SOUTH DAKOTA

STATE GEOLOGICAL SURVEY

E. P. ROTHROCK, STATE GEOLOGIST

REPORT OF INVESTIGATIONS

No. 30

GROUND WATER FLUCTUATIONS IN EASTERN SOUTH DAKOTA

BY
E. P. ROTHROCK
AND
DOROTHY ULLERY

UNIVERSITY OF SOUTH DAKOTA
VERMILLION, S. DAK.

NOVEMBER, 1938
REPRINT NOVEMBER, 1956

Table of Contents

GROUND WATER FLUCUATIONS IN EASTERN SOUTH DAKOTA

INTRODUCTION

PURPOSE OF THE REPORT--THE DROUGHT WHICH BEGAN TO MAKE ITSELF FELT ABOUT 1932 AND REACHED ITS CLIMAX IN 1937 BROUGHT THE ATTENTION OF SOUTH DAKOTANS SHARPLY TO THE WATER SUPPLY SITUATION. THE DRYING UP OF LAKES AND THE DEPLETION OF CITY WATER SUPPLIES WERE THE MOST NOTICEABLE MANIFESTATIONS AND MADE IT EVIDENT THAT SOMETHING MUST BE DONE IF SOUTH DAKOTA WAS TO SUPPORT A LARGE POPULATION COMFORTABLY. MANY QUESTIONS ALSO BEGAN TO ARISE CONCERNING THE POSSIBILITIES OF IRRIGATING LARGE AND SMALL AREAS IN ORDER TO MITIGATE THE LACK OF RAINFALL.

IT BECAME EVIDENT THAT THE ANSWER TO MOST OF THESE PROBLEMS LAY IN THE POSITION OF THE WATER TABLE AND NO DATA WAS AVAILABLE EITHER ON ITS DEPTH BELOW THE SURFACE OR THE AMOUNT OF FLUCTUATION THAT MIGHT BE EXPECTED IN IT AT DIFFERENT TIMES OF THE YEAR OR OVER LONG PERIODS OF TIME.

IN 1935 WHEN LAKES APPEARED TO BE AT THEIR LOWEST LEVEL, THE STATE GEOLOGIST STARTED A STUDY OF THE ELEVATIONS OF THE VARIOUS BEACHES REPORTED BY PERSONS WHO WERE FAMILIAR WITH THE LAKES. IN THIS WAY IT IS POSSIBLE TO DETERMINE THE RATE AT WHICH THE LAKES HAD LOWERED AND IT WAS HOPED THAT THE STUDY COULD BE CONTINUED UNTIL THE LAKES CAME BACK TO A MAXIMUM FULLNESS AGAIN. THESE LAKE LEVELS, THEREFORE, WOULD GIVE AN INDICATION OF THE AMOUNT OF FLUCTUATION WHICH COULD BE EXPECTED IN THE WATER TABLE OF THE REGION AND THE RATE AT WHICH THE FLUCTUATION TOOK PLACE, AS WILL BE EXPLAINED LATER.

A SECOND ATTACK ON THE PROBLEM WAS STARTED DURING THE SUMMER OF 1936 AT THE INSTIGATION OF DR. O. E. MEINZER OF THE GROUND WATER DIVISION OF THE FEDERAL GEOLOGICAL SURVEY. AT THIS TIME THE WATER LEVELS IN SELECTED WELLS SCATTERED OVER EASTERN SOUTH DAKOTA WERE MEASURED AND RECORDS HAVE BEEN KEPT OF AS MANY OF THESE WELLS AS POSSIBLE BY THE STATE GEOLOGICAL SURVEY SINCE THAT TIME.

THE FOLLOWING REPORT THEREFORE IS WRITTEN FOR THE PURPOSE OF COMPILING THE DATA MADE AVAILABLE DURING THESE FEW YEARS AND IS TO BE CONSIDERED ONLY AS A PROGRESS REPORT.

GROUND WATER AND WATER TABLE. THE AVERAGE AMOUNT OF PRECIPITATION ON THE LAND IS ESTIMATED AT ABOUT 40 INCHES PER YEAR. TWO-THIRDS TO FOUR-FIFTHS OF THIS WATER SINKS BENEATH THE SURFACE OF THE EARTH AND IS THEREFORE CALLED GROUND WATER.

WATER OCCURS UNDERGROUND IN TWO GREAT ZONES IN WHICH ITS OCCURRENCE AND MOVEMENTS ARE MARKEDLY DIFFERENT. THE LOWER ONE IS KNOWN AS THE ZONE OF SATURATION BECAUSE ALL OPENINGS OF THE ROCKS ARE COMPLETELY FILLED WITH GROUND WATER. THE FACTORS CONTROLLING MOVEMENT OF WATER IN THIS ZONE ARE GEOLOGIC STRUCTURE, PORE SPACE AND OTHER CHARACTERISTICS OF THE WATER-BEARING MATERIALS. THE UPPER ZONE IS KNOWN AS THE ZONE OF AERATION, BECAUSE ITS INTERSTICES ARE LARGELY FILLED WITH AIR. THIS ZONE IS DIVIDED INTO THREE DISTINCT BELTS; A CAPILLARY FRINGE, AN INTERMEDIATE ZONE, AND A BELT OF SOIL WATER. CAPILLARITY DRAWS MOISTURE UP FROM THE ZONE OF SATURATION, AND THE FINE-GRAINED EARTH IS FOUND TO BE MOIST FOR SOME DISTANCE ABOVE IT. THE HEIGHT TO WHICH THIS WATER RISES VARIES WITH THE SIZE OF THE GRAINS, BEING AN INCH OR SO IN GRAVEL, AND SEVERAL FEET IN FINE MATERIAL. THE BELT OF SOIL WATER, WHICH CONSTITUTES THE UPPER PORTION OF THE ZONE OF AERATION, IS LIMITED TO THE SURFACE LAYER PENETRATED BY ROOTS. IT INCLUDES SOIL AND OTHER MATERIALS NEAR ENOUGH TO THE SURFACE TO DISCHARGE WATER IN APPRECIABLE AMOUNTS INTO THE ATMOSPHERE BY EVAPORATION. IN PLACES AND AT TIMES WHERE THE SOIL WATER DOES NOT EXTEND DOWN TO THE CAPILLARY FRINGE, THERE IS AN INTERMEDIATE ZONE. THIS BELT IS THICK WHERE THE TOP OF THE ZONE OF SATURATION IS LOW, AND THIN OR ABSENT WHERE IT IS HIGH.

THE ZONE OF SATURATION AND THE ZONE OF AERATION ARE SEPARATED BY THE WATER TABLE OR GROUND WATER SURFACE. THE OUTCROP OF THIS WATER TABLE IS MARKED BY THE UPPERMOST APPEARANCE OF SEEPAGE, THE SURFACE INDICATIONS OF WHICH ARE SPRINGS, AND THE UPPER LIMIT OF PERMANENTLY MOISTENED AREAS---RIVERS, LAKES, AND SWAMPS. THE WATER TABLE IS NOT A LEVEL SURFACE BUT HAS IRREGULARITIES COMPARABLE WITH AND RELATED TO THOSE OF THE LAND SURFACE, ALTHOUGH IT IS LESS RUGGED. IT DOES NOT REMAIN IN A STATIONARY POSITION BUT FLUCTUATES UP AND DOWN. THE IRREGULARITIES ARE DUE CHIEFLY TO LOCAL DIFFERENCE IN GAIN AND LOSS OF WATER. THESE IRREGULARITIES WILL BE MORE FULLY DISCUSSED LATER.

IMPORTANCE OF WATER TABLE. THE IMPORTANCE OF THE WATER TABLE SHOULD BE BROUGHT OUT AT THIS POINT AS IT IS SOMETIMES SOMEWHAT OVER EMPHASIZED. AS IT IS A BOUNDARY BETWEEN THE SATURATED ZONE AND THAT OF SUSPENDED WATER, IT RECORDS THE LEVEL TO WHICH THE SUBSURFACE RESERVOIR IS FILLED, THE QUANTITY OF GROUND WATER IN STORAGE, AND THE DEPTH TO THE WATER SUPPLY IN ANY PARTICULAR AREA. THE DEPTH OF RIVERS AND LAKES DEPENDS UPON THE GROUND WATER AND THE WATER TABLE. MANY CITY AND RURAL WATER SUPPLIES ALSO RELY ON GROUND WATER IN THE SATURATION ZONE. HOWEVER, THE FLUCTUATION OF THIS TABLE HAS LITTLE INFLUENCE ON VEGETATION SINCE MOST PLANTS ARE DEPENDENT ON SOIL WATER FOR THEIR SUPPLY. THE DEPTHS TO WHICH THE ROOTS OF PLANTS GO FOR WATER VARY GREATLY WITH DIFFERENT KINDS OF PLANTS AND WITH DIFFERENT KINDS OF SOIL AND MOISTURE CONDITIONS, BUT ORDINARY GRASSES AND FIELD CROPS DO NOT DRAW FROM DEPTHS OF MORE THAN A FEW FEET.

METHODS OF INVESTIGATION. CHANGES IN LAKE LEVELS WERE DETERMINED BY ESTABLISHING PERMANENT BENCH MARKS CLOSE TO THE SHORES OF THE LAKES INVESTIGATED. LEVEL LINES, RUN FROM THESE BENCH MARKS TO THE WATER'S EDGE, GAVE THE DATA RECORDED IN THIS REPORT. ON LAKES WHERE IT WAS POSSIBLE TO OBTAIN AN APPROXIMATE SEA LEVEL ELEVATION FROM HIGHWAY PROFILES, THESE FIGURES HAVE BEEN USED. IN OTHER CASES THE ELEVATIONS OF THE BENCH MARKS WERE ASSUMED. THIS HAS PREVENTED COMPARISON OF THE LEVELS OF DIFFERENT LAKES BUT IT IS HOPED THAT ACCURATE SEA LEVEL ELEVATIONS CAN BE BROUGHT TO EACH BENCH MARK IN THE NEAR FUTURE, AS A COMPARISON MIGHT SHED CONSIDERABLE LIGHT ON REGIONAL WATER CONDITIONS.

THE WATER LEVEL IN WELLS WAS MEASURED WITH A STEEL TAPE WEIGHTED WITH A LEAD PLUMMET. ON EACH WELL A MEASURING POINT HAS BEEN MARKED SO THAT ALL MEASUREMENTS ARE TAKEN FROM THE SAME PLACE. IN MOST INSTANCES THE MEASURING POINT IS INDICATED BY A CUT IN THE FLOOR OR A PAINTED MARK AT THE TOP OF THE WELL CASING. IN MOST CASES ABANDONED OR LITTLE USED WELLS ARE USED. THE SELECTION OF SUCH WELLS PREVENTS ERRORS WHICH CREEP IN WHEN MEASURING WELLS THAT ARE BEING PUMPED FREQUENTLY. SUCH ERRORS ARE DUE TO THE CONE OF DEPRESSION WHICH FORMS AROUND THE WELL DUE TO EXTRACTION OF WATER IN THE IMMEDIATE VICINITY. UNLESS THE MATERIAL FROM WHICH WATER IS BEING TAKEN IS EXTREMELY POROUS, CONSIDERABLE TIME MUST ELAPSE AFTER EACH PUMPING TO ALLOW THE WATER TO REACH ITS FORMER LEVEL.

LAKE LEVELS ARE MEASURED TWICE A YEAR, ONCE IN THE SPRING WHEN THE LAKES SHOULD BE AT THEIR HIGHEST LEVEL OF THE SEASON, AND ONCE IN THE FALL AFTER THE SUMMER DROUGHT AND SEEPAGE HAS HAD A CHANCE TO BRING THEM TO THEIR LOWEST LEVELS. UNFORTUNATELY MOST OF THE LEVELS HAD TO BE MADE IN OCTOBER OR NOVEMBER BEFORE THE LOWEST SEASONAL LEVELS ARE REACHED. THE MINIMUM LEVELS COME IN DECEMBER OR JANUARY, BUT WEATHER DIFFICULTIES MAKE SYSTEMATIC READINGS AT THIS TIME OF YEAR IMPOSSIBLE. THOUGH THESE MINIMUM READINGS ARE NOT AS ACCURATE AS MIGHT BE DESIRED, THEY ARE WITHIN A FEW INCHES OF THE SEASONAL MINIMUM. THE RECORD OF LAKE KAMPESKA IS CONTINUOUS AS IT IS KEPT BY THE CITY OF WATERTOWN, AND THEREFORE GIVES A MUCH MORE ACCURATE RECORD THAN DO THOSE OF OTHER LAKES. WELLS IN THE SOUTHEASTERN PART OF THE STATE WERE READ EVERY MONTH OR TWO AND THEREFORE GIVE A FAIRLY ACCURATE CURVE. WELLS FARTHER AWAY WERE READ AT INFREQUENT INTERVALS AND THEREFORE CAN BE USED ONLY AS CHECK OBSERVATIONS.

IT IS UNFORTUNATE THAT THESE RECORDS CAN NOT BE MORE COMPLETE SINCE A GREAT DEAL OF DETAIL MUST NECESSARILY BE LOST. THE INFORMATION OBTAINABLE FROM THESE SCATTERED READINGS, HOWEVER, IS SUFFICIENT TO GIVE THE GENERAL TREND OF WATER TABLE FLUCTUATIONS AND SOME INFORMATION ON THE SEASONAL VARIATION. IT IS POSSIBLE, THEREFORE, TO COMPILE FROM THE FOLLOWING RECORDS A FAIRLY CLEAR PICTURE OF THE RISE AND FALL OF THE GROUND WATER TABLE DURING THE TIME COVERED.

FLUCTUATION OF LAKE LEVELS

ALL THE LAKES ON WHICH LEVELS HAVE BEEN KEPT LIE IN THE BIG SIOUX BASIN WITH THE EXCEPTION OF LAKE ANDES. AS A MATTER OF CONVENIENCE, THEREFORE, THEY WILL BE DIVIDED INTO FOUR GROUPS, EACH GROUP INCLUDING A REGION WHICH HAS A SIMILAR PRECIPITATION.

THE FIRST GROUP LIES IN THE NORTHERN BIG SIOUX BASIN AND INCLUDES LAKES IN DAY AND MARSHALL COUNTIES. IN THIS SECTION RECORDS HAVE BEEN KEPT OF ROY, CLEAR, BUFFALO, PICKEREL, ENEMY SWIM, MINNEWASTA, AND BLUE DOG LAKES.

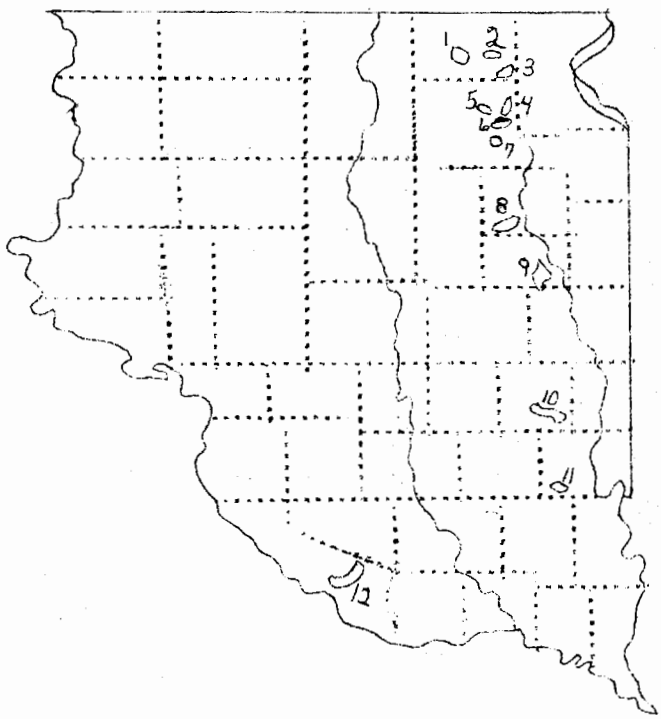
IN THE CENTRAL BIG SIOUX BASIN, IN CODINGTON AND HAMLIN COUNTIES, TWO LAKES, KAMPESKA AND POINSETT HAVE BEEN MEASURED.

TWO LAKES WERE ALSO MEASURED TO DETERMINE CHANGES IN THE SOUTHERN BIG SIOUX BASIN; MADISON IN LAKE COUNTY AND WALL IN MINNEHAHA COUNTY.

LAKE ANDES IN CHARLES MIX DOES NOT REALLY REPRESENT A DISTRICT SINCE IT IS THE ONLY LAKE IN A LARGE SECTION OF THE STATE. IT IS USEFUL, HOWEVER, BECAUSE IT IS FARTHER WEST THAN THE LAKES WHICH HAVE BEEN MENTIONED ABOVE AND NOT FAR FROM A COUNTRY WHERE WATER TROUBLES HAVE BEEN RATHER SEVERE DURING THE RECENT DROUTH.

LAKES RECORDED

1. ROY
2. CLEAR
3. BUFFALO
4. PICKEREL
5. MINNEWASTA
6. ENEMY SWIM
7. BLUE DOG
8. KAMPESKA
9. POINSETT
10. MADISON
11. WALL
12. ANDES



INDEX MAP OF EASTERN SOUTH DAKOTA

North Big Sioux Basin

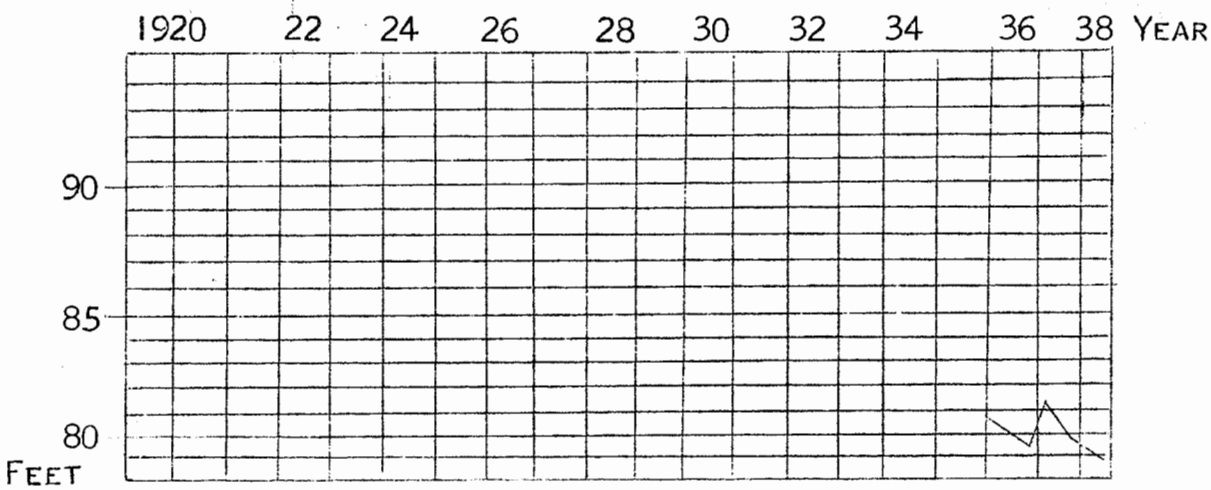
(Roy, Clear, Buffalo, Pickerel, Enemy Swim, Minnewasta and Blue Dog Lakes)

Lake Roy, in the central part of Marshall County, just west of Lake City, is a large lake which at one time was used as a resort. Along with the other lakes this one became almost dry during the recent drought. According to a letter from Mr. G. Sommers of St. Paul, Minnesota, dated December 3, 1936 this lake was dry during the drought of 1894 and came back rather suddenly in 1910. To quote from Mr. Sommers's letter:

> "I might add that in the year 1910 Roy Lake, five miles north of Fort Sisseton, which up to that year had been a grassy slough that could be waded through, rose with extreme rapidity."

The bench mark used in recent measurements is a large boulder of granite four feet in diameter, which is on the west side of the lake, six feet west of a concrete house at Garland Park Resort. The elevations used for this lake were measured from a datum of 100 which was assumed as the elevation of a cross cut on top of the boulder. Records kept since 1936 show only a little variation in the level of this lake, and it is interesting to note that in October, 1937 when most lakes had gained on their previous low water mark this lake had made no advancement whatever.

May	1936	80.4
Oct.	1936	79.5
May	1937	81.0
Oct.	1937	79.8
Oct.	1938	78.8

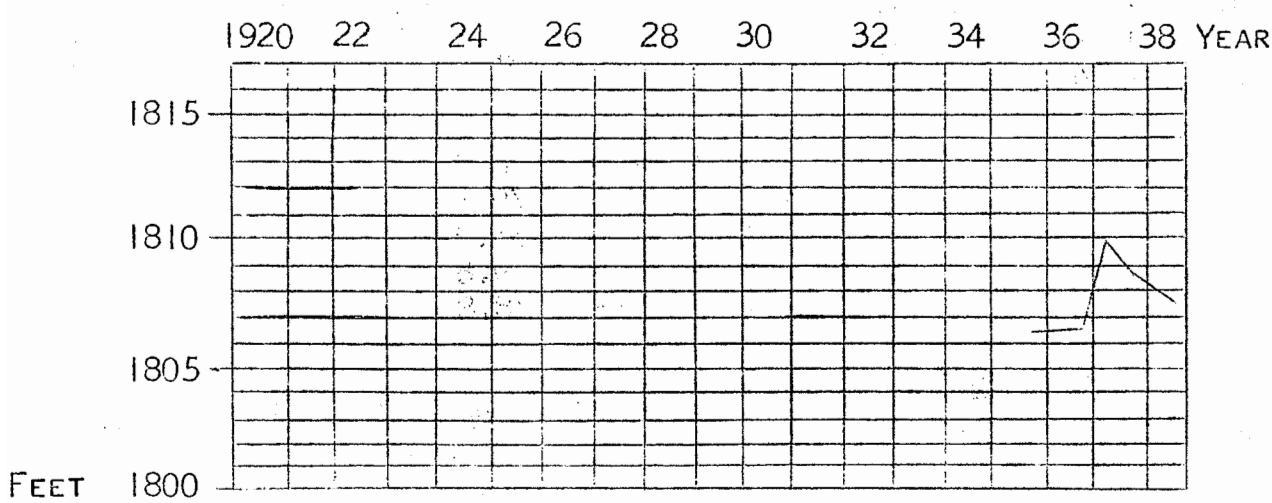


CLEAR LAKE, LYING A FEW MILES EAST OF LAKE ROY, IN MARSHALL COUNTY IS SKIRTED BY HIGHWAY NO. 10. SEA LEVEL ELEVATIONS WERE CARRIED TO THE WATER LEVEL FROM A U. S. COAST AND GEODETIC SURVEY BENCH MARK IN THE GATE POST AT THE STATE GAME WARDENS STATION NEAR THE EAST END OF THE LAKE.

THIS LAKE HAS MADE A STEADY GAIN SINCE IT WAS MEASURED IN THE FALL OF 1935 WHEN IT WAS DRY EXCEPT FOR A FEW MOIST SPOTS IN THE BOTTOM OF THE LAKE.

THE READINGS ARE AS FOLLOWS:

OCT.	1935----------	1806.5
NOV.	1936----------	1806.6
MAY	1937----------	1810.6
OCT.	1937----------	1808.8
JUNE	1938----------	1808.0
OCT.	1938----------	1807.4

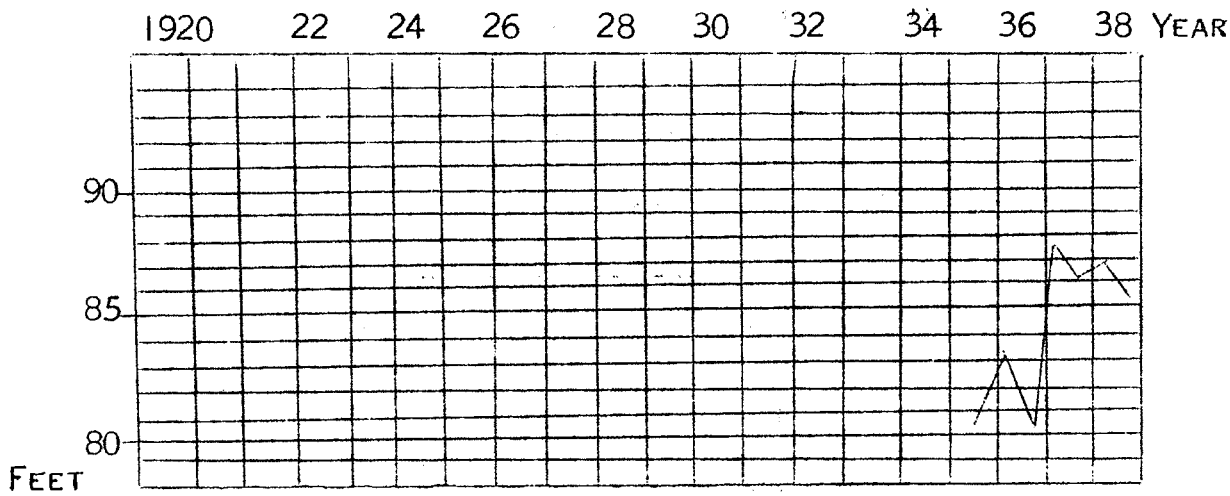


BUFFALO LAKES LIE NEAR THE SOUTHEASTERN CORNER OF MARSHALL COUNTY SIX MILES WEST OF THE CITY OF EDEN. THE MEASURING POINT LIES AT THE NORTHERNMOST POINT OF THE LAKE AT ITS EAST END NEAR THE BUFFALO LAKES NURSERY. THE BENCH MARK IS AN X ON TOP OF A THREE FOOT BOULDER, 100 FEET EAST OF THE SOUTHWEST CORNER OF THE GARDEN FENCE. THIS LOCATION LIES AT THE TOP OF AN ICE WALL, PROBABLY MARKING THE HIGHEST BEACH.

THE ELEVATIONS ARE BASED ON AN ASSUMED ELEVATION OF 100 FEET AT THE BENCH.

WINTER	1935--------80	ESTIMATED (ONLY A PUDDLE OUT IN THE MIDDLE)
MAY	1936--------83.5	(ABOUT 3 FEET OF WATER)
WINTER	1936--------80.0	ESTIMATED
MAY	1937--------87.6	
OCT.	1937--------86.0	
JUNE	1938--------86.7	
OCT.	1938--------85.15	

THIS LAKE SHOWS A RATHER RAPID FLUCTUATION IN LEVELS BUT A CONSTANT GAIN SINCE 1935.

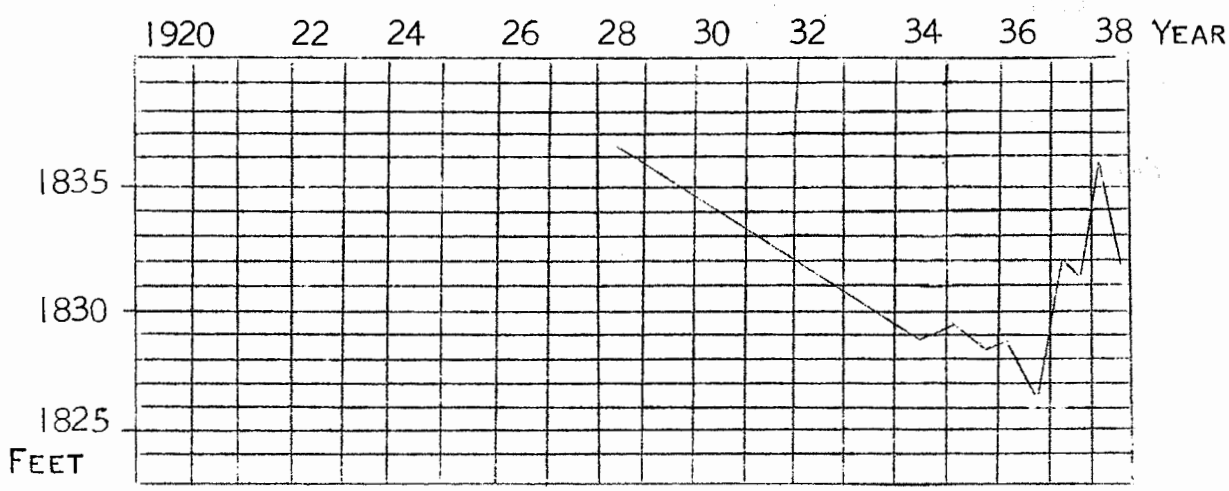


PICKEREL LAKE, ONE OF THE MOST POPULAR RESORT LAKES IN THE STATE, IS IN THE NORTHEASTERN CORNER OF DAY COUNTY. IT IS DEEP AND NARROW AND IS PROTECTED BY HIGH SURROUNDING HILLS. FOR THESE REASONS IT HAS NOT FLUCTUATED AS MUCH AS HAVE OTHER LAKES IN THE REGION, THOUGH IT SHOWED A STEADY DECLINE FROM 1928 TO 1936 AND SINCE THAT TIME HAS BEEN COMING BACK TOWARD ITS OLD LEVELS.

MEASUREMENTS ON THIS LAKE ARE REFERRED TO A BENCH MARK AT THE SOUTHERN END OF THE LAKE. THIS BENCH IS AN X CUT ON A CIORITE BOULDER WHICH FORMS THE TOP STEP OF A SHORT FLIGHT IN FRONT OF THE STATE GAME WARDEN'S COTTAGE AT THE FISH HATCHERY. AN APPROXIMATE SEA LEVEL ELEVATION WAS DETERMINED FOR THIS BENCH BY TYING IT IN WITH A HIGHWAY ELEVATION BROUGHT FROM WAUBAY. THE APPROXIMATE ELEVATION OF THIS BENCH WAS FOUND TO BE 1836.3 FEET ABOVE SEA LEVEL.

FROM INFORMATION FURNISHED BY DEPUTY GAME WARDEN URY DAHLING, THE LOCATION OF THE BEACHES FOR THE YEARS 1928, 1932, 1933, AND 1934 WERE LOCATED. SINCE 1934 THE ELEVATIONS HAVE BEEN MEASURED REGULARLY TWICE A YEAR.

	1928	1836.3 FEET
	1932	1831.5
	1933	1830.0
	1934	1828.9
MAY	1934	1828.6
MAY	1935	1829.2
OCT.	1935	1828.4
MAY	1936	1828.6
OCT.	1936	1826.3
MAY	1937	1832.0
OCT.	1937	1831.5
JUNE	1938	1836.8
OCT.	1938	1831.9

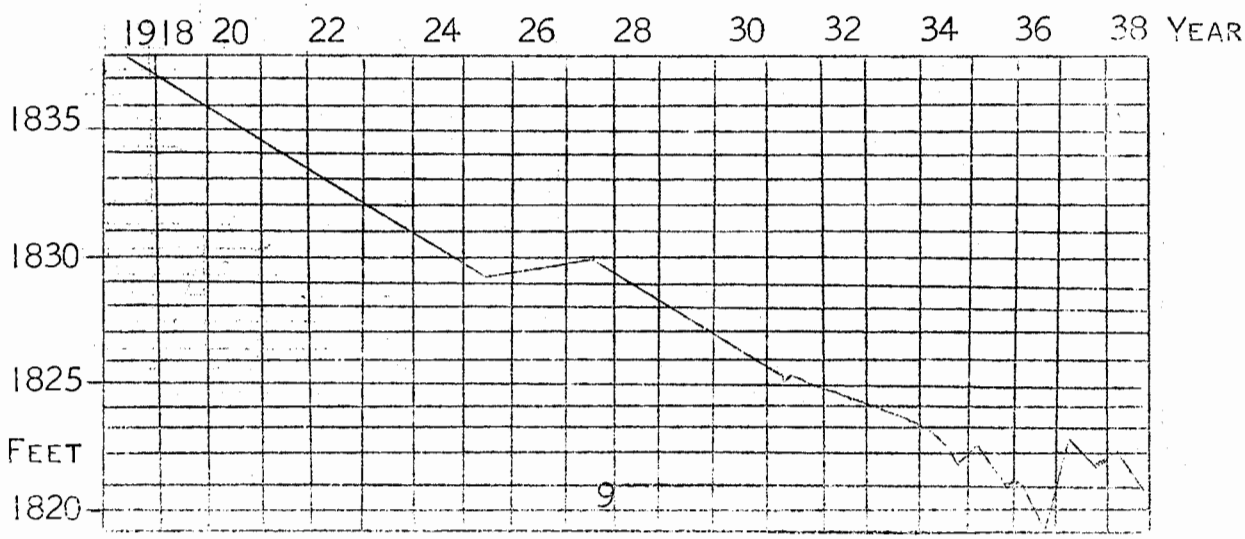


LAKE ENEMY SWIM LIES ABOUT THREE MILES SOUTH OF PICKEREL LAKE ON THE EXTREME EASTERN EDGE OF DAY COUNTY. IT IS MUCH USED AS A FISHING RESORT, AND HAS NOT BEEN DRY IN ANY OF THE DROUGHTS OF WHICH WE HAVE RECORD. IT LIES IN A GRAVEL CHANNEL SURROUNDED BY MORANIC HILLS AND DRAINS SOUTHWARD UNDERGROUND IN A GRAVEL CHANNEL INTO BLUE DOG LAKE. MR. O. M. TIFFANY OF ABERDEEN REPORTS THAT DURING THE DROUGHT OF 1894 THE LAKE WAS SO LOW THAT THERE WAS A LAND CONNECTION ACROSS THE CENTER, DIVIDING IT INTO TWO LAKES. THE STUMPS OF A POPLAR GROVE WHICH HE DESCRIBES AS COVERING A LARGE PORTION OF THE SOUTH BAY WERE UNDER THREE OR FOUR FEET OF WATER IN 1934.

THE SEA LEVEL ELEVATIONS USED IN THE RECORDS OF THIS LAKE WERE OBTAINED FROM HIGHWAY PROFILES AND THEREFORE ARE ONLY APPROXIMATE. THEY WILL SERVE, HOWEVER, AS A ROUGH CORRELATION BETWEEN THIS LAKE AND THE OTHERS ON WHICH THE SEA LEVEL ELEVATIONS WERE KEPT. THE BENCH MARKS WERE SET AT THE STATE BIOLOGICAL STATION--(A) SE CORNER OF CONCRETE BLOCK USED FOR PORCH IN FRONT OF THE BIOLOGICAL DOOR. (B) EIGHT PENNY NAIL IN NORTH SIDE OF COTTONWOOD TREE TRUNK WHICH GROWS ON LOWER BEACH SOUTHEAST OF THE LABORATORY AT THE WEST SIDE OF THE VOLLEYBALL COURT. THE NAIL IS THREE FEET ABOVE THE GROUND. (C) LARGE BOULDER, HAS FLAT TOP AND IS THE ONLY BOULDER IN THE VICINITY. (DESTROYED IN 1937)

THE WATER LEVELS PREVIOUS TO 1934 WERE OBTAINED FROM BENCHES ON BEACHES IDENTIFIED BY PROF. S. R. LIPSCOMB OF NORTHERN STATE TEACHERS COLLEGE, DIRECTOR OF THE BIOLOGICAL STATION AND SEVERAL RESIDENTS OF THE REGION.

1918	1838 FEET	1935 OCT.	1821.0
1925	1829.2	1936 APR.	1821.05
1927	1830.6	1936 OCT.	1819.0
1931	1825.6	1937 MAY	1822.8
1933 AUG.	1823.9	1937 OCT.	1821.8
1934 JULY	1822.6	1938 JUNE	1822.0
1934 AUG.	1821.9	1938 OCT.	1821.1
1935 MAY	1822.3		

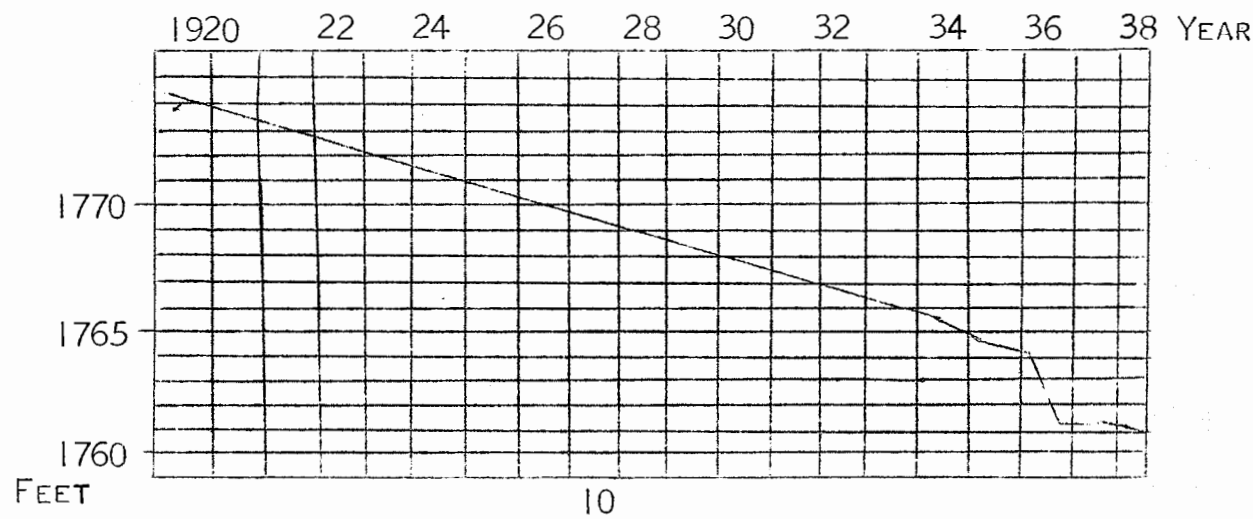


LAKE MINNEWASTA LIES IMMEDIATELY WEST OF LAKE ENEMY SWIM IN DAY COUNTY BETWEEN IT AND THE LARGE WAUBAY LAKE. SINCE THE MEASUREMENTS WERE STARTED MINNEWASTA HAS CONSISTED OF TWO SMALL LAKES SEPARATED BY A SAND BAR WHICH WOULD BE CONCEALED IN TIMES OF HIGH WATER. MEASUREMENTS WERE MADE ON THE EASTERN LAKE AND WHILE NOT AS SATISFACTORY AS THOSE OF OTHER LAKES IT WILL GIVE A PICTURE OF THE FLUCTUATION OF THESE SMALL LAKES. MINNEWASTA IS CONNECTED TO BLUE DOG LAKE BY A GRAVEL CHANNEL AND THEREFORE DRAINS BY SEEPAGE SOUTHWARD. ITS FEEDING AREA IS IN THE IMMEDIATE VICINITY AND THERE SEEMS TO BE NO GRAVEL CONNECTION WITH WAUBAY LAKE. IT SHOULD, THEREFORE, BE AN EXCELLENT INDICATOR OF THE WATER TABLE IN THAT PARTICULAR REGION.

SEA LEVEL ELEVATIONS WERE CARRIED TO THIS LAKE BY LEVELS TO LAKE WAUBAY AND THEN FROM THE WATER LEVEL OF WAUBAY TO THE WATER LEVEL OF MINNEWASTA. THIS, OF COURSE, GIVES ONLY APPROXIMATE ELEVATIONS, BUT SUFFICIENT ACCURACY WAS OBTAINED TO MAKE THE FIGURES USEFUL FOR COMPARISON WITH THE OTHER LAKES OF THE VICINITY. THE BENCH MARK FROM WHICH THE LEVELS WERE MEASURED IS A SCREW DRIVEN IN THE SOUTHWESTERN SIDE OF AN ELM TREE, THREE FEET ABOVE THE GROUND. THE ELM TREE IS LOCATED ON THE TOP OF A GRAVEL BEACH, ON THE HELVIG FARM, WHICH IS PROBABLY THE HIGHEST LAKE LEVEL.

ACCORDING TO RESIDENTS THE LAKE WAS FULL ABOUT 1916 OR 1917. THE FIRST AUTHENTIC RECORDS BEGIN IN 1934:

	1934----------	1765.6 FEET
	1935----------	1764.6
MAY	1936----------	1764
OCT.	1936----------	1761 (IT WAS DRY LATER IN THE WINTER)
OCT.	1937----------	1763 (NEARLY DRY WITH PUDDLE IN THE MIDDLE)
JUNE	1938----------	ABOUT ONE FOOT LOWER THAN IN OCTOBER, 1937
OCT.	1938----------	1761.45



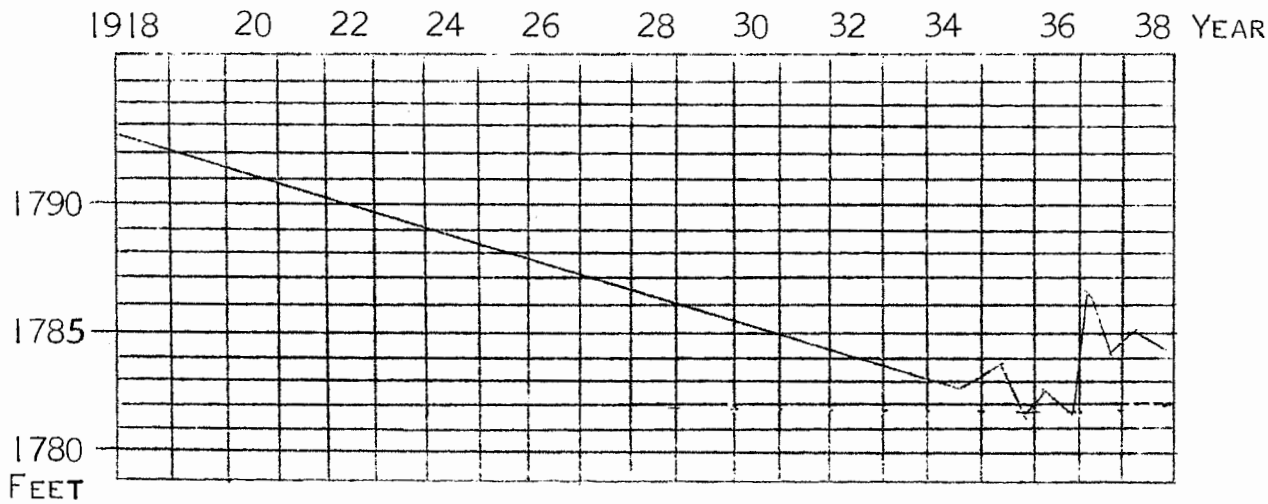
BLUE DOG LAKE LIES AT THE NORTHWEST EDGE OF THE CITY OF WAUBAY IN DAY COUNTY. THE FLUCTUATIONS OF THIS LAKE ARE OF INTEREST PARTLY BECAUSE IT RECEIVES SEEPAGE FROM TWO LARGE GRAVEL CHANNELS CONNECTING IT WITH ENEMY SWIM AND MINNEWASTA LAKES AND BECAUSE IT DRAINS THROUGH ANOTHER GRAVEL CHANNEL SOUTHWARD INTO BITTER LAKE. ITS FLUCTUATIONS ARE NOT AS PRONOUNCED AS THOSE OF THE OTHER LAKES AND IT HAS COME BACK MORE RAPIDLY THAN HAVE THE OTHER NORTHERN LAKES.

A BENCH WAS ESTABLISHED AT CHARLIE'S PLACE. THE ELEVATION CARRIED TO A KNOT IN A TREE USED AS A BENCH MARK IS 1788.4 FT. THIS BENCH WAS NOT VERY SATISFACTORY AND THEREFORE ANOTHER WAS SET IN THE WAUBAY CITY PARK BY CHISELING A CROSS ON THE BOULDER WHICH IS USED AS THE NORTHWEST PILLAR OF THE DANCE HALL. THE ELEVATION OF THIS BENCH IS 1789.9 FEET.

THE HIGHEST WATER LEVEL ACCORDING TO RESIDENTS OF WAUBAY OCCURRED IN 1916-1918 AND THE BEACH WHICH REPRESENTS THIS LEVEL HAS THE ELEVATION OF 1792.8 FEET.

THE FLUCTUATIONS UP TO DATE ARE:

	1916----------	1792.8
AUG.	1934----------	1782.7
JUNE	1935----------	1783.7
OCT.	1935----------	1781.3
MAY	1936----------	1782.5
NOV.	1936----------	1781.6
MAY	1937----------	1786.3
OCT.	1937----------	1784.05
JUNE	1938----------	1785.05
OCT.	1938----------	1784.25



Central Big Sioux Basin

(Lake Kampeska and Lake Poinsett)

Lake Kampeska. An excellent record of the fluctuation of Lake Kampeska is available from the year 1927. This lake supplied the water for the city of Watertown until it became so low that its water was not useable. For this reason the city of Watertown has kept a gauging station at the lake and a monthly record is complete since 1927. It is interesting to note that the lake has not gone dry either during the recent drought or in the drought of 1894, although its sister lake a few miles to the south, Lake Pelican, was dry and it was possible to drive wagons across its bottom.

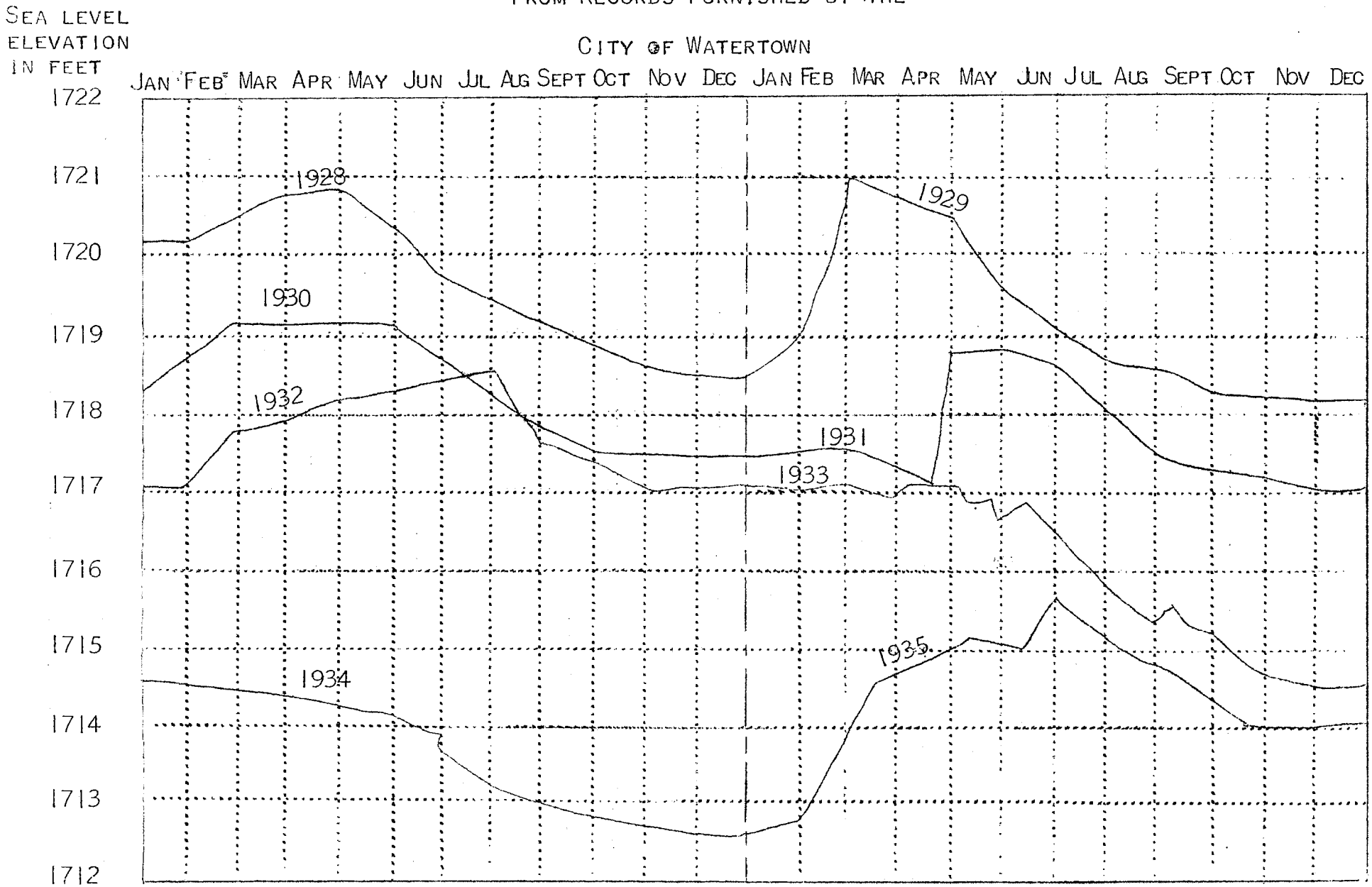
The following graph is a copy of the one made by the city engineer and is particularly interesting since it shows the details of water fluctuation from month to month. It probably gives a better picture of the minor fluctuations of these lakes than do the semi-annual records which have been kept for most of them.

Although variations would not be exactly the same on all lakes, the general low point in December or January would doubtless hold. Drops for July and August with a little comeback in the fall are especially noticeable

WATER LEVEL FLUCTUATIONS IN LAKE KAMPESKA

FROM RECORDS FURNISHED BY THE

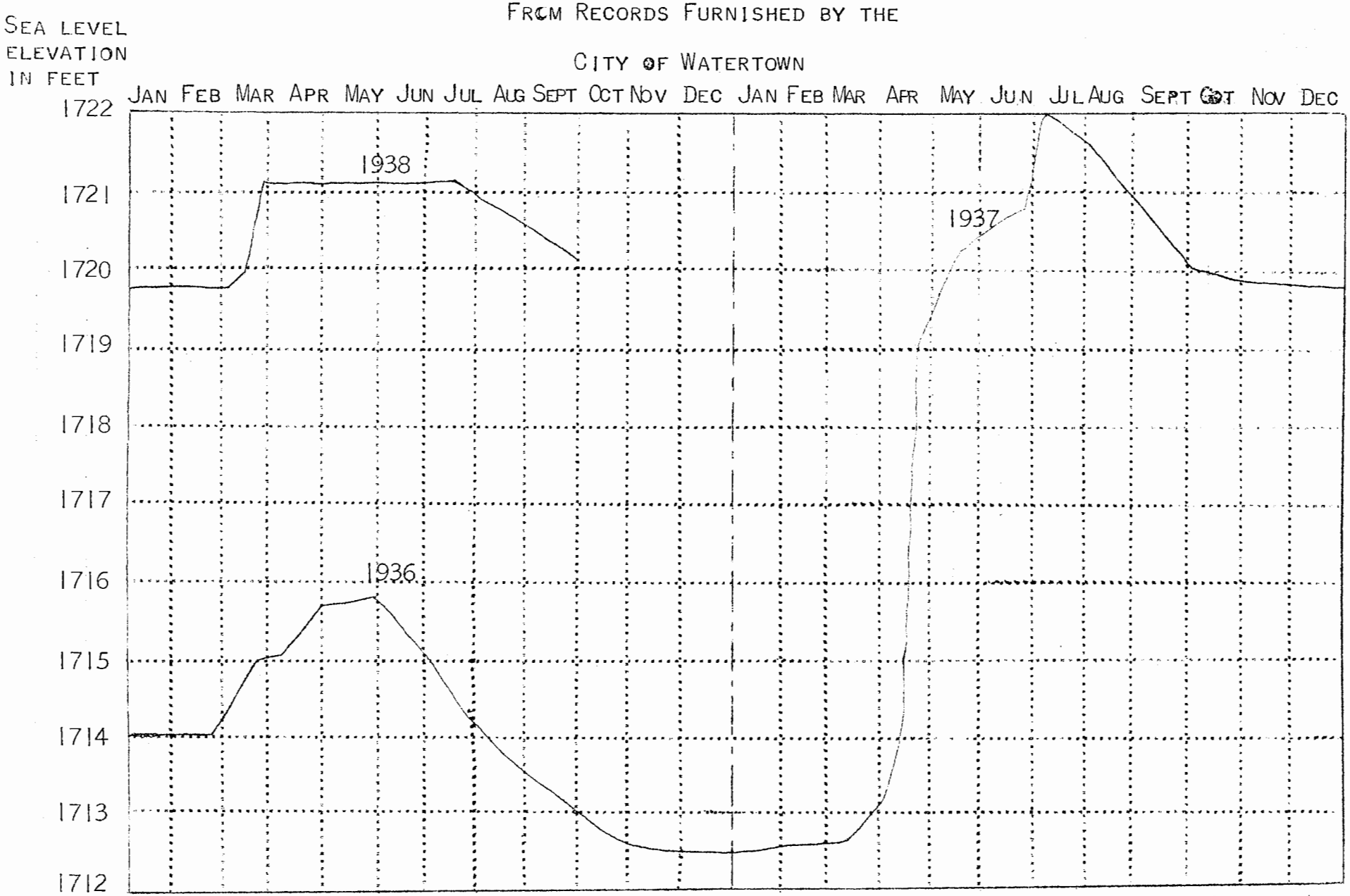
CITY OF WATERTOWN



WATER LEVEL FLUCTUATIONS IN LAKE KAMPESKA

FROM RECORDS FURNISHED BY THE

CITY OF WATERTOWN



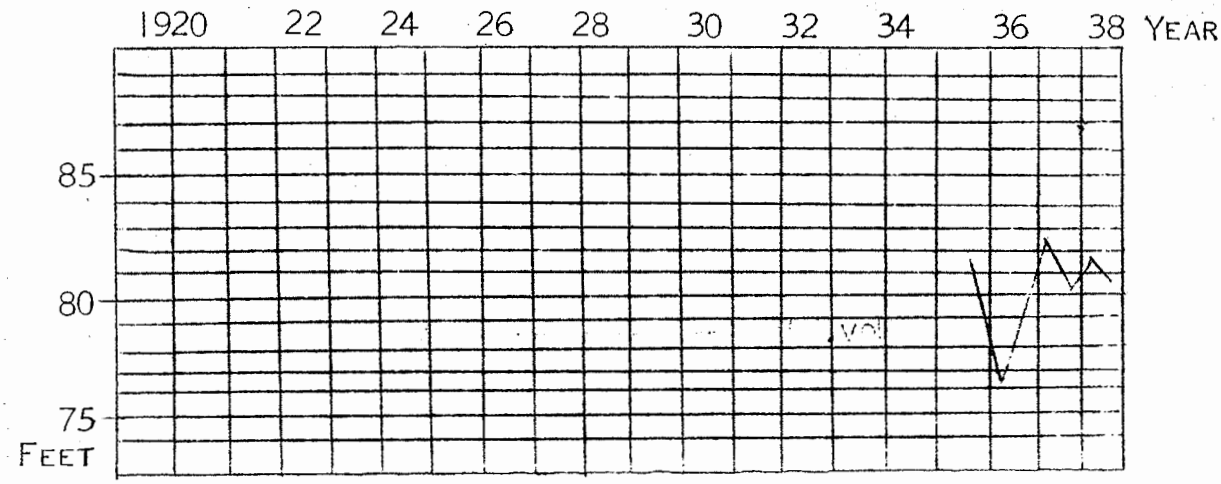
LAKE POINSETT IN THE SOUTHERN PART OF HAMLIN COUNTY, SOME 20 MILES SOUTH OF LAKE KAMPESKA, IS A VERY LARGE SHALLOW SHEET OF WATER. IN FACT IT COVERS HALF A TOWNSHIP. EVAPORATION LOSSES FROM THIS LAKE ARE VERY LARGE AND PROBABLY KEEP ITS SURFACE BELOW THE LEVEL OF THE WATER TABLE IN THE SURROUNDING COUNTRY MUCH OF THE TIME. THE WIDE MUD FLAT WHICH HAS SURROUNDED THIS LAKE DURING THIS DROUGHT ATTESTS TO THIS FACT. IN SPITE OF ITS AREA AND SHALLOWNESS, HOWEVER, THE FLUCTUATIONS OF THIS LAKE SEEM TO CORRESPOND FAIRLY WELL TO THOSE OF THE OTHER LAKES WHICH ARE DESCRIBED.

THE SHORES ARE VERY FLAT AND SANDY AND GOOD LOCATIONS FOR BENCH MARKS ARE NOT AVAILABLE ALONG THE HIGHWAY. THE ELEVATIONS, THEREFORE, WHICH WILL BE RECORDED WERE TAKEN FROM A CROSS CUT OUT ON TOP OF THE SOUTHWEST RAIL OF A CONCRETE BRIDGE ON THE NORTH END OF THE LAKE. THIS IS KNOWN AS STONE BRIDGE AND CROSSES THE WATER-WAY CONNECTING THE MAIN BODY OF LAKE POINSETT WITH A LITTLE SLOUGH NORTH OF IT KNOWN AS DRY LAKE.

LAKE POINSETT NEVER HAS BEEN DRY BUT THE NORTHERN SLOUGH WAS DRY IN THE 1890'S. ONE FARMER GOT HIS START BY RAISING CROPS ON THE BOTTOM OF THE SLOUGH. RECORDS HAVE BEEN KEPT OF POINSETT SINCE 1935:

OCT. 1935----------81.5 (LAKE SHORE ½ MILE AWAY, BUT DITCH DIGGING IN THE CHANNEL EXPOSED THE TABLE IMMEDIATELY SOUTH OF THE BRIDGE)

MAY 1936----------76.2
MAY 1937----------81.25
OCT. 1937----------80.1
JUNE 1938----------81.9
OCT. 1938----------80.95



South Big Sioux Basin

(Lake Madison and Wall Lake)

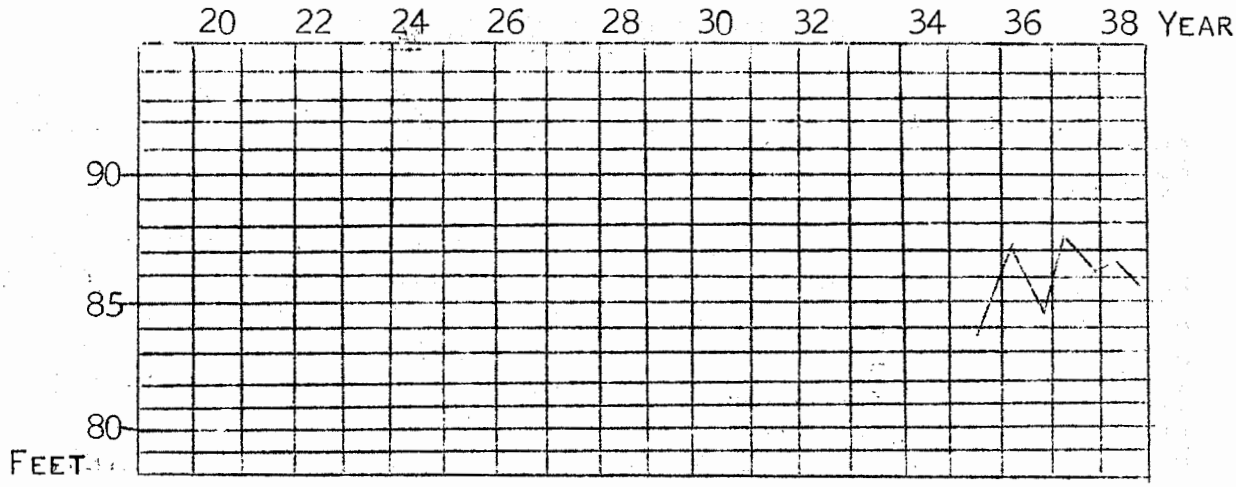
Lake Madison. Prominent lakes are not as common in the southern Big Sioux basin as farther north. The two lakes whose levels have been measured, however, are important because of their size and location.

Lake Madison has been much used as a resort and it was with great regret that people saw it go entirely dry during the last drought. It was in a long gravel channel connecting Lake Herman with the Big Sioux drainage system. It is, therefore, subject to greater seepage losses than lakes with clay basins which surround it. The level of the water in this lake, however, should show indications of the fluctuation of the surrounding ground water table since the lake would fill by inflow from the gravels as rapidly when the water table is raised, as it will drain from seepage through it when the water table lowers. A further significance of this lake is that it is in the same channel which furnishes the water supply for the city of Madison and any lowering of the lake levels means a consequent drainage of the water stored in gravels from which the city draws its supply.

The levels are measured from a bench at the east end of the lake in Smith's Park. This bench is a cross chiseled on the concrete pump platform in front of the residents. It has not been possible to reduce these to sea level and therefore the datum used is the bench mark which is assumed at 100 feet.

There is a dispute among local people as to whether Lake Madison was entirely dry in the drought of 1893. Some contend that there were still small ponds in the middle of the lake at the eastern end during the worst of the drought. Whatever may have been the condition then, it is certain that it has gone dry during the last drought. During the summer of 1935 there was a small lake at the eastern end, but by October it was entirely dry. Actual measurements began the next spring, June, 1936 and the following record has been obtained:

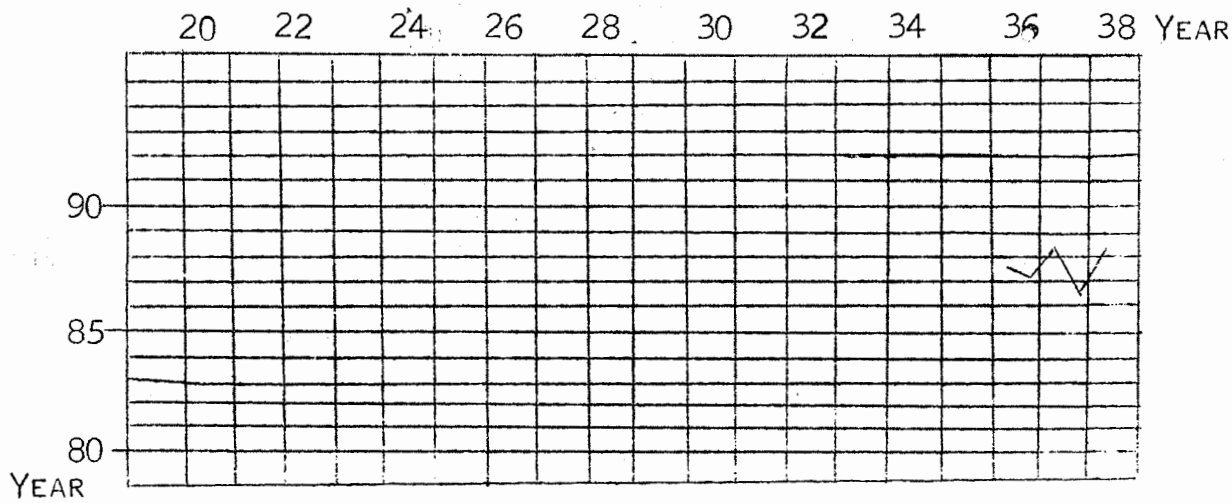
June 1936----------	87.2	(If the bench mark and store represented the highest beach mark, 13 feet of water had disappeared)
Nov. 1936----------	84 or 85	(Absolutely dry--cracks in the deepest part showed mud, but no water at least 8" below the bottom.)
May 1937----------	87.5	
Nov. 1937----------	86.1	
June 1938----------	86.7	
Oct. 1938----------	85.7	



WALL LAKE IS IN MINNEHAHA COUNTY ABOUT 12 MILES EAST OF SIOUX FALLS AND 27 MILES SOUTH OF LAKE MADISON. IT IS A KETTLE LAKE SURROUNDED BY CLAY HILLS AND THEREFORE NOT SUBJECT TO THE RAPID CHANGE BY SEEPAGE WHICH IS CHARACTERISTIC OF LAKE MADISON THE LEVELS ARE REFERRED TO A BENCH MARK WHICH IS AN X CARVED IN A BOULDER USED AS THE NORTHWEST PILLAR OF THE DANCE HALL ON THE SOUTH SHORE OF THE LAKE.

THE OWNER OF THE LAKE REPORTS THAT IT WAS DRY IN 1876. HE WAS ONLY FOUR YEARS OLD AT THE TIME BUT LATER HE FOUND AN OLD BOAT WHICH OLD TIMERS SAID WAS LEFT ON THE FLOOR OF THE LAKE IN '76. AUTHENTIC RECORDS HAVE BEEN KEPT SINCE 1936. THESE ARE INTERESTING IN THAT THE LEVELS WERE LOWER IN 1937 THAN PREVIOUSLY WHILE MOST OF THE LAKES RECORDED AN INCREASE BETWEEN 1936 AND 1937. THE FOLLOWING IS THE RECORD:

1936 MAY----------87.6 FEET
1936 NOV.----------87.2
1937 MAY----------88.35
1937 NOV.----------86.4
1938 JUNE----------88.2



Outside the Big Sioux Basin

Lake Andes, in Charles Mix county, is west of the Big Sioux basin and in a region which has been severely tried by recent droughts.

It lies in a gravel channel and is therefore very sensitive to fluctuation in ground water level. Its large surface however, allows rapid evaporation which doubtless keeps the lake level slightly below the ground water level especially during the hot windy months of the summer. Following the drought of 1894 three large artesian wells were drilled about the lake and popular report had it that these wells supplied the lake with water. It is interesting to note that during the recent drought they played a very small part in supplying the lake water.

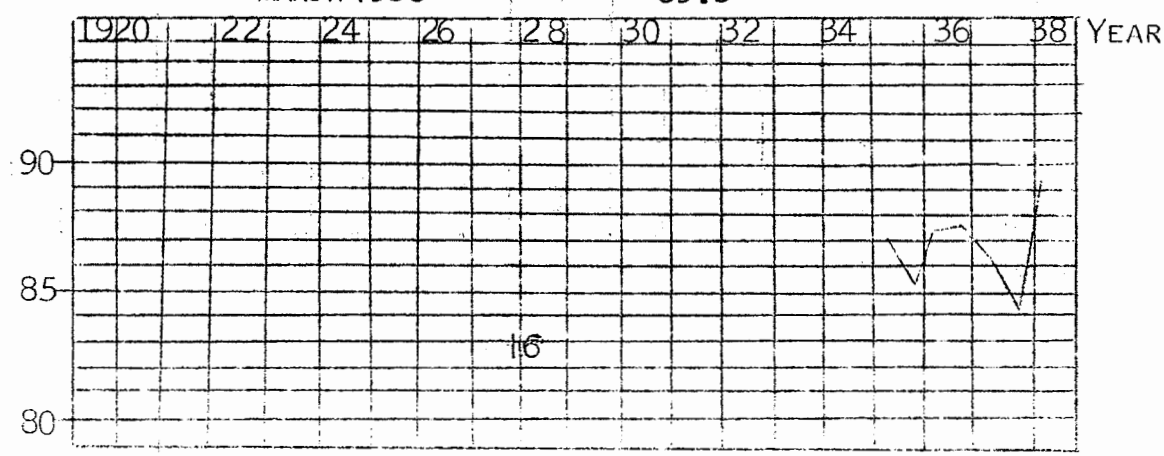
A newspaper article dated August, 1934 states:

> "Armour, S. Dak. Lake Andes, one of the largest waters of this community, is at the lowest ebb since 1894 and at that time was completely dry.— An artesian well in the north end is flowing freely, and water spreading fanwise on a mud flat is evaporated before reaching the lake. Two wells at Stoney Point and the southeast section of the lake are inactive."

The artesian wells at the southern corner of the lake as well as the one at the north end furnished only small puddles of water in front of them during the dry times.

A bench mark was set on the concrete wall back of the swimming pool at Rest Haven and consists of a cross at the base of a cobblestone pillar at the west end. The following are records kept of the lake:

June 1935----------87.0
Nov. 1935----------85.3
May 1936----------87.3
Oct. 1936----------87.8
June 1937----------86.4
Sept. 1937----------84.1
March 1938----------89.3



Summary of Fluctuation of Lake Levels

All these lakes on which observations have been carried show a marked seasonal fluctuation. This is, of course, to be expected, especially in years when ample spring precipitation is followed by a hot summer with its high wind which dries much of the water out of the soil as well as from the surface of the lakes and swamps, thereby reducing the high water level in the lakes' vicinity. The low point reached in early winter, December or January, as shown by the Lake Kampeska graph and checked by the reports of residents along the shores of other lakes indicates the settling of the lake to the lowest possible level of ground water seepage. The effect of surface waters flowing into these lakes has not been closely studied. Apparently it is slight, however, since noticeable changes in lake levels are not recorded unless precipitation has been very general and in large quantities. Thus it would seem that there is a change in water levels in the vicinity of the lake amounting to about one to three feet per year depending upon the spring precipitation.

Nearly all these lakes were reported as being at their lowest levels about 1893 or 1894 and at their highest levels between 1918 and 1920. Since that time there has been a loss of 15 or 16 feet of water in most of the lakes measured. This represents approximately the fall of the ground water table during the recent drouth.

The records indicate that the water table reached its lowest levels between 1934 and 1936. Since then a turn for the better has set in. In many lakes there has been little rise but the downward trend has stopped. This was especially noted in the southern and western regions represented by Wall Lake and Lake Andes. The lakes of the Big Sioux Basin, however, indicate a general rise averaging about three or four feet. Individual lakes vary greatly in the amount of recovery even in this region, however. Lake Kampeska made a gain of nearly 10 feet, Blue Dog five feet and Pickerel eight feet. These lakes settled back a few feet from these high points but the little loss left them high above their low water levels. Others were not so fortunate. Enemy Swim gained about four feet and settled back a foot and a half leaving it but two feet above its low water level. Clear Lake gained three feet only to settle back to a point a foot higher than its low level. Lake Roy made a maximum gain of only a foot since 1936 and then settled back till its level this year is a foot below that of 1936, and Minnewasta has gone entirely dry.

The reason for these differences lies in the local geological conditions largely dependant on the type and porosity of the feeding and seepage areas surrounding each lake. Apparently these have a great deal to do with the control of the water table in their vicinity. In spite of local setbacks, however, the lake levels as a whole present a picture of a generally rising water table.

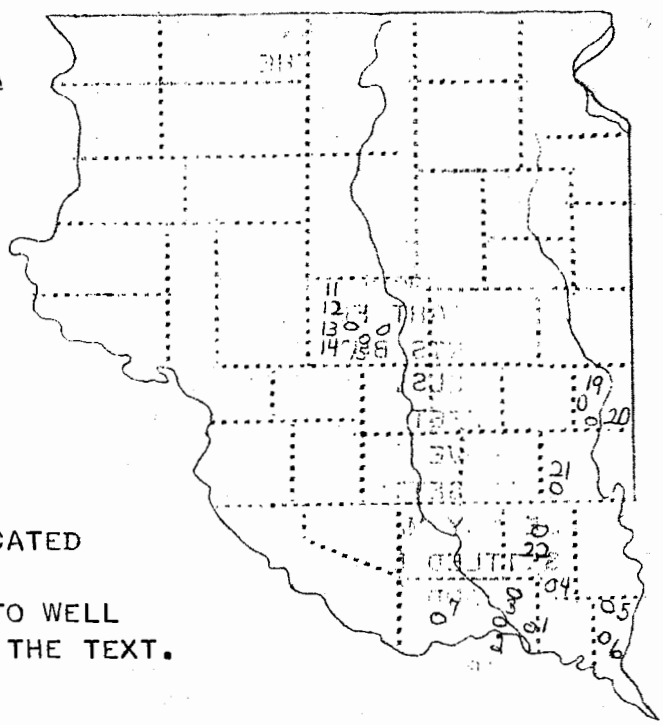
FLUCTUATION OF WELL LEVELS

FOR CONVENIENCE IN DESCRIBING THE WELLS ON WHICH OBSERVATIONS HAVE BEEN KEPT THEY ARE DIVIDED INTO FOUR GROUPS:

1. WELLS IN THE EXTREME SOUTHEASTERN PART OF THE STATE IN YANKTON, UNION, AND CLAY COUNTIES.
2. WELLS IN THE SOUTHERN BIG SIOUX BASIN IN MINNEHAHA AND MOODY COUNTIES.
3. WELLS IN BON HOMME COUNTY.
4. WELLS IN THE VICINITY OF HURON IN BEADLE COUNTY.

THE WELLS IN THE FIRST GROUP HAVE BEEN READ RATHER FREQUENTLY SINCE THEY ARE CLOSE TO THE SURVEY OFFICE. RECORDS ON OTHER WELLS, HOWEVER, HAD TO BE TAKEN AS OPPORTUNITY OFFERED AND, THEREFORE, THEIR RECORDS LACK DETAIL. THE WELLS IN GROUP NO. 4, THOSE ABOUT HURON, WERE FIRST MEASURED BY MR. MORRIS E. KIRBY FROM THE U. S. ARMY ENGINEER'S OFFICE AT OMAHA, WHO MADE A STUDY OF THE SHALLOW WATER SUPPLY FOR THE CITY OF HURON.

INDEX MAP OF EASTERN SOUTH DAKOTA



WELLS RECORDED INDICATED BY CIRCLES.
NUMBERS CORRESPOND TO WELL NUMBERS USED IN THE TEXT.

GROUP 1

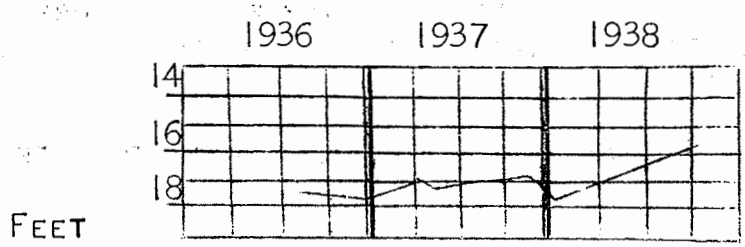
(YANKTON, TURNER AND UNION COUNTIES)

OF THE SEVEN WELLS, THREE ARE IN YANKTON, ONE IN TURNER, AND TWO ARE IN UNION COUNTY.

WELL NO. 1. (NW¼, NW¼, SEC. 11, T 93 N, R 54 W) THIS WELL IS IN THE CEMETERY NEAR GAYVILLE, YANKTON COUNTY. THE FOLLOWING FIGURES GIVE THE NUMBER OF FEET FROM THE MEASURING POINT TO THE TOP OF THE WATER. THE FLUCTUATION OF THE GROUND WATER LEVEL, THEREFORE, IS JUST THE OPPOSITE OF THE FIGURES GIVEN, THE LOWER FIGURES REPRESENTING THE HIGHER WATER LEVELS.

THE DEPTH TO THE WATER WAS MEASURED FROM A POINT ON THE TOP OF THE WELL PLATFORM WHICH IS 0.2 FEET ABOVE THE SURFACE OF THE GROUND.

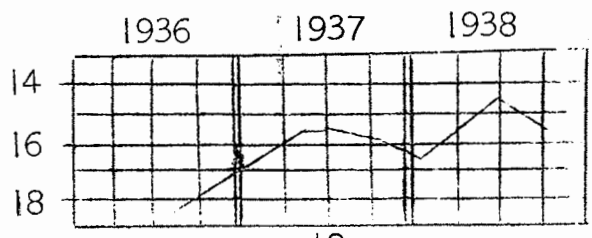
AUG.	1936----------	17.2 DEPTH TO WATER
MAY	1937----------	17.16
APR.	1937----------	16.9
OCT.	1937----------	16.7
NOV.	1937----------	16.79
JAN.	1938----------	17.73
JUNE	1938----------	16.19
OCT.	1938----------	15.77



WELL NO. 2 IS FOUR MILES NORTH OF YANKTON, YANKTON COUNTY, AT THE YANKTON GOLF AND COUNTRY CLUB NEAR THE BOTTOM OF A SHARP RAVINE,

THE MEASURING POINT IS THE TOP EDGE OF THE WELL PLATFORM 0.5 FEET ABOVE THE SURFACE OF THE GROUND.

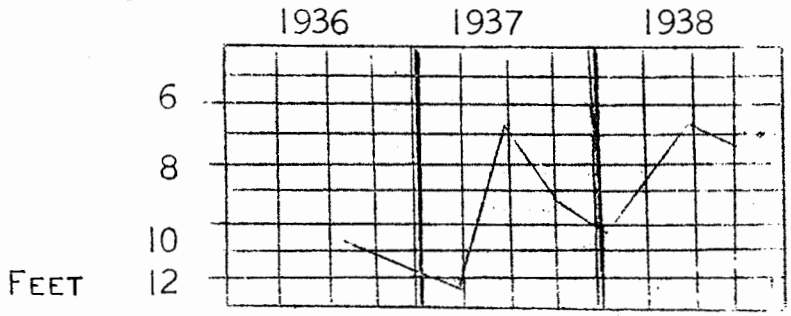
AUG.	1936----------	18.83 DEPTH TO WATER
MAY	1937----------	15.6
JUNE	1937----------	15.48
OCT.	1937----------	15.75
JAN.	1938----------	16.44
JUNE	1938----------	14.3
OCT.	1938----------	15.59



Well No. 5 is on the J. J. Dolan farm one mile south of Junction of 77 and 46, in Union county. (NW¼, NW¼ Sec. 8, T 95 N, R 50 W) The depths to water were measured from the top edge of the tile which forms the top of the well curbing.

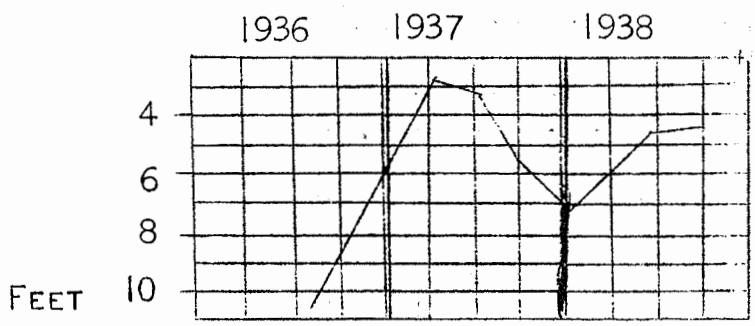
The compiled figures are as follows:

Aug.	1936	10.81	Depth to water
Mar.	1937	12.33	
June	1937	6.73	
Oct.	1937	9.37	
Jan.	1938	10.28	
June	1938	6.66	
Oct.	1938	7.26	



Well No. 6 is on the Mike Manning farm (NW¼, SE¼, Sec. 18, T 93 N, R 50 W). The depths to the water were measured from below the top edge of the first board on the north side, which is one foot above the surface.

Aug.	1936	10.97	Depth to water
Mar.	1937	2.71	
June	1937	3.0	
Oct.	1937	5.63	
Jan.	1938	7.23	
June	1938	4.48	
Oct.	1938	4.37	

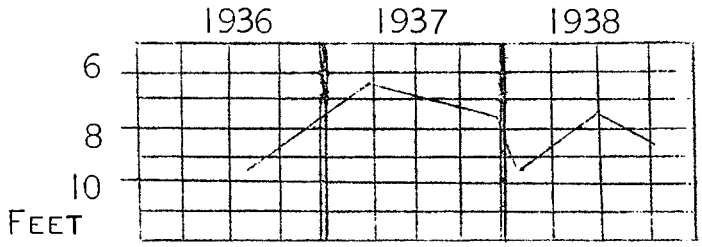


WELL NO. 22 IS THREE MILES SOUTH OF PARKER IN TURNER COUNTY. ($NE\frac{1}{4}$ OF $NE\frac{1}{4}$ SEC. 29, T 99 N, R. 53 W) IT IS IN AN OPEN FIELD A HUNDRED FEET WEST OF HIGHWAY NO. 19, IN THE BOTTOM OF A SMALL DRAW.

THE MEASURING POINT IS THE TOP OF THE WELL PLATFORM, ONE AND ONE HALF FEET ABOVE THE SURFACE OF THE GROUND.

THE FOLLOWING ARE THE COMPILED FIGURES:

AUG.	1936----------	9.36	DEPTH TO WATER
MAR.	1937----------	6.35	
DEC.	1937----------	7.67	
FEB.	1938----------	9.65	
JUNE	1938----------	7.15	
OCT.	1938----------	8.31	

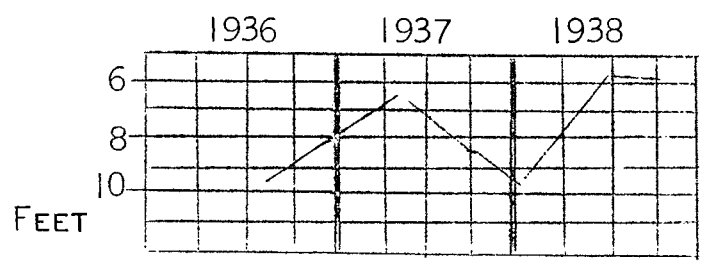


WELL NO. 3 IS FOUR OR FIVE MILES WEST OF IRENE AND THE COUNTY LINE, IN YANKTON COUNTY.

THE MEASURING POINT IS THE TOP OF A SIX INCH PLANK IN THE WEST SIDE OF THE WELL AND IS 1.5 FEET ABOVE THE GROUND.

THE FOLLOWING FIGURES INDICATE THE FLUCTUATION:

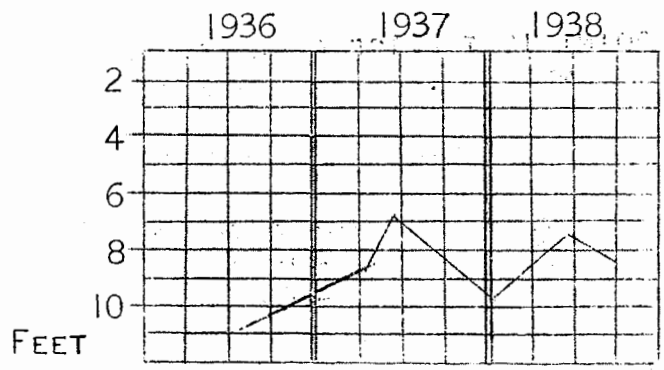
AUG.	1936----------	9.69	DEPTH TO WATER
MAY	1937----------	6.34	
JUNE	1937----------	6.73	
OCT.	1937----------	8.47	
JAN.	1938----------	9.64	
JUNE	1938----------	5.6	
OCT.	1938----------	5.98	



Well No. 4 is one mile east of Irene, on the J. H. Shaw farm (SW¼, SW¼ Sec. 32, T 96 N, R 53 W), Turner county. The measuring point is the top of the 4 x 4 making the frame for the flooring of the well platform, about four inches above the ground surface.

The following figures indicate the fluctuations:

Aug.	1936----------	10.99	Depth to water
May	1937----------	8.61	
June	1937----------	6.8	
Oct.	1937----------	8.46	
Jan.	1938----------	9.88	
June	1938----------	7.58	
Oct.	1938----------	8.39	



GROUP 11

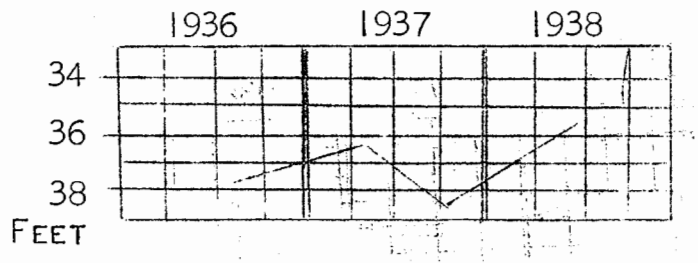
(MOODY AND MINNEHAHA COUNTIES)

TWO WELLS IN MOODY AND ONE IN MINNEHAHA COUNTY MAKE UP THIS GROUP.

WELL NO. 19 IS ONE AND ONE HALF MILES WEST OF COLEMAN, ON THE CARL B. JENSEN FARM, IN MOODY COUNTY. ($SE\frac{1}{4}$, $SE\frac{1}{4}$ SEC. 16, T 106 N, R 50 W). MEASUREMENTS WERE TAKEN FROM THE TOP OF THE UPPERMOST UPRIGHT BOARD IN THE WELL, ONE FOOT ABOVE THE SURFACE OF THE GROUND.

THE FOLLOWING FIGURES INDICATE THE FLUCTUATIONS:

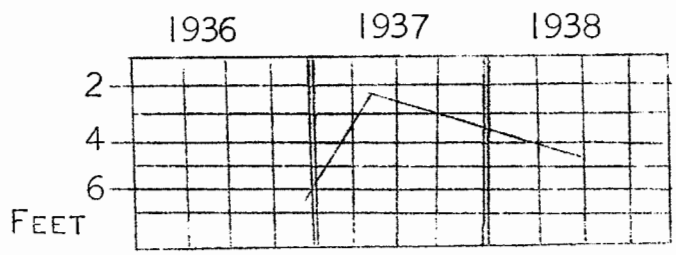
AUG.	1936----------	37.45	DEPTH TO WATER
MAY	1937----------	36.22	
OCT.	1937----------	38.4	
JUNE	1938----------	35.69	



WELL NO. 20 IS IN MOODY COUNTY. ($SE\frac{1}{4}$, $SE\frac{1}{4}$ SEC. 33, T 106 N, R 49 W) THE MEASUREMENTS WERE TAKEN FROM THE BOTTOM EDGE OF THE PUMP AND IS 1.8 FEET ABOVE THE SURFACE OF THE GROUND.

THE FOLLOWING FIGURES INDICATE THE FLUCTUATIONS:

AUG.	1936----------	6.55	DEPTH TO WATER
MAY	1937----------	2.18	
JUNE	1938----------	4.4	

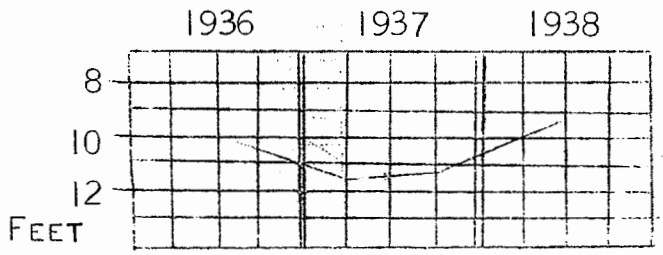


Well No. 21 is called the Wall Lake well because is just north of this lake in Minnehaha County. It is located behind the Mid West oil station on the Wm. Killeaney farm on the south side of highway No. 16. (NW¼, NW¼, Sec. 27, T. 101 N, R 51 W)

The measuring point is the top of the well platform 0.5 feet above the ground surface.

The following figures indicate the ground water levels:

Aug.	1936----------	10.08	Depth to water
Mar.	1937----------	11.45	
Oct.	1937----------	11.19	
June	1938----------	9.2	



GROUP III

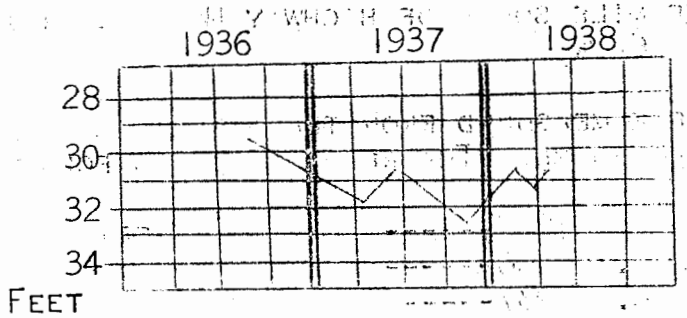
(BONNE HOMME COUNTY)

WELL NO. 7 IS ON THE T. DUOVIC FARM ONE HALF A MILE WEST OF TABOR. (SEC. 14, T 94 N, R 58 W)

DEPTHS ARE MEASURED AT THE SOUTH SIDE OF THE WELL FROM THE TOP OF THE STOVE CASING, 1.5 FEET ABOVE THE SURFACE OF THE GROUND.

THE RECORD IS AS FOLLOWS:

AUG.	1936	29.39	DEPTH TO WATER
APR.	1937	31.87	
JUNE	1937	30.53	
SEPT.	1937	32.53	
NOV.	1937	32.5	
FEB.	1938	30.8	
MARCH	1938	31.3	
APR.	1938	30.82	



GROUP IV

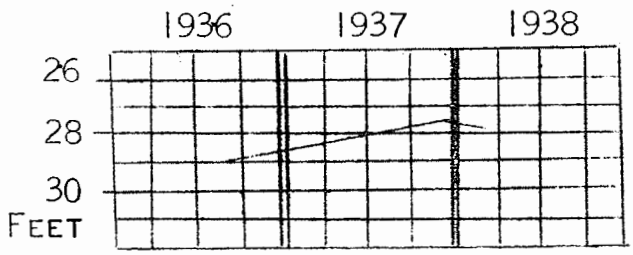
(BEADLE COUNTY)

THERE ARE FIVE WELLS IN THIS GROUP LYING A SHORT DISTANCE SOUTHWEST OF HURON, IN BEADLE COUNTY.

WELL NO. 11 LIES 5.5 MILES SOUTH AND A HALF MILE WEST OF HURON. ($SE\frac{1}{4}$, $SW\frac{1}{4}$, SEC. 36, T 110 N, R 62 W). THE MEASURING POINT IS THE TOP OF THE WELL PLATFORM 1.4 FEET ABOVE THE GROUND.

THE FOLLOWING FIGURES INDICATE THE FLUCTUATIONS:

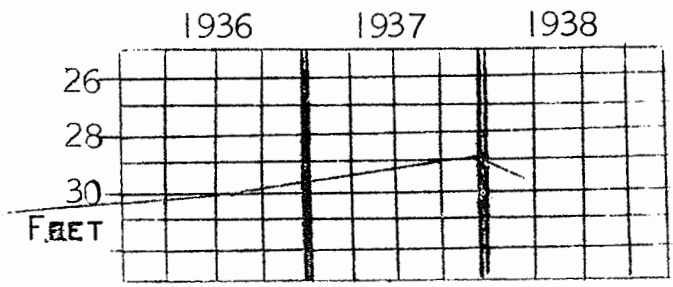
AUG.	1936----------	28.87	DEPTH TO WATER
DEC.	1937----------	27.4	
FEB.	1938----------	27.8	



WELL NO. 12 IS ON AN ABANDONED FARM ONE AND A HALF MILES WEST AND ONE MILE SOUTH OF HIGHWAY NO. 11. ($SE\frac{1}{4}$, $SE\frac{1}{4}$ SEC. 3, T 109 N, R 62 W)

THE DEPTHS WERE MEASURED FROM THE TOP OF THE TILE CASING 1.3 FEET ABOVE THE GROUND. THE RECORDS ARE AS FOLLOWS:

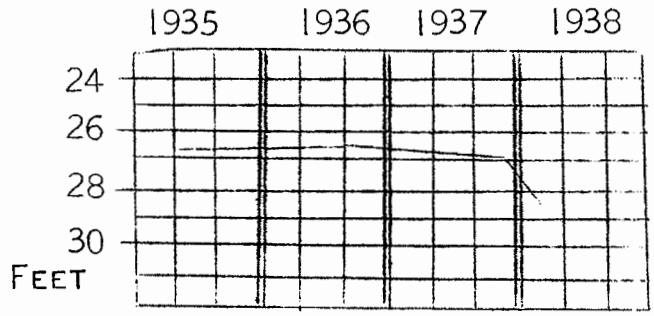
APR.	1935----------	30.64	DEPTH TO WATER
AUG.	1936----------	29.81	
DEC.	1937----------	28.89	
FEB.	1938----------	29.46	



WELL NO. 13 IS ONE MILE EAST AND ¼ MILE SOUTH OF NO. 12 ON THE HILDUR ERICKSON FARM, (SE¼,NE¼, SEC. 9, T 109 N, R 62 W).

DEPTHS MEASURED FROM THE TOP OF THE TILE CASING, 1.3 FEET ABOVE THE GROUND SURFACE GAVE THE FOLLOWING:

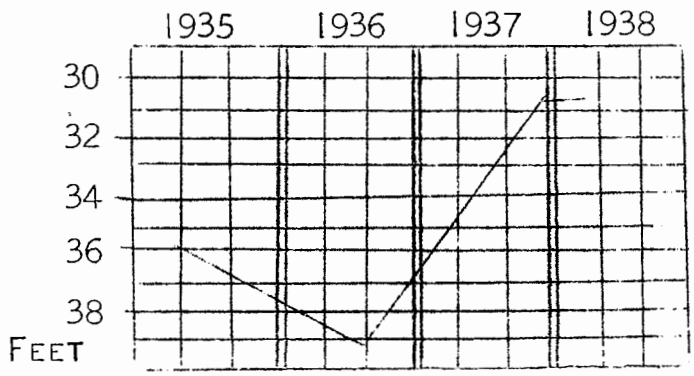
APR.	1935----------	-26.58	DEPTH TO WATER
AUG.	1936----------	-26.36	
DEC.	1937----------	-27.0	
FEB.	1938----------	-28.39	



WELL NO. 14 IS ON THE ELLA JOHNSON FARM, THREE MILES EAST OF NO. 12, AND ABOUT TWO MILES EAST OF WELL NO. 13. (NE¼, NE¼, SECTION 7, T 109 N, R 62 W).

THE MEASUREMENTS WERE MADE FROM THE TOP OF THE WELL PLATFORM BUT A FEW INCHES ABOVE THE GROUND.

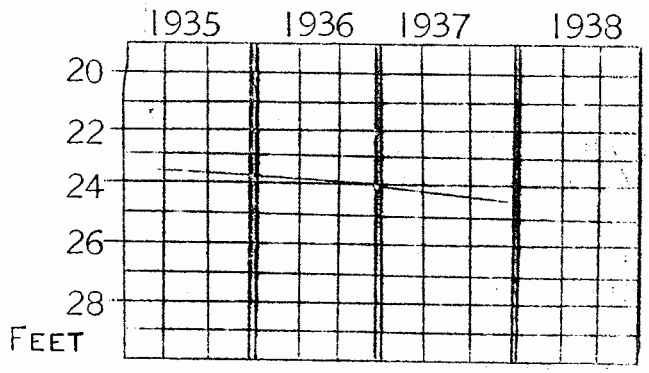
APR.	1935----------	-35.83	DEPTH TO WATER
AUG.	1936----------	-39.16	
DEC.	1937----------	-30.85	
FEB.	1938----------	-30.75	



Well No. 15 is the most westerly well of the group. It is located on the Nels Christensen farm. (NE¼, Sec. 1, T 109 N, R 62 W).

Depths were measured from the top of the flooring of the well platform, one foot above the ground.

Apr.	1935----------	23.47	Depth to water
Aug.	1936----------	23.91	
Dec.	1937----------	24.32	



Summary of Well Water Fluctuations

In southeastern South Dakota the ground water rose from one to six feet during the one year period of August, 1936 to August, 1937.

The two wells in Moody and Minnehaha counties show a tendency for a slight fall of the ground water table.

Well No. 7 in Bon Homme county shows a fall of about half a foot from the spring of 1937 to the spring of 1938.

The water table in the Huron district shows only slight seasonal fluctuations--as four of the wells vary only one or two feet in 3½ years. One well shows a decided rise; two wells, a slight rise, and two wells a slight decrease.