1	06-12-98	1,854.4	06-14-99	1,854.06
04-13-97	1,856.2	06-15-98	1,854.4	07-01-99	1,853.9
04-14-97	1,856.2	06-16-98	1,854.4	07-07-99	1,853.59
04-15-97	1,856.3	06-22-98	1,854.3	07-12-99	1,853.82
04-16-97	1,856.27	06-29-98	1,854.2	07-19-99	1,853.7
04-17-97	1,856.2	07-06-98	1,854.2	07-26-99	1,854.03
04-18-97	1,856.2	07-20-98	1,854.0	08-02-99	1,853.56
04-21-97	1,856.1	07-27-98	1,853.9	08-09-99	1,853.48
04-22-97	1,856.1	08-05-98	1,853.7	08-16-99	1,853.42
04-25-97	1,856.0	08-10-98	1,853.6	08-24-99	1,853.36
04-28-97	1,855.8	08-21-98	1,853.5	09-03-99	1,853.48
05-05-97	1,855.5	08-28-98	1,853.6	09-13-99	1,853.58
05-08-97	1,855.4	09-04-98	1,853.4	09-20-99	1,853.50
05-12-97	1,855.2	11-13-98	1,853.9	09-27-99	1,853.52
05-20-97	1,854.9	03-23-99	1,854.0	10-04-99	1,853.44
05-26-97	1,854.85	04-07-99	1,854.14	10-12-99	1,853.40
10-08-97	1,853.3	04-12-99	1,854.12	10-18-99	1,853.38
10-29-97	1,853.32	04-19-99	1,854.08	10-25-99	1,853.6
05-04-98	1,854.6	04-26-99	1,854.02	11-02-99	1,853.32
05-18-98	1,854.85	05-05-99	1,854.14		
05-26-98	1,854.85	05-13-99	1,854.14		

Table E11. Water-level measurements for Hillebrands Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
04-01-97	1,798.3	05-18-98	1,802.59	07-12-99	1,803.61
04-10-97	1,797.5	05-20-98	1,802.6	07-19-99	1,803.55
05-20-97	1,799.2	05-26-98	1,802.68	07-26-99	1,804.03
10-01-97	1,800.08	07-06-98	1,802.57	08-02-99	1,803.97
10-08-97	1,799.4	11-13-98	1,802.1	08-09-99	1,803.83
11-14-97	1,799.98	03-23-99	1,802.7	08-16-99	1,803.83
04-14-98	1,801.34	04-07-99	1,802.91	08-24-99	1,803.67
04-20-98	1,801.43	04-12-99	1,802.93	09-03-99	1,803.75
04-27-98	1,801.9	04-19-99	1,802.93	09-13-99	1,803.75
04-28-98	1,801.9	04-26-99	1,802.93	09-20-99	1,803.65
05-04-98	1,801.6	05-05-99	1,803.07	09-27-99	1,803.65
05-04-98	1,801.95	05-13-99	1,803.21	10-04-99	1,803.47
05-05-98	1,801.95	06-01-99	1,803.21	10-12-99	1,803.92
05-07-98	1,801.94	06-10-99	1,803.55	10-18-99	1,803.37
05-11-98	1,801.98	06-14-99	1,803.51	10-25-99	1,803.33
05-11-98	1,802.02	06-21-99	1,803.53	11-02-99	1,803.23
05-12-98	1,802.4	07-01-99	1,803.61		
05-15-98	1,802.48	07-07-99	1,803.59		

Table E12. Water-level measurements for Hurricane Lake in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-19-97	1,751.1	05-05-98	1,751.3	05-04-99	1,751.0
10-07-97	1,750.7	09-29-98	1,750.4	09-28-99	1,750.6

Table E13. Water-level measurements for Pickerel Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
04-11-97	1,846.6	05-26-98	1,845.89	06-10-99	1,846.08
04-12-97	1,846.5	06-02-98	1,845.7	06-21-99	1,845.72
04-13-97	1,846.4	06-12-98	1,845.7	07-01-99	1,845.66
04-14-97	1,846.4	06-16-98	1,845.7	07-07-99	1,845.56
04-15-97	1,846.4	06-22-98	1,845.5	07-12-99	1,845.64
04-16-97	1,846.5	06-29-98	1,845.5	07-19-99	1,845.46
04-17-97	1,846.5	07-06-98	1,845.6	07-26-99	1,845.38
04-18-97	1,846.5	07-20-98	1,845.3	08-02-99	1,845.34
04-21-97	1,846.5	07-27-98	1,845.2	08-09-99	1,845.28
04-22-97	1,846.5	08-05-98	1,845.0	08-16-99	1,845.32
04-25-97	1,846.3	08-10-98	1,845.1	08-24-99	1,845.26
04-28-97	1,846.2	08-21-98	1,845.1	09-03-99	1,845.42
05-01-97	1,846.0	08-28-98	1,845.2	09-13-99	1,845.54
05-05-97	1,845.9	09-04-98	1,845.0	09-20-99	1,845.46
05-08-97	1,845.9	04-07-99	1,845.73	09-27-99	1,845.44
05-12-97	1,845.8	04-12-99	1,845.68	10-04-99	1,845.36
05-20-97	1,846.6	04-19-99	1,845.62	10-12-99	1,845.36
10-08-97	1,846.7	04-26-99	1,845.52	10-18-99	1,845.36
05-04-98	1,846.6	05-05-99	1,845.62	10-25-99	1,845.36
05-20-98	1,846.00	05-13-99	1,845.76	11-02-99	1,845.38
05-25-98	1,845.9	06-01-99	1,845.46		

Table E14. Water-level measurements for Piyas Lake in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-19-97	1,831.5	05-05-98	1,831.3	05-03-99	1,832.4
10-07-97	1,830.9	09-28-98	1,831.0	09-28-99	1,832.6

Table E15. Water-level measurements for Red Iron Lake North in Marshall County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-19-97	1,830.6	05-05-98	1,829.3	05-03-99	1,829.2
10-07-97	1,829.3	09-28-98	1,828.5	09-28-99	1,828.7

Table E16. Water-level measurements for Spring Lake in Day County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
04-01-97	1,798.22	05-15-98	1,802.48	07-07-99	1,803.59
04-10-97	1,796.4	05-18-98	1,802.59	07-12-99	1,803.61
05-29-97	1,799.2	05-20-98	1,802.60	07-19-99	1,803.55
06-09-97	1,799.6	05-26-98	1,802.68	07-26-99	1,804.03
10-01-97	1,800.08	07-06-98	1,802.57	08-02-99	1,803.97
10-08-97	1,799.4	11-13-98	1,802.1	08-09-99	1,803.83
11-14-97	1,799.98	03-23-99	1,802.7	08-16-99	1,803.83
04-14-98	1,801.34	04-07-99	1,802.91	08-24-99	1,803.67
04-20-98	1,801.43	04-12-99	1,802.93	09-03-99	1,803.75
04-27-98	1,801.9	04-19-99	1,802.93	09-13-99	1,803.75
04-28-98	1,801.9	04-26-99	1,802.93	09-20-99	1,803.65
05-04-98	1,801.6	05-05-99	1,803.07	09-27-99	1,803.65
05-04-98	1,801.95	05-13-99	1,803.21	10-04-99	1,803.47
05-05-98	1,801.95	06-01-99	1,803.21	10-12-99	1,803.92
05-07-98	1,801.94	06-10-99	1,803.55	10-18-99	1,803.37
05-11-98	1,801.98	06-14-99	1,803.51	10-25-99	1,803.33
05-11-98	1,802.02	06-21-99	1,803.53	11-02-99	1,803.23
05-12-98	1,802.4	07-01-99	1,803.61		

Table E17. Water-level measurements for Whitestone Lake North in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-19-97	2,015.0	05-05-98	2,015.3	05-03-99	2,015.0
10-07-97	2,013.9	09-29-98	2,013.9	09-28-99	2,014.9

Table E18. Water-level measurements for Whitestone Lake South in Roberts County

Date	Water-level elevation (feet)	Date	Water-level elevation (feet)	Date	Water-level elevation (feet)
05-19-97	2,015.0	05-05-98	2,015.3	05-03-99	2,015.0
10-07-97	2,014.0	09-29-98	2,013.9	09-28-99	2,014.9