Spring 5-18-1951

The Groundwater of the Area North of Flathead Lake, Montana

Frederick M. Hilpert

Note - This is a reference on hydrology on the index map of Montana put by the Mont Bureau of Mines Aug 1966

MONTANA SCHOOL OF MINES

Butte, Montana

TABLE OF CONTENTS

AN INVESTIGATION OF THE GROUNDWATER OF THE AREA NORTH OF FLATHEAD LAKE, MONTANA

Submitted to

Dr. E. S. Perry

by

Frederick M. Hilpert

May 18, 1951

TABLE OF CONTENTS

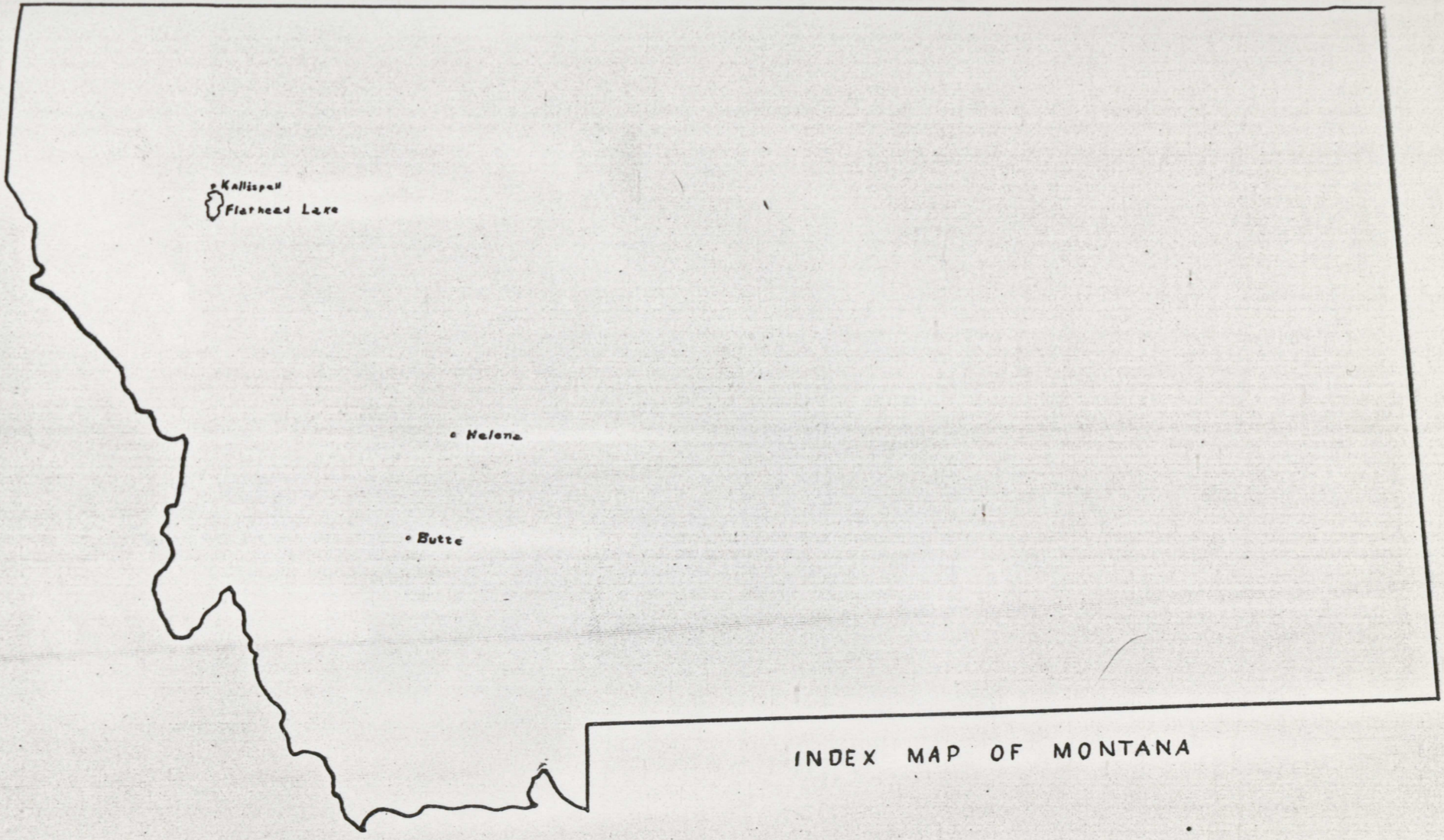
Title
writer

INTRODUCTION

The purpose of this investigation is to determine the reasons for the ground water variations in the area north of Flathead Lake, Montana. Previous to this study, the United States Geological Survey made an investigation of the area for the purpose of determining the effect upon the water table if the lake level was raised artificially. Their conclusions concerning the water table was that only the areas nearest the lake and river show the rise and fall of the water table, and in the interior of the area this effect disappears.

Several methods were used in pursuing this investigation. Hydrographs were made of the various wells showing the season to season change as well as the year to year variation. Superimposed upon these hydrographs is the level of Flathead Lake. The last method of investigation was the construction of cross sections of the area.

The writer, at this time, would like to express his gratitude and appreciation to Dr. E. S. Perry for the use of his hydrographs, and also for the aid and encouragement he so ably gave.



INDEX MAP OF MONTANA

LOCATION

The area under investigation in this problem lies just to the north of Flathead Lake, and includes an area of roughly 25 square miles. Flathead Lake, as seen from the enclosed map, is just south of Kalispell, which is in the northwestern part of the state of Montana.

DESCRIPTION OF AREA

Flathead Lake, according to Cady (1-60), is about 30 miles long and about 15 miles wide at its broadest point. The lake is supplied with water from the Flathead River, which enters at the northern extremity of the lake. During most of the year, the river carries a uniform quantity of water, but in the early summer it reaches flood proportions. This, of course, has a direct bearing upon the water level of the lake itself in that the lake also rises during the early summer. The average yearly rise in the level of the lake varies between four and six feet.

The actual area under consideration in this report lies just to the north of Flathead Lake, and is bordered on two sides by the Flathead River. The land itself, was considered by Cady (1-61), to be a delta-like alluvial plain. This plain is rather flat with a gradual rise to 2,900 feet in the first mile, and remaining at that level for as far north as the Flathead River. The land near the eastern border next to the river is rather low, varying between 2,890 and 2,894 feet. There is a beach deposit about a half mile from the lake, which breaks the gradual rise of the land from the lake. The banks of the river in the northern and eastern sides of the area are very abrupt, and in some cases almost vertical.

There are several small features of the land, as described by Cady (1-61), of considerable importance in a ground water investigation. These features are the oxbow lakes, deserted river channels, the channels of extinct tributary streams, and one small existing stream, Ashley Creek. There are four sloughs situated near the northwest and northeast corners of the area. The majority of the deserted channels lie in the western part of the area, although there is one small channel, which runs north and south across the eastern part of the area. Another small channel runs parallel to the first channel through the central portion. In addition to these features, there are several undrained depressions, one of which is in the northwestern part of sec. 18, and another near well 20. There are numerous small drainage channels throughout the area, which are discernable only with the aid of a topographic map.

The soil, according to Cady (1-62), is underlain by silt with varying quantities of clay or sand. This silt varys between 1 foot and 10 feet thick and averages about 3 to4 feet in thickness. A sand of fine to medium texture with silt predominate lies just below the first silt. This sand is generally 3 to 5 feet in thickness, but it sometimes varys from 1 to 8 feet. In parts of the area, there is a thin layer of clay below the sand at an altitude of 2,890 feet. Below this series of sediments is a coarse sand, which contains interbedded thin laminae of clay. None of the wells pass through this coarse sand, which lies at an elevation of 2,890 feet. Two of the wells do not encounter the coarse sand, but do encounter a dark clay in section 18.

HYDROGRAPHS

The hydrographs were plotted from Water-Supply Papers 777, 817, and 840. These papers listed the water table heights in each well for the years 1928 through 1937. Upon completion of the hydrographs, the water level of the lake was superimposed upon the graphs to show the heights of the lake during the year and over a period of several years.

Wells 24, 47, 23, 25, 26, 27, 22, and 32 lie in the northern part of the area along the Flathead River. These wells are almost in a straight line from east to west, and cover the entire northern part of the area. All the wells in this area show a wide fluctuation from season to season and also from year to year. The fluctuations are lessened to a certain extent in wells 22, and 32, as shown by the enclosed hydrograph.

The central part of the investigated area is covered by wells 29, 21, 30, 31, 33, 34, 35, 18, 19, 36, 37, 38, 17, and 16. These wells do not show the wide fluctuations that are present in the northern portion of the area, although wells 33, 29, and 19 have a wide range in ground water levels.

The southwestern portion of the alluvial plain is represented by wells 8, 45, 7, 44, 43, 1, 41, 9, 10, 5, 20, and 11. These hyrographs do not vary as much as the hydrographs for the northern and central parts of the area. Wells 41, 9, 10, and 5, show some range in water level heights from season to season, but not as strongly as the graphs of the other two areas. Each of these wells have a wide variation in 1933, which is due to the large amount of rainfall and subsequent high water levels of the lake and river.

Wells 15, 3, 2, 4, 40, 12, 13, 46, 39, and 14 are situated in the southeastern part of the investigated area. In general, these wells show very little season to season change, although wells 40, 14, 13, and to a lesser extent well 39 show a variation in regards to season. Again one well, number 40, has been perticularly sensitive to the large amount of rainfall in 1933. Well 13, and to a lesser extent wells 4 and 13 show a peculiar phenomenom from 1937 through 1943. This feature consists of the fact that the water table is below the minimum water level of the lake for these years. One possible explanation is that the ground water may be moving to the southeastern part of the area, which is below lake level. An earthern dam, built some 25 years ago, keeps the lake from encroaching into land. This explanation is not valid since the periods of time do not coincide, therefore no explanation is offered.

CROSS SECTION

The cross sections were made to determine if there was any apparent reason for the fluctuations in the ground water level of perticular wells. The solid lines in the wells represent the maximum and minimum water table levels of the various wells.

Cross section A-A' was constructed along the wells in the southern portion of the area. The western part of the cross section shows very little flucuation until well number 9 is reached. Wells 9, 10, and 41 exhibit a wide range in variation due to the proximity of the lake. Proceding along the cross section from well 41, the variation in the water table is not large until well 3 is reached. The fluctuation in 3 is due to the closeness of the river.

Cross Section B-B' runs from well 5 to well 11, again along the southern portion of the deltalike plain. The water table in this cross section is very close to the surface and occasionaly floods

the two depressions. The wide range between the maximum and minimum water table levels is again due to the close proximity of the well to the lake and also to a deserted stream channel or drainage channel, which passes close to well 41.

The cross section C-C' was constructed from the lake in a northern direction to well 34. Well number 40 has occasionaly been under water henceforth the wide variation in maiximum and minimum water table levels. The tendency torwards a wide fluctuation gradually decrease to the northwards, because of the increasing distance from the lake.

Cross section D-D' was constructed across the northern portion of the alluvial plain. Wells 24, 47, and 23 have a wide variation in their water table, which is due to the proximity of the Flathead River to these wells. Wells 25 and 26 fluctuate because of the closeness of the river and the Ashley Creek. Wells 27, and 22 are controlled by the Church Slough, although well 22 does not have the same magnitude of variation, as well 27, due to its distance from the slough. The fluctuations are decreased in well 32, although there is a small nameless slough east of the well, which accounts for its variations.

The last cross section E-E' was made of the northeastern part of the area. The wide variation in well 29 is due to the Church Slough. The rest of the wells in this section have a limited variation until well 33 is reached. The same nameless slough which influenced well 32 also influences well 33 to a much greater extent.

The evidence gathered from the cross sections point to one thing that the variation in the level of the water table is due to the lake, river, sloughs, creek, and drainage channels. These features control the seasonal changes in water level in all the wells. The magnitude of the variations decrease with the increase in distance

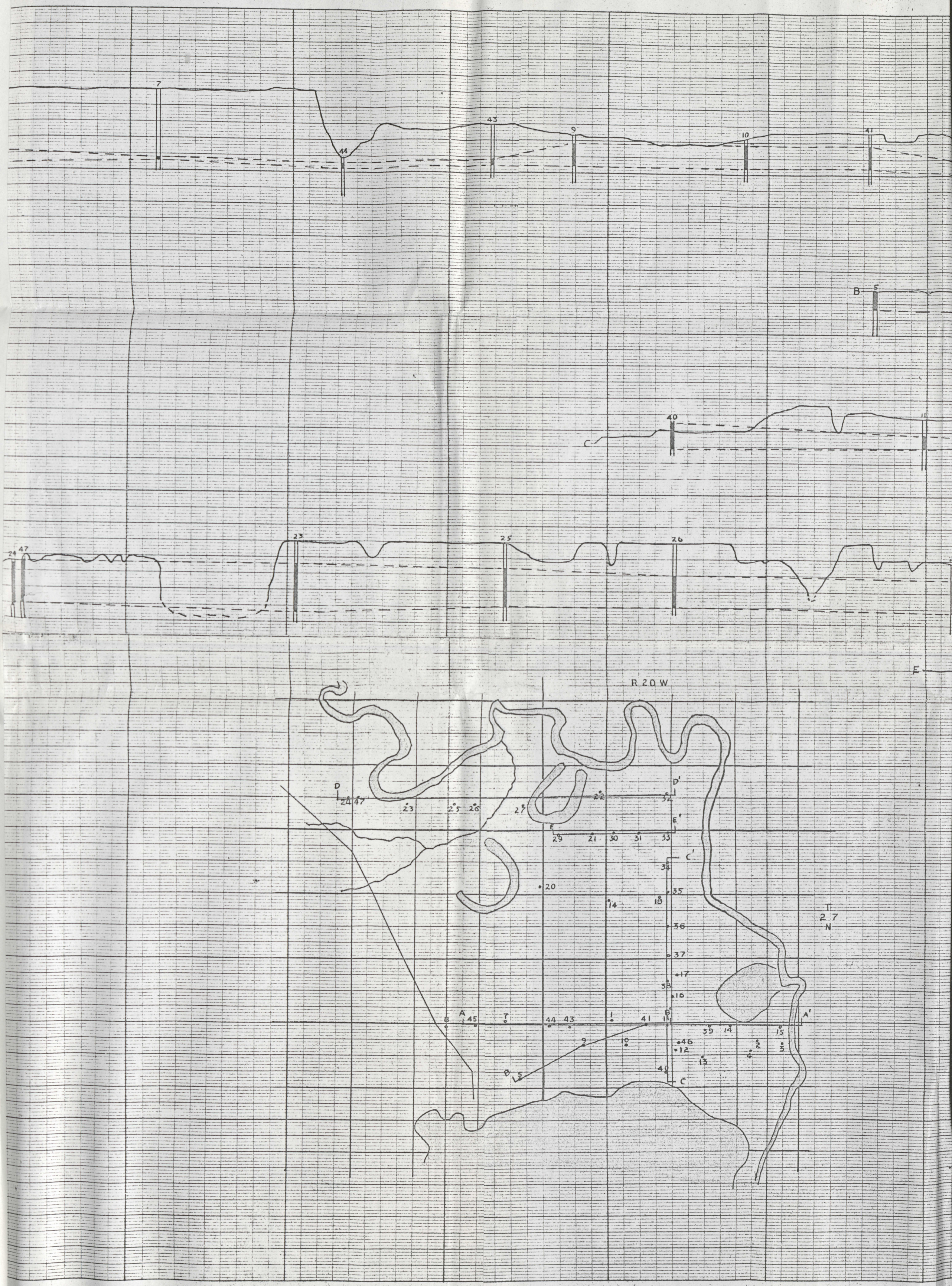
from the above features.

Summary CONCLUSIONS

This investigation of the ground water level, was conducted on the area just north of Flathead Lake, Montana. The actual area is bordered by the Flathead Lake on the south and by the Flathead river on the north and east sides. This land is an alluvial plain deposited by the Flathead River, and as such is made up of unconsolidated clays, silts, and sands.

Various methods were used in the pursuance of this problem. The first method was the constructing of the hydrographs from information in the United States Geological Survey Water Supply Papers. Upon completion of the hydrographs, the water level of Flathead Lake was superimposed upon the graphs. The final method used was the construction of cross sections along the various lines of wells.

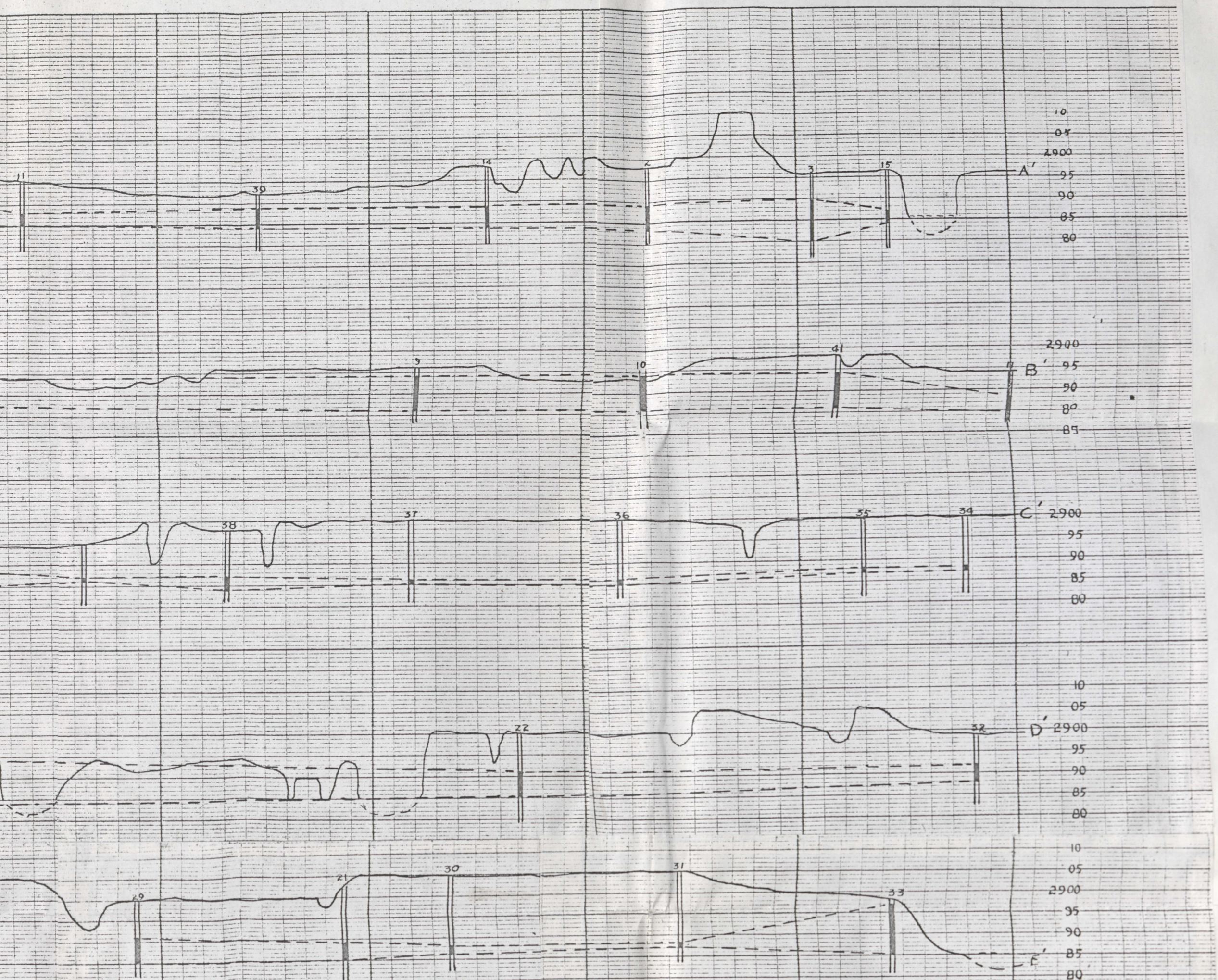
From the information revealed by the cross sections, one major conclusion is possible. The primary reason for the wide variation between the maximum and minum water table levels in the wells is due to the proximity of the wells to the oxbow lakes, deserted river channels, the channels of extinct tributary streams, and the small existing stream, Ashley Creek.



CHARLES BRUNING COMPANY

PROFILE PLATE A

PRINTED IN U.S.A.



CROSS SECTIONS OF AREA NORTH OF FLATHEAD LAKE

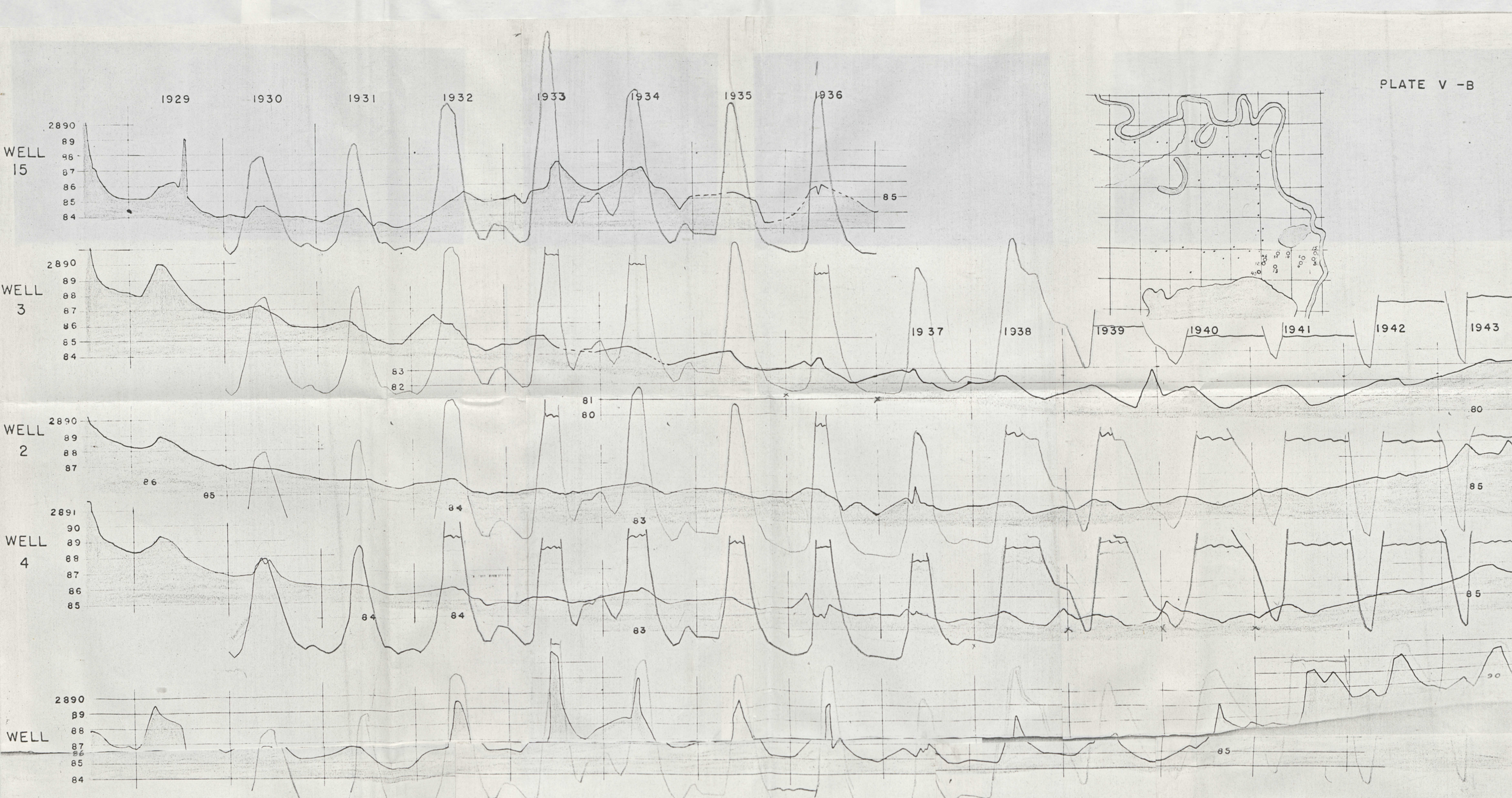
---- MAXIMUM AND MINIMUM WATER TABLE LEVEL

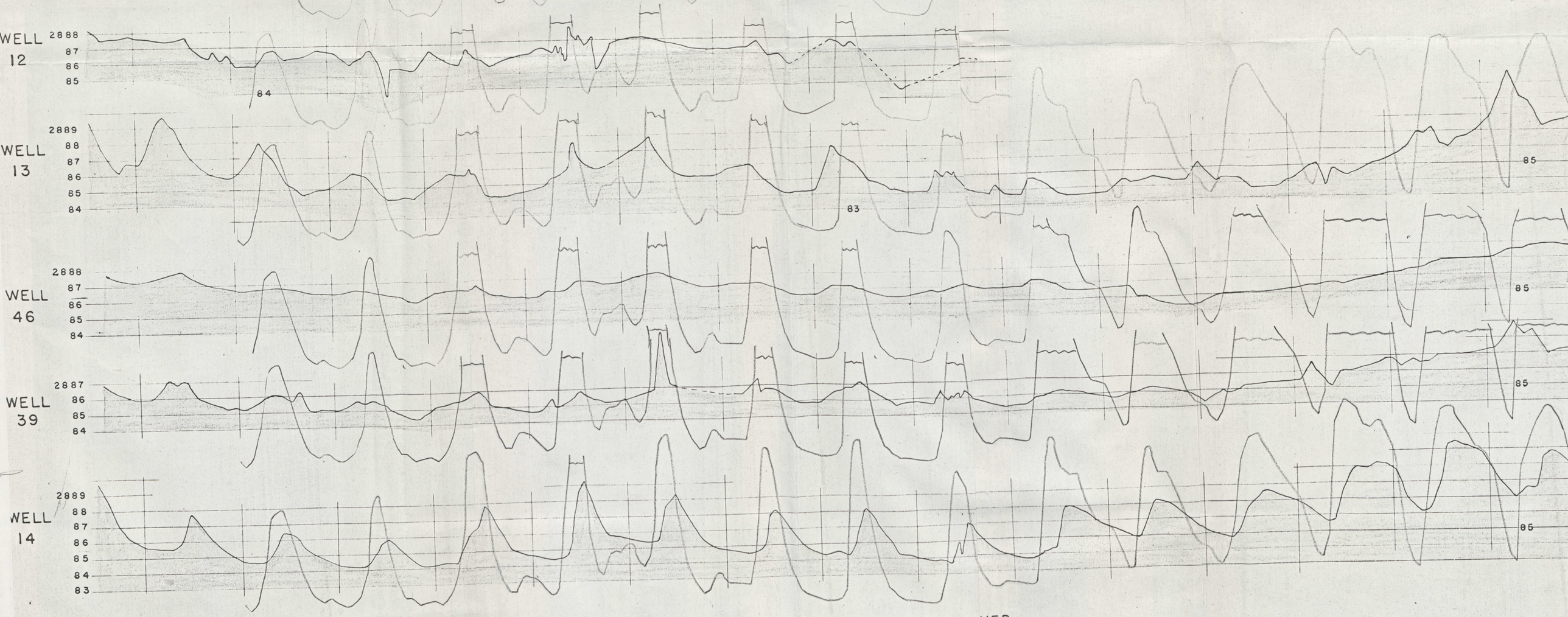
CHARLES BRUNING COMPANY
PROFILE PLATE A
PRINTED IN U.S.A.

BIBLIOGRAPHY

1. Cady, R. C., "Effect Upon Ground-Water Levels of Proposed Surface-Water Storage in Flathead Lake, Montana", U. S. G. S. Water-Supply Paper 849-B, 1941.

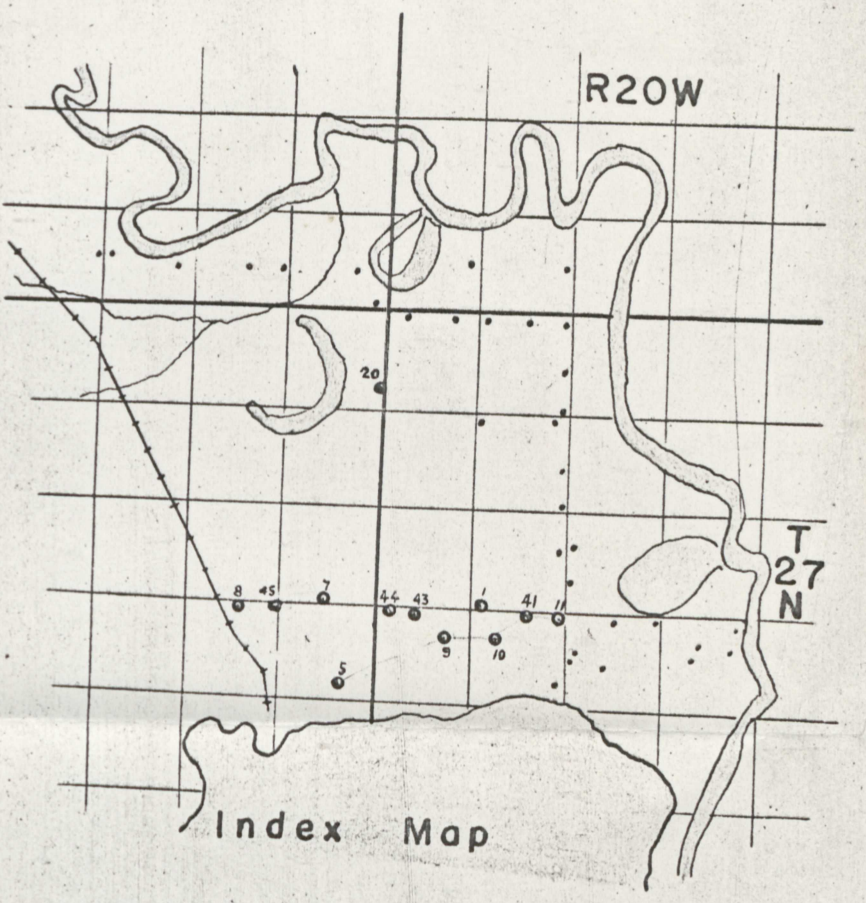
PLATE V -B


1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
WELL 15
WELL 3
WELL 2
WELL 4
WELL
2890
2891
85
84
83
82
81
80
86
87
88
89
90

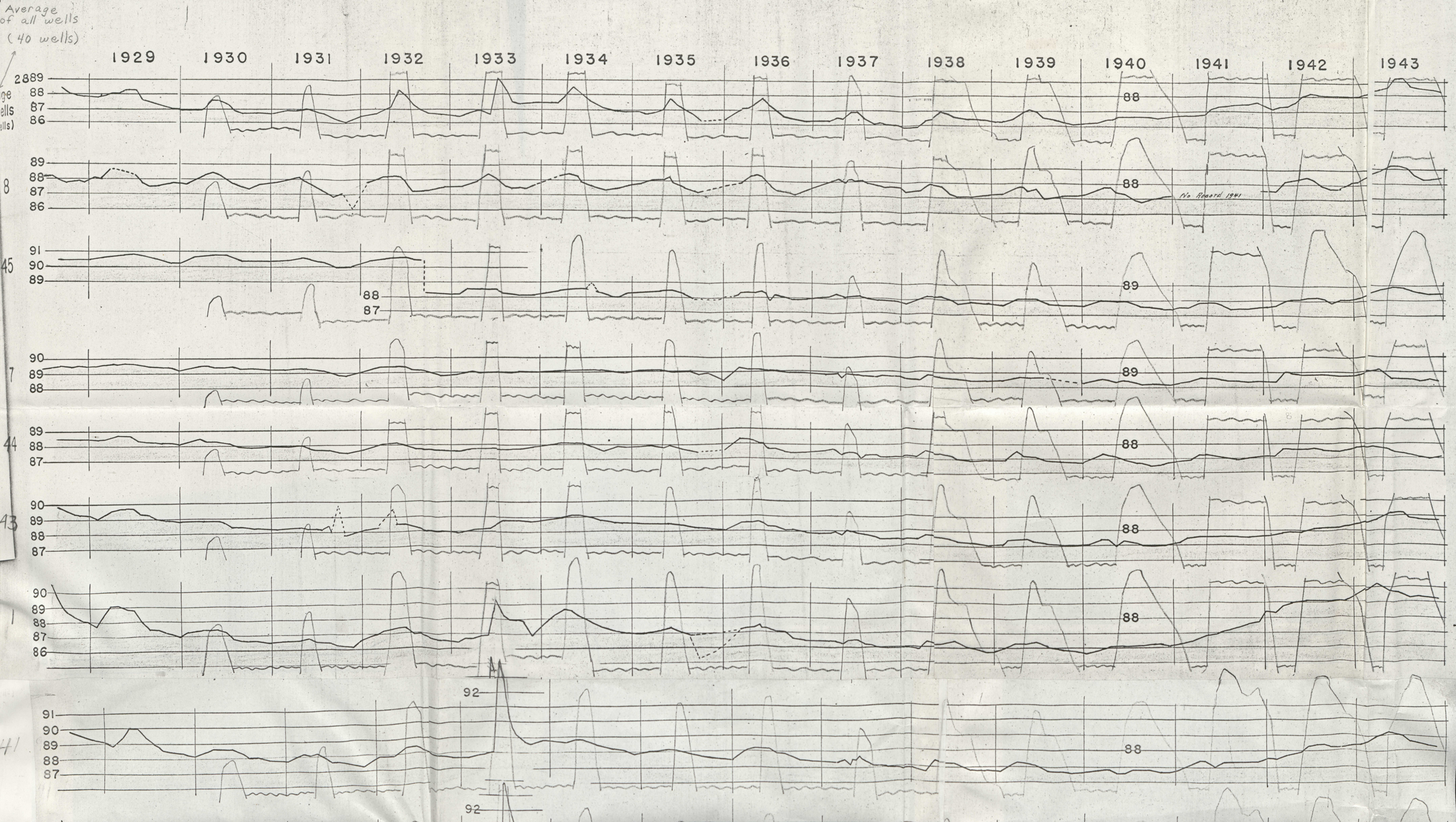


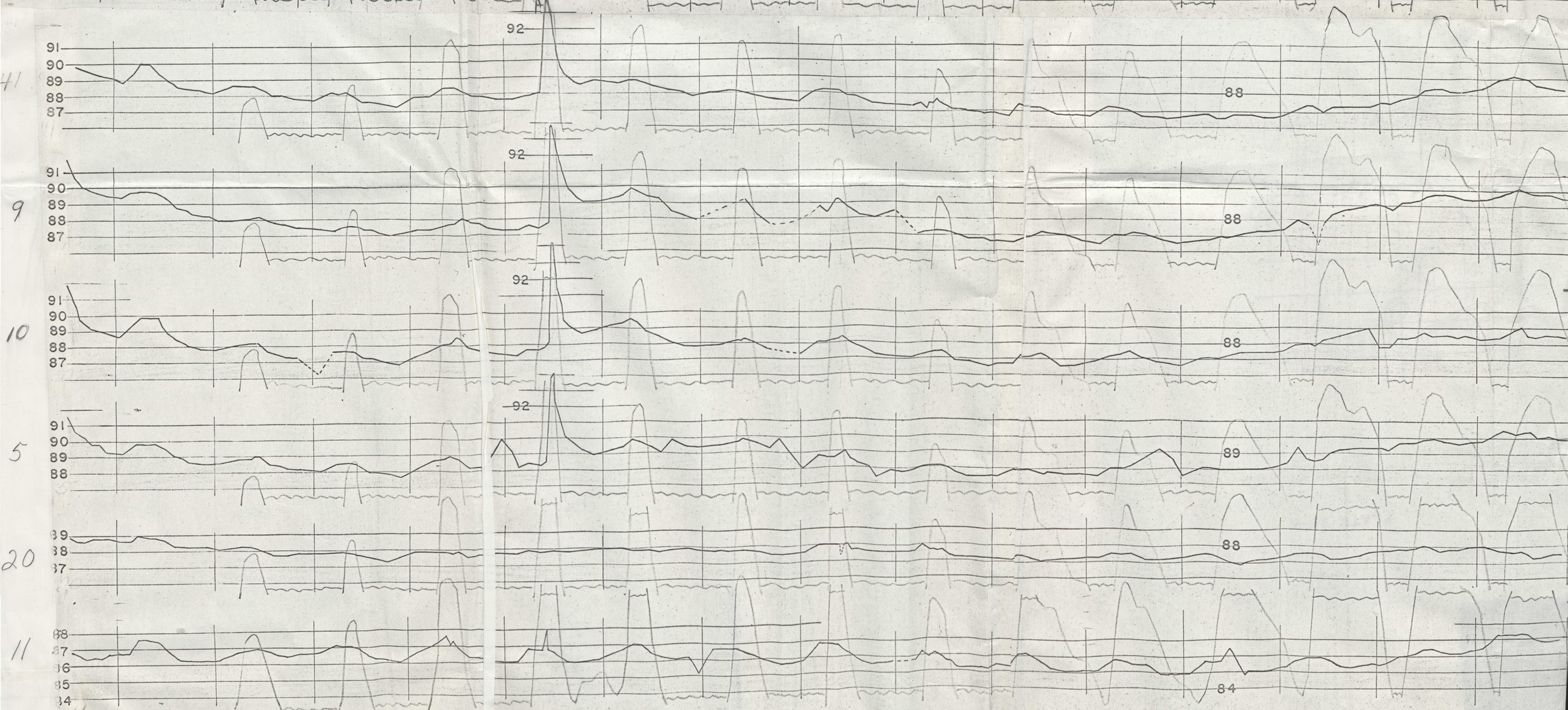
HYDROGRAPHS OF WELLS IN SOUTHEAST PART OF AREA NEAR FLATHEAD LAKE AND RIVER

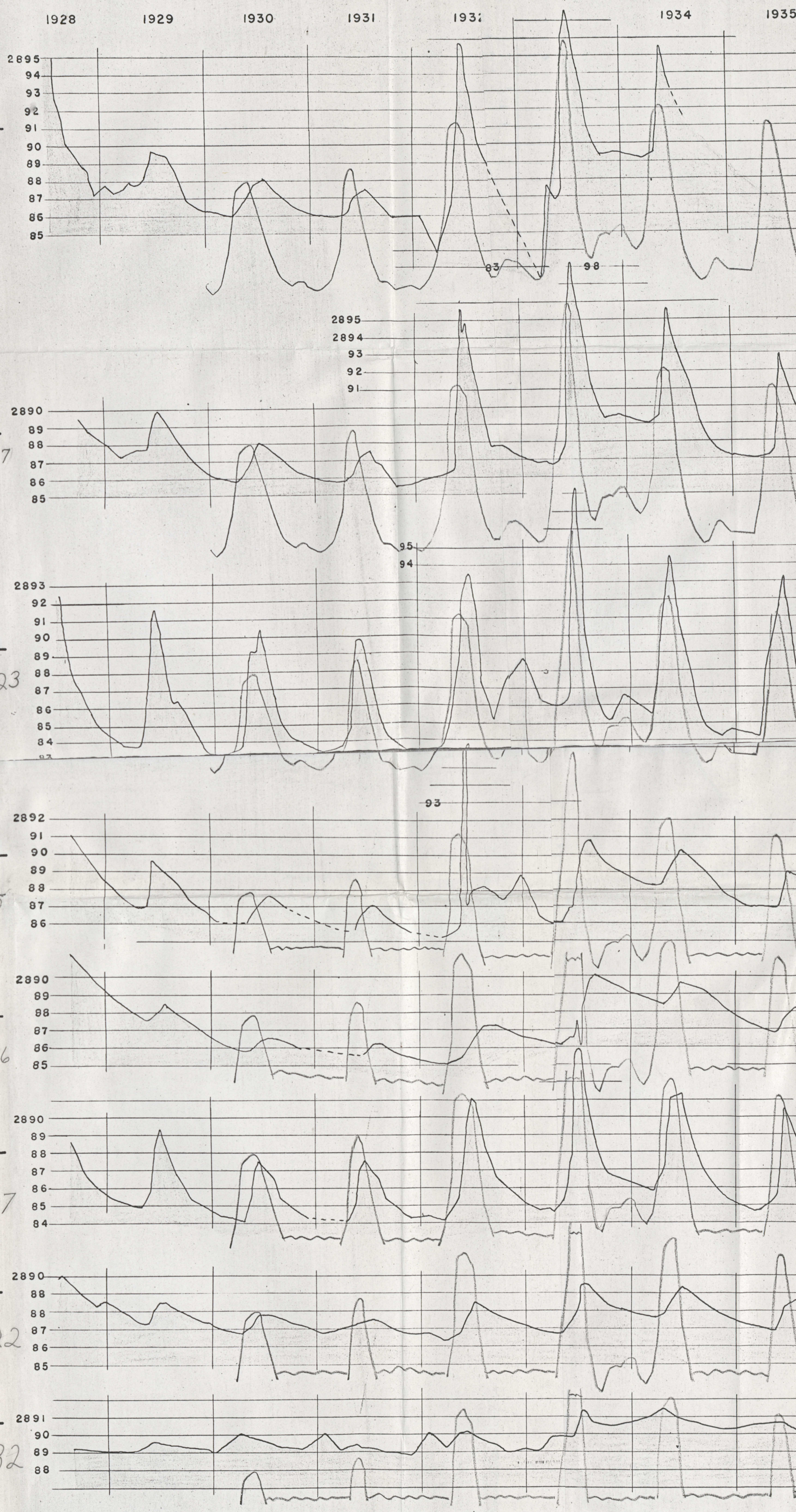
PLATE VII-A



Index Map


Average of all wells (40 wells)
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
No Record 1941

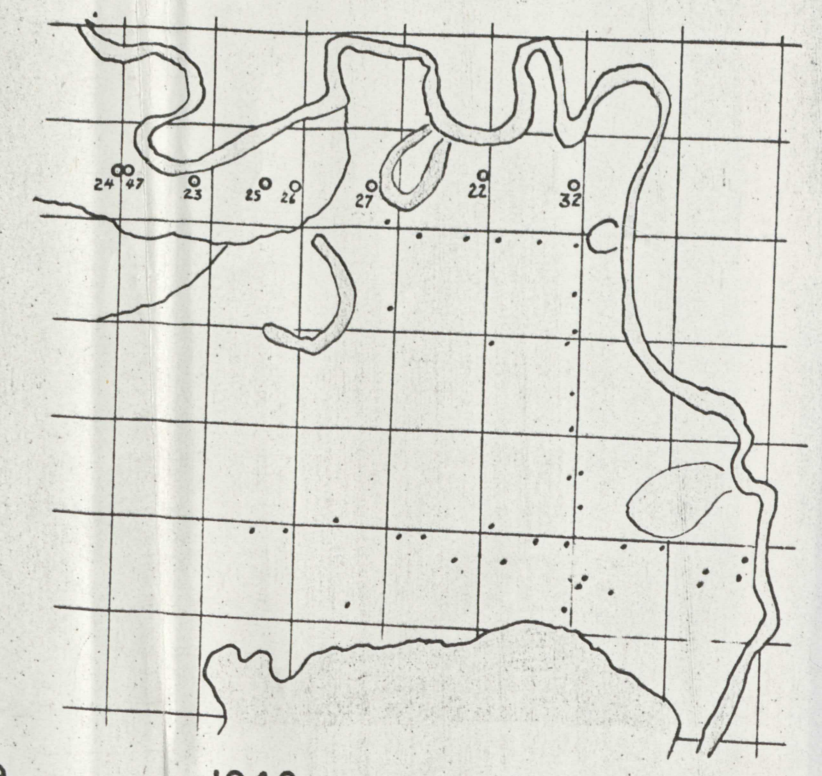




HYDROGRAPHS OF WELLS 4 1/2 MILES NORTH OF FLATHEAD LAKE

PLATE VII

C



1936 1937 1937 1938 1939 1940 1941 1942 1943

90

90

85

97

90

90

85

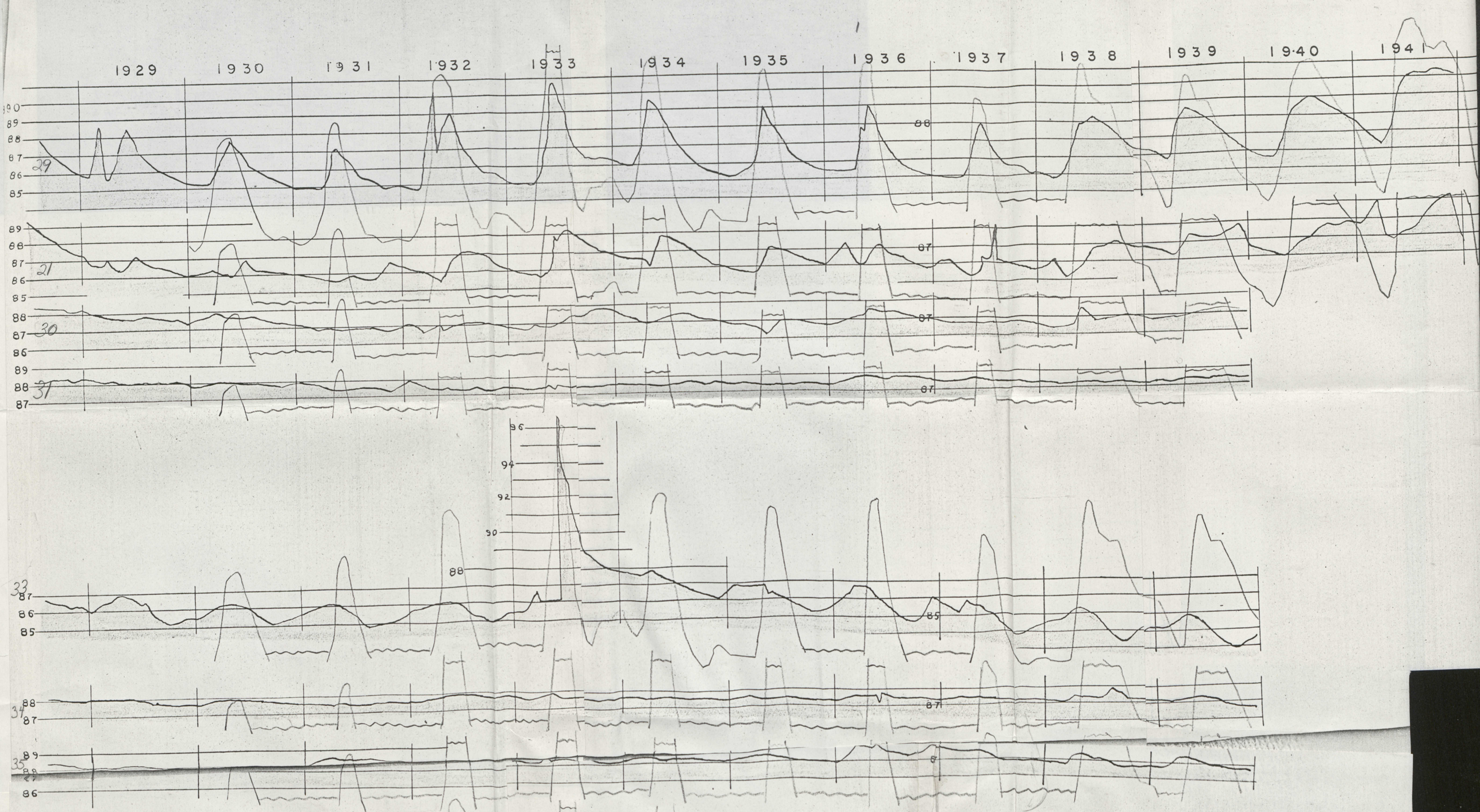
90

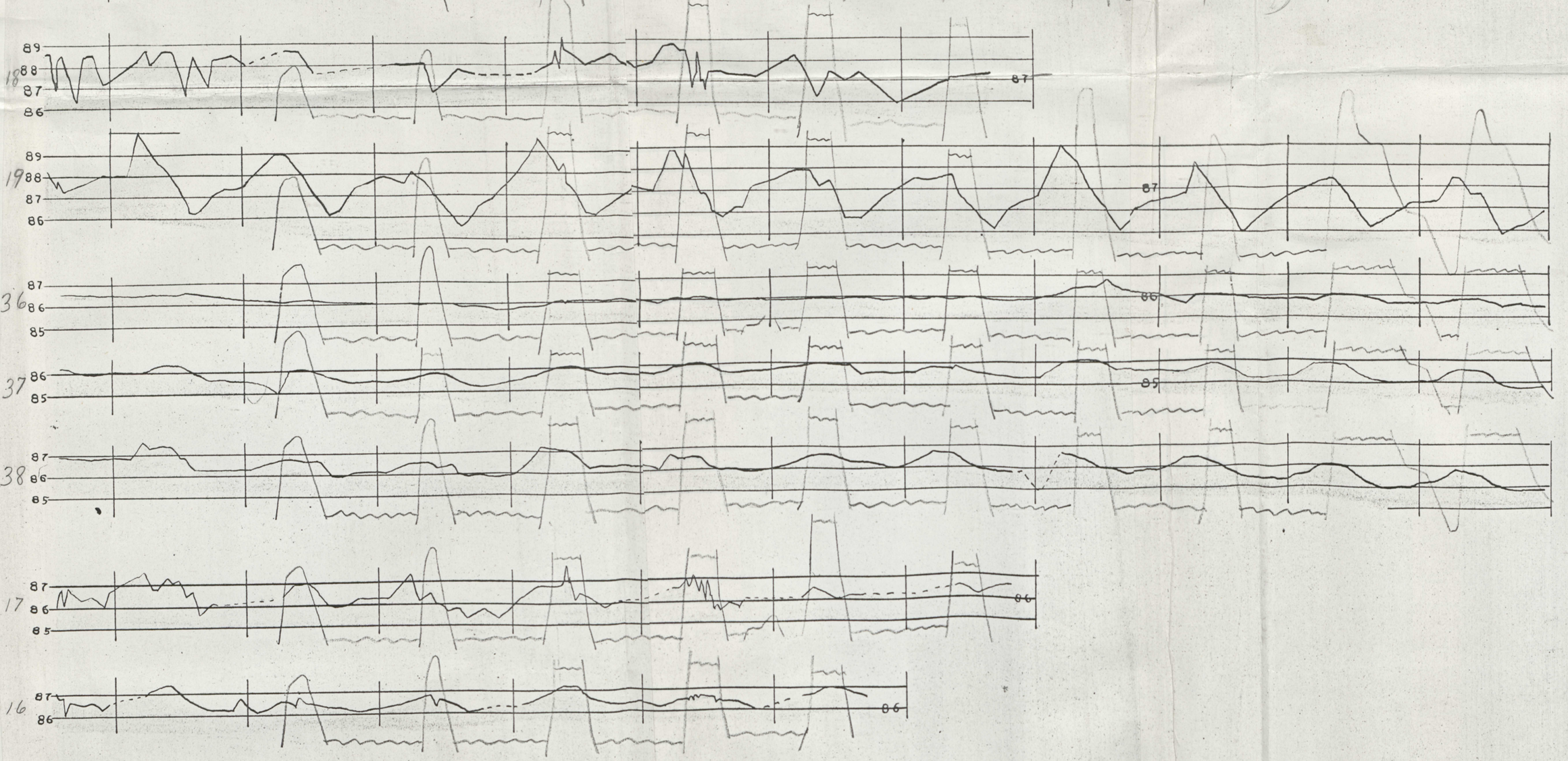
85

90

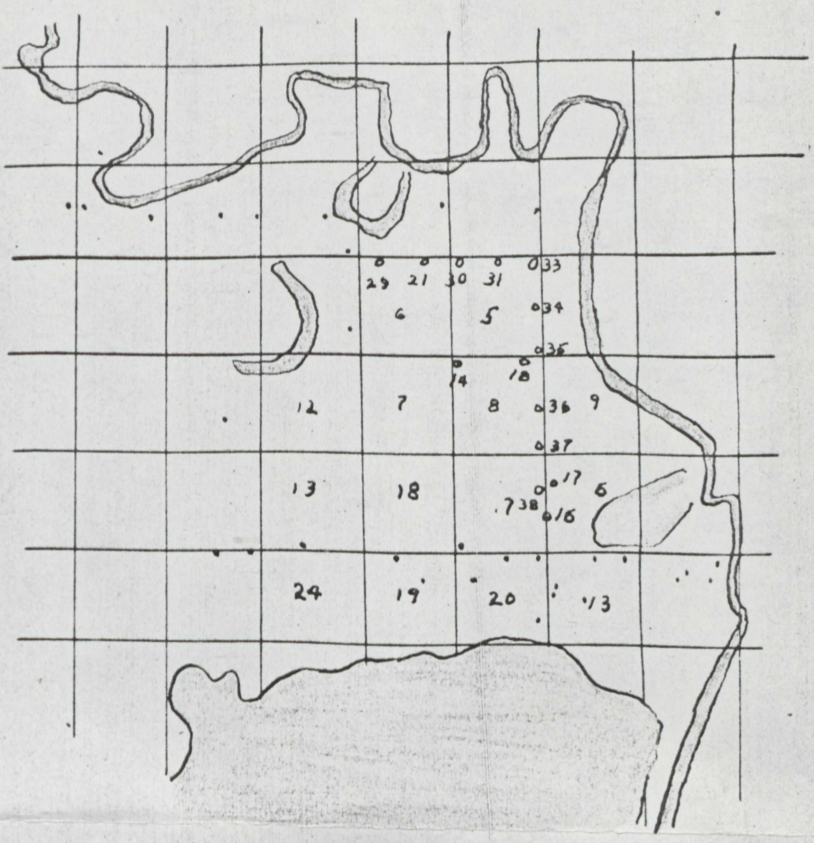
85

NEAR RIVER.


1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
29
21
30
31
33
34
35



HYDROGRAPH OF WELLS IN EAST PART OF AREA NEAR FLATHEAD LAKE AND RIVER


29
21
30
31
33
6
5
34
35
14
18
12
7
8
36
9
37
13
18
17
6
38
16
24
19
20
13