Bulletin No. 28 June 1980

GROUND WATER HYDROLOGY OF SWIFT COUNTY, MINNESOTA

a preliminary investigation and data summary

JUNE 1980

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATERS

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Hydrology Section

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400

MINNESOTA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATERS

ACKNOWLEDGEMENTS

The authors would like to thank the Minnesota Geological Survey, U.S. Geological Survey-Minnesota District, and the Swift County Soil and Water Conservation District who supplied data and information for this report. Special thanks go to Conroy Well Drilling, Hancock, Minnesota for test drilling and observation well construction; Steffel Well Drilling, Glenwood and Clark Irrigation, Appleton, Minnesota, for well log and irrigation well data; Joe Stelzig, Pomme de Terre Irrigation Association and Jim Edmonds, Swift County Extension Agent, for help in drilling site location; Gene Scott, Jim Zicopula, Jean Olson, and Pat Harvell of the Division of Waters; and all those individuals who permitted test drilling and observation well construction on their property.

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I. INTRODUCTION

A. PURPOSE AND SCOPE

The purposes for this publication are:

(1) To demonstrate the use of the Department of Natural Resources, Division of Waters, ground-water data system in providing reconnaissance or preliminary maps of the ground-water resources of an area;

(2) To emphasize the need for delineation of buried outwash aquifers;

(3) To tabulate and furnish to the public, in useable form, the data gathered by the Division of Waters for Swift County; and

(4) To provide preliminary interpretations of these data so that all currently available information can be used for decision-making.

The severe drought of the mid-70's demonstrated the need for development of water sources other than surface water. Since the drought there has been a dramatic increase in ground-water withdrawals from glacial drift aquifers statewide, including Swift County. A number of ground-water studies that emphasize surficial outwash aquifers have been completed or are continuing in Swift County. It was the intent of this investigation to compile and interpret existing data on aquifers with emphasis on buried outwash so future water researchers can better plan drilling or geophysical programs.

Swift County was chosen for study because of the concentration of high capacity well use in buried aquifers, the increase in water-use conflicts, and the availability of hydrogeologic data. Test drilling and observation well installation accomplished during the study were initiated in response to increased irrigation from ground-water sources and the need to expand the ground-water level monitoring network in the area. This report was compiled to complement existing publications on the ground-water resources of Swift County.

B. LOCATION AND DESCRIPTION

Swift County is located in west-central Minnesota (figure 1) and comprises about 478,720 acres or 748 square miles.

The topography of Swift County is generally flat and undulating with steep, hilly terrain occurring in the northeastern corner and several smaller areas throughout the county. The highest elevation, 1,150 feet above sea level, occurs in the northeastern part of the county, while the lowest elevation, 934 feet above sea level, lies at the mouth of the Pomme de Terre River. The mean elevation is about 1,075 feet above sea level (SCS, 1973).

Swift County lies entirely within the drainage basin of the Minnesota River. Parts of the county lie in three watersheds: the Big Stone Lake, the Chippewa River, and the Pomme de Terre River. The eastern three-fourths of Swift County is drained by the Chippewa River. A majority of the remaining western one-fourth of the county is drained by the Pomme de Terre River, except for the extreme

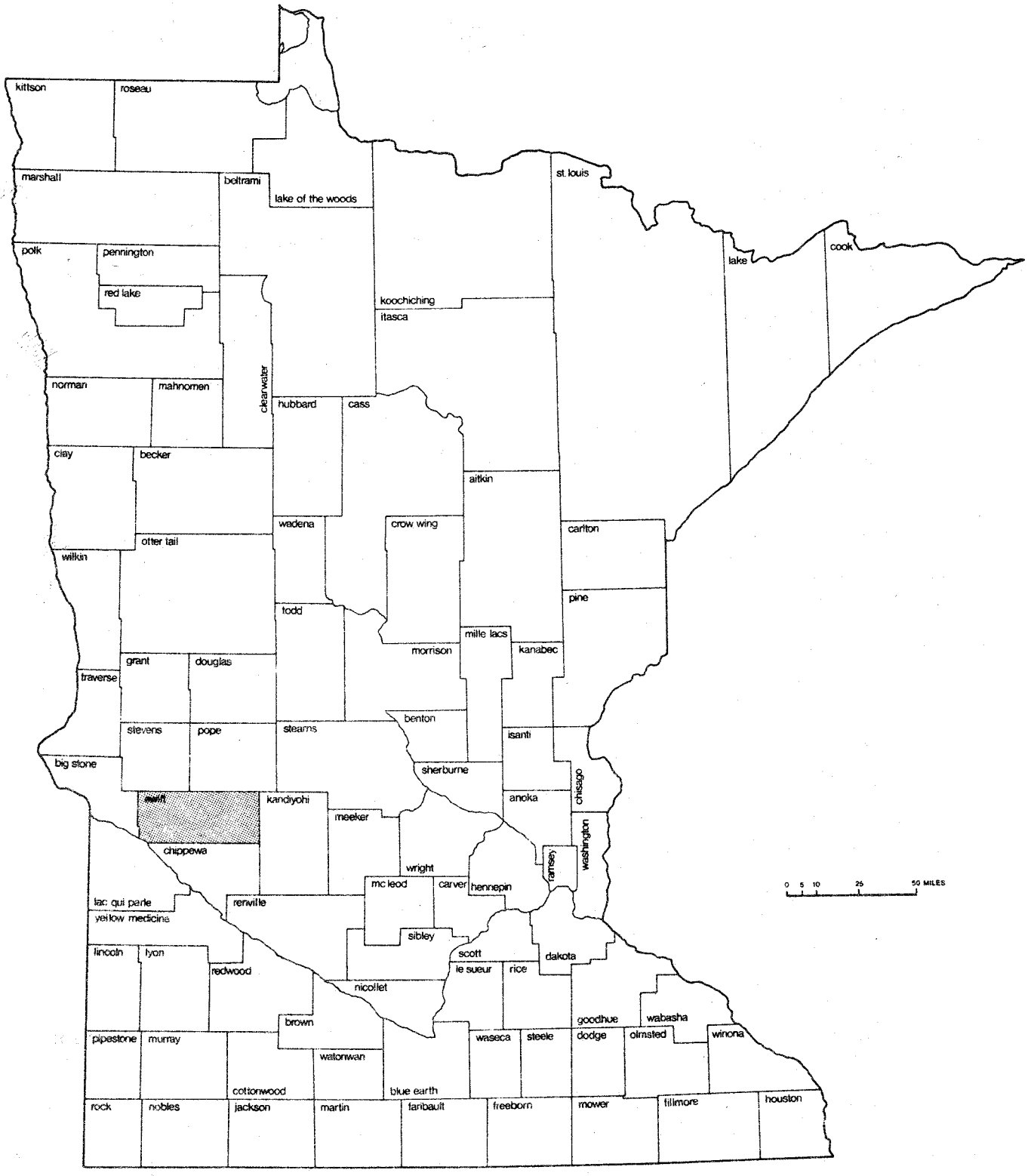


Figure 1. Location of Swift County, Minnesota.

southwest corner which drains into Big Stone Lake (SCS, 1973).

Swift County has a continental climate with generally hot and humid summers and very cold winters. Maximum and minimum temperatures may vary from 100° F in the summer to -30° F in the winter (SCS, 1973). The average annual precipitation is about 24 inches, of which 70 percent occurs during the late spring and summer months (Larson, 1976).

C. PREVIOUS INVESTIGATIONS

In the past seventy years, several general hydrogeologic investigations have been completed which include Swift County. More recently, the U.S. Geological Survey (U.S.G.S.), in cooperation with the Division of Waters, completed hydrologic reconnaissance studies of the watershed units, as defined in Bulletin 10 of the Division of Waters (1959), that include Swift County. These are Hydrologic Investigations Atlases 213 (1966), 220 (1966), and 286 (1968). The U.S.G.S. has also published an appraisal of ground water resources for irrigation in the Appleton Area (Larson, 1976).

A study of the surface and buried outwash in parts of Swift, Grant, Stevens, and Pope Counties is currently in progress (1980) by the U.S.G.S. in cooperation with the Division of Waters and the Upper Pomme de Terre - Chippewa ground-water study steering committee.

D. METHOD OF INVESTIGATION

Since this report represents a reconnaissance investigation, most of the data used were compiled from existing reports and files. Well log data were obtained from Division of Waters permit and well log files and from the Minnesota Geological Survey (M.G.S.) subsurface geology data base (Note: As of this writing, the logs for Swift County were not yet entered into the computer file).

All of the irrigation wells were field located by Division of Waters staff. A limited drilling program was initiated by the Division of Waters and carried out through the services of a private contractor.

II. GENERAL GEOLOGY

The geology in the study area consists of a bedrock complex overlain by a mantle of glacial drift. The bedrock consists of Precambrian crystalline rocks and Cretaceous sandstones and shales. The Cretaceous rocks are not present over the entire area and are generally less than 100 feet thick (Larson, 1976).

The contact between the sedimentary Cretaceous rocks and the underlying Precambrian basement is marked in many places by a weathered zone in the basement rock. This residuum was formed during early Cretaceous time before seas invaded western Minnesota (Austin, 1972).

Glacial drift of Late Wisconsinan age forms the major present-day topographic features in Swift County. Pre-Late Wisconsinan drift is probably present in the subsurface, but was not documented during this study. The total thickness of drift ranges from 150 to 300 feet in the county and can be divided into two major categories: Till and outwash. Till is a heterogeneous mixture of clay, silt, sand, gravel and rocks which was deposited directly by advance or retreat of glacial ice. Outwash in Swift County is composed of stratified beds of silt, sand, and gravel deposited by glacial meltwaters. The outwash is over 100 feet thick in places (Larson, 1976).

Extensive outwash deposits are present in central and southwestern Swift County primarily along the Pomme de Terre and Chippewa River Valleys. Smaller areas of surface outwash are present in the northeastern part of the County.

Buried outwash deposits are also present throughout the County but their areal extent and thickness are not clearly defined. The known distribution of these deposits is shown on Map 2 and Figures 2, 3, and 4.

Recent alluvial deposits occur along present-day river valleys but their distribution was not mapped for this study.

III. MAP DESCRIPTIONS

A. MAP 1 - Location of Wells and Test Holes with Lithologic Logs.

Well and test hole logs were obtained from Division of Waters and M.G.S. files. Selected logs were used to develop cross-sections illustrative of the regional glacial geology (appendix C). The geologic interpretation shown on the cross-sections is subject to change as more information is developed from current and future studies.

B. MAP 2 - Inferred Boundaries of Buried Outwash Aquifers.

The boundaries shown on Map 2 indicate the areas where buried outwash aquifers are known to exist. The buried outwash deposits in Swift County occur in a stratigraphically complex sequence of glacial drift. The sand and gravel bodies that make up the buried aquifers are interbedded with silt, clay and glacial till. The buried outwash complex can be further divided into separate aquifers many of which are likely to be hydraulically connected. Some identifiable aquifer units are shown in Figures 2, 3 and 4. Most wells finished in buried outwash produce water under confined or artesian conditions.

Aquifer A 1, near Appleton, is shown in Figure 2. The top of the aquifer ranges in elevation from about 924 to 980 feet above mean sea level; the higher elevations generally occurring north of Appleton in Shible township. Depth to the top of the aquifer ranges from 36 to 105 feet below land surface. Saturated thickness is generally not known since most wells completed in the aquifer do not fully penetrate the unit. Larson (1976) discusses an area near Appleton where the surficial outwash is connected with buried outwash. This area is not shown on maps and figures in this report because very few well logs documented the lack of a confining bed and most within that area do show a separation between the surficial and buried outwash.

Aquifers A 2 and A 3, also near Appleton, are shown in Figure 3. The top of aquifer A 2 ranges in elevation from 890 to 913 feet above mean sea level. The depth to the top of the aquifer ranges from 110 to 122 feet below land surface. Known elevation of the top of aquifer A 3 ranges from 850 to 863 feet above MSL. Depth to the top of A 3 ranges from 136 to 163 feet below land surface. Saturated thickness is not shown and no aquifer test results are available for aquifers A 2 and A 3.

Aquifer B 1, near Benson and Danvers, is shown in Figure 4. The top of B 1 ranges in elevation from 887 to 942 feet above MSL. Depth to the top of the aquifer ranges from 90 to 148 feet below land surface. There are at least two other sand bodies at greater depth in the Benson area, but the data are not complete enough to show them on a separate illustration. A more detailed analysis of existing aquifer test data and several scientifically planned aquifer tests are needed before the hydraulic relationships between these buried outwash aquifers im this area are defined.

C. MAP 3 - Surficial Outwash Boundaries and Thickness

The boundaries shown on this map were modified from existing reports (Larson, 1976 and Kanivetsky,1979). The thickness figures and contours are for the total thickness of sand from the surface to the first confining bed. Saturated thickness was not shown or estimated because mass measurements of water

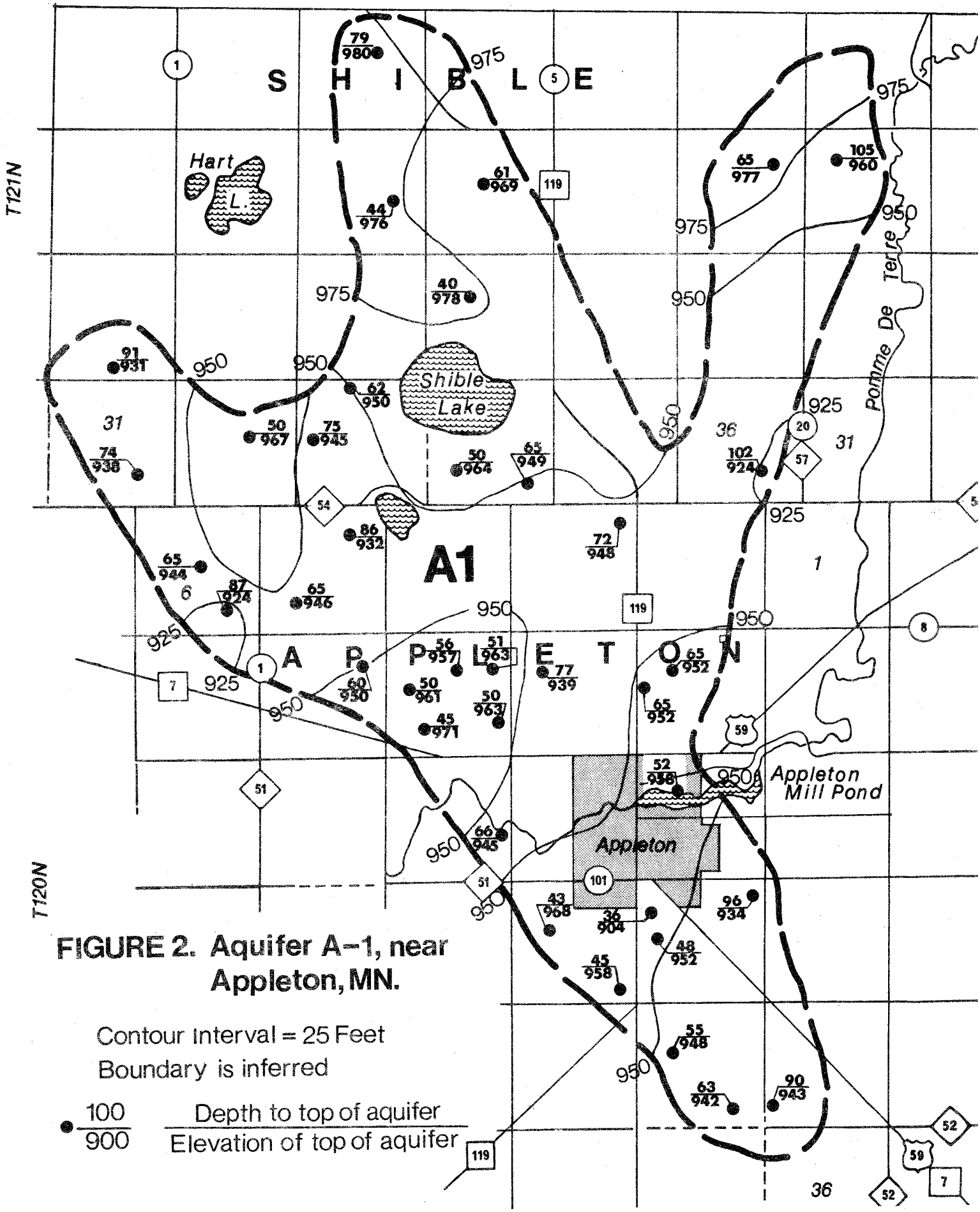


FIGURE 2. Aquifer A–1, near Appleton, MN.

Contour Interval = 25 Feet

Boundary is inferred

100/900 — Depth to top of aquifer / Elevation of top of aquifer

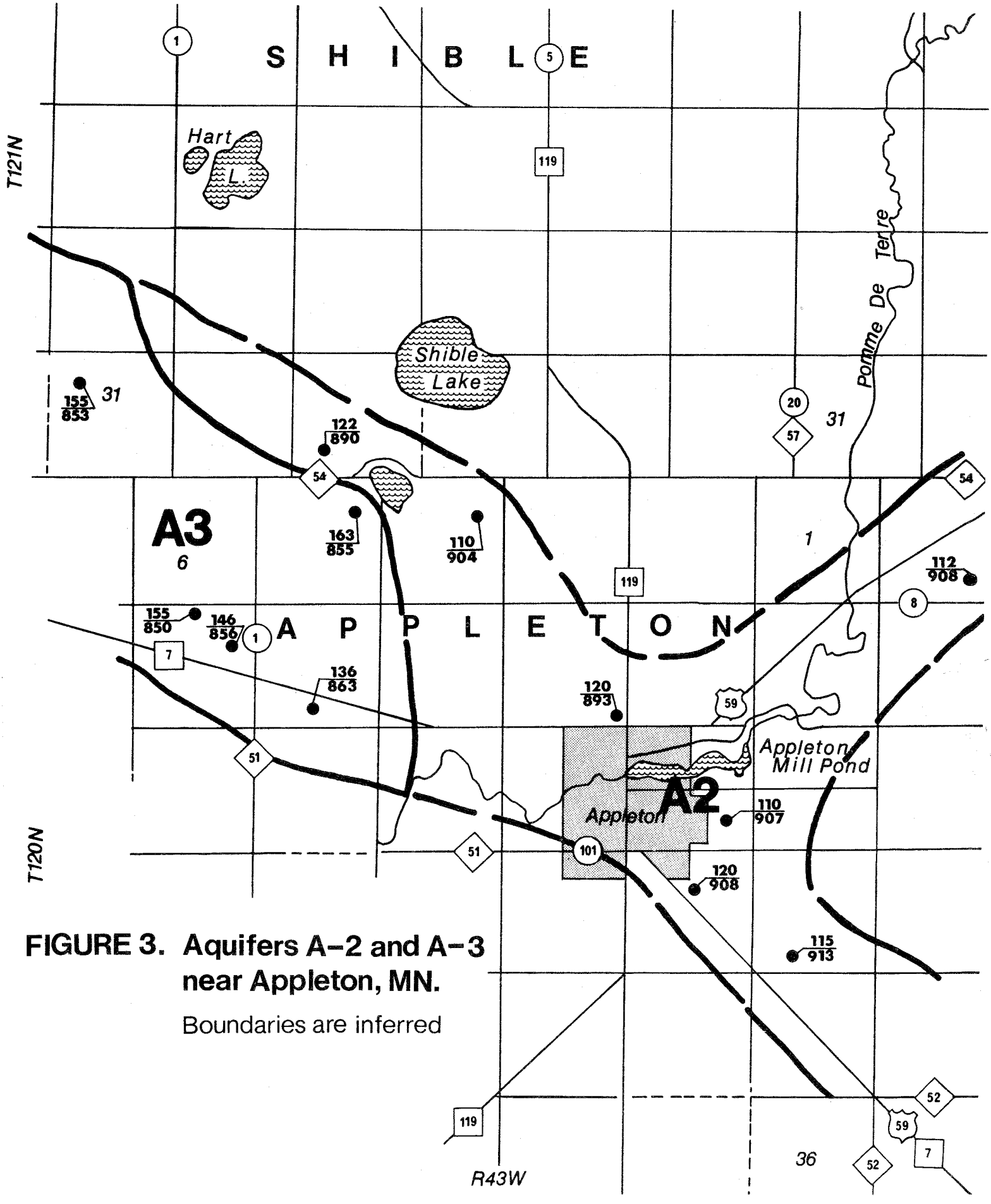


FIGURE 3. Aquifers A–2 and A–3 near Appleton, MN.

Boundaries are inferred

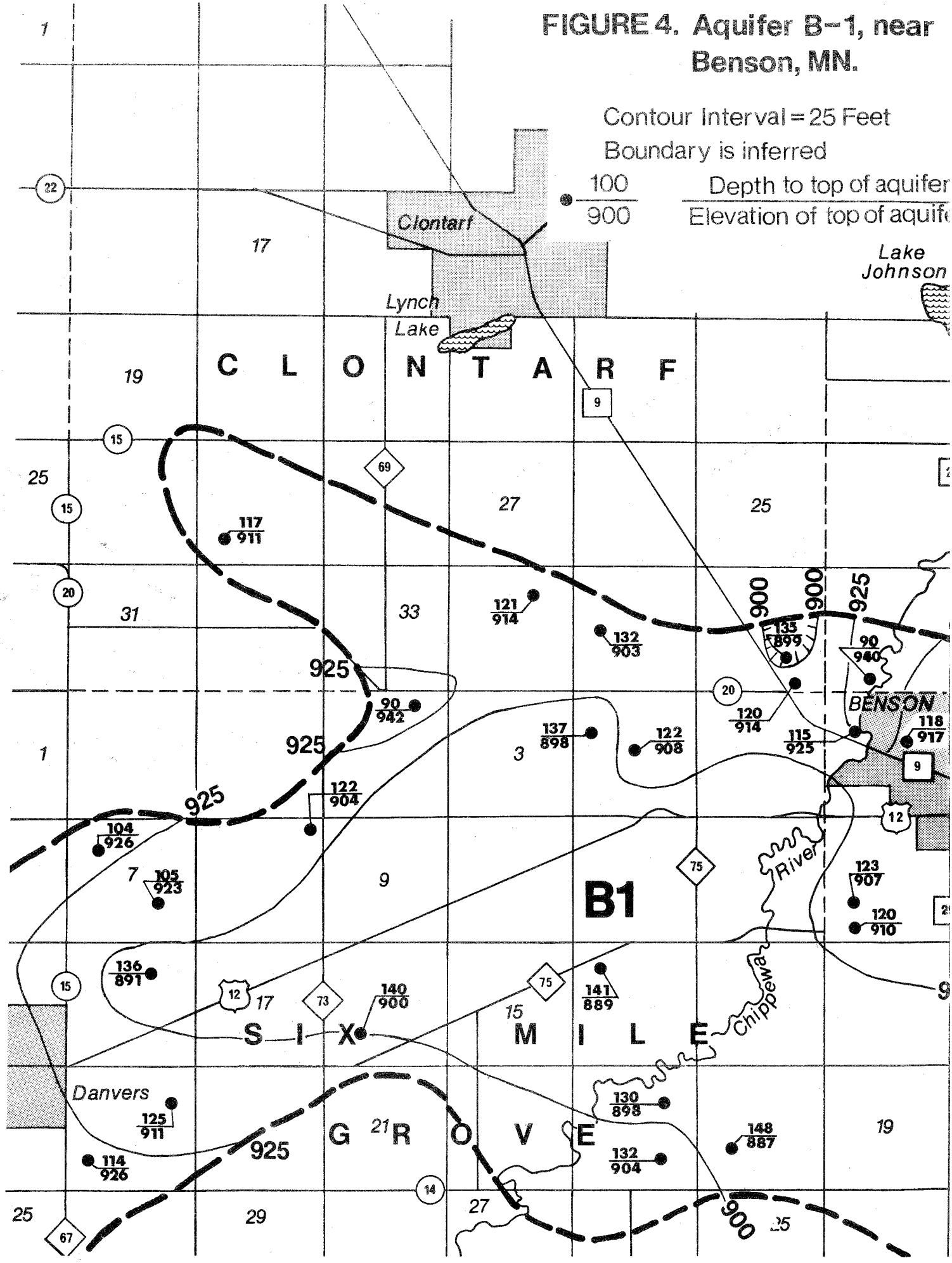


FIGURE 4. Aquifer B-1, near Benson, MN.

levels at the same year and season were not available. The thickness in the Appleton study area was also omitted because a detailed saturated thickness map is available in the 1976 USGS report by Larson. A USGS study of the Upper Pomme de Terre - Chippewa River area, initiated in 1980 and scheduled for completion in 1983, will provide up-to-date saturated thickness estimates of the surficial outwash for most of Swift County.

Almost all of the wells developed in the surficial outwash produce water under unconfined or water table conditions. There are number of shallow wells shown on Map 2 (buried outwash) that have static water levels above the top of the producing sand and are thus classified as artesian wells. However, most of these wells produce under water table conditions because the pumping level is below the top of the aquifer.

D. MAP 4 - Location of Irrigation Wells

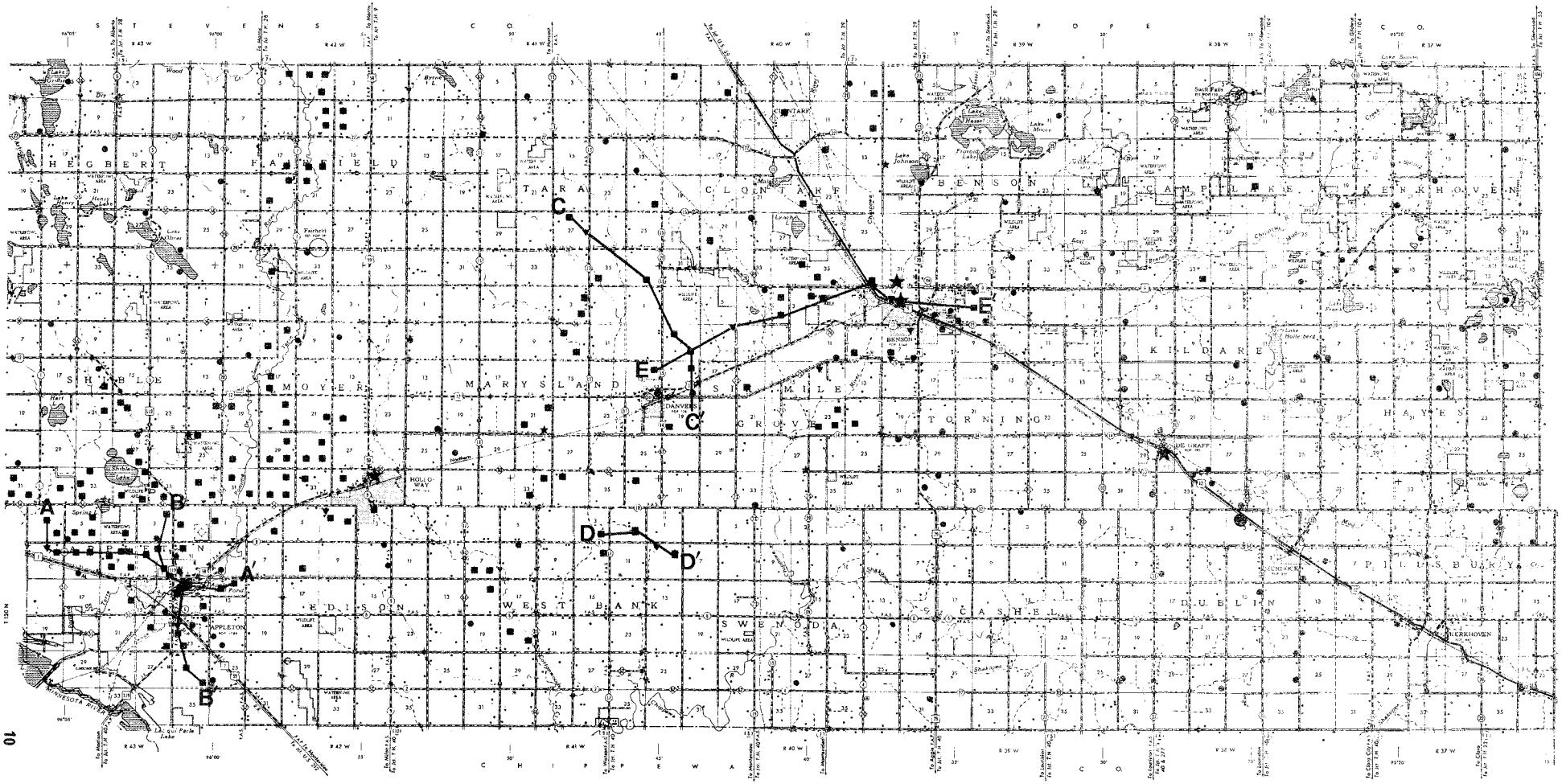
Irrigation wells were first plotted according to the locations in Division of Waters permit records and ground water data base. The locations of existing irrigation wells were field-checked in Fall 1979 by Division of Waters staff. Additional locations were obtained from the M.G.S. Map 4 shows the distribution of irrigation wells by aquifer type where well logs were available and by location where well logs could not be obtained.

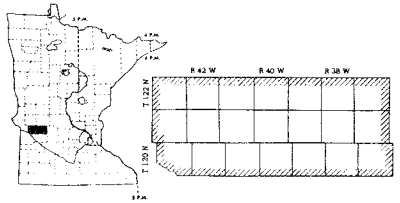
E. MAP 5 - Aquifer Test and Observation Well Locations

As of January, 1980, there were nineteen aquifer test analyses available for Swift County. A summary of these tests is shown on Table 1. The test data were obtained from the U.S.G.S., Division of Waters, and various private companies. Four of the tests were conducted for water table aquifers, fifteen for artesian aquifers. Transmissivities ranged from 9600 to 31000 square feet per day (ft^2/day) for the water table aquifers and from 1310 to 13200 ft^2/day for the artesian aquifers.

Twenty four observation wells are shown on Map 5. Eighteen were being measured and six were not actively being monitored as of January, 1980. Eight of the actively monitored wells were installed in 1979 by the Division of Waters in order to increase the monitoring program for buried outwash aquifers.

Of the eighteen active observation wells, sixteen are measured monthly by the Swift County SWCD and two by the U.S.G.S.. All of the data are submitted to the Division of Waters where they are entered into the ground water data base. Data from the six inactive observation wells are also available from the Division of Waters. Well construction and water level data for all twenty four observation wells are tabulated in Appendix A. Selected hydrographs are shown in Appendix B.



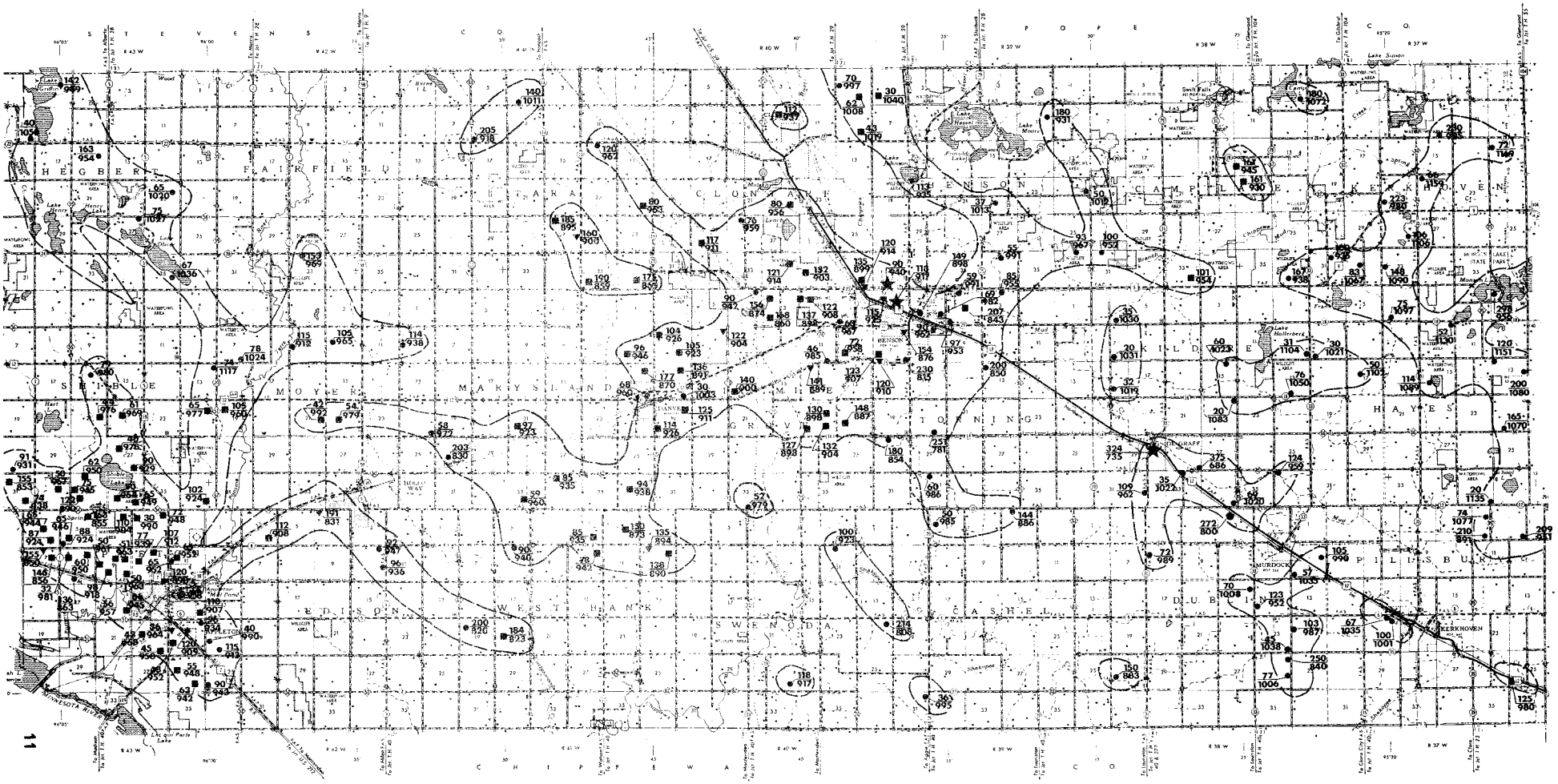


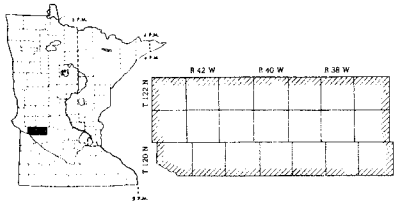
Map 1. LOCATION of WELLS and TEST HOLES with LITHOLOGIC LOGS, SWIFT COUNTY, as of JANUARY 1980, and INDEX to GEOLOGIC CROSS-SECTIONS

Map Symbols:

- ■ Irrigation
- ● Domestic
- ⬤ Industrial/Commercial
- ★ Municipal
- ▼ Observation
- ★ Test Hole

■^{2} – Number of wells at that location.





Map 2. INFERRED BOUNDARIES of BURIED OUTWASH AQUIFERS in SWIFT COUNTY

See Figures 2, 3, 4 for more detail of selected buried outwash aquifers.

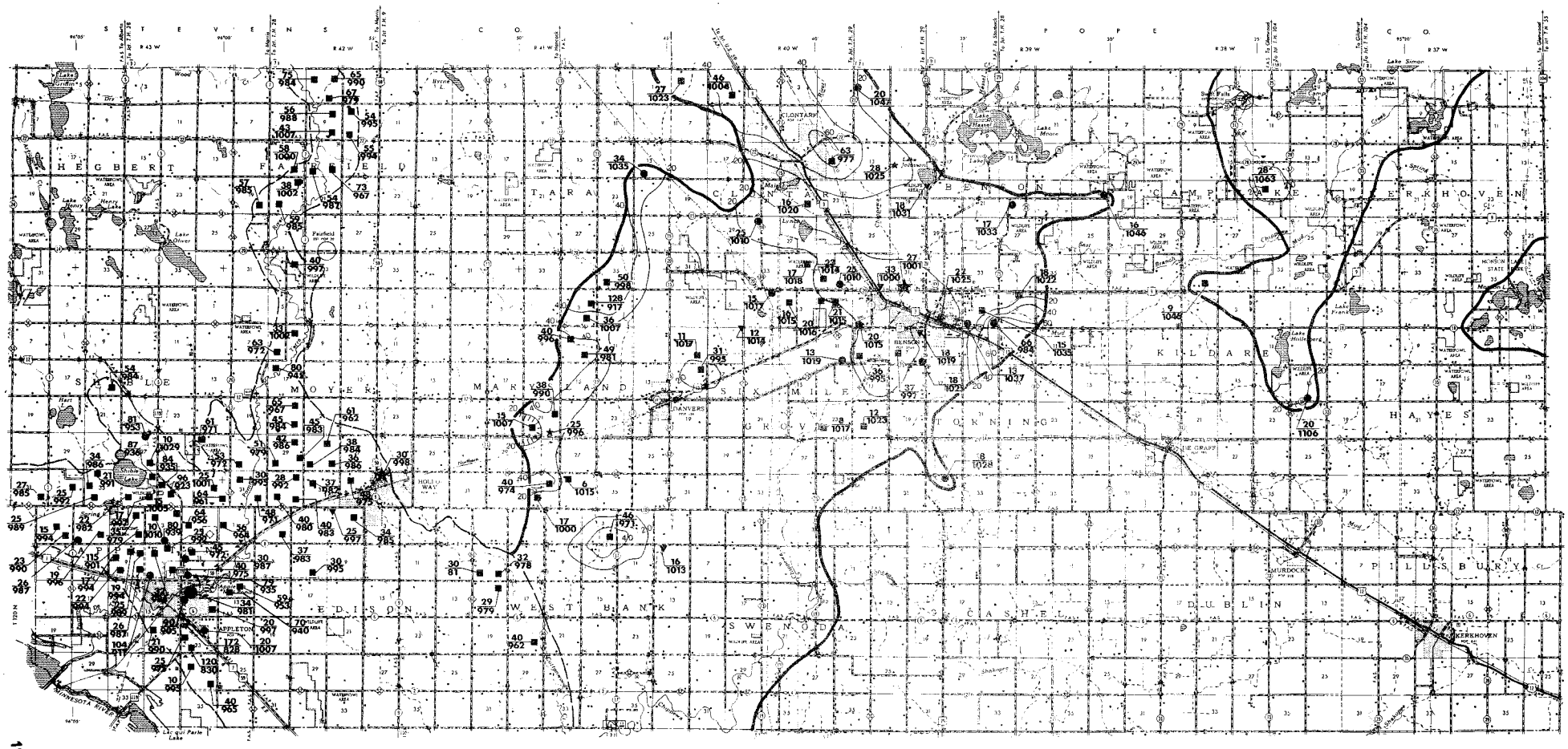
Map Symbols:

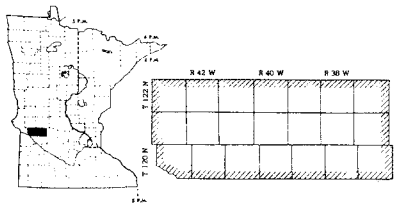
Inferred Aquifer Boundary

100 / 900 — depth to top of aquifer / elevation of top of aquifer

Types of Wells:

- Irrigation
- Domestic
- Commercial / Industrial
- Municipal
- Observation Well
- Test Hole





Map Symbols:

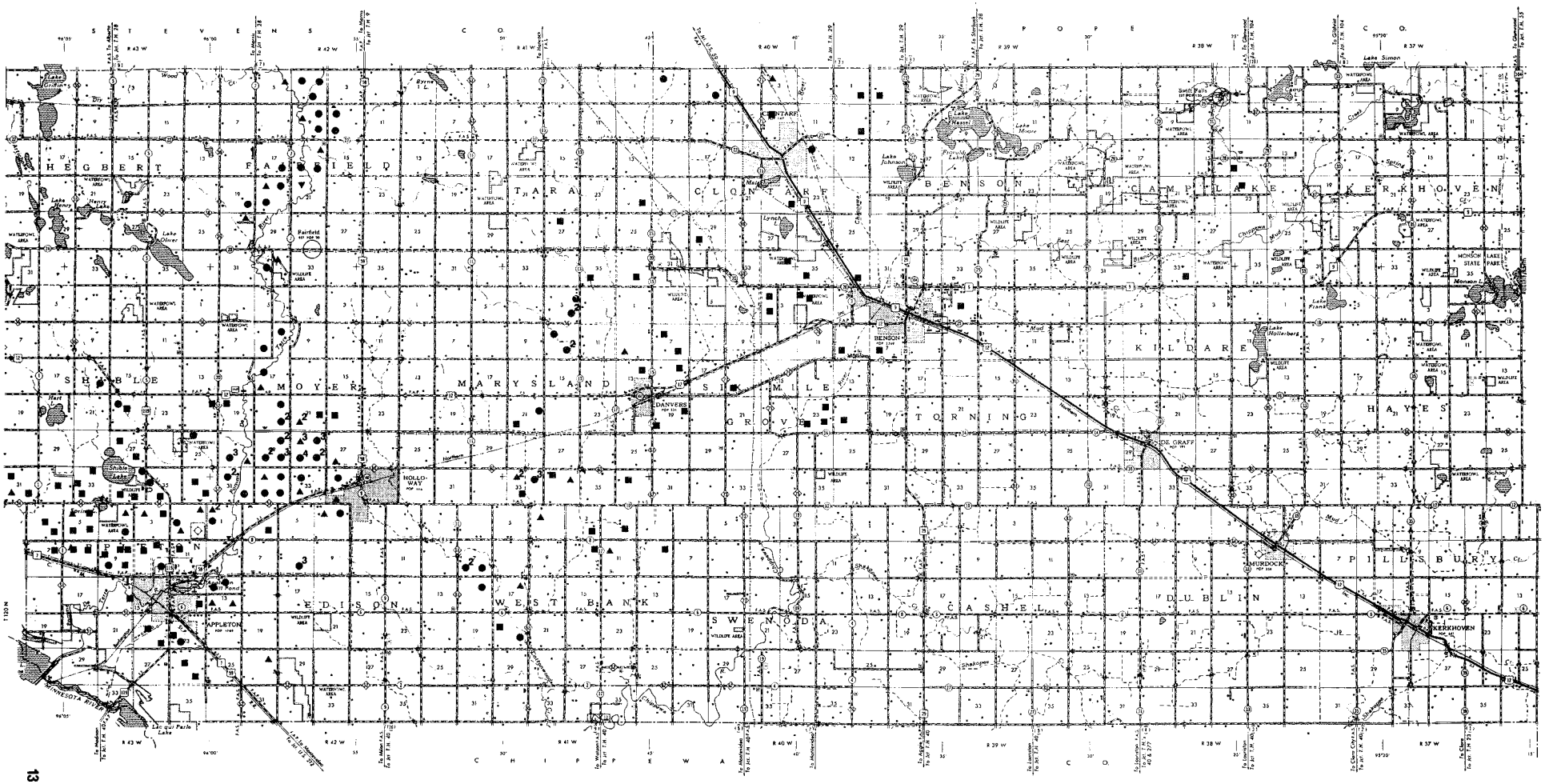
- Outwash Boundary
- U.S.G.S. Appleton Study Area
- Thickness Contour
- 50/900 thickness / bottom elevation

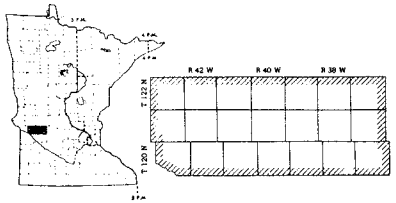
Types of Wells:

- Irrigation
- Domestic
- Commercial / Industrial
- Municipal
- Observation Well
- Test Hole

Map 3. SURFICIAL OUTWASH BOUNDARIES and THICKNESS, SWIFT COUNTY

Modified from U.S. Geological Survey Water Supply Paper 2039-B, 1976 and Minnesota Geological Survey Map S-3, 1979.





Map 4. LOCATION of IRRIGATION WELLS in SWIFT COUNTY as of JANUARY, 1980

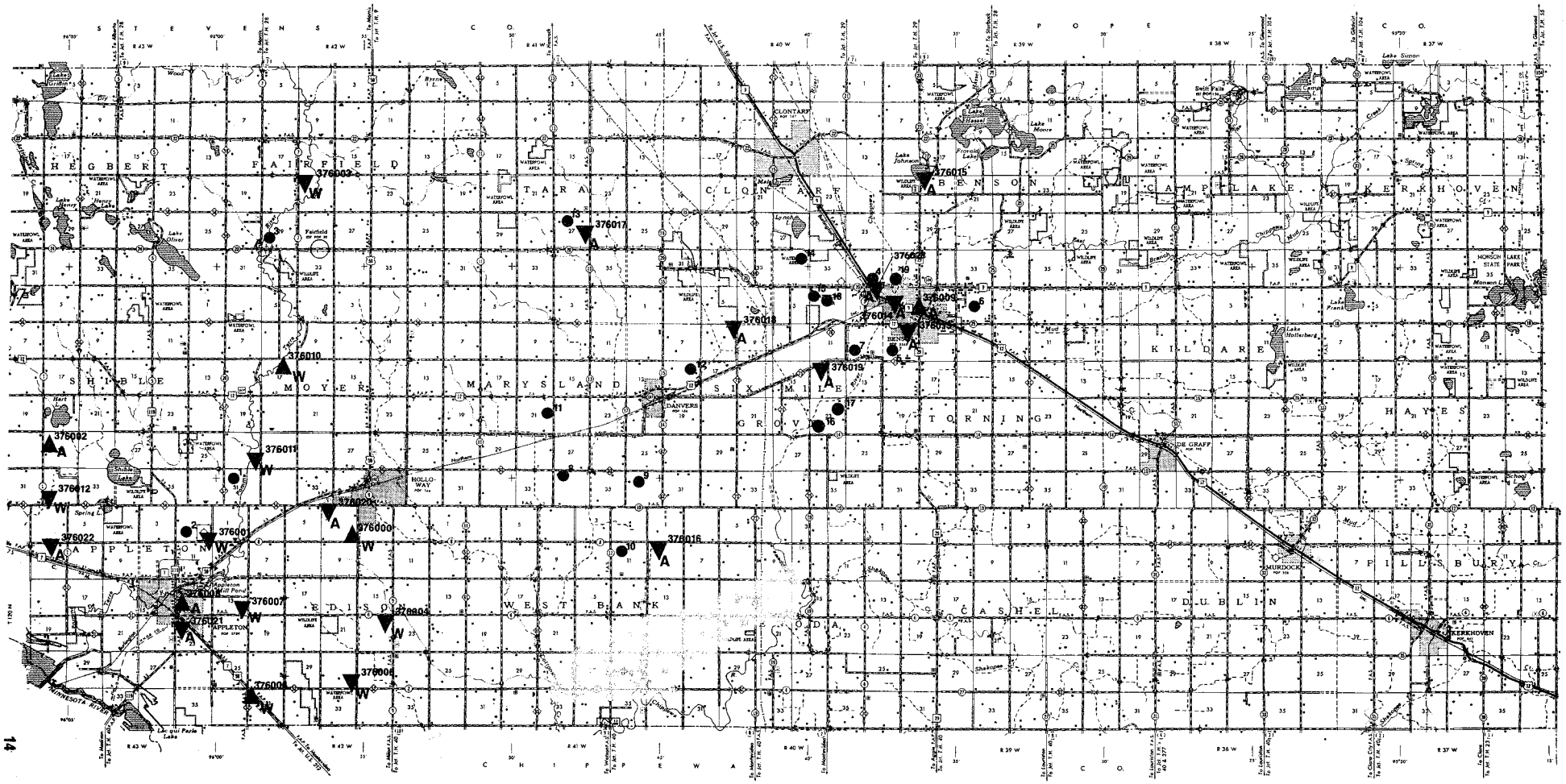
*Most surficial outwash wells produce under water table conditions and most buried outwash wells produce under artesian conditions. All wells have been field located.

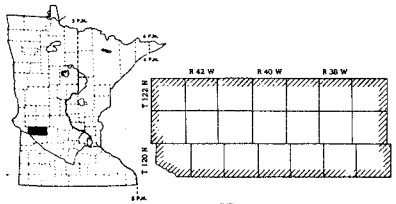
Map Symbols:

Aquifer Used*

- ● Surficial Outwash
- ■ Buried Outwash
- ▼ Bedrock
- ▲ No Well Log

■2 — Number of wells at that location.





Map 5. AQUIFER TEST and OBSERVATION WELL LOCATIONS in SWIFT COUNTY as of JANUARY, 1980

Map Symbols:

- ● Aquifer Test Site
- ▼ Observation Well – Active
- ▲ Observation Well – Inactive
- **W** – Water Table Conditions
- **A** – Artesian Conditions

TABLE 1. SUMMARY OF AQUIFER TESTS IN SWIFT COUNTY

TEST NO.	LOCATION T.R. SEC.	DATE	DURATION (HOURS)	DISCHARGE gpm	TRANSMISSIVITY DRAWDOWN/RECOVERY	STORAGE COEFFICIENT	AQUIFER/ CONDITION	WELL DEPTH	CONDUCTED BY
1.	121.42.31 bdb		44	475	71,800 gpd/Ft/ 9,600 Ft^2/day/	0.15	Qows/Water Table		U.S.G.S.
2.	120.43.2 cbd		56	1150	109,950/ 14,700/	0.20	Qows/WT		U.S.G.S.
3.	122.42.29 bac		65	495	231,900/ 31,000/	0.27	Qows/WT		U.S.G.S.
4.	122.40.36 dcd	5/78	24	750	24,000/30,462 3,209/ 4,073	0.0001	Qowb/Artesian	150'	D.N.R.
5.	121.39.7 cca	6/78	16	700	20,500/ 2,740/	0.0002	Qowb/A	178'	D.N.R.
6.	121.39.4 dbb	4/78	20	1200	31,000/ 4,144/	0.00017	Qowb/A	254'	PRIVATE
7.	121.40.12 cca	6/78	25.5	900	36,000/ 4,813/		Qowb/A	128'	PRIVATE
8.	121.41.34 bab	8/78	24	800	41,000/48,360 5,481/ 6,465		Qowb/A	119'	D.N.R.
9.	121.41.36 bdb	7/78	24	800	44,330/41,722 5,926/ 5,578	0.0004	Qowb/A	120'	D.N.R.
10.	120.41.11 bdb	7/78	24	750	13,750/13,655 1,838/ 1,814	0.000097	Qowb/A	167'	D.N.R.
11.	121.41.21 ada	8/78	53.5	700	/98,800 /13,290		Qows/WT	38'	D.N.R.
12.	121.40.18 aca	8/78	16.6	700	40,200/ 5,374/	0.00026	Qowb/A	161'	D.N.R.
13.	122.41.27 bad	8/78	23.3	750	9,800/ 9,900 1,310/ 1,324		Qowb/A	218'	D.N.R.
14.	122.40.34 adb	5/78	11	1000	33,400/29,700 4,465/ 3,970	0.00015	Qowb/A	162'	PRIVATE

15.	121.40.2 bbc	5/77	4	825	61,500/37,200 8,222/ 4,973		Qowb/A	170'	PRIVATE
16.	121.40.23 cdb	6/77	7	750	24,150/16,500 3,229/ 2,206		Qowb/A	163'	PRIVATE
17.	121.40.23 adb	1/79	24	1240	23,900/27,000 3,195/ 3,610	0.00006	Qowb/A	159'	PRIVATE
18.	121.40.2 bdb	12/78	9	1250	34,900/33,700 4,666/ 4,505	0.00003	Qowb/A	166'	PRIVATE
19.	122.39.31 cdd	10/78	24	600	19,800/24,400 2,647/ 3,262		Qowb/A	137'	PRIVATE

IV. WATER USE

A. GENERAL DISCUSSION

A water appropriations permit must be obtained from the Commissioner of Natural Resources by any person, corporation, or political subdivision of the State who appropriates surface or ground water in quantities exceeding 10,000 gallons per day or 1,000,000 gallons per year. Domestic uses serving under twenty five people are excepted.*

Appropriations permit holders are required to submit annual pumpage reports to the Division of Waters. These reports were used to produce the water use tables shown in this report. The years 1974 and 1978 were chosen to compare water use totals before and after the mid 1970's drought.

B. MUNICIPAL WELLS

According to Minnesota Department of Health public water supply data (1977), there are six municipalities in Swift County that obtain ground water from a total of sixteen wells. All six have appropriation permits, but Holloway, Kerkhoven, and Murdock obtained theirs in 1980. These communities did not report water usage for previous years with the exception of Kerkhoven which did report in 1974.

As shown in Table 2, the cities of Appleton and DeGraff reported a 20.5% and 54% increase, respectively, in ground water usage from 1974 to 1978. The city of Benson reported a decrease of 6.5% over the same time period. The overall totals shown on the table do not accurately reflect the increase in municipal ground water use in Swift County because all cities did not report.

C. IRRIGATION WELLS

Table 3 shows the number of irrigation wells by township in Swift County as determined by the 1979 field survey. Reported ground water use for irrigation in 1974 and 1978 are shown in millions of gallons. Since there are more wells in 1980 than existed in 1974 and 1978, the present annual water use is potentially greater now than that reported in 1978 although the amount of water used in a given year will depend on climatic conditions for that year.

Reported ground water withdrawals for irrigation increased 458% from 1974 to 1978. Analysis of individual pumpage reports shows an increase of 150% from water table aquifers and 930% from artesian aquifers over the four year period.

* Details of water appropriations rules and permit procedures can obtained from: MN DNR - Waters, 3rd Floor Space Center Bldg., 444 Lafayette Road, St. Paul, MN 55101 (612/296-4800).

TABLE 2.

REPORTED GROUND WATER USE

FOR MUNICIPAL WELLS, SWIFT CO.

MUNICIPALITY	NO. OF WELLS	1974	1978
APPLETON PN 75-4207	3	132,490,300	159,637,200 (+20.5%)
BENSON PN 75-4194	4	174,668,000	163,451,000 (-6.5%)
DEGRAFF PN 75-4204	2	7,062,000	10,870,000 ? (+54%)
HOLLOWAY PN 80-4180	2	---	---
KERKHOVEN PN 80-4188	3	30,109,600	---
MURDOCK PN 80-4189	2	---	---
TOTAL	16	344,329,900	333,958,200

T-R	TOWNSHIP NAME	NUMBER OF WELLS [1]	WATER USE	
			1974*	1978*
120.37	PILLSBURY	0	--	--
120.38	DUBLIN	0	--	--
120.39	CASHEL	0	--	--
120.40	SWENODA	0	--	--
120.41	WEST BANK	13	0	277
120.42	EDISON	8	0	53.8
120.43	APPLETON	40	252.5	825.3
121.37	HAYES	0	--	--
121.38	KILDARE	0	--	--
121.39	TORNING	2	--	NR
121.40	SIX MILE GROVE	15	0	55.3
121.41	MARYSLAND	19	0	270.1
121.42	MOYER	46	168.2	530.3
121.43	SHIBLE	20	57.8	397
122.37	KERKHOVEN	0	--	--
122.38	CAMP LAKE	3	NR	NR
122.39	BENSON	1	NR	NR
122.40	CLONTARF	12	0	71.7
122.41	TARA	4	0	35.2
122.42	FAIRFIELD	21	23	274.5
122.43	HEGBERT	0	--	--
TOTALS		204	501.5	2800

1- DETERMINED BY WINDSHIELD SURVEY MN DNR - DOW 1979
*- FIGURES, IN MILLIONS OF GALLONS
NR- NOT REPORTED

TABLE 3 -- REPORTED GROUND WATER USE FOR IRRIGATION, SWIFT CO.

Almost all of the artesian aquifer withdrawals are from buried glacial outwash. The large increase in the use of buried outwash aquifers definitely confirms the need to expand the observation well monitoring network in this County. Eight new observation wells were installed for this purpose in 1979 through the Division of Waters drilling program.

V. CONCLUSION

The continued increase in ground water withdrawals in Swift County underlines the need for careful monitoring of water levels, pumping rates, and consumptive use. Expansion of the observation well network in the County in 1979 and the assistance in monitoring these wells by the Swift County SWCD have contributed greatly to the knowledge needed for management of withdrawals from these aquifers. The pumping data submitted yearly to the Division of Waters by water users provide a means of monitoring withdrawal rates and total water use. These data combined with water level data enable the observation of aquifer response to pumping and provide a means of early identification of potential problems such as excessive withdrawals. The cooperation shown by users of high-capacity wells in furnishing pumping data is another important contribution toward responsible water resource management

Along with improvement of data collection, it is important that the geologic framework and hydraulic relationships between aquifers be determined. Current studies by the U.S.G.S. and Division of Waters will provide needed technical data and data interpretations to define the occurrence and availability of ground water resources in Swift County. Current and future work must include determination of hydraulic boundaries of buried outwash aquifers; the hydrologic relationship between buried, and surficial and buried, aquifers; and an assessment of the impacts of ground-water withdrawals on surface water supplies, ie., stream flows and lake levels.

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APPENDIX A.

OBSERVATION WELLS IN SWIFT COUNTY

1. Well Location And Construction Data
2. Water Levels, In Feet, From Land Surface Datum

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : USGS USGS A-49
DNR NO. : 376001

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : APPLETON

TOWNSHIP : 121
RANGE : 43
SECTION : 02
1/4 SECTION
PLS : SESESE
USGS : DDD

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1020 FEET ABOVE SEA LEVEL
DEPTH : 34 FT.
COMPLETED : 06/07/72
TYPE : WATER TABLE

METHOD DRILLED : BORED/AUGERED
DIAMETER : 1.25 IN.
SCREEN LENGTH : 2 FT.
CASING DEPTH : 32 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 3.0 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	3	SOIL BLACK WITH GRAVEL AT BOTTOM	SOIL	PLEISTOCENE
3	8	SAND FINE BROWN CLEAN WELL SORTED	SAND	
8	33	SAND COARSE SILTY BRN W/GRVL FINE	SAND	
33	37	SAND COARSE GRAY CLEAN WITH GRAVEL	SAND	
37	39	TILL GRAY SILT HARD	TILL	

PERIOD OF MONITORING
BEGIN : 09/14/72
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY SURFACE OUTWASH

REMARKS: APPLETON IRRIGATION STUDY. USGS NETWORK.

DNR OBSERVATION WELL NUMBER : 376001
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.

WATER LEVELS FOR YEAR 1972 NUMBER OF READINGS 4

SEP 14	18.44	NOV 7	18.88		
SEP 29	18.55	DEC 18	19.13		

WATER LEVELS FOR YEAR 1973 NUMBER OF READINGS 27

JAN 22	19.37	APR 16	19.38	JUL 16	19.85
FEB 20	19.56	APR 24	19.45	JUL 30	19.92
FEB 27	19.58	APR 30	19.46	AUG 13	20.12
MAR 5	19.52	MAY 7	19.49	AUG 27	20.28
MAR 12	19.45	MAY 14	19.54	SEP 10	20.40
MAR 19	19.40	MAY 21	19.50	SEP 24	20.50
MAR 26	19.38	MAY 28	19.42	OCT 9	20.61
APR 2	19.34	JUN 11	19.60	OCT 22	20.67
APR 9	19.39	JUL 2	19.74	DEC 21	20.85

WATER LEVELS FOR YEAR 1974 NUMBER OF READINGS 6

FEB 15	21.09	AUG 20	21.28	NOV 1	22.45
JUL 19	21.47	SEP 23	22.17	DEC 24	22.63

WATER LEVELS FOR YEAR 1975 NUMBER OF READINGS 11

FEB 7	22.72	AUG 4	21.89	OCT 24	22.63
MAR 20	22.58	SEP 15	22.30	NOV 17	23.00
JUN 24	21.70	SEP 18	22.33	DEC 15	23.00
JUL 11	21.80	OCT 15	22.80		

WATER LEVELS FOR YEAR 1976 NUMBER OF READINGS 20

JAN 14	23.10	MAY 17	22.30	SEP 29	23.75
FEB 11	22.94	JUN 15	22.50	OCT 15	24.20
FEB 13	23.10	JUN 21	22.29	NOV 10	24.32
MAR 15	22.80	JUL 15	22.80	NOV 17	24.70
MAR 19	22.52	AUG 10	22.93	DEC 10	24.56
APR 12	22.30	AUG 16	23.30	DEC 15	24.90
MAY 5	22.00	SEP 15	23.80		

WATER LEVELS FOR YEAR 1977 NUMBER OF READINGS 20

JAN 3	24.68	MAY 9	23.68	SEP 15	24.80
JAN 14	25.00	MAY 16	24.10	SEP 19	24.87
FEB 8	23.82	JUN 13	23.82	OCT 14	25.00
FEB 16	25.20	JUN 15	24.00	NOV 8	24.14
MAR 15	24.40	JUL 14	24.10	NOV 15	25.10
MAR 30	23.72	AUG 1	24.21	DEC 15	25.00
APR 15	24.00	AUG 12	24.40		

WATER LEVELS FOR YEAR 1978 NUMBER OF READINGS 17

JAN 16	24.90	MAY 22	22.92	OCT 13	23.20
FEB 15	24.90	JUN 19	22.70	NOV 3	23.30
MAR 10	24.55	JUL 6	22.69	NOV 15	23.40
MAR 15	24.70	AUG 15	22.70	DEC 12	22.83
APR 17	23.40	AUG 28	22.80	DEC 15	23.50
MAY 15	23.10	SEP 15	23.02		

WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 18

JAN 15	23.60	APR 27	22.08	AUG 15	21.90
JAN 18	23.55	MAY 14	22.00	AUG 16	21.79
FEB 20	23.60	MAY 29	21.82	SEP 17	22.20
MAR 15	23.70	JUN 15	21.90	OCT 11	22.27
MAR 27	23.29	JUL 9	21.68	OCT 15	22.50
APR 16	22.40	JUL 13	21.70	DEC 17	22.80

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 3

JAN 16	22.90	FEB 15	23.00	MAR 14	23.00

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : USGS A-34
DNR NO. : 376003

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : HOLLOWAY

TOWNSHIP : 122
RANGE : 42
SECTION : 21
1/4 SECTION
PLS : NWNWNW
USGS : BBB

TOPOGRAPHIC SETTING : VALLEY FLAT

ELEVATION : 1048 FEET ABOVE SEA LEVEL
DEPTH : 27 FT.
COMPLETED : 05/31/72
TYPE : WATER TABLE

METHOD DRILLED : BORED/AUGERED
DIAMETER : 1.25 IN.
SCREEN LENGTH : 2 FT.
CASING DEPTH : 25 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 2.8 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	4	TOPSOIL BLACK	SOIL	PLEISTOCENE
4	25	SAND COARSE BROWN AND GRAVEL	SAND	
25	34	SAND VERY COARSE BROWN AND GRAVEL	SAND	
34	51	SAND COARSE GRAY AND GRAVEL	SAND	
51	70	SAND COARSE GRAY FINER AT BOTTOM	SAND	
70	72	TILL GRAY	TILL	

PERIOD OF MONITORING
BEGIN : 09/14/72
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY SURFACE OUTWASH

REMARKS: APPLETON IRRIGATION STUDY. USGS NETWORK.

DNR OBSERVATION WELL NUMBER : 376003
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.

WATER LEVELS FOR YEAR 1972 NUMBER OF READINGS 4

SEP 14	15.43	NOV 7	16.37		
SEP 29	15.83	DEC 18	16.85		

WATER LEVELS FOR YEAR 1973 NUMBER OF READINGS 27

JAN 22	16.94	APR 16	15.73	JUL 16	16.85
FEB 20	17.06	APR 24	15.86	JUL 30	16.28
FEB 27	16.99	APR 30	15.95	AUG 13	16.98
MAR 5	16.63	MAY 7	15.92	AUG 27	17.42
MAR 12	16.24	MAY 14	16.00	SEP 10	17.65
MAR 19	15.74	MAY 21	16.10	SEP 24	17.80
MAR 26	15.60	MAY 28	16.14	OCT 9	17.92
APR 2	15.52	JUN 11	16.31	OCT 22	17.90
APR 9	15.59	JUL 2	16.80	DEC 21	18.14

WATER LEVELS FOR YEAR 1974 NUMBER OF READINGS 4

FEB 15	18.05	AUG 20	18.22		
JUL 19	17.88	SEP 23	18.90		

WATER LEVELS FOR YEAR 1975 NUMBER OF READINGS 5

JUL 11	15.40	OCT 15	17.10	DEC 15	17.50
SEP 15	16.30	NOV 17	17.40		

WATER LEVELS FOR YEAR 1976 NUMBER OF READINGS 20

JAN 14	17.70	MAY 17	16.30	SEP 29	18.71
FEB 11	17.32	JUN 15	16.70	OCT 15	19.00
FEB 13	17.60	JUN 21	16.68	NOV 10	18.83
MAR 15	17.10	JUL 15	17.40	NOV 17	19.10
MAR 19	16.81	AUG 10	17.86	DEC 10	18.76
APR 12	16.30	AUG 16	18.20	DEC 15	19.00
MAY 5	15.99	SEP 15	18.80		

WATER LEVELS FOR YEAR 1977 NUMBER OF READINGS 20

JAN 3	18.67	MAY 9	17.41	SEP 15	18.90
JAN 14	18.90	MAY 16	17.70	SEP 19	18.97
FEB 8	18.55	JUN 13	17.50	OCT 14	18.90
FEB 16	18.80	JUN 15	17.70	NOV 8	18.79
MAR 15	18.80	JUL 14	18.00	NOV 15	18.70
MAR 30	17.91	AUG 9	18.39	DEC 15	18.21
APR 15	17.90	AUG 12	18.50		

WATER LEVELS FOR YEAR 1978 NUMBER OF READINGS 20

JAN 16	17.70	MAY 23	15.01	SEP 25	16.55
FEB 6	17.45	JUN 19	15.20	OCT 13	16.90
FEB 15	17.40	JUL 6	15.28	NOV 3	16.96
MAR 10	17.12	JUL 14	15.40	NOV 15	17.10
MAR 15	17.20	AUG 15	15.70	DEC 12	17.26
APR 17	16.00	AUG 28	15.94	DEC 15	17.40
MAY 15	15.10	SEP 15	16.50		

WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 20

JAN 15	17.60	MAY 15	15.60	SEP 17	16.00
FEB 20	17.70	MAY 29	15.22	OCT 11	16.43
FEB 21	17.50	JUN 15	15.20	OCT 15	16.70
MAR 15	17.60	JUL 9	14.81	NOV 15	16.90
MAR 27	17.34	JUL 13	14.90	NOV 26	16.81
APR 16	16.70	AUG 15	15.10	DEC 17	16.80
APR 27	16.14	AUG 16	15.09		

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 3

JAN 16	17.20	FEB 15	17.30	MAR 14	17.30

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : USGS A-14
DNR NO. : 376004

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : APPLETON

TOWNSHIP : 120
RANGE : 42
SECTION : 22
1/4 SECTION
PLS : NENENE
USGS : AAA

TOPOGRAPHIC SETTING : UNDULATING

ELEVATION : 1010 FEET ABOVE SEA LEVEL
DEPTH : 20 FT.
COMPLETED : 11/04/71
TYPE : WATER TABLE

METHOD DRILLED : BORED/AUGERED
DIAMETER : 1.25 IN.
SCREEN LENGTH : 2 FT.
CASING DEPTH : 18 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 3.0 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	2	SOIL SILTY DARK BROWN	SOIL	PLEISTOCENE
2	20	SAND MEDIUM-VERY COARSE AND GRAVEL	SAND	
20	28	SILT SATURATED POORLY SORTED	SILT	
28	42	SAND MED-VCCARSE GRAY SOME PEBBLES	SAND	
42	52	TILL SILTY POORLY SORTED	TILL	

PERIOD OF MONITORING
BEGIN : 02/27/73
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY SURFACE OUTWASH

REMARKS: APPLETON IRRIGATION STUDY

DNR OBSERVATION WELL NUMBER : 376004
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.

WATER LEVELS FOR YEAR 1973 NUMBER OF READINGS 24

FEB 27	6.08	APR 24	5.19	JUL 16	5.61
MAR 5	6.08	APR 30	5.10	JUL 30	6.00
MAR 12	6.00	MAY 7	5.02	AUG 13	6.28
MAR 19	5.85	MAY 14	5.00	AUG 27	6.53
MAR 26	5.68	MAY 21	4.89	SEP 10	6.85
APR 2	5.54	MAY 28	4.85	SEP 24	7.15
APR 9	5.39	JUN 11	4.82	OCT 9	7.40
APR 16	5.30	JUL 2	5.09	OCT 22	6.97

WATER LEVELS FOR YEAR 1975 NUMBER OF READINGS 5

JUL 11	7.00	OCT 15	7.90	DEC 15	7.90
SEP 15	7.80	NOV 17	7.90		

WATER LEVELS FOR YEAR 1976 NUMBER OF READINGS 12

JAN 14	8.00	MAY 17	7.70	SEP 15	8.00
FEB 13	8.10	JUN 15	7.70	OCT 15	8.20
MAR 15	8.00	JUL 15	7.80	NOV 17	8.40
APR 12	7.80	AUG 16	7.80	DEC 15	8.40

WATER LEVELS FOR YEAR 1977 NUMBER OF READINGS 12

JAN 14	8.60	MAY 16	8.30	SEP 15	8.00
FEB 16	8.70	JUN 15	8.10	OCT 14	8.10
MAR 15	8.70	JUL 14	8.00	NOV 15	8.10
APR 15	8.60	AUG 12	8.10	DEC 15	8.10

WATER LEVELS FOR YEAR 1978 NUMBER OF READINGS 12

JAN 16	7.90	MAY 15	7.40	SEP 15	6.50
FEB 15	7.90	JUN 19	7.10	OCT 13	6.50
MAR 15	7.90	JUL 14	6.90	NOV 15	6.60
APR 17	7.80	AUG 15	6.60	DEC 15	6.60

WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 12

JAN 15	6.70	MAY 14	6.60	SEP 17	6.10
FEB 20	6.90	JUN 15	6.30	OCT 15	6.30
MAR 15	7.00	JUL 13	6.00	NOV 15	6.30
APR 16	6.90	AUG 15	5.90	DEC 17	6.40

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 3

JAN 16	6.50	FEB 15	6.70	MAR 14	6.70

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : USGS A-69
INR NO. : 376005

COUNTY : SWIFT COUNTY
CITY : APPLETON

TOWNSHIP : 120
RANGE : 42
SECTION : 28
1/4 SECTION
PLS : SESESE
USGS : DDD

ELEVATION : 1023 FEET ABOVE SEA LEVEL
DEPTH : 11 FT.
COMPLETED : 06/14/72
TYPE : WATER TABLE

OBSERVER: USGS

TOPOGRAPHIC SETTING : UNDULATING

METHOD DRILLED : BORED/AUGERED
DIAMETER : 1.25 IN.
SCREEN LENGTH : 2 FT.
CASING DEPTH : 9 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 4.6 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	2	TOPSOIL SILTY	SOIL	PLEISTOCENE
2	12	SILT DARK BROWN BANDED	SILT	
12	16	TILL BROWN SOFT	TILL	
16	22	TILL GRAY SOFT	TILL	

PERIOD OF MONITORING
BEGIN : 09/14/72
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY SURFACE OUTWASH

REMARKS: APPLETON IRRIGATION STUDY.

DNR OBSERVATION WELL NUMBER : 376005
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.

WATER LEVELS FOR YEAR 1972 NUMBER OF READINGS 4

SEP 14	2.18	NOV 6	1.27
SEP 29	3.51	DEC 18	.61

WATER LEVELS FOR YEAR 1973 NUMBER OF READINGS 26

JAN 22	4.46	APR 16	.15	JUL 16	5.89
FEB 20	5.09	APR 24	1.00	JUL 30	4.44
FEB 27	3.42	APR 30	.64	AUG 13	5.40
MAR 5	1.34	MAY 7	.65	AUG 27	5.75
MAR 12	.50	MAY 14	1.55	SEP 10	6.10
MAR 19	.59	MAY 21	1.00	SEP 24	6.56
MAR 26	.52	MAY 28	.70	OCT 9	6.15
APR 2	.70	JUN 11	3.30	OCT 22	5.37
APR 9	.78	JUL 2	4.83		

WATER LEVELS FOR YEAR 1977 NUMBER OF READINGS 9

JAN 3	10.11	MAY 9	5.00	SEP 19	8.70
FEB 8	10.17	JUN 13	6.41	NOV 8	6.54
APR 1	3.70	AUG 4	7.78	DEC 15	6.09

WATER LEVELS FOR YEAR 1978 NUMBER OF READINGS 8

FEB 6	7.55	JUL 6	3.59	NOV 3	5.88
MAR 10	8.07	AUG 28	5.11	DEC 12	6.32
MAY 22	3.80	SEP 25	4.65		

WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 7

JAN 18	7.21	MAY 29	.54	OCT 11	6.24
MAR 27	4.12	JUL 9	2.05		
APR 27	.82	AUG 16	3.73		

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : USGS A-58
DNR NO. : 376007

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : APPLETON

TOWNSHIP : 120
RANGE : 43
SECTION : 13
1/4 SECTION
PLS : SESESE
USGS : DDD

TOPOGRAPHIC SETTING : UNDULATING

ELEVATION : 1019 FEET ABOVE SEA LEVEL
DEPTH : 34 FT.
COMPLETED : 06/09/72
TYPE : WATER TABLE

METHOD DRILLED : BORED/AUGERED
DIAMETER : 1.25 IN.
SCREEN LENGTH : 2 FT.
CASING DEPTH : 32 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 3.0 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	1	TOPSOIL BLACK	SOIL	PLEISTOCENE
1	9	ROAD FILL	FILL	
9	26	SAND FINE TO MEDIUM BROWN CLEAN	SAND	
26	41	SAND MEDIUM TO COARSE GRAY CLEAN	SAND	
41	44	GRAVEL COARSE AND COBBLES	GRVL	
44	46	TILL GRAY HARD	TILL	

PERIOD OF MONITORING
BEGIN : 09/14/72
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY SURFACE OUTWASH

REMARKS: APPLETON IRRIGATION STUDY.

DNR OBSERVATION WELL NUMBER : 376007
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.

WATER LEVELS FOR YEAR 1972 NUMBER OF READINGS 4

SEP 14	14.18	NOV 6	14.46		
SEP 29	14.32	DEC 18	14.69		

WATER LEVELS FOR YEAR 1973 NUMBER OF READINGS 27

JAN 22	15.00	APR 16	14.45	JUL 16	15.27
FEB 20	15.17	APR 24	14.75	JUL 30	15.60
FEB 27	15.22	APR 30	14.76	AUG 13	16.00
MAR 5	15.02	MAY 7	14.50	AUG 27	16.24
MAR 12	14.92	MAY 14	14.77	SEP 10	16.48
MAR 19	14.89	MAY 21	14.76	SEP 24	16.51
MAR 26	14.82	MAY 28	14.75	OCT 9	16.56
APR 2	14.72	JUN 11	14.82	OCT 22	16.53
APR 9	14.82	JUL 2	15.00	DEC 21	16.59

WATER LEVELS FOR YEAR 1974 NUMBER OF READINGS 1

FEB 15	16.96

WATER LEVELS FOR YEAR 1975 NUMBER OF READINGS 5

JUL 11	18.00	OCT 15	18.50	DEC 15	18.50
SEP 15	18.50	NOV 17	18.60		

WATER LEVELS FOR YEAR 1976 NUMBER OF READINGS 12

JAN 14	18.60	MAY 17	18.20	SEP 15	20.10
FEB 13	18.70	JUN 15	18.40	OCT 15	20.10
MAR 15	18.40	JUL 15	18.80	NOV 17	20.10
APR 12	17.90	AUG 16	19.40	DEC 15	20.00

WATER LEVELS FOR YEAR 1977 NUMBER OF READINGS 12

JAN 14	20.10	MAY 16	19.30	SEP 15	20.00
FEB 16	20.10	JUN 15	19.20	OCT 14	19.80
MAR 15	19.60	JUL 14	19.40	NOV 15	19.70
APR 15	19.40	AUG 12	19.90	DEC 15	19.50

WATER LEVELS FOR YEAR 1978 NUMBER OF READINGS 12

JAN 16	19.20	MAY 15	17.70	SEP 15	17.80
FEB 15	19.10	JUN 19	17.50	OCT 13	17.70
MAR 15	18.80	JUL 14	17.40	NOV 15	17.70
APR 17	18.20	AUG 15	17.50	DEC 15	17.70

WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 12

JAN 15	17.80	MAY 14	16.30	SEP 17	16.30
FEB 20	17.80	JUN 15	16.30	OCT 15	16.60
MAR 15	17.90	JUL 13	15.70	NOV 15	16.50
APR 16	16.70	AUG 15	15.90	DEC 17	16.40

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 3

JAN 16	16.50	FEB 15	16.80	MAR 14	16.90

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : USGS A-97
DNR NO. : 376011

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : HOLLOWAY

TOWNSHIP : 121
RANGE : 42
SECTION : 30
1/4 SECTION
PLS : SENESE
USGS : DAD

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1020 FEET ABOVE SEA LEVEL
DEPTH : 25 FT.
COMPLETED : 07/13/72
TYPE : WATER TABLE

METHOD DRILLED : BORED/AUGERED
DIAMETER : 1.25 IN.
SCREEN LENGTH : 2 FT.
CASING DEPTH : 23 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 4.5 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	1	SOIL AND FILL	SOIL	PLEISTOCENE
1	17	SAND COARSE BROWN AND GRAVEL	SAND	
17	25	SAND COARSE GRAY AND GRAVEL	SAND	
25	34	SAND FINE TO MEDIUM GRAY	SAND	
34	36	TILL GRAY	TILL	

PERIOD OF MONITORING
BEGIN : 09/14/72
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY SURFACE OUTWASH

REMARKS: APPLETON IRRIGATION STUDY

DNR OBSERVATION WELL NUMBER : 376011
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.

WATER LEVELS FOR YEAR 1972 NUMBER OF READINGS 4

SEP 14	7.21	NOV 7	7.77		
SEP 29	7.58	DEC 18	8.05		

WATER LEVELS FOR YEAR 1973 NUMBER OF READINGS 27

JAN 22	7.94	APR 16	7.60	JUL 16	8.67
FEB 20	8.03	APR 24	7.72	JUL 30	8.79
FEB 27	7.94	APR 30	7.79	AUG 13	8.93
MAR 3	7.71	MAY 7	7.59	AUG 27	8.86
MAR 12	7.44	MAY 14	7.82	SEP 10	9.13
MAR 19	7.28	MAY 21	7.91	SEP 24	9.22
MAR 26	7.28	MAY 28	7.75	OCT 9	9.17
APR 2	7.30	JUN 11	7.99	OCT 22	9.18
APR 9	7.44	JUL 2	8.45	DEC 21	9.19

WATER LEVELS FOR YEAR 1974 NUMBER OF READINGS 1

FEB 15	9.02

WATER LEVELS FOR YEAR 1975 NUMBER OF READINGS 3

OCT 10	10.00	NOV 17	10.00	DEC 15	9.70

WATER LEVELS FOR YEAR 1976 NUMBER OF READINGS 12

JAN 14	9.60	MAY 17	9.50	SEP 15	10.70
FEB 13	9.30	JUN 15	9.70	OCT 15	10.80
MAR 15	8.90	JUL 15	10.10	NOV 17	10.90
APR 12	8.80	AUG 16	10.40	DEC 15	10.70

WATER LEVELS FOR YEAR 1977 NUMBER OF READINGS 12

JAN 14	10.50	MAY 16	10.10	SEP 15	10.80
FEB 16	9.90	JUN 15	10.10	OCT 14	10.60
MAR 15	8.90	JUL 14	10.30	NOV 15	10.20
APR 15	9.70	AUG 12	10.50	DEC 15	10.00

WATER LEVELS FOR YEAR 1978 NUMBER OF READINGS 12

JAN 16	9.60	MAY 15	8.30	SEP 15	9.60
FEB 15	9.40	JUN 19	8.80	OCT 13	9.80
MAR 15	9.10	JUL 14	8.10	NOV 15	9.90
APR 17	7.90	AUG 15	9.00	DEC 15	9.90

WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 12

JAN 15	9.70	MAY 14	7.90	SEP 17	9.90
FEB 20	9.20	JUN 15	8.60	OCT 15	9.90
MAR 15	8.90	JUL 13	7.90	NOV 15	9.50
APR 16	7.20	AUG 13	9.20	DEC 17	9.50

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 3

JAN 16	9.40	FEB 15	9.30	MAR 14	10.10

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : USGS A-28
DNR NO. : 376012

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : APPLETON

TOWNSHIP : 121
RANGE : 43
SECTION : 32
1/4 SECTION
PLS : SWSWSW
USGS : CCC

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1035 FEET ABOVE SEA LEVEL
DEPTH : 21 FT.
COMPLETED : 11/11/71
TYPE : WATER TABLE

METHOD DRILLED : BORED/AUGERED
DIAMETER : 1.25 IN.
SCREEN LENGTH : 2 FT.
CASING DEPTH : 19 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 4.0 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	1	SAND FINE BROWN	SAND	PLEISTOCENE
1	2	SILT LIGHT BROWN	SILT	
2	18	SAND FINE WELL SORTED BROWN	SAND	
18	22	TILL GRAY	TILL	

PERIOD OF MONITORING
BEGIN : 02/27/73
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY SURFACE OUTWASH

REMARKS: APPLETON IRRIGATION STUDY.

DNR OBSERVATION WELL NUMBER : 376012
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.

WATER LEVELS FOR YEAR 1973 NUMBER OF READINGS 24

FEB 27	10.38	APR 24	9.70	JUL 16	10.47
MAR 5	10.33	APR 30	9.74	JUL 30	10.68
MAR 12	10.01	MAY 7	9.75	AUG 13	10.85
MAR 19	10.08	MAY 14	9.75	AUG 27	11.00
MAR 26	9.89	MAY 21	9.78	SEP 10	11.18
APR 2	9.77	MAY 28	9.86	SEP 24	11.29
APR 9	9.70	JUN 11	9.95	OCT 9	11.39
APR 16	9.69	JUL 2	10.30	OCT 22	11.38

WATER LEVELS FOR YEAR 1975 NUMBER OF READINGS 5

JUL 11	11.20	OCT 13	12.00	DEC 15	12.10
SEP 15	11.70	NOV 17	12.10		

WATER LEVELS FOR YEAR 1976 NUMBER OF READINGS 12

JAN 14	12.30	MAY 17	11.50	SEP 15	12.80
FEB 13	12.40	JUN 15	11.30	OCT 15	13.20
MAR 15	11.60	JUL 15	12.10	NOV 17	13.50
APR 12	11.20	AUG 16	12.40	DEC 15	13.60

WATER LEVELS FOR YEAR 1977 NUMBER OF READINGS 12

JAN 14	13.80	MAY 16	12.80	SEP 15	13.50
FEB 16	13.90	JUN 15	12.80	OCT 14	13.80
MAR 15	13.80	JUL 14	13.00	NOV 15	13.70
APR 15	12.80	AUG 12	13.30	DEC 15	13.20

WATER LEVELS FOR YEAR 1978 NUMBER OF READINGS 12

JAN 16	12.90	MAY 15	11.90	SEP 15	11.70
FEB 15	13.10	JUN 19	11.60	OCT 13	12.00
MAR 15	13.20	JUL 14	11.60	NOV 15	12.40
APR 17	12.30	AUG 15	11.40	DEC 15	12.60

WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 12

JAN 15	12.70	MAY 14	11.40	SEP 17	11.90
FEB 20	12.70	JUN 15	11.40	OCT 15	12.20
MAR 15	13.00	JUL 13	11.40	NOV 15	12.50
APR 16	11.60	AUG 15	11.80	DEC 17	12.30

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 3

JAN 16	12.70	FEB 15	12.90	MAR 14	12.60

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : CITY OF BENSON #1
DNR NO. : 376013

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : BENSON

TOWNSHIP : 121
RANGE : 39
SECTION : 07
1/4 SECTION
PLS : SWNENE
USGS : AAC

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1038 FEET ABOVE SEA LEVEL
DEPTH : 167 FT.
COMPLETED : 03/20/79
TYPE : ARTESIAN

METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DIAMETER : 3 IN.
SCREEN LENGTH : 10 FT.
CASING DEPTH : 157 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 0.0 FT. TOP OF VALVE BOX AT LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	3	TOPSOIL BLACK	SOIL	PLEISTOCENE
3	18	SAND GRAY	SAND	
18	20	ROCK RED	ROCK	
20	36	CLAY GRAY	CLAY	
36	37	ROCK RED	ROCK	
37	45	CLAY GRAY	CLAY	
45	50	SAND GRAY	SAND	
50	52	CLAY GRAY	CLAY	
52	62	SAND GRAY	SAND	
62	72	CLAY SANDY GRAY	CLAY	
72	80	SAND GRAY	SAND	
80	84	CLAY SANDY	CLAY	
84	95	CLAY AND SAND GRAY	CLAY	
95	111	SAND GRAY	SAND	
111	143	CLAY GRAY	CLAY	
143	145	SAND GRAY	SAND	
145	154	CLAY GRAY	CLAY	
154	167	SAND GRAY	SAND	
167	175	CLAY GRAY	CLAY	

PERIOD OF MONITORING
BEGIN : 05/21/79
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY BURIED OUTWASH

REMARKS: USGS NETWORK.

DNR OBSERVATION WELL NUMBER : 376013
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 23

MAR 20	14.00	JUL 23	7.75	SEP 24	8.08
APR 16	11.42	JUL 30	7.75	OCT 11	8.09
MAY 14	8.58	AUG 6	7.83	OCT 15	8.25
MAY 21	8.90	AUG 13	7.75	NOV 15	7.83
JUN 15	8.00	AUG 16	7.49	NOV 26	7.10
JUL 2	7.58	AUG 20	7.67	DEC 17	7.50
JUL 9	7.37	SEP 13	7.74		
JUL 16	7.58	SEP 17	7.92		

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 2

JAN 16	7.50	FEB 15	7.90

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : CITY OF BENSON #2
DNR NO. : 376314

OBSERVER: JSGS

COUNTY : SWIFT COUNTY
CITY : BENSON

TOWNSHIP : 121
RANGE : 39
SECTION : 06
1/4 SECTION
PLS : NWSENW
USGS : BDB

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1030 FEET ABOVE SEA LEVEL
DEPTH : 143 FT.
COMPLETED : 03/22/79
TYPE : ARTESIAN

METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DIAMETER : 3 IN.
SCREEN LENGTH : 10 FT.
CASING DEPTH : 133 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 3.1 FT. TOP OF RCDR FLOOR ABV LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	18	CLAY BLACK	CLAY	PLEISTOCENE
18	35	CLAY SANDY GRAY	CLAY	
35	48	CLAY GRAY	CLAY	
48	55	CLAY SANDY GRAY	CLAY	
55	60	CLAY GRAY	CLAY	
60	65	CLAY SANDY GRAY	CLAY	
65	75	CLAY GRAY	CLAY	
75	85	CLAY SANDY GRAY	CLAY	
85	89	SAND GRAY	SAND	
89	115	CLAY SANDY GRAY	CLAY	
115	150	SAND GRAY	SAND	
150	155	CLAY GRAY	CLAY	

PERIOD OF MONITORING
BEGIN : 05/21/79
END : / /
FREQ OF MEAS : CONTINUOUS

METHOD OF MEASUREMENT : WATER STAGE RECORDER

AQUIFER : QUATERNARY BURIED OUTWASH

REMARKS: USGS NETWORK.

DNR OBSERVATION WELL NUMBER : 376014
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 31

MAR 22	3.00	JUN 30	9.63	SEP 15	15.78
APR 6	5.70	JUL 9	10.20	SEP 20	14.38
MAY 21	8.18	JUL 10	12.94	SEP 25	16.79
MAY 25	10.66	JUL 15	10.30	SEP 30	12.84
MAY 31	9.72	JUL 20	13.26	OCT 5	11.82
JUN 1	8.24	JUL 25	12.47	OCT 10	11.29
JUN 5	11.83	JUL 31	10.19	OCT 11	10.09
JUN 10	10.30	AUG 5	10.32	OCT 15	14.70
JUN 15	13.30	AUG 10	12.07	NOV 26	10.41
JUN 20	8.74	AUG 16	9.59		
JUN 25	9.42	SEP 13	11.74		

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : WAYSIDE PARK 79-2
DNR NO. : 376015

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : BENSON

TOWNSHIP : 122
RANGE : 39
SECTION : 20
1/4 SECTION
PLS : SWNWNW
USGS : BBC

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1048 FEET ABOVE SEA LEVEL
DEPTH : 130 FT.
COMPLETED : 06/18/79
TYPE : ARTESIAN

METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DIAMETER : 2 IN.
SCREEN LENGTH : 4 FT.
CASING DEPTH : 126 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 2.75 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	5	SAND FINE DARK BROWN	SAND	PLEISTOCENE
5	12	CLAY LACUSTRINE WHITE	CLAY	
12	18	SAND COARSE BROWN	SAND	
18	30	CLAY WITH GRAVEL GRAY	CLAY	
30	57	CLAY GRAY	CLAY	
57	60	SAND DIRTY GRAY	SAND	
60	70	CLAY WITH GRAVEL	CLAY	
70	71	SAND BROWN	SAND	
71	113	CLAY SANDY GRAY	CLAY	
113	130	GRAVEL MEDIUM TO COARSE GRAY BROWN	GRVL	

PERIOD OF MONITORING
BEGIN : 06/25/79
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY BURIED OUTWASH

REMARKS:

DNR OBSERVATION WELL NUMBER : 376015
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 6

JUN 25	4.00	SEP 17	7.85	NOV 15	5.95
AUG 15	8.25	OCT 15	7.35	DEC 17	6.45

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 2

JAN 16	6.85	FEB 15	7.45

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : MIKE O'LEARY 79-5 OBSERVER: SWCD
DNR NO. : 376016

COUNTY : SWIFT COUNTY
CITY : DANVERS

TOWNSHIP : 120 TOPOGRAPHIC SETTING : FLAT SURFA
RANGE : 41
SECTION : 12
1/4 SECTION
PLS : NENWNW
USGS : BBA

ELEVATION : 1029 FEET ABOVE SEA LEVEL
DEPTH : 157 FT.
COMPLETED : 06/21/79
TYPE : ARTESIAN

METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DIAMETER : 2 IN.
SCREEN LENGTH : 4 FT.
CASING DEPTH : 153 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 3.35 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	5	SAND FINE BROWN	SAND	PLEISTOCENE
5	16	SAND MEDIUM TO COARSE BROWN	SAND	
16	25	CLAY SANDY GRAY SOFT	CLAY	
25	33	CLAY GRAY STICKY	CLAY	
33	40	SAND FINE BROWN	SAND	
40	45	SAND WITH COAL BROWN AND BLACK	SAND	
45	70	CLAY WITH GRAVEL GRAY STICKY	CLAY	
70	75	SAND FINE TO MEDIUM BROWN	SAND	
75	82	GRAVEL COARSE BROWN	GRVL	
82	83	SAND WITH CLAY LENSES BROWN	SAND	
83	115	SAND FINE BROWN	SAND	
115	120	SAND FINE TO MEDIUM BROWN	SAND	
120	131	GRAVEL COARSE BROWN	GRVL	
131	135	CLAY WITH GRAVEL	CLAY	
135	157	GRAVEL MEDIUM TO COARSE	GRVL	

PERIOD OF MONITORING
BEGIN : 06/26/79
END : / /
FREQ OF MEAS : MONTHLY METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY BURIED OUTWASH

REMARKS: MEASURING POINT WAS 2.5" BEFORE NOVEMBER 1979.

DNR OBSERVATION WELL NUMBER : 376016
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 5

JUN 26	9.87	SEP 17	23.70	DEC 17	12.35
AUG 15	16.10	OCT 15	22.30		

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 2

JAN 16	12.35	FEB 15	12.65

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : KEN ROHLOFF 79-7
DNR NO. : 376017

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : DANVERS

TOWNSHIP : 122
RANGE : 41
SECTION : 27
1/4 SECTION
PLS : NENESE
USGS : DAA

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1060 FEET ABOVE SEA LEVEL
DEPTH : 184 FT.
COMPLETED : 06/22/79
TYPE : ARTESIAN

METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DIAMETER : 2 IN.
SCREEN LENGTH : 4 FT.
CASING DEPTH : 180 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 3.0 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	18	CLAY YELLOW SOFT	CLAY	PLEISTOCENE
18	25	GRAVEL YELLOW	GRVL	
25	30	CLAY YELLOW	CLAY	
30	39	CLAY GRAY	CLAY	
39	50	SAND COARSE BROWN	SAND	
50	51	CLAY GRAY	CLAY	
51	52	SAND COARSE BROWN	SAND	
52	60	CLAY GRAY	CLAY	
60	63	SAND FINE BROWN	SAND	
63	69	SAND COARSE BROWN	SAND	
69	105	CLAY WITH GRAVEL GRAY	CLAY	
105	107	GRAVEL COARSE BROWN	GRVL	
107	138	CLAY WITH GRAVEL GRAY	CLAY	
138	140	GRAVEL GRAY DIRTY	GRVL	
140	154	SAND FINE BROWN	SAND	
154	160	CLAY GRAY	CLAY	
160	162	GRAVEL COARSE BROWN	GRVL	
162	185	SAND FINE TO MEDIUM BROWN	SAND	
185	190	GRANITE DECOMPOSED WHITE-GREEN	ROCK	

PERIOD OF MONITORING
BEGIN : 06/26/79
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY BURIED OUTWASH

DNR OBSERVATION WELL NUMBER : 376017
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 6

JUN 26	20.71	SEP 17	23.60	NOV 15	21.50
AUG 15	23.30	OCT 15	21.80	DEC 17	21.30

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 2

JAN 16	21.40	FEB 15	21.20

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : WILLIAM SUKKE 79-9
DNR NO. : 376019

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : BENSON

TOWNSHIP : 121
RANGE : 40
SECTION : 14
1/4 SECTION
PLS : SWNENW
USGS : BAC

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1030 FEET ABOVE SEA LEVEL
DEPTH : 147 FT.
COMPLETED : 06/22/79
TYPE : ARTESIAN

METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DIAMETER : 2 IN.
SCREEN LENGTH : 4 FT.
CASING DEPTH : 143 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 3.3 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	5	CLAY SANDY BROWN SOFT	CLAY	PLEISTOCENE
5	17	CLAY YELLOW STICKY	CLAY	
17	25	CLAY GRAY STICKY	CLAY	
25	55	CLAY SANDY GRAY	CLAY	
55	85	CLAY SANDY WITH GRAVEL GRAY	CLAY	
85	120	CLAY SANDY GRAY	CLAY	
120	141	CLAY SANDY WITH GRAVEL GRAY	CLAY	
141	147	SAND FINE TO MEDIUM BROWN	SAND	
147	151	CLAY SANDY BROWN & ORGANICS W/GRVL	CLAY	
151	152	SAND FINE BROWN	SAND	
152	190	CLAY SANDY WITH GRAVEL & ORGANICS	CLAY	

PERIOD OF MONITORING
BEGIN : 06/27/79
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY BURIED OUTWASH

REMARKS:

DNR OBSERVATION WELL NUMBER : 376019
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 6

JUN 27	3.34	SEP 17	9.50	NOV 15	9.80
AUG 15	8.00	OCT 15	10.10	DEC 17	9.10

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 2

JAN 16	9.40	FEB 15	9.90

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : W. SCHMIDT 79-10 OBSERVER: SWCD
DNR NO. : 376020

COUNTY : SWIFT COUNTY
CITY : HOLLOWAY

TOWNSHIP : 120 TOPOGRAPHIC SETTING : FLAT SURFACE
RANGE : 42
SECTION : 04
1/4 SECTION
PLS : NENWNW
USGS : BBA

ELEVATION : 1021 FEET ABOVE SEA LEVEL METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DEPTH : 204 FT. DIAMETER : 2 IN.
COMPLETED : 06/27/79 SCREEN LENGTH : 4 FT.
TYPE : ARTESIAN CASING DEPTH : 200 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 2.5 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	15	SAND COARSE BROWN	SAND	PLEISTOCENE
15	25	GRAVEL WHITE	GRVL	
25	30	CLAY GRAY	CLAY	
30	39	GRAVEL GRAY	GRVL	
39	60	CLAY SANDY GRAY HARD	CLAY	
60	75	CLAY SANDY GRAY WITH GRAVEL	CLAY	
75	80	CLAY SANDY GRAY	CLAY	
80	85	CLAY SANDY WITH GRAVEL LENS	CLAY	
85	130	CLAY GRAY STICKY HARD	CLAY	
130	135	CLAY SANDY GRAY SOFT	CLAY	
135	144	CLAY GRAY STICKY HARD	CLAY	
144	146	CLAY GRAVELLY GRAY SOFT	CLAY	
146	185	CLAY GRAY SOFT	CLAY	
185	191	CLAY SANDY GRAY W/GRAVEL & ORGANICS	CLAY	
191	200	SAND COARSE BROWN	SAND	
200	220	GRAVEL COARSE GRAY	GRVL	

PERIOD OF MONITORING
BEGIN : 07/09/79
END : / /
FREQ OF MEAS : MONTHLY METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY BURIED OUTWASH

REMARKS:

DNR OBSERVATION WELL NUMBER : 376020
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 6

JUL 9	31.33	SEP 17	49.40	NOV 15	31.50
AUG 15	42.10	OCT 15	37.00	DEC 17	28.50

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 2

JAN 16	26.70	FEB 15	25.50

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : O. LAGRANGE 79-11
DNR NO. : 376021

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : APPLETON

TOWNSHIP : 120
RANGE : 43
SECTION : 23
1/4 SECTION
PLS : NWSWNW
USGS : BCB

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1000 FEET ABOVE SEA LEVEL
DEPTH : 165 FT.
COMPLETED : 07/09/19
TYPE : ARTESIAN

METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DIAMETER : 2 IN.
SCREEN LENGTH : 4 FT.
CASING DEPTH : 161 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 0.0 FT. TOP OF CASING AT LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	1	TOPSOIL BLACK SOFT	SOIL	PLEISTOCENE
1	10	CLAY SANDY YELLOW	CLAY	
10	20	GRAVEL BROWN	CLAY	
20	28	SAND MEDIUM TO COARSE BROWN	SAND	
28	36	CLAY GRAY WITH GRAVEL	CLAY	
36	85	SAND MEDIUM TO COARSE BROWN	SAND	
85	95	GRAVEL GRAY	GRVL	
95	110	SAND COARSE GRAY	SAND	
110	145	GRAVEL GRAY	GRVL	
145	150	SAND MEDIUM GRAY	SAND	
150	160	SAND COARSE GRAY	SAND	
160	172	GRAVEL GRAY	GRVL	
172		CLAY BLUE-GRAY	CLAY	

PERIOD OF MONITORING
BEGIN : 07/09/79
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY BURIED OUTWASH

REMARKS: MEASURING POINT WAS 3.1' BEFORE SEPTEMBER 1979.

DNR OBSERVATION WELL NUMBER : 376021
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 6

JUL 9	23.67	SEP 17	25.50	NOV 15	25.10
AUG 15	21.90	OCT 15	25.20	DEC 17	25.20

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 2

JAN 16	25.40	FEB 15	25.60

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : MINNESOTA FARMS
DNR NO. : 376022
OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : APPLETON

TOWNSHIP : 120
RANGE : 43
SECTION : 07
1/4 SECTION
PLS : NWNWNE
USGS : ABB

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1005 FEET ABOVE SEA LEVEL
DEPTH : 173 FT.
COMPLETED : 07/09/79
TYPE : ARTESIAN

METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DIAMETER : 2 IN.
SCREEN LENGTH : 4 FT.
CASING DEPTH : 169 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 3.3 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	15	CLAY YELLOW-BROWN SOFT	CLAY	PLEISTOCENE
15	24	SAND MEDIUM TO COARSE BROWN	SAND	
24	25	CLAY GRAY SOFT	CLAY	
25	37	SAND MEDIUM TO COARSE BROWN	SAND	
37	55	GRAVEL BROWN	GRVL	
55	56	CLAY GRAY SOFT	CLAY	
56	60	GRAVEL GRAY	GRVL	
60	65	GRAVEL GRAY WITH CLAY SOFT	GRVL	
65	78	GRAVEL GRAY	GRVL	
78	80	GRAVEL GRAY WITH CLAY SOFT	GRVL	
80	85	SAND MEDIUM BROWN	SAND	
85	95	GRAVEL BROWN	GRVL	
95	110	SAND MEDIUM TO COARSE BROWN	SAND	
110	131	GRAVEL BRN W/GRANITE BLDR 129-131"	GRVL	
131	145	CLAY GRAY	CLAY	
145	150	SAND FINE GRAY WITH CLAY	SAND	
150	155	CLAY GRAY STICKY	CLAY	
155	165	SAND FINE TO MEDIUM GRAY	SAND	
165	178	GRAVEL COARSE GRAY	GRVL	
178	182	CLAY GRAY WITH GRAVEL	CLAY	

PERIOD OF MONITORING
BEGIN : 07/10/79
END : / /
FREQ OF MEAS : MONTHLY
METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY BURIED OUTWASH

DNR OBSERVATION WELL NUMBER : 376022
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 6

JUL 10	20.18	SEP 17	20.90	NOV 15	19.70
AUG 15	21.80	OCT 15	19.90	DEC 17	19.40

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 2

JAN 16	19.50	FEB 15	19.60

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
ACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : RON LARSON
DNR NO. : 376023

OBSERVER: USGS

COUNTY : SWIFT COUNTY
CITY : BENSON

TOWNSHIP : 122
RANGE : 40
SECTION : 36
1/4 SECTION
PLS : SESWSE
USGS : DCD

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1034 FEET ABOVE SEA LEVEL
DEPTH : 141 FT.
COMPLETED : 05/21/78
TYPE : ARTESIAN

METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DIAMETER : 3 IN.
SCREEN LENGTH : 20 FT.
CASING DEPTH : 121 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 0.6 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	3	TOPSOIL SANDY BLACK	SOIL	PLEISTOCENE
3	5	CLAY YELLOW	CLAY	
5	33	SAND FINE TO COARSE BROWN AND BLUE	SAND	
33	45	CLAY LENSES OF SAND BLUE	CLAY	
45	51	SAND BLUE	SAND	
51	120	CLAY BLUE HARD	CLAY	
120	132	SAND BLUE DIRTY	SAND	
132	141	SAND FINE BLUE AND A LITTLE CLAY	SAND	
141	167	CLAY SANDY BLUE	CLAY	

PERIOD OF MONITORING
BEGIN : 05/21/79
END : / /
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY BURIED OUTWASH

REMARKS: USGS NETWORK.

DNR OBSERVATION WELL NUMBER : 376023
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 6

MAY 21	4.84	AUG 16	7.05	OCT 11	7.76
JUL 9	5.80	SEP 13	8.38	NOV 26	6.69

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
INACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : USGS A-57
DNR NO. : 376000

OBSERVER: USGS

COUNTY : SWIFT COUNTY
CITY : HOLLOWAY

TOWNSHIP : 120
RANGE : 42
SECTION : 04
1/4 SECTION
PLS : SESESE
USGS : DDD

TOPOGRAPHIC SETTING : UNDULATING

ELEVATION : 1017 FEET ABOVE SEA LEVEL
DEPTH : 25 FT.
COMPLETED : 06/09/50
TYPE : WATER TABLE

METHOD DRILLED : BORED/AUGERED
DIAMETER : 1.25 IN.
SCREEN LENGTH : 2 FT.
CASING DEPTH : 23 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 4.7 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	2	SOIL BLACK	SOIL	PLEISTOCENE
2	8	SILT DARK BROWN	SILT	
8	17	SAND FINE TO COARSE SILTY	SAND	
17	41	SAND COARSE VERY SILTY GRAY	SAND	
41	42	TILL GRAY	TILL	

PERIOD OF MONITORING
BEGIN : 09/14/72
END : 07/06/78
FREQ OF MEAS : MONTHLY
METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY SURFACE OUTWASH

REMARKS: APPLETON IRRIGATION STUDY. USGS NETWORK.

DNR OBSERVATION WELL NUMBER : 376000
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.

WATER LEVELS FOR YEAR 1972 NUMBER OF READINGS 4

SEP 14	3.05	NOV 7	2.45
SEP 29	3.61	DEC 18	3.72

WATER LEVELS FOR YEAR 1973 NUMBER OF READINGS 24

JAN 22	3.87	APR 30	2.18	JUL 30	4.66
FEB 20	4.63	MAY 7	1.57	AUG 13	5.16
FEB 27	4.36	MAY 14	1.45	AUG 27	5.28
MAR 5	3.85	MAY 21	2.42	SEP 10	5.63
MAR 12	2.75	MAY 28	1.82	SEP 24	5.77
APR 10	2.10	JUN 11	3.02	OCT 9	5.69
APR 16	1.79	JUL 2	4.28	OCT 22	5.32
APR 24	2.02	JUL 16	4.90	DEC 21	5.39

WATER LEVELS FOR YEAR 1974 NUMBER OF READINGS 6

FEB 15	5.86	AUG 20	6.06	NOV 1	6.56
JUL 19	5.62	SEP 23	6.50	DEC 24	6.72

WATER LEVELS FOR YEAR 1975 NUMBER OF READINGS 11

FEB 7	6.78	AUG 4	5.70	OCT 24	6.23
MAR 20	6.60	SEP 15	5.90	NOV 17	6.30
JUN 24	4.03	SEP 18	5.99	DEC 15	6.30
JUL 11	5.10	OCT 15	6.30		

WATER LEVELS FOR YEAR 1976 NUMBER OF READINGS 20

JAN 14	6.40	MAY 17	5.20	SEP 29	7.32
FEB 11	6.50	JUN 15	5.90	OCT 15	7.60
FEB 13	6.60	JUN 21	5.87	NOV 10	7.51
MAR 15	5.70	JUL 15	6.50	NOV 17	7.70
MAR 19	5.14	AUG 10	6.80	DEC 10	7.62
APR 12	4.70	AUG 16	7.00	DEC 15	7.70
MAY 5	4.78	SEP 15	7.40		

WATER LEVELS FOR YEAR 1977 NUMBER OF READINGS 20

JAN 3	7.65	MAY 9	5.78	SEP 15	7.10
JAN 14	7.80	MAY 16	6.10	SEP 19	7.19
FEB 8	7.74	JUN 13	5.62	OCT 14	6.90
FEB 16	7.90	JUN 15	5.80	NOV 8	6.48
MAR 15	6.90	JUL 14	6.30	NOV 15	7.20
APR 1	6.13	AUG 4	6.64	DEC 15	5.80
APR 15	6.20	AUG 12	6.80		

WATER LEVELS FOR YEAR 1978 NUMBER OF READINGS 8

JAN 16	6.00	MAR 10	6.42	MAY 22	3.77
FEB 6	6.34	MAR 15	6.30	JUL 6	3.02
FEB 15	6.50	APR 17	3.70		

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
INACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : ED RHEIGHANS
DNR NO. : 376002

OBSERVER: USGS

COUNTY : SWIFT COUNTY
CITY : APPLETON

TOWNSHIP : 121
RANGE : 43
SECTION : 29
1/4 SECTION
PLS : SWSWNW
USGS : BCC

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1027 FEET ABOVE SEA LEVEL
DEPTH : 48 FT.
COMPLETED : 12/ /62
TYPE : ARTESIAN

METHOD DRILLED : CABLE TOOL
DIAMETER : 4 IN.
SCREEN LENGTH : NONE FT.
CASING DEPTH : 36 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 1.4 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)	LITHOLOGY	LITH ABBR	STRATIGRAPHY
	NO LOG AVAILABLE		

PERIOD OF MONITORING
BEGIN : 10/19/76
END : 05/09/77
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER :

REMARKS:

DNR OBSERVATION WELL NUMBER : 376002
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1976 NUMBER OF READINGS 2

OCT 19	32.06	NOV 10	31.78

WATER LEVELS FOR YEAR 1977 NUMBER OF READINGS 4

JAN 3	31.50	MAR 30	30.76
FEB 8	31.47	MAY 9	30.64

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
INACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : USGS A-13
DNR NO. : 376006

OBSERVER: USGS

COUNTY : SWIFT COUNTY
CITY : APPLETON

TOWNSHIP : 120
RANGE : 42
SECTION : 31
1/4 SECTION
PLS : NWNWNW
USGS : BBB

TOPOGRAPHIC SETTING : UNDULATING

ELEVATION : 1030 FEET ABOVE SEA LEVEL
DEPTH : 22 FT.
COMPLETED : 11/03/71
TYPE : WATER TABLE

METHOD DRILLED : BORED/AUGERED
DIAMETER : 1.25 IN.
SCREEN LENGTH : 2 FT.
CASING DEPTH : 20 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 3.0 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	2	TOPSOIL SANDY DARK BROWN	SOIL	PLEISTOCENE
2	17	SAND VERY FINE BROWN	SAND	
17	37	SILT WELL SORTED DARK BROWN	SILT	
37	47	TILL SILTY HARD	TILL	

PERIOD OF MONITORING
BEGIN : 02/27/73
END : 10/22/78
FREQ OF MEAS : MONTHLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY SURFACE OUTWASH

REMARKS: APPLETON IRRIGATION STUDY.

DNR OBSERVATION WELL NUMBER : 376006
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1973 NUMBER OF READINGS 24

FEB 27	9.71	APR 24	7.84	JUL 16	9.29
MAR 5	9.65	APR 30	7.85	JUL 30	9.58
MAR 12	9.42	MAY 7	7.65	AUG 13	9.84
MAR 19	8.86	MAY 14	7.54	AUG 27	10.18
MAR 26	8.57	MAY 21	7.77	SEP 10	10.42
APR 2	8.22	MAY 28	7.47	SEP 24	10.69
APR 9	8.00	JUN 11	7.85	OCT 9	10.85
APR 16	7.95	JUL 2	8.80	OCT 22	10.50

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
INACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : DOEGE BAKERY
DNR NO. : 376008

OBSERVER: USGS

COUNTY : SWIFT COUNTY
CITY : APPLETON

TOWNSHIP : 120
RANGE : 43
SECTION : 14
1/4 SECTION
PLS : NWNWSW
USGS : CBB

TOPOGRAPHIC SETTING : UNDULATING

ELEVATION : 1005 FEET ABOVE SEA LEVEL
DEPTH : 38 FT.
COMPLETED : / /49
TYPE : ARTESIAN

METHOD DRILLED :
DIAMETER : 4 IN.
SCREEN LENGTH : UNKNOWNFT.
CASING DEPTH : FT.
CASING MATERIAL : STEEL
MEASURING POINT : 0.60 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	2	SOIL	SOIL	PLEISTOCENE
2	12	CLAY SANDY	CLAY	
12	24	GRAVEL	GRVL	
24	40	CLAY	CLAY	
40	43	SAND	SAND	

PERIOD OF MONITORING
BEGIN : 12/12/63
END : 11/07/66
FREQ OF MEAS : WEEKLY

METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY BURIED OUTWASH

REMARKS:

DNR OBSERVATION WELL NUMBER : 376008
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1963 NUMBER OF READINGS 1

DEC 12 18.72

WATER LEVELS FOR YEAR 1964 NUMBER OF READINGS 39

FEB 3	18.50	MAY 5	18.44	AUG 25	19.51
FEB 10	19.52	MAY 11	18.58	AUG 31	18.38
FEB 17	19.50	MAY 19	18.60	SEP 7	19.29
FEB 24	19.54	JUN 1	19.04	SEP 14	19.29
MAR 4	19.54	JUN 15	19.18	SEP 28	19.23
MAR 10	19.51	JUN 29	19.40	OCT 12	19.54
MAR 17	19.54	JUL 7	19.20	OCT 20	19.66
MAR 23	19.53	JUL 13	19.27	OCT 26	19.64
APR 1	19.38	JUL 21	19.77	NOV 9	19.63
APR 7	19.25	JUL 27	19.66	NOV 16	19.69
APR 13	19.00	AUG 4	19.77	NOV 23	19.70
APR 20	18.68	AUG 10	19.54	DEC 8	19.73
APR 27	18.38	AUG 17	19.68	DEC 28	19.92

WATER LEVELS FOR YEAR 1965 NUMBER OF READINGS 33

JAN 5	19.99	MAR 22	20.46	JUN 15	16.64
JAN 12	20.07	MAR 29	20.50	JUN 22	16.61
JAN 19	20.07	APR 4	20.48	JUL 12	16.57
JAN 25	20.13	APR 12	17.54	JUL 21	16.56
FEB 2	20.30	APR 20	16.82	AUG 2	16.90
FEB 8	20.19	APR 26	16.78	AUG 9	17.20
FEB 16	20.17	MAY 3	17.19	AUG 16	17.33
FEB 22	20.40	MAY 10	17.39	AUG 23	17.49
MAR 1	20.45	MAY 24	17.35	SEP 7	17.48
MAR 8	20.20	JUN 2	17.24	OCT 11	17.30
MAR 15	20.37	JUN 8	16.89	OCT 26	17.35

WATER LEVELS FOR YEAR 1966 NUMBER OF READINGS 22

FEB 26	18.51	MAY 3	17.20	SEP 22	18.23
MAR 5	18.50	MAY 30	17.60	OCT 4	18.28
MAR 12	18.50	JUL 25	18.30	OCT 18	18.43
MAR 23	18.50	AUG 1	18.32	OCT 26	18.57
MAR 26	17.70	AUG 7	18.27	NOV 1	18.89
APR 4	16.90	AUG 24	18.22	NOV 7	19.03
APR 19	16.90	AUG 31	18.24		
APR 26	17.11	SEP 13	18.20		

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
INACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : BENSON COOP CREAMERY
DNR NO. : 376009

OBSERVER: USGS

COUNTY : SWIFT COUNTY
CITY : BENSON

TOWNSHIP : 121
RANGE : 39
SECTION : 06
1/4 SECTION
PLS : NENESE
USGS : DAA

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1035 FEET ABOVE SEA LEVEL
DEPTH : 151 FT.
COMPLETED : / /27
TYPE : ARTESIAN

METHOD DRILLED :
DIAMETER : 8 IN.
SCREEN LENGTH : UNKNOWNFT.
CASING DEPTH : FT.
CASING MATERIAL : STEEL
MEASURING POINT : 0.70 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)	LITHOLOGY	LITH ABBR	STRATIGRAPHY
0 151	DRIFT	SAND	PLEISTOCENE

PERIOD OF MONITORING
BEGIN : 09/05/64
END : 12/31/65
FREQ OF MEAS : CONTINUOUS

METHOD OF MEASUREMENT : WATER STAGE RECORDER

AQUIFER :

REMARKS:

DNR OBSERVATION WELL NUMBER : 376009
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1964 NUMBER OF READINGS 19

SEP 5	34.20	NOV 5	35.40	DEC 10	42.00
OCT 5	36.20	NOV 10	37.10	DEC 15	32.90
OCT 10	38.00	NOV 15	36.60	DEC 20	34.20
OCT 15	38.90	NOV 20	36.20	DEC 25	35.70
OCT 20	40.50	NOV 25	37.50	DEC 31	35.50
OCT 25	36.00	NOV 30	36.80		
OCT 31	34.90	DEC 5	36.90		

WATER LEVELS FOR YEAR 1965 NUMBER OF READINGS 70

JAN 5	36.10	MAY 5	38.90	SEP 10	35.50
JAN 10	38.70	MAY 10	35.50	SEP 20	36.20
JAN 15	33.00	MAY 15	37.60	SEP 25	37.40
JAN 20	36.00	MAY 20	36.70	SEP 30	36.00
JAN 25	35.50	MAY 25	42.40	OCT 5	37.10
JAN 31	36.30	MAY 31	37.70	OCT 10	34.40
FEB 5	35.70	JUN 5	35.90	OCT 15	36.70
FEB 10	35.60	JUN 10	36.60	OCT 20	35.20
FEB 15	34.80	JUN 15	38.90	OCT 25	35.30
FEB 20	37.00	JUN 20	42.10	OCT 31	34.50
FEB 25	38.10	JUN 25	37.70	NOV 5	33.20
FEB 28	34.50	JUN 30	38.30	NOV 10	34.10
MAR 5	37.80	JUL 5	42.60	NOV 15	31.90
MAR 10	36.80	JUL 10	38.20	NOV 20	34.00
MAR 15	38.10	JUL 15	37.20	NOV 25	32.90
MAR 20	38.20	JUL 20	36.00	NOV 30	33.20
MAR 25	39.40	JUL 31	32.80	DEC 5	33.20
MAR 31	38.90	AUG 5	33.60	DEC 10	29.20
APR 5	38.30	AUG 10	36.90	DEC 15	27.80
APR 10	37.20	AUG 15	41.30	DEC 20	28.50
APR 15	39.00	AUG 20	39.90	DEC 25	34.20
APR 20	37.20	AUG 25	38.60	DEC 31	26.10
APR 25	35.30	AUG 31	37.40		
APR 30	38.80	SEP 5	34.80		

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
INACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : USGS A-32 OBSERVER: USGS
DNR NO. : 376010

COUNTY : SWIFT COUNTY
CITY : HOLLOWAY

TOWNSHIP : 121 TOPOGRAPHIC SETTING : SLOPE
RANGE : 42
SECTION : 17
1/4 SECTION
PLS : NWNWNE
USGS : ABB

ELEVATION : 1033 FEET ABOVE SEA LEVEL METHOD DRILLED : BORED/AUGERED
DEPTH : 33 FT. DIAMETER : 1.25 IN.
COMPLETED : 11/12/71 SCREEN LENGTH : 2 FT.
TYPE : WATER TABLE CASING DEPTH : 31 FT.
CASING MATERIAL : STEEL
MEASURING POINT : 2.0 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	1	TOPSOIL BLACK	SOIL	PLEISTOCENE
1	16	SAND FINE-COARSE GRVL FINE-MCOARSE	SAND	
16	47	SAND COARSE-VCRSE & GRAVEL F-MEDIUM	SAND	
47	52	TILL HARD	TILL	

PERIOD OF MONITORING
BEGIN : 02/27/73
END : 02/15/74
FREQ OF MEAS : MONTHLY METHOD OF MEASUREMENT : STEEL TAPE

AQUIFER : QUATERNARY SURFACE OUTWASH

REMARKS: APPLETON IRRIGATION STUDY.

DNR OBSERVATION WELL NUMBER : 376010
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1973 NUMBER OF READINGS 25

FEB 27	11.41	APR 30	10.76	AUG 13	12.60
MAR 5	11.32	MAY 7	9.84	AUG 27	12.69
MAR 12	11.25	MAY 14	10.79	SEP 10	12.85
MAR 19	9.66	MAY 21	10.95	SEP 24	12.85
MAR 26	9.90	MAY 28	11.10	OCT 9	12.82
APR 2	10.00	JUN 11	11.20	OCT 22	13.70
APR 9	10.20	JUL 2	11.73	DEC 21	12.60
APR 16	10.42	JUL 16	12.00		
APR 24	10.52	JUL 30	12.28		

WATER LEVELS FOR YEAR 1974 NUMBER OF READINGS 1

FEB 15 12.14

MINNESOTA DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS
INACTIVE OBSERVATION WELL DATA BASE - SWIFT COUNTY

WELL NAME : DANVERS WLOLFE 79-8
DNR NO. : 376018

OBSERVER: SWCD

COUNTY : SWIFT COUNTY
CITY : DANVERS

TOWNSHIP : 121
RANGE : 40
SECTION : 08
1/4 SECTION
PLS : NENENE
USGS : AAA

TOPOGRAPHIC SETTING : FLAT SURFACE

ELEVATION : 1026 FEET ABOVE SEA LEVEL
DEPTH : 175 FT.
COMPLETED : 06/23/79
TYPE : ARTESIAN

METHOD DRILLED : HYDRAULIC OR MUD ROTARY
DIAMETER : 2 IN.
SCREEN LENGTH : 4 FT.
CASING DEPTH : 171 FT.
CASING MATERIAL : PLASTIC
MEASURING POINT : 2.43 FT. TOP OF CASING ABOVE LSD

GEOLOGIC LOG

DEPTH INTERVAL (IN FEET)		LITHOLOGY	LITH ABBR	STRATIGRAPHY
0	5	SAND COARSE BROWN	SAND	PLEISTOCENE
5	12	GRAVEL BLACK	GRVL	
12	20	CLAY WITH GRAVEL GRAY SOFT	CLAY	
20	50	CLAY SANDY WITH GRAVEL GRAY STICKY	CLAY	
50	60	CLAY GRAY STICKY	CLAY	
60	92	CLAY SANDY GRAY	CLAY	
92	96	SAND COARSE BROWN	SAND	
96	122	CLAY SANDY GRAY SOFT	CLAY	
122	140	SAND FINE TO MEDIUM BROWN SOFT	SAND	
140	141	SAND VERY FINE BROWN SOFT	SAND	
141	155	GRAVEL COARSE BROWN	GRVL	
155	156	SAND FINE TO MEDIUM BROWN	SAND	
156	175	GRAVEL COARSE BROWN	SAND	

PERIOD OF MONITORING
BEGIN : 06/25/79
END : / / M
FREQ OF MEAS :

METHOD OF MEASUREMENT :

AQUIFER : QUATERNARY BURIED OUTWASH

REMARKS: MEASURING POINT WAS 2.5' BEFORE NOVEMBER 1979.

DNR OBSERVATION WELL NUMBER : 376018
MEASUREMENTS ARE IN FEET BELOW LAND SURFACE DATUM.
WATER LEVELS FOR YEAR 1979 NUMBER OF READINGS 6

JUN 25	.50	SEP 17	4.70	NOV 15	2.20
AUG 15	3.40	OCT 15	4.00	DEC 17	2.67

WATER LEVELS FOR YEAR 1980 NUMBER OF READINGS 2

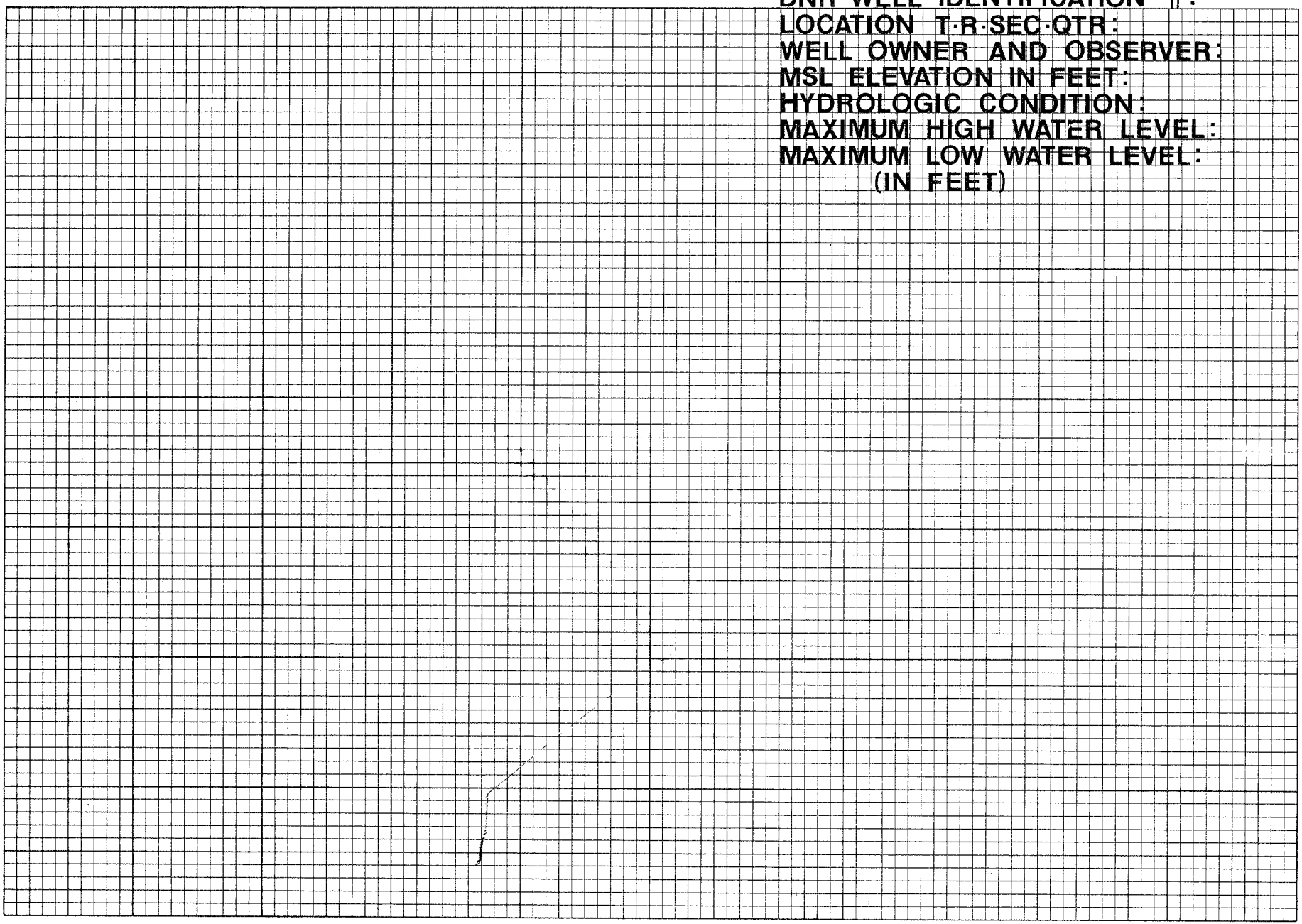
JAN 16	2.87	FEB 15	2.97

APPENDIX B.

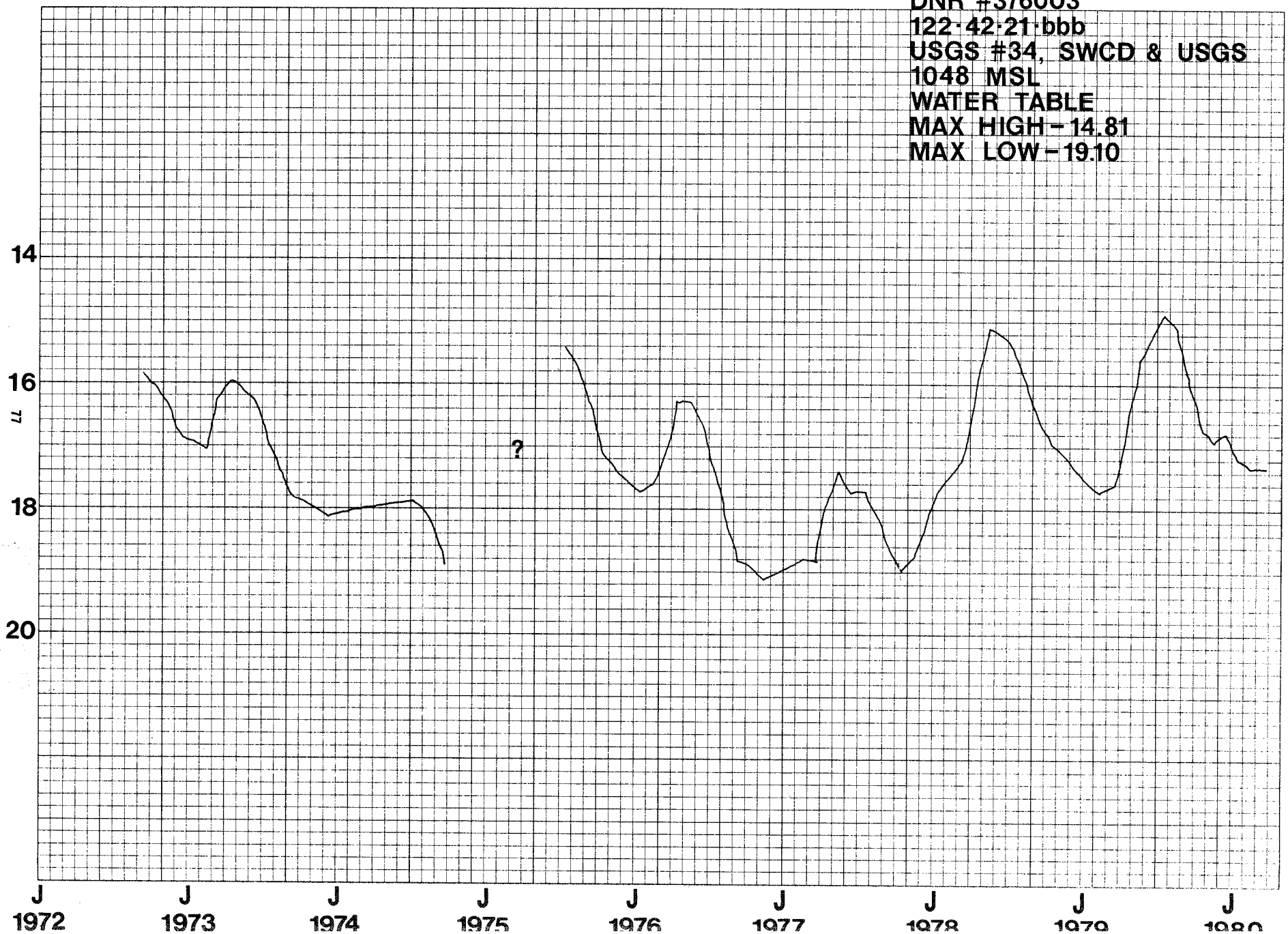
Selected Hydrographs From Swift County

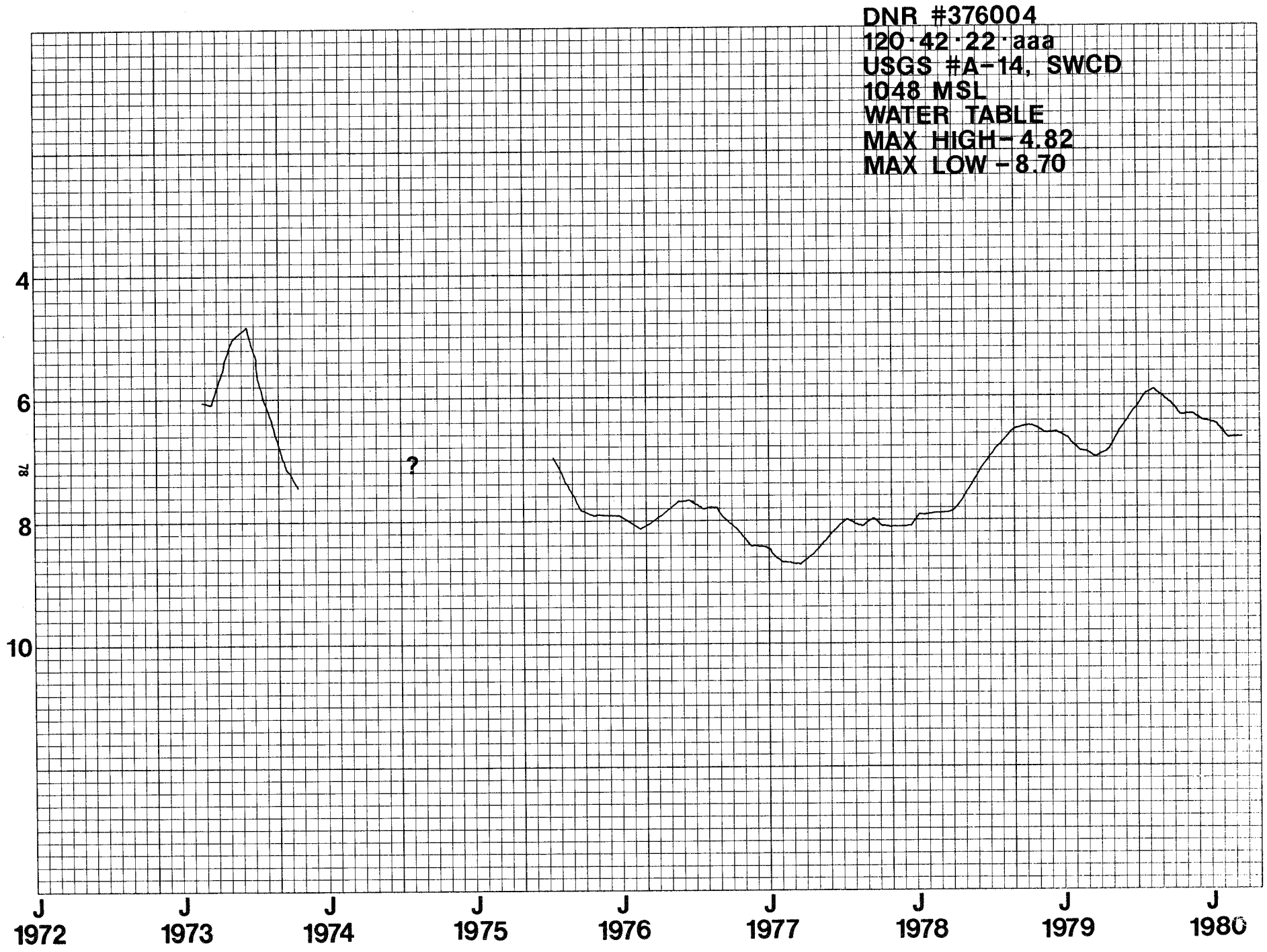
Water Levels, In Feet, From Land Surface Datum.

HYDROGRAPH EXPLANATION

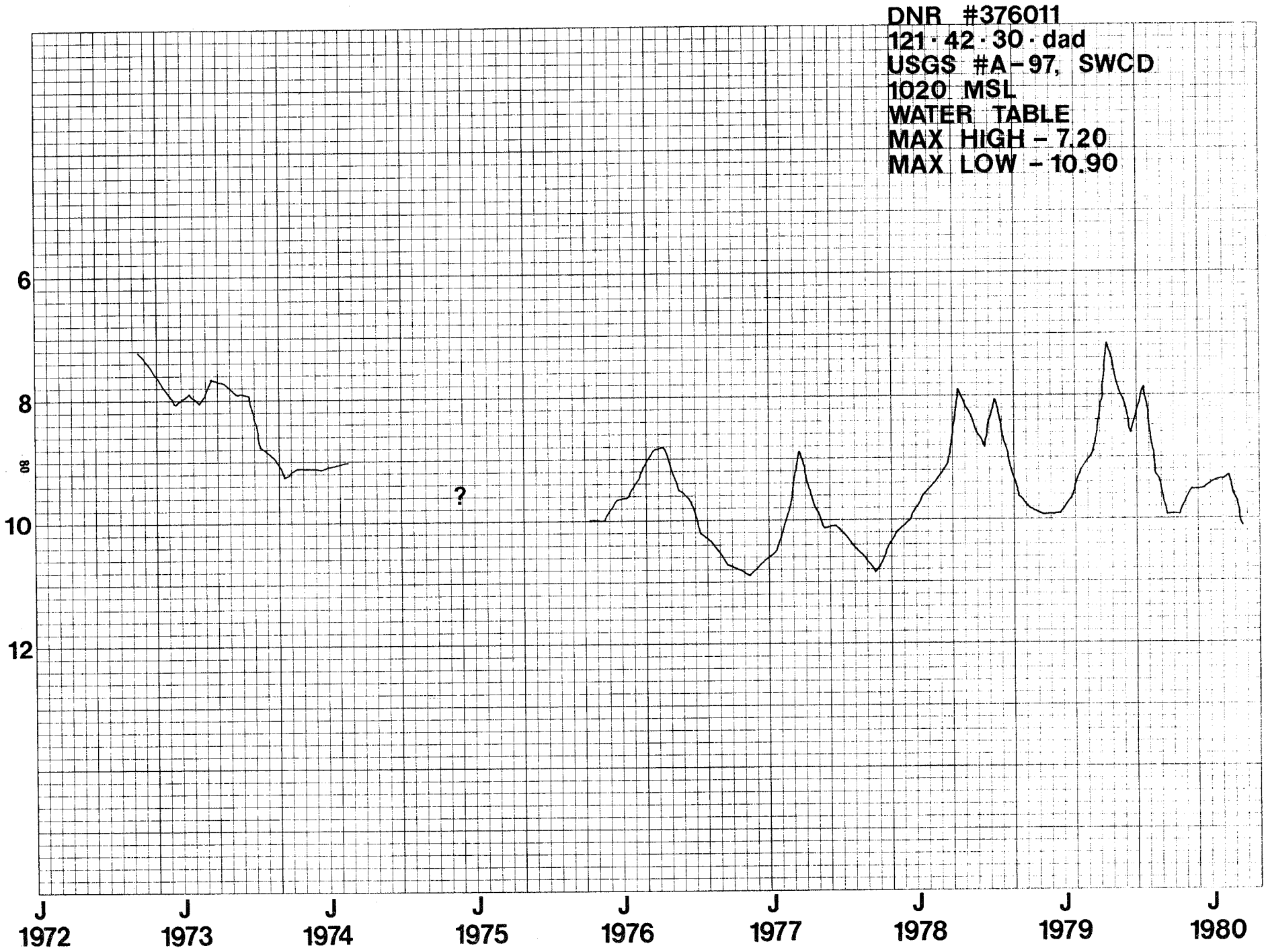


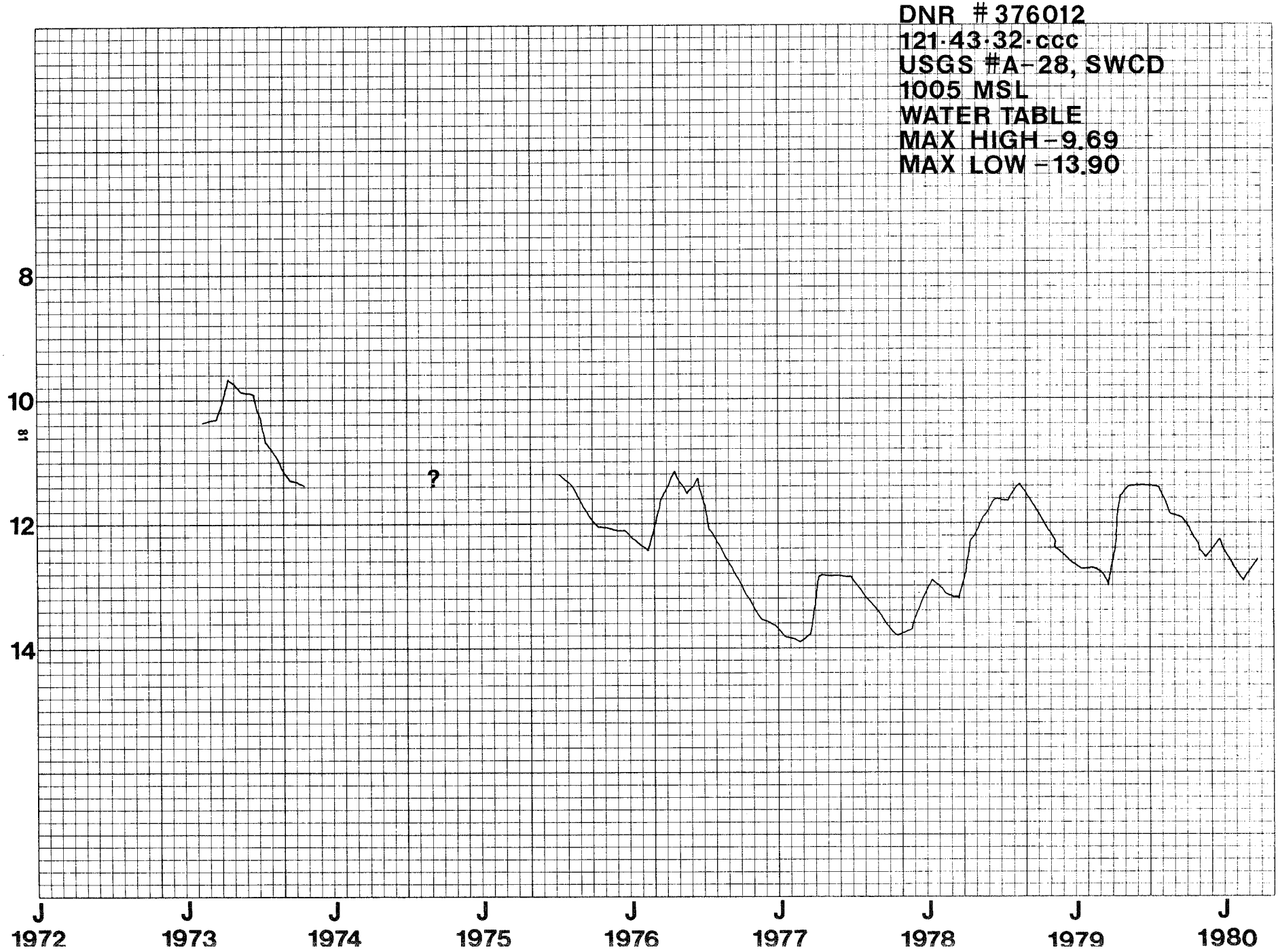

DNR #376001
120-43-3-ddd
USGS #A-49, USGS & SWCD
1020 MSL
WATER TABLE
MAX HIGH - 18.44
MAX LOW - 25.20
18
20
22
24
26
76
J
1972
J
1973
J
1974
J
1975
J
1976
J
1977
J
1978
J
1979

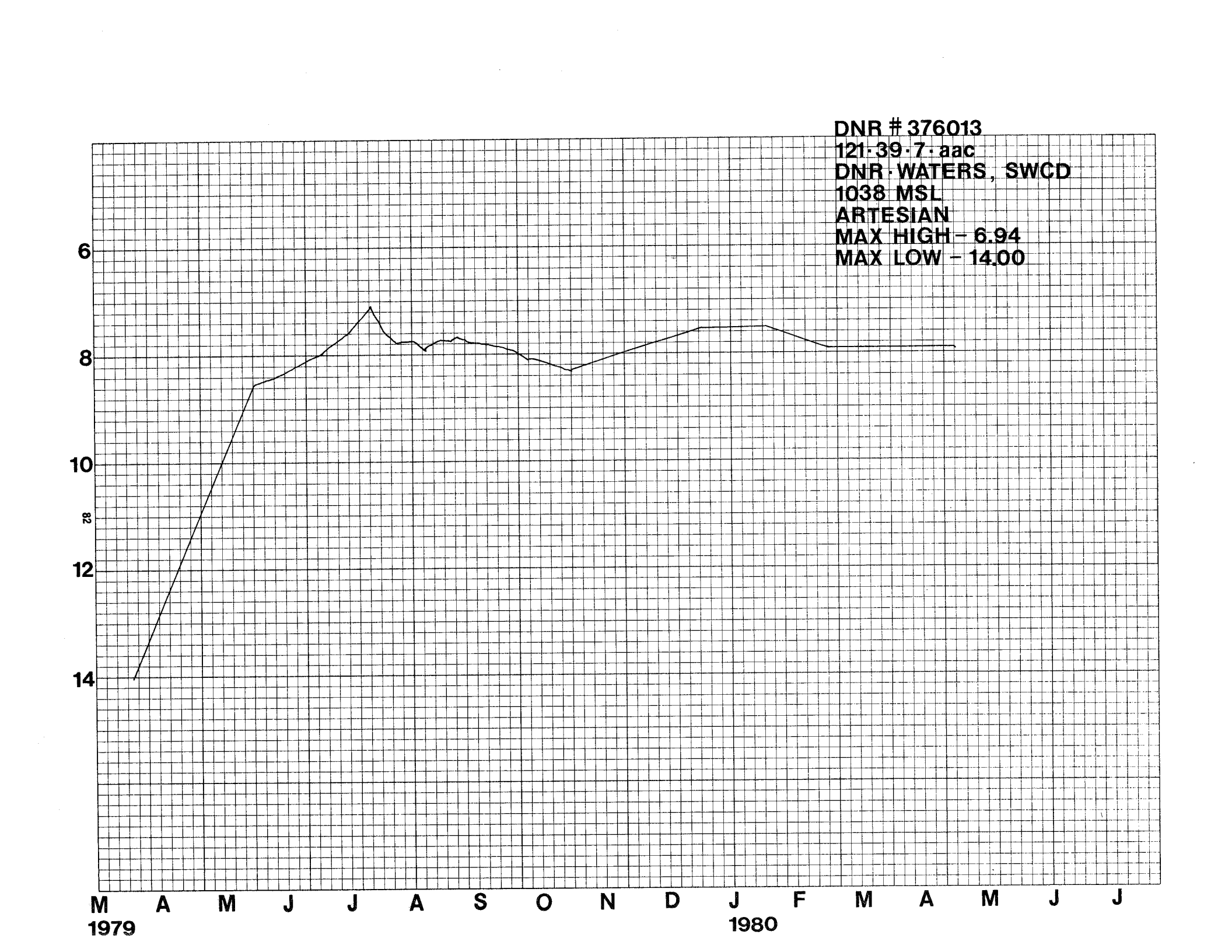

DNR #376003
122·42·21·bbb
USGS #34, SWCD & USGS
1048 MSL
WATER TABLE
MAX HIGH - 14.81
MAX LOW - 19.10
14
16
18
20
FT
?
J
1972
J
1973
J
1974
J
1975
J
1976
J
1977
J
1978
J
1979
J
1980

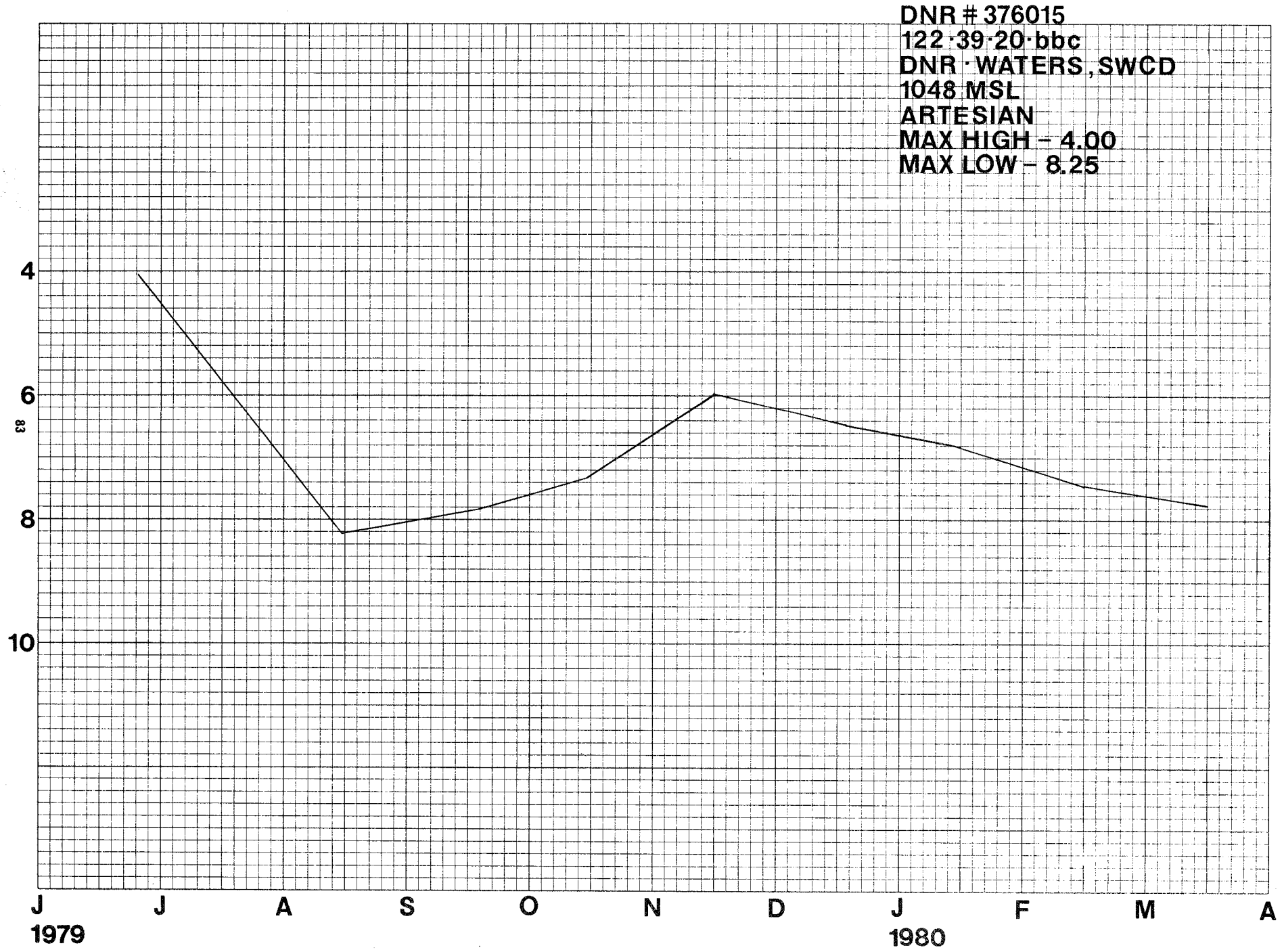

DNR #376004
120·42·22·aaa
USGS #A-14, SWCD
1048 MSL
WATER TABLE
MAX HIGH-4.82
MAX LOW-8.70
4
6
8
10
FT
?
J
1972
J
1973
J
1974
J
1975
J
1976
J
1977
J
1978
J
1979
J
1980

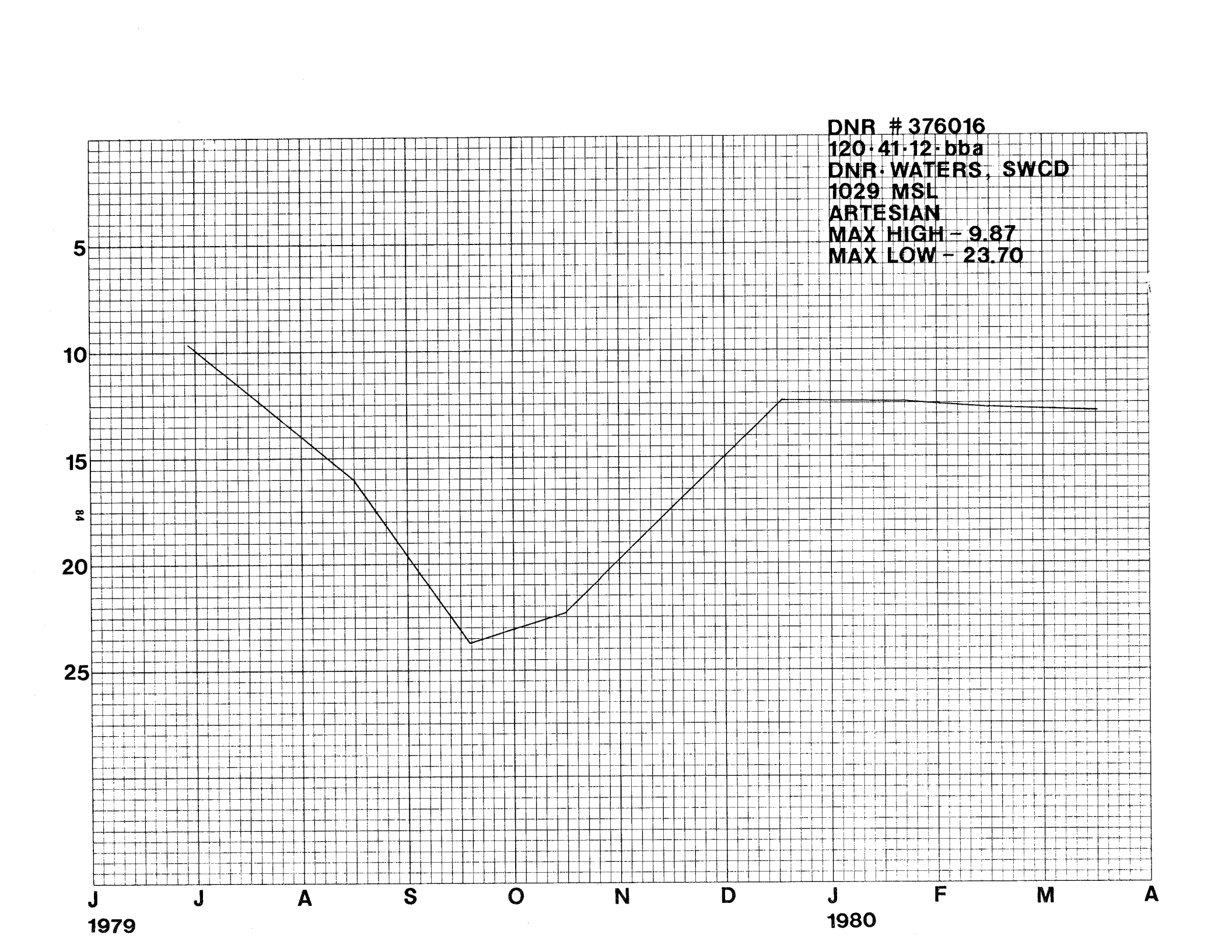

DNR #376007
120·43·13·ddd
USGS #A-58, SWCD
1019 MSL
WATER TABLE
MAX HIGH - 14.18
MAX LOW - 20.10
14
16
18
20
22
79
?
J 1972
J 1973
J 1974
J 1975
J 1976
J 1977
J 1978
J 1979
J 1980


DNR #376011
121 · 42 · 30 · dad
USGS #A-97, SWCD
1020 MSL
WATER TABLE
MAX HIGH - 7.20
MAX LOW - 10.90
6
8
10
12
FEET
?
J
1972
J
1973
J
1974
J
1975
J
1976
J
1977
J
1978
J
1979
J
1980

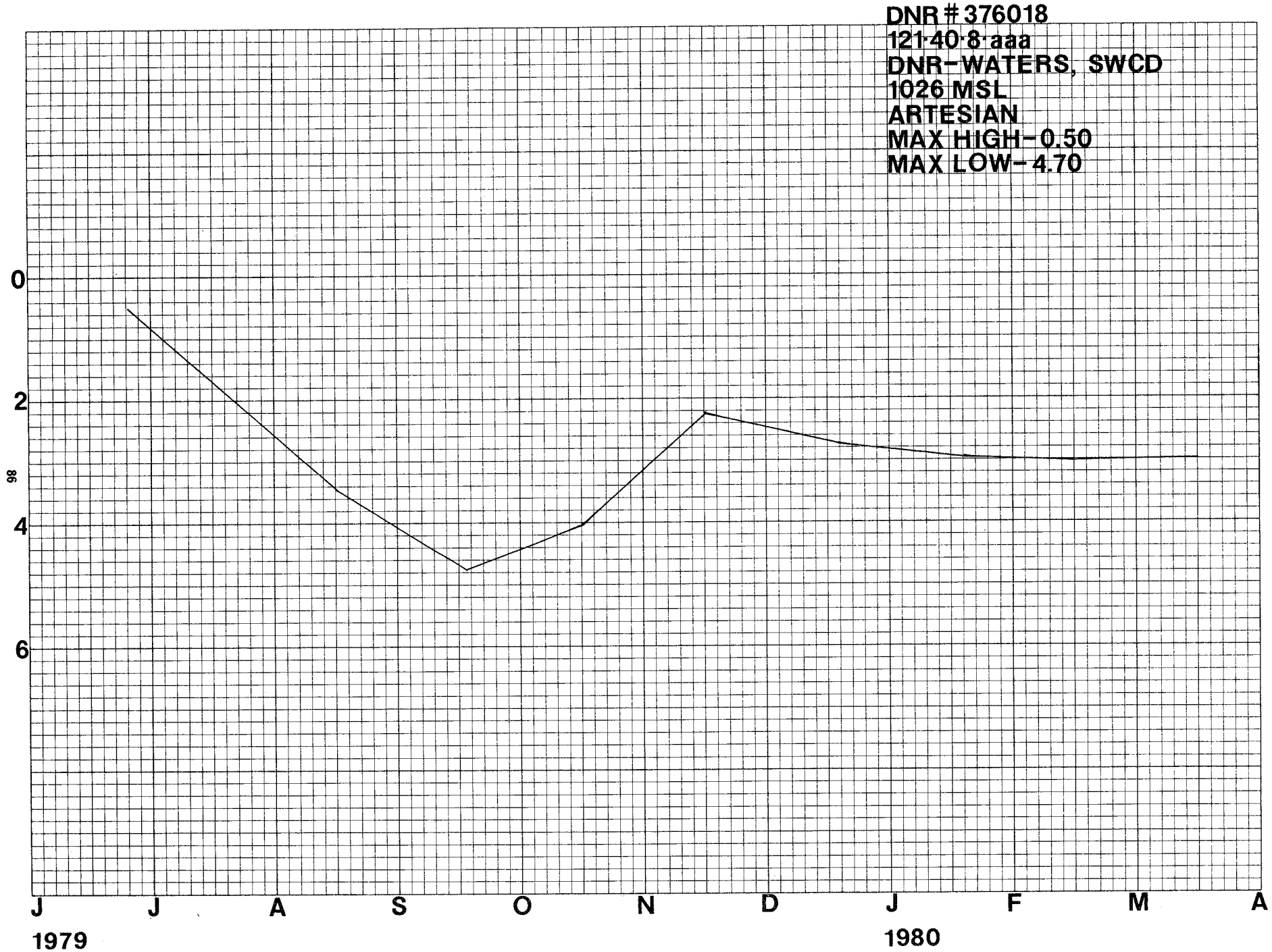

DNR # 376012
121·43·32·ccc
USGS #A-28, SWCD
1005 MSL
WATER TABLE
MAX HIGH - 9.69
MAX LOW - 13.90
8
10
12
14
?
J 1972
J 1973
J 1974
J 1975
J 1976
J 1977
J 1978
J 1979
J 1980

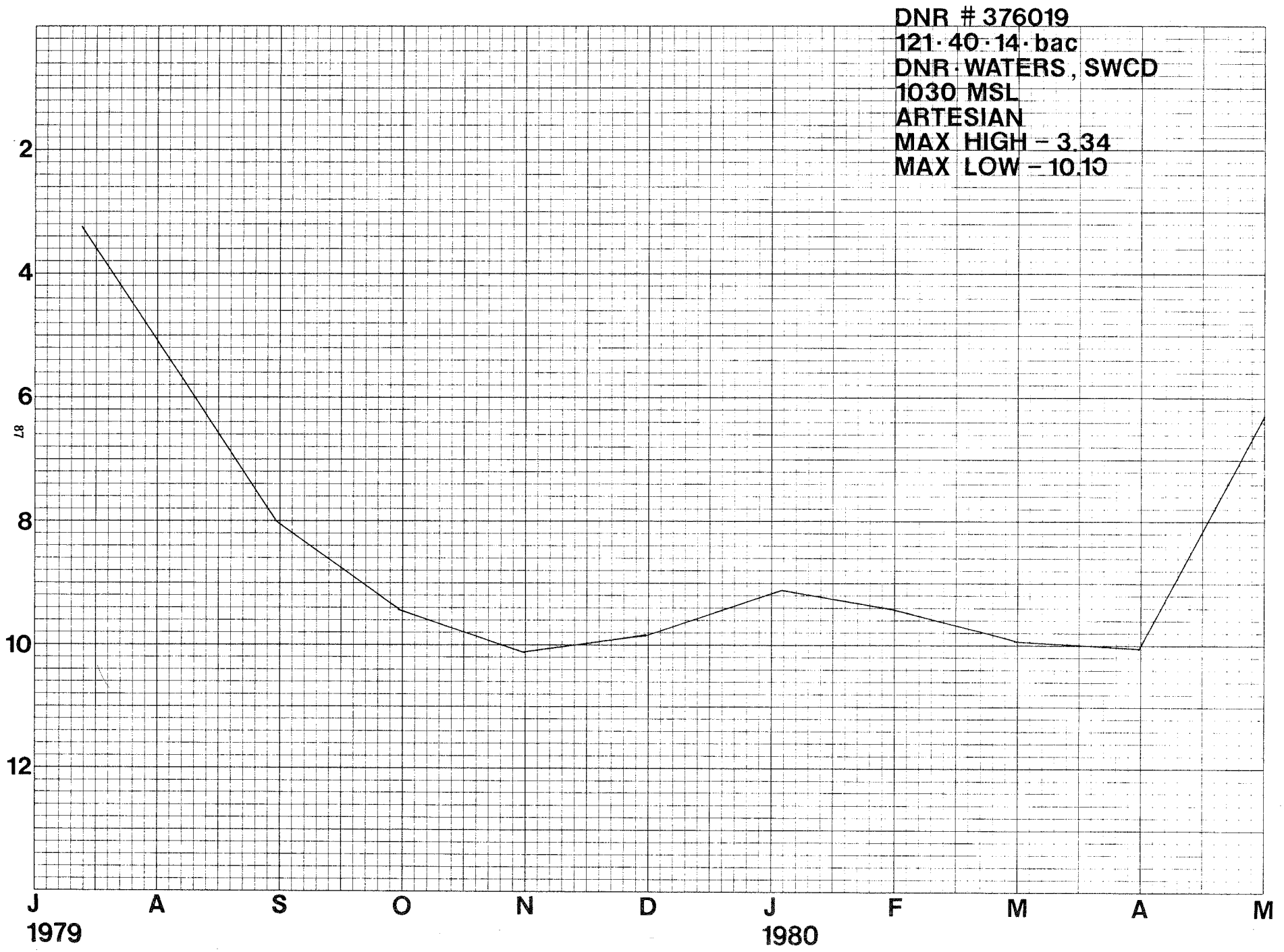

DNR # 376013
121-39-7-aac
DNR-WATERS, SWCD
1038 MSL
ARTESIAN
MAX HIGH - 6.94
MAX LOW - 14.00
6
8
10
FEET
12
14
M
A
M
J
J
A
S
O
N
D
J
F
M
A
M
J
J
1979
1980

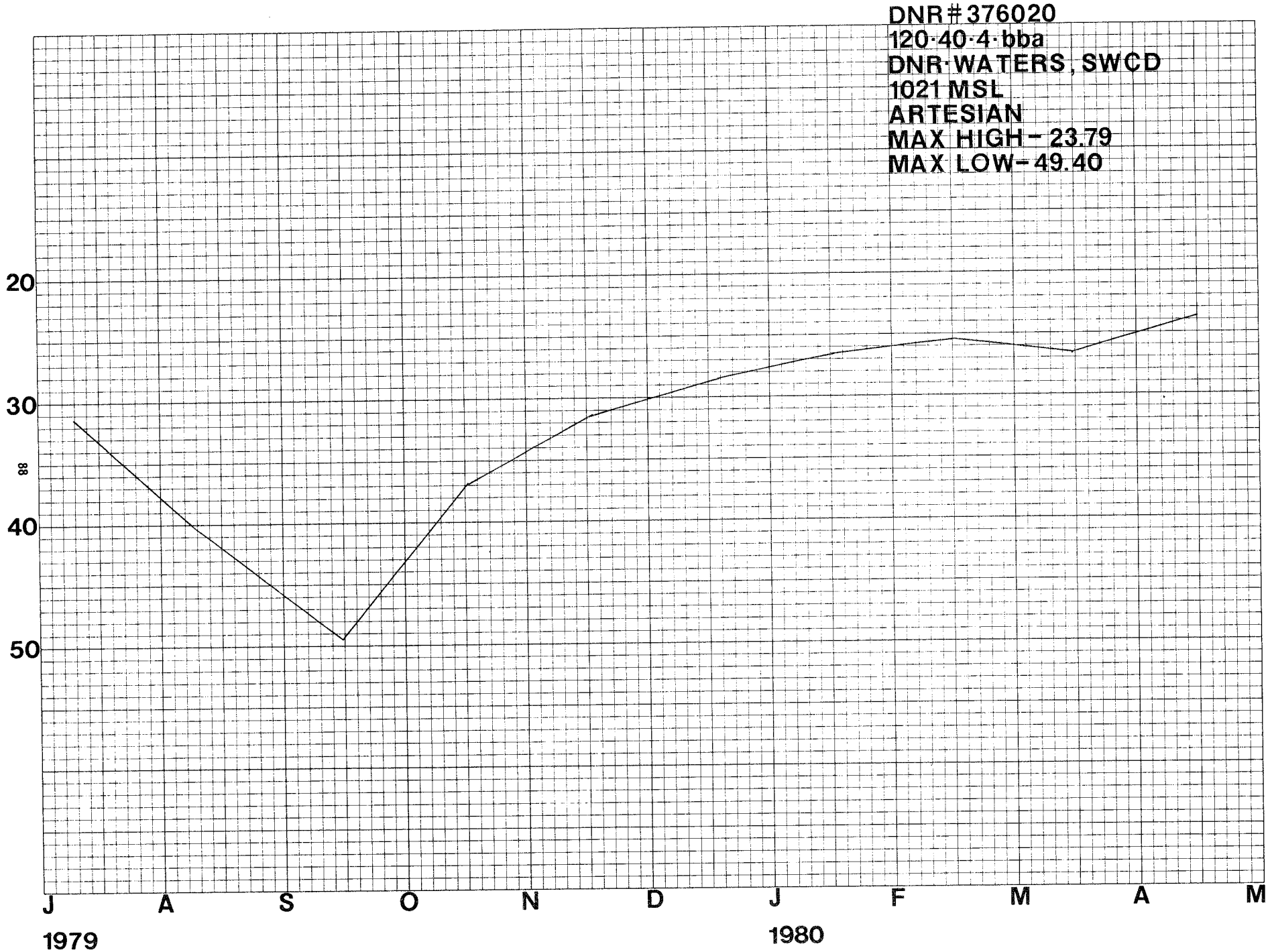

DNR # 376015
122·39·20·bbc
DNR · WATERS, SWCD
1048 MSL
ARTESIAN
MAX HIGH – 4.00
MAX LOW – 8.25
4
6
8
10
83
J
1979
J
A
S
O
N
D
J
1980
F
M
A

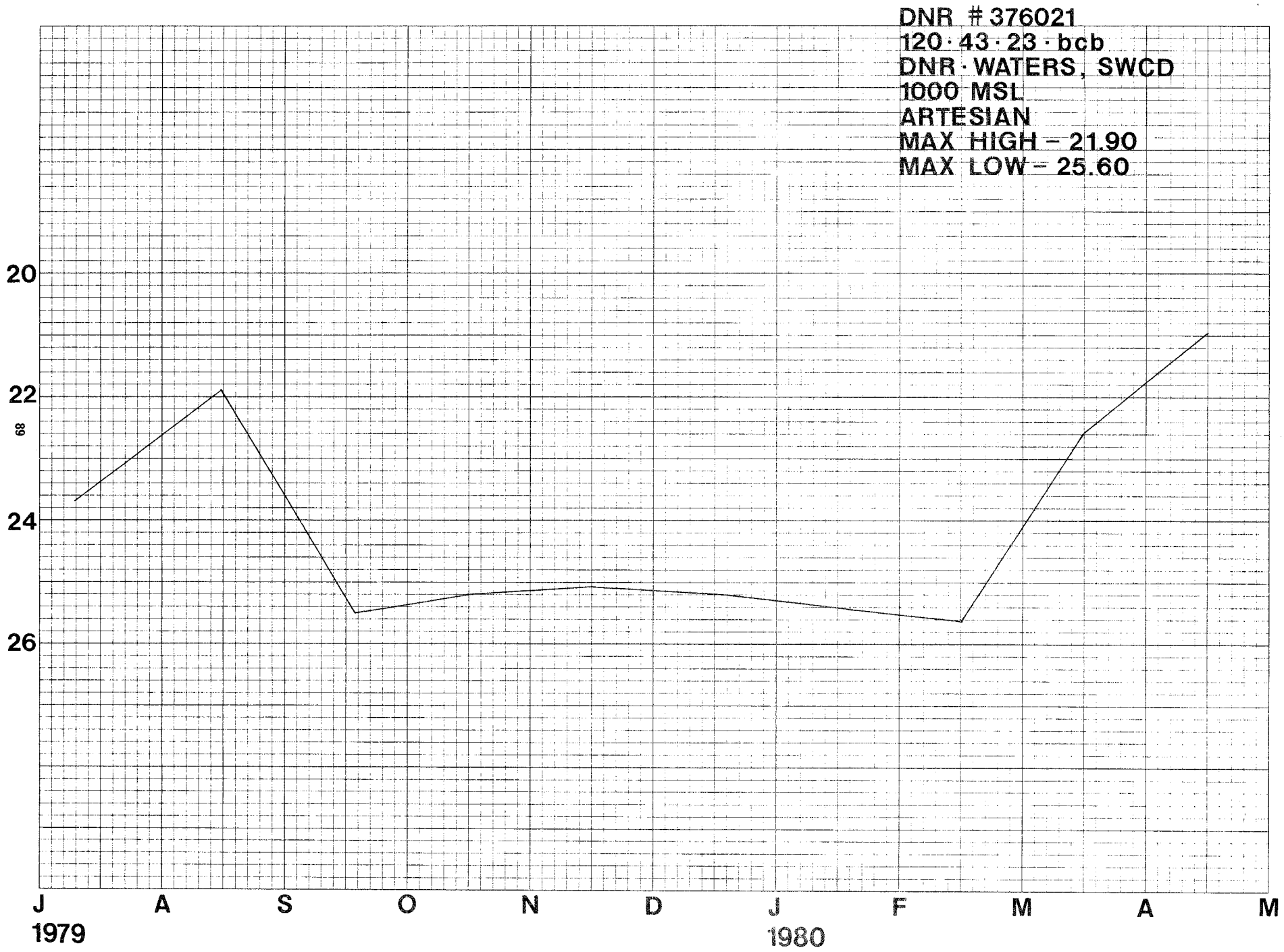

DNR # 376016
120·41·12·bba
DNR·WATERS, SWCD
1029 MSL
ARTESIAN
MAX HIGH - 9.87
MAX LOW - 23.70
5
10
15
20
25
84
J
J
A
S
O
N
D
J
F
M
A
1979
1980

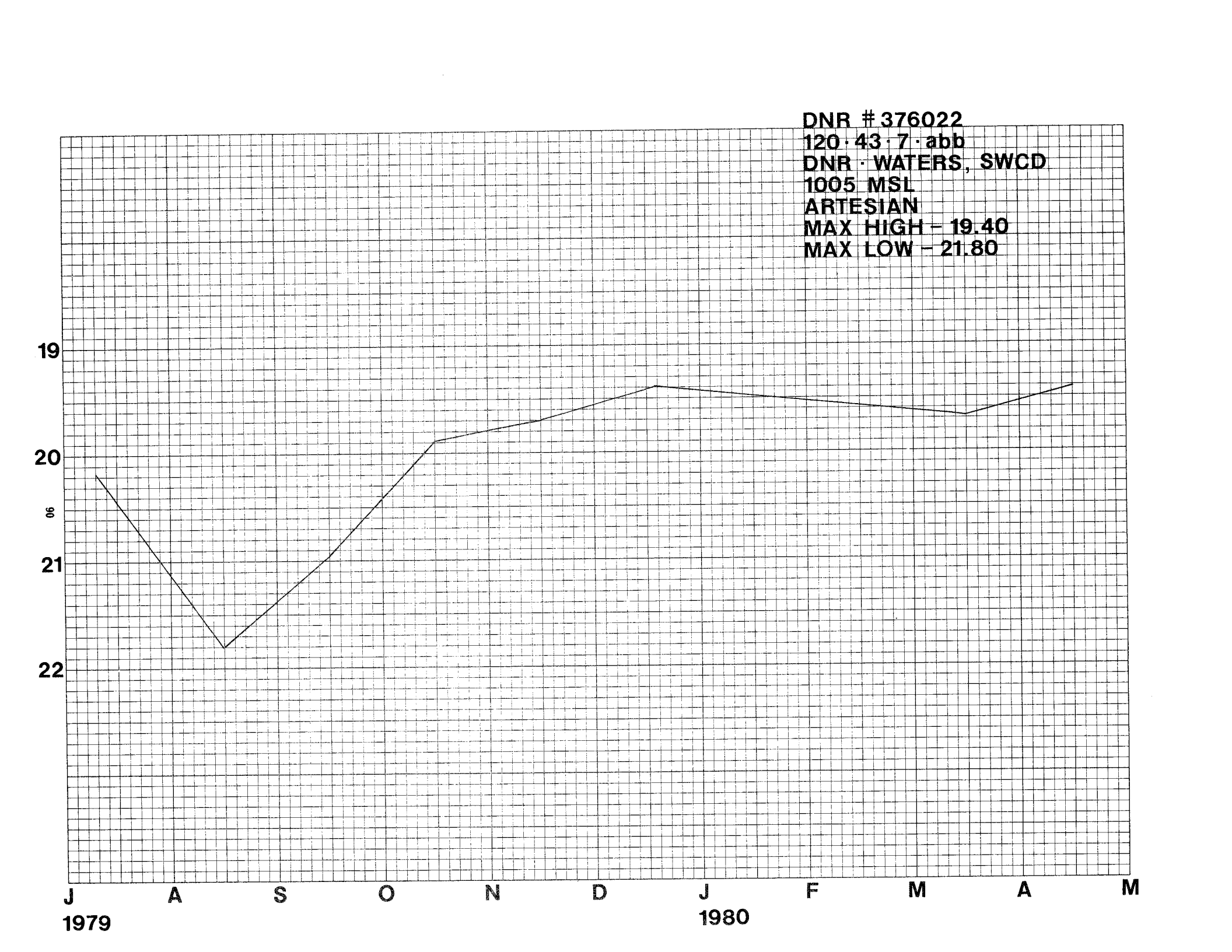

DNR #376017
122-41-27-daa
DNR-WATERS, SWCD
1060 MSL
ARTESIAN
MAX HIGH-20.71
MAX LOW-23.60
20
21
22
23
24
FEET
J
J
A
S
O
N
D
J
F
M
A
1979
1980


DNR # 376018
121-40-8-aaa
DNR-WATERS, SWCD
1026 MSL
ARTESIAN
MAX HIGH-0.50
MAX LOW-4.70
0
2
4
6
98
J
J
A
S
O
N
D
J
F
M
A
1979
1980


DNR # 376019
121·40·14·bac
DNR·WATERS, SWCD
1030 MSL
ARTESIAN
MAX HIGH – 3.34
MAX LOW – 10.10
2
4
6
8
10
12
87
J
A
S
O
N
D
J
F
M
A
M
1979
1980


DNR # 376020
120-40-4-bba
DNR-WATERS, SWCD
1021 MSL
ARTESIAN
MAX HIGH - 23.79
MAX LOW - 49.40
20
30
40
50
88
J
A
S
O
N
D
J
F
M
A
M
1979
1980


DNR # 376021
120 · 43 · 23 · bcb
DNR · WATERS, SWCD
1000 MSL
ARTESIAN
MAX HIGH – 21.90
MAX LOW – 25.60
20
22
24
26
68
J
A
S
O
N
D
J
F
M
A
M
1979
1980


DNR # 376022
120 · 43 · 7 · abb
DNR · WATERS, SWCD
1005 MSL
ARTESIAN
MAX HIGH – 19.40
MAX LOW – 21.80
19
20
21
22
90
J
A
S
O
N
D
J
F
M
A
M
1979
1980

Appendix C. Selected Geologic Cross-Sections in Swift County

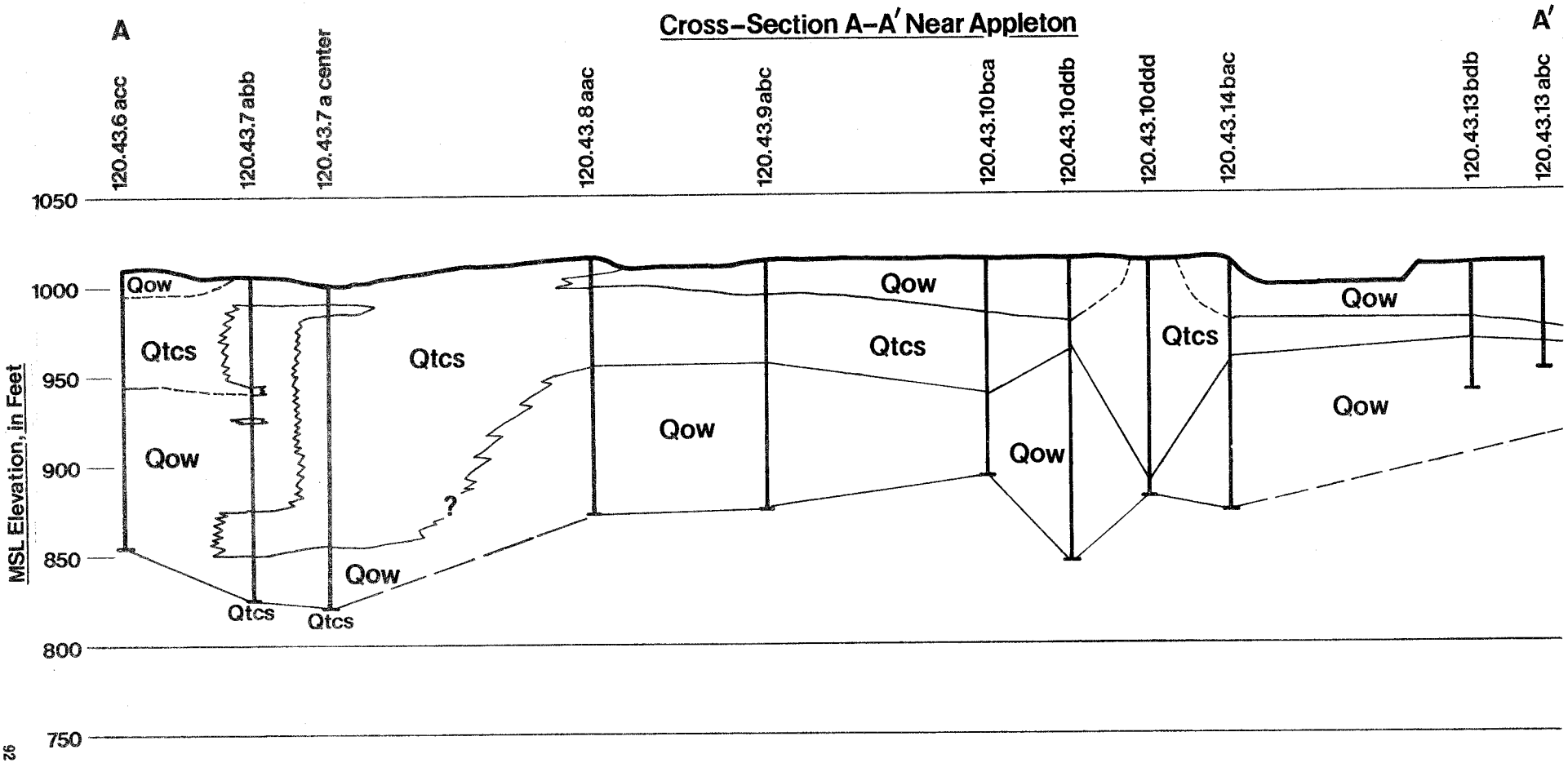
1. Cross-Section Symbols

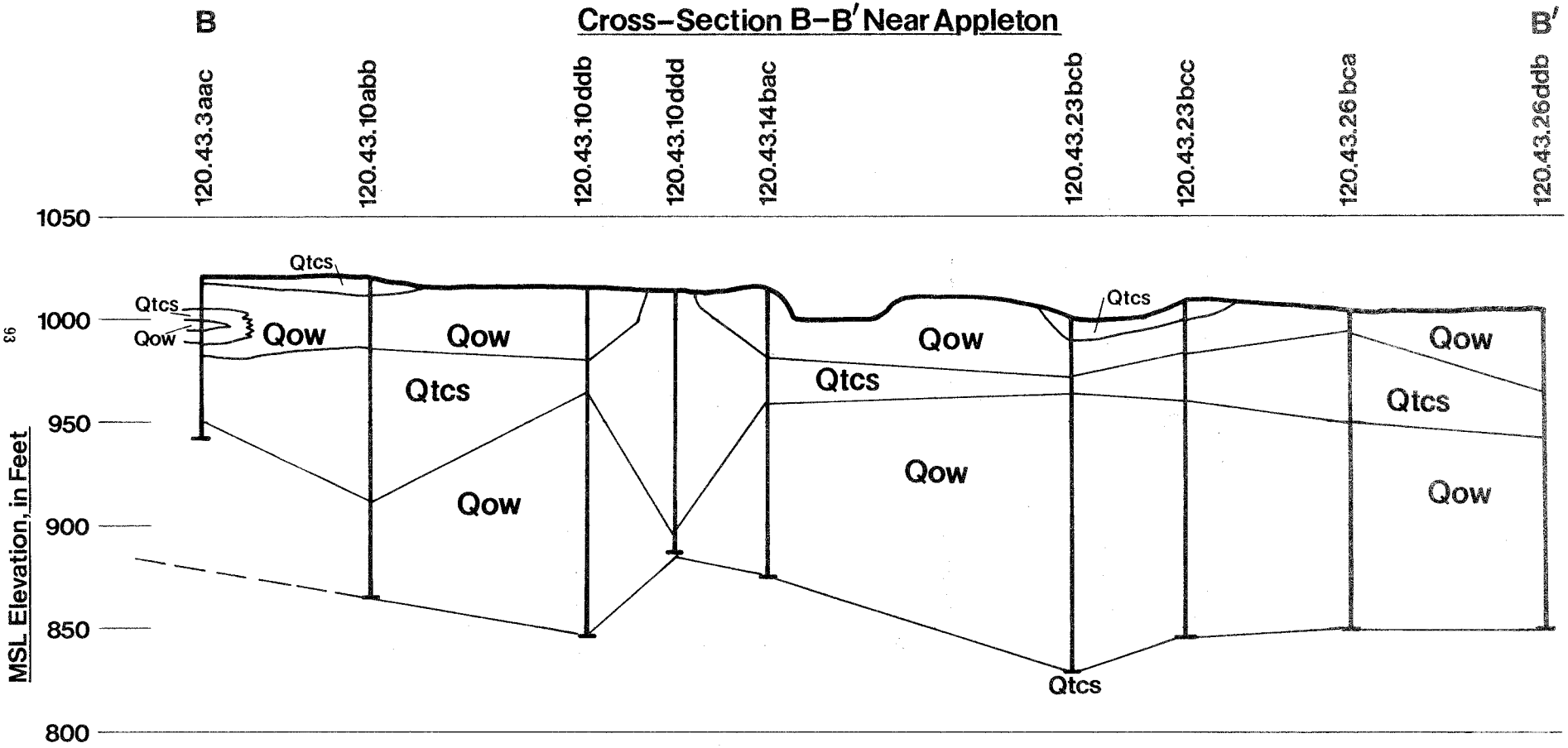
Qow—Quaternary outwash, usually sand and gravel deposits.

Qtcs—Quaternary glacial till, clay, and/or silt, usually aquifer boundary or confining bed.

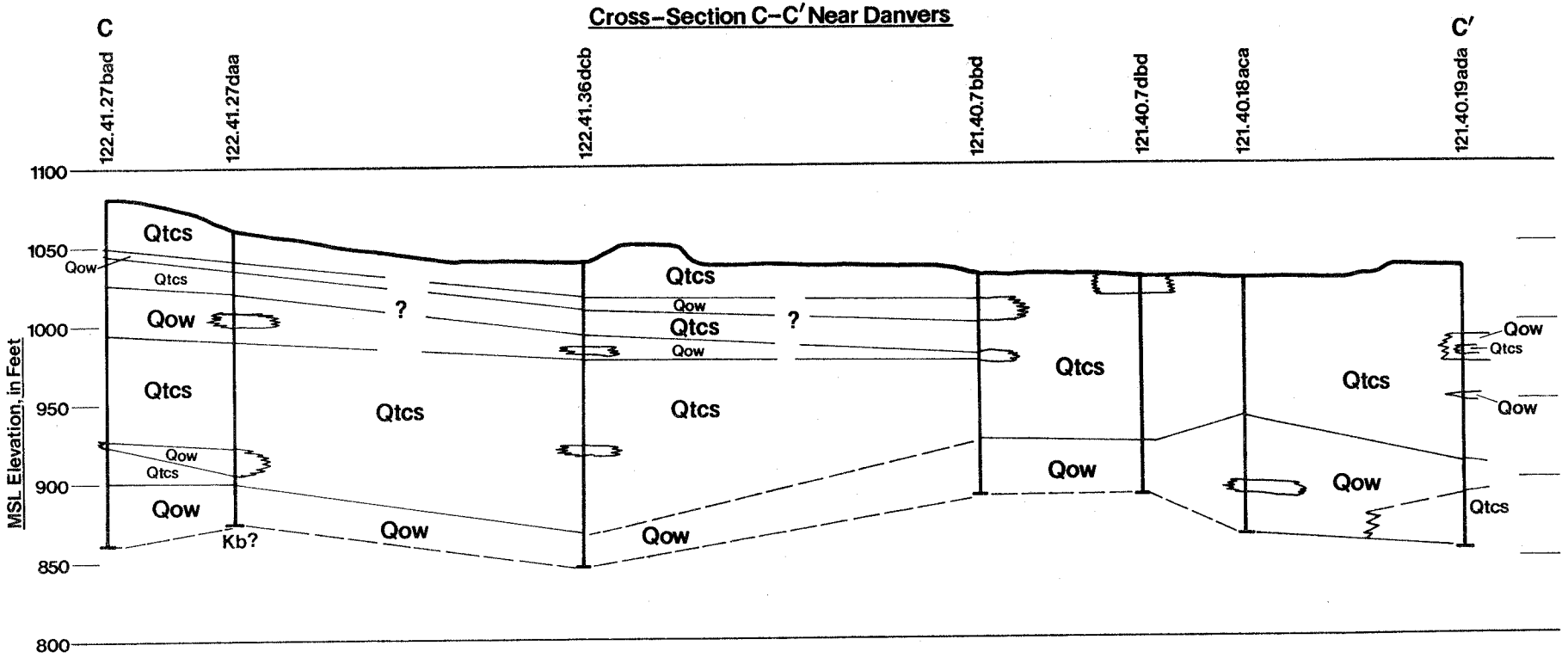
Kb?—Cretaceous bedrock?

2. Well Logs used in the cross-sections.

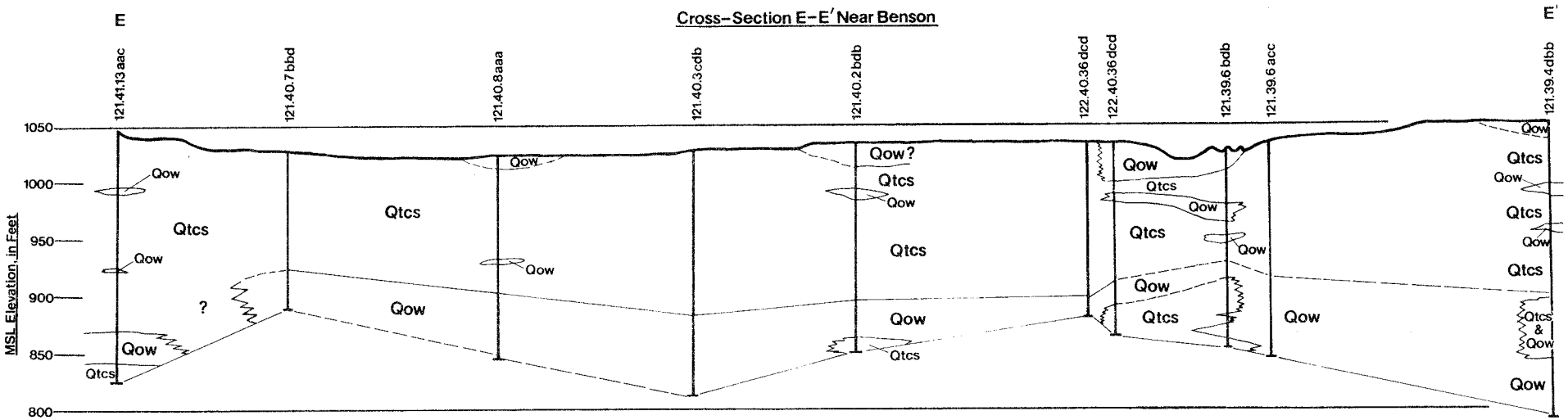

Cross–Section A–A′ Near Appleton
A
A′
120.43.6 acc
120.43.7 abb
120.43.7 a center
120.43.8 aac
120.43.9 abc
120.43.10 bca
120.43.10 ddb
120.43.10 ddd
120.43.14 bac
120.43.13 bdb
120.43.13 abc
MSL Elevation, in Feet
1050
1000
950
900
850
800
750
Qow
Qtcs
?


B
Cross–Section B–B′ Near Appleton
B′
120.43.3aac
120.43.10abb
120.43.10ddb
120.43.10ddd
120.43.14bac
120.43.23bcb
120.43.23bcc
120.43.26bca
120.43.26ddb
1050
1000
950
900
850
800
MSL Elevation, in Feet
Qtcs
Qow
Qtcs
Qow
Qow
Qtcs
Qow
Qtcs
Qow
Qtcs
Qow
Qtcs
Qow
Qtcs
Qow
Qtcs

Cross–Section C–C′ Near Danvers



Cross–Section D–D′ Near Danvers
D
D′
120.41.3ddb
120.41.2dba
120.41.12bba
120.41.12aad
MSL Elevation, in Feet
1050
1000
950
900
850
800
Qtcs
Qow


Cross-Section E-E' Near Benson
E
E'
121.41.13 aac
121.40.7 bbd
121.40.8 aaa
121.40.3 cdb
121.40.2 bdb
122.40.36 dcd
122.40.36 dcd
121.39.6 bdb
121.39.6 acc
121.39.4 dbb
MSL Elevation, in Feet
1050
1000
950
900
850
800
Qow
Qtcs
Qow?
?

CROSS - SECTION A-A' NEAR APPLETON

120.43.6 acc

INTERVAL	DESCRIPTION
0-3	Topsoil
3-15	Sand and gravel
15-65	Clay
65-100	Sand, dirty
100-140	Sand, fine
140-154	Sand, medium

120.43.7 abb

INTERVAL	DESCRIPTION
0-15	Clay, yellow-brown, soft
15-24	Sand, med-coarse
24-25	Clay, grey, soft
25-55	Sand, and gravel, brown
55-56	Clay, grey, soft
56-60	Gravel, grey
60-65	Gravelly clay, grey, soft
65-78	Gravel, grey
78-80	Gravelly clay, grey, soft
80-131	Sand and gravel, brown
131-145	Clay, grey
145-150	Sandy clay, grey
150-155	Clay, sticky, grey
155-178	Sand and gravel, grey
178-182	Gravelly clay, grey

120.43.7 a center

INTERVAL	DESCRIPTION
0-10	Clay, brown, med.
10-15	Sand, brown, soft
15-146	Clay, brown, med.
146-156	Sand, fine, grey, med.
156-176	Sand, med., grey
176-180	Clay, grey, hard

120.43.8 aac

INTERVAL	DESCRIPTION
0-8	Clay, brown, med.
8-16	Sand, fine, brown
16-27	Sandy clay, blue, med.
27-34	Clay, blue, soft
34-60	Sandy clay, blue
60-143	Sand, grey

CROSS - SECTION A-A' NEAR APPLETON (CONT)

120.43.9 abc

INTERVAL	DESCRIPTION
0-5	Topsoil
5-15	Sand, fine, brown
15-19	Sand, coarse, brown
19-56	Sandy clay, grey
56-106	Sand, fine, brown
106-138	Sand and gravel, grey

120.43.10 bca

INTERVAL	DESCRIPTION
0-2	Topsoil
2-32	Sand and gravel, red
32-77	Clay, blue, hard
77-100	Sand, fine, blue-grey
100-122	Sand and gravel, coarse

120.43.10 ddb

INTERVAL	DESCRIPTION
0-35	Sand and gravel, brown
35-40	Sand and clay
40-50	Clay
50-90	Sand, fine, white
90-168	Sand and gravel, white, coarse

120.43.10 ddd

INTERVAL	DESCRIPTION
0-3	Topsoil
3-30	Sandy clay, brown, soft
30-120	Clay, grey, med.
120-130	Sand, grey, soft

120.43.14 bac

INTERVAL	DESCRIPTION
0-34	Sand, brown, soft
34-57	Clay, grey, med.
57-140	Sand and gravel

CROSS - SECTION A-A' NEAR APPLETON (CONT)

120.43.13 bdb

INTERVAL	DESCRIPTION
0-22	Sand, fine, grey, soft
22-29	Sand and gravel, w/boulders
29-42	Sand, fine w/clay stringers
42-68	Sand and gravel, coarse
68-70	Sand, fine, dirty

120.43.13 abc

INTERVAL	DESCRIPTION
0-37	Sand and gravel
37-45	Sand and gravel, w/caly stringers
45-59	Sand, coarse

CROSS - SECTION B-B' NEAR APPLETON

120.43.3 aac

INTERVAL	DESCRIPTION
0-3	Clay, brown, soft
3-15	Gravel, brown, soft
15-23	Clay, grey, soft
23-26	Gravel, brown, soft
26-33	Clay, grey, soft
33-38	Gravel, grey, soft
38-72	Clay, grey, med.
72-77	Gravel, grey, hard

120.43.10 abb

INTERVAL	DESCRIPTION
0-4	Topsoil
4-8	Clay, brown, soft
8-35	Gravel, coarse
35-72	Clay, grey, med.
72-91	Sandy clay, fine
91-95	Clay, grey, med
95-107	Sandy clay, fine
107-153	Sand, grey, soft

CROSS - SECTION B-B' NEAR APPLETON (CONT)

120.43.10 ddb

Log From A-A' Near Appleton

120.43.10 ddd

Log From A-A' Near Appleton

120.43.14 bac

Log From A-A' Near Appleton

120.43.23 bcb

INTERVAL	DESCRIPTION
0-1	Topsoil
1-10	Sandy clay, yellow
10-20	Gravel, brown
20-28	Sand, brown, med.-coarse
28-36	Gravelly clay, grey
36-85	Sand, med.-coarse
85-95	Gravel, grey
95-110	Sand, coarse, grey
110-145	Gravel, grey
145-160	Sand, med.-coarse
160-172	Gravel, grey
172-	Clay, blue-grey

120.43.26 bcc

INTERVAL	DESCRIPTION
0-4	Topsoil
4-8	Sandy clay, brown, soft
8-25	Gravel, coarse, grey, soft
25-48	Clay, grey, med.
48-75	Sand, fine, grey,soft
75-135	Sand, coarse, grey, soft
135-136	Clay, blue, soft
136-162	Sand, coarse, grey, soft

120.43.26 bca

INTERVAL	DESCRIPTION
0-3	Topsoil
3-10	Sand, brown, soft
10-55	Clay, blue, hard
55-140	Sand, fine, brown, soft
140-156	Gravel, coarse, brown, soft

CROSS - SECTION B-B' NEAR APPLETON (CONT)

120.43.26 ddb

INTERVAL	DESCRIPTION
0-2	Topsoil
2-9	Sand, fine, loose
9-12	Sandy clay, brown, med.
12-40	Sand, fine, brown, loose
40-63	Clay, grey, med.
63-114	Sand, fine, brown, loose
114-156	Sand, brown, loose

CROSS - SECTION C-C' NEAR DANVERS

122.41.27 bad

INTERVAL	DESCRIPTION
0-2	Topsoil
2-18	Clay, yellow, soft
18-32	Clay, grey, med.
32-35	Sand and gravel, brown, med.
35-55	Clay, grey, hard
55-86	Sand and gravel, brown
86-153	Clay, grey, hard

122.41.27 daa

INTERVAL	DESCRIPTION
10-18	Clay, yellow, soft
18-25	Gravel, yellow
25-30	Clay, yellow
30-39	Clay, grey
39-50	Sand, coarse, brown
50-51	Clay, grey
51-52	Sand, coarse
52-60	Clay, grey
60-69	Sand, fine to coarse, brown
69-105	Gravelly clay, grey
105-107	Gravel, coarse, brown
107-138	Gravelly clay, grey
138-140	Gravel, dirty, grey
140-154	Sand, fine, brown
154-160	Clay, grey
160-162	Gravel, coarse, brown
162-185	Sand, fine to med., brown
185-190	Sandstone, granular, white-green

122.41.36 dcb

INTERVAL	DESCRIPTION
0-2	Topsoil
2-6	Clay, yellow, soft
6-22	Clay w/limestone pebbles, grey, hard

CROSS - SECTION C-C' NEAR DANVERS (CONT)

22-31	Sand, fine, brown, soft
31-47	Clay, grey, soft
47-54	Sand and gravel, grey, med.
54-58	Clay w/limestone pebbles, grey, hard
58-60	Sand and gravel, grey, soft
60-117	Clay w/limestone pebbles, grey, hard
117-122	Sand and gravel, grey, soft
122-175	Clay w/limestone pebbles, grey, hard
175-193	Sand and gravel, coarse, grey, soft

121.40.7 bbd

INTERVAL	DESCRIPTION
0-2	Topsoil
2-6	Clay, yellow, soft
6-16	Clay, grey, soft
16-30	Sand, fine w/gravel, brown, soft
30-50	Clay, grey, med-hard
50-54	Sand and gravel, grey, soft
54-104	Clay, grey, med.-hard
104-139	Sand and gravel, grey, soft

121.40.7 dbd

INTERVAL	DESCRIPTION
0-2	Topsoil
2-7	Sandy clay, yellow, soft
7-11	Sand, fine, yellow, soft
11-32	Clay, grey, soft
32-82	Clay, grey, med.-hard
82-105	Clay, grey, soft
105-137	Sand and gravel, yellow-brown, soft

121.40.18 aca

INTERVAL	DESCRIPTION
0-2	Topsoil
2-12	Clay, yellow
12-31	Gravel
31-49	Clay, blue
49-51	Gravel
51-87	Clay, blue
87-110	Sand, fine
110-128	Sand, med.
128-136	Clay, blue w/rocks
136-161	Gravel

121.40.19 ada

INTERVAL	DESCRIPTION
0-2	Topsoil
2-10	Clay, yellow

CROSS - SECTION C-C' NEAR DANVERS (CONT)

10-47	Clay, blue
47-53	Gravel
53-60	Clay, blue
60-63	Gravel
63-85	Clay, blue
85-87	Sand
87-125	Clay, blue
125-145	Sand, fine-med.
145-165	Clay, blue, w/rocks
165-180	Shale

CROSS - SECTION D-D' NEAR DANVERS

120.41.3 ddb

INTERVAL	DESCRIPTION
0-46	Sand
46-66	Gravel?
66-85	Gravel w/limestone pebbles and clay stringers
85-117	Gravel, coarse

120.41.2 dba

INTERVAL	DESCRIPTION
0-145	Sandy clay
145-150	Hardpan
150-190	Gravel, coarse

120.41.12 bba

INTERVAL	DESCRIPTION
0-5	Sand, fine, brown
5-16	Sand, med.-coarse
16-25	Sandy clay
25-33	Clay, grey, sticky
33-40	Sand, fine, brown, soft
40-45	Sand w/bits of coal, brown, black
45-70	Gravelly clay, grey
70-75	Sand, fine-med., brown
75-82	Gravel, coarse, brown
82-83	Sandy clay, brown
83-120	Sand, fine-med., brown
120-131	Gravel, coarse
131-135	Gravelly clay
135-157	Gravel, med.-coarse

120.41.12 aad

INTERVAL	DESCRIPTION
0-2	Topsoil
2-12	Clay, yellow

CROSS - SECTION D-D' NEAR DANVERS (CONT)

12-21	Clay, grey
21-45	Sand, fine
45-50	Sand and gravel
50-65	Clay, grey, w/limestone pebbles
65-72	Sand and gravel
72-106	Clay, grey
106-135	Sand and gravel
135-138	Clay, grey
138-157	Sand and gravel
157-160	Clay

CROSS - SECTION E-E' NEAR BENSON

121.41.13 aac

INTERVAL	DESCRIPTION
0-2	Topsoil
2-12	Clay, brown-yellow
12-50	Clay, blue
50-55	Sand, fine w/rocks
55-122	Clay, blue
122-124	Sand
124-153	Clay, blue
153-177	Clay, yellow
177-205	Sand and gravel
205-220	Clay, blue

121.40.7 dbd

Log From C-C' Near Danvers

121.40.8 aaa

INTERVAL	DESCRIPTION
0-5	Sand, coarse, brown
5-12	Gravel, black
12-20	Gravelly clay, grey, soft
20-50	Sandy clay, w/gravel
50-60	Clay, grey, sticky
60-92	Sandy clay, grey
92-96	Sand, coarse, brown
96-122	Sandy clay, grey, soft
122-140	Sand, fine-med., brown, soft
140-141	Sand, very fine, brown, soft
141-155	Gravel, coarse, brown
155-156	Sand, fine-med., brown
156-175	Gravel, coarse, brown

CROSS - SECTION E-E' NEAR BENSON (CONT)

121.40.3 cdb

INTERVAL	DESCRIPTION
0-168	Clay, blue, med.
168-175	Sand, med., grey, soft
175-213	Sand, coarse, grey, soft

121.40.2 bdb

INTERVAL	DESCRIPTION
0-2	Topsoil
2-21	Sand, dirty
21-84	Sandy clay, grey
84-102	Clay, grey
102-105	Sand and gravel
105-137	Sandy clay
137-170	Sand, fine
170-182	Clay and sand

122.40.36 dcd

INTERVAL	DESCRIPTION
0-2	Topsoil
2-130	Clay, grey
130-135	Gravel, w/clay stringers
135-150	Gravel, coarse

122.40.36 dcd

INTERVAL	DESCRIPTION
0-3	Topsoil
3-5	Clay, yellow
5-33	Sand, fine-coarse, brown
33-45	Clay, w/sand lenses, blue
45-51	Sand, blue
51-120	Clay, blue, hard
120-132	Sand, dirty, blue
132-141	Sand, fine, blue
141-167	Sandy clay, blue

121.39.6 bdb

INTERVAL	DESCRIPTION
0-18	Clay, black
18-35	Sandy clay
35-48	Clay, grey
48-55	Sandy clay, grey
55-60	Clay, grey
60-65	Sandy clay, grey
65-75	Clay, grey
75-85	Sandy clay, grey

CROSS - SECTION E-E' NEAR BENSON (CONT)

85-89	Sand, grey
89-115	Sandy clay, grey
115-150	Sand, grey
150-155	Clay, grey

121.39.04 dbb

INTERVAL	DESCRIPTION
0-11	Clay
11-23	Hardpan
23-28	Clay
28-50	Hardpan
50-85	Clay and gravel
85-100	Clay, grey
100-118	Sandy clay, grey
118-115	Sand