Ground-Water Factors Affecting Drainage in the First Division, Buffalo Rapids Irrigation Project Prairie and Dawson Counties, Montana

By E. A. MOULDER *and* F. A. KOHOUT

With a section on
CHEMICAL QUALITY OF THE WATER
By E. R. JOCHENS

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1424

Prepared as part of the program of the Department of the Interior for development of the Missouri River basin

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1958

UNITED STATES DEPARTMENT OF THE INTERIOR

FRED A. SEATON, *Secretary*

GEOLOGICAL SURVEY

Thomas B. Nolan, *Director*

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

CONTENTS

ILLUSTRATIONS

[All plates are in pocket]

TABLES

GROUND-WATER FACTORS AFFECTING DRAINAGE IN THE FIRST DIVISION, BUFFALO RAPIDS IRRIGATION PROJECT PRAIRIE AND DAWSON COUNTIES, MONTANA

By E. A. Moulder and F. A. Kohout

ABSTRACT

The First Division of the Buffalo Rapids Irrigation Project borders the northwest bank of the Yellowstone River in Prairie and Dawson Counties, Mont. Water for irrigation is pumped from the Yellowstone River into a high-lying canal that borders the area along its northwest side. The irrigated tracts are on terraces that range in height from 20 to 190 feet above the river and are underlain by unconsolidated deposits, principally terrace deposits, of Quaternary age. In the southwestern two-thirds of the area the only bedrock formation above river level is the nearly horizontal Fort Union formation of Tertiary age. In the northeastern third of the area, where the Cedar Creek anticline crosses the Yellowstone River valley, the Hell Creek formation, Fox Hills sandstone, and Pierre shale, all of Cretaceous age, are above river level.

The unconsolidated deposits, which are recharged largely by canal leakage and infiltrating irrigation water and, in the northeastern part of the area, partly by inflow from bedrock aquifers, are saturated to a level that in many places is within a few feet of the land surface. In general, the water within these deposits moves almost directly riverward. Despite the construction of drainage ditches to intercept excess ground water, progressively more land has become waterlogged. The detailed hydrologic studies on which this report is based have revealed the causes of poor drainage. Possible means of alleviating the waterlogging—reduction of recharge, improvement of existing drainage systems, or construction of new drainage systems—are suggested for each of the waterlogged areas.

Ground water in the report area is used mostly for domestic purposes and the watering of livestock. The water in the unconsolidated deposits has a wide range in concentration of dissolved solids, hardness, and percent sodium; the water generally has a greater concentration of dissolved solids where the water table is high and drainage is poor than it does where drainage is good. Water from the bedrock aquifers is more uniform in composition than that in the unconsolidated deposits, is very soft, and contains appreciable quantities of sodium bicarbonate. Water from the Yellowstone River is rated as excellent to permissible for irrigation.

INTRODUCTION

LOCATION AND EXTENT OF AREA

The area described in this report is the First Division of the Buffalo Rapids Irrigation Project in eastern Montana. It borders the northwest bank of the Yellowstone River from a point 2 miles northeast of Fallon to a point 1 mile north of Glendive, a distance of about 30 miles. (See fig. 1.) It is almost wholly in Dawson

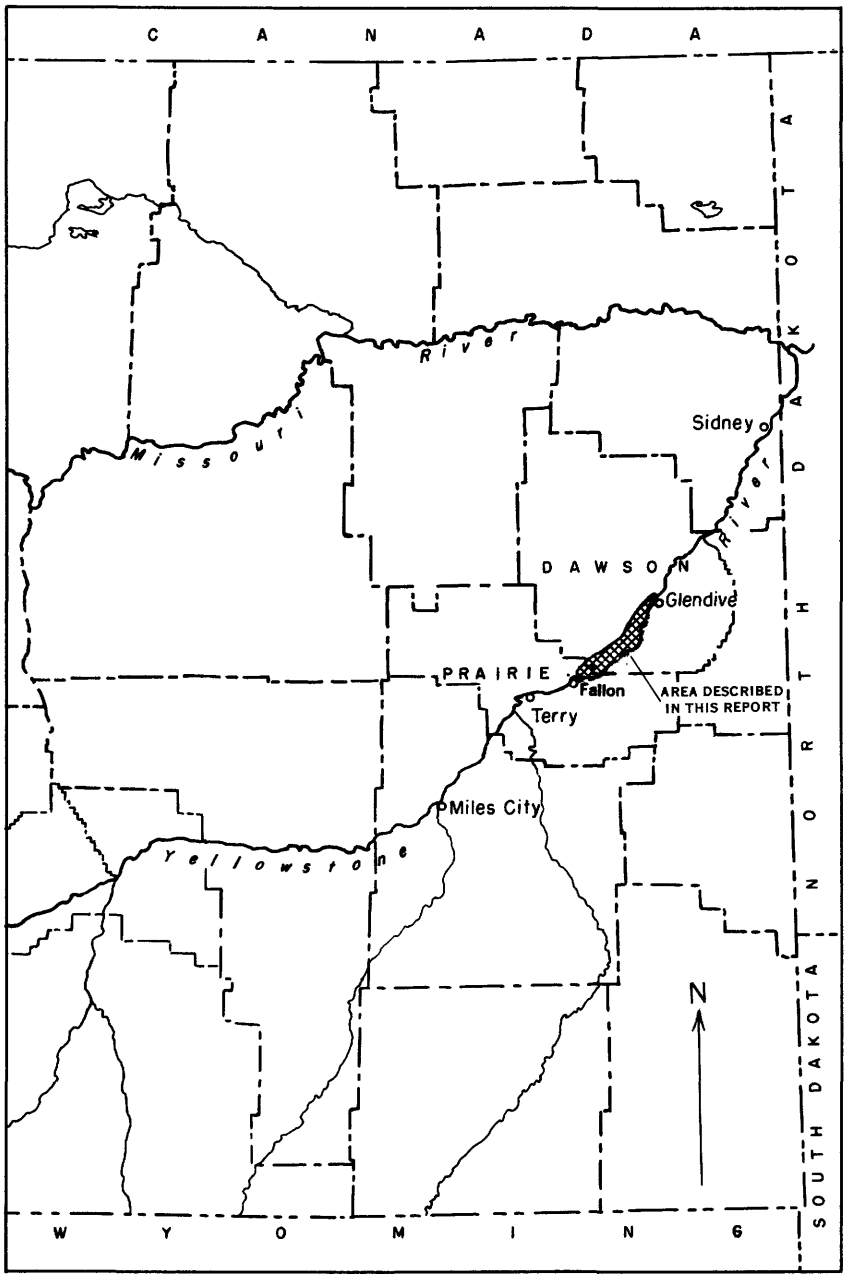

Figure 1.—Map of eastern Montana showing location of area described in this report.

County but also extends southwest a short distance into Prairie County. The area comprises about 60 square miles and includes about 15,000 acres of irrigated land. Water for irrigation is pumped from the Yellowstone River into a high-lying canal that borders the entire length of the northwest side of the report area. The principal creeks crossing the First Division of the Buffalo Rapids Irrigation Project subdivide it into 10 areas, each of which is designated by a Roman numeral. (See pl. 1.)

SCOPE AND PURPOSE OF INVESTIGATION

An ever-increasing area of irrigated land on the project has become waterlogged despite the construction of drainage ditches to facilitate the removal of excess ground water. Recognizing that the solution to the problem required a detailed study of all the factors involved in effecting improved drainage, the United States Bureau of Reclamation, which originally developed the project, requested the United States Geological Survey to collect and interpret the geological and ground-water data needed to design and construct adequate facilities. The field studies by the Survey were begun in May 1950 and ended in April 1952. The detailed study of Area IV was completed first, and a report embodying the results of that study was prepared by Moulder, Torrey, and Koopman (1953). The results of the study of the other nine areas are presented in this report. In addition to presenting information needed for the solution of existing drainage problems, both the report on Area IV and this report present data that can be used to forestall similar drainage problems that may develop when the project is expanded.

The investigation was under the general supervision of G. H. Taylor, regional engineer in charge of ground-water investigations under the program of the Department of the Interior for development of the Missouri River basin. F. A. Swenson, district geologist, Billings, Mont., was in immediate charge of the field studies, and P. C. Benedict, regional engineer in charge of chemical-quality investigations in the Missouri River basin, supervised the study of the chemical quality of the water. J. G. Ferris, district engineer, Lansing, Mich., and A. I. Johnson, materials engineer, Lincoln, Nebr., assisted in planning the investigation and in analyzing data collected in the field. F. E. Busch and party, Lincoln, Nebr., determined by instrumental leveling the altitude of the measuring points of the observation wells used in the study.

METHODS OF INVESTIGATION

Test holes were drilled and water-level observation wells were installed throughout the report area. (See pls. 2 and 3.) In general, this work was done jointly by personnel of the Bureau of Reclamation and the Geological Survey. The former, using hand augers, bored through the fine-grained materials between the land surface and the top of the underlying zone of coarse-grained sediments; the latter, using jetting equipment, deepened each hole to bedrock and completed it as a water-level observation well by inserting a pipe with strainer attached. (See fig. 2.) The

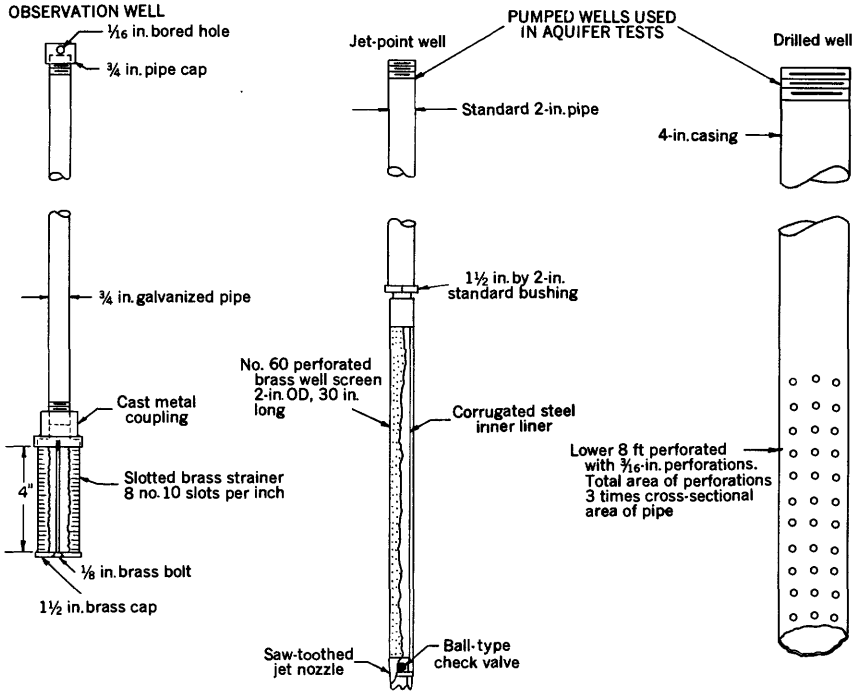

Figure 2.—Types of wells constructed for this investigation.

materials penetrated during both the boring and jetting operations were logged. Geological Survey personnel also collected and compiled information about wells drilled in the area previous to and during the investigation. Measurements of the depth to water in observation wells were made periodically by the wetted-tape method, and measurements of the flow of springs and of the flow in the major drains were made by using either a Parshall flume or a pygmy current meter. The hydrologic properties of the principal water-bearing materials in the terrace deposits were

determined by making laboratory tests of representative samples and by making pumping tests at 11 sites in the report area. Geologic and drainage features were mapped in the field on aerial photos and later transferred to a base map. Other fieldwork included determining the altitude of observation wells and drainage features, obtaining pertinent data by interviewing local residents, and mapping the location of all water wells in the area. Topographic maps having a scale of 400 feet to 1 inch and a contour interval of 1 foot on leveled land and 5 feet on nonleveled land were compiled from maps furnished by the Soil Conservation Service of the United States Department of Agriculture; these maps facilitated the drawing of lines to show the contour of the ground-water surface and the delineation of areas having different depths to water.

PREVIOUS INVESTIGATIONS

Poulson (1945), who installed 54 wood-cased test holes throughout the First Division, evaluated the effectiveness of the existing drains from the data he obtained, and recommended improvement of the drainage system. His report discussed the Bad Route bottom in Area III in considerable detail and other parts of the First Division in a more general way.

When McConnell (1948) made a preliminary soil and drainage investigation of waterlogged areas on farm units 40, 42, 44, 61, 62, 65-1, and 65-2 of the First Division (pl. 1), he obtained his data from about 30 test holes which were cased with perforated downspouting. In his report on the investigation, McConnell suggested that further study be made of the source and amount of ground-water recharge.

In 1948 Torrey and Swenson (1951) made a general investigation of the ground-water resources of the lower Yellowstone River valley between Miles City and Glendive, and in 1949 Torrey and Kohout (1955) made a similar investigation between Glendive and Sidney. Both reports called attention to the need for drainage and recommended that detailed studies of the waterlogged areas be made prior to the construction of drainage facilities. The relationship of the area described in this report to Area IV and to the areas covered by the previous investigations is shown by figure 3.

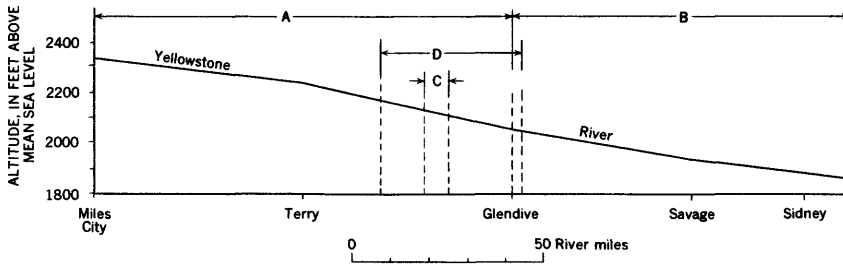

Figure 3.—Relation of area described in this report to Area IV and to areas covered by previous ground-water investigations in the lower Yellowstone River valley. (A) Torrey, A, E., and Swenson, F. A., 1951, Ground-water resources of the lower Yellowstone River valley between Miles City and Glendive, Mont.: U. S. Geol. Survey Circ. 93; (B) Torrey, A. E., and Kohout, F. A., 1955, Ground-water resources of the lower Yellowstone River valley between Glendive and Sidney, Mont.: U. S. Geol. Survey Water-Supply Paper 1355; (C) Moulder, E. A., Torrey, A. E., and Koopman, F. C., 1953, Ground-water factors affecting the drainage of Area IV, First Division, Buffalo Rapids Irrigation Project, Montana: U. S. Geol. Survey Circ. 198; (D) this report.

ACKNOWLEDGMENTS

Personnel of the office of the Bureau of Reclamation at Billings, Mont., cooperated fully in many of the field activities. William Harkin and Henry Dierks of the Soil Conservation Service supplied several maps and other pertinent data. Ford Martin, manager of the Buffalo Rapids Farm Association, supplied records (Buffalo Rapids Farm Assoc., 1943–51) of irrigation-water use and of crop yields. The Helena office of the United States Weather Bureau supplied climatological data for Glendive, and the Buffalo Rapids Farm Association furnished similar data for Terry. The residents of the area were cooperative and helpful at all times.

WELL-NUMBERING SYSTEM

Each well, test hole, or trench-type vertical exposure of the soil profile (bank cut) was assigned two numbers, one a field number and the other based on location within the United States Bureau of Land Management's survey of the area.

The field number indicates either the location of the well, test hole, or trench, its functional part in the investigation, or both. Most of the observation wells and test holes are situated on lines that are roughly perpendicular to the Yellowstone River. In each area of the First Division, the lines of wells and test holes are designated alphabetically in a downstream direction, and the individual wells and test holes on the lines are numbered in riverward order. Cased wells are designated by whole numbers and uncased holes by fractions. For example, the fourth well on the

B line in Area III is numbered III B4, and the first of two test holes riverward from well 3 on the D line in Area VI is numbered VI D3 1/3. A well situated between the A and B lines in Area V is numbered V AB. Similarly Cb, CI, DI, Fa, P, Rf, and TE following the area number indicate, respectively, well in canal bank, well used in creek investigation, well used in drainage investigation, privately owned farm well, pumped well in an aquifer test, well for relief of hydrostatic pressure, and well used in terrace-edge investigation. Observation wells measured during an aquifer test were assigned numbers that indicate their location with respect to the pumped well—for example, the first well west of pumped well VIII P2 is VIII 2W1.

The other number is composed of numerals indicating the township, range, and section in which the well is situated. Lower-cased letters following the section number indicate the position of the well within the section. The first letter denotes the quarter section, the second the quarter-quarter section, and the third the quarter-quarter-quarter section (10-acre tract). These subdivisions of the section are lettered a, b, c, and d in a counterclockwise direction, beginning in the northeast quarter. If more than one well is in a 10-acre tract, consecutive numbers beginning with 1 are added to the well number. (See fig. 4.)

Throughout the text and illustrations of this report, the wells and test holes are identified by their field numbers. For the convenience of the reader, when referring to the tables in which wells are arranged according to their coordinate-system number, the field numbers, together with their corresponding coordinate-system numbers, are arranged in order in table 12.

GEOGRAPHY

CLIMATE

Wide deviations from average precipitation and a wide range in temperature characterize the climate of east-central Montana. During the period 1890–1951, the annual precipitation at Glendive ranged from 4.83 inches (1934) to 26.02 inches (1916) and averaged 14.45 inches. The graph of monthly precipitation during 1950 and 1951 at Glendive and Terry illustrates the erratic distribution of precipitation in this section of Montana. (See fig. 5.) At Glendive, the average temperature in January, the coldest month, is 14.0°F, and in July, the warmest month, 73.7°F. The average annual temperature is 44.3°F. The extremes of temperature at Glendive are 117°F in July 1893 and -50°F in February 1936. The average frost-free season of 136 days extends from May 12 to September 25.

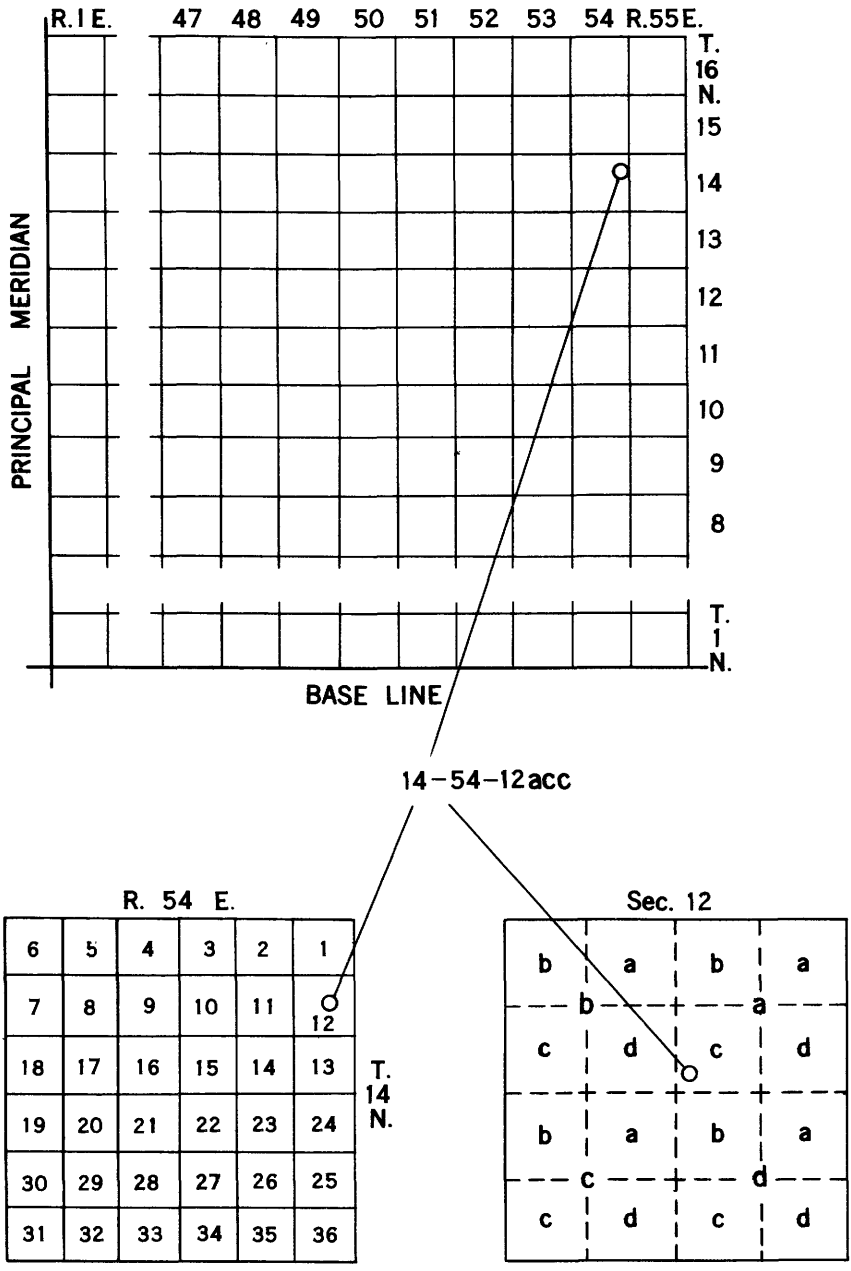

Figure 4.—Well-numbering system.

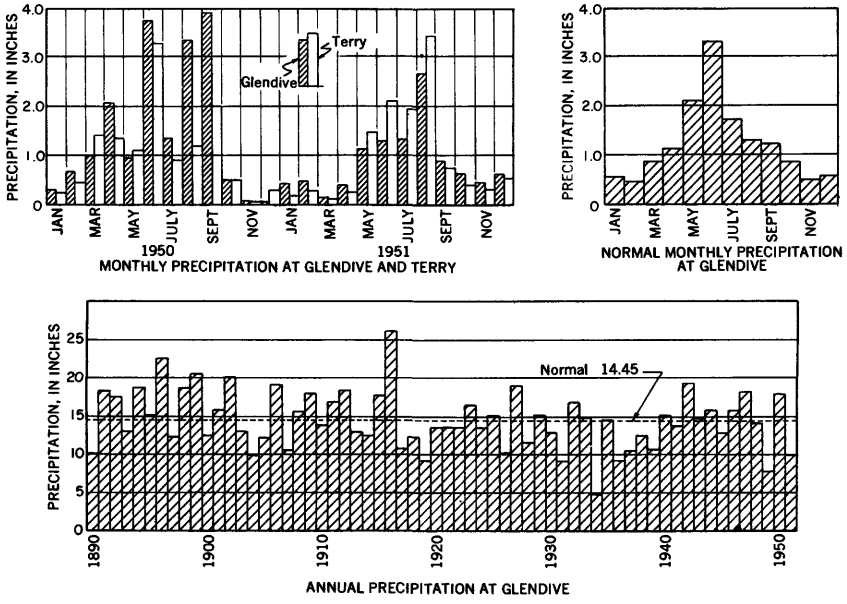

Figure 5.—Annual precipitation at Glendive during the period 1890-1951, monthly precipitation at Glendive and Terry during 1950 and 1951, and normal monthly precipitation at Glendive.

LAND USE AND INDUSTRY

The Bureau of Reclamation started construction on the First Division of the Buffalo Rapids Irrigation Project in 1937 and delivered irrigation water to some of the farm units first in 1940. The number of irrigated acres increased from 10,322 in 1943 to 14,509 in 1951, and the planned Cracker Box relift will bring more than 1,000 additional acres under irrigation. From 1945 to 1951, water delivered to land under irrigation averaged 1.47 acre-feet per acre per year. During this period the maximum (1.86 acre-feet per acre) was delivered in 1949 when precipitation totaled 7.78 inches, and the minimum (1.03 acre-feet per acre) was delivered in 1950 when precipitation totaled 17.84 inches.

Alfalfa, sugar beets, wheat, potatoes, beans, corn, oats, and barley are raised on the irrigated land. The main products reaching the outside market are sugar beets, sweet corn, potatoes, beans, and wheat. A factory specializing in the freezing and canning of sweet corn is located at Glendive. Alfalfa, corn, oats, barley, and beet greens are used for fattening livestock, an increasingly important occupation in the area.

Wells producing oil from strata of Ordovician age have been drilled recently on the axis of the Cedar Creek anticline, which

crosses the Yellowstone River valley about 6 miles southwest of Glendive, and other wells are being drilled in adjacent areas. Oil companies active in this part of the Williston oil basin are bringing considerable industry to Glendive.

TOPOGRAPHY

The area described in this report consists largely of five step-like to ramplike stream terraces which border the northwest side of the Yellowstone River and which range in height from 20 to 190 feet above the river. Each terrace is a remnant of a broad flood plain developed by the wide-sweeping meanders of the river when its rate of downcutting was temporarily halted. After each period of flood-plain development, the river carved its channel deeper into the valley floor. Subsequent to the development of the higher terraces, but before the lowest terrace was formed, a glacial lake occupied the valley. Although the lake was relatively short lived, geologically speaking, erosion by its waters beveled—and in some places obliterated—the normally sharp terrace edges. After the glacial lake drained from the valley, the river developed the flood plain that is now the lowest terrace, then cut a sharp-edged valley into it, and since then has developed its present flood plain.

The lowest terrace and present flood plain are nearly smooth and have a maximum slope of about 10 feet per mile; the higher terraces are less smooth and have slopes of as much as 60 feet per mile. The slope of the flood plain and the lowest terrace is toward the river and downstream, whereas the slope of the higher terraces is principally perpendicular to the river. In several places, where remnants of only the highest terraces are present, the river impinges against sheer cliffs that are as much as 150 feet high.

The stream terraces in the report area were developed by the Yellowstone River during Quaternary time. In this report they are distinguished by numbers which have been assigned in ascending order.

At the south end of the report area the altitude of the main canal above the pumping plant is about 2,224 feet, and at the north end it is about 2,162 feet. In the same stretch, the Yellowstone River drops about 100 feet from an altitude of about 2,140 feet.

GEOLOGY

Rocks ranging in age from Late Cretaceous to Recent crop out in the report area. (See table 1.)

Table 1.—*Generalized section of the geologic formations exposed in the First Division of the Buffalo Rapids Irrigation Project*

System	Series	Geologic unit	Thickness (feet)	Lithology
Quaternary	Recent	Alluvium	0–20	Clay, silt, sand, and gravel.
	Pleistocene	Colluvium, slope wash, and glacio-lacustrine deposits	0–40	Clay, silt, sand, and gravel.
		Terrace deposits	0–75	Sandy, silty, and clayey soils underlain by gravel that consists of rounded quartzite pebbles and cobbles, fragments of extrusive and intrusive igneous rock, and some agate and petrified wood.
Tertiary	Paleocene	Fort Union formation	1,200±	Yellowish-gray to buff clay and shale, interbedded with carbonaceous shale and lignite.
Cretaceous	Upper Cretaceous	Hell Creek formation	500±	Brownish-gray sandstone with interbedded carbonaceous shale and gray mudstone.
		Fox Hills sandstone	150–220	Massive white to light-gray medium-grained friable sandstone in upper part; brownish-gray sandy shale with interbedded gray shale in lower part.
		Pierre shale	4,000±	Dark-gray marine shale interbedded with thin sandstone layers.

BEDROCK FORMATIONS

Because unconsolidated deposits of Pleistocene age blanket the bedrock surface throughout most of the report area, the bedrock formations are seen only in cliffs or steep slopes where stream action has cut through the unconsolidated deposits. South of Whoopup Creek the Fort Union formation of Tertiary (Paleocene) age is the only bedrock above stream level. Between Clear and Whoopup Creeks, the formations underlying the Fort Union—the Hell Creek formation, Fox Hills sandstone, and Pierre shale—successively rise above river level on the southwest flank of the Cedar Creek anticline; north of Whoopup Creek these bedrock formations dip gently northeastward and disappear below river level about 2 miles northeast of Glendive. Because the bedrock formations

458513 O - 58 - 2

have been described in detail by others (Calvert, 1912; Torrey and Swenson, 1951), they are discussed in this report only insofar as they, or the water in them, affect the occurrence of ground water in the overlying unconsolidated deposits. For example, in places between Clear and Whoopup Creeks, permeable strata of truncated bedrock formations discharge artesian water into mantling terrace deposits, and near the north end of the report area the terrace deposits transmit recharge to the underlying bedrock. Elsewhere in the report area movement of water from one to the other is prevented by impermeable strata in the bedrock.

UNCONSOLIDATED DEPOSITS

While excavating its valley, the Yellowstone River successively reached, and was held for a time at, several temporary base levels. During such periods the river alluviated its valley, depositing first a layer of interfingering lenses of gravel and sand and then a thinner layer of fine-grained sediments. The terrace deposits along the valley sides are remnants of the alluvium laid down by the river during those earlier periods of aggradation. Characteristically, a newly formed terrace is smooth and nearly flat, and both its riverward edge and the landward riser are sharp cut. With time, however, erosion bevels the riverward edge of the terrace and the landward part of the terrace becomes buried beneath a wedge-shaped deposit of colluvium and wash derived from higher slopes. The successive formation of terraces and their progressive deterioration are shown schematically in figure 6.

In much of the report area, the complete obliteration of the usual steplike character of the terrace deposits suggests that they have been subjected to cut and fill by more than the ordinary process of slope erosion. Geologic evidence observed by Alden (1932) led him to conclude that the Yellowstone River valley at one time was blocked by a tongue of glacial ice that reached upstream as far as Intake (about 15 miles northeast of Glendive) and that water was ponded for a distance of at least 90 miles upstream from that point. On the other hand, Torrey and Kohout (1955) concluded that glaciation in eastern Montana south of Sidney (50 miles northeast of Glendive) was restricted almost wholly to the upland on the west side of the Yellowstone River valley and that Sidney and not Intake marks the southernmost point at which the Yellowstone River valley was blocked by the glacial ice. According to Torrey and Kohout, the lake formed by the ponding of the Yellowstone River overflowed eastward principally through the large valley now occupied by Pierre Creek, which enters the Yellowstone River east of Sidney, although temporarily it may have overflowed through the valleys

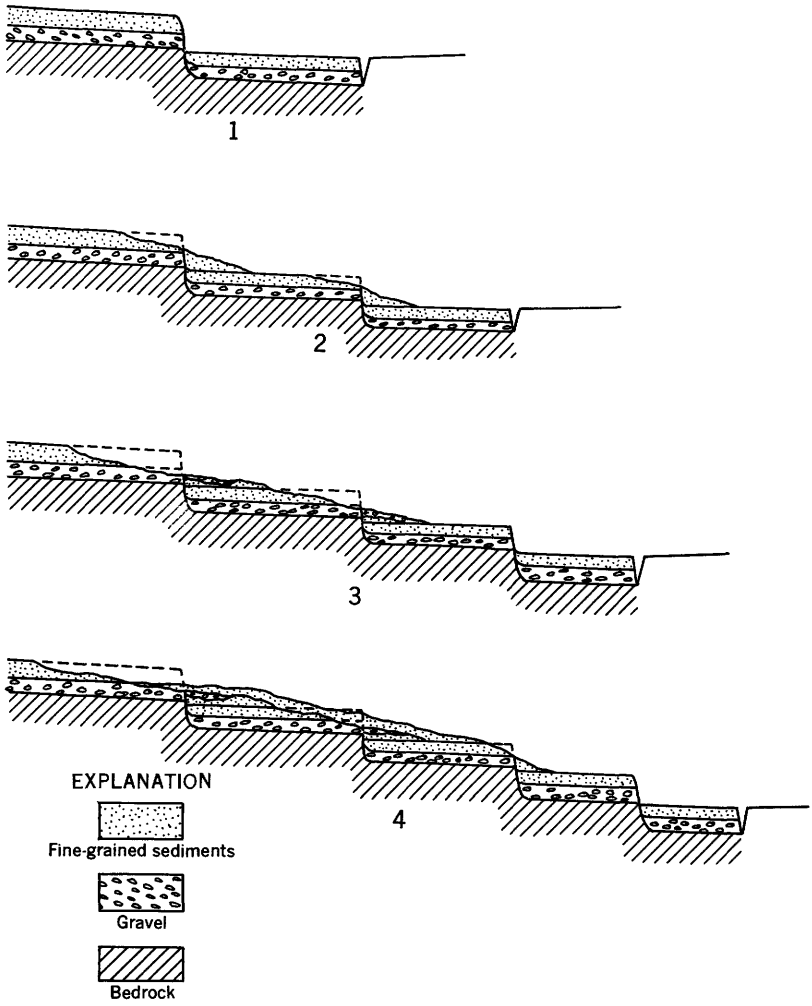

Figure 6. —Schematic diagrams showing progressive deterioration of terrace edges and mantling of terraces by colluvium and slope wash.

now occupied by O'Brien, Shadwell, and Smith Creeks, which enter the Yellowstone River upstream from Sidney. As the altitude of the lowest point on the topographic divide between the drainage basin of the Yellowstone River and streams to the east is 2,200 feet (Torrey and Kohout, 1955, fig. 8), the lake must have been at least that high and must have inundated all the terrace deposits in the area described in this report. The authors believe that current and wave action and sedimentation along the shoreline, while the level of the ponded water slowly rose and then rapidly declined, probably were responsible in part for the

Table 2.—*Relation of terraces mapped during this investigation to those*

This report				Moulder, E. A., Torrey, A. E., and Koopman, F. C., 1953, Ground-water factors affecting the drainage of Area IV, First Division, Buffalo Rapids Irrigation Project, Montana: U. S. Geol. Survey Circ. 198.		
Terrace	Height above Yellowstone River (feet)	Thickness of gravel underlying topsoil (feet)	Description	Terrace	Height above Yellowstone River (feet)	Thickness of gravel underlying topsoil (feet)
No terrace present				No terrace present		
1	20–30	4–15	Gentle slope. Separated from higher terraces by steep escarpment. Highest terrace unaffected by glaciation. Easily correlated within report area.	1	20–35	4–11
2	35–45	5–15	Moderately steep slope. Grades into next higher terrace without escarpment except where recent erosion has re-exposed terrace edge. Original terrace mantled by glacial lake deposits.	Not present		
3	50–60	4–15	Moderately steep slope. Grades into next higher terrace without escarpment except where recent erosion has re-exposed terrace edge. Probably developed because resistant bedrock strata southwest of Cedar Creek anticline retarded downcutting action of Yellowstone River. Original terrace mantled by glacial lake deposits.	Not present		
4	70–100	6–25	Moderately steep slope. Grades into next higher terrace without escarpment except where recent erosion has re-exposed terrace edge. Mantled by glacial lake deposits as much as 40 feet thick adjacent to next higher terrace. Extends full length of report area.	4	60–90	10–15
5	150–190	30–40	Moderately steep slope. Separated from higher lying terraces by bedrock exposures. Mantled by thick wedge of colluvium and slope wash derived from higher slopes. Submerged by glacial lake for only a short time, if at all. Extends full length of report area but apparently cannot be identified north of area.	5	150–190	30–40

previously mapped in the same area and in the adjacent downstream area

Torrey, A. E., and Swenson, F. A., 1951, Ground-water resources of the lower Yellowstone River valley between Miles City and Glendive, Mont.: U. S. Geol. Survey Circ. 93.			Torrey, A. E., and Kohout, F. A., 1955, Ground-water resources of the lower Yellowstone River valley between Glendive and Sidney, Mont.: U. S. Geol. Survey Water-Supply Paper 1355.				Correlation of terraces upstream from Glendive with terraces downstream from Glendive.
Terrace	Height above Yellowstone River (feet)	Thickness of gravel underlying topsoil (feet)	Terrace	Height above Yellowstone River (feet)	Thickness of gravel underlying topsoil (feet)	Description	
No terrace present			A	14-17	Less than 10	Discontinuous remnants	
A	15-20	3-5	B	20-25	5-10	Extends full length of report area.	Easily correlated from one to the other.
B	35-45	5-8	C	40-46	30	Very flat. One remnant extends from vicinity of Sidney to confluence of Yellowstone and Missouri Rivers. Apparently developed when high base level of Misouri River (after recession of latest ice sheet) retarded downcutting by Yellowstone River.	Apparently unrelated. South of Glendive terrace is mantled by glacial lake deposits whereas north of Glendive it is unmodified by glacial deposits.
C	50-60	10-15	D	50-60	10-20	Discontinuous remnants. Town of Savage is situated on largest remnant.	Possibly related.
D	80-100	15-20	E	70-90	15-25	Discontinuous remnants. Moderately steep slope. Mantled by glacial lake deposits.	Can be correlated from one to the other.
E	155-165	30-40	Not described. (If present, obscured by glacial moraine.)				

general masking of terrace deposits upslope from the lowest, or last developed, terrace.

Of interest in this connection is the comparatively sharp definition of the terrace remnant on which Terry is situated (about 13 miles upstream from the report area). Because this terrace remnant is between 2,250 and 2,275 feet above sea level, it would have been inundated only if the lake formed by the ponding of the Yellowstone River had risen high enough to overflow eastward through the valleys of O'Brien, Shadwell, or Smith Creeks. This inundation, if it did occur, must have been of short duration, because the terrace at Terry was less affected than were the downstream remnants of the same terrace.

The identification and mapping of terraces during this investigation (see pls. 2 and 3) does not agree in all respects with that done in the same area by Torrey and Swenson (1951) because detailed subsurface information available to the writers of this report enabled them to delineate more exactly the buried terrace edges. In addition, the authors of this report had more detailed data on the thickness of the terrace deposits and on the thickness of the mantling sediments than did Torrey and Swenson. Because the terrace deposits are mantled by sediments that range considerably in thickness and because the river has cut back the terrace edge farther in some places than in others, it is difficult to designate precisely the range in height of the different terraces. The terrace heights given in this report are based on the more recent information and hence are not in complete agreement with those given by Torrey and Swenson. (See table 2.)

The gravel layer underlying each of the terraces was deposited by the river on a relatively smooth bedrock floor having an average downstream slope of about 3 to 4 feet per mile. Although the gravel layer ranges slightly in thickness, its surface is relatively smooth and its average downstream slope is similar to that of the bedrock floor. Beneath all terraces higher than terrace 1, the sediments overlying the gravel layer are progressively thicker away from the river and are composed not only of fine-grained terrace deposits but also of colluvium, slope wash, and delta and glaciolacustrine deposits. The surface of these sediments slopes more steeply than that of the gravel surface they rest upon, and the slope is principally riverward rather than downstream. Where the colluvium, slope wash, and delta and glaciolacustrine deposits are thick and can be differentiated from the underlying terrace deposits, they are shown on plates 2 and 3 as separate units; where they are thin or not readily distinguishable, they are included with the terrace deposits. The fine-grained sediments overlying the gravel layer of terrace 1 were deposited almost

entirely by the river and are relatively uniform in thickness. The relation of fine-grained sediments to the underlying gravel layer, and of the gravel layer to the bedrock on which it rests, is displayed typically in the outcrop shown in figure 7.

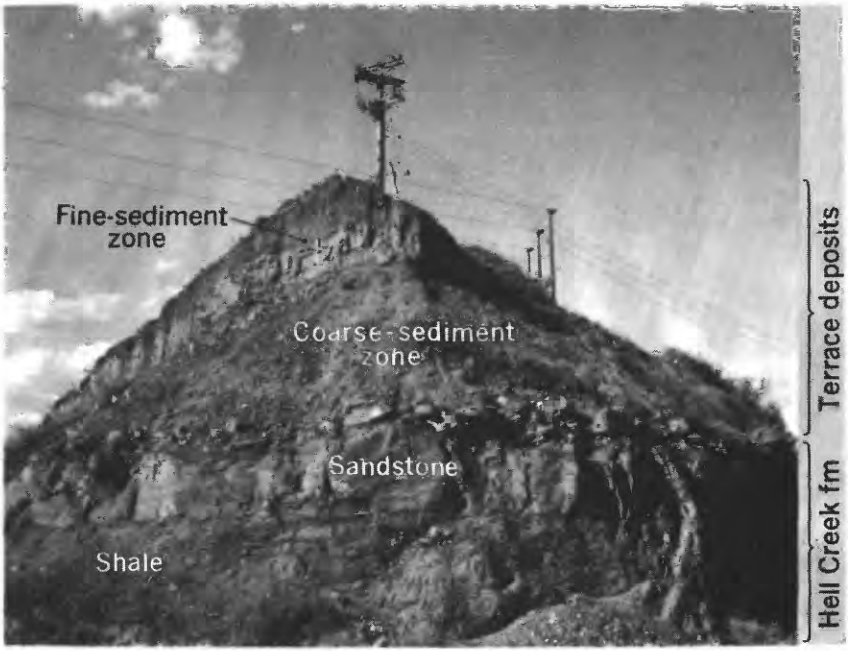

Figure 7.—Terrace deposits overlying the Hell Creek formation in Area X.

Sediments underlying the elevated flats along creeks tributary to the Yellowstone River have been designated and mapped as creek-terrace deposits. Deposits underlying the flood plains of the Yellowstone River and tributary creeks have been mapped as alluvium.

GROUND WATER IN THE UNCONSOLIDATED DEPOSITS

OCCURRENCE

The pore space within the unconsolidated deposits is filled with water to a level that ranges in depth below the land surface from less than a foot to as much as 35 feet. Throughout much of the report area the ground water in these deposits is semiartesian because the fine-grained sediments imperfectly confine the water in the underlying gravel; elsewhere in the area the ground water is under water-table conditions.

Where the ground water is semiartesian, the zone of saturation extends upward into the less permeable confining layer. In such places the water may be discharged from the fine-grained sediments by evapotranspiration, thereby causing the level of saturation to be below the water level in a well tapping the underlying gravel; also, pressure changes in the gravel cause a difference in water levels because the changes are transmitted slowly through the fine-grained sediments. Nowhere in the area, however, is the water in the unconsolidated deposits known to be under sufficient pressure to cause water to flow at the natural land surface. The imaginary plane to which confined water will rise in wells is referred to as the piezometric surface, or pressure-head-indicating surface.

Where the ground water occurs under water-table conditions, the top of the zone of saturation generally is below the top of the gravel, and the water level in a well penetrating the zone of saturation coincides with the water table, or top of the zone of saturation.

The position of the water level in wells with respect to the water table and piezometric surface is illustrated by figure 8.

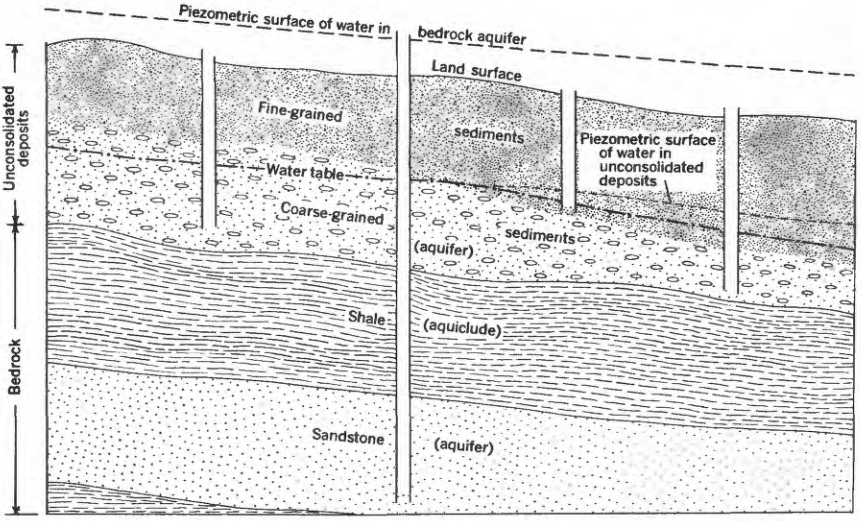

Figure 8.—Occurrence of ground water under water-table, semiartesian, and artesian conditions.

RECHARGE

The unconsolidated deposits in the report area are recharged by (1) infiltration of precipitation and of irrigation water from fields, (2) influent seepage from canals, streams, and ponded

water, (3) percolation from adjoining upgradient unconsolidated deposits, and (4) inflow, under pressure, from underlying or adjacent bedrock aquifers. The relative importance of these sources of recharge can be evaluated, in part, by comparing records of water-level fluctuations with other pertinent data.

Recharge resulting from precipitation is illustrated by the fluctuation of the water level in wells IV P, VI A4, and VII A3a, which are situated in nonirrigated fields. If the hydrographs of the water-level fluctuations in these wells (figs. 9, 10, and

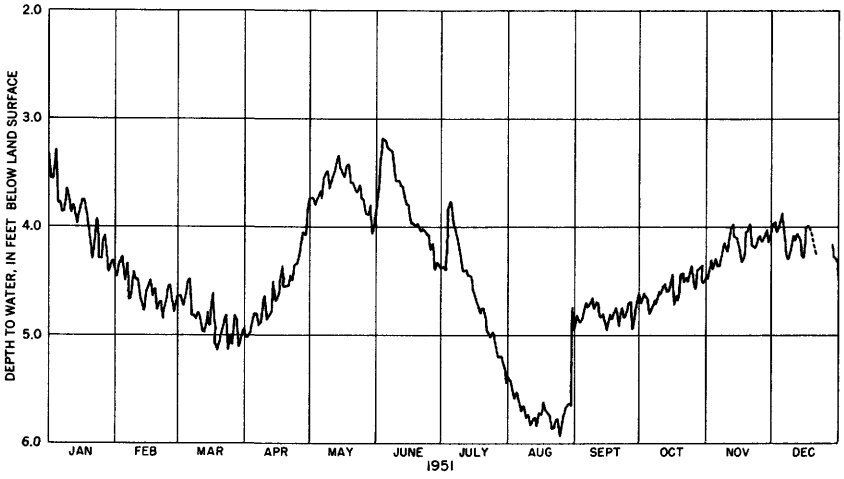

Figure 9. —Daily (2:00 a. m.) water level in observation well IV P.

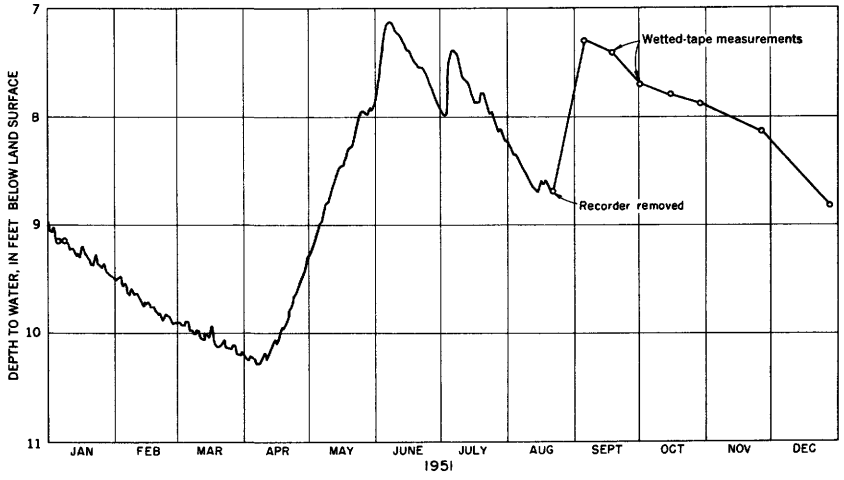

Figure 10. — Daily (2:00 a. m.) water level in observation well VI A4.

11) are compared with the daily record of precipitation at Terry (fig. 12), it is obvious that the water level rose in response to heavy precipitation. Such close correlation, however, is characteristic only of wells in areas where the water table is shallow and the materials between the land surface and the water table are at least moderately permeable. Lack of detectable response to direct infiltration of precipitation is shown in the hydrograph

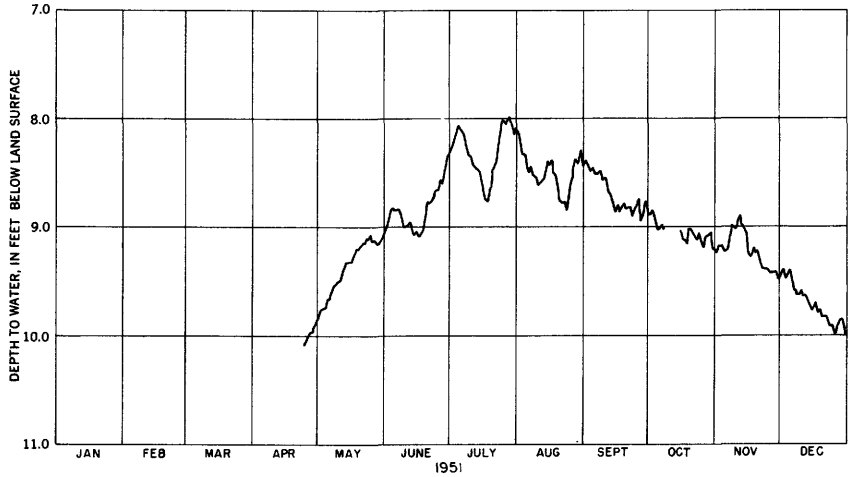

Figure 11. —Daily (2:00 a. m.) water level in observation well VII A3a.

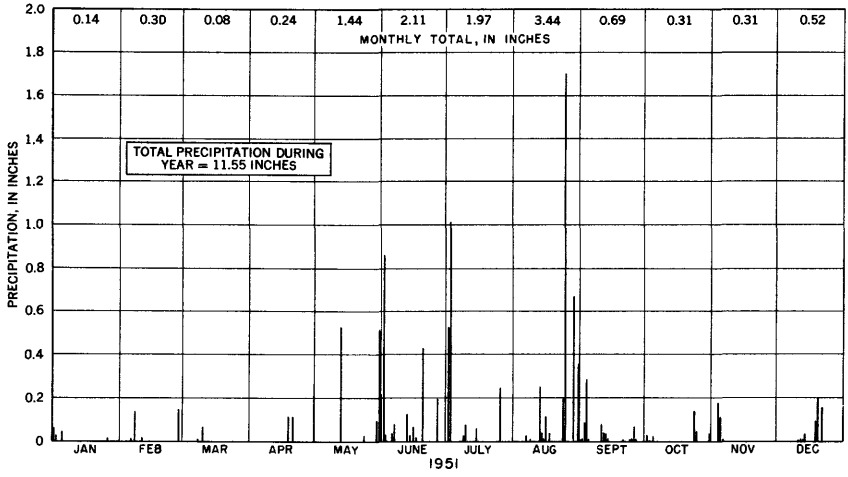

Figure 12. —Daily precipitation at Terry, Mont.

of well VIII E4 (fig. 13). The rise of the water level in this well between the middle of May and the end of August apparently is the result of widespread recharge to the aquifer by canal leakage and infiltration of irrigation water.

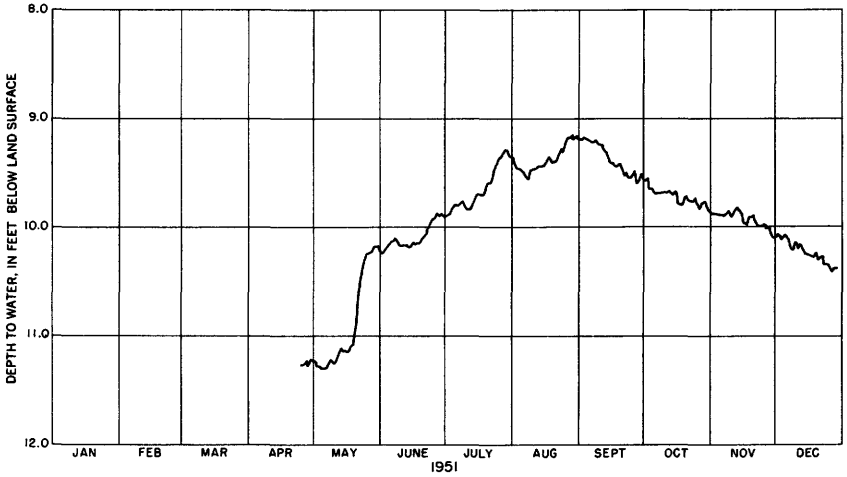

Figure 13. —Daily (2:00 a. m.) water level in observation well VIII E4.

In irrigated parts of the area the stage of the water level in wells generally is related more closely to the amount of applied irrigation water than to the amount of precipitation. This is illustrated by the water-level fluctuation in well VI I1. (See fig. 14.) In 1949, when 22.3 acre-inches per acre of irrigation water was applied, the water level in the well rose during the irrigation season to a stage nearly 2 feet higher than it did in 1950, when 11.6 acre-inches per acre was applied. In 1951, when 17.5 acre-inches of water was applied, the water level in the well rose to a stage midway between that reached in 1949 and 1950. As precipitation during the 3 years was inversely proportional to the amount of applied irrigation water, it is apparent that the infiltration of irrigation water generally is far more effective than precipitation as an agent of recharge.

Although well III P1 also is in an irrigated part of the area, the water level in this well evidently rises in response to recharge from both precipitation and irrigation water. Most rises

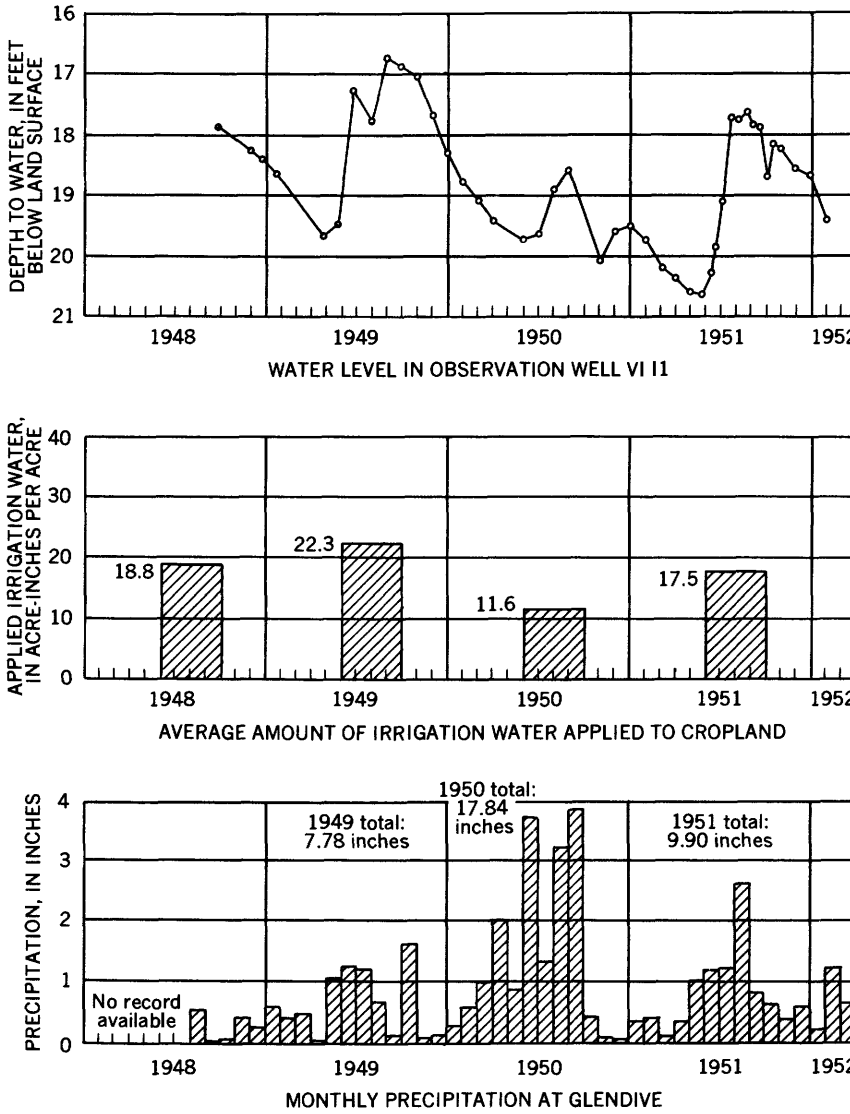

Figure 14.—Water level in observation well VI I1, average amount of irrigation water applied to cropland, and monthly precipitation at Glendive.

of the water level shown by the hydrograph in figure 15 can be correlated with periods of heavy precipitation shown in figure 12; however, infiltrating irrigation water apparently was responsible for the peak rise of the season.

In areas where the canal and laterals are incised in highly permeable materials, leakage from them is an important source

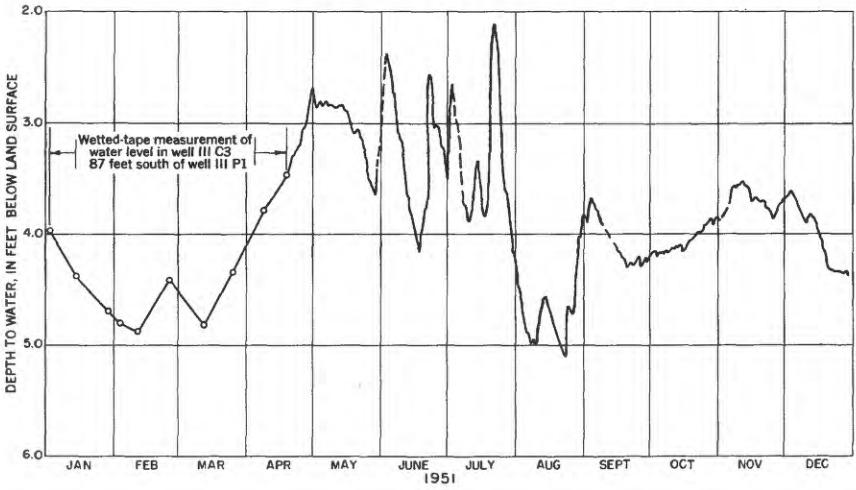

Figure 15.—Daily (2:00 a. m.) water level in observation well III P1.

of recharge. The water level in wells adjacent to a leaking canal rises sharply when water is first turned into the canal. Although the canal continues to carry water, the water level in nearby wells soon begins to decline, apparently because the canal bottom becomes sealed with silt. When the canal is not carrying water, the canal bottom dries and cracks appear. These cracks facilitate rapid recharge to the ground-water reservoir when water again flows through the canal. The water level in two wells near the main canal rose more than 7 feet after the canal began carrying water in the spring of 1951. (See fig. 16.)

Irrigation waste water and runoff from precipitation accumulates in topographic depressions where some of it infiltrates to the zone of saturation. The rise of the water level in wells VI A4 (fig. 10) and VII A3a (fig. 11) during April and May was caused by infiltrating snowmelt and seepage of water ponded during the spring thaw. Locally, melt water from the large bodies of ice that form in the vicinity of springs (see fig. 17) is the source of considerable recharge to the ground-water reservoir.

Sandstone layers in the Fox Hills sandstone and in the Hell Creek and Fort Union formations are the aquifers tapped by the deep artesian wells in the southwestern part of the report area. On the southwestern flank of the Cedar Creek anticline, the northwestward-trending axis of which crosses the report area between Clear and Whoopup Creeks (Area VI), the upturned sandstone layers are beveled by the erosion surface upon which the mantling terrace deposits were laid down, and discharge water into those deposits (see fig. 18); in some places the water is under

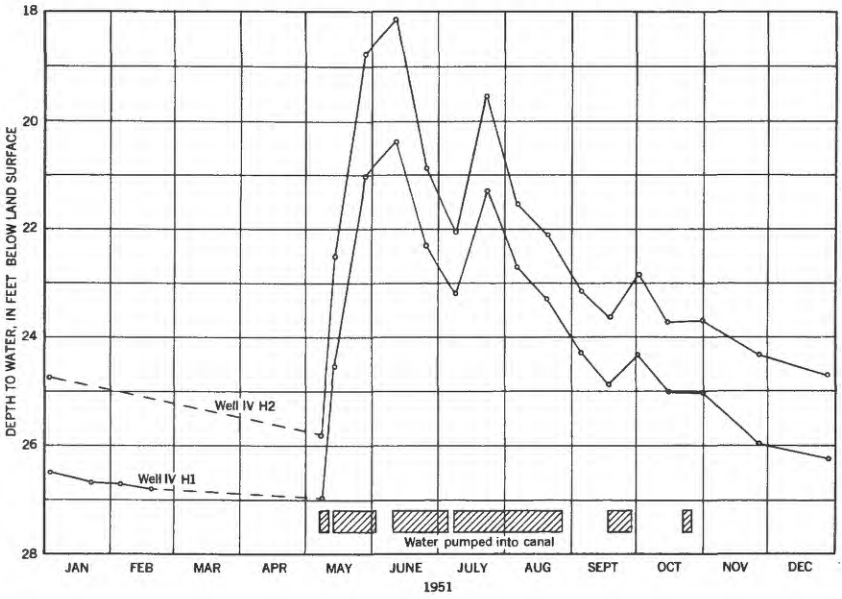

Figure 16. —Water level in wells IV H1 and IV H2 near the main canal.

Figure 17. —Ice on the slope between terraces 1 and 4, Area VI.

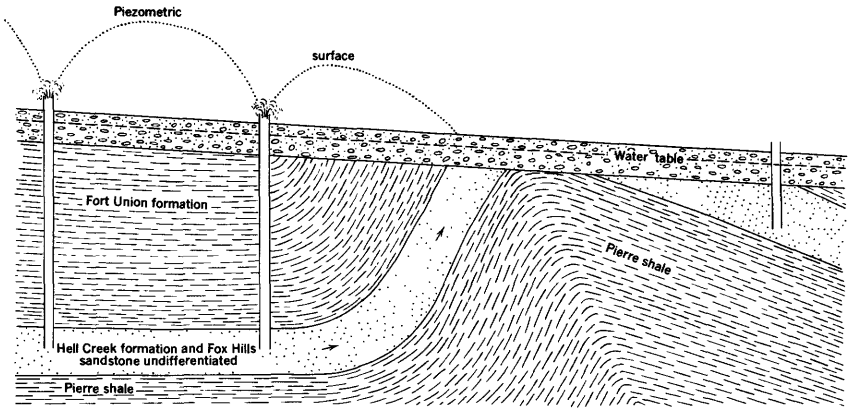

Figure 18.—Idealized cross section through Cedar Creek anticline, showing movement of ground water from upturned bedrock aquifers into overlying terrace deposits.

sufficient artesian pressure to cause wells tapping the bedrock aquifers to flow at the land surface. On the northeastern flank of the anticline the sandstone aquifers have gentle dips and the water in them is under water-table conditions.

The unconsolidated deposits in the report area are recharged principally during the irrigation season. In 1951, between the first of May and the end of September, the net rise of the water table was about 3 feet. If it is assumed that the materials thus saturated have an effective porosity of 0.3, the increase in the amount of water stored in the ground-water reservoir was about 0.9 acre-foot per acre, or about one half the sum of precipitation and irrigation water applied to the land during that period.

MOVEMENT

Water infiltrating the ground in excess of the field capacity of the soil and the intermediate belt of the zone of aeration moves downward until it reaches the zone of saturation, then percolates laterally through the interstices of the aquifer toward points of discharge. The path of movement coincides with the direction of greatest slope of the water table or pressure surface, as the case may be. (See pls. 4–10). The rate of percolation is related directly to the permeability of the aquifer and the hydraulic gradient. Samples of both the fine- and coarse-grained water-bearing materials were collected so that their coefficient of permeability[1] could be determined by laboratory methods. The coefficient of

[1] The coefficient of permeability is the rate of flow of water at 60°F, in gallons per day, through a cross section of 1 square foot, under a hydraulic gradient of 100 percent.

permeability of six samples of the more permeable fine-grained sediments ranged from 25 to 87 gallons per day (gpd) per square foot and averaged 56. On the other hand, the lowest coefficient of permeability of the coarse-grained sediments was more than 400 gpd per square foot. Under equal hydraulic gradients, therefore, the rate of percolation through the coarse-grained sediments is at least 7 times faster than the average rate of percolation through the fine-grained deposits.

DISCHARGE

Where the base of water-bearing terrace deposits is exposed in the steep banks along terrace edges, springs or seeps issue at the contact of the terrace deposits and the underlying bedrock. Ground water is discharged also by outflow into natural and artificial drains that have been cut into the zone of saturation. The quantity of water issuing from the larger perennial springs and flowing in perennial drains was measured by using either a Parshall flume or a pygmy current meter. (See table 3.) Even though these measurements were made during a period when flow was greater than at any other time during the investigation, they represent only a fraction of the total discharge of ground water.

Table 3.— *Measurements of the discharge of springs and of the flow in drains*

Station no. (See pls. 2 and 3 for location)	Date of measurement	Altitude of water surface (feet)	Discharge	
			Cubic feet per second	Acre-feet per day
III- 1	July 25, 1951	2,140.58	0.865	1.72
- 2	do	2,129.53	1.82	3.61
- 3	do	2,136.95	.991	1.97
- 4	Aug. 20, 1951	2,139.73	.076	.151
	Sept. 5, 1951		.082	.163
	Sept. 18, 1951		.058	.115
VI- 1	Aug. 23, 1951	2,099.18	.069	.137
- 2	do	2,119.42	2.93	5.81
VII-1	Oct. 1, 1951		.109	.216
	Oct. 15, 1951		.095	.188
	Oct. 29, 1951		.095	.188
	Nov. 26, 1951		.138	.274
	Dec. 28, 1951		.124	.246
	Jan. 29, 1952		.076	.151
-2	Aug. 23, 1951		.073	.145
-3	do		.806	1.60
-4	do	2,114.00	.734	1.46
VIII-1	do	2,076.71	1.64	3.26

Where the top of the zone of saturation is at or close to the land surface, much ground water is discharged either by direct evaporation or by the transpiration of plants. According to the

U. S. Weather Bureau, the rate of evaporation from a class A pan at Terry averaged 0.25 inch per day during the 1951 growing season.

Pumped wells in the report area discharge only a minor amount of ground water, essentially all of which is used for either domestic purposes or the watering of livestock.

During the period of this investigation, the lowest recorded water level in wells was about 3 feet lower, on the average, than the highest recorded water level. Although this difference in water levels indicates that the ratio of discharge to recharge varied considerably during the investigation, the slight net difference between water levels at the beginning and end of the investigation indicates that the total amount of water discharged during the entire period approximately equalled the total amount of water added to the zone of saturation. If, over a span of several years, the net discharge were significantly less than the net recharge, the areas now waterlogged would enlarge and new waterlogged areas would appear, the flow of existing springs would be greater and new springs would emerge, and the outflow of ground water into streams and artificial drains would increase. Such results conceivably could be brought about during a succession of years in which applications of irrigation water were unusually heavy.

HYDROLOGIC PROPERTIES OF THE UNCONSOLIDATED DEPOSITS

The capacity of the unconsolidated deposits to transmit water (coefficient of transmissibility) and to yield water from storage (coefficient of storage) was determined at 10 sites by the pumping-test method. (See pls. 2 and 3.) The wells pumped during the tests were either drilled and 4 inches in diameter or jetted and 2 inches in diameter. The lower 8 feet of casing of the drilled wells was perforated with holes having a diameter of three-sixteenths of an inch and an aggregate area equivalent to three times the cross-sectional area of the casing. The lower end of the jetted wells was terminated in a No. 60 perforated brass screen 30 inches long. The observation wells were installed by jetting, were three-fourths of an inch in diameter, and were terminated at the lower end by a 4-inch-long brass screen having eight No. 10 slots per inch. (See fig. 2.) A truck-mounted centrifugal pump was used for each test. The discharge was controlled by adjusting gate valves, and the rate of flow was measured by an orifice meter. Insofar as possible, a constant rate of discharge was maintained during the test and measurements of water-level drawdown were made according to a predetermined time schedule. The measurements are listed in table 8 at the end of this report.

458513 O - 58 - 3

The tests were analyzed by means of the Theis (1935, p. 519–524) nonequilibrium formula using the methods outlined by Wenzel 1942, p. 87–89) and by Cooper and Jacob (1946, p. 526–529). The Theis nonequilibrium formula is based on the assumption that the

1. The discharging well penetrates the entire thickness of the water-bearing formation, and its diameter is infinitesimal.
2. The water-bearing formation is homogeneous and isotropic.
3. The coefficient of transmissibility of the water-bearing formation is constant at all times and places.
4. The water taken from storage as a result of decline in water level is discharged instantaneously with the decline in head.
5. The aquifer is infinite in extent.

As these ideal conditions were closely approximated at test sites III P2, VI P1, VII A3, VII P1, and VIII P1, the interpretation of the test data did not necessitate taking into account the effect of drainage from fine-grained sediments while the test was in progress. (See figs. 19–23.) At test sites III P1, III P3, VI P2, and

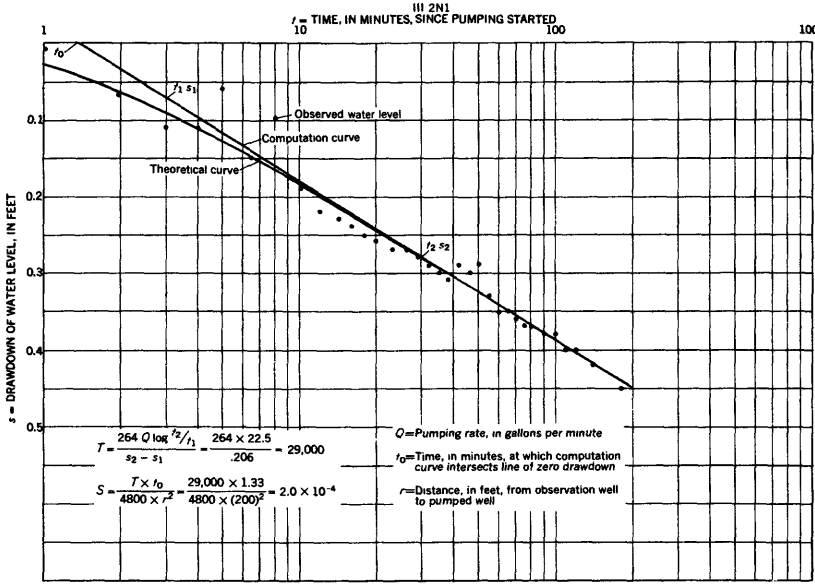

Figure 19.—Semilogarithmic plot of water-level drawdown in observation well III 2N1 at test site III P2.

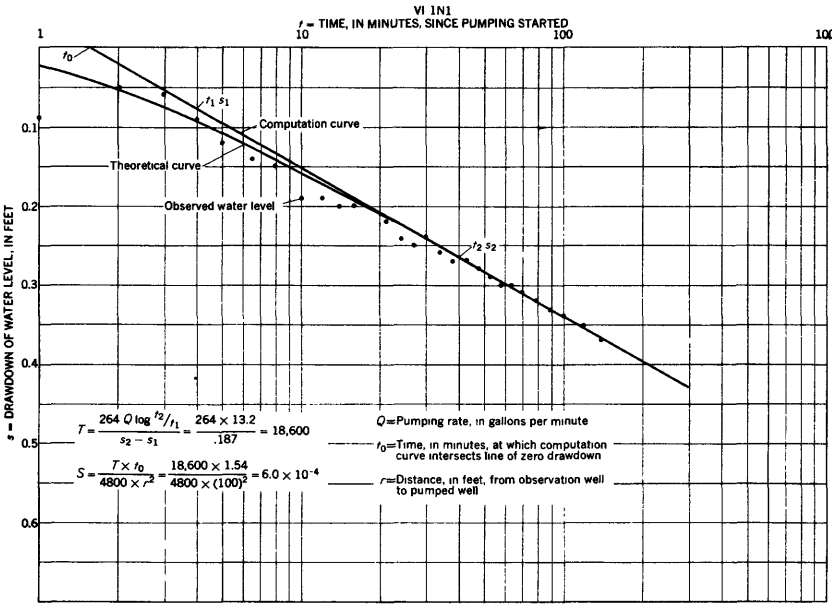

Figure 20. —Semilogarithmic plot of water-level drawdown in observation well VI 1N1 at test site VI P1.

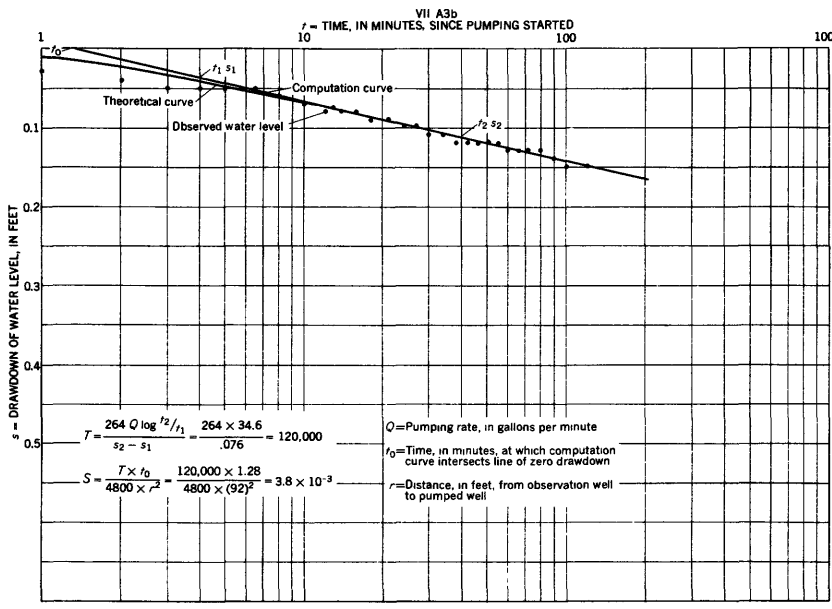

Figure 21. —Semilogarithmic plot of water-level drawdown in observation well VII A3b at test site VII A3.

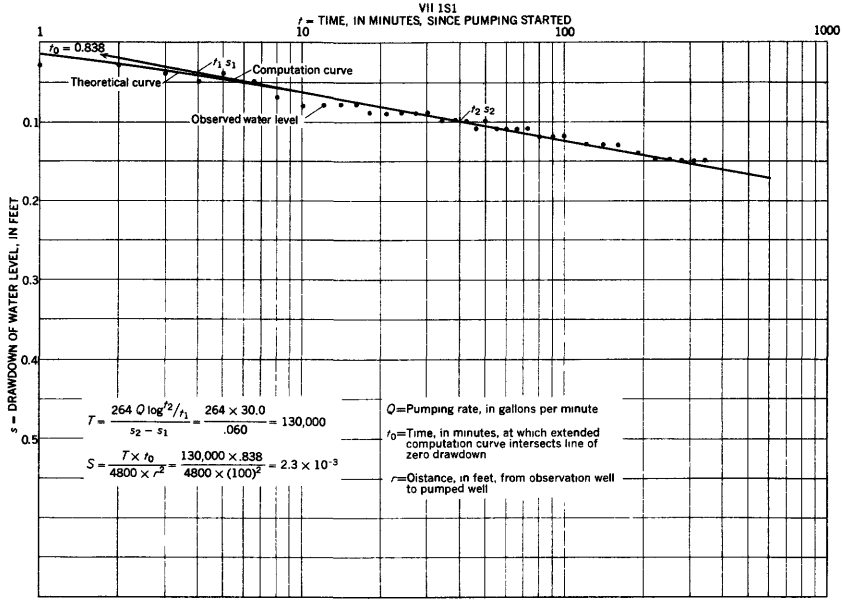

Figure 22. —Semilogarithmic plot of water-level drawdown in observation well VII 1S1 at test site VII P1.

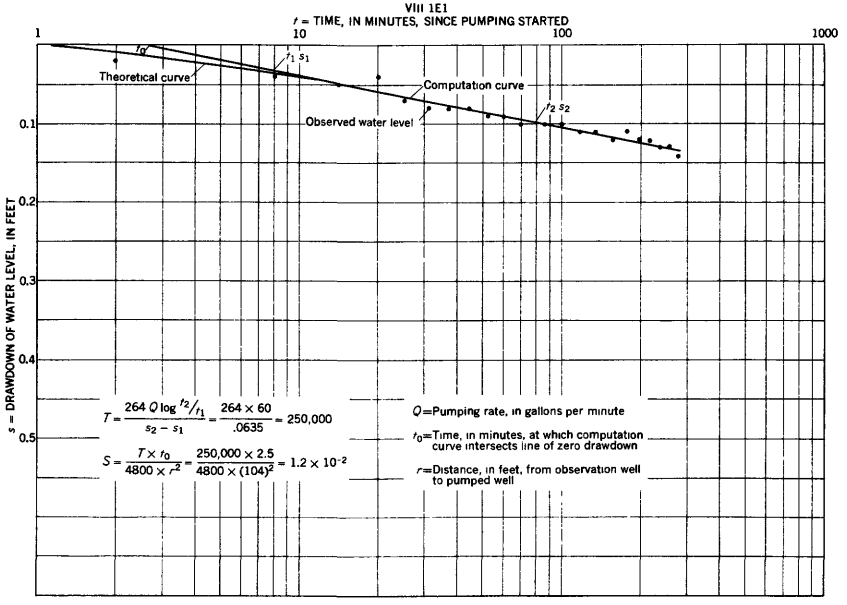

Figure 23. —Semilogarithmic plot of water-level drawdown in observation well VIII 1E1 at test site VIII P1.

VIII P2, however, condition 4 could not be satisfied because drainage from the fine-grained sediments affected the rate of development of the cone of depression around the pumped well. For example, during the early part of the test at site III P1, the cone of depression developed as if true artesian conditions existed, but during the later part of the test, drainage from the fine-sediment zone retarded further development of the cone. (See fig. 24.) At sites III P3, VI P2, VIII P2, and X P1, on the other hand, drainage

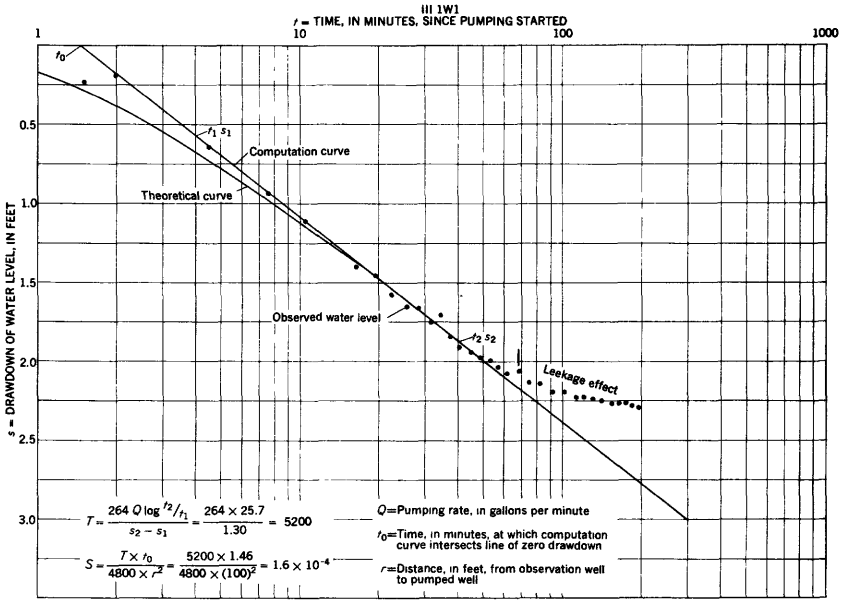

Figure 24.—Semilogarithmic plot of water-level drawdown in observation well III 1W1 at test site III P1.

from the fine-sediment zone promptly affected development of the cone of depression and it was not until later during the test that the cone developed its characteristic form. (See figs. 25–28.) As the sediments in the upper part of the zone of saturation were not of uniform texture at site III P3 (fig. 26, the rate of drainage from these sediments varied considerably; consequently, the cone of depression did not develop symmetrically until the yield from storage was constant throughout the area of significant water-level drawdown.

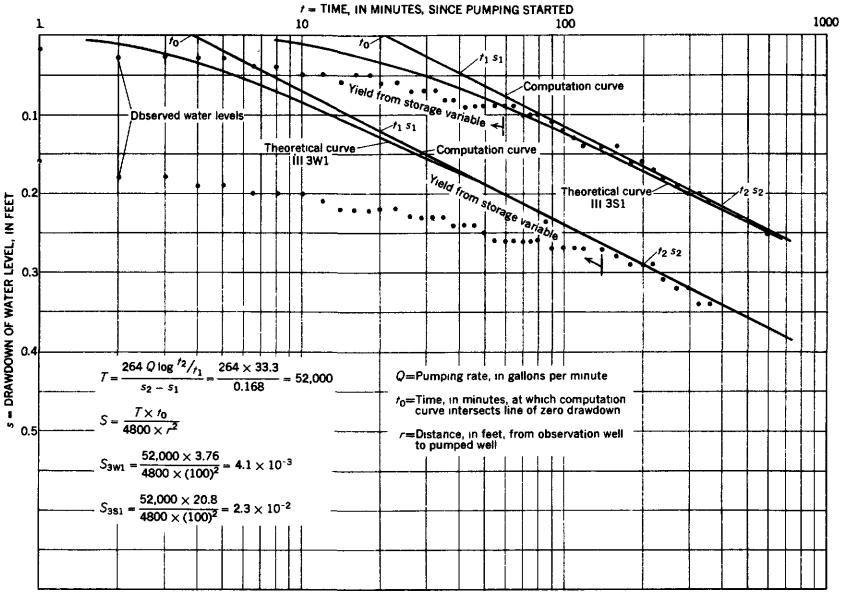

Figure 25. —Semilogarithmic plots of water-level drawdown in observation wells III 3S1 and III 3W1 at test site III P3.

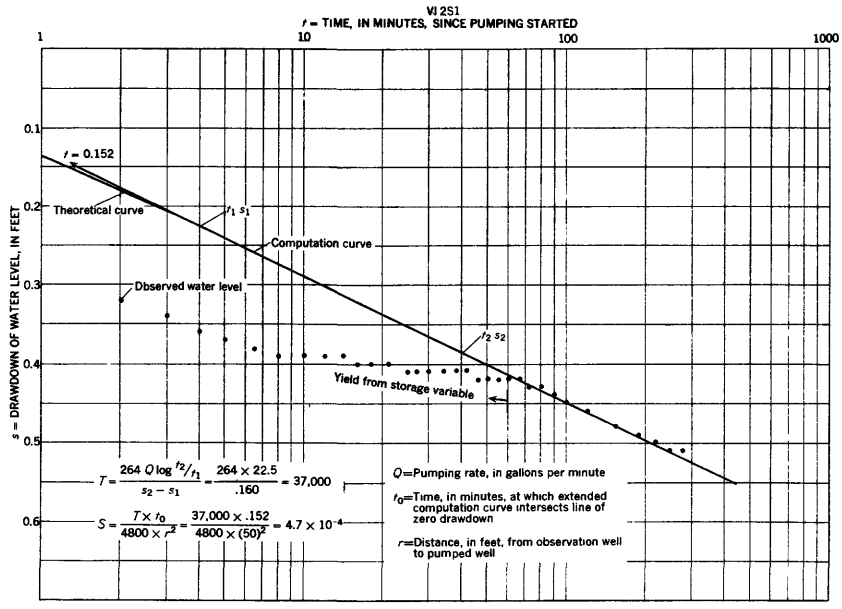

Figure 26. —Semilogarithmic plot of water-level drawdown in observation well VI 2S1 at test site VI P2.

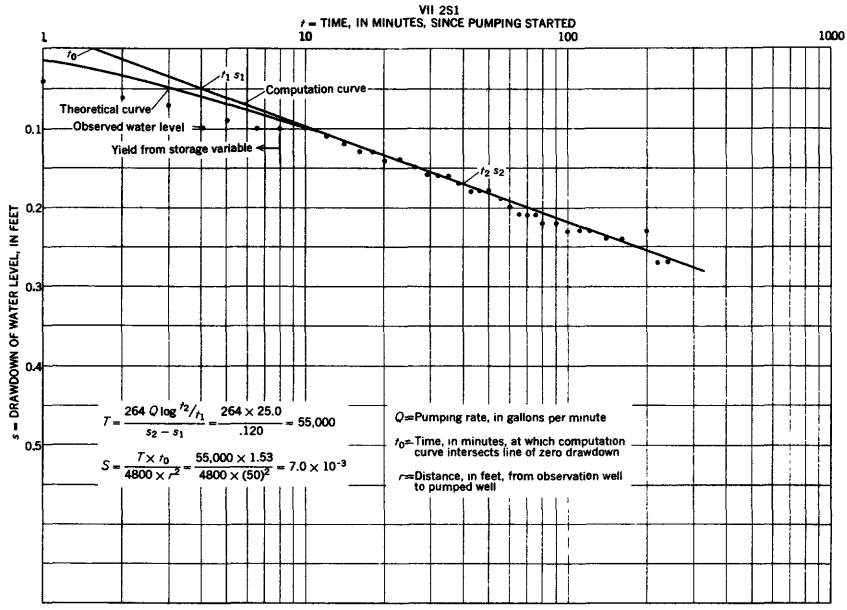

Figure 27. —Semilogarithmic plot of water-level drawdown in observation well VIII 2S1 at test site VIII P2.

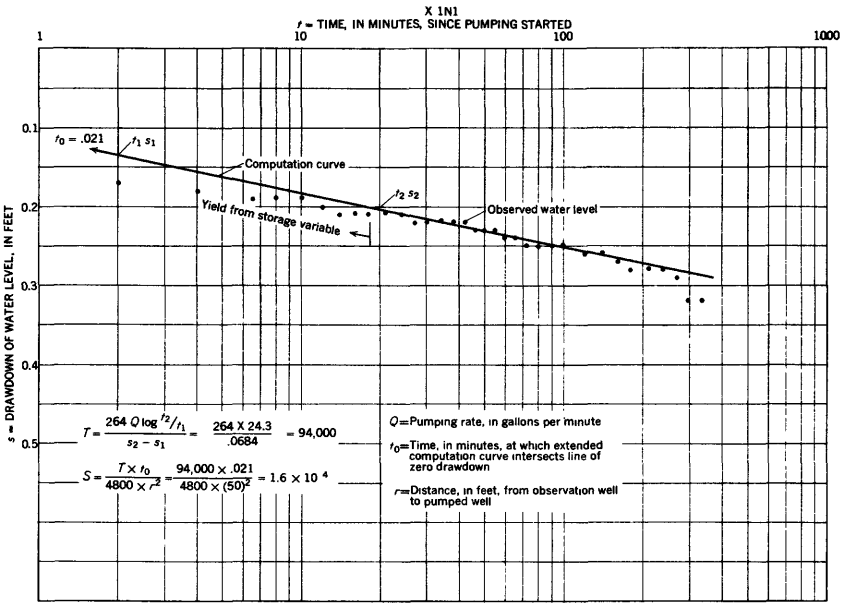

Figure 28. —Semilogarithmic plot of water-level drawdown in observation well X 1N1 at test site X P1.

The results of the pumping tests are as follows:

Pumping test site	Average coefficient of transmissibility (T) (gallons per day per foot)	Average coefficient of storage (S)[1]
III P1	5,400	2×10^{-4}
III P2	29,000	2×10^{-4}
III P3	53,000	3×10^{-3}
VI P1	19,000	3×10^{-4}
VI P2	37,000	6×10^{-4}
VII A3	120,000	4×10^{-3}
VII P1	130,000	3×10^{-3}
VIII P1	250,000	9×10^{-3}
VIII P2	55,000	6×10^{-3}
X P1	94,000	2×10^{-4}

[1]As computed for an extensive aquifer not showing effects of leakage.

DRAINAGE PROBLEMS AND POSSIBLE REMEDIAL MEASURES

In those parts of the First Division, Buffalo Rapids Irrigation Project, where the piezometric surface of the water in the terrace deposits is within 4 feet of the land surface (see pls. 4-9), waterlogging generally is so severe that crop production is impossible. Where the piezometric surface is between 4 and 8 feet below the land surface waterlogging is a lesser problem, and where the piezometric surface is more than 8 feet below the land surface it is no problem at all. Exceptions, however, are those places where downward infiltration of water is impeded to the extent that a suspended, or perched, zone of saturation exists during at least part of the year.

Because drainage problems are caused by a variety of geologic and hydrologic conditions, planning remedial measures for a given locality requires consideration of the causes of the waterlogging in that particular area. In general, the piezometric surface can be lowered most effectively by a drain that (1) intercepts water as close as practicable to the source of recharge, (2) extends below the piezometric surface and either is incised in permeable water-bearing beds or is connected to them by flowing wells, and (3) is located where the transmissibility of the water-bearing beds and the artesian pressure are the greatest.

The cause and extent of, and possible remedy for, waterlogging in each of the 10 areas is described in the following paragraphs.

AREAS I AND II

Most of terrace 4 in Areas I and II (see pl. 2) is irrigated. Because this terrace has excellent subsurface drainage, waterlogging

is unlikely to be a problem except possibly in parts of sec. 16 where the piezometric surface of the ground water in the terrace deposits is less than 8 feet below land surface. (See pl. 4.) Measurements of the water level in observation wells should be made periodically in and near the possible problem area so that a progressive rise of the piezometric surface can be detected promptly and corrective measures taken before damage to agricultural land results.

Discharge of water from terrace 4 has caused high water levels throughout much of terrace 2 west of Hatchet Creek. (See pl. 4.) Crop production has been affected noticeably despite the construction of a drain along the terrace edge. Terrace 2 east of Hatchet Creek was classed as nonirrigable and consequently has never been irrigated.

The only irrigated land in Areas I and II that requires drainage now (1952) is that on terrace 2 west of Hatchet Creek. The existing drain is ineffective because it is only 4 to 5 feet deep and is not incised into the underlying terrace gravel. As the top of the gravel is more than 10 feet below the land surface along most of the length of the drain, it will be necessary either to deepen the drain to the gravel or to deepen the drain only 1 to 2 feet and install small-diameter wells, hereinafter referred to as "relief wells," at intervals along its floor. The relief wells, if they penetrate the water-bearing gravel, will flow and thus relieve the hydrostatic pressure that causes the waterlogging. The one drain probably would be adequate, provided subsequent applications of irrigation water were no greater than necessary for growing crops and keeping the soil flushed of accumulated salts.

Terrace 2 east of Hatchet Creek probably could be developed for irrigation if a deep drain were constructed so that it would intercept underflow from the higher lying terrace 4. To prevent waterlogging after irrigation is begun, it will be necessary to construct another drain across the southeastern third of this part of terrace 2.

AREA III

In Area III, leakage of water from the main canal causes water-level rises of about 4 feet in wells close to the canal and progressively lesser rises in wells as far as 4,000 feet downslope from the canal. In addition to the water-level rise caused by canal leakage, a rise of as much as 2 feet results from the infiltration of water applied to cropland. Despite this large amount of recharge, no drainage problems have developed on terrace 4.

Underflow from this terrace, however, definitely is one of the factors causing waterlogging on the adjacent lower lying terrace 2. (See pl. 5.)

Problems of drainage characterized parts of terrace 2 even before it or terrace 4 was first irrigated. Prior to irrigation in Area III, Bad Route Creek followed a meandering course across terrace 2 and influent seepage from the creek maintained a high water level south of the creek much of the time. In an attempt to lower the water level, Bad Route Creek was diverted into an artificially cut and more direct channel to the yellowstone River and a deep drain sloping directly toward the river was constructed in the SE$\frac{1}{4}$ sec. 15. Because it was realized that excess irrigation water applied to terrace 4 would eventually collect in the abandoned channel of Bad Route Creek and thus become a source of recharge to the gravel layer underlying terrace 2, shallow drains to intercept this waste water were constructed along the north edge of the abandoned flood plain of the creek. Six years after these remedial measures were taken, however, the water level was lowered nowhere as much as 2 feet and in some places had even risen. (See fig. 29.)

Much of the area north of the old channel in secs. 14 and 15 and the topographic depression in the N$\frac{1}{2}$ sec. 12 are waterlogged; the affected area in secs. 14 and 15 is reported to be extending northward. The other waterlogged lands on terrace 2 have never been irrigated.

Profiles of the land, ground-water, and gravel surfaces along the A, B, and C lines (figs. 30, 31, and 32) illustrate, in part, the cause of the waterlogging in secs. 14 and 15. In its riverward movement, much of the ground water in the gravel layer underlying terrace 4 must pass through fine-grained sediments before it can enter the gravel layer underlying terrace 2, and it is where the water is forced to move through the fine-grained sediments that the waterlogging occurs. This waterlogging results, therefore, from the coincidence of a convex ground-water surface and a concave land surface.

Well III P1 is situated where the zone of saturation consists of 23 feet of fine-grained sediments underlain by 12.5 feet of gravel (see fig. 32), and at the beginning of the irrigation season the water level in this well rises sharply (see fig. 15). This initial rise is caused by a rapid increase in artesian pressure which is the result of rapid recharge to the upgradient terrace gravel. The slow decline that follows is caused by a release of pressure resulting from the gradual saturation of the fine-sediment zone and consequent increased transmission of ground water into the downgradient terrace gravel.

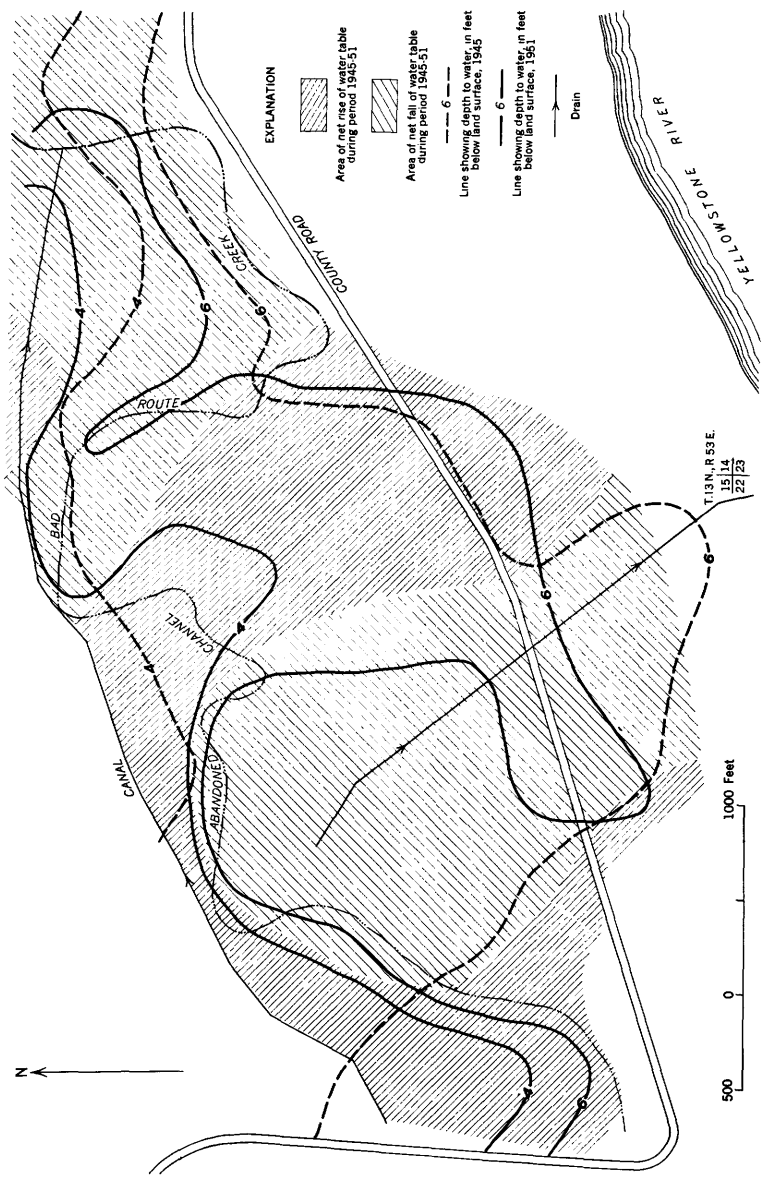

Figure 29.—Map of part of Area III showing depth to water before (1945) and after (1951) land was developed for irrigation and drains were installed.

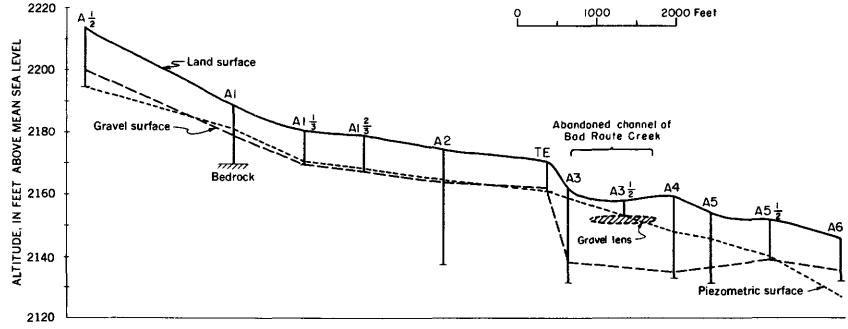

Figure 30. —Profiles of the land, ground-water, and gravel surfaces along the A line in Area III.

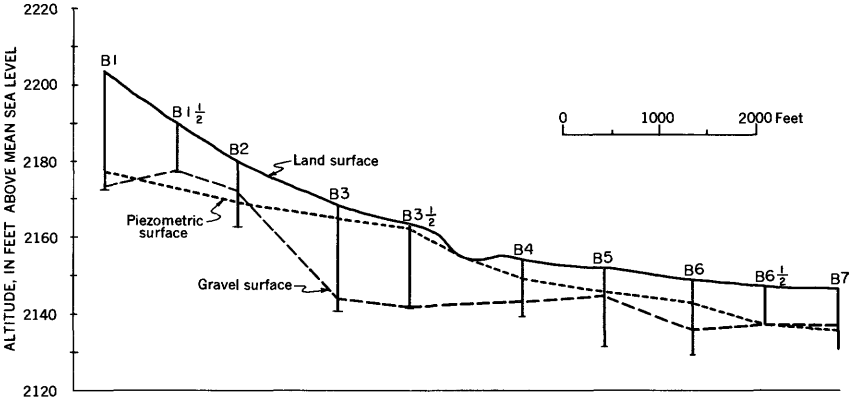

Figure 31. —Profiles of the land, ground-water, and gravel surfaces along the B line in Area III.

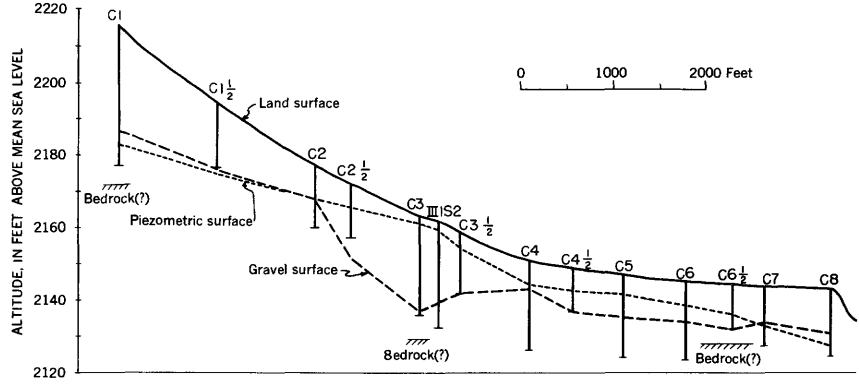

Figure 32. —Profiles of the land, ground-water, and gravel surfaces along the C line in Area III.

As terrace 2 is not waterlogged between the D and E lines, it is believed that the two existing artificial drains adequately reduce the underflow from terrace 4. As measured at stations III-2 and III-3, this segment of the two drains was removing ground water at the rate of 1.94 cfs on July 25, 1951, which was about the time of maximum flow in the drains that year. At the same time, as measured at station III-1, the drain between the B and D lines (which are approximately the same distance apart as the D and E lines) was removing only 0.87 cfs. It is concluded from this evidence that a little more than doubling the amount of ground-water pickup by the drain between the B and D lines would relieve the waterlogging of the north part of secs. 14 and 15.

If a drain in this area is to lower the ground-water surface effectively, the drain must either be incised in the water-bearing terrace gravel or be hydraulically connected with it by means of relief wells. The latter would be necessary in those places where the gravel surface is below the depth to which, for practical purposes, a drain can be dug. To test the effectiveness of relief wells as a means of hydraulic connection, a 2-inch pipe (well Rf) was jetted into the floor of the drain in the SE$\frac{1}{4}$ sec. 15. At this point the gravel surface was 4 feet below the floor of the drain. The water rose in the well to a point 1.8 feet above the floor of the drain, and when the pipe was cut off at a height of 1.0 foot the flow from the well was 2.5 gpm. (See fig. 33.) Because the rate of flow is directly proportional to the artesian head, the flow from the well could have been doubled by lowering the point of discharge an additional 0.8 foot. Similarly, in the 1,500-foot stretch of the drain that is incised in the terrace gravel, the rate of ground-water pickup fluctuates in proportion to changes in the artesian head. When the flow from the well in the drain was 2.5 gpm, the rate of pickup by the drain was 100 gpm, and when, as a result of a seasonal decrease in recharge, the flow from the well had declined to 1 gpm, the rate of pickup was reduced correspondingly to 40 gpm. The water level in well III B6 declined 1 foot during the period that the rate of flow in the drain declined from 100 gpm to 40 gpm.

The waterlogged land in secs. 14 and 15 can be drained by cutting a ditch between the 2,160- and 2,165-foot contour lines on the land surface and installing in it a series of relief wells that penetrate to the underlying gravel. The drain should empty into the river instead of terminating in the abandoned channel of Bad Route Creek.

Drainage of the area between the old creek channel and the county road could be improved by deepening the existing drains and installing relief wells in them where they are not incised in the terrace gravel. By cutting lateral drains through areas of

Figure 33. —Well Rf in Area III. The well is flowing about 2.5 gpm and the point of discharge is about 1 foot above the floor of the drain. The salt encrustation on the ditch bank is the result of evaporation of ground water.

shallow water table and interconnecting them with the existing drains, it would be possible to lower the ground-water surface more effectively. The waterlogging of irrigated lands south of the county road can be prevented by intercepting some of the underflow from the area north of the county road.

Waterlogging also threatens land near well III P3. Damage to the land could be forestalled by deepening the existing drain in this vicinity.

AREA IV

The geologic and hydrologic factors affecting the drainage of Area IV were described in the report by Moulder, Torrey, and Koopman (1953). All information collected in Area IV since the completion of that report substantiates the conclusions and recommendations therein. The subsequent measurements of the water level in observation wells are included in table 10 of this report.

The drain constructed in Area IV was photographed in the late winter when the ground-water surface was low. (See fig. 34.) At that time the drain was ineffective, but since then relief wells

Figure 34.—Drain in Area IV before relief wells were installed. In this downstream view it is apparent that the water was standing, not flowing, in the drain.

have been installed in the floor of the drain and the ground-water level has been lowered considerably. A water-level recording gage was in operation on well 14-54-33ba10 when the relief wells were installed. In 24 hours the water level in the well was 1.47 feet lower than before the relief wells were installed; in a few days it was more than 2 feet lower.

AREA V

Most of the irrigated land in Area V is on terraces 4 and 1 (see pl. 3), which are separated by an abrupt, gullied slope (see fig. 35). The terrace deposits are recharged principally by infiltrating irrigation water; during the irrigation season, the water level in wells on terrace 4 rises about 4 feet (fig. 36) and in those on terrace 1, a little more than 4 feet.

At the present time (1952) no part of terrace 4 is waterlogged; the ground water either issues as springs along the terrace edge or percolates through the gravel fill of the several gullies in the

Figure 35. — One of the coulees along slope between terraces 4 and 1 in Area V.

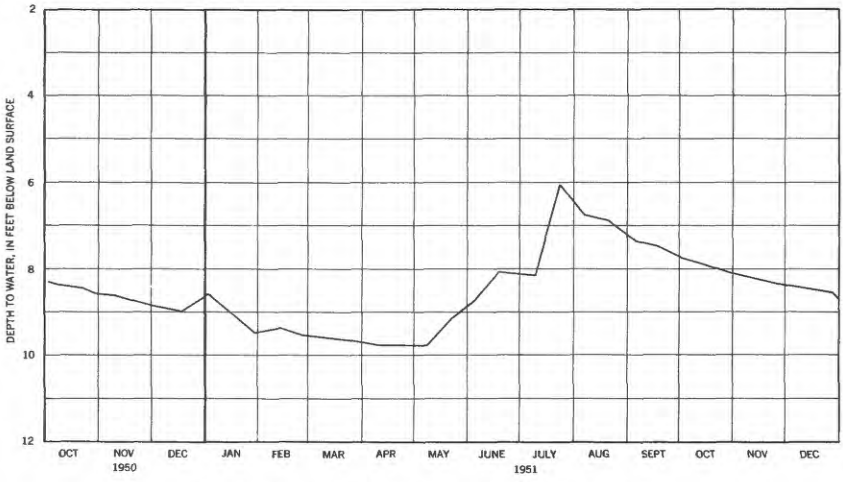

Figure 36. —Water level in observation well V A1.

slope between terraces 4 and 1. Most of the spring water is intercepted by shallow drains at the base of the slope, but during periods of high discharge the drainage system is overtaxed and the excess water inundates the surrounding land. The underflow from terrace 4 enters the gravel underlying terrace 1.

Although most of terrace 1 is underlain by relatively thick, permeable gravel, subsurface drainage is inadequate; as a result, much of this terrace is waterlogged. (See pl. 6). The existing shallow drain through the center of the waterlogged area is ineffective insofar as subsurface drainage is concerned. If the drain were deepened, however, and if relief wells were installed along the floor of the drain where it does not incise the water-bearing gravel, the excess underflow from the higher terrace could be intercepted and the cause of waterlogging thereby eliminated.

In addition to the large area of waterlogged land in Area V, two small areas need drainage. (See pl. 6.) One is in the $SE\frac{1}{4}SW\frac{1}{4}$ sec. 14, where the amount of underflow from terrace 4 is greater than that which the adjacent creek-terrace deposits are capable of transmitting. A short, deep drain incising the deposits underlying terrace 4 where they are in contact with the creek-terrace deposits would intercept enough of the underflow to relieve the waterlogging of the latter. The other small waterlogged area is in the south-central part of the $NW\frac{1}{4}$ sec. 23. The poorly drained material consists of fine-textured colluvium, but if a ditch cutting into the underlying gravel fill were constructed down the middle of this natural drainageway, the colluvial material could be drained. Lateral ditches into the fields on either side of the main ditch probably would be required if waterlogging is to be eliminated completely.

Although to date (1952) no waterlogging has occurred on terrace 4, it is possible that heavy applications of irrigation water for several successive years would result in a threatening rise of ground-water levels. Because, in July 1951, the water level in observation well V A1 rose to a point only 6 feet below the land surface (see fig. 36), measurements of the water level in this well should be made frequently to forewarn the landowners of possible damage to their fields.

AREA VI

Except for an isolated remnant of terrace 3 and those terrace lands that are either waterlogged or too steeply sloping to be cultivated, all of Area VI is supplied with irrigation water. A rise in the water level of as much as 4 feet during the irrigation season indicates that the infiltration of leakage from irrigation laterals and of applied irrigation water is the principal source of recharge to the terrace deposits. In part of Area VI, as evidenced by differences in the chemical quality of water samples from wells, springs, and ground-water drains, another significant source of recharge to the terrace deposits is inflow from underlying truncated bedrock aquifers. (See figs. 37 and 38.) No

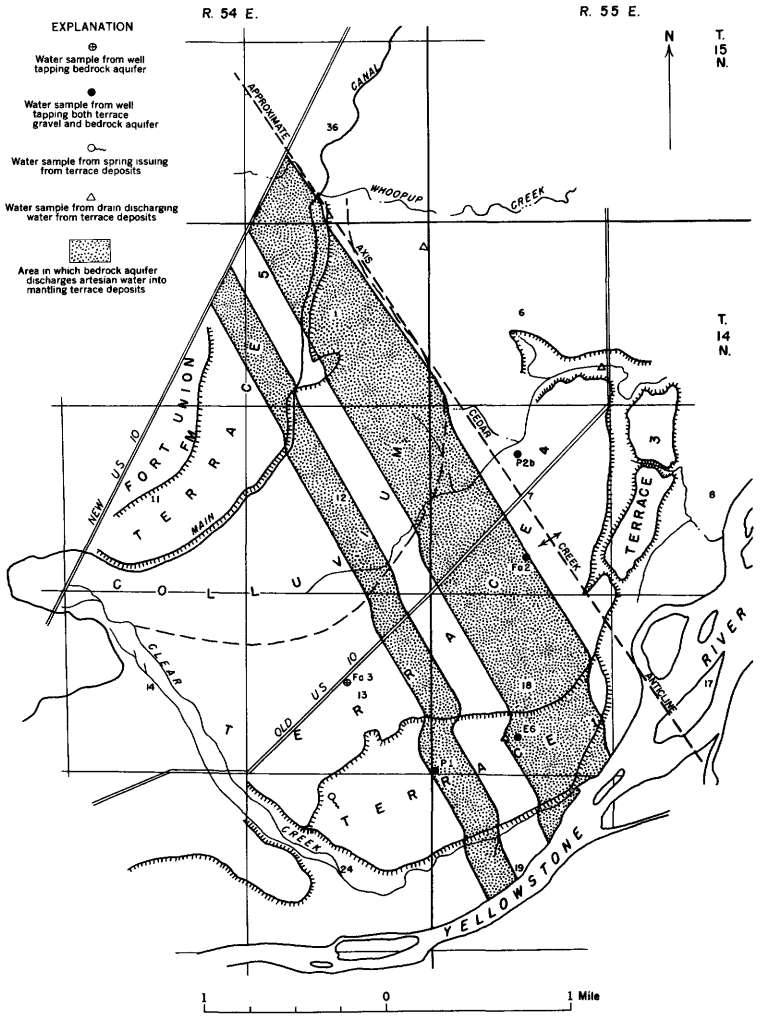

Figure 37. —Map of Area VI showing areas where truncated bedrock aquifers discharge artesian water into the mantling terrace deposits.

evidence indicates that leakage from the main canal is a significant source of recharge in Area VI.

Several extensive tracts within Area VI still are waterlogged (see pl. 7) despite the construction of drains to remedy the condition. The principal causes of the waterlogging and practicable remedial measures are described in the following paragraph.

In the southern part of sec. 12 the bedrock is close to the land surface (see fig. 39) and the thin mantle of colluvium cannot

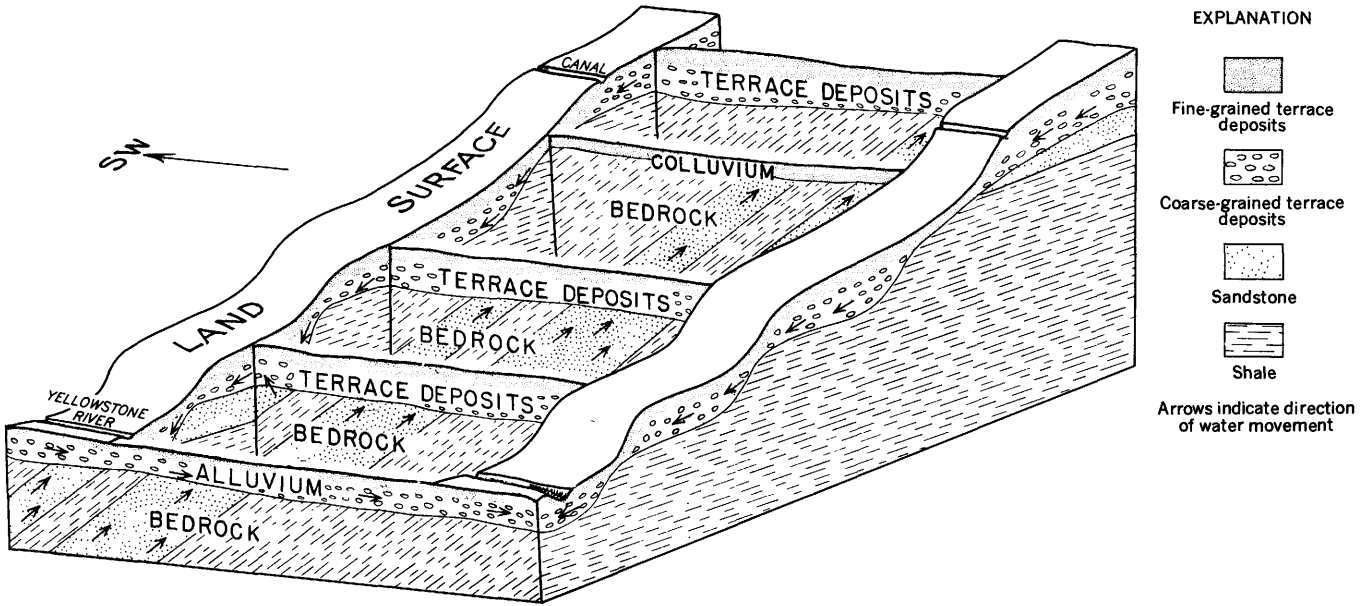

Figure 38. —Diagrammatic block section showing terrace deposits and underlying southwestward-dipping bedrock, Area VI. Arrows indicate direction of groundwater movement.

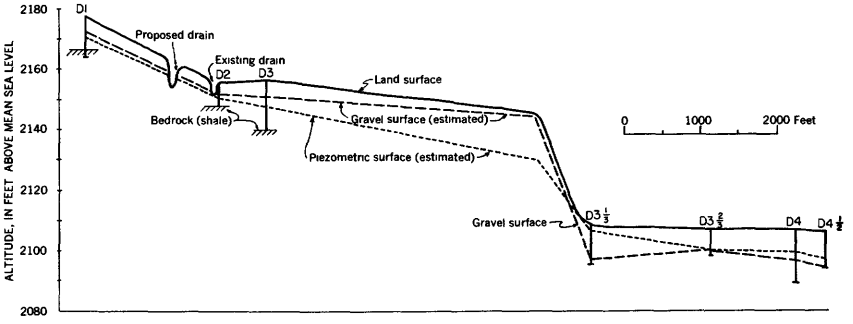

Figure 39. —Profiles of the land, ground-water, and gravel surfaces along the D line in Area VI.

transmit all the recharge. The drain across this area effectively intercepts and confines to a narrow channel most of the surface runoff but does not remove any of the ground water. By deepening this drain so that it would incise the full thickness of the unconsolidated deposits, all the underflow from the north could be intercepted and most of the waterlogged land south of the drain reclaimed. A better plan, however, would be to construct a new drain that would intercept all the underflow from the north before it reaches the waterlogged area. Such a drain not only would prevent enlargement of the waterlogged area but would make possible the reclamation of part, and possibly most, of the area now affected by a high water table.

Waterlogging of terrace 4 is due to a combination of excessive recharge from irrigation and inflow of water from underlying artesian aquifers. A deep drain, which cuts into the terrace gravel and follows the course of a natural drainageway across this terrace, intercepts almost all of the ground-water underflow from the northwest. The flow in the drain at station VI-2 was 1,460 gpm, a rate which nearly equals the theoretical rate of southeastward underflow toward the drain (1,500 to 2,000 gpm) that would exist if the coefficient of transmissibility of the terrace deposits north of the drain were the same as that computed for the terrace deposits at test site VI P1. Because this drain is so effective, the direction of ground-water movement southeast of the drain is northeastward, or at a right angle to that of the ground water northwest of the drain. By drilling wells that would tap the underlying artesian aquifers, the inflow of water from bedrock could be reduced or eliminated. The wells should be located along the floor of a drain that would slope toward the river. The wells would flow if the drain were incised below the piezometric surface of the artesian aquifer, but pumping the wells would so increase their discharge that equivalent effectiveness could be attained with

fewer wells. The line of wells should be parallel to and about three-fourths of a mile southwest of the axis of the Cedar Creek anticline. If the pressure surface of the artesian aquifer were lowered below the base of the terrace deposits, the artesian aquifer would no longer discharge into the terrace deposits but instead would receive recharge from them.

Waterlogging along the contact of terraces 4 and 3 in sec. 6 is related to the presence of a subsurface, shelflike layer of impermeable material that extends out from the buried bedrock wall. (See fig. 40.) Subsurface flow from terrace 4 is upheld by

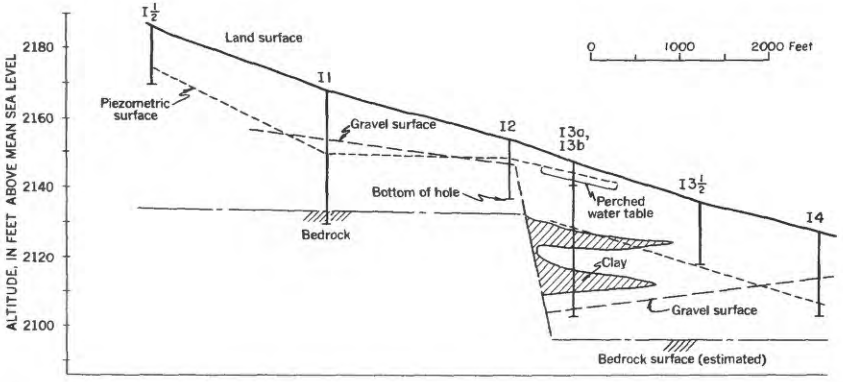

Figure 40.—Profiles of the land, ground-water, and gravel surfaces along the I line in Area VI.

this layer, and during periods of high recharge the so-called "perched" water table rises to a level less than 6 feet below the land surface. To relieve the resultant waterlogging, a deep drain should be cut into the terrace deposits upgradient from the affected area. As the drain would not be very effective unless it incised coarse-grained water-bearing materials, a network of test holes should be bored to determine the most advantageous location for the drain.

Throughout a large part of terrace 1 the depth to water is less than 6 feet and, as a result, the land is waterlogged and nonproductive. (See fig. 41.) Because irrigated fields south of the waterlogged land have no wasteways, the excess irrigation water spreads over the affected area. Discharge from the adjacent terrace 4 also is a source of recharge to terrace 1; in the winter such discharge forms ice masses on the slope between the terraces (fig. 17), and in the spring much of the melt water infiltrates terrace 1 along the base of the slope. Leakage from the irrigation

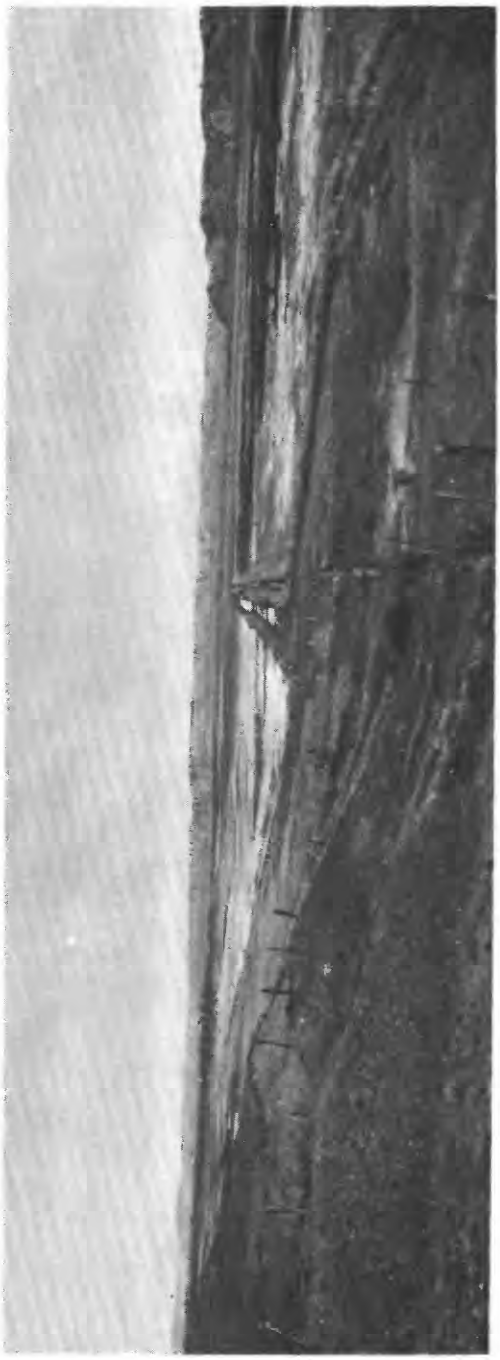

Figure 41.—Waterlogged land on terrace 1 in Area VI.

lateral crossing terrace 1 is a third important source of recharge. The drain along the base of the slope between terraces 4 and 1 is shallow and intercepts only a small part of the ground water discharged from terrace 4. The flow in this drain at station VI-1 (sec. 18) was only 31 gpm.

Several measures to reduce waterlogging in this area are possible. One would be the construction of shallow drains to channel irrigation wastewater from the terrace so that it would not infiltrate to the zone of saturation; another would be the deepening of the existing drain so that more of the underflow from terrace 4 would be intercepted; and, if wet areas persist, still another would be the lining of the irrigation lateral. Also helpful would be either the filling in of topographic depressions or the construction of ditches to effect drainage of these depressions.

The waterlogged area between terrace 4 and the isolated remnant of terrace 3 is reported to be increasing in extent. The waterlogging is caused by restricted underflow from terrace 4; therefore a drain that would intercept most of this underflow not only would relieve the condition but would prevent its spread to surrounding irrigable land.

AREA VII

Of the two terraces in Area VII, only the upper (terrace 4) is irrigated; the lower (terrace 3) is mostly nonirrigated pasture. The principal sources of recharge to the unconsolidated deposits underlying terrace 4 are canal leakage and infiltration of both spring discharge and applied irrigation water.

A comparison of the water-level fluctuations in wells along the B line (see figs. 42 and 43) indicates the relative importance of

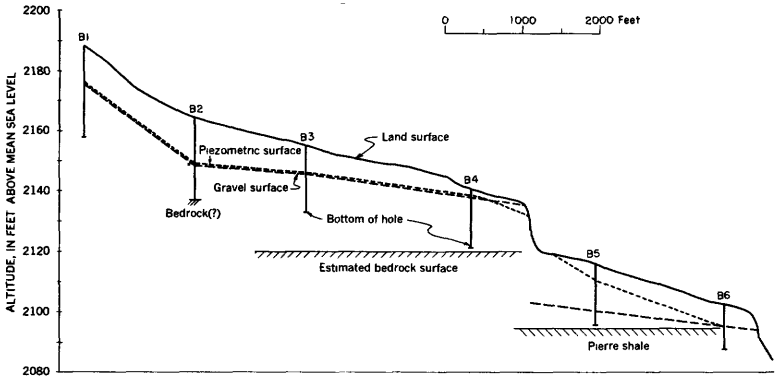

Figure 42.—Profiles of the land, ground-water, and gravel surfaces along the B line in Area VII.

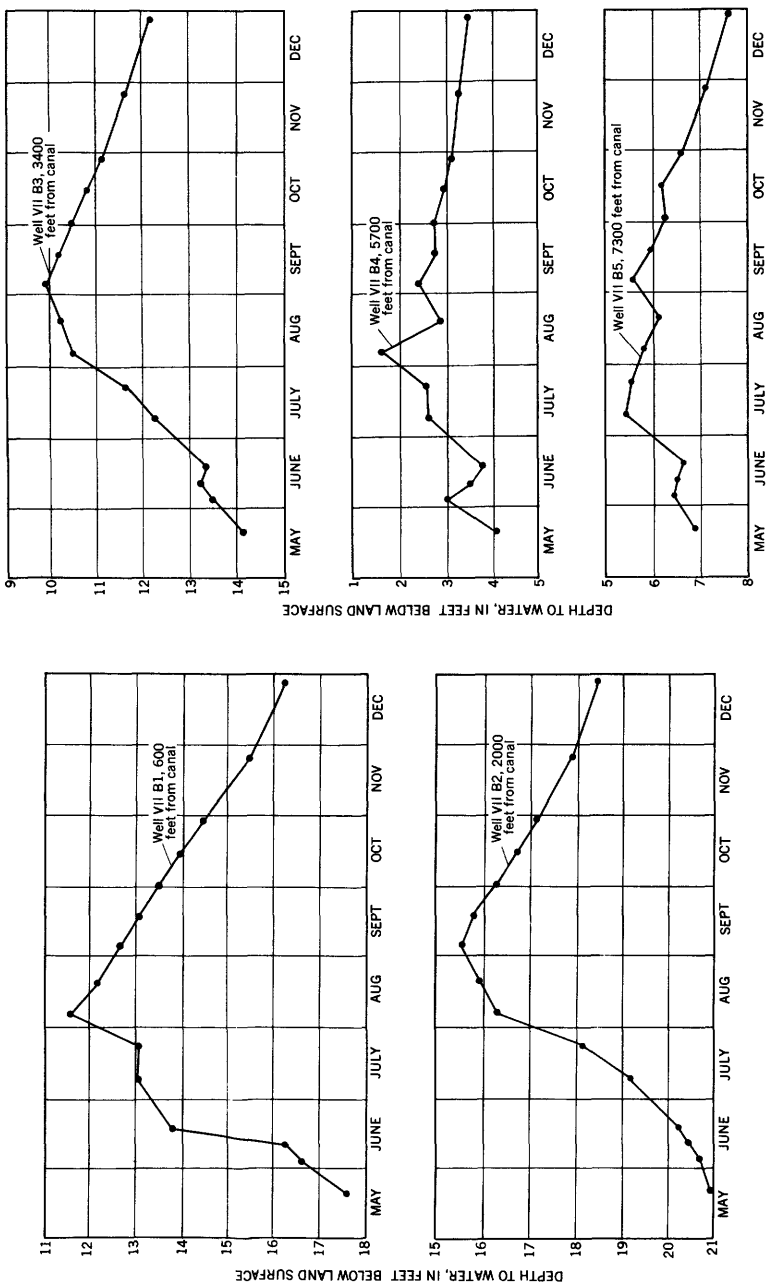

Figure 43.—Water level in observation wells along the B line in Area VII.

canal leakage and applied irrigation water as sources of recharge. In 1951 the water level in the well nearest the canal rose 6 feet, largely as a result of canal leakage, whereas the level rose about 2 feet in the wells where irrigation water was the only source of recharge. As the average rise of the water table on terrace 4 along the B line was about 4.4 feet, it may be assumed that about 2.4 feet of this amount is due to leakage from the canal.

The quantity of recharge required to effect a water-level rise of 2.4 feet in a section 1 foot wide along the B line from the canal to the edge of terrace 4 may be computed as follows:

Let

Q = volume of water, in cubic feet;
L = distance from canal to terrace edge (6,000 ft);
H = average rise of water level caused by canal leakage (2.4 ft); and
p = porosity (0.3, estimated);

then

$$Q = L \times H \times p$$
$$= 6{,}000 \times 2.4 \times 0.3$$
$$= 4{,}320 \text{ cubic feet;}$$

and if it is assumed that this change in storage represents the minimum amount of leakage per foot of canal (that is, discharge from terrace 4 is not considered), then the leakage rate per mile of canal may be computed thus:

Let

R = rate of leakage, in cubic feet per second per mile of canal, and
t = time during which water flowed in the canal, in seconds,

then

$$R = \frac{Q \times 5{,}280}{t}$$
$$= \frac{4{,}320 \times 5{,}280}{112 \text{ (days)} \times 1{,}440 \text{ (minutes per day)} \times 60 \text{ (seconds per minute)}}$$
$$= 2.4 \text{ cfs per mile of canal.}$$

Although this value may be considerably in error, it is indicative of the magnitude of recharge attributable to canal leakage.

Ground water in the deposits underlying terrace 4 moves riverward and discharges through the colluvium that mantles the slope between terraces 4 and 3. Much of this discharge infiltrates the

deposits underlying terrace 3 and eventually reappears either in the natural drainageways that cross the terrace or as springs and seeps that issue at the exposed contact of the terrace deposits and the underlying Pierre shale. Where Whoopup Creek cuts through the deposits of terrace 3, its flow is maintained by ground-water discharge; at the old U. S. Highway 10 crossing, the rate of flow was estimated to be between 1 and 2 cfs. The flow of the stream that is about 1,000 feet north of Whoopup Creek was 0.8 cfs at station VII-3 (table 3); the flow of this stream, as well as that of the stream between it and Sand Creek, also is derived largely from ground-water discharge.

Three parts of Area VII are waterlogged: one is a very small area of colluvium and terrace deposits near the main canal; another extends across terrace 4 in the $S\frac{1}{2}$ sec. 30; and the third includes most of the riverward margin of terrace 4, the colluvial slope between terraces 4 and 3, and most of the southern half of terrace 3. (See pl. 8.)

The waterlogging of the small area near the canal is the result of canal leakage into unconsolidated material that is too thin to transmit all the recharge. This area of waterlogging is not likely to enlarge because the unconsolidated material thickens considerably within a distance of a few hundred feet and its transmitting capacity increases accordingly. Lining the canal where leakage is occurring would remedy the condition.

According to longtime residents, the several large springs near the base of the colluvial slope in the $NW\frac{1}{4}SW\frac{1}{4}$ sec. 30 existed prior to construction of the project. (See fig. 44.) In an effort to drain the marsh caused by these springs, a ditch was constructed to collect and channel the spring discharge across terrace 4 and into a natural drainageway to the river. The drain is not wholly effective, however, and, although waterlogging has been alleviated somewhat, it has not been entirely remedied. The flow in the drain, as measured during the period October 1951 through January 1952 at station VII-1, ranged from 0.076 to 0.138 cfs, but these measurements represented only a part of the total flow from the springs. If the springs at the head of the drain were cleaned out so that they would flow at a maximum rate and if the capacity of the drain were increased so that all the spring discharge could be accommodated, drainage of this waterlogged area would be hastened materially. The difference in the position of the water level in wells VII E1a and VII E1b indicates that the waterlogging in the vicinity of the springs is caused by a body of perched ground water rather than the main zone of saturation in the deposits underlying terrace 4.

Figure 44. —Spring discharging from colluvium into drain at station VII-1.

The mantle of colluvium on the slope between terraces 4 and 3 retards discharge from terrace 4 and, as a result, part of terrace 4 as well as the colluvial slope and a large part of the adjacent lower lying terrace 3 are waterlogged. When kept clean and in good condition, existing drains in the waterlogged area channel much of the spring flow and irrigation wastewater to the river; in some stretches, however, considerable drain water seeps to the zone of saturation.

To prevent extension of waterlogging on terrace 4 and to restore the waterlogged area to productivity, a deep drain could be dug in sec. 31 along the 2,140-foot land-surface contour line. The drain should discharge into the coulee that passes through the NE cor. sec. 31. The existing south-sloping drain in the SE$\frac{1}{4}$ sec. 30, should be deepened in its lower 500- to 800-foot reach to help relieve waterlogging north of the coulee. The added discharge from these drains will require the enlargement of the existing drain that cuts into the floor of the coulee and then crosses terrace 3 to the natural drainageway in the NW$\frac{1}{4}$ sec. 32. If this drain is deepened to 8 feet or more, it will incise water-bearing gravel along most of its length and will facilitate drainage of both

the coulee and terrace 3. It is believed that construction of the drains would be a more effective means of relieving waterlogging in Area VII than lining the main canal. Lining the canal should be considered, however, in those stretches where erosion of the canal bank is evident or where canal leakage is causing waterlogging of land adjacent to the canal.

AREA VIII

Area VIII consists almost entirely of a broad remnant of terrace 4 (see pl. 3), much of which is irrigated.

Surface drainage is for the most part adequate; however, in the spring the stream that enters Area VIII at a point in the SE¼NE¼ sec. 18 overflows onto land on both sides of its course along the south line of sec. 17. The flooding could be prevented by increasing the capacity of the surface drains in this vicinity. The drainageway that originates in the SW¼ sec. 16 has a shallow, poorly defined channel in its northerly course across sec. 16. Its channel deepens as it crosses secs. 9 and 4 and its flow increases after it begins to receive ground-water discharge; at gaging station VIII-1 the flow was 1.64 cfs on August 23, 1951. Irrigation wastewater and ground-water seepage collects in a borrow pit near the SW cor. sec. 4, but the pit could be drained readily by constructing an outlet to the nearest natural drainageway.

The unconsolidated deposits underlying terrace 4 are recharged partly by canal leakage, as shown by the rise of the water level in observation wells VIII E1 and VIII E2 (see figs. 45 and 46), and partly by the infiltration of applied irrigation water. As the average net rise of the water level in 31 observation wells during the irrigation season was between 2 and 3 feet, it is reasonable to assume that the water-level rise would have amounted to at least 3 feet if no discharge of ground water had occurred.

Throughout Area VIII the ground water in the unconsolidated deposits moves toward the river at almost a right angle to the river (see pl. 9), and the maximum underflow occurs when water levels are highest. The coefficient of transmissibility of the deposits was computed from aquifer tests at wells VIII P1 and VIII P2. At the former the coefficient of transmissibility was 250,000 gpd per foot and the coefficient of permeability was 9,200 gpd per square foot. At the latter site the coefficient of transmissibility was 55,000 gpd per foot but the coefficient of permeability could not be computed because the total thickness of the water-bearing material was not known. When water levels in wells were

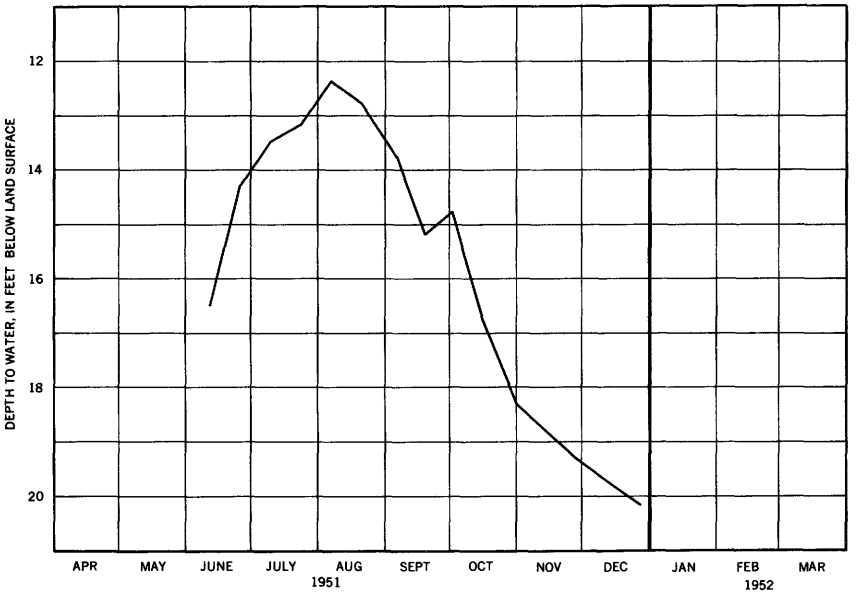

Figure 45. —Water level in observation well VIII E1.

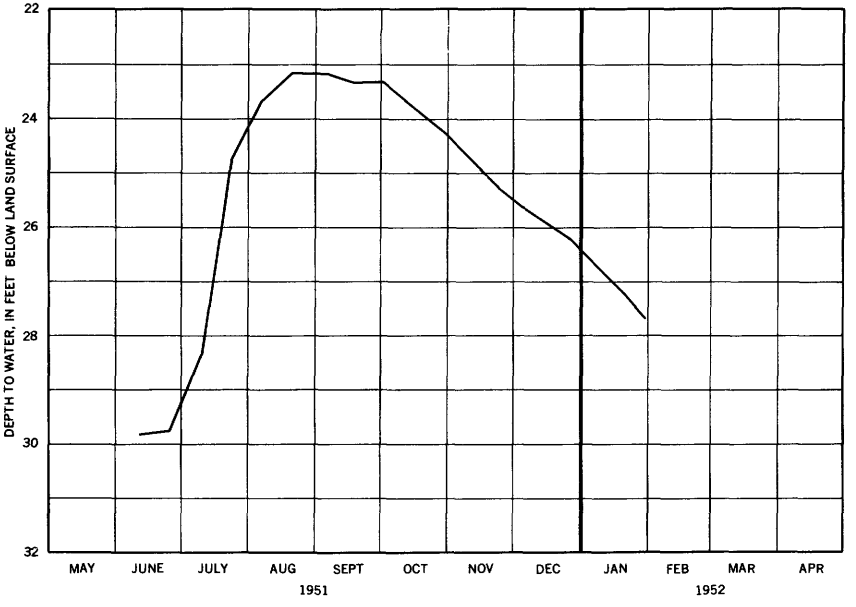

Figure 46. —Water level in observation well VIII E2.

near maximum, the rate of flow at both sites through a section of the aquifer 1 foot wide was computed from the formula

$$Q = T\,I\,L,$$

in which

Q = rate of flow, in gallons per day;
T = coefficient of transmissibility;
I = slope of the water surface; and
L = length of section.

As the slope of the water table at site VIII P1 was 0.73 foot in the 400-foot distance between observation wells VIII 1W2 and VIII 1E2,

$$Q = 250,000 \times \frac{0.73}{400} \times 1$$

$$= 456 \text{ gpd.}$$

The flow through a 1-foot wide section of the aquifer at site VIII P2, where the hydraulic gradient is more than 4 times as steep, was computed in a similar manner and found to be 440 gpd. The close agreement between the rates of underflow suggests that the coefficient of transmissibility obtained from the pumping tests may be used with confidence.

A cross section of the terrace deposits along the F line (fig. 47) shows that gravel underlying Area VIII is much thinner at well VIII F2 than at test hole VIII F1½. It is this north-trending constriction in the water-transmitting gravel that impedes ground-water movement to the extent that the water table is mounded and a large area is waterlogged.

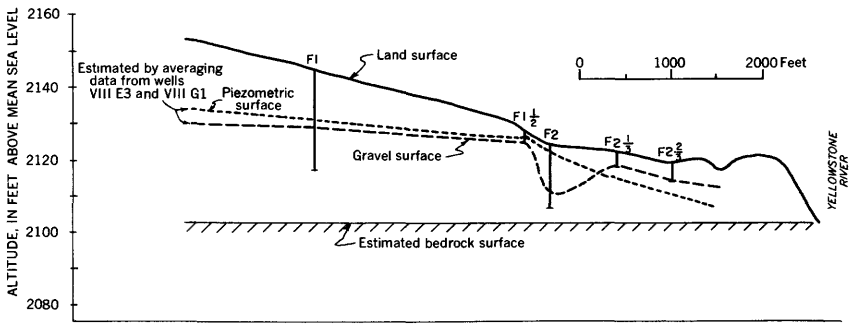

Figure 47.—Profiles of the land, ground-water, and gravel surfaces along the F line in Area VIII.

Waterlogging in Area VIII could be alleviated by constructing a drain that would intercept part of the ground-water flow before it reaches the constriction in the gravel layer. Such a drain should originate in the NW$\frac{1}{4}$ sec. 21 and pass through well VIII F2 in its northward course across the W$\frac{1}{2}$ secs. 16 and 9. It should be dug several feet into water-bearing gravel throughout the length of the waterlogged area.

AREA IX

Area IX also consists almost wholly of a remnant of terrace 4. (See pl. 3.) Apparently both surface and subsurface drainage in this area is adequate, as no part of the area is waterlogged. Available subsurface information (see pl. 10) indicates that poor drainage is not likely to become a problem in the near future.

AREA X

Although terrace 4 in Area X (see pl. 3) is irrigated extensively, waterlogging is limited to a few small areas where a shallow layer of clay retards infiltration of irrigation water to the underlying gravel. The two test holes drilled on terrace 4 did not penetrate any zone of saturation above the bedrock. Apparently the terrace deposits store little or no water, but transmit recharge to the underlying Hell Creek formation.

The Hell Creek formation is exposed in the abrupt escarpment between terraces 4 and 1 in the SE$\frac{1}{4}$ sec. 27 and NW$\frac{1}{4}$ sec. 34. Considerable water issues from the bedrock, some in the form of springs and some as underflow into the adjacent lower lying unconsolidated deposits. The discharge from the springs is greater during the irrigation season and causes flooding of a frozen-food plant and canning factory. Water from the springs either collects in ponds or flows slowly northeastward along a natural drainageway to the river. (See pl. 3.)

Throughout both remnants of terrace 1 the depth to water is less than 8 feet and in the part of terrace 1 adjacent to the line of springs issuing from the Hell Creek formation it is less than 6 feet. (See fig. 48.) Crops in this part of the area are noticeably affected by the excess soil moisture. Waterlogged land in the NE$\frac{1}{4}$SE$\frac{1}{4}$ sec. 27 is shown in figure 49.

In the southern remnant of terrace 1, waterlogging could be relieved by constructing a drain deep enough to intercept ground water along the base of the escarpment between terraces 4 and 1

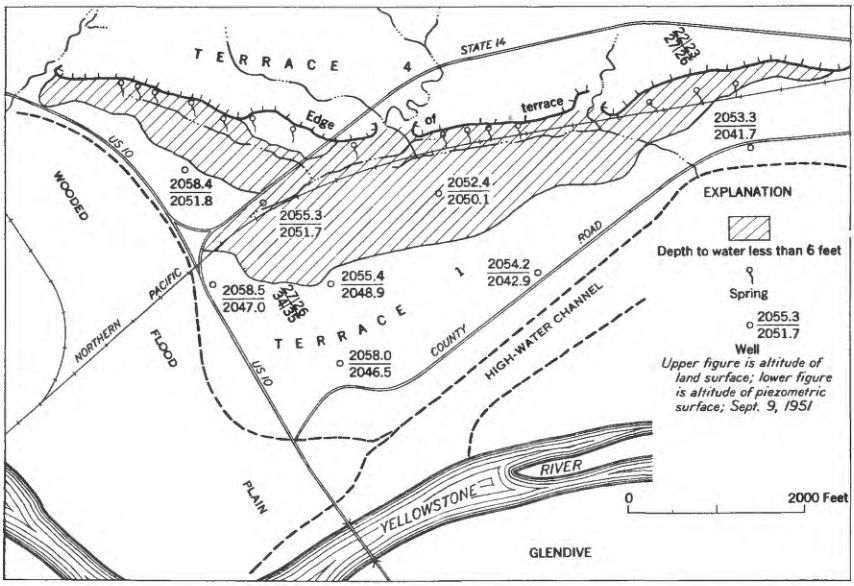

Figure 48. —Map of part of Area X showing area of shallow water table, T. 16N., R. 55E.

Figure 49. —Waterlogged land on terrace 1 in Area X. Ponded water in foreground is water discharged by springs issuing from Hell Creek formation. The city of Glendive is in distant background.

and also by improving surface drainage so that the discharge from the springs would have less opportunity to infiltrate to the zone of saturation. Subsurface information indicates that the water table in the northern remnant of terrace 1 could be lowered by

drains that incise the terrace gravel. Topographic maps should be prepared for this part of the area so that the best locations for drains can be determined.

CHEMICAL QUALITY OF THE WATER

By E. R. Jochens

During the study of the First Division, 32 samples of ground water were collected for chemical analysis, and during an earlier study of an area which included the First Division (Torrey and Swenson, 1951), 8 samples of ground water and 1 sample of Yellowstone River water were collected and analyzed. The location of all sampling points and the geologic source of all ground-water samples are shown on plate 11. However, for some of the samples the geologic source given in this report differs from that reported by Torrey and Swenson because more accurate information was obtained during this study. The ground-water samples were obtained from drains, seeps or springs, and wells in the unconsolidated deposits and from wells tapping bedrock aquifers. The sample of river water was collected at the pumping plant near Fallon, Mont. The results of the chemical analysis of all 41 samples are given in table 4.

Ground water in the report area is used mostly for domestic purposes and the watering of livestock, whereas water from the Yellowstone River is used for irrigation. Most of the ground-water samples were moderately mineralized and contained objectionably large quantities of several mineral constituents. The softest water was obtained from bedrock sources. The maximum and minimum values for dissolved solids, hardness, and percent sodium in the ground-water samples are as follows:

	Water from unconsolidated deposits (28 samples)		*Water from bedrock (5 samples)*		*Water from both unconsolidated deposits and bedrock (7 samples)*	
	Maximum	*Minimum*	*Maximum*	*Minimum*	*Maximum*	*Minimum*
Dissolved solids..... (ppm)..	7,520	408	1,760	824	1,940	778
Hardness ... (ppm)..	2,690	241	19	5	260	17
Percent sodium.....	71	29	99	98	97	70

458513 O - 58 - 5

Table 4.—*Mineral constituents and related*

[Analytical results in parts per

Source of water: Kfh, Fox Hills sandstone; Khc, Hell Creek formation; Tfu, Fort Union forma-

Well no.		Source of water	Depth (feet)	Date of collection	Temperature (°F)	Silica (SiO_2)	Total iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)
Coordinate system	Field										
											Yellowstone
Pumping plant near Fallon, Mont.	.....	.....		10-16-48	.....	14	.....	70	28	59	
											Area
13-52-25bda	I Fa1	Tfu-Khc	611	5-23-51	.....	6.3	.....	2.0	0.7	374	1.3
53-29acb	I E1	Qt_2	18.1	10-18-51	47	21	.....	89	103	327	9.3
											Area
13-53-10dbc1	III Fa1	Qt_4	40	9-29-50	48	24	0.29	224	321	415	19
10dbc2	III Fa2	Tfu-Khc	540	10-15-48	52	12	1.5	3.0	.4	585	
11acc2	III Fa3	Tfu-Khc	772	10-15-48	58	14	.20	2.0	.0	310	
11cd	.....	Qt_4	Seep	10-15-48	48	15	.20	233	255	576	6.4
11daa	III Fa4	Qt_4	41	10-16-48	52	28	.20	305	470	547	14
12acb1	III P3	Qal	20.1	9-17-51	52	23	.56	265	360	472	18
15aac3	III P1	Qcl from Qt_4	52.9	9-11-51	48	20	6.9	357	283	464	12
15dad1	III P2	Qt_2	20.2	9-27-51	48	22	1.0	104	85	237	7.4
14-53-36aa	.....	Qt_5	Spring	5-23-51	.....	12	.....	72	61	179	4.9
											Area
14-54-28bb	.....	Qt_5	Seep	10-15-48	48	9.8	0.20	214	272	1,790	23
28dd	IV G3	Qal	16.5	10-11-50	49	20	6.2	200	102	910	9.2
33ba10	.....	Qt_1	40.0	8-22-50[2]	47	20	3.4	70	103	420	7.0
				8-23-50[3]	47	20	.30	103	106	422	7.4
33bc9	IV C4	Qt_1	13.3	10-12-50	49	22	2.6	81	58	450	8.9
33cc1	.....	Tfu-Khc	412	10-15-48	54	11	.02	4.5	2.0	733	4.8
33cd1	IV C6	Qt_1	17.0	10-11-50	49	20	.....	74	58	153	6.1
33da2	IV E5	Qt_1	21.5	10-12-50	49	22	4.1	87	62	376	7.8
											Area
14-54-23bdc	V A2	Qt_4	8.9	10-18-51	53	27	.....	74	78	433	9.8
											Area
14-54- 1aa	.....	Qt_4	Drain	10-16-48	48	19	0.30	68	71	532	6.8
13dbb	VI Fa3	Tfu-Khc	703	10-15-48	54	15	.14	6.0	.5	356	2.0
24ba	.....	Qcl from Qt_4	Spring	9-29-50	49	21	.20	136	152	735	16
55- 6dda	.....	Qal	Drain	10-18-51	48	17	.14	73	87	600	10
7bda2	VI P2b	Qt_4-Kfh[4]	14.2	10-17-51	53	26	.....	13	5.0	338	4.5
7dcb	VI Fa2	Qt_4-Kfh[5]	42	9-29-50	48	26	.20	18	15	273	7.4
18cad	.....	Qt_1	Drain	10-18-51	47	16	.09	90	126	810	15
18ccc1	VI P1	Qt_1-Khc[4]	21.1	10- 9-51	53	19	.....	44	36	568	8.4
18cda	VI E6	Qt_1-Kfh[5]	13.3	10-18-51	49	9.6	.....	9.0	1.1	380	1.6

See footnotes at end of table.

physical measurements of surface and ground water

million except as indicated]

tion; Qt, terrace deposits (numeral indicates terrace number); Qcl, colluvium; Qal, alluvium

Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Percentage of carbonate and bicarbonate	Specific conductance (micromhos at 25°C)	pH
River													
193	10	214	12	0.5	2.4	0.20	604	290	115	31	42	920	8.4
I													
756	52	71	19	3.0	0.6	0.81	901	8	0	99	87	1,440	8.8
578	0	825	41	.8	11	.25	1,710	646	172	52	34	2,370	7.6
III													
459	0	2,130	20	0.8	254	0.20	3,630	1,880	1,500	32	13	4,120	7.7
1,440	27	8.0	28	2.0	2.5	.56	1,390	9	0	99	96	2,190	8.3
681	43	10	22	2.2	2.5	.64	824	5	0	99	93	1,330	8.8
646	0	2,220	63	.9	22	.46	3,710	1,630	1,100	43	18	4,410	7.7
376	0	3,140	94	.9	115	.57	4,900	2,690	2,380	30	8	5,410	8.0
530	0	2,430	46	.8	191	.83	4,070	2,140	1,710	32	14	4,660	7.5
368	0	2,600	31	.7	.5	.36	3,960	2,050	1,750	33	10	4,460	7.2
383	0	775	7.5	.5	.6	.22	1,430	611	297	45	28	1,980	7.5
598	0	292	7.0	1.5	3.7	.59	984	430	0	47	60	1,390	7.8
IV[1]													
625	8	4,860	26	0.6	2.1	1.3	7,520	1,650	1,120	70	9	8,610	8.1
1,070	0	1,970	35	.8	2.9	.20	3,780	920	43	68	29	4,550	7.3
600	0	975	17	.8	3.4	.30	1,920	599	107	60	32	2,580	8.1
702	0	995	18	.8	4.1	.30	2,020	692	116	57	35	2,660	7.8
644	0	795	13	.8	.5	.30	1,750	440	0	68	38	2,460	7.6
1,950	0	2.4	24	1.4	.9	.00	1,760	19	0	98	98	2,580	7.9
509	0	304	13	.8	13	.20	920	424	7	43	55	1,310	7.5
736	0	625	17	1.0	7.5	.30	1,570	470	0	63	47	2,180	7.6
V													
741	0	750	18	0.6	1.2	0.39	1,760	507	0	64	43	2,530	7.7
VI													
589	7	1,030	40	0.8	19	0.59	2,090	462	0	71	33	2,710	8.1
734	65	38	27	2.8	2.5	.78	878	17	0	98	89	1,460	9.0
651	0	1,840	42	.8	5.8	.20	3,270	965	431	62	21	3,970	7.6
520	0	1,280	50	.9	46	.66	2,420	539	113	70	23	3,310	7.9
847	0	86	20	1.6	1.0	.56	924	53	0	93	85	1,440	8.0
499	29	233	12	1.0	10	.20	893	108	0	83	63	1,290	8.7
725	0	1,840	35	1.2	1.5	.61	3,290	742	147	70	23	4,290	8.1
721	0	885	17	1.2	1.1	.36	1,940	260	0	82	38	2,830	7.9
683	0	244	30	2.0	3.2	.51	1,020	27	0	97	65	1,600	8.1

See footnotes at end of table.

Table 4.— *Mineral constituents and related physical*

Well no. Coordinate system	Well no. Field	Source of water	Depth (feet)	Date of collection	Temperature (°F)	Silica (SiO_2)	Total iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)
											Area
15-55-30cba	.....	Qcl from Qt_5	Spring	10-18-51	.....	22	0.09	58	23	46	3.8
31cbb	VII Fa1	Qt_4	55	9-29-50	48	27	.51	83	62	90	6.6
31daa1	VII A3a	Qt_3	45.6	10-17-51	49	25	1.6	95	78	172	9.2
											Area
15-55- 4cda	.....	Qt_4-Kfh	Spring	10-18-51	45	16	0.07	33	15	463	6.7
16bab1	VIII P2	Qt_4	17.5	9-28-51	49	28	.06	70	40	300	6.9
16cbb2	VIII Fa1	Qt_4	17.4	9-29-50	49	25	.49	101	84	218	15
17daa1	VIII E4, P1	Qt_4	51.6	10- 2-51	48	25	.64	96	58	193	7.2
											Area
16-55-26bb	.....	Qt_4	Spring	9-29-50	48	31	0.10	110	42	279	9.9
26ccc1	X P1	Qt_1-Khc[4]	11.9	10-12-51	52	19	.13	59	21	262	4.8
27cad	X C1	Qt_4-Khc[5]	45.2	4-17-51	.....	9.5	.....	5.0	1.1	285	1.8
27dcc	.....	Qt_4	Spring	10-18-51	.....	18	1.8	137	49	353	9.1

[1]For records of wells in Area IV, see table 1 *in* Moulder, Torrey and Koopman (1953).
[2]After 2 hrs of pumping.
[3]After 23 hrs of pumping.

EXPRESSION OF RESULTS

The expression of analytical results in this report is in accordance with Geological Survey Water-Supply Paper 1102 (p. 5–6), which reads as follows:

The dissolved mineral constituents are reported in parts per million. A part per million is a unit weight of a constituent in a million unit weights of water. * * * An equivalent per million is a unit chemical combining weight of a constituent in a million unit weights of water and is calculated by dividing the concentration in parts per million by the chemical combining weight of the constituents. For convenience in making this conversion the reciprocals of chemical combining weights of the most commonly reported constituents are given in the following table:

Constituent [*Basic radicals*]	*Factor*	*Constituent* [*Acid radicals*]	*Factor*
Iron (Fe^{++})	0.0358	Carbonate (CO_3^{--})	0.0333
Iron (Fe^{+++})	.0537	Bicarbonate (HCO_3^-)	.0164
Calcium (Ca^{++})	.0499	Sulfate (SO_4^-)	.0208
Magnesium (Mg^{++})	.0822	Chloride (Cl^-)	.0282
Sodium (Na^+)	.0435	Fluoride (F^-)	.0526
Potassium (K^+)	.0256	Nitrate (NO_3^-)	.0161

Results given in parts per million can be converted to grains per United States gallon by dividing by 17.12. A calculated quantity of sodium and potassium is given in some analyses and is the quantity of sodium needed in addition to the calcium and magnesium to balance against the acid radicals. ***The hardness caused by calcium and magnesium (and other ions if significant) equivalent to the carbonate and bicarbonate is called carbonate hardness; the hardness in excess of this quantity is called noncarbonate hardness.

measurements of surface and ground water—Continued

Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Percentage of carbonate and bicarbonate	Specific conductance (micromhos at 25°C)	pH
VII													
266	0	114	5.5	0.5	1.2	0.12	408	241	23	29	63	643	7.9
485	0	212	13	.2	30	.20	768	461	63	29	60	1,110	8.1
576	0	425	17	.5	.6	.18	1,110	558	86	40	50	1,610	7.4
VIII													
579	14	613	31	0.8	7.6	0.46	1,490	145	0	87	42	2,230	8.3
508	0	490	42	.6	38	.42	1,270	339	0	65	41	1,850	7.8
579	0	505	41	.6	39	.30	1,310	596	121	44	43	1,850	7.9
512	0	418	33	.4	7.4	.15	1,090	476	56	46	46	1,590	7.8
X													
445	0	655	32	0.6	5.5	0.20	1,380	447	82	57	33	1,910	7.7
576	0	305	19	.9	.9	.39	996	233	0	70	58	1,480	7.5
534	16	168	4.5	1.0	1.4	.63	778	17	0	97	71	1,190	8.5
544	0	773	31	.6	48	.52	1,690	542	96	58	33	2,330	7.6

[4]Well bottomed in gravel.
[5]Casing perforated in bedrock and gravel.

In the analyses of most waters used for irrigation, the quantity of dissolved solids is given in tons per acre-foot as well as in parts per million. Percent sodium [percentage of sodium among the cations] has been computed for those analyses where sodium and potassium are reported separately by dividing the equivalents per million of sodium by the sum of the equivalents per million of calcium, magnesium, sodium, and potassium and multiplying the quotient by 100. In analyses where sodium and potassium were calculated and reported as a combined value, the value reported for percent sodium will include the equivalent quantity of potassium. In most waters of moderate to high concentration, the proportion of potassium is much smaller than that of sodium.

* * * Hydrogen-ion concentration (pH) is given as the negative logarithm of the number of moles of ionized hydrogen per liter of water.

Specific conductance, in micromhos at 25°C is an electrical measurement of the ionized salts in solution. Percentage of carbonate and bicarbonate, as used in this report, has been computed by dividing the equivalents per million of carbonate plus bicarbonate by the sum of the equivalents per million of bicarbonate, carbonate, sulfate, chloride, fluoride, and nitrate.

QUALITY OF THE WATER IN RELATION TO SOURCE

In the report area, water derived from bedrock aquifers is extremely soft and the percent sodium is relatively high, whereas water derived from unconsolidated deposits is very hard and the

percent sodium is relatively low. Water from wells tapping both bedrock and unconsolidated deposits is intermediate in chemical character and is referred to as "mixed water." Plotting the percentages of carbonate and bicarbonate and the percent sodium on a diamond graph shows that the source of the three types of water can be identified by the relative concentration of minerals in the water. (See fig. 50.)

BEDROCK

Water from bedrock aquifers contains appreciable quantities of sodium bicarbonate. In general, water from this source is more uniform in concentration than is that from the overlying unconsolidated materials. Renick (1924) states that the softness of the water from the Fort Union formation is caused by natural base-exchange minerals, which are plentiful in the formation. He refers to these minerals as belonging to the leverrierite group, but that name has since been discarded for beidellite (Ross and Hendricks, 1945).

UNCONSOLIDATED DEPOSITS

Water in the unconsolidated deposits has a wide range in concentration of dissolved solids, hardness, and percent sodium. Where water has moved rapidly from the point of recharge to the point of sampling, the dissolved mineral content of the water is less than where the water has been in contact with soluble rock materials for long periods. In places where the water table is high and drainage is poor, the concentration of dissolved solids may be increased as a result of evaporation.

MIXED WATER

Water from wells that tap both unconsolidated and bedrock aquifers or that tap unconsolidated deposits recharged by artesian flow from underlying bedrock is intermediate in chemical quality. The hardness and percent sodium in such mixed water probably are related directly to the relative amount of water from each source.

SURFACE WATER

Only one sample of water was obtained from the Yellowstone River in the report area. The sample was collected at the pumping plant near Fallon in October, at which time the river probably contains a higher percentage of ground water and is more mineralized than during the irrigation season. In addition,

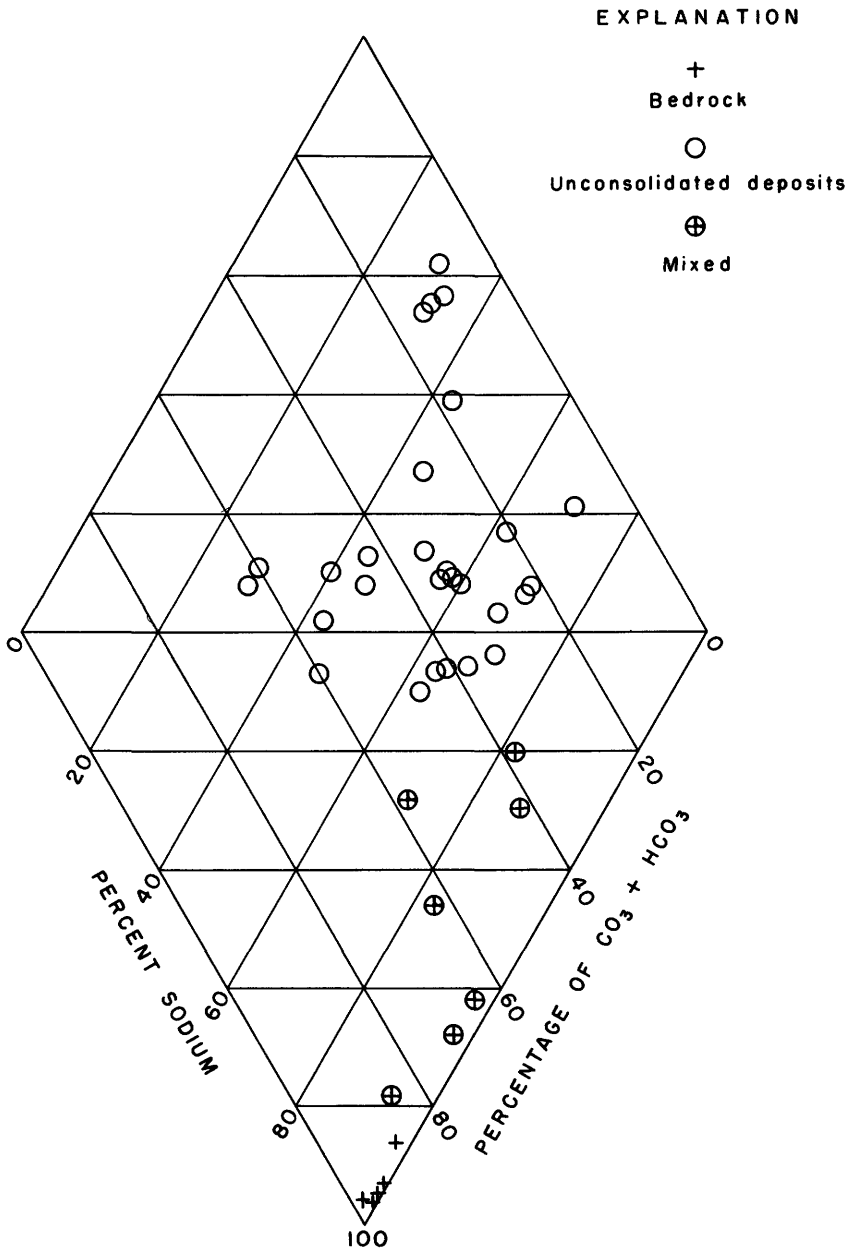

Figure 50. —Relation of the chemical composition of ground water to geologic source.

several samples were collected during the period 1948–50 from the Yellowstone River at Miles City and Sidney. The concentration of dissolved solids in the water at the Fallon pumping plant was 604 ppm (table 4), whereas the highest concentration at either the Miles City or Sidney station throughout the 3-year period was 680 ppm (tables 5 and 6). The sample containing 680 ppm was collected at Sidney, about 50 miles downstream from the report area, where the concentration would more likely be substantially greater than it is in the report area.

In October 1948 a sample of water was collected from a drain in Area VI, and in October 1951 samples were collected from two other drains in the same area. Water in all three drains had a high percent sodium and was highly mineralized and very hard. In chemical composition the water more nearly resembled ground water from the unconsolidated deposits than water from the Yellowstone River.

QUALITY OF THE WATER IN RELATION TO USE

DOMESTIC SUPPLY

Although most of the samples for this study are from test wells, they probably are representative of water used for domestic purposes throughout the report area. Ground water suitable for domestic use may contain variable amounts of dissolved minerals. Some of these minerals, when present even in small amounts, are objectionable in water used in the home as they may affect the health of the user or cause inconvenience or expense.

Excess fluoride (more than 1.5 ppm) in drinking water used by children during the period of calcification of the teeth may cause permanent mottling of tooth enamel. However, the incidence of dental caries (tooth decay) is decreased by a small quantity of fluoride (about 1 ppm) in drinking water (Dean and others, 1941).

Nitrate in water often indicates pollution by sewage or other organic matter. Comly (1945), Waring (1949), Bosch (1950), and others have written articles on the occurrence of cyanosis in infants, in relation to nitrate in drinking water. The National Research Council (Maxcy, 1950), through its Committee on Sanitary Engineering and Environment, recommended that, pending further study, water from private sources having a nitrate content (NO_3) in excess of 45 ppm should be regarded as unsafe for infant feeding.

Iron and manganese in water are objectionable because, if present in sufficient quantities, they stain porcelain, enamel, and fabrics. Iron also may cause turbidity in water and introduce an unpleasant taste.

Large amounts of calcium and magnesium in water may cause much expense and trouble in the home. Scale formed from calcium and magnesium salts reduces flow in hot-water pipes, and excessive hardness leads to increased consumption of soap. Water having a hardness of 120 to 200 ppm is considered to be hard, and domestic users may find softening of the water advantageous. Water much harder than 200 ppm may be expensive to soften or to use untreated.

The U. S. Public Health Service (1946) established standards by which the suitability of water for drinking purposes can be evaluated. The concentrations of chemical substances preferably should not exceed the following limits:

Constituent	*Parts per million*
Iron and manganese (together)	0.3
Magnesium	125
Sulfate	250
Chloride	250
Fluoride	1.5
Dissolved solids	500 (1,000 permitted)

However, people accustomed to drinking highly mineralized water may find less mineralized water, which conforms to these standards, unpalatable.

The concentrations of constituents that exceed the suggested limits are underscored in table 7 for ground water in the report area. Many of the samples from unconsolidated deposits were excessively hard and contained excessive amounts of iron, sulfate, and dissolved solids. A few contained excessive amounts of magnesium and nitrate, but none contained concentrations of fluoride or chloride higher than the standards. Four of the five samples of water from bedrock contained excessive amounts of fluoride. In general, however, water from the bedrock aquifers is of better quality for domestic use than water from the unconsolidated deposits. The analyses of the samples of mixed water indicated that the water is of intermediate chemical quality and, therefore, of median value for domestic use.

IRRIGATION

The Yellowstone River is the only source of water used for irrigation in the report area. In many places, ground water is too

Table 5.— *Mineral constituents and related physical measure-*

[Analytical results in parts per

Date of collection	Discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)
Sept. 10, 1948	4,720	13	0.10	61	27	86	3.2	190
Oct. 26	6,820	9.6	.04	70	28	84		220
Dec. 22	4,550	18	.08	84	29	78		244
Feb. 27, 1949	3,840	20	.03	66	23	55		180
Apr. 25	8,590	17	.10	54	11	73		180
May 26	22,900	16	.15	40	22	20		128
June 24	35,100	13	.10	28	8.1	21		96
Dec. 6	5,880	31	.02	69	23	87		214
Jan. 6, 1950	3,360	20	.04	76	26	77		230
Feb. 8	4,350	17	.02	69	24	81		226
Feb. 9	4,950	21	.02	75	29	72		234
Mar. 2	9,080	21	.04	59	26	59		198
Apr. 6	28,800	21	.02	65	17	77		191
Apr. 21	7,680	17	.02	67	23	79		206
May 10	7,850	11	.04	57	23	85		194
May 18	12,020	17	.02	53	18	62		184
June 2	21,260	18	.04	38	10	30		124
June 19	51,740	11	.04	38	5.7	30		126
July 6	47,180	15	.08	27	6.0	14		87
July 18	27,840	13	.02	30	9.4	24		100
Aug. 2	19,460	16	.02	46	11	43		123
Aug. 6	13,310	14	.04	47	9.6	45		137
Sept. 5	6,530	13	.02	55	18	70		171
Sept. 27	9,920	15	.02	65	18	78		168

Table 6.— *Mineral constituents and related physical measure-*

[Analytical results in parts per

Date of collection	Discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)
Sept. 26, 1948	6,850	17	0.02	65	31	100		220
Oct. 17	6,400	16	.02	66	29	87		220
Apr. 3, 1949	16,900	9.8	.02	60	20	83		162
Apr. 29	9,030	13	.00	66	28	66		194
June 10	37,300	14	.10	38	12	35		124
July 6	17,100	13	.05	32	11	28		108
Aug. 8	4,290	12	.05	47	14	81		167
Mar. 2, 1950	[1]9,200	17	.04	64	25	83		188
Mar. 15	[1]6,000	14	.04	64	25	73		184
Apr. 5	[1]30,000	18	.04	44	14	62		160
May 5	9,160	23	.10	60	26	81		212
May 31	[1]21,400	18	.04	46	12	42		146
July 10	39,400	13	.03	35	4.5	24		102
Aug. 4	14,900	12	.02	53	11	47		131
Sept. 8	4,990	11	.08	55	18	73		166

[1]Mean daily discharge.

ments of Yellowstone River water at Miles City

million except as indicated]

Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids		Hardness as $CaCO_3$		Percent sodium	Specific conductance (micromhos at 25°C)	pH
					Parts per million	Tons per acre-foot	Calcium, magnesium	Non-carbonate			
276	13	0.5	1.0	0.35	592	0.81	263	107	41	767	7.7
258	14	.5	2.1	.20	628	.85	290	110	39	826	8.2
264	14	.6	3.3	.20	628	.85	328	128	34	926	8.4
202	12	.4	3.2	.03	498	.68	259	111	32	745	7.4
168	10	.4	1.8	.....	450	.61	181	33	47	648	7.2
102	14	.3	1.8	.....	276	.38	191	86	18	414	7.0
62	4.0	.2	1.3	.....	196	.27	104	25	31	302	7.1
248	13	.4	4.1	.40	584	.79	267	92	42	841	7.9
242	12	.5	4.7	.....	638	.87	297	108	36	850	7.9
228	15	.2	4.6	.....	582	.79	271	86	40	808	7.6
240	12	.4	4.0	.....	608	.83	307	115	34	850	7.5
200	6.0	.2	4.3	.....	506	.69	254	92	34	714	7.5
215	12	.6	.2	.....	506	.69	232	75	42	747	7.5
230	16	.6	1.7	.....	538	.73	262	93	40	794	7.7
233	12	.4	1.9	.....	540	.73	237	78	44	800	7.8
163	12	.4	4.2	.....	462	.63	207	56	40	618	7.6
88	5.0	.2	1.5	.....	258	.35	136	34	33	394	7.9
69	3.0	.2	3.5	.....	226	.31	119	16	35	355	7.7
43	3.5	.3	1.3	.....	168	.23	92	21	26	256	7.3
71	4.5	.3	1.6	.30	208	.28	114	32	31	335	7.5
135	7.5	.3	1.3	.25	338	.46	161	60	37	516	7.7
124	8.0	.4	1.6	.....	330	.45	157	45	39	494	7.7
201	10	.5	1.8	.....	466	.63	213	73	42	695	7.5
242	11	.4	2.6	.....	542	.74	238	100	42	773	7.8

ments of Yellowstone River water near Sidney

million except as indicated]

Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids		Hardness as $CaCO_3$		Percent sodium	Specific conductance (micromhos at 25°C)	pH
					Parts per million	Tons per acre-foot	Calcium, magnesium	Non-carbonate			
294	13	0.6	2.0	0.18	680	0.92	290	110	43	946	7.5
260	13	.5	2.4	.24	616	.84	284	104	40	878	7.5
250	11	.2	2.8	.12	531	.72	232	99	44	762	7.6
234	12	.4	2.2	.00	543	.74	279	120	34	787	7.6
107	4.0	.3	1.8	.....	286	.39	145	43	35	436	6.8
87	4.0	.3	1.8	.....	244	.33	126	37	33	374	6.8
190	10	.4	1.8	.....	446	.61	175	38	50	678	8.0
260	11	.2	4.4	.....	574	.78	263	109	41	809	7.5
243	10	.2	3.3	.....	544	.74	263	112	38	781	7.6
150	7.0	.3	4.0	.20	460	.63	168	37	44	548	7.9
227	14	.6	2.1	.....	612	.83	257	83	41	836	7.9
119	6.0	.4	2.5	.....	324	.44	165	45	35	491	7.7
64	3.5	.3	2.9	.10	198	.27	106	22	33	300	8.0
153	6.5	.4	3.3	.17	370	.50	177	70	37	534	7.9
208	10	.5	1.8	.22	482	.66	211	75	43	694	8.3

Table 7.—*Concentration of several constituents in water from wells and springs*

[Parts per million. Underscored figures exceed suggested limits]

Well no.		Iron (Fe)	Magnesium (Mg)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$[1] (Calcium, magnesium)
Coordinate system	Field								
Water from unconsolidated deposits									
13-53-10dbc1.....	III Fa1.....	0.29	321	2,130	20	0.8	254	3,630	1,880
-11cd.....	.....	.20	255	2,220	63	.9	22	3,710	1,630
-11daa.....	III Fa4.....	.20	470	3,140	94	.9	115	4,900	2,690
-12acb1.....	III P3.....	.56	360	2,430	46	.8	191	4,070	2,140
-15aac3.....	III P1.....	6.9	283	2,600	31	.7	.5	3,960	2,050
-15dad1.....	III P2.....	1.0	85	775	7.5	.5	.6	1,430	611
-29acb.....	I E1.....	.....	103	825	41	.8	11	1,710	646
14-53-36aa.....	.....	.....	61	292	7.0	1.5	3.7	984	430
-23bdc	V A2.....	.....	78	750	18	.6	1.2	1,760	507
-24ba.....	.....	.20	152	1,840	42	.8	5.8	3,270	965
-28bb.....	.....	.20	272	4,860	26	.6	2.1	7,520	1,650
-28dd.....	IV G3	6.2	102	1,970	35	.8	2.9	3,780	920
-33ba10.....	.....	3.4	103	975	17	.8	3.4	1,920	599
-33bc9.....	IV C4	2.6	58	795	13	.8	.5	1,750	440
-33cd1.....	IV C6	.....	58	304	13	.8	13	920	424
-33da2.....	IV E5.....	4.1	62	625	17	1.0	7.5	1,570	470
15-55-16bab1.....	VIII P2.....	.06	40	490	42	.6	38	1,270	339
-16cbb2.....	VIII Fa1.....	.49	84	505	41	.6	39	1,310	596
-17daa1.....	VIII E4, P1...	.64	58	418	33	.4	7.4	1,090	476
-30cba.....	.....	.09	23	114	5.5	.5	1.2	408	241
-31cbb.....	VII Fa1.....	.51	62	212	13	.2	30	768	461
-31daa1.....	VII A3a.....	1.6	78	425	17	.5	.6	1,110	558
16-55-26bb.....	.....	.10	42	655	32	.6	5.5	1,380	447
-27dcc.....	.....	1.8	49	773	31	.6	48	1,690	542
Water from bedrock									
13-52-25bda.....	I Fa1.....	.....	0.7	71	19	3.0	0.6	901	8
-53-10dbc2.....	III Fa2.....	1.5	.4	8.0	28	2.0	2.5	1,390	9
-11acc2.....	III Fa3.....	.20	.0	10	22	2.2	2.5	824	5
14-54-13dbb.....	VI Fa3.....	.14	.5	38	27	2.8	2.5	878	17
-33cc1.....	.....	.02	2.0	24	24	1.4	.9	1,760	19
Mixed water									
14-55-7bda2.....	VI P2b.....	.....	5.0	86	20	1.6	1.0	924	53
-7dcb.....	VI Fa2.....	0.20	15	233	12	1.0	10	893	108
-18ccc1.....	VI P1.....	.....	36	885	17	1.2	1.1	1,940	260
-18cda.....	VI E6.....	.....	1.1	244	30	2.0	3.2	1,020	27
15-55-4cda.....	.....	.07	15	613	31	.8	7.6	1,490	145
16-55-26ccc1.....	X P1.....	.13	21	305	19	.9	.9	996	233
-27cad.....	X C1.....	.....	1.1	168	4.5	1.0	1.4	778	17

[1]Limit of 120 ppm. A somewhat arbitrary figure.

highly mineralized or has too high a percent sodium to be used safely for irrigation. The results of the analyses of river water (tables 5 and 6) indicate a variation in the chemical quality of the water during the irrigation season. A comparison of applied irrigation water from the Yellowstone River and of ground-water discharge from drains can be made by rating the waters graphically according to their suitability for irrigation. (See fig. 51.) The graphic method of classification of water was proposed by Wilcox (1948). This classification is somewhat arbitrary, however, because the soil composition, permeability, drainage, irrigation practices, precipitation, and crop tolerances must be taken into consideration.

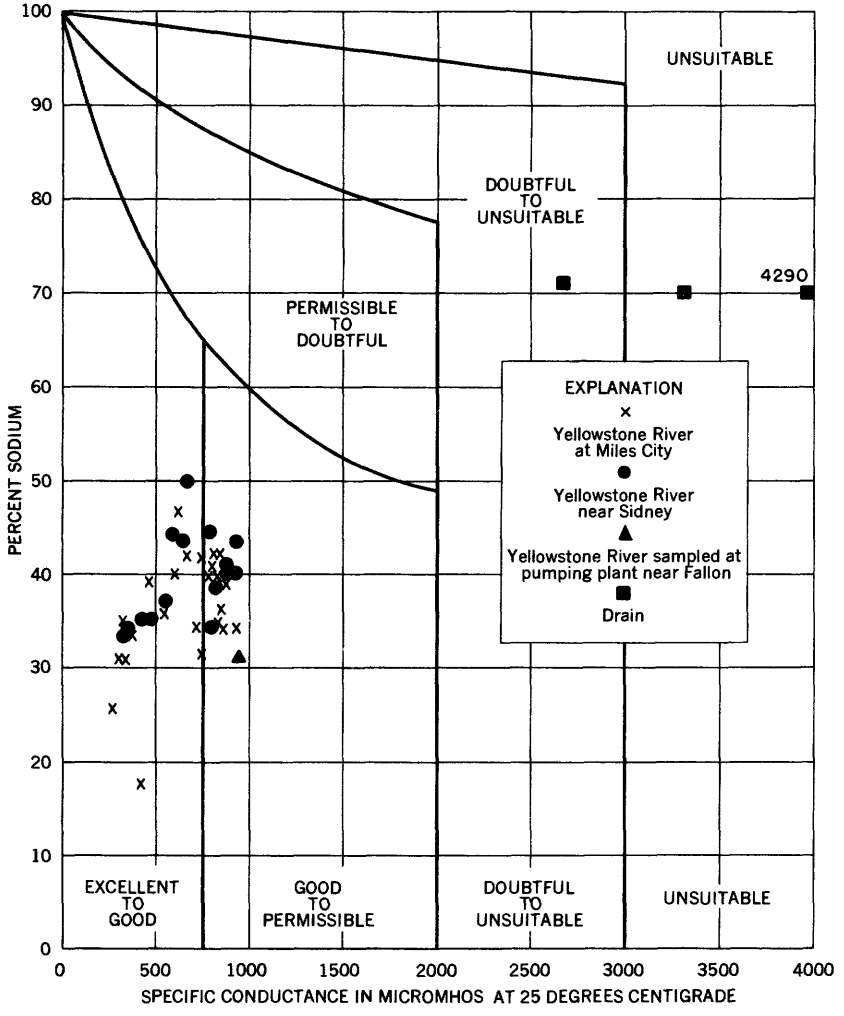

Figure 51.—Classification of water for irrigation use (after Wilcox)

Water from the Yellowstone River rates as excellent to permissible for irrigation. The water is still acceptable for irrigation, even at times when the flow is relatively low. Water from the drains, on the other hand, has a higher percent sodium and is much more highly mineralized than the Yellowstone River water because it is derived from waterlogged areas where the high rate of evaporation causes an increase in concentration of mineral matter.

SELECTED REFERENCES

Alden, W. C., 1932, Physiography and glacial geology of eastern Montana and adjacent areas: U. S. Geol. Survey Prof. Paper 174.

Bosch, H. M., and others, 1950, Methemoglobinemia and Minnesota well supplies: Am. Water Works Assoc. Jour., v. 42, p. 161-170.

Buffalo Rapids Farm Assoc., 1943-51, Water journals, Glendive, Mont.

Calvert, W. R., 1912, Geology of certain lignite fields in eastern Montana: U. S. Geol. Survey Bull. 471-D, p. 187-201.

Comly, H. H., 1945, Cyanosis in infants caused by nitrates in well water: Am. Med. Assoc. Jour., v. 129, p. 112-116.

Cooper, H. H., Jr., and Jacob, C. E., 1946, A generalized graphical method for evaluating formation constants and summarizing well-field history: Am. Geophys. Union Trans., v. 27, no. 4, p. 526-534.

Dean, H. T., Jay, P., Arnold, F. A., Jr., and Elvove, E., 1941, Domestic water and dental caries: Public Health Repts., v. 56, p. 365-381, 761-792.

DeYoung, William, Nunns, F. K., and Smith, L. H., 1939, The lower Yellowstone Valley area, Montana: U. S. Dept. Agriculture Soil Survey Rept., ser. 1932, no. 38.

Donnan, W. W., Aronovici, W. S., Blaney, H. F., 1947, Drainage investigations in irrigated areas of Imperial Valley, Calif.: U. S. Dept. Agriculture, Soil Conserv. Service, Los Angeles, Calif. (Mimeographed rept.)

Jacob, C. E., 1946, Radial flow in a leaky artesian aquifer: Am. Geophys. Union Trans., v. 27, no. 2, p. 198-208.

Maxcy, K. F., 1950, Report on the relation of nitrate concentrations in well waters to the occurrence of methemoglobinemia: Natl. Research Council Bull., Sanitary Engineer, p. 265, App. D.

McConnell, R. C., 1948, Soil and drainage investigations, Buffalo Rapids Irrigation Project, Montana: U. S. Dept. Agriculture, Soil Conserv. Service. (Typed rept.)

Moulder, E. A., Torrey A. E., and Koopman, F. C., 1953, Ground-water factors affecting the drainage of Area IV, First Division, Buffalo Rapids Irrigation Project, Montana: U. S. Geol. Survey Circ. 198.

Poulson, E. N., 1945, Soil and drainage investigations, Buffalo Rapids Irrigation Project, Montana: U. S. Dept. Agriculture, Farm Security Adm. (Typed rept.)

Renick, B. C., 1924, Base exchange in ground water by silicates as illustrated in Montana: U. S. Geol. Survey Water-Supply Paper 520-D, p. 53-72.

Ross, C. S., and Hendricks, S. B., 1945, Minerals of the montmorillonite group, their origin and relation to soils and clays: U. S. Geol. Survey Prof. Paper 205-B, p. 23-79.

Theis, C. V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage: Am. Geophys. Union Trans., v. 16, pt. 2, p. 519-524.

——1938, The significance and nature of the cone of depression in ground-water bodies: Econ. Geology, v. 33, no. 8, p. 889-902.

Torrey, A. E., and Kohout, F. A., 1956, Geology and ground-water resources of the lower Yellowstone River valley between Glendive and Sidney, Mont., with a section on chemical quality of the water, by H. A. Swenson: U. S. Geol. Survey Water-Supply Paper 1355.

Torrey, A. E., and Swenson, F. A., 1951, Ground-water resources of the lower Yellowstone River valley between Miles City and Glendive, Mont., with a section on the chemical quality of the water, by H. A. Swenson: U. S. Geol. Survey Circ. 93.

U. S. Geological Survey, 1952, Quality of surface waters of the United States, 1947: U. S. Geol. Survey Water-Supply Paper 1102, p. 5-6.

U. S. Public Health Service, 1946, Drinking-water standards: Public Health Repts., v. 61, no. 11, p. 371-384.

Waring, F. H., 1949, Significance of nitrates in water supplies: Am. Water Works Assoc. Jour., v. 41, p. 147-150.

Wenzel, L. K., 1942, Methods for determining permeability of water-bearing materials, with special reference to discharging-well methods, with a section on direct laboratory methods and a bibliography on permeability and laminar flow, by V. C. Fishel: U. S. Geol. Survey Water-Supply Paper 887.

Wilcox, L. V., 1948, The quality of water for irrigation use: U. S. Dept. Agriculture Tech. Bull. 962.

BASIC DATA

Table 8.—*Pumping-test data*

Drawdown, test site 1, Area III. September 13, 1951

[Well 13-53-15aab2 (1N2) plugged; no water-level measurements made]

Time since pumping began (constant pumping rate, 25.7 gpm)	Well no.						
	13-53-15aab1 (1N1) (100 feet from pumped well)	13-53-15aac2 (1S1, C3) (87 feet from pumped well)	13-53-15aac6 (1S2) (200 feet from pumped well)	13-53-15aac7 (1E1) (100 feet from pumped well)	13-53-15aac4 (1W1) (100 feet from pumped well)	13-53-15aac5 (1W2) (200 feet from pumped well)	13-53-15aac3 (P1) (pumped well)
Minutes	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.5	.15	.18	.....	.24	.23	.....	.....
3.0	.....	.....	.15	.44	.....	.09	.....
4.5	.50	.54	.....	.64	.64	.....	.....
6.0	.....	.....	.19	.....	.....	.21	.....
7.5	.75	.67	.....	.79	.93	.....	.....
9.0	.....	.....	.31	.79	.....	.32	.....
10.5	.93	.83	.....	.86	1.12	.....	.....
12.0	.....	.....	.38	.95	.....	.42	8.89
13.5	1.07	.95	.....	1.04	1.26	.....	.....
15.0	.....	.....	.46	1.06	.....	.51	.....
16.5	1.17	1.06	.....	1.08	1.41	.....	.....
18.0	.....	.....	.63	1.06	.....	.58	.....
19.5	1.30	1.16	.....	1.14	1.46	.....	.....
21.0	.....	.....	.61	1.18	.....	.65	.....
22.5	1.34	1.23	.....	1.31	1.58	.....	9.33
24.0	.....	.....	.65	1.26	.....	.69	.....
25.5	1.44	1.29	.....	1.31	1.66	.....	.....
27.0	.....	.....	.65	1.35	.....	.75	.....
28.5	1.49	1.30	.....	1.34	1.67	.....	.....
30.0	.....	.....	.85	1.35	.....	.79	.....
31.5	1.46	1.54	.....	1.50	1.76	.....	.....
33.0	.....	.....	.92	1.51	.....	.82	9.58
34.5	1.45	1.49	.....	1.58	1.72	.....	.....
36.0	.....	.....	.86	1.51	.....	.88	.....
37.5	1.69	1.50	.....	1.58	1.85	.....	.....
39.0	.....	.....	.97	1.59	.....	.89	.....
41	1.58	1.66	.....	1.59	1.92	.....	9.68
43	.....	.....	1.02	1.59	.....	.92	.....
45	1.69	1.59	.....	1.59	1.94	.....	.....
47	.....	.....	.96	1.62	.....	.97	.....
49	1.72	1.75	.....	1.71	1.98	.....	.....
51	.....	.....	1.09	1.74	.....	1.00	.....
53	1.74	1.80	.....	1.76	2.00	.....	.....
55	.....	.....	1.12	1.71	.....	1.03	.....
57	1.77	1.82	.....	1.73	2.04	.....	9.83
59	.....	.....	1.15	1.80	.....	1.05	.....
62	.....	1.86	.....	1.81	2.08	.....	.....
64	.....	.....	1.06	1.78	.....	1.07	.....
68	1.84	1.90	.....	1.81	2.07	.....	.....
70	.....	.....	1.18	1.79	.....	1.10	.....
75	1.91	1.77	.....	1.91	2.14	.....	.....
80	.....	.....	1.24	1.84	.....	1.14	.....
82	1.93	1.81	.....	1.81	2.15	.....	.....
87	1.89	.....	1.24	1.89	.....	1.17	.....
92	1.89	1.98	.....	1.86	2.20	.....	.....
100	.....	.....	1.28	1.91	.....	1.19	.....
102	1.91	1.86	.....	.....	2.20	.....	.....
110	.....	.....	1.30	1.91	.....	1.20	10.05
112	1.95	2.01	.....	.....	2.23	.....	.....
120	.....	.....	1.30	1.91	2.23	1.21	10.06
122	1.99	1.94	.....	.....	.....	1.23	.....
130	.....	.....	1.31	1.91	2.24	.....	10.07
132	2.00	2.01	.....	.....	.....	1.23	.....
140	.....	.....	1.32	1.94	2.25	.....	10.09

Table 8.—*Pumping-test data*—Continued

Drawdown, test site 1, Area III. September 13, 1951—Continued

Time since pumping began (constant pumping rate, 25.7 gpm)	Well no. 13-53-15aab1 (1N1) (100 feet from pumped well)	13-53-15aac2 (1S1, C3) (87 feet from pumped well)	13-53-15aac6 (1S2) (200 feet from pumped well)	13-53-15aac7 (1E1) (100 feet from pumped well)	13-53-15aac4 (1W1) (100 feet from pumped well)	13-53-15aac5 (1W2) (200 feet from pumped well)	13-53-15aac3 (P1) (pumped well)
Minutes	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*
142	2.01	2.04	.....	.....	.....	1.24	.....
150	.....	.....	1.32	1.98	.....	1.25	10.09
152	2.03	1.96	.....	.....	2.27	.....	.....
160	.....	.....	1.27	2.06	.....	1.25	.....
162	2.03	2.06	.....	.....	2.27	.....	10.11
170	.....	.....	1.31	2.01	.....	1.25	.....
172	2.03	1.99	.....	.....	2.27	.....	10.13
180	.....	.....	1.31	2.03	.....	1.26	.....
182	2.04	2.03	.....	.....	2.28	.....	10.13
195	2.04	.....	.....	.....	2.29	.....	.....
196[a]	.....	.....	.....	.....	.....	.....	.....

[a]Pumping stopped.

Residusl drawdown, test site 1, Area III. September 13, 1951

Time since pumping stopped	Well 13-53-15aac3 (III P1)	Time since pumping stopped	Well 13-53-15aac3 (III P1)	Time since pumping stopped	Well 13-53-15aac3 (III P1)	Time since pumping stopped	Well 13-53-15aac3 (III P1)
Minutes	*Feet*	*Minutes*	*Feet*	*Minutes*	*Feet*	*Minutes*	*Feet*
0	10.13	18.0	0.86	39.0	0.45	64	0.25
1.5	2.29	19.5	.81	41	.43	68	.23
3.0	1.92	21.0	.77	43	.41	80	.20
4.5	1.68	22.5	.73	45	.39	87	.17
6.0	1.53	24.0	.69	47	.37	92	.15
7.5	1.40	25.5	.65	49	.35	100	.13
9.0	1.29	27.0	.63	51	.33	112	.12
10.5	1.19	28.5	.59	53	.32	140	.08
12.0	1.11	33.0	.51	55	.31	162	.07
13.5	1.04	34.5	.50	59	.28	170	.07
15.0	.97	36.0	.48	62	.26	180	.07
16.5	.92	37.5	.46				

Table 8.— *Pumping-test data*— Continued

Drawdown, test site 2, Area III. September 27, 1951

Time since pumping began (constant pumping rate, 22.5 gpm)	Well no. 13-53-14cbc1 (2N1) (200 feet from pumped well)	13-53-15dad3 (2S1) (100 feet from pumped well)	13-53-14cbc2 (2E1) (100 feet from pumped well)	13-53-15dad4 (2W1) (200 feet from pumped well)	13-53-15dad2 (P2a) (1 foot from pumped well)
Minutes	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*
0	0.00	0.00	0.00	0.00	0.00
1	.01	.21	.29	.01	.....
2	.07	.31	.43	.05	.....
3	.11	.54	.51	.08	.....
4	.11	.56	.62	.10	.....
5	.06	.67	.69	.12	.....
6.5	.15	.80	.77	.16	.....
8	.10	.81	.85	.17	.....
10	.19	.92	.90	.20	2.56
12	.22	.93	.94	.22	.....
14	.23	1.06	.96	.24	.....
16	.24	1.08	1.04	.25	2.64
18	.25	1.11	1.05	.27	2.71
20	.26	1.13	1.06	.28	2.74
23	.27	1.10	1.08	.28	2.75
26	.27	1.15	1.09	.29	2.81
29	.28	1.19	1.10	.29	2.81
32	.29	1.20	1.12	.31	.....
35	.30	1.21	1.13	.32	.....
38	.31	1.22	1.14	.32	2.83
42	.29	1.23	1.16	.33	.....
46	.30	1.24	1.16	.33	2.87
50	.29	1.23	1.17	.33	.....
55	.33	1.23	1.18	.33	.....
60	.35	1.26	1.18	.33	2.87
65	.35	1.28	1.19	.35	.....
70	.36	1.28	1.20	.35	2.89
75	.37	1.29	1.21	.36	.....
80	.37	1.29	1.21	.36	2.91
90	.38	1.31	1.23	.36	2.91
100	.38	1.31	1.23	.38	2.91
110	.40	1.33	1.24	.38	2.95
120	.40	1.33	1.24	.38	2.96
140	.42	1.35	1.25	.39	2.97
160	.43	.....	1.26	.41	2.98
180	.45	1.36	1.27	.41	2.97
181[a]	.....	.....	.....	.....	.....

[a] Pumping stopped.

Residual drawdown, test site 2, Area III, September 27, 1951

Time since pumping stopped	Well 13-53-15dad2 (P2a)	Time since pumping stopped	Well 13-53-15dad2 (P2a)	Time since pumping stopped	Well 13-53-15dad2 (P2a)
Minutes	*Feet*	*Minutes*	*Feet*	*Minutes*	*Feet*
0	2.97	18	0.25	60	0.15
1	.96	20	.24	65	.14
2	.78	23	.22	70	.14
3	.68	26	.19	75	.13
4	.61	29	.17	80	.12
5	.54	32	.19	90	.12
6.5	.47	35	.18	100	.11
8	.42	38	.18	110	.10
10	.37	42	.17	120	.10
12	.34	46	.17	140	.09
14	.30	50	.16	160	.08
16	.28	55	.15	180	.08

Table 8.— *Pumping-test data*—Continued

Drawdown, test site 3, Area III. September 17, 1951

Time since pumping began (constant pumping rate, 33.3 gpm)	Well no. 13-53-12acb3 (3N1) (50 feet from pumped well)	13-53-12acc1 (3S1) (100 feet from pumped well)	13-53-12acb2 (3E1) (50 feet from pumped well)	13-53-12acc2 (3W1) (100 feet from pumped well)	13-53-12acb1 (P3) (pumped well)
Minutes	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*
0	0.00	0.00	0.00	0.00	0.00
1	.25	.02	.08	.16	.....
2	.27	.03	.09	.18	.....
3	.28	.03	.11	.18	.....
4	.28	.03	.13	.19	.....
5	.27	.03	.15	.19	.....
6.5	.28	.04	.16	.20	.....
8	.29	.04	.18	.20	.....
10	.29	.05	.16	.20	2.65
12	.30	.05	.20	.21	.....
14	.31	.06	.17	.22	2.69
16	.31	.05	.19	.22	.....
18	.31	.05	.19	.22	.....
20	.31	.06	.21	.22	2.69
23	.31	.06	.23	.22	.....
26	.32	.07	.21	.23	2.70
29	.33	.07	.19	.23	.....
32	.33	.07	.21	.23	.....
35	.33	.08	.22	.23	2.72
38	.33	.08	.20	.24	.....
42	.34	.09	.22	.24	.....
46	.33	.09	.24	.24	.....
50	.34	.09	.23	.25	.....
55	.34	.09	.24	.26	.....
60	.34	.09	.25	.26	2.75
65	.35	.09	.23	.26	2.74
70	.35	.10	.26	.26	2.74
75	.35	.10	.24	.26	.....
80	.36	.10	.25	.26	2.76
90	.36	.11	.26	.27	2.76
100	.37	.12	.26	.27	2.81
110	.37	.13	.26	.27	.....
120	.38	.14	.24	.27	2.81
140	.38	.14	.26	.27	2.77
160	.39	.14	.26	.28	2.83
180	.39	.16	.26	.29	.....
200	.40	.16	.26	.29	.....
210[b]	.....	.....	.....	.....	.....
220	.41	.17	.28	.29	.....
240	.41	.18	.30	.31	2.78
270	.42	.19	.29	.32	2.81
300	.43	.20	.32	.32	2.86
330	.44	.20	.34	.34	2.84
360	.44	.21	.36	.34	2.84
361[a]	.....	.....	.....	.....	.....

[a]Pumping stopped.
[b]Pumping stopped for 40 seconds.

Residual drawdown, test site 3, Area III. September 17, 1951

Time since pumping stopped	Well 13-53-12acb1 (P3)	Time since pumping stopped	Well 13-53-12acb1 (P3)	Time since pumping stopped	Well 13-53-12acb1 (P3)	Time since pumping stopped	Well 13-53-12acb1 (P3)
Minutes	*Feet*	*Minutes*	*Feet*	*Minutes*	*Feet*	*Minutes*	*Feet*
0	2.84	3	0.17	6.5	0.14	12	0.13
1	.22	4	.16	8	.14	14	.12
2	.17	5	.15	10	.13	16	.12

Table 8.— *Pumping-test data*— Continued

Residual drawdown, test site 3, Area III, September 17, 1951—Continued

Time since pumping stopped	Well 13-53-12acb1 (P3)	Time since pumping stopped	Well 13-53-12acb1 (P3)	Time since pumping stopped	Well 13-53-12acb1 (P3)	Time since pumping stopped	Well 13-53-12acb1 (P3)
Minutes	*Feet*	*Minutes*	*Feet*	*Minutes*	*Feet*	*Minutes*	*Feet*
18	0.11	26	0.11	38	0.10	50	0.10
20	.11	29	.11	42	.10	55	.09
23	.11	35	.10	46	.10	60	.09

Drawdown, test site 1, Area VI. October 9, 1951

Time since pumping began (constant pumping rate, 13.2 gpm)	Well no. 14-55-18ccc2 (1N1) (100 feet from pumped well)	Well no. 14-55-18ccc3 (1E1) (50 feet from pumped well)	Well no. 14-55 18ccc4 (1W1, C4) (50 feet from pumped well)	Time since pumping began (constant pumping rate, 13.2 gpm)	Well no. 14-55-18ccc2 (1N1) (100 feet from pumped well)	Well no. 14-55-18ccc3 (1E1) (50 feet from pumped well)	Well no. 14-55-18ccc4 (1W1, C4) (50 feet from pumped well)
Minutes	*Feet*	*Feet*	*Feet*	*Minutes*	*Feet*	*Feet*	*Feet*
0	0.00	0.00	0.00	30	0.24	0.45	0.26
1	.09	.24	.....	34	.26	.46	.27
2	.05	.28	.....	38	.27	.47	.28
3	.06	.31	.....	43	.27	.48	.29
4	.09	.33	.....	48	.28	.49	.29
5	.12	.34	.....	53	.29	.50	.30
6.5	.14	.35	.19	58	.30	.50	.30
8	.15	.36	.....	64	.30	.51	.31
10	.19	.38	.20	70	.31	.52	.32
12	.19	.39	.22	80	.32	.53	.33
14	.20	.40	.22	90	.33	.55	.34
16	.20	.40	.23	100	.34	.55	.34
18	.28	.41	.23	120	.35	.57	.36
21	.22	.42	.24	140	.37	.59	.37
24	.24	.43	.25	147	.....	.59	.....
27	.25	.44	.26				

Drawdown, test site 2, Area VI. October 10, 1951

Time since pumping began (constant pumping rate, 22.5 gpm)	Well no. 14-55-7bda3 (2N1) (50 feet from pumped well)	Well no. 14-55-7bda4 (2S1) (50 feet from pumped well)	Well no. 14-55-7bda5 (2W1, G3) (100 feet from pumped well)	Time since pumping began (constant pumping rate, 22.5 gpm)	Well no. 14-55-7bda3 (2N1) (50 feet from pumped well)	Well no. 14-55-7bda4 (2S1) (50 feet from pumped well)	Well no. 14-55-7bda5 (2W1, G3) (100 feet from pumped well)
Minutes	*Feet*	*Feet*	*Feet*	*Minutes*	*Feet*	*Feet*	*Feet*
0	0.00	0.00	0.00	38	0.46	0.41	0.33
1	.28	.17	.....	42	.46	.41	.34
2	.33	.32	.....	46	.47	.42	.34
3	.37	.34	.26	50	.47	.42	.34
4	.39	.36	.....	55	.48	.42	.34
5	.40	.37	.30	60	.48	.42	.34
6.5	.41	.38	.31	66	.48	.42	.34
8	.41	.39	.31	72	.49	.43	.34
10	.42	.39	.31	80	.49	.43	.35
12	.43	.39	.32	90	.50	.44	.35
14	.43	.39	.32	100	.51	.45	.35
16	.44	.40	.32	120	.52	.46	.36
18	.44	.40	.32	154	.54	.48	.37
21	.45	.40	.32	187	.55	.49	.38
25	.45	.41	.33	219	.56	.50	.39
27	.45	.41	.33	247	.57	.51	.39
30	.46	.41	.33	275	.58	.51	.41
34	.46	.41	.33				

Table 8.—*Pumping-test data*—Continued

Drawdown, test site A3, Area VII. October 17, 1951

Time since pumping began (constant pumping rate, 34.6 gpm)	Well no. 15-55-31daa1 (A3a) (pumped well)	Well no. 15-55-31daa2 (A3b) (92 feet from pumped well)	Time since pumping began (constant pumping rate, 34.6 gpm)	Well no. 15-55-31daa1 (A3a) (pumped well)	Well no. 15-55-31daa2 (A3b) (92 feet from pumped well)
Minutes	*Feet*	*Feet*	*Minutes*	*Feet*	*Feet*
0	0.00	0.00	27	1.10	0.10
1	.....	.03	30	1.10	.11
2	.....	.04	34	1.10	.11
3	.....	.05	38	1.10	.12
4	1.01	.05	42	1.11	.12
5	.....	.05	46	1.12	.12
6.5	1.07	.05	50	1.12	.12
8	1.08	.06	55	1.12	.12
10	1.08	.07	60	1.05	.13
12	1.09	.08	66	1.07	.13
14	1.05	.08	72	1.07	.13
16	1.08	.08	80	1.08	.13
18	1.08	.09	90	1.09	.14
21	1.08	.09	100	1.10	.15
24	1.10	.10	120	1.10	.15

Drawdown, test site 1, Area VII. October 11, 1951

Time since pumping began (constant pumping rate, 30.0 gpm)	Well no. 15-55-31aab (1N1,C1) (50 feet from pumped well)	Well no. 15-55-31abd2 (1S1) (100 feet from pumped well)	Well no. 15-55-31abd1 (1W1) (50 feet from pumped well)	Time since pumping began (constant pumping rate, 30.0 gpm)	Well no. 15-55-31aab (1N1,C1) (50 feet from pumped well)	Well no. 15-55-31abd2 (1S1) (100 feet from pumped well)	Well no. 15-55-31abd1 (1W1) (50 feet from pumped well)
Minutes	*Feet*	*Feet*	*Feet*	*Minutes*	*Feet*	*Feet*	*Feet*
0	0.00	0.00	0.00	42	0.15	0.10	0.10
1	.06	.03	.....	46	.16	.11	.10
2	.08	.03	.....	50	.16	.10	.11
3	.08	.04	.04	55	.16	.11	.11
4	.09	.05	.....	60	.16	.11	.11
5	.09	.04	.05	66	.16	.11	.12
6.5	.09	.05	.06	72	.17	.11	.12
8	.10	.07	.06	80	.17	.12	.12
10	.10	.08	.07	90	.17	.12	.12
12	.11	.08	.07	100	.18	.12	.12
14	.12	.08	.08	120	.19	.13	.13
16	.13	.08	.08	140	.19	.13	.13
18	.12	.09	.08	160	.19	.13	.13
21	.13	.09	.08	190	.20	.14	.14
24	.13	.09	.09	220	.21	.15	.15
27	.14	.09	.09	250	.21	.15	.15
30	.14	.09	.09	280	.22	.15	.15
34	.15	.10	.09	310	.21	.15	.15
38	.15	.10	.10	340	.22	.15	.16

Table 8.—*Pumping-test data*—Continued

Drawdown, test site 1, Ares VIII. October 2, 1951

Time since pumping began (constant pumping rate, 60.0 gpm)	Well no.						
	15-55-17add (1N1) (100 feet from pumped well)	15-55-17daa3 (1S1) (200 feet from pumped well)	15-55-17daa2 (1E1) (104 feet from pumped well)	15-55-16cbb1 (1E2) (200 feet from pumped well)	15-55-17daa4 (1W1) (100 feet from pumped well)	15-55-17daa5 (1W2) (200 feet from pumped well)	15-55-17daa1 (P1, E4) (pumped well)
Minutes	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	.....	.....	.02	.....	.01	.....	.....
4	.02	.00	.....	.....	.....	.....	.....
6	.....	.....	.....	.00	.....	.01	.....
8	.....	.....	.04	.....	.02	.....	.....
10	.03	.01	.....	.....	.....	.....	6.23
12	.....	.....	.....	.00	.....	.01	.....
14	.....	.....	.05	.....	.03	.....	.....
16	.04	.01	.....	.....	.....	.....	6.24
18	.....	.....	.....	.01	.....	.02	.....
20	.....	.....	.04	.....	.04	.....	.....
22	.04	.00	.....	.....	.....	.....	.....
25	.....	.....	.07	.01	.....	.02	6.20
28	.06	.00	.....	.....	.06	.....	.....
31	.....	.....	.08	.01	.....	.01	.....
34	.06	.00	.....	.....	.07	.....	.....
37	.....	.....	.08	.01	.....	.02	.....
40	.05	.02	.....	.....	.07	.....	.....
44	.....	.....	.08	.01	.....	.02	.....
48	.05	.02	.....	.....	.08	.....	.....
52	.....	.....	.09	.02	.....	.02	.....
56	.06	.02	.....	.....	.08	.....	.....
60	.....	.....	.09	.02	.....	.03	.....
68	.08	.02	.....	.....	.09	.....	.....
70	.....	.....	.10	.02	.....	.04	.....
84	.08	.03	.....	.....	.09	.....	.....
86	.....	.....	.10	.02	.....	.03	.....
98	.09	.03	.....	.....	.10	.....	.....
100	.....	.....	.10	.03	.....	.03	.....
116	.09	.03	.....	.....	.11	.....	.....
118	.....	.....	.11	.03	.....	.03	.....
132	.10	.04	.....	.....	.11	.....	.....
134	.....	.....	.11	.03	.....	.04	.....
154	.10	.04	.....	.....	.11	.....	.....
156	.....	.....	.12	.04	.....	.04	.....
174	.10	.05	.....	.....	.....	.....	.....
176	.....	.....	.11	.04	.11	.04	.....
194	.10	.06	.....	.....	.....	.....	.....
196	.....	.....	.12	.05	.11	.06	.....
214	.12	.06	.....	.....	.....	.....	.....
216	.....	.....	.12	.05	.11	.06	.....
234	.12	.07	.....	.....	.....	.....	.....
236	.....	.....	.13	.05	.12	.07	.....
254	.12	.07	.....	.....	.....	.....	.....
256	.....	.....	.13	.06	.12	.07	.....
277	.12	.07	.....	.....	.....	.....	.....
279	.....	.....	.14	.06	.12	.06	.....
290	.....	.....	.....	.....	.....	.....	6.47
293[a]	.....	.....	.....	.....	.....	.....	.....

[a]Pumping stopped.

Table 8.— *Pumping-test data*—Continued

Residual drawdown, teat site 1, Area VIII. October 2, 1951

Time since pumping stopped	Well 15-55-17daa1 (P1, E4)	Time since pumping stopped	Well 15-55-17daa1 (P1, E4)	Time since pumping stopped	Well 15-55-17daa1 (P1, E4)
Minutes	*Feet*	*Minutes*	*Feet*	*Minutes*	*Feet*
0	6.48	10	0.12	29	0.09
1	.21	12	.11	32	.09
2.5	.17	14	.11	35	.09
3	.15	16	.10	38	.09
4	.15	18	.10	42	.08
5	.14	20	.10	49	.08
6.5	.13	23	.10	55	.07
8	.13	26	.09		

Drawdown, test site 2, Area VIII. September 28, 1951

Time since pumping began (constant pumping rate, 25.0 gpm)	Well no.			
	15-55-16bab2 (2N1, FG) (100 feet from pumped well)	15-55-16bac (2S1) (50 feet from pumped well)	15-55-16bab4 (2E1) (100 feet from pumped well)	15-55-16bab3 (2W1) (100 feet from pumped well)
Minutes	*Feet*	*Feet*	*Feet*	*Feet*
0	0.00	0.00	0.00	0.00
1	.01	.04	.....	.00
2	.02	.06	.....	.00
3	.02	.07	.....	.01
4	.03	.10	.....	.01
5	.03	.09	.....	.01
6.5	.03	.10	.....	.00
8	.04	.10	.05	.00
10	.05	.10	.05	.02
12	.05	.11	.06	.02
14	.05	.12	.07	.01
16	.05	.13	.07	.00
18	.06	.13	.08	.02
20	.06	.14	.08	.02
23	.06	.14	.08	.03
26	.07	.15	.09	.04
29	.09	.16	.10	.04
32	.08	.16	.10	.05
35	.07	.16	.10	.04
38	.08	.17	.11	.05
42	.09	.18	.11	.05
46	.09	.18	.12	.04
50	.09	.18	.12	.05
55	.09	.19	.13	.05
60	.10	.20	.13	.06
65	.11	.21	.13	.05
70	.11	.21	.14	.07
75	.11	.21	.14	.07
80	.12	.22	.15	.06
90	.12	.22	.15	.07
100	.12	.23	.15	.07
110	.12	.23	.15	.08
120	.13	.23	.16	.07
140	.14	.24	.18	.07
160	.14	.24	.18	.07
180	.14	.....	.19	.09
200	.16	.26	.19	.10
220	.16	.27	.20	.11
240	.16	.27	.20	.11

Table 8.—*Pumping-test data*—Continued

Drawdown, test site 1, Area X. October 12, 1951

Time since pumping began (constant pumping rate, 24.3 gpm)	Well no. 16-55-26ccc2 (1N1) (50 feet from pumped well)	Well no. 16-55-26ccc4 (1S1, B2) (50 feet from pumped well)	Well no. 16-55-26ccc3 (1E1) (100 feet from pumped well)	Time since pumping began (constant pumping rate, 24.3 gpm)	Well no. 16-55-26ccc2 (1N1) (50 feet from pumped well)	Well no. 16-55-26ccc4 (1S1, B2) (50 feet from pumped well)	Well no. 16-55-26ccc3 (1E1) (100 feet from pumped well)
Minutes	*Feet*	*Feet*	*Feet*	*Minutes*	*Feet*	*Feet*	*Feet*
0	0.00	0.00	0.00	42	0.22	0.23	0.03
1	.....	.15	.01	46	.23	.23	.04
2	.17	.16	.02	50	.23	.23	.03
3	.....	.17	.01	55	.23	.24	.04
4	.18	.17	.02	60	.24	.24	.04
5	.....	.17	.02	65	.24	.24	.04
6.5	.19	.18	.03	72	.25	.25	.04
8	.19	.19	.03	80	.25	.25	.04
10	.19	.20	.03	90	.25	.25	.04
12	.20	.20	.02	100	.25	.25	.04
14	.21	.20	.03	120	.26	.26	.04
16	.21	.20	.03	140	.26	.27	.05
18	.21	.20	.03	160	.27	.28	.05
21	.21	.21	.03	180	.28	.28	.05
24	.21	.21	.03	210	.28	.28	.05
27	.22	.21	.03	240	.28	.30	.05
30	.22	.22	.03	270	.29	.30	.05
34	.22	.22	.03	300	.32	.31	.07
38	.22	.22	.03	333	.32	.32	.07

Table 9—*Logs of wells and test holes*

[Unless otherwise indicated, all holes were logged by personnel of either the U. S. Bureau Reclamation or U. S. Geological Survey. An asterisk (*) indicates hole was logged by commercial driller.]

AREA I

	Thickness (feet)	Depth (feet)
13-52-24dca (I Cb1)		
Loam	0.5	0.5
Loam, clayey	5.0	5.5
Loam, sandy and clayey	5.0	10.5
Loam, silty and clayey	2.5	13.0
13-52-25bda (I Fa1)*		
Sand and silt	24.0	24.0
Gravel, sandy, coarse	18.0	42.0
Claystone, soft, plastic	2.6	44.6
Claystone, green, plastic	11.4	56.0
Coal and carbonaceous shale	3.0	59.0
Siltstone, clayey, light-gray	6.0	65.0
Sandstone, clayey, fine-grained	15.0	80.0
Siltstone. Hard concretion at 80 feet	11.0	91.0
Coal	3.0	94.0
Claystone, gray	17.0	111.0
Coal	2.0	113.0
Siltstone, clayey, variably carbonaceous	67.0	180.0
Coal	7.0	187.0
Claystone, gray	10.0	197.0
Shale, light-gray, hard	3.0	200.0
Claystone	9.0	209.0
Shale, gray, hard	1.0	210.0
Shale with thin coal seams	10.0	220.0
Claystone, gray, plastic	20.0	240.0
Claystone. Thin coal seams at 263 feet	30.0	270.0
Sandstone, fine-grained, uncemented	16.0	286.0
Claystone with hard concretions	5.0	291.0
Sandstone, fine-grained, medium-hard	46.0	337.0
Claystone, variably carbonaceous	57.0	394.0
Siltstone, hard	25.0	419.0
Siltstone, greenish-gray, soft	41.0	460.0
Sandstone, fine-grained, uncemented	12.0	472.0
Claystone	10.0	482.0
Sandstone, silty	29.0	511.0
Siltstone, greenish-gray, medium-hard	59.0	570.0
Sandstone, medium-grained, gray, poorly cemented; principal aquifer	41.0	611.0
13-53-19cba (I Cb2)		
Loam	0.5	0.5
Loam, clayey	9.5	10.0
13-53-19dba (I Cb3)		
Loam	0.8	0.8
Loam, sandy and clayey	3.7	4.5
Gravel, sandy	2.5	7.0
Sand, silty	6.0	13.0
13-53-19ddc (I C1)		
Clay, medium	8.5	8.5
Loam, very fine sandy	1.7	10.2
Loam, silty	1.8	12.0

Table 9.—*Logs of wells and test holes* —Continued

AREA I—Continued

	Thickness (feet)	Depth (feet)
13-53-19ddc (I C1)—Continued		
Gravel and cobbles	4.0	16.0
Gravel and sand	3.9	19.9
13-53-29acb (I E1)		
Loam	1.0	1.0
Loam, clayey	1.0	2.0
Loam, fine sandy	2.0	4.0
Loam, silty and clayey	2.5	6.5
Clay, medium	2.5	9.0
Loam, silty and clayey	2.5	11.5
Gravel, coarse	6.6	18.1
13-53-29acc (I B1 2/3)		
Loam, silty	5.5	5.5
Loam, fine sandy	1.0	6.5
Sand	1.5	8.0
Gravel	2.0	10.0
13-53-29bbc (I C2)		
Loam, very fine sandy	2.0	2.0
Loam, silty	1.5	3.5
Loam, very fine sandy	2.0	5.5
Gravel	6.5	12.0
13-53-29bcd1 (I C3a)		
Loam, clayey	2.0	2.0
Clay, light	2.0	4.0
Loam, sandy and clayey	.5	4.5
Clay, heavy	1.5	6.0
Loam, silty	.5	6.5
Clay, heavy	.5	7.0
Loam, sandy	.5	7.5
Clay, heavy	.7	8.2
Loam, silty and clayey	1.0	9.2
Clay, heavy	5.8	15.0
Sand and loam, sandy	2.0	17.0
Clay, heavy	2.5	19.5
Sand	1.5	21.0
Gravel	2.5	23.5
13-53-29bcd2 (I C3b)		
Loam, clayey	2.0	2.0
Clay, light	2.0	4.0
Loam, sandy and clayey	.5	4.5
Clay, heavy	1.5	6.0
13-53-29bcd3 (I C3 1/3)		
Loam, silty	3.0	3.0
Clay, light	1.0	4.0
Loam, silty	1.3	5.3

Table 9.—*Logs of wells and test holes* —Continued

AREA I—Continued

	Thickness (feet)	Depth (feet)
13-53-29bcd3 (I C3 1/3)—Continued		
Loam, fine sandy	1.7	7.0
Loam, silty	.3	7.3
Sand	.7	8.0
Gravel	1.0	9.0
13-53-29bda (I D1 1/3)		
Loam, silty	1.5	1.5
Clay, medium	6.5	8.0
Loam, silty	2.0	10.0
Loam, fine sandy	1.5	11.5
Sand	1.5	13.0
Gravel	.....	.....
13-53-29bdb (I D1)		
Loam	1.0	1.0
Loam, silty	1.5	2.5
Clay, light	1.0	3.5
Loam, sandy and clayey	1.5	5.0
Loam, fine sandy	2.0	7.0
Gravel, sandy	1.0	8.0
Gravel	8.5	16.5
13-53-29cab (I C3 2/3)		
Loam	1.0	1.0
Loam, silty	1.5	2.5
Loam, sandy	2.0	4.5
Clay, light	2.0	6.5
Sand, fine loamy	2.0	8.5
Sand	1.5	10.0
Gravel	.....	.....
13-53-29cbb (I B1 1/3)		
Loam	2.0	2.0
Clay, medium	2.0	4.0
Loam, silty	2.0	6.0
Loam, fine sandy	2.5	8.5
Loam, silty	.7	9.2
Sand and gravel	.8	10.0
13-53-29cbc (I B1 2/3)		
Loam, sandy and clayey	15.0	15.0
Gravel	.....	.....
13-53-30add (I B1)		
Loam	1.0	1.0
Clay, light	2.5	3.5
Clay, medium	3.0	6.5
Loam, silty and clayey	1.5	8.0

Table 9.—*Logs of wells and test holes*—Continued

AREA I—Continued

	Thickness (feet)	Depth (feet)
13-53-30add (I B1)—Continued		
Loam, silty	1.5	9.5
Clay, heavy	3.0	12.5
Loam, silty	5.3	17.8
Sand	1.2	19.0
Gravel	1.5	20.5
Coal	1.0	21.5
Clay, heavy	3.7	25.2
Sandstone (?)	.....	.....
13-53-30bbb (I A1)		
Clay, medium	1.0	1.0
Loam, clayey	2.0	3.0
Clay, medium	6.0	9.0
Loam, silty	2.0	11.0
Gravel	5.5	16.5
Sand	6.5	23.0
Gravel	10.2	33.2
13-53-30bdd (I A2)		
Clay, light	1.0	1.0
Loam, sandy and clayey	2.0	3.0
Loam, silty and clayey	2.5	5.5
Clay, light	1.5	7.0
Loam, sandy	2.5	9.5
Gravel, coarse	8.8	18.3
13-53-30dac (I A3)		
Loam, silty and clayey	2.0	2.0
Loam, very fine sandy	5.5	7.5
Loam, sandy and clayey	2.0	9.5
Clay, medium	1.5	11.0
Loam, sandy and clayey	1.5	12.5
Sand	2.5	15.0
Gravel, coarse	4.0	19.0
13-53-30ddb (I A3 1/2)		
Loam, silty, and loam, silty and clayey	5.0	5.0
Sand	2.0	7.0
Gravel	.....	.....

AREA II

13-53-15ccb (II D2)		
Loam, very fine sandy	4.5	4.5
Loam, clayey	1.0	5.5
Loam, very fine sandy	4.5	10.0
Loam, fine sandy	1.5	11.5
Sand and gravel	3.5	15.0
Gravel	3.4	18.4

Table 9.—*Logs of wells and test holes*—Continued

AREA II—Continued

	Thickness (feet)	Depth (feet)
13-53-16baa (II D1)		
Loam	1.0	1.0
Loam, silty and clayey	1.5	2.5
Loam, silty	2.0	4.5
Loam, silty and clayey	.5	5.0
Gravel, sandy	7.0	12.0
Sand, gravelly	6.2	18.2
13-53-16bdb (II C1)		
Loam, silty	2.0	2.0
Loam, very fine sandy	2.0	4.0
Clay, light	1.7	5.7
Clay, heavy	4.3	10.0
Clay, medium	3.0	13.0
Loam, silty	4.5	17.5
Loam, sandy, and sand	3.5	21.0
Gravel	4.0	25.0
13-53-16dbc (II C2)		
Clay, medium	3.0	3.0
Loam, clayey	1.5	4.5
Loam, sandy and clayey	1.0	5.5
Clay, medium	1.0	6.5
Sand	1.0	7.5
Gravel	.5	8.0
Sand	2.0	10.0
Gravel	7.6	17.6
13-53-16ddb (II C3)		
Loam, very fine sandy	1.0	1.0
Loam, silty	2.0	3.0
Loam, silty and clayey	1.0	4.0
Gravel	4.5	8.5
Gravel, sandy	7.1	15.6
13-53-17aaa (II Cb6)		
Loam	0.8	0.8
Loam, clayey	10.2	11.0
13-53-17adb (II Cb5)		
Loam	0.5	0.5
Loam, silty and clayey	4.5	5.0
Sand, loamy	5.0	10.0
13-53-17ccd (II A 1/2)		
Loam, silty	4.0	4.0
Clay, light	4.0	8.0
Loam, silty	7.5	15.5
Clay, light	.5	16.0
Loam, very fine sandy	2.0	18.0
Clay, light	2.0	20.0
Clay	12.0	32.0

Table 9.—*Logs of wells and test holes*—Continued

AREA II—Continued

	Thickness (feet)	Depth (feet)
13-53-17ccd (II A 1/2)—Continued		
Sand	1.0	33.0
Clay	1.0	34.0
Sand	1.0	35.0
Gravel	1.0	36.0
13-53-17dbb (II Cb4)		
Loam	0.8	0.8
Loam, clayey	3.2	4.0
Sand, loamy	7.0	11.0
13-53-20aac (II B)		
Loam, clayey	3.0	3.0
Clay, light	4.5	7.5
Gravel and sand	11.0	18.5
13-53-20dca (II A1)		
Loam	1.5	1.5
Loam, sandy and clayey	1.5	3.0
Loam	2.0	5.0
Loam, silty	2.3	7.3
Sand, fine, loamy	3.7	11.0
Sand	1.0	12.0
Gravel and sand	2.0	14.0
Gravel	2.4	16.4

AREA III

13-53-1aac (III G1)		
Loam, silty and clayey	8.0	8.0
Loam, clayey	11.9	19.9
Gravel	6.1	26.0
Clay, sandy	5.0	31.0
Gravel	20.4	51.4
13-53-1add (III G2)		
Clay, light	2.0	2.0
Clay, medium	2.5	4.5
Gravel, sandy	18.4	22.9
13-53-1cbc (III F1)		
Loam	2.0	2.0
Loam, very fine sandy	1.0	3.0
Clay, medium	9.0	12.0
Loam, sandy and clayey	2.0	14.0
Loam	1.0	15.0
Loam, clayey	12.0	27.0
Clay, sandy	1.0	28.0
Gravel	3.7	31.7

Table 9.—*Logs of wells and testholes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-1cdc (III F2)		
Clay, light	2.0	2.0
Clay, medium	5.0	7.0
Clay, light	4.0	11.0
Loam, fine sandy	2.0	13.0
Gravel	9.9	22.9
13-53-9dad (III A 1/2)		
Loam, clayey	8.5	8.5
Clay, medium	4.2	12.7
Loam, very fine sandy	.7	13.4
Gravel	6.1	19.5
13-53-10acd (III Cb9)		
Loam	0.8	0.8
Clay, loamy	4.2	5.0
Loam, sandy and clayey	5.5	10.5
Gravel, sandy	2.5	13.0
13-53-10ada (III D1)		
Loam, very fine sandy	2.0	2.0
Loam, fine sandy, and gravel	1.5	3.5
Loam, silty	1.2	4.7
Loam, clayey	1.3	6.0
Loam	.7	6.7
Loam, silty and clayey	9.5	16.2
Loam, silty	2.8	19.0
Loam, fine sandy	1.0	20.0
Loam	2.0	22.0
Clay, light	5.0	27.0
Clay, medium	5.0	32.0
Gravel	8.0	40.0
13-53-10cab (III Cb8)		
Loam	0.5	0.5
Clay, loamy	10.5	11.0
13-53-10cbb (III Cb7)		
Loam	1.0	1.0
Clay, loamy	9.0	10.0
13-53-10ccc (III A1)		
Clay, light	5.0	5.0
Loam	3.0	8.0
Loam, very fine sandy	.7	8.7
Gravel and sand	10.8	19.5
Clay (shale?)	.....	.....

458513 O - 58 - 7

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-10cdb (III B1)		
Loam, clayey	2.0	2.0
Clay, light	1.8	3.8
Loam, clayey	.7	4.5
Clay, light	3.7	8.2
Loam, silty and clayey	1.8	10.0
Clay, light	.6	10.6
Loam, silty and clayey	3.4	14.0
Loam, sandy and clayey	.5	14.5
Loam, silty and clayey	2.3	16.8
Loam, fine sandy	.8	17.6
Loam, silty	3.8	21.4
Loam, fine sandy	3.1	24.5
Sand	4.2	28.7
Gravel	1.0	29.7
13-53-10cdd (III B1 1/2)		
Loam, clayey	3.0	3.0
Clay, light	2.0	5.0
Clay, medium	3.0	8.0
Loam, silty	1.5	9.5
Loam, very fine sandy	.5	10.0
Loam, silty	.5	10.5
Sand, fine, loamy	1.0	11.5
Loam, very fine sandy	1.0	12.5
Gravel	.....	.....
13-53-10dbb (III C1)		
Loam	4.0	4.0
Sand	2.5	6.5
Sand, fine, loamy	2.0	8.5
Loam, clayey	1.5	10.0
Loam, silty	1.0	11.0
Loam, very fine sandy	5.0	16.0
Loam, silty	3.0	19.0
Loam, very fine sandy	4.0	23.0
Loam silty	3.0	26.0
Clay, light	2.2	28.2
Loam, silty	2.3	30.5
Gravel	8.5	39.0
13-53-10dbc1 (III Fa1)*		
Sand and clay	35.0	35.0
Gravel	5.0	40.0
Clay, blue (shale)	20.0	60.0
13-53-10dca (III C1 1/2)		
Loam, clayey	9.0	9.0
Sand, fine, loamy	1.0	10.0
Clay, light	5.0	15.0
Clay, sandy	3.5	18.5
Gravel	.....	.....

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-10ddc (III C2)		
Loam, clayey	2.2	2.2
Clay, light	2.4	4.6
Loam, silty	1.2	5.8
Clay, light	1.0	6.8
Loam, silty	.4	7.2
Loam, clayey	2.3	9.5
Loam, silty	.5	10.0
Gravel	9.5	19.5
13-53-11accl (III E2)		
Loam, clayey	3.2	3.2
Loam, sandy	.2	3.4
Loam, clayey	.6	4.0
Loam, silty	2.5	6.5
Clay, light	1.0	7.5
Clay, medium	2.0	9.5
Clay, silty	1.0	10.5
Sand	1.2	11.7
Gravel	6.0	17.7
13-53-11baal (III El)		
Loam	1.0	1.0
Loam, silty	3.0	4.0
Loam, fine sandy	2.5	6.5
Loam, sandy	2.5	9.0
Loam, clayey	5.0	14.0
Loam, silty	12.0	26.0
Gravel	11.2	37.2
13-53-11baa2 (III Cb11)		
Loam	1.5	1.5
Gravel, sandy	4.5	6.0
13-53-11cbb (III D1 1/2)		
Clay, light	2.3	2.3
Loam, silty and clayey	1.2	3.5
Clay, light	2.8	6.3
Clay, medium	.7	7.0
Clay, light	1.0	8.0
Loam, clayey	1.0	9.0
Loam, sandy and clayey	.5	9.5
Clay, medium	2.5	12.0
Loam, silty and clayey	3.5	15.5
Gravel	.....	.....
13-53-11cca (III D2)		
Loamy material	10.0	10.0
Gravel	7.0	17.0
13-53-11ccd (III D3)		
Loam, silty	1.0	1.0
Loam, silty and clayey	1.0	2.0

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-11ccd (III D3)—Continued		
Loam, clayey	2.0	4.0
Loam, silty	1.0	5.0
Loam, clayey	2.0	7.0
Clay, medium	.5	7.5
Clay, heavy	6.0	13.5
Gravel and sand	1.0	14.5
Clay, light	1.0	15.5
Loam, sandy and clayey	1.0	16.5
Clay, light	2.5	19.0
Clay, heavy	1.0	20.0
Gravel and sand	6.0	26.0
13-53-11ddb (III E2 1/2)		
Clay, light	5.0	5.0
Sand	1.7	6.7
Gravel	.....	.....
13-53-11ddd (III E3)		
Cobbles	4.0	4.0
Gravel, coarse	6.7	10.7
Sandstone (?)	1.3	12.0
13-53-12abb (III F3)		
Loam, silty	2.5	2.5
Gravel	15.0	17.5
13-53-12aca (III F4)		
Clay, medium	2.0	2.0
Gravel	8.8	10.8
13-53-12acb1 (III P3)		
Loam, clayey	5.0	5.0
Clay	.9	5.9
Gravel, fine	6.1	12.0
Gravel, coarse	3.1	15.1
Shale, blue-gray	5.0	20.1
13-53-12acb2 (III 3E1)		
Loam, clayey	3.5	3.5
Clay	2.5	6.0
Gravel	1.2	7.2
13-53-12acb3 (III 3N1)		
Loam	1.5	1.5
Loam, clayey	2.5	4.0
Clay	2.5	6.5
Gravel	3.4	9.9

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-12acc1 (III 3S1)		
Sand	2.0	2.0
Gravel	1.0	3.0
Sand	1.0	4.0
Gravel	.5	4.5
Sand	1.5	6.0
Gravel	7.3	13.3
13-53-12acc2 (III 3W1)		
Loam, clayey	3.0	3.0
Clay, heavy	2.5	5.5
Loam, clayey	.5	6.0
Gravel	2.9	8.9
13-53-13bbd (III E4)		
Loam, very fine sandy	1.0	1.0
Loam, fine sandy	3.2	4.2
Loam, silty	1.3	5.5
Loam, fine sandy	.5	6.0
Sand	3.0	9.0
Gravel and sand	1.3	10.3
Gravel	8.7	19.0
13-53-14bab (III D3 1/2)		
Clay, heavy	13.0	13.0
Loam, sandy, and sand	4.0	17.0
13-53-14bac1 (III D4)		
Loam	6.0	6.0
Clay, loamy	3.0	9.0
Sand	9.5	18.5
Gravel, sandy	4.5	23.0
13-53-14bac2 (III D4 1/2)		
Loam, clayey	3.5	3.5
Loam, fine sandy	.5	4.0
Clay, heavy	3.5	7.5
Loam, silty	.5	8.0
Sand	6.0	14.0
Gravel	.....	.....
13-53-14bdb (III D5)		
Loam, silty	4.0	4.0
Loam, sandy and clayey	1.0	5.0
Loam, very fine sandy	1.5	6.5
Loam, silty and clayey	1.0	7.5
Loam, sandy, and sand, loamy	4.5	12.0
Gravel	7.0	19.0

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-14bdc (III D5 1/4)		
Loam, very fine sandy	2.5	2.5
Loam, silty	4.5	7.0
Loam, silty and clayey	3.0	10.0
Gravel		
13-53-14caa (III D5 1/2)		
Loam	1.5	1.5
Loam, silty and clayey	.5	2.0
Loam, very fine sandy	.7	2.7
Loam, silty	3.8	6.5
Sand, fine, loamy	1.0	7.5
13-53-14cba (III CD)		
Loam, sandy	9.0	9.0
Clay	2.0	11.0
Sand, medium	1.0	12.0
Gravel	1.5	13.5
13-53-14cbb (III C5)		
Loam, silty	0.5	0.5
Loam, fine sandy	.5	1.0
Loam, silty and clayey	2.0	3.0
Loam	.8	3.8
Loam, clayey	.7	4.5
Loam, sandy	1.7	6.2
Loam, silty	2.3	8.5
Loam, very fine sandy	2.0	10.5
Sand	1.5	12.0
Gravel and sand	1.5	13.5
Loam, sandy and clayey	.5	14.0
Gravel and sand	5.0	19.0
Clay	2.0	21.0
Sand and gravel	2.0	23.0
Gravel	2.0	25.0
13-53-14cbc1 (III 2N1)		
Loam, clayey	8.0	8.0
Sand	3.5	11.5
Gravel	5.4	16.9
13-53-14cbc2 (III 2E1)		
Loam, sandy	3.0	3.0
Sand	2.5	5.5
Clay	1.0	6.5
Sand	6.0	12.5
Gravel	4.7	17.2
13-53-14cbc3 (III C6)		
Loam, silty	3.9	3.9
Clay, light	.8	4.7
Sand, fine, loamy	1.3	6.0

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-14cbc3 (III C6)—Continued		
Loam, clayey	0.8	6.8
Sand, loamy	4.5	11.3
Sand and gravel	4.3	15.6
Sand	1.6	17.2
Gravel	4.3	21.5
13-53-14cbd (III C6 1/2)		
Loam, silty	2.5	2.5
Loam, silty and clayey	4.0	6.5
Clay, light	.5	7.0
Loam, silty and clayey	1.0	8.0
Loam, fine sandy	.6	8.6
Sand, loamy	3.4	12.0
Gravel	.....	.....
13-53-14cca (III C7)		
Loam, silty	3.0	3.0
Loam, very fine sandy	.3	3.3
Loam, silty	.5	3.8
Loam, very fine sandy	1.1	4.9
Clay, light	.9	5.8
Loam, very fine sandy	.4	6.2
Sand, fine, loamy	1.6	7.8
Loam, very fine sandy	1.2	9.0
Sand	.8	9.8
Gravel and sand	3.7	13.5
Sand	2.0	15.5
Siltstone	1.0	16.5
13-53-14cdb (III C8)		
Loam, silty	6.0	6.0
Sand, fine, loamy	1.6	7.6
Loam, very fine sandy	2.2	9.8
Clay, light	.5	10.3
Loam, very fine sandy	1.7	12.0
Gravel and sand	6.2	18.2
13-53-14dbc (III D5 3/4)		
Loam, very fine sandy	4.2	4.2
Loam, silty and clayey	.8	5.0
Sand, fine, loamy	4.7	9.7
Gravel	.....	.....
13-53-15aab1 (III 1N1)		
Loam	8.0	8.0
Loam, clayey	20.0	28.0
Sand	2.0	30.0
Gravel	5.6	35.6

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-15aab2 (III 1N2)		
Loam	5.0	5.0
Loam, sandy	6.0	11.0
Loam, clayey	11.0	22.0
Sand	6.0	28.0
Gravel	7.2	35.2
13-53-15aab3 (III C2 1/2)		
Loam, clayey	1.0	1.0
Clay, medium	6.0	7.0
Loam, sandy, to sand	8.0	15.0
13-53-15aac1 (III C3 1/2)		
Clay, light	1.5	1.5
Clay, medium	2.0	3.5
Clay, heavy	5.5	9.0
Sand	2.0	11.0
Clay, heavy	.5	11.5
Clay, sandy	1.5	13.0
Sand	4.0	17.0
Gravel	.....	.....
13-53-15aac2 (III C3, 1S1)		
Loam, clayey	2.0	2.0
Loam, silty	1.0	3.0
Loam, fine sandy	1.2	4.2
Loam, silty	1.3	5.5
Clay, light	1.0	6.5
Loam, silty	2.0	8.5
Clay, medium	2.0	10.5
Loam, very fine sandy	.6	11.1
Clay, medium	2.9	14.0
Clay, heavy	3.8	17.8
Loam, very fine sandy	5.7	23.5
Gravel and sand	2.5	26.0
Gravel, coarse	2.0	28.0
13-53-15aac3 (III P1)		
Loam, clayey	2.0	2.0
Loam, silty	1.0	3.0
Loam, fine sandy	1.2	4.2
Loam, silty	1.3	5.5
Clay, light	1.0	6.5
Loam, silty	2.0	8.5
Clay, medium	2.0	10.5
Loam, very fine sandy	.6	11.1
Clay, medium	2.9	14.0
Clay, heavy	3.8	17.8
Loam, very fine sandy	5.2	23.0
Gravel	12.5	35.5
Shale, blue-gray	9.5	45.0
Shale, sandy, gray	7.9	52.9

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-15aac4 (III 1W1)		
Loam, sandy	10.0	10.0
Loam, clayey	8.5	18.5
Loam, sandy	2.0	20.5
Sand	5.7	26.2
Gravel	5.1	31.3
13-53-15aac5 (III 1W2)		
Loam, sandy	9.0	9.0
Loam, clayey	3.0	12.0
Loam, sandy	.5	12.5
Loam, clayey	6.0	18.5
Sand	8.5	27.0
Gravel	8.4	35.4
13-53-15aac6 (III 1S2)		
Loam, sandy	7.5	7.5
Loam, clayey	1.5	9.0
Loam, sandy	1.8	10.8
Loam, clayey	4.7	15.5
Sand	6.5	22.0
Gravel and sand	7.6	29.6
13-53-15aac7 (III 1E1)		
Loam, sandy	8.0	8.0
Loam, clayey	10.5	18.5
Sand	7.5	26.0
Gravel	9.7	35.7
13-53-15abc (III B3)		
Clay, light	1.6	1.6
Clay, medium	2.2	3.8
Loam, silty	.5	4.3
Clay, medium	3.5	7.8
Loam, silty	1.3	9.1
Clay, heavy	4.9	14.0
Loam, silty	.7	14.7
Loam, very fine sandy	.8	15.5
Loam, clayey	1.0	16.5
Sand, fine, loamy	3.5	20.0
Sand	4.0	24.0
Sand and gravel	2.0	26.0
Gravel	2.0	28.0
13-53-15aca (III B3 1/2)		
Clay, light	0.5	0.5
Clay, heavy	10.5	11.0
Loam, clayey, and loam, sandy	11.0	22.0
13-53-15acd (III B4)		
Loam, very fine sandy	4.5	4.5
Sand, loamy	.4	4.9
Loam, silty	.9	5.8

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-15acd (III B4)—Continued		
Sand and gravel	4.2	10.0
Gravel	12.0	22.0
13-53-15ada (III C4)		
Loam, silty	5.0	5.0
Loam, sandy	2.8	7.8
Loam, silty	.7	8.5
Gravel	1.0	9.5
Gravel and sand	18.5	28.0
13-53-15add1 (III C4 1/2)		
Loam, silty and clayey	1.4	1.4
Loam, fine sandy	2.1	3.5
Clay, light	2.5	6.0
Loam, silty and clayey	1.0	7.0
Loam, sandy	1.0	8.0
Loam, silty and clayey	2.0	10.0
Clay, heavy	2.0	12.0
13-53-15add2 (III DI11)		
Loam, sandy and clayey	12.0	12.0
Sand	2.0	14.0
Gravel	1.0	15.0
Sand	1.0	16.0
Gravel, coarse	1.0	17.0
13-53-15baa (III B2)		
Clay, light	2.0	2.0
Loam, clayey	.8	2.8
Loam	1.9	4.7
Loam, silty	1.3	6.0
Loam sandy and clayey	1.2	7.2
Gravel	9.8	17.0
13-53-15bba (III A1 1/3)		
Loam	1.3	1.3
Loam, very fine sandy	1.7	3.0
Loam, silty and clayey	2.0	5.0
Loam, sandy and clayey	5.0	10.0
Sand	1.0	11.0
Gravel	1.0	12.0
13-53-15bca (III A1 2/3)		
Loam, very fine sandy	11.0	11.0
Gravel	.....	.....
13-53-15bdc (III A2)		
Loam, silty	4.0	4.0
Loam, very fine sandy	7.3	11.3

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-15bdc (III A2)—Continued		
Gravel and sand	4.7	16.0
Sand	3.0	19.0
Gravel and sand	7.0	26.0
Sand	3.0	29.0
Gravel	1.0	30.0
Sand	2.0	32.0
Gravel	5.0	37.0
13-53-15cab1 (III TE4)		
Loam, sandy	12.0	12.0
Gravel	1.0	13.0
Loam, clayey	8.0	21.0
Sand	2.5	23.5
Gravel	1.5	25.0
13-53-15cab2 (III TE3)		
Loam, sandy	10.5	10.5
Loam, sandy and clayey	12.5	23.0
Gravel	2.0	25.0
13-53-15cab3 (III TE2)		
Loam, sandy	8.0	8.0
Gravel	3.0	11.0
Sand	1.0	12.0
Gravel and sand	10.0	22.0
Gravel coarse	2.0	24.0
13-53-15cab4 (III TE1)		
Loam, sandy	8.5	8.5
Gravel	5.5	14.0
13-53-15cad (III A3)		
Loam	3.0	3.0
Loam, silty and clayey	2.0	5.0
Loam, sandy	.9	5.9
Clay, heavy	1.0	6.9
Loam, fine sandy	.9	7.8
Loam, clayey	.7	8.5
Loam, fine sandy, and sand, fine, loamy	3.0	11.5
Loam, clayey	2.0	13.5
Clay, medium	1.0	14.5
Loam, fine sandy, and loam, clayey	4.5	19.0
Clay, light	1.0	20.0
Clay, heavy	1.5	21.5
Loam, fine sandy, and loam, clayey	2.5	24.0
Gravel	6.1	30.1
13-53-15cda (III A3 1/2)		
Loam, very fine sandy	2.0	2.0
Loam, fine sandy	1.3	3.3

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-15cda (III A3 1/2)—Continued		
Clay, sandy	1.4	4.7
Sand, loamy	.3	5.0
Gravel	.....	.....
13-53-15daa (III DI10)		
Loam, sandy and clayey	10.0	10.0
Sand	2.0	12.0
Gravel	2.2	14.2
13-53-15dab1 (III BC1)		
Gravel	19.0	19.0
13-53-15dab2 (III BC2)		
Loam, sandy	10.0	10.0
Gravel and sand	17.2	27.2
13-53-15dab3 (III DI9)		
Loam	7.0	7.0
Sand and some gravel	2.7	9.7
Gravel	2.2	11.9
13-53-15dac1 (III DI7)		
Loam, sandy and clayey	13.5	13.5
Sand	1.5	15.0
Gravel	1.6	16.6
13-53-15dac2 (III DI8)		
Loam, silty and clayey	5.0	5.0
Gravel, sandy	7.1	12.1
13-53-15dad1 (III P2)		
Loam, sandy	9.0	9.0
Loam	3.0	12.0
Gravel	8.2	20.2
13-53-15dad2 (III P2A)		
Clay, light	1.0	1.0
Clay, medium	1.0	2.0
Loam, silty	1.5	3.5
Loam, silty and clayey	1.5	5.0
Loam, sandy and clayey	2.0	7.0
Loam, silty and clayey	2.0	9.0
Clay, light	1.3	10.3
Sand	1.7	12.0
Gravel	7.4	19.4

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-15dad3 (III 2S1)		
Loam	4.0	4.0
Loam, clayey	1.0	5.0
Loam	3.0	8.0
Sand	3.0	11.0
Gravel and sand	5.9	16.9
13-53-15dad4 (III 2W1)		
Loam, clayey	4.0	4.0
Sand	2.0	6.0
Loam, clayey	2.5	8.5
Sand	1.5	10.0
Gravel	7.4	17.4
13-53-15dbd (III B5)		
Loam, clayey	2.0	2.0
Loam, silty	1.8	3.8
Loam, fine sandy	.5	4.3
Loam, silty	.9	5.2
Loam, very fine sandy	.9	6.1
Loam, fine sandy	1.4	7.5
Sand and gravel	10.5	18.0
Sand	1.0	19.0
Gravel	1.5	20.5
13-53-15dca (III DI6)		
No record	19.2	19.2
13-53-15dcc1 (III A4)		
Loam silty	5.0	5.0
Loam, fine sandy	1.0	6.0
Clay, medium	.5	6.5
Clay, heavy	1.5	8.0
Loam, silty	1.5	9.5
Clay, heavy	1.5	11.0
Loam	.2	11.2
Clay, heavy	2.8	14.0
Loam, silty and clayey	1.0	15.0
Clay, heavy	1.0	16.0
Loam, fine sandy	2.0	18.0
Sand, loamy	1.0	19.0
Loam, sandy	5.0	24.0
Gravel	4.0	28.0
13-53-15dcc2 (III A5)		
Loam	3.0	3.0
Loam, very fine sandy	1.3	4.3
Loam	.6	4.9
Loam, clayey	1.1	6.0
Clay, heavy	2.5	8.5
Loam, sandy	.3	8.8
Clay, heavy	2.7	11.5

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-15dcc2 (III A5)—Continued		
Clay, light	3.0	14.5
Loam, fine sandy	3.0	17.5
Gravel	5.5	23.0
13-53-15ddb1 (III DI1)		
No record	14.0	14.0
Gravel	.....	.....
13-53-15ddb2 (III DI2)		
No record	14.0	14.0
Gravel	6.4	20.4
13-53-15ddb3 (III DI3)		
No record	13.5	13.5
Gravel	5.5	19.0
13-53-15ddb4 (III B6, DI4)		
Clay, light	1.2	1.2
Loam	2.3	3.5
Sand, medium	1.3	4.8
Clay, medium	.4	5.2
Clay, heavy	1.3	6.5
Loam	1.5	8.0
Loam, fine sandy	.7	8.7
Loam	1.0	9.7
Loam, very fine sandy	.8	10.5
Loam	.9	11.4
Loam, very fine sandy	1.1	12.5
Sand and gravel	4.0	16.5
Gravel	3.6	20.1
13-53-15ddb5 (III DI5)		
No record	18.9	18.9
13-53-15ddb6 (III R)		
Sand and clay	4.0	4.0
Gravel	10.0	14.0
13-53-15ddc (III B6 1/2)		
Clay, light	1.0	1.0
Loam, very fine sandy	1.5	2.5
Clay, light	3.1	5.6
Loam, fine sandy	.4	6.0
Loam, sandy and clayey	1.3	7.3
Sand, loamy	2.2	9.5
Gravel	.....	.....

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-22aab (III B7)		
Loam, silty	3.0	3.0
Clay, light	1.0	4.0
Loam, fine sandy	3.5	7.5
Sand, fine	2.2	9.7
Gravel	5.9	15.6
13-53-22abc (III A5 1/2)		
Loam, silty	1.0	1.0
Loam, very fine sandy	2.5	3.5
Clay, silty	3.0	6.5
Loam, sandy and clayey	1.0	7.5
Loam, sandy	5.0	12.5
Loam, silty	.5	13.0
Gravel	.....	.....
13-53-22abd (III A6)		
Loam, very fine sandy	2.0	2.0
Loam, silty	1.5	3.5
Clay, light	2.0	5.5
Loam, very fine sandy	1.0	6.5
Sand, medium	.8	7.3
Loam	.7	8.0
Loam, fine sandy	1.5	9.5
Loam	1.0	10.5
Gravel	2.5	13.0
13-53-22baa1 (III CI6)		
No record	20.0	20.0
Gravel	5.9	25.9
13-53-22baa2 (III CI5)		
No record	26.0	26.0
Gravel	5.6	31.6
13-53-22baa3 (III CI4)		
No record	13.5	13.5
Gravel	4.2	17.7
13-53-22bac1 (III CI2)		
No record	12.0	12.0
Gravel	8.5	20.5
13-53-22bac2 (III CI1)		
No record	13.5	13.5
Gravel	4.9	18.4

Table 9.—*Logs of wells and test holes*—Continued

AREA III—Continued

	Thickness (feet)	Depth (feet)
13-53-22bad (III CI3)		
No record	13.3	13.3
Gravel	1.2	14.5
Sand	1.0	15.5
Gravel	1.5	17.0
Sand	2.0	19.0
Gravel	2.1	21.1
13-54-6cbd (III G3)		
Loam, sandy and clayey	6.5	6.5
Sand, loamy	.5	7.0
Loam, sandy and clayey	1.0	8.0
Clay, light	1.0	9.0
Clay, sandy	.5	9.5
Gravel and sand	1.5	11.0
Loam, sandy, and gravel	2.0	13.0
Clay, medium	1.0	14.0
Gravel, coarse	3.0	17.0
Sand	.5	17.5
Gravel	4.0	21.5

AREA V

14-54-14cab (V Cb12)		
Loam	1.0	1.0
Loam, sandy and clayey	2.0	3.0
Loam, sandy	1.5	4.5
Shale	6.0	10.5
14-54-22abb (V Cb10)		
Loam	0.5	0.5
Loam, clayey	9.0	9.5
Sand	2.0	11.5
14-54-23aba (V B1)		
Loam	2.0	2.0
Loam, very fine sandy	2.0	4.0
Gravel	8.0	12.0
Sand	1.0	13.0
Gravel	2.0	15.0
Sand and gravel	3.0	18.0
14-54-23bbd (V A1)		
Loam	1.0	1.0
Loam, clayey	1.0	2.0
Loam, fine sandy	3.0	5.0
Clay, light	2.0	7.0
Sand	2.0	9.0
Gravel	9.0	18.0

Table 9.—*Logs of wells and test holes*—Continued

AREA V—Continued

	Thickness (feet)	Depth (feet)
14-54-23bdc (V A2)		
Gravel	8.0	8.0
Shale (?)	.9	8.9
14-54-23cab (V A3)		
Loam, silty and clayey	2.0	2.0
Loam, silty	2.0	4.0
Gravel	.2	4.2
Loam, sandy and clayey	8.8	13.0
Sand	5.0	18.0
Gravel	3.3	21.3
14-54-23cad (V A4)		
Loam, very fine sandy	5.0	5.0
Loam, silty	2.0	7.0
Loam, very fine sandy	2.0	9.0
Sand, fine, loamy, and sand, clean	5.0	14.0
Gravel	7.6	21.6
14-54-23dad (V B2)		
Loam	1.0	1.0
Loam, very fine sandy	3.0	4.0
Loam, silty and clayey	4.0	8.0
Loam	3.0	11.0
Loam, fine sandy	2.0	13.0
Loam, clayey	1.0	14.0
Sand	2.0	16.0
Gravel	5.5	21.5
14-54-23dba (V AB)		
Loam, silty	3.0	3.0
Loam, fine sandy	2.0	5.0
Sand, fine to medium	8.0	13.0
Gravel	9.6	22.6

AREA VI

14-54-1ccc (VI E1)		
Loam	1.0	1.0
Gravel	3.0	4.0
Loam, gravelly	4.0	8.0
Sand	1.1	9.1
Loam, gravelly	12.5	21.6
Loam	3.9	25.5
Gravel, loamy	6.1	31.6
Gravel, fine to coarse	14.4	46.0
Sand	3.2	49.2
Gravel, coarse	16.3	65.5

458513 O - 58 - 8

Table 9.—*Logs of wells and test holes*—Continued

AREA VI—Continued

	Thickness (feet)	Depth (feet)
14-54-1daa (VI I1)		
Clay, light	5.0	5.0
Loam, clayey	2.5	7.5
Loam, fine sandy	1.5	9.0
Clay, medium	3.0	12.0
Loam	2.0	14.0
Gravel		
14-54-1dbb (VI I 1/2)		
Loam, silty and clayey	2.0	2.0
Clay, light	.8	2.8
Loam, sandy	.7	3.5
Clay, medium	3.5	7.0
Clay, silty	2.0	9.0
Loam, silty	4.0	13.0
Clay, medium	4.0	17.0
14-54-12acc (VI E2)		
Loam, silty	2.0	2.0
Loam, sandy	1.0	3.0
Gravel and sand	5.0	8.0
Loam, sandy	6.0	14.0
Clay	11.0	25.0
14-54-12cca (VI D1)		
Loam, silty and clayey	1.0	1.0
Clay, light	3.0	4.0
Loam, silty and clayey	1.0	5.0
Gravel, coarse	6.0	11.0
Shale, sandy, blue	2.5	13.5
14-54-12daa (VI F1)		
Loam, silty and clayey	4.0	4.0
Loam, very fine sandy	4.5	8.5
Gravel	8.1	16.6
14-54-12dcb (VI E3)		
Loam, silty	1.5	1.5
Clay, light	1.5	3.0
Loam, silty and clayey	4.5	7.5
Gravel and loam, silty	.5	8.0
Sand, gravelly	1.0	9.0
Gravel, coarse	4.0	13.0
Sand	2.0	15.0
Gravel, coarse	1.0	16.0
14-54-12dcc (VI D2)		
Loam, fine sandy	1.0	1.0
Sand, loamy	2.5	3.5
Gravel and sand	1.5	5.0
Gravel, coarse	2.5	7.5
Shale, sandy, blue	5.5	13.0

Table 9.—*Logs of wells and test holes*—Continued

AREA VI—Continued

	Thickness (feet)	Depth (feet)
14-54-13aaa (VI E4)		
Loam, silty	1.0	1.0
Loam, clayey	3.0	4.0
Loam, fine sandy	1.8	5.8
Sand and gravel	.3	6.1
Gravel	12.0	18.1
14-54-13abb (VI D3)		
Loam	1.0	1.0
Clay, light	2.2	3.2
Loam, very fine sandy	2.8	6.0
Gravel	9.0	15.0
Sand, gravelly, black	2.0	17.0
Clay, heavy (shale?)	8.0	25.0
Sandstone, gray	14.0	39.0
14-54-13bba (VI CD)		
Loam, gravelly and silty	1.2	1.2
Loam, silty and clayey	1.0	2.2
Gravel and sand	6.8	9.0
Gravel, coarse	1.0	10.0
14-54-13bdd (VI C2)		
Loam, silty and clayey	2.0	2.0
Clay, light	2.0	4.0
Loam, fine sandy	3.0	7.0
Gravel	8.0	15.0
Clay	12.0	27.0
Sand and gravel	6.2	33.2
14-54-13cca (VI A2)		
Loam, very fine sandy	1.5	1.5
Loam, silty	1.3	2.8
Loam, fine sandy	3.7	6.5
Gravel	21.2	27.7
14-54-13cdd (VI A3)		
Loam, silty	1.7	1.7
Clay, light	1.3	3.0
Sand	1.0	4.0
Sand and gravel	.7	4.7
Gravel	2.3	7.0
Sand	2.0	9.0
Loam	1.5	10.5
Sand and gravel	.5	11.0
Loam	.5	11.5
Gravel	9.7	21.2
14-54-13dbd (VI C3)		
Loam, clayey	6.0	6.0
Gravel	13.0	19.0

Table 9.—*Logs of wells and test holes*—Continued

AREA VI—Continued

	Thickness (feet)	Depth (feet)
14-54-13dcd (VI B 1/4)		
Loam, silty and clayey	1.0	1.0
Clay, medium	3.0	4.0
Loam, silty	3.0	7.0
Clay, heavy	2.5	9.5
Loam, fine sandy	4.0	13.5
Sand and loam, sandy	11.0	24.5
Gravel	.....	.....
14-54-14aaa (VI C1)		
Loam, sandy	3.8	3.8
Gravel, coarse	2.2	6.0
Shale, gray-blue	10.0	16.0
14-54-14daa (VI A1)		
Loam	1.0	1.0
Loam, clayey	1.0	2.0
Loam, fine sandy	5.0	7.0
Gravel and sand	.....	.....
14-54-24aab (VI B 1/2)		
Clay, light	2.0	2.0
Loam, silty and clayey	3.0	5.0
Loam, silty	2.0	7.0
Clay, light	1.0	8.0
Loam, fine sandy	3.0	11.0
Sand	1.0	12.0
Gravel	.....	.....
14-54-24aac (VI A4 1/2)		
Loam, silty and clayey	2.0	2.0
Clay, heavy	1.0	3.0
Sand, fine, loamy	1.1	4.1
Clay, light	1.5	5.6
Loam, silty	3.4	9.0
Gravel	.....	.....
14-54-24abb (VI A3 1/2)		
Loam, silty and clayey	2.5	2.5
Loam, fine sandy	1.0	3.5
Sand, loamy	1.5	5.0
Sand	2.0	7.0
Gravel	.....	.....
14-54-24abc (VI A4)		
Loam	1.8	1.8
Loam, silty	1.0	2.8
Loam, very fine sandy	6.2	9.0
Clay, medium	2.0	11.0
Loam, silty	2.7	13.7

Table 9.—*Logs of wells and test holes*—Continued

AREA VI—Continued

	Thickness (feet)	Depth (feet)
14-54-24abc (VI A4)—Continued		
Sand, loamy, and sand, clean	4.8	18.5
Gravel	3.5	22.0
Sand	1.0	23.0
Gravel	2.0	25.0
Sand	2.0	27.0
Cobbles	.....	.....
14-54-24ada (VI B 3/4)		
Loam, silty	2.0	2.0
Loam, silty and clayey, or clay, light	3.0	5.0
Loam, silty	4.3	9.3
Clay, light	1.2	10.5
Gravel	.....	.....
14-54-24adb (VI A5)		
Loam, silty	2.0	2.0
Loam, fine sandy	1.0	3.0
Loam, silty	1.0	4.0
Loam, silty and clayey	1.5	5.5
Loam, very fine sandy	.5	6.0
Clay, medium	.8	6.8
Loam, fine sandy	2.0	8.8
Clay, heavy	2.2	11.0
Sand, fine, loamy	2.0	13.0
Sand	2.0	15.0
Gravel	2.0	17.0
14-55-6abc (VI J 1/2)		
Clay, light	1.0	1.0
Clay, sandy	1.5	2.5
Loam, sandy	2.0	4.5
Sand	2.5	7.0
Sand and gravel	1.0	8.0
Clay, heavy	3.0	11.0
Loam, sandy	.8	11.8
Sand	2.2	14.0
Clay, heavy	1.3	15.3
Sand	2.7	18.0
Gravel	.....	.....
14-55-6acd (VI I3 1/2)		
Loam	[illegible]	0.9
Loam, silty	[illegible]	4.0
Loam	[illegible]	5.5
Sand, fine, loamy	[illegible]	7.0
Loam, silty and clayey	[illegible]	9.0
Sand	.5	9.5
Clay, medium	2.5	12.0
Loam, silty and clayey	6.0	18.0

Table 9.—*Logs of wells and test holes*—Continued

AREA VI—Continued

	Thickness (feet)	Depth (feet)
14-55-6add (VI I4)		
Loam	3.0	3.0
Loam, very fine sandy	2.5	5.5
Clay, light	.8	6.3
Loam	.7	7.0
Clay, heavy	3.0	10.0
Loam, clayey	.5	10.5
Loam, very fine sandy	2.0	12.5
Loam	1.2	13.7
Sand, loamy	.4	14.1
Gravel	2.9	17.0
Sand	5.0	22.0
Gravel, coarse	3.7	25.7
14-55-6baa (VI K1)		
Clay, light	1.0	1.0
Clay, heavy	2.9	3.9
Loam, clayey	3.4	7.3
Loam, sandy	1.2	8.5
Clay, medium	1.5	10.0
Loam, clayey	2.0	12.0
Loam, sandy, and sand	3.0	15.0
Gravel	9.0	24.0
14-55-6bdc (VI I2)		
Loam, fine sandy	1.0	1.0
Loam	2.1	3.1
Clay, heavy	2.4	5.5
Loam, sandy and clayey	2.0	7.5
Gravel	8.5	16.0
Gravel, sandy	1.9	17.9
14-55-6bdd1 (VI I3a)		
Clay, heavy	3.0	3.0
Loam, sandy and clayey	1.5	4.5
Clay, medium	1.0	5.5
Loam	1.5	7.0
Loam, sandy	3.5	10.5
Loam, clayey	1.0	11.5
Clay, heavy	2.5	14.0
Loam, sandy	1.5	15.5
Clay, heavy	2.0	17.5
Loam, sandy	2.5	20.0
Clay	5.0	25.0
Gravel	2.0	27.0
Sand, loamy	4.0	31.0
Clay	7.0	38.0
Sand	4.0	42.0
Gravel	2.3	44.3
14-55-6bdd2 (VI I3b)		
Clay, heavy	3.0	3.0
Loam sandy and clayey	1.5	4.5

Table 9.—*Logs of wells and test holes*—Continued

AREA VI—Continued

	Thickness (feet)	Depth (feet)
14-55-6bdd2 (VI I3b)—Continued		
Clay, medium	1.0	5.5
Loam	1.3	6.8
14-55-6cac (VI H1)		
Clay, heavy	9.0	9.0
Clay, medium	1.5	10.5
Loam, clayey, and gravel	2.0	12.5
Gravel	5.5	18.0
14-55-6ccc (VI G1)		
Loam, clayey	2.0	2.0
Clay, light	2.0	4.0
Gravel	.3	4.3
Sand	.7	5.0
Gravel	.5	5.5
Sand	1.5	7.0
Gravel	8.0	15.0
Sandstone (?)	2.9	17.9
14-55-6dad (VI Fa1)*		
No record	20.0±	20.0±
Gravel	10.0±	30.0
Shale	1.0	31.0
14-55-6dbc (VI H2)		
Loam	2.0	2.0
Gravel	13.3	15.3
14-55-6ddc (VI H3)		
Loam, very fine sandy	2.0	2.0
Loam	1.0	3.0
Sand, fine	2.0	5.0
Gravel, coarse	10.6	15.6
14-55-7aca (VI G4)		
Loam	1.5	1.5
Loam, silty	1.5	3.0
Sand, fine, loamy	.5	3.5
Gravel, sandy	9.5	13.0
Gravel, coarse	4.0	17.0
14-55-7add (VI G5)		
Loam	1.6	1.6
Loam, clayey	2.4	4.0
Sand and gravel	1.0	5.0
Gravel	7.6	12.6

Table 9.—*Logs of wells and test holes*—Continued

AREA VI—Continued

	Thickness (feet)	Depth (feet)
14-55-7bad (VI G2)		
Loam, sandy	1.5	1.5
Loam, fine sandy	1.0	2.5
Gravel, sandy	2.5	5.0
Gravel, coarse	10.5	15.5
14-55-7bda1 (VI P2a)		
Loam, sandy	3.5	3.5
Gravel and sand	10.2	13.7
14-55-7bda2 (VI P2b)		
Loam, sandy	3.5	3.5
Gravel and sand	10.7	14.2
14-55-7bda3 (VI 2N1)		
Loam, sandy	3.5	3.5
Gravel and sand	9.6	13.1
14-55-7bda4 (VI 2S1)		
Loam, sandy	3.8	3.8
Gravel and sand	10.0	13.8
14-55-7bda5 (VI G3, 2W1)		
Loam, silty and clayey	1.0	1.0
Clay, light	1.8	2.8
Loam, sandy and clayey	1.2	4.0
Gravel	4.0	8.0
Sand	2.0	10.0
Gravel and sand	7.0	17.0
14-55-7cac (VI F2)		
Loam, sandy and clayey	2.5	2.5
Gravel	13.1	15.6
14-55-7cdd (VI F3)		
Loam, clayey	1.0	1.0
Clay, light	2.0	3.0
Loam, sandy	2.7	5.7
Sand and gravel	1.3	7.0
Gravel	8.6	15.6
14-55-7dcb (VI Fa2)*		
No record	24.0	24.0
Shale	18.0	42.0

Table 9.—*Logs of wells and test holes*—Continued

AREA VI—Continued

	Thickness (feet)	Depth (feet)
14-55-7dda (VI FG)		
Loam, very fine sandy	2.3	2.3
Loam, silty and clayey	1.7	4.0
Gravel	7.0	11.0
Gravel and coal	1.6	12.6
14-55-18bad (VI EF)		
Loam	2.0	2.0
Clay, medium	1.0	3.0
Loam, very fine sandy	1.0	4.0
Clay, heavy	.5	4.5
Gravel	13.6	18.1
14-55-18caa (VI E5)		
Sand and gravel	12.5	12.5
Sand	1.5	14.0
Gravel	5.1	19.1
14-55-18ccb (VI D3 1/3)		
Loam, very fine sandy	3.0	3.0
Loam, silty	2.0	5.0
Loam, sandy, to sand	5.3	10.3
Sand, coarse	.7	11.0
Gravel	2.0	13.0
14-55-18ccc1 (VI P1)		
Loam, clayey	3.0	3.0
Loam, sandy	2.0	5.0
Sand	8.0	13.0
Gravel	8.1	21.1
14-55-18ccc2 (VI 1N1)		
Loam, sandy	2.0	2.0
Loam, clayey	1.0	3.0
Sand	9.0	12.0
Gravel and sand	7.0	19.0
14-55-18ccc3 (VI 1E1)		
Loam, sandy	9.5	9.5
Gravel	.5	10.0
Sand	4.0	14.0
Gravel and sand	1.7	15.7
14-55-18ccc4 (VI C4, 1W1)		
Loam, very fine sandy	2.5	2.5
Loam, silty	2.3	4.8
Loam, very fine sandy	2.2	7.0
Loam, silty and clayey	1.3	8.3

Table 9.—*Logs of wells and test holes*—Continued

AREA VI—Continued

	Thickness (feet)	Depth (feet)
14-55-18ccc4 (VI C4, 1W1)		
Sand, fine, loamy	0.7	9.0
Gravel	6.0	15.0
14-55-18ccd (VI D3 2/3)		
Loam, fine sandy	1.0	1.0
Loam, silty and clayey	2.5	3.5
Loam, silty	2.0	5.5
Loam, fine sandy	1.5	7.0
Gravel	1.5	8.5
14-55-18cda (VI E6)		
Sand, very fine, loamy	2.0	2.0
Loam, silty and clayey	1.0	3.0
Clay, heavy	3.5	6.5
Loam, silty	1.0	7.5
Gravel and sand	4.2	11.7
Gravel, coarse	1.3	13.0
Sandstone, hard, gray	.3	13.3
14-55-18cdd (VI D4)		
Loam	1.0	1.0
Clay, light	2.0	3.0
Loam, very fine sandy	3.5	6.5
Loam, silty	1.0	7.5
Sand, loamy	1.5	9.0
Sand	1.0	10.0
Gravel and sand	7.0	17.0
Bedrock (?)	.4	17.4
14-55-18ddc (VI E6 1/2)		
Loam, very fine sandy	9.0	9.0
Gravel	4.0	13.0
14-55-19baa (VI D4 1/2)		
Loam, silty	3.5	3.5
Sand, fine, loamy	1.5	5.0
Sand, fine	7.0	12.0
Gravel	.....	.....
14-55-19bbd (VI C4 1/2)		
Loam, silty	2.5	2.5
Clay, light	1.1	3.6
Loam, very fine sandy	2.4	6.0
Loam, silty	1.0	7.0
Sand, fine, loamy	.8	7.8
Gravel	.....	.....

Table 9.—*Logs of wells and test holes*—Continued

AREA VI—Continued

	Thickness (feet)	Depth (feet)
14-55-19bda (VI C5)		
Loam	1.5	1.5
Loam, very fine sandy	2.5	4.0
Loam, sandy	6.0	10.0
Gravel	4.0	14.0
Sand	2.5	16.5
Gravel	9.0	25.5

AREA VII

15-54-25daa (VII Cb16)		
Loam	0.8	0.8
Loam, silty and clayey	4.2	5.0
Loam, silty and clayey; contains some gravel	5.5	10.5
15-54-25dda (VII Cb15)		
Loam	2.0	2.0
Sand	4.0	6.0
Gravel, sandy	1.5	7.5
Sand, loamy	1.0	8.5
Sand	1.0	9.5
Sand, loamy	4.0	13.5
15-54-36aab (VII D 1/2)		
Loam	7.5	7.5
Loam, sandy	1.1	8.6
Gravel	.2	8.8
15-54-36aac1 (VII C 1/3)		
Loam, sandy and clayey	3.8	3.8
Loam, sandy	1.6	5.4
Gravel and sand	1.6	7.0
15-54-36aac2 (VII C 2/3)		
Loam	6.8	6.8
Loam, clayey	1.2	8.0
Loam, sandy	1.5	9.5
Sand	.7	10.2
Loam	.6	10.8
Sand, loamy	1.4	12.2
Sand	1.5	13.7
Gravel	.3	14.0
15-54-36aca1 (VII B1)		
Loam, sandy, and gravel	2.7	2.7
Loam, sandy; contains some gravel	10.3	13.0
Gravel	2.0	15.0
Sand, gravelly	15.9	30.9

Table 9.—*Logs of wells and test holes*—Continued

AREA VII—Continued

	Thickness (feet)	Depth (feet)
15-54-36aca2 (VII Cb14)		
Loam	0.5	0.5
Loam, clayey	4.0	4.5
Gravel, loamy	4.0	8.5
Sand, gravelly	1.0	9.5
Gravel, sandy	2.5	12.0
15-54-36caa (VII A 1/2)		
Loam, silty	5.0	5.0
Gravel		
15-54-36cad (VII Cb13)		
Loam	0.8	0.8
Loam, clayey	1.7	2.5
Gravel, sandy	2.5	5.0
15-55-30add (VII E 3)		
Loam, clayey	2.0	2.0
Loam, very fine sandy	1.5	3.5
Gravel	12.9	16.4
15-55-30bdc1 (VII E1a)		
Loam, fine sandy	2.0	2.0
Sand	2.0	4.0
Loam, sandy and clayey	1.0	5.0
Loam, sandy, and gravel	4.0	9.0
Loam, sandy	5.0	14.0
Loam, sandy and clayey	6.0	20.0
Sand	1.0	21.0
Clay	2.5	23.5
Gravel	1.5	25.0
Sand	2.5	27.5
Gravel	3.5	31.0
Clay, heavy (bedrock?)	2.0	33.0
15-55-30bdc2 (VII E1b)		
Loam, fine sandy	2.0	2.0
Sand	2.0	4.0
Loam, sandy and clayey	1.0	5.0
Loam, sandy, and gravel	4.0	9.0
Loam, sandy	2.7	11.7
15-55-30cda (VII D2)		
Loam, clayey	2.0	2.0
Clay, medium	2.5	4.5
Gravel	8.0	12.5
Sand	2.5	15.0
Gravel and sand	7.3	22.3

Table 9.—*Logs of wells and test holes*—Continued

AREA VII—Continued

	Thickness (feet)	Depth (feet)
15-55-30cdb1 (VII D1)		
Sand and gravel	6.5	6.5
Sand	9.5	16.0
Gravel	10.0	26.0
15-55-30cdb2 (VII D1 1/2)		
Loam, sandy	2.0	2.0
Loam, silty	3.0	5.0
Clay, medium	8.0	13.0
Gravel		
15-55-30dba (VII E2)		
Loam, fine sandy	4.0	4.0
Loam, silty	2.5	6.5
Clay, light	3.3	9.8
Gravel, sandy	18.1	27.9
15-55-30ddc (VII D3)		
Loam, fine sandy	2.0	2.0
Gravel; contains some clay	12.5	14.5
15-55-30ddd (VII D4)		
Loam, very fine sandy	3.5	3.5
Gravel, sandy	16.2	19.7
15-55-31aab (VII LN1, C1)		
Loam	2.5	2.5
Sand and gravel	11.4	13.9
15-55-31aac (VII P1)		
Loam, sandy	1.5	1.5
Loam, clayey	2.0	3.5
Sand and gravel	5.5	9.0
Gravel; contains some sand	5.6	14.6
15-55-31abd1 (VII 1W1)		
Loam	10.0	10.0
Gravel and sand	4.0	14.0
15-55-31abd2 (VII 1S1)		
Loam	9.5	9.5
Sand and gravel	7.4	16.9

Table 9.—*Logs of wells and test holes*—Continued

AREA VII—Continued

	Thickness (feet)	Depth (feet)
15-55-31aca (VII B4)		
Loam, sandy	1.3	1.3
Clay, light	2.7	4.0
Clay, heavy	2.0	6.0
Gravel, sandy	13.5	19.5
15-55-31ada (VII B5)		
Loam, sandy	1.2	1.2
Loam, sandy and clayey	1.6	2.8
Clay, light	.7	3.5
Loam, sandy	2.0	5.5
Clay, heavy	1.0	6.5
Loam, fine sandy	1.5	8.0
Sand and loam, sandy	7.0	15.0
Gravel	6.2	21.2
15-55-31bcb (VII B2)		
Loam	1.3	1.3
Clay, medium	3.2	4.5
Sand, loamy	2.5	7.0
Clay, heavy	6.5	13.5
Loam, sandy	.5	14.0
Loam, silty	2.0	16.0
Loam, silty and clayey	.5	16.5
Gravel and sand	11.5	28.0
Clay and coal	1.0	29.0
15-55-31bdb (VII B3)		
Clay, medium	9.0	9.0
Loam, clayey	1.5	10.5
Gravel, sandy	12.0	22.5
15-55-31caa1 (VII A2a)		
Clay, light	1.0	1.0
Loam, silty and clayey	1.0	2.0
Sand	1.0	3.0
Loam, sandy	1.7	4.7
Loam, clayey	.3	5.0
Loam, sandy	1.0	6.0
Gravel	11.9	17.9
15-55-31caa2 (VII A2b)		
Clay, light	1.0	1.0
Loam, silty and clayey	1.0	2.0
Sand	1.0	3.0
Loam, sandy	1.7	4.7
Loam, clayey	.3	5.0
Loam, sandy	1.0	6.0
Gravel	7.8	13.8

Table 9.—*Logs of wells and test holes*—Continued

AREA VII—Continued

	Thickness (feet)	Depth (feet)
15-55-31cbc (VII A1)		
Loam	2.5	2.5
Loam, sandy	1.0	3.5
Loam, clayey	.5	4.0
Gravel	2.0	6.0
Loam	1.0	7.0
Sand	4.0	11.0
Loam, sandy	2.0	13.0
Loam	4.5	17.5
Loam, clayey	5.5	23.0
Gravel	3.5	26.5
15-55-31daa1 (VII A3a)		
Clay, medium	3.3	3.3
Loam, sandy and clayey	1.7	5.0
Loam, sandy	1.0	6.0
Gravel	1.0	7.0
Clay, sandy	7.9	14.9
Sand	1.5	16.4
Gravel, coarse	12.7	29.1
Shale, heavy, blue-gray	16.5	45.6
15-55-31daa2 (VII A3b)		
Clay, medium	3.3	3.3
Loam, sandy and clayey	1.7	5.0
Loam, sandy	1.0	6.0
Gravel	1.0	7.0
Loam, clayey	.5	7.5
Clay, sandy	6.5	14.0
Sand	2.0	16.0
Gravel and sand	8.1	24.1
15-55-32bdb (VII B6)		
Loam, fine sandy	3.0	3.0
Loam, clayey	1.0	4.0
Loam, fine sandy	2.5	6.5
Sand, loamy	.5	7.0
Gravel	4.0	11.0
Shale, black	3.0	14.0

AREA VIII

15-55-4caa (VIII J2)		
Loam	2.5	2.5
Clay, light	2.0	4.5
Loam, very fine sandy	1.0	5.5
Loam, fine sandy	.7	6.2
Gravel	14.8	21.0

Table 9.—*Logs of wells and test holes*—Continued

AREA VIII—Continued

	Thickness (feet)	Depth (feet)
15-55-4cbb (VIII J1)		
Clay, light	6.5	6.5
Clay, heavy	8.5	15.0
Gravel	9.7	24.7
15-55-9aba (VIII I1)		
Clay, light	2.0	2.0
Loam, sandy and clayey	2.5	4.5
Sand, loamy	1.8	6.3
Gravel	12.9	19.2
Clay (bedrock?)	1.8	21.0
Sand	3.0	24.0
Clay	4.0	28.0
Sand	7.0	35.0
Clay or sandstone, hard	2.0	37.0
15-55-8acd (VIII H1)		
Loam	1.0	1.0
Loam, sandy	1.0	2.0
Gravel and sand	12.0	14.0
Sand	4.0	18.0
Sand, gravelly	13.0	31.0
Gravel	6.6	37.6
15-55-8add (VIII H2)		
Clay, medium	1.0	1.0
Clay, heavy	2.5	3.5
Loam, very fine sandy	1.5	5.0
Gravel and sand	14.3	19.3
15-55-8dcc (VIII G1)		
Loam, sandy and clayey	2.5	2.5
Sand, loamy	2.0	4.5
Loam, silty and clayey	2.0	6.5
Sand, loamy	3.0	9.5
Sand and gravel	2.8	12.3
Gravel and sand	25.9	38.2
Gravel	3.8	42.0
15-55-8ddd (VIII G2)		
Loam, sandy and clayey	1.0	1.0
Clay, light	.8	1.8
Loam, sandy and clayey	.7	2.5
Sand, loamy	1.0	3.5
Loam, clayey	.6	4.1
Clay, medium	3.4	7.5
Loam, fine sandy	2.5	10.0
Gravel, sandy	5.0	15.0
Sand, gravelly	4.5	19.5

Table 9.—*Logs of wells and test holes*—Continued

AREA VIII—Continued

	Thickness (feet)	Depth (feet)
15-55-9bbb (VIII I2)		
Clay, light	3.0	3.0
Clay, medium	1.3	4.3
Loam, silty	.9	5.2
Gravel	.8	6.0
Sand	2.0	8.0
Gravel	4.0	12.0
Sand	9.2	21.2
15-55-9cab (VIII H3)		
Clay, heavy	5.5	5.5
Loam, silty	2.5	8.0
Loam, fine sandy	.5	8.5
Clay, medium	.8	9.3
Gravel	7.2	16.5
15-55-9ccd (VIII G2 1/2)		
Loam, sandy	1.5	1.5
Loam	2.0	3.5
Gravel	.....	.....
15-55-9cdc (VIII G3)		
Loam, silty	3.5	3.5
Gravel, coarse; contains some sand	10.5	14.0
15-55-16bab1 (VIII P2)		
Loam, clayey	3.0	3.0
Loam, sandy, and sand	5.5	8.5
Gravel and sand	9.0	17.5
15-55-16bab2 (VIII FG, 2N1)		
Clay	4.0	4.0
Loam, clayey	3.0	7.0
Gravel and sand	8.9	15.9
15-55-16bab3 (VIII 2W1)		
Loam, clayey	3.0	3.0
Loam, sandy	6.0	9.0
Gravel and sand	8.0	17.0
Gravel	2.0	19.0
15-55-16bab4 (VIII 2E1)		
Clay	2.0	2.0
Loam	3.0	5.0
Gravel	12.4	17.4

458513 O - 58 - 9

Table 9.—*Logs of wells and test holes*—Continued

AREA VIII—Continued

	Thickness (feet)	Depth (feet)
15-55-16bac (VIII 2S1)		
Clay	3.5	3.5
Loam, clayey	2.0	5.5
Gravel and sand	12.5	18.0
15-55-16bbd (VIII F2)		
Clay, light	3.0	3.0
Clay, sandy	3.0	6.0
Sand, loamy	1.0	7.0
Sand, clean, and sand, loamy	6.0	13.0
Gravel	5.0	18.0
15-55-16bca (VIII F1 1/2)		
Loam, clayey	1.0	1.0
Loam, sandy and clayey	2.0	3.0
Gravel	.....	.....
15-55-16bda1 (VIII F2 2/3)		
Clay, light	1.0	1.0
Clay, medium	3.8	4.8
Gravel	.....	.....
15-55-16bda2 (VIII F2 1/3)		
Clay, light	2.0	2.0
Loam, sandy and clayey	1.6	3.6
Gravel	.4	4.0
15-55-16bdd (VIII E5)		
Loam	1.0	1.0
Loam, silty	3.0	4.0
Loam, fine sandy	1.5	5.5
Gravel, sandy	3.5	9.0
Gravel, coarse	2.0	11.0
Sand	2.0	13.0
Gravel, some sand	4.4	17.4
15-55-16caa (VIII E5 1/2)		
Loam, clayey	1.0	1.0
Clay, heavy	4.0	5.0
Clay, medium	1.0	6.0
Sand	1.5	7.5
Gravel	.....	.....
15-55-16cad (VIII D2 1/2)		
Clay, heavy	1.5	1.5
Clay, medium	2.5	4.0
Sand, loamy	1.0	5.0
Sand	1.0	6.0
Gravel	.....	.....

Table 9.—*Logs of wells and test holes*—Continued

AREA VIII—Continued

	Thickness (feet)	Depth (feet)
15-55-16cba (VIII E4 1/2)		
Loam, silty and clayey	1.0	1.0
Loam, sandy and clayey	2.0	3.0
Loam, sandy	1.0	4.0
Loam, clayey	2.0	6.0
Loam, sandy and clayey	2.0	8.0
Gravel	.....	.....
15-55-16cbb1 (VIII 1E2)		
Loam, sandy and clayey	6.0	6.0
Sand	1.0	7.0
Gravel, sandy	8.3	15.3
15-55-16cbd (VIII D2)		
Loam, sandy and clayey	1.0	1.0
Clay, sandy	1.0	2.0
Loam, sandy and clayey	4.5	6.5
Clay, heavy	2.2	8.7
Loam, silty and clayey	1.8	10.5
Gravel	3.6	14.1
15-55-16ccd1 (VIII C4)		
Clay, light	1.0	1.0
Clay, heavy	4.3	5.3
Loam, clayey	.7	6.0
Loam, silty	1.0	7.0
Clay, medium	1.0	8.0
Sand and gravel	5.0	13.0
Gravel; contains some sand	6.9	19.9
15-55-16ccd2 (VIII C3 1/2)		
Clay, light	1.0	1.0
Clay, medium	3.0	4.0
Gravel	.....	.....
15-55-16cdd (VIII C4 1/2)		
Loam	1.0	1.0
Loam, silty	1.0	2.0
Loam, sandy	1.5	3.5
Gravel	.7	4.2
15-55-16dcb (VIII D3)		
Clay, light	0.8	0.8
Clay, heavy	4.4	5.2
Loam, sandy	.6	5.8
Loam, silty and clayey	1.2	7.0
Gravel	8.8	15.8

Table 9.—*Logs of wells and test holes*—Continued

AREA VIII—Continued

	Thickness (feet)	Depth (feet)
15-55-17aac (VIII F1)		
Loam	2.0	2.0
Loam, sandy	1.0	3.0
Clay, medium	3.0	6.0
Clay, light	5.0	11.0
Sand, loamy	.8	11.8
Clay, light	2.4	14.2
Loam	1.3	15.5
Gravel and sand	12.6	28.1
15-55-17add (VIII 1N1)		
Loam, clayey	5.0	5.0
Loam, sandy	4.5	9.5
Gravel	8.4	17.9
15-55-17bdd (VIII E3)		
Loam	1.5	1.5
Sand	1.0	2.5
Sand, gravelly	8.5	11.0
Loam, sandy and clayey	14.0	25.0
Clay	1.0	26.0
Gravel, coarse	6.5	32.5
15-55-17cbb (VIII E2)		
Loam, sandy and clayey	3.0	3.0
Gravel	8.0	11.0
Loam, sandy and clayey	14.0	25.0
Gravel	6.0	31.0
Clay	2.0	33.0
Gravel	5.0	38.0
Sand, cemented	1.5	39.5
Gravel	1.5	41.0
15-55-17daa1 (VIII E4, P1)		
Clay, light	4.3	4.3
Loam, fine sandy	2.7	7.0
Sand and gravel	1.5	8.5
Gravel, fine, and sand	25.4	33.9
Sandstone, fine, gray	13.4	47.3
Shale and sandstone	4.3	51.6
15-55-17daa2 (VIII 1E1)		
Loam, sandy	9.0	9.0
Gravel, sandy	6.3	15.3
15-55-17daa3 (VIII 1S1)		
Loam, clayey	8.0	8.0
Sand	1.0	9.0
Gravel	8.4	17.4

Table 9.—*Logs of wells and test holes*—Continued

AREA VIII—Continued

	Thickness (feet)	Depth (feet)
15-55-17daa4 (VIII 1W1)		
Loam, clayey	5.0	5.0
Sand	2.5	7.5
Gravel, sandy	9.9	17.4
15-55-17daa5 (VIII 1W2)		
Loam, sandy	10.0	10.0
Gravel and sand	1.0	11.0
Gravel	6.4	17.4
15-55-17dad (VIII D1)		
Clay, light	3.7	3.7
Loam, very fine sandy	1.8	5.5
Gravel, sandy	12.0	17.5
15-55-18add (VIII Cb20)		
Loam	0.5	0.5
Sand, clayey	3.0	3.5
Sand, silty	3.0	6.5
Gravel and sand	1.5	8.0
15-55-18dab (VIII E1)		
Clay	2.0	2.0
Loam, sandy	13.8	15.8
Clay, sandy	4.0	19.8
Gravel	.9	20.7
Shale, blue	.9	21.6
15-55-18dad (VIII Cb19)		
Loam	0.5	0.5
Loam, gravelly	2.0	2.5
Clay, sandy	7.5	10.0
Gravel	2.0	12.0
15-55-18ddc (VIII Cb18)		
Loam	1.0	1.0
Sand, silty	5.0	6.0
Sand, silty, fine	4.0	10.0
15-55-19daa (VIII B1)		
Loam	2.0	2.0
Loam, sandy	2.2	4.2
Sand	2.8	7.0
Sand and gravel	2.5	9.5
Gravel	1.5	11.0
Loam, sandy	9.0	20.0
Sand	.5	20.5
Loam, sandy	.5	21.0

Table 9.—*Logs of wells and test holes*—Continued

AREA VIII—Continued

	Thickness (feet)	Depth (feet)
15-55-19daa (VIII B1)—Continued		
Sand	.5	21.5
Loam, sandy	.5	22.0
Loam, clayey	1.8	23.8
Gravel	2.2	26.0
Sand	.6	26.6
Gravel	7.1	33.7
15-55-19dab (VIII Cb17)		
Loam	0.8	0.8
Loam, sandy and clayey	4.2	5.0
Sand, clayey	2.5	7.5
Gravel, loamy	2.0	9.5
Sand	1.5	11.0
15-55-20aaa (VIII C3)		
Clay, light	3.5	3.5
Loam	1.5	5.0
Gravel and sand	14.8	19.8
15-55-20add (VIII B3)		
Loam	1.0	1.0
Clay, medium	2.5	3.5
Loam, clayey	2.0	5.5
Loam, sandy and clayey	.8	6.3
Loam, sandy	1.7	8.0
Sand, gravelly	5.0	13.0
Gravel	4.0	17.0
Sand	1.0	18.0
Gravel	1.0	19.0
15-55-20baa (VIII C2)		
Loam	1.5	1.5
Clay, medium	3.5	5.0
Loam, fine sandy	.6	5.6
Clay, medium	2.8	8.4
Loam, silty and clayey	1.6	10.0
Clay, medium	.5	10.5
Clay, light	1.0	11.5
Loam, silty and clayey	.5	12.0
Sand and gravel	1.0	13.0
Gravel	6.7	19.7
15-55-20bba (VIII C1)		
Loam, sandy and clayey	3.8	3.8
Clay, medium	1.2	5.0
Sand, loamy	1.8	6.8
Loam, sandy	1.2	8.0
Clay, medium	.5	8.5
Loam, sandy and clayey	1.5	10.0
Loam, clayey	5.5	15.5
Loam, sandy	2.5	18.0

Table 9.—*Logs of wells and test holes*—Continued

AREA VIII—Continued

	Thickness (feet)	Depth (feet)
15-55-20bba (VIII C1)—Continued		
Loam, clayey	5.8	23.8
Gravel, clayey	2.2	26.0
Gravel, sandy	4.0	30.0
Sand and gravel	4.0	34.0
15-55-20caa (VIII B2)		
Loam, clayey	2.0	2.0
Clay, light	1.0	3.0
Loam, silty	2.0	5.0
Loam, sandy	1.5	6.5
Loam, sandy and clayey	.5	7.0
Clay, light	1.5	8.5
Loam, silty and clayey	1.0	9.5
Gravel, sandy	1.5	11.0
Sand, gravelly	2.0	13.0
Gravel, coarse	4.9	17.9
15-55-20ccd (VIII A1)		
Loam, fine sandy	3.0	3.0
Sand, some gravel	13.0	16.0
Gravel, coarse	5.5	21.5
Sand, some gravel	17.5	39.0
Gravel	1.9	40.9
15-55-20cdd (VIII A2)		
Loam, very fine sandy	2.5	2.5
Loam, clayey	2.0	4.5
Loam, silty and clayey	1.5	6.0
Sand	1.0	7.0
Loam, silty	2.0	9.0
Gravel and sand	10.1	19.1
15-55-20ddd (VIII A3)		
Loam, very fine sandy	6.5	6.5
Gravel, sandy	8.5	15.0
Gravel, coarse; contains some sand	6.9	21.9
15-55-21bdc (VIII B4)		
Clay, light	1.0	1.0
Clay, medium	1.0	2.0
Clay, heavy	1.3	3.3
Loam, silty and clayey	.9	4.2
Clay, heavy	1.3	5.5
Sand	1.5	7.0
Loam, silty	1.5	8.5
Sand	.5	9.0
Gravel, coarse	8.5	17.5

Table 9.—*Logs of wells and test holes*—Continued

AREA IX

	Thickness (feet)	Depth (feet)
16-55-28dca (IX A 1/2)		
Clay, medium	2.0	2.0
Loam, silty and clayey	2.7	4.7
Clay, light	3.8	8.5
Clay, heavy	1.0	9.5
Loam, silty	1.0	10.5
Sand, loamy, fine	1.0	11.5
Gravel	.....	.....
16-55-33add (IX A1)		
Loam, silty	1.0	1.0
Clay, heavy	1.5	2.5
Loam, sandy	2.1	4.6
Loam, clayey	1.9	6.5
Gravel	5.5	12.0
Clay, sandy (bedrock?)	11.5	23.5

AREA X

16-55-22cdd (X D1)		
Loam	1.0	1.0
Loam, sandy	1.0	2.0
Sand, loamy	1.0	3.0
Loam, sandy and clayey	3.0	6.0
Loam, sandy	1.0	7.0
Loam, sandy and clayey	1.0	8.0
Loam, sandy	5.5	13.5
Loam, clayey	1.5	15.0
Loam, fine sandy	2.0	17.0
Loam, clayey	1.5	18.5
Clay, light	.7	19.2
Loam, silty	1.8	21.0
Clay, gray	2.0	23.0
Loam	5.5	28.5
Clay, gray	5.3	33.8
Gravel	3.2	37.0
Shale, blue	3.1	40.1
16-55-22ddd (X D1 1/2)		
Loam, clayey	4.0	4.0
Gravel	21.0	25.0
16-55-23aab (X F1)		
Loam	1.3	1.3
Loam, very fine sandy	8.7	10.0
Sand	7.5	17.5
Gravel	1.8	19.3
16-55-23aad (X F2)		
Loam	1.0	1.0
Loam, very fine sandy	3.0	4.0

Table 9.—*Logs of wells and test holes*—Continued

AREA X—Continued

	Thickness (feet)	Depth (feet)
16-55-23aad (X F2)—Continued		
Loam, silty	2.0	6.0
Sand	5.2	11.2
Gravel	2.8	14.0
Sand	2.0	16.0
Gravel	.9	16.9
16-55-23acc (X E2)		
Loam, clayey	1.3	1.3
Loam, very fine sandy	6.7	8.0
Gravel and loam, very fine sandy	1.0	9.0
Gravel and sand	1.0	10.0
Loam, sandy	3.5	13.5
Sand	1.5	15.0
Gravel	2.8	17.8
16-55-23bdd (X E1)		
Loam, very fine sandy	2.0	2.0
Sand, loamy, fine	4.3	6.3
Sand and gravel	1.7	8.0
Gravel	2.0	10.0
Sand, loamy	14.0	24.0
16-55-23cdc (X D2)		
Loam	1.3	1.3
Loam, fine sandy	5.7	7.0
Gravel, coarse	8.2	15.2
16-55-24bcb (X F3)		
No record	49.2	49.2
16-55-26cba (X C3)		
Loam	2.5	2.5
Loam, very fine sandy	4.5	7.0
Gravel	8.5	15.5
16-55-26ccc1 (X P1)		
Sand, loamy	5.0	5.0
Sand	3.0	8.0
Gravel	3.9	11.9
16-55-26ccc2 (X 1N1)		
Sand, loamy	5.0	5.0
Sand	4.0	9.0
Gravel, sandy	4.4	13.4

Table 9.—*Logs of wells and test holes*—Continued

AREA X—Continued

	Thickness (feet)	Depth (feet)
16-55-26ccc3 (X 1E1)		
Loam, sandy	6.0	6.0
Gravel and sand	9.8	15.8
16-55-26ccc4 (X B2, 1S1)		
Loam, silty	2.0	2.0
Loam, very fine sandy	1.0	3.0
Sand, fine, loamy	1.0	4.0
Loam, silty	2.0	6.0
Gravel and sand	3.3	9.3
Gravel	3.4	12.7
16-55-26ccd (X B3)		
Sand, loamy, fine	5.5	5.5
Loam, very fine sandy	2.5	8.0
Gravel and loam, very fine sandy	1.0	9.0
Gravel	4.2	13.2
16-55-27bad (X CD 1/2)		
Loam, clayey	9.5	9.5
Clay	9.5	19.0
16-55-27cad (X C1)		
Clay, heavy, to clay, sandy	8.8	8.8
Gravel	21.4	30.2
Shale, sandy, brown-gray	7.1	37.3
Shale, blue-gray	3.0	40.3
Sandstone, blue-gray	3.5	43.8
Coal	.2	44.0
Sandstone, blue-gray	1.2	45.2
16-55-27daa (X C2)		
Loam, very fine sandy	2.5	2.5
Sand	1.1	3.6
Clay, light	.9	4.5
Gravel and sand	13.4	17.9
16-55-27dcd (X B 1/2)		
No record	23.4	23.4
16-55-27ddc (X B1)		
Clay, light	1.0	1.0
Loam, silty and clayey	1.0	2.0
Loam, silty	3.5	5.5
Loam, sandy	1.5	7.0
Sand	6.0	13.0
Gravel	5.5	18.5

Table 9.—*Logs of wells and test holes*—Continued

AREA X—Continued

	Thickness (feet)	Depth (feet)
16-55-34aaa (X A2)		
Loam, silty	2.5	2.5
Clay, heavy	1.0	3.5
Loam, silty	1.0	4.5
Loam, fine sandy	1.0	5.5
Gravel		
No record	129.5	135.0
16-55-34aba (X A1)		
No record	22.8	22.8
16-55-34abb (X A 2/3)		
No record	32.7	32.7
16-55-34bba (X A 1/3)		
Loam, sandy	1.5	1.5
Gravel	12.5	14.0
Sand, hard	14.2	28.2

Table 10.—*Measurements of depth to water in observation wells*

[Feet below land-surface datum]

AREA I

Date	Water level	Date	Water level	Date	Water level
13-53-19ddc (I C1)					
July 23, 1951	15.95	Sept. 18, 1951	15.33	Nov. 26, 1951	15.89
Aug. 6	15.30	Oct. 16	15.51	Dec. 27	16.09
Aug. 20	15.23	Oct. 29	15.50	Feb. 4, 1952	16.44
Sept. 5	15.28				
13-53-29acb (I E1)					
Aug. 6, 1951	9.47	Oct. 2, 1951	11.05	Nov. 26, 1951	10.65
Aug. 20	9.91	Oct. 16	10.31	Dec. 27	10.20
Sept. 5	9.85	Oct. 29	10.45	Feb. 4, 1952	10.97
Sept. 18	10.12				
13-53-29bbc (I C2)					
July 23, 1951	7.10	Sept 18, 1951	7.72	Nov. 26, 1951	7.72
Aug. 6	7.24	Oct. 2	7.53	Dec. 27	7.95
Aug. 20	7.71	Oct. 16	7.64	Feb. 4, 1952	7.82
Sept. 5	7.52	Oct. 29	7.64		
13-53-29bcd1 (I C3a)					
July 23, 1951	2.64	Sept. 18, 1951	4.46	Nov. 26, 1951	5.55
Aug. 6	3.42	Oct. 2	4.47	Dec. 27	5.11
Aug. 20	4.23	Oct. 16	5.11	Feb. 4, 1952	3.79
Sept. 9	3.71	Oct. 29	5.27		
13-53-29bcd2 (I C3b)					
July 23, 1951	2.62	Sept. 18, 1951	4.28	Nov. 26, 1951	5.47
Aug. 6	3.35	Oct. 2	4.22	Dec. 27	4.98
Aug. 20	4.12	Oct. 16	4.87	Feb. 4, 1952	3.55
Sept. 5	3.49	Oct. 29	5.02		
13-53-29bdb (I D1)					
July 23, 1951	2.65	Sept. 18, 1951	3.70	Nov. 26, 1951	4.77
Aug. 6	2.80	Oct. 2	3.43	Dec. 27	5.37
Aug. 20	3.73	Oct. 16	4.04	Feb. 4, 1952	4.44
Sept. 5	2.74	Oct. 29	4.11		
13-53-30add (I B1)					
July 23, 1951	6.05	Sept. 18, 1951	6.82	Nov. 26, 1951	9.30
Aug. 6	5.57	Oct. 2	7.14	Dec. 27	10.05
Aug. 20	6.42	Oct. 16	8.17	Feb. 4, 1952	9.02
Sept. 5	6.63	Oct. 29	9.30		
13-53-30bbb (I A1)					
July 23, 1951	27.08	Sept. 18, 1951	25.84	Nov. 26, 1951	26.42
Aug. 6	26.66	Oct. 2	25.79	Dec. 27	26.72
Aug. 20	26.28	Oct. 16	26.00	Feb. 4, 1952	27.27
Sept. 5	25.88	Oct. 29	26.02		

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA I—Continued

Date	Water level	Date	Water level	Date	Water level
13-53-30bdd (I A2)					
Aug. 6, 1951	10.04	Oct. 2, 1951	10.51	Nov. 26, 1951	11.17
Aug. 20	10.31	Oct. 16	10.72	Dec. 27	11.50
Sept. 5	10.42	Oct. 29	10.84	Feb. 4, 1952	11.85
13-53-30dac (I A3)					
July 23, 1951	8.33	Sept. 18, 1951	9.46	Nov. 26, 1951	10.69
Aug. 6	8.70	Oct. 2	9.39	Dec. 27	11.10
Aug. 20	8.93	Oct. 16	9.93	Feb. 4, 1952	11.54
Sept. 5	9.13	Oct. 29	10.15		
AREA II					
13-53-15ccb (II D2).					
July 9, 1951	8.15	Sept. 5, 1951	7.65	Oct. 29, 1951	7.95
July 23	7.02	Sept. 18	7.85	Nov. 26	8.20
Aug. 6	7.90	Oct. 2	7.79	Dec. 27	8.42
Aug. 20	7.93	Oct. 16	7.90	Feb. 4, 1952	8.95
13-53-16baa (II D1)					
Sept. 5, 1951	11.02	Oct. 16, 1951	11.82	Dec. 27, 1951	13.09
Sept. 18	11.33	Oct. 29	12.11	Feb. 4, 1952	13.33
Oct. 2	11.31	Nov. 26	12.75		
13-53-16bdb (II C1)					
July 9, 1951	11.89	Sept. 5, 1951	10.97	Oct. 29, 1951	11.80
July 23	10.87	Sept. 18	11.20	Nov. 26	12.42
Aug. 6	10.49	Oct. 2	10.86	Dec. 27	12.97
Aug. 20	10.98	Oct. 16	11.53	Feb. 4, 1952	13.59
13-53-16dbc (II C2)					
July 9, 1951	3.45	Sept. 5, 1951	2.98	Oct. 29, 1951	3.73
July 23	2.61	Sept. 18	3.31	Nov. 26	4.10
Aug. 6	2.58	Oct. 2	3.20	Dec. 27	4.50
Aug. 20	2.82	Oct. 16	3.65	Feb. 4, 1952	4.09
13-53-16ddb (II C3)					
July 9, 1951	4.42	Sept. 5, 1951	3.90	Oct. 29, 1951	4.30
July 23	4.36	Sept. 18	4.05	Nov. 26	4.58
Aug. 6	4.09	Oct. 2	4.07	Dec. 27	4.91
Aug. 20	4.22	Oct. 16	4.21	Feb. 4, 1952	5.48
13-53-20aac (II B)					
July 9, 1951	10.29	Sept. 18, 1951	9.86	Nov. 26, 1951	10.10
Aug. 6	9.49	Oct. 2	9.83	Dec. 27	10.27
Aug. 20	9.77	Oct. 16	10.03	Feb. 4, 1952	10.47
Sept. 5	9.78	Oct. 29	10.00		

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA II—Continued

Date	Water level	Date	Water level	Date	Water level
13-53-20dca (II A1)					
July 9, 1951	5.35	Sept. 5, 1951	4.74	Oct. 29, 1951	4.61
July 23	4.62	Sept. 18	5.24	Nov. 26	4.58
Aug. 6	5.21	Oct. 2	4.65	Dec. 27	5.08
Aug. 20	6.05	Oct. 16	4.80	Feb. 4, 1952	4.64
AREA III					
13-53-1aac (III G1)					
May 21, 1951	30.95	Aug. 6, 1951	26.94	Oct. 16, 1951	26.12
June 4	30.78	Aug. 20	25.78	Oct. 29	26.33
June 18	30.14	Sept. 5	25.13	Nov. 26	27.22
July 9	29.12	Sept. 18	25.24	Dec. 27	27.85
July 23	28.24	Oct. 1	25.60	Feb. 1, 1952	28.78
13-53-1add (III G2)					
May 21, 1951	11.77	Aug. 6, 1951	8.94	Oct. 16, 1951	9.11
June 4	10.92	Aug. 20	8.50	Oct. 29	9.05
June 18	9.77	Sept. 5	8.71	Nov. 26	9.76
July 9	10.00	Sept. 18	9.84	Dec. 27	10.19
July 23	9.46	Oct. 1	8.88	Feb. 1, 1952	10.72
13-53-1cbc (III F1)					
May 7, 1951	24.56	Aug. 6, 1951	20.70	Oct. 16, 1951	21.47
May 21	24.51	Aug. 20	20.58	Oct. 29	21.51
June 4	23.58	Sept. 5	20.40	Nov. 26	22.07
June 28	22.93	Sept. 18	20.70	Dec. 27	22.63
July 9	22.55	Oct. 1	20.75	Feb. 1, 1952	23.00
July 23	21.65				
13-53-1cdc (III F2)					
May 7, 1951	13.27	Aug. 6, 1951	9.90	Oct. 16, 1951	11.20
May 21	12.91	Aug. 20	10.02	Oct. 29	10.92
June 4	11.68	Sept. 5	10.38	Nov. 26	11.63
June 18	10.67	Sept. 18	10.68	Dec. 27	11.98
July 9	11.05	Oct. 1	10.77	Feb. 1, 1952	12.36
July 23	10.00				
13-53-10ada (III D1)					
Oct. 20, 1950	33.31	Jan. 29, 1951	34.16	July 9, 1951	33.97
Oct. 23	33.36	Feb. 5	34.18	July 23	33.37
Oct. 30	33.39	Feb. 12	34.28	Aug. 6	32.98
Nov. 6	33.54	Feb. 26	34.39	Aug. 20	32.62
Nov. 13	33.37	Mar. 13	34.60	Sept. 5	32.57
Nov. 20	33.56	Mar. 26	34.49	Sept. 18	32.60
Nov. 27	33.65	Apr. 9	34.62	Oct. 1	32.61
Dec. 4	33.70	Apr. 23	34.68	Oct. 16	33.06
Dec. 18	33.92	May 7	34.73	Oct. 29	32.94
Jan. 3, 1951	34.03	May 21	34.77	Nov. 26	33.30
Jan. 15	33.94	June 4	34.51	Dec. 27	33.45
Jan. 22	34.04	June 18	34.38	Feb. 4, 1952	33.94

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

Date	Water level	Date	Water level	Date	Water level
13-53-10ccc (III A1)					
July 24, 1950	7.08	Nov. 20, 1950	8.49	May 21, 1951	9.23
July 31	6.83	Nov. 27	8.65	June 4	8.54
Aug. 7	7.36	Dec. 4	8.78	June 18	8.34
Aug. 14	8.47	Dec. 18	9.06	July 9	7.59
Aug. 21	7.35	Jan. 3, 1951	9.43	July 23	7.00
Aug. 28	7.59	Jan. 15	9.73	Aug. 6	7.24
Sept. 11	7.79	Jan. 22	9.90	Aug. 20	7.28
Sept. 18	7.89	Jan. 29	10.08	Sept. 5	7.23
Sept. 25	7.92	Feb. 5	10.24	Sept. 18	7.36
Oct. 2	7.97	Feb. 12	10.40	Oct. 1	7.53
Oct. 9	7.90	Feb. 26	10.66	Oct. 16	7.78
Oct. 16	8.05	Mar. 13	10.81	Oct. 29	8.00
Oct. 23	8.12	Mar. 26	10.92	Nov. 26	8.55
Oct. 30	8.16	Apr. 9	10.36	Dec. 27	9.12
Nov. 6	8.29	Apr. 23	10.35	Feb. 1, 1952	10.00
Nov. 13	8.38	May 7	10.14		
13-53-10cdb (III B1)					
July 24, 1950	27.05	Nov. 13, 1950	25.88	May 21, 1951	28.67
July 31	27.32	Nov. 20	25.99	June 4	28.31
Aug. 7	27.22	Nov. 27	26.03	June 18	27.85
Aug. 14	26.25	Dec. 4	26.20	July 9	26.84
Aug. 21	26.25	Jan. 3, 1951	26.80	July 23	26.15
Aug. 28	26.14	Jan. 15	27.13	Aug. 6	25.27
Sept. 6	25.93	Jan. 22	27.38	Aug. 20	24.74
Sept. 11	25.84	Feb. 5	27.87	Sept. 5	24.45
Sept. 18	25.83	Feb. 12	28.02	Sept. 18	24.33
Sept. 25	25.80	Feb. 26	28.25	Oct. 1	24.37
Oct. 9	25.47	Mar. 13	28.42	Oct. 16	24.58
Oct. 16	25.66	Mar. 26	28.51	Oct. 29	24.68
Oct. 23	25.64	Apr. 9	28.63	Nov. 26	25.23
Oct. 30	24.73	Apr. 23	28.62	Dec. 27	25.73
Nov. 6	25.81	May 7	28.70	Feb. 4, 1952	25.68
13-53-10dbb (III C1)					
July 17, 1950	37.58	Nov. 6, 1950	35.77	May 7, 1951	37.37
July 24	37.47	Nov. 13	35.48	May 21	37.42
July 31	36.14	Nov. 20	35.61	June 4	37.01
Aug. 7	37.62	Nov. 27	35.74	June 18	37.02
Aug. 14	35.44	Dec. 4	35.90	July 9	36.00
Aug. 21	35.56	Jan. 3, 1951	36.32	July 23	35.40
Aug. 28	35.38	Jan. 15	36.49	Aug. 6	34.59
Sept. 6	33.50	Jan. 22	36.59	Aug. 20	34.16
Sept. 11	35.20	Jan. 29	36.70	Sept. 5	33.90
Sept. 18	35.18	Feb. 5	37.10	Sept. 18	33.94
Sept. 25	35.43	Feb. 12	36.65	Oct. 1	34.05
Oct. 2	33.30	Feb. 26	37.01	Oct. 16	34.30
Oct. 9	35.08	Mar. 13	36.90	Oct. 29	34.45
Oct. 16	35.16	Mar. 26	37.29	Nov. 26	34.98
Oct. 23	35.21	Apr. 9	37.28	Dec. 27	35.55
Oct. 30	35.26	Apr. 23	37.31	Feb. 4, 1952	36.14
13-53-10ddc (III C2)					
July 17, 1950	10.60	Aug. 21, 1950	10.17	Sept. 25, 1950	9.99
July 24	10.58	Aug. 28	10.14	Oct. 9	10.03
July 31	10.32	Sept. 6	10.04	Oct. 16	10.09
Aug. 7	10.93	Sept. 11	10.05	Oct. 23	9.95
Aug. 14	9.99	Sept. 18	9.91	Oct. 30	10.03

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

13-53-10ddc (III C2)—Continued

Date	Water level	Date	Water level	Date	Water level
Nov. 6, 1950	9.99	Apr. 9, 1951	11.72	Aug. 20, 1951	10.05
Dec. 4	10.35	Apr. 23	11.85	Sept. 5	9.97
Jan. 3, 1951	10.20	May 7	11.94	Sept. 18	9.93
Jan. 15	10.70	May 21	11.92	Oct. 1	9.95
Jan. 29	10.85	June 4	11.65	Oct. 16	10.05
Feb. 5	10.95	June 18	11.62	Oct. 29	10.01
Feb. 12	11.08	July 9	10.78	Nov. 26	10.16
Feb. 26	11.24	July 23	10.25	Dec. 27	10.35
Mar. 13	12.35	Aug. 6	10.07	Feb. 4, 1952	9.45
Mar. 26	11.54				

13-53-11accl (III E2)

Oct. 23, 1950	15.16	Feb. 5, 1951	15.97	July 23, 1951	15.16
Oct. 30	15.37	Feb. 12	15.70	Aug. 6	14.95
Nov. 6	15.30	Feb. 26	16.06	Aug. 20	14.66
Nov. 13	15.28	Mar. 13	16.10	Sept. 5	14.70
Nov. 20	15.43	Mar. 26	16.15	Sept. 18	14.83
Nov. 27	15.49	Apr. 9	16.21	Oct. 1	14.83
Dec. 4	15.53	Apr. 23	16.30	Oct. 16	14.93
Dec. 18	15.69	May 7	16.30	Oct. 29	15.02
Jan. 3, 1951	15.80	May 21	16.16	Nov. 26	15.26
Jan. 15	15.85	June 4	15.79	Dec. 27	15.49
Jan. 22	15.90	June 18	15.64	Feb. 4, 1952	15.66
Jan. 29	15.95	July 9	15.29		

13-53-11baal (III E1)

Aug. 7, 1950	32.54	Nov. 27, 1950	31.86	May 21, 1951	33.02
Aug. 14	32.45	Dec. 4	31.92	June 4	32.97
Aug. 21	32.40	Dec. 18	32.22	June 18	33.02
Aug. 28	32.27	Jan. 3, 1951	32.26	July 9	32.71
Sept. 6	34.95	Jan. 15	32.29	July 23	32.35
Sept. 11	32.03	Jan. 22	32.25	Aug. 6	32.00
Sept. 18	32.01	Jan. 29	32.36	Aug. 20	31.58
Sept. 25	31.88	Feb. 5	32.31	Sept. 5	31.23
Oct. 2	32.90	Feb. 12	32.54	Sept. 18	31.09
Oct. 9	31.85	Feb. 26	32.57	Oct. 1	31.12
Oct. 16	31.85	Mar. 13	32.70	Oct. 16	31.40
Oct. 23	31.73	Mar. 26	32.66	Oct. 29	31.27
Oct. 30	31.71	Apr. 9	32.51	Nov. 26	31.49
Nov. 6	31.80	Apr. 23	32.94	Dec. 27	31.67
Nov. 13	31.64	May 7	32.96	Feb. 4, 1952	32.12
Nov. 20	31.78				

13-53-11ccd (III D3)

Oct. 30, 1950	5.66	Feb. 5, 1951	6.41	July 9, 1951	6.53
Nov. 6	5.72	Feb. 12	6.46	July 23	6.92
Nov. 13	5.70	Feb. 26	6.26	Aug. 6	7.12
Nov. 20	5.80	Mar. 13	6.44	Aug. 20	6.61
Nov. 27	5.80	Mar. 26	6.25	Sept. 5	5.80
Dec. 4	5.82	Apr. 9	6.10	Sept. 18	6.13
Dec. 18	6.12	Apr. 23	5.80	Oct. 1	6.00
Jan. 3, 1951	5.90	May 7	5.93	Oct. 16	6.01
Jan. 15	6.16	May 21	6.15	Oct. 29	5.85
Jan. 22	6.23	June 4	5.31	Nov. 26	5.93
Jan. 29	6.33	June 18	6.41	Feb. 4, 1952	5.98

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

Date	Water level	Date	Water level	Date	Water level
13-53-11ddd (III E3)					
Oct. 20, 1950	8.87	Feb. 5, 1951	9.46	July 23, 1951	8.52
Oct. 23	8.96	Feb. 12	9.46	Aug. 6	8.63
Nov. 6	8.97	Feb. 26	9.49	Aug. 20	8.48
Nov. 13	9.07	Mar. 13	9.52	Sept. 5	8.57
Nov. 20	8.97	Mar. 26	9.50	Sept. 18	8.68
Nov. 27	9.14	Apr. 9	9.52	Oct. 1	8.76
Dec. 4	9.40	Apr. 23	9.63	Oct. 16	8.88
Dec. 18	9.24	May 8	9.68	Oct. 29	8.96
Jan. 3, 1951	9.40	May 21	9.60	Nov. 26	9.11
Jan. 15	9.39	June 4	9.25	Dec. 27	9.22
Jan. 22	9.40	June 18	9.12	Feb. 1, 1952	9.34
Jan. 29	9.20	July 9	8.68		
13-53-12abb (III F3)					
May 7, 1951	15.26	Aug. 6, 1951	14.09	Oct. 16, 1951	13.58
May 21	15.06	Aug. 20	13.90	Oct. 29	13.23
June 4	14.86	Sept. 5	13.71	Nov. 26	13.38
June 18	14.93	Sept. 18	13.62	Dec. 27	13.69
July 9	14.62	Oct. 1	13.52	Feb. 1, 1952	14.15
July 23	14.47				
13-53-12aca (III F4)					
May 8, 1951	2.97	Aug. 6, 1951	3.40	Oct. 16, 1951	2.83
May 21	2.52	Aug. 20	2.93	Oct. 29	2.63
June 4	2.59	Sept. 5	2.35	Nov. 26	3.05
June 18	2.83	Sept. 18	2.83	Dec. 27	3.45
July 9	3.03	Oct. 1	2.50	Feb. 1, 1952	2.94
July 23	3.11				
13-53-12acb1 (III P3)					
Aug. 20, 1951	2.92	Oct. 1, 1951	2.60	Oct. 29, 1951	2.70
Sept. 5	2.37	Oct. 16	3.00	Nov. 26	3.24
Sept. 18	3.00				
13-53-13bbd (III E4)					
Oct. 23, 1950	13.14	Feb. 5, 1951	13.84	July 23, 1951	11.49
Oct. 30	13.26	Feb. 12	13.83	Aug. 6	11.44
Nov. 6	13.29	Mar. 13	14.00	Sept. 5	11.28
Nov. 13	13.24	Mar. 26	13.86	Sept. 18	11.95
Nov. 20	13.40	Apr. 9	13.88	Oct. 1	12.37
Nov. 27	13.50	Apr. 23	13.90	Oct. 16	12.77
Dec. 4	13.53	May 8	13.82	Oct. 29	12.95
Dec. 18	13.63	May 21	13.71	Nov. 26	13.59
Jan. 3, 1951	13.77	June 4	13.00	Dec. 27	14.02
Jan. 15	13.74	June 18	13.11	Feb. 1, 1952	14.20
Jan. 22	13.78	July 9	12.45		
13-53-14bac1 (III D4)					
May 21, 1951	0.68	Aug. 6, 1951	1.56	Oct. 16, 1951	1.23
June 4	+.10	Aug. 20	1.43	Oct. 29	1.26
June 18	.28	Sept. 5	1.25	Nov. 26	1.08
July 9	1.55	Sept. 18	2.24	Dec. 27	1.25
July 23	1.55	Oct. 1	1.25		

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

Date	Water level	Date	Water level	Date	Water level
13-53-14bdb (III D5)					
Oct. 30, 1950	5.56	Feb. 12, 1951	5.14	July 23, 1951	5.73
Nov. 6	5.52	Feb. 26	4.96	Aug. 6	6.25
Nov. 13	5.50	Mar. 13	5.31	Aug. 20	6.42
Nov. 20	5.40	Mar. 26	5.27	Sept. 5	5.78
Nov. 27	5.45	Apr. 9	5.30	Sept. 18	5.88
Dec. 4	5.50	Apr. 23	5.08	Oct. 1	5.69
Jan. 3, 1951	5.47	May 8	4.87	Oct. 16	5.58
Jan. 15	5.50	May 21	5.02	Oct. 29	5.55
Jan. 22	5.45	June 4	4.71	Nov. 26	5.46
Jan. 29	5.57	June 18	5.31	Dec. 27	5.28
Feb. 5	5.51	July 9	5.40	Feb. 1, 1952	4.65
13-53-14cba (III CD)					
June 29, 1950	7.01	Oct. 30, 1950	7.45	Apr. 9, 1951	8.70
July 17	5.58	Nov. 6	7.58	Apr. 23	8.64
July 24	6.18	Nov. 13	7.60	May 8	8.50
July 31	6.22	Nov. 20	7.70	May 21	8.22
Aug. 7	5.24	Nov. 27	7.81	July 9	6.38
Aug. 14	5.74	Dec. 4	8.00	July 23	6.57
Aug. 21	6.46	Dec. 18	8.01	Aug. 6	7.06
Aug. 28	6.94	Jan. 3, 1951	8.18	Aug. 20	7.31
Sept. 5	7.31	Jan. 15	8.16	Sept. 5	7.46
Sept. 11	6.80	Jan. 22	8.28	Sept. 18	7.63
Sept. 18	6.85	Jan. 29	8.31	Oct. 1	7.75
Sept. 25	7.00	Feb. 5	8.36	Oct. 16	8.04
Oct. 2	7.27	Feb. 12	8.40	Oct. 29	7.99
Oct. 9	7.30	Feb. 26	8.53	Nov. 26	6.18
Oct. 16	7.33	Mar. 13	8.38	Dec. 27	8.30
Oct. 23	7.40	Mar. 26	8.21	Feb. 1, 1952	8.50
13-53-14cbb (III C5)					
July 7, 1950	4.85	Nov. 6, 1950	5.71	May 8, 1951	5.93
July 17	4.75	Nov. 13	5.67	May 21	4.23
July 24	5.14	Nov. 20	5.69	June 4	2.52
July 31	5.12	Nov. 27	5.77	June 18	3.69
Aug. 7	5.36	Dec. 4	5.88	July 9	4.13
Aug. 14	5.10	Dec. 18	5.95	July 23	2.38
Aug. 21	5.42	Jan. 3, 1951	6.03	Aug. 6	4.69
Aug. 28	5.59	Jan. 15	6.11	Aug. 20	5.25
Sept. 5	5.74	Jan. 22	6.18	Sept. 5	5.35
Sept. 11	5.60	Jan. 29	6.29	Sept. 18	5.68
Sept. 18	5.58	Feb. 5	6.08	Oct. 1	5.91
Sept. 25	5.60	Feb. 12	6.49	Oct. 16	6.00
Oct. 2	5.53	Feb. 26	6.51	Oct. 29	6.09
Oct. 9	5.56	Mar. 13	6.58	Nov. 26	6.06
Oct. 16	5.66	Mar. 26	6.65	Dec. 27	6.22
Oct. 23	5.64	Apr. 9	6.60	Feb. 1, 1952	6.50
Oct. 30	5.70	Apr. 23	6.41		

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

13-53-14cbc3 (III C6)

Water level at 2:00 a. m. in feet below land-surface datum (from recorder charts)

Day	1950						1951			
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	.....	4.78	6.52	6.34	6.84	7.21	7.56	7.79	8.05	8.21
2	.....	4.63	6.55	6.36	6.84	7.26	7.56	7.80	8.06	8.21
3	.....	4.60	6.59	6.39	6.85	7.27	7.53	7.80	8.06	8.21
4	.....	4.60	6.60	6.36	6.84	7.28	7.60	7.83	8.06	8.21
5	.....	4.63	6.67	6.35	6.84	7.32	7.60	7.83	8.06	8.21
6	.....	4.82	6.67	6.34	6.89	7.32	7.61	7.88	8.07	8.21
7	.....	5.05	6.67	6.44	6.89	7.28	7.61	7.89	8.07	8.21
8	.....	5.23	6.43	6.49	6.93	7.32	7.59	7.87	8.08	8.21
9	.....	5.34	5.65	6.45	6.96	7.35	7.61	7.89	8.07	8.19
10	.....	5.41	5.25	6.51	6.95	7.35	7.62	7.90	8.08	8.24
11	.....	5.46	5.31	6.52	6.95	7.36	7.62	7.91	8.09	8.24
12	[a]6.09	5.52	5.45	6.53	6.98	7.37	7.63	7.93	8.09	8.23
13	5.95	5.49	5.56	6.53	6.99	7.38	7.64	7.94	8.09	8.21
14	5.68	5.49	5.63	6.58	6.98	7.38	7.65	7.94	8.11	8.21
15	5.68	5.55	5.64	6.54	7.02	7.40	7.67	7.94	8.11	8.21
16	5.72	5.64	5.65	6.63	7.07	7.41	7.63	7.94	8.09	8.21
17	5.78	5.76	5.63	6.59	7.03	7.43	7.67	7.96	8.13	8.20
18	5.58	5.76	5.69	6.64	7.05	7.43	7.69	7.96	8.14	8.21
19	5.31	5.89	5.73	6.68	7.08	7.44	7.70	7.98	8.16	8.21
20	5.54	5.89	5.79	6.64	7.11	7.44	7.72	7.99	8.17	.....
21	5.69	5.92	5.89	6.70	7.16	7.45	7.73	7.99	8.17	.....
22	5.77	6.06	5.90	6.70	7.16	7.46	7.69	8.00	8.17	.....
23	5.88	6.18	5.94	6.69	7.20	7.47	7.75	8.00	8.18	[a]8.22
24	5.96	6.23	5.97	6.76	7.19	7.49	7.76	8.00	8.19	.....
25	6.05	6.28	6.00	6.73	7.20	7.46	7.76	8.01	8.19	.....
26	6.11	6.31	6.08	6.73	7.20	7.52	7.76	8.01	8.19	.....
27	6.16	6.34	6.16	6.78	7.21	7.49	7.78	8.05	8.19	.....
28	6.06	6.37	6.23	6.80	7.23	7.51	7.78	8.05	8.20	.....
29	5.52	6.37	6.27	6.81	7.23	7.52	7.78		8.20	.....
30	5.07	6.41	6.29	6.82	7.25	7.53	7.79		8.20	.....
31	4.82	6.46		6.84		7.51	7.79		8.20	

[a]Tape measurement.

Date	Water level	Date	Water level	Date	Water level
13-53-14cbc3 (III C6)—Continued					
May 8, 1951	8.08	Aug. 6, 1951	6.25	Oct. 16, 1951	7.54
May 21	7.23	Aug. 20	6.63	Oct. 29	7.61
June 4	4.61	Sept. 5	6.90	Nov. 26	7.78
June 18	4.48	Sept. 18	7.11	Dec. 27	7.95
July 9	5.62	Oct. 1	7.32	Feb. 1, 1952	8.20
July 23	4.48				
13-53-14cca (III C7)					
July 17, 1950	10.54	Oct. 9, 1950	9.78	Jan. 15, 1951	11.30
July 24	10.39	Oct. 16	10.03	Jan. 22	11.34
July 31	9.98	Oct. 23	10.25	Jan. 29	11.37
Aug. 7	9.29	Oct. 30	10.38	Feb. 5	11.38
Aug. 14	9.46	Nov. 6	10.66	Feb. 12	11.45
Aug. 21	9.22	Nov. 13	10.67	Feb. 26	11.51
Aug. 28	10.10	Nov. 20	10.80	Mar. 13	11.58
Sept. 5	9.63	Nov. 27	10.88	Mar. 26	11.62
Sept. 11	8.29	Dec. 4	10.90	Apr. 9	11.60
Sept. 18	8.85	Dec. 18	11.10	Apr. 23	11.62
Sept. 25	9.22	Jan. 3, 1951	11.21	May 8	11.63

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

Date	Water level	Date	Water level	Date	Water level
13-53-14cca (III C7)—Continued					
May 21, 1951	11.66	Aug. 6, 1951	9.82	Oct. 16, 1951	11.00
June 4	8.89	Aug. 20	10.23	Oct. 29	11.08
June 18	9.64	Sept. 5	10.44	Nov. 26	11.33
July 9	9.78	Sept. 18	10.77	Dec. 27	11.48
July 23	8.88	Oct. 1	10.82	Feb. 1, 1952	11.47
13-53-14cdb (III C8)					
July 11, 1950	15.76	Nov. 20, 1950	15.60	May 21, 1951	16.21
July 17	15.62	Nov. 27	15.77	June 4	14.83
July 24	15.44	Dec. 4	15.80	June 18	15.19
July 31	15.00	Dec. 18	15.76	July 9	14.55
Aug. 7	15.44	Jan. 3, 1951	15.80	July 23	14.49
Aug. 21	15.23	Jan. 15	15.89	Aug. 6	15.08
Aug. 28	15.45	Jan. 22	15.93	Aug. 20	15.38
Sept. 5	16.53	Jan. 29	15.95	Sept. 5	15.53
Sept. 11	15.01	Feb. 5	15.99	Sept. 18	15.72
Sept. 18	13.63	Feb. 12	15.85	Oct. 1	15.80
Sept. 25	15.03	Feb. 26	15.87	Oct. 16	15.88
Oct. 9	15.26	Mar. 13	15.90	Oct. 29	15.91
Oct. 23	15.42	Mar. 26	15.85	Nov. 26	15.99
Oct. 30	15.51	Apr. 9	16.05	Dec. 27	16.00
Nov. 6	15.62	Apr. 23	16.02	Feb. 1, 1952	15.65
Nov. 13	15.47	May 8	16.10		
13-53-15aab1 (III 1N1)					
Aug. 6, 1951	6.59	Sept. 5, 1951	5.64	Sept. 18, 1951	6.07
Aug. 20	6.75				
13-53-15aab2 (III 1N2)					
Aug. 6, 1951	4.70	Sept. 5, 1951	4.27	Sept. 18, 1951	4.60
Aug. 20	5.04				
13-53-15aac2 (III C3)					
July 12, 1950	2.70	Oct. 30, 1950	2.08	June 4, 1951	1.46
July 17	3.04	Nov. 6	2.00	June 18	3.27
July 24	2.87	Dec. 4	2.87	July 9	2.90
July 31	2.78	Jan. 3, 1951	2.97	July 23	1.34
Aug. 7	4.26	Jan. 15	3.88	Aug. 6	4.08
Aug. 14	2.59	Jan. 29	3.68	Aug. 20	4.09
Aug. 21	2.26	Feb. 5	3.80	Sept. 5	2.68
Aug. 28	2.07	Feb. 12	3.87	Sept. 18	3.23
Sept. 5	2.94	Feb. 26	3.40	Oct. 1	3.21
Sept. 11	2.33	Mar. 13	3.81	Oct. 16	3.14
Sept. 18	1.35	Mar. 26	3.33	Oct. 29	2.82
Sept. 25	1.93	Apr. 9	2.79	Nov. 26	2.83
Oct. 9	1.49	May 7	1.77	Dec. 27	3.30
Oct. 10	1.91	May 21	2.13	Feb. 4, 1952	2.98
Oct. 23	1.89				

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

13-53-15aac3 (III P1)

Water level at 2:00 a. m. in feet below land-surface datum (from recorder charts)

Day	1951									1952	
	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
1	.....	2.68	.....	3.42	4.22	3.82	4.23	3.85	3.67	4.40	[b]4.48
2	.....	2.84	.....	3.51	4.38	3.85	4.18	3.88	3.65	4.42	4.43
3	.....	2.85	.....	2.64	4.50	3.89	4.15	.....	3.66	[b]4.46	4.44
4	.....	2.83	2.36	2.71	4.62	3.69	4.15	.....	3.62	[b]4.49	4.38
5	.....	2.80	2.48	.....	4.72	3.68	4.18	[a]3.84	3.60	[b]4.51	4.33
6	.....	2.84	2.56	.....	4.81	3.72	4.17	3.76	3.64	4.52	4.31
7	.....	2.81	2.72	.....	4.88	3.78	4.16	3.62	3.71	4.50	4.26
8	.....	2.79	2.82	.....	4.97	3.80	4.17	3.56	3.77	4.53	4.24
9	.....	2.84	3.04	3.72	4.95	3.89	4.15	3.55	3.79	4.59	4.16
10	.....	2.85	3.15	3.78	4.97	3.92	4.15	3.56	3.85	[a]4.61	4.13
11	.....	2.85	3.30	3.87	5.01	.....	4.14	3.53	3.90	.....	4.08
12	.....	2.85	3.46	4.00	4.95	.....	4.11	3.51	3.84	.....	4.03
13	.....	2.84	3.63	3.82	4.78	[a]4.10	4.11	3.54	3.80	.....	4.03
14	.....	2.84	3.67	3.40	4.61	4.05	4.13	3.56	3.81	.....	4.03
15	.....	2.81	3.81	3.33	4.57	4.10	4.09	3.60	[b]3.84	.....	.....
16	.....	2.86	3.92	3.42	4.55	4.10	4.15	3.66	[b]3.93	[a]4.63	.....
17	.....	2.88	4.01	3.62	4.63	4.16	4.16	3.69	[a]4.07	.....	.....
18	.....	2.93	4.08	3.81	.....	4.18	4.13	3.66	.....	.....	.....
19	.....	3.03	4.18	3.87	.....	4.21	4.07	3.69	.....	.....	.....
20	3.45	3.09	3.96	3.53	[a]4.89	4.24	4.05	3.70	.....	.....	.....
21	3.36	3.08	3.81	2.90	4.96	4.30	4.05	3.70	[a]4.31	4.54	.....
22	3.31	3.03	3.73	2.21	5.00	4.24	4.00	3.70	.....	4.64	.....
23	3.23	3.06	2.54	2.11	5.05	4.27	3.99	3.76	.....	4.66	.....
24	3.24	3.18	2.64	2.32	5.10	4.28	3.95	3.78	.....	4.66	.....
25	3.15	3.27	2.98	2.76	4.68	4.25	3.98	3.80	.....	4.60	.....
26	3.10	3.40	3.11	3.15	4.64	4.19	3.95	3.86	.....	4.67	.....
27	3.03	3.49	3.00	3.34	4.68	4.29	3.90	3.85	[a]4.35	4.66	.....
28	3.02	3.56	3.02	3.50	4.72	4.26	3.87	3.78	.....	4.64	.....
29	2.92	3.63	3.22	3.72	4.60	4.20	3.85	3.77	[a]4.35	4.59	.....
30	.....	3.64	3.32	3.88	4.05	4.25	3.91	3.72	4.33	4.56	
31		3.38		4.03	4.00		3.84		4.38	4.50	

[a] Tape measurement.
[b] Estimated.

13-53-15aac4 (III 1W1)

Date	Water level	Date	Water level	Date	Water level
July 23, 1951	2.00	Aug. 29, 1951	4.76	Sept. 18, 1951	3.96
Aug. 6	4.76	Sept. 5	3.34		

13-53-15aac6 (III 1S2)

Date	Water level	Date	Water level	Date	Water level
July 23, 1951	0.63	Aug. 20, 1951	3.32	Sept. 18, 1951	2.44
Aug. 6	3.34	Sept. 5	1.82		

13-53-15aac7 (III 1E1)

Date	Water level	Date	Water level	Date	Water level
Aug. 6, 1951	4.84	Sept. 5, 1951	3.90	Sept. 18, 1951	4.31
Aug. 20	4.95				

13-53-15abc (III B3)

Date	Water level	Date	Water level	Date	Water level
July 14, 1950	3.00	Aug. 7, 1950	3.96	Sept. 6, 1950	2.90
July 17	2.87	Aug. 14	3.77	Sept. 11	2.87
July 24	3.33	Aug. 21	2.76	Sept. 18	2.47
July 31	3.28	Aug. 28	2.00	Sept. 25	2.76

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

13-53-15abc (III B3)—Continued

Date	Water level	Date	Water level	Date	Water level
Oct. 9, 1950	2.57	Apr. 9, 1951	3.71	Aug. 20, 1951	3.69
Oct. 16	2.78	Apr. 23	3.27	Sept. 5	2.70
Oct. 23	2.70	May 7	3.32	Sept. 18	3.11
Oct. 30	2.76	May 21	3.12	Oct. 1	3.05
Nov. 6	2.71	June 4	2.81	Oct. 16	3.04
Feb. 12, 1951	4.07	June 18	3.90	Oct. 29	2.85
Feb. 26	3.82	July 9	3.30	Nov. 26	3.15
Mar. 13	4.30	July 23	2.55	Dec. 27	3.44
Mar. 26	4.05	Aug. 6	4.08	Feb. 4, 1952	3.52

13-53-15acd (III B4)

Date	Water level	Date	Water level	Date	Water level
July 19, 1950	6.75	Nov. 13, 1950	7.41	May 8, 1951	7.72
July 24	5.34	Nov. 20	7.45	May 21	6.28
July 31	5.26	Nov. 27	7.50	June 4	5.43
Aug. 7	5.57	Dec. 4	7.55	June 18	4.52
Aug. 14	6.83	Dec. 18	7.55	July 9	6.07
Aug. 21	7.04	Jan. 3, 1951	7.73	July 23	3.80
Aug. 28	7.25	Jan. 15	7.83	Aug. 6	6.08
Sept. 5	7.48	Jan. 22	7.85	Aug. 20	6.88
Sept. 11	7.54	Jan. 29	7.90	Sept. 5	7.19
Sept. 18	7.40	Feb. 5	7.82	Sept. 18	7.35
Sept. 25	7.52	Feb. 12	7.98	Oct. 1	7.50
Oct. 2	7.40	Feb. 26	8.03	Oct. 16	7.69
Oct. 9	7.32	Mar. 13	7.97	Oct. 29	7.65
Oct. 16	7.43	Mar. 26	8.11	Nov. 26	7.75
Oct. 23	7.36	Apr. 9	8.00	Dec. 27	7.84
Oct. 30	7.38	Apr. 23	7.94	Feb. 1, 1952	7.93
Nov. 6	7.40				

13-53-15ada (III C4)

Date	Water level	Date	Water level	Date	Water level
July 10, 1950	3.85	Nov. 6, 1950	6.29	May 8, 1951	6.25
July 17	4.89	Nov. 13	6.30	May 21	3.11
July 24	5.46	Nov. 20	6.32	June 4	3.15
July 31	5.75	Nov. 27	6.34	June 18	4.84
Aug. 7	5.95	Dec. 4	6.43	July 9	5.00
Aug. 14	5.88	Dec. 18	6.45	July 23	3.93
Aug. 21	5.13	Jan. 3, 1951	6.46	Aug. 6	5.60
Aug. 28	6.32	Jan. 15	6.67	Aug. 20	6.15
Sept. 5	6.52	Jan. 22	6.77	Sept. 5	6.27
Sept. 11	6.59	Jan. 29	6.83	Sept. 18	6.47
Sept. 18	6.54	Feb. 5	6.87	Oct. 1	6.59
Sept. 25	6.55	Feb. 12	7.00	Oct. 16	6.63
Oct. 2	6.49	Feb. 26	7.07	Oct. 29	6.52
Oct. 9	6.44	Mar. 13	7.18	Nov. 26	6.49
Oct. 16	6.36	Mar. 26	7.30	Dec. 27	6.70
Oct. 23	6.28	Apr. 9	7.16	Feb. 1, 1952	6.53
Oct. 30	6.28	Apr. 23	6.84		

13-53-15add2 (III D11)

Date	Water level	Date	Water level	Date	Water level
Aug. 20, 1951	4.92	Oct. 1, 1951	3.74	Nov. 26, 1951	4.17
Sept. 5	3.50	Oct. 16	3.83	Dec. 27	4.60
Sept. 18	3.59	Oct. 29	3.97	Feb. 4, 1952	5.39

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

Date	Water level	Date	Water level	Date	Water level
13-53-15baa (III B2)					
July 14, 1950	10.47	Oct. 23, 1950	10.46	June 4, 1951	11.73
July 17	10.38	Oct. 30	10.50	June 18	11.78
July 24	10.48	Nov. 6	10.36	July 9	10.97
July 31	10.33	Jan. 3, 1951	11.18	July 23	10.47
Aug. 7	10.28	Jan. 15	11.35	Aug. 6	10.31
Aug. 14	10.63	Feb. 5	11.72	Aug. 20	10.30
Aug. 21	10.33	Feb. 12	11.90	Sept. 5	10.17
Aug. 28	10.10	Feb. 26	12.07	Sept. 18	10.28
Sept. 6	10.25	Mar. 13	12.26	Oct. 1	10.27
Sept. 11	10.38	Mar. 26	12.45	Oct. 16	10.40
Sept. 18	10.34	Apr. 9	12.64	Oct. 29	10.40
Sept. 25	10 41	Apr. 23	12.61	Nov. 26	10.62
Oct. 2	10.35	May 7	12.65	Dec. 27	10.94
Oct. 9	10.41	May 21	12.17	Feb. 4, 1952	11.44
Oct. 16	10.48				
13-53-15bdc (III A2)					
July 24, 1950	8.14	Nov. 13, 1950	10.15	May 21, 1951	10.78
July 31	9.22	Nov. 20	10.20	June 4	10.50
Aug. 7	9.44	Nov. 27	10.32	June 18	10.88
Aug. 14	9.22	Dec. 4	10.45	July 9	10.38
Aug. 21	9.45	Jan. 3, 1951	10.79	July 23	10.27
Aug. 28	9.44	Jan. 15	10.96	Aug. 6	10.56
Sept. 5	9.30	Jan. 22	11.12	Aug. 20	10.67
Sept. 11	9.55	Jan. 29	11.18	Sept. 5	10.32
Sept. 18	9.32	Feb. 5	11.30	Sept. 18	10.47
Sept. 25	9.45	Feb. 12	11.37	Oct. 1	10.54
Oct. 2	9.34	Feb. 26	10.78	Oct. 16	10.63
Oct. 9	9.62	Mar. 13	11.30	Oct. 29	10.63
Oct. 16	9.69	Mar. 26	11.19	Nov. 26	10.80
Oct. 23	9.83	Apr. 9	11.09	Dec. 27	11.00
Oct. 30	9.97	Apr. 23	11.28	Feb. 1, 1952	11.45
Nov. 6	10.04	May 8	11.16		
13-53-15cad (III A3)					
July 24, 1950	1.60	Nov. 20, 1950	2.28	May 21, 1951	2.90
July 31	1.54	Nov. 27	2.39	June 4	2.51
Aug. 14	1.52	Dec. 4	2.41	June 18	2.78
Aug. 21	1.82	Dec. 18	2.62	July 9	2.61
Aug. 28	1.91	Jan. 3, 1951	2.75	July 23	2.54
Sept. 5	2.03	Jan. 15	2.90	Aug. 6	2.82
Sept. 11	1.94	Jan. 22	2.96	Aug. 20	2.88
Sept. 18	1.77	Jan. 29	3.06	Sept. 5	2.56
Sept. 25	1.80	Feb. 5	3.03	Sept. 18	2.71
Oct. 2	1.76	Feb. 12	3.05	Oct. 1	2.77
Oct. 9	1.83	Feb. 26	2.65	Oct. 16	2.78
Oct. 10	1.98	Mar. 13	3.13	Oct. 29	2.79
Oct. 23	2.02	Mar. 26	2.84	Nov. 26	2.95
Oct. 30	2.16	Apr. 9	3.00	Dec. 27	3.06
Nov. 6	2.16	Apr. 23	3.16	Feb. 1, 1952	3.42
Nov. 13	2.26	May 8	3.04		
13-53-15daa (III DI10)					
Aug. 20, 1951	4.50	Oct. 1, 1951	2.39	Nov. 26, 1951	2.95
Sept. 5	2.17	Oct. 16	2.55	Dec. 27	3.00
Sept. 18	2.25	Oct. 29	2.77	Feb. 1, 1952	4.49

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

Date	Water level	Date	Water level	Date	Water level
13-53-15dab2 (III BC2)					
July 23, 1951	3.52	Sept. 5, 1951	6.39	Oct. 1, 1951	6.78
Aug. 6	5.60	Sept. 18	6.65	Oct. 16	6.85
Aug. 20	6.28				
13-53-15dab3 (III DI9)					
Sept. 5, 1951	4.64	Oct. 16, 1951	5.26	Dec. 27, 1951	5.35
Sept. 18	4.90	Oct. 29	5.15	Feb. 1, 1952	5.44
Oct. 1	5.06	Nov. 26	5.20		
13-53-15dac1 (III DI7)					
Aug. 20, 1951	6.58	Oct. 1, 1951	6.88	Nov. 26, 1951	6.94
Sept. 5	6.61	Oct. 16	6.92	Dec. 27	6.94
Sept. 18	6.81	Oct. 29	6.91	Feb. 1, 1952	7.03
13-53-15dac2 (III DI8)					
Aug. 20, 1951	5.66	Oct. 1, 1951	5.90	Nov. 26, 1951	6.18
Sept. 5	5.57	Oct. 16	6.07	Dec. 27	6.29
Sept. 18	5.70	Oct. 29	6.13	Feb. 1, 1952	6.48
13-53-15dad2 (III P2a)					
Aug. 20, 1951	4.05	Oct. 1, 1951	4.40	Nov. 26, 1951	4.84
Sept. 5	3.69	Oct. 16	4.57	Dec. 27	5.06
Sept. 18	4.20	Oct. 29	4.71	Feb. 1, 1952	5.30
13-53-15dbd (III B5)					
July 24, 1950	5.98	Oct. 23, 1950	6.24	June 18, 1951	4.57
July 31	6.27	Oct. 30	6.21	July 9	5.80
Aug. 7	6.60	Nov. 6	6.02	July 23	4.25
Aug. 14	7.27	Nov. 13	6.24	Aug. 6	5.90
Aug. 21	5.92	Jan. 15, 1951	6.40	Aug. 20	6.24
Aug. 28	6.21	Jan. 22	6.50	Sept. 5	6.21
Sept. 5	4.30	Feb. 5	6.50	Sept. 18	6.30
Sept. 11	6.25	Feb. 26	6.35	Oct. 1	6.35
Sept. 18	6.77	Mar. 13	6.27	Oct. 16	6.43
Sept. 25	7.39	Mar. 26	6.39	Oct. 29	6.40
Oct. 2	7.30	Apr. 9	6.41	Nov. 26	6.47
Oct. 9	6.15	Apr. 23	6.31	Dec. 27	6.35
Oct. 16	6.13	June 4	5.38	Feb. 1, 1952	6.50
13-53-15dca (III DI6)					
Aug. 21, 1950	5.49	Sept. 5, 1950	5.59	Jan. 3, 1951	6.35
Aug. 28	5.76	Sept. 11	5.32	Jan. 15	6.47
13-53-15dcc1 (III A4)					
July 24, 1950	10.42	Aug. 28, 1950	10.84	Oct. 2, 1950	10.87
July 31	10.48	Sept. 5	10.86	Oct. 9	10.97
Aug. 7	10.84	Sept. 11	10.78	Oct. 16	10.97
Aug. 14	9.74	Sept. 18	10.82	Oct. 23	10.98
Aug. 21	11.70	Sept. 25	10.91	Oct. 30	10.98

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

Date	Water level	Date	Water level	Date	Water level
13-53-15dcc1 (III A4)—Continued					
Nov. 6, 1950	11.06	Feb. 12, 1951	11.27	July 23, 1951	9.80
Nov. 13	11.07	Feb. 26	11.52	Aug. 6	10.98
Nov. 20	11.10	Mar. 13	11.67	Aug. 20	11.21
Nov. 27	11.13	Mar. 26	11.32	Sept. 5	11.19
Dec. 4	11.17	Apr. 9	11.63	Sept. 18	11.34
Dec. 18	11.21	Apr. 23	11.68	Oct. 1	11.30
Jan. 3, 1951	11.30	May 8	11.65	Oct. 16	11.33
Jan. 15	11.34	May 21	10.82	Oct. 29	11.36
Jan. 22	11.36	June 4	10.36	Nov. 26	11.40
Jan. 29	11.38	June 18	10.55	Dec. 27	11.47
Feb. 5	11.41	July 9	10.94	Feb. 1, 1952	11.65
13-53-15dcc2 (III A5)					
July 31, 1950	6.83	Apr. 9, 1951	8.60	Aug. 20, 1951	7.85
Aug. 7	10.59	Apr. 23	8.66	Sept. 5	8.02
Aug. 14	9.76	May 8	8.59	Sept. 18	8.10
Aug. 21	7.16	May 21	7.56	Oct. 1	8.22
Aug. 28	7.59	June 4	5.67	Oct. 16	8.27
Sept. 5	7.72	June 18	6.58	Oct. 29	8.29
Sept. 11	7.73	July 9	7.61	Nov. 26	8.44
Jan. 3, 1951	8.35	July 23	5.86	Dec. 27	8.48
Jan. 15	8.38	Aug. 6	7.49	Feb. 1, 1952	8.65
Mar. 26	8.39				
13-53-15ddb2 (III DI2)					
July 31, 1950	8.08	Aug. 28, 1950	8.02	Jan. 3, 1951	8.33
Aug. 7	8.12	Sept. 5	7.98	Jan. 15	8.35
Aug. 14	8.26	Sept. 11	7.77	July 9	6.73
Aug. 21	7.91				
13-53-15ddb3 (III DI3)					
July 31, 1950	4.93	Aug. 28, 1950	7.52	Jan. 3, 1951	7.54
Aug. 7	5.14	Sept. 5	7.17	Jan. 15	7.51
Aug. 14	5.44	Sept. 11	6.94	July 9	5.39
Aug. 21	7.15				
13-53-15ddb4 (III B6)					
July 24, 1950	5.60	Nov. 20, 1950	5.95	May 21, 1951	5.44
July 31	5.15	Dec. 4	6.01	June 4	4.64
Aug. 7	5.72	Dec. 18	6.02	June 8	4.74
Aug. 14	5.17	Jan. 3, 1951	6.00	July 9	5.51
Aug. 21	5.48	Jan. 15	6.11	July 23	4.60
Aug. 28	5.74	Jan. 22	6.13	Aug. 6	5.61
Sept. 5	5.37	Jan. 29	6.05	Aug. 20	5.94
Sept. 11	5.40	Feb. 5	5.98	Sept. 5	5.87
Sept. 18	5.64	Feb. 12	5.76	Sept. 18	6.00
Sept. 25	5.79	Feb. 26	5.90	Oct. 1	6.03
Oct. 9	5.73	Mar. 13	5.74	Oct. 16	6.07
Oct. 16	5.82	Mar. 26	5.94	Oct. 29	6.08
Oct. 23	5.86	Apr. 9	6.09	Nov. 26	6.17
Oct. 30	5.90	Apr. 23	6.04	Dec. 27	6.00
Nov. 6	5.94	May 8	5.90	Feb. 1, 1952	5.08
Nov. 13	5.92				

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

Date	Water level	Date	Water level	Date	Water level
13-53-15ddb5 (III DI5)					
Aug. 21, 1950	5.48	Sept. 5, 1950	5.51	Jan. 3, 1951	6.12
Aug. 28	5.65	Sept. 11	5.26	Jan. 15	6.14
13-53-22aab (III B7)					
Aug. 7, 1950	10.16	Feb. 5, 1951	11.90	July 9, 1951	10.45
Aug. 14	10.03	Feb. 12	11.92	July 23	9.40
Aug. 21	10.28	Feb. 26	12.01	Aug. 6	9.74
Sept. 11	10.72	Mar. 13	12.05	Sept. 5	10.46
Sept. 18	10.72	Mar. 26	12.11	Sept. 18	10.62
Sept. 25	10.81	Apr. 9	12.11	Oct. 2	10.89
Oct. 9	10.87	Apr. 23	12.04	Oct. 16	11.10
Oct. 16	11.06	May 8	12.01	Oct. 29	11.26
Oct. 23	11.12	May 21	11.96	Nov. 26	11.54
Oct. 30	11.19	June 4	10.10	Dec. 27	11.75
Jan. 29, 1951	11.85	June 18	9.97	Feb. 1, 1952	11.84
13-53-22baa1 (III CI6)					
July 31, 1950	9.14	Aug. 28, 1950	9.27	Jan. 15, 1951	9.70
Aug. 7	11.86	Sept. 5	9.34	Jan. 29	9.76
Aug. 14	12.17	Sept. 11	9.33	Feb. 26	9.88
Aug. 21	9.29	Jan. 3, 1951	9.68	July 10	9.33
13-53-22baa2 (III CI5)					
July 31, 1950	9.80	Aug. 28, 1950	10.09	Jan. 15, 1951	10.45
Aug. 7	11.93	Sept. 5	10.11	Feb. 12	10.40
Aug. 14	11.64	Sept. 11	10.14	July 10	10.10
Aug. 21	9.94	Jan. 3, 1951	10.25		
13-53-22baa3 (III CI4)					
July 31, 1950	11.67	Aug. 28, 1950	11.83	Jan. 15, 1951	12.04
Aug. 7	14.02	Sept. 5	11.82	Feb. 12	11.97
Aug. 14	13.86	Sept. 11	11.86	July 10	11.80
Aug. 21	11.73	Jan. 3, 1951	12.06		
13-53-22bac1 (III CI2)					
July 31, 1950	12.13	Aug. 28, 1950	12.16	Jan. 3, 1951	12.22
Aug. 7	11.92	Sept. 5	12.18	Jan. 15	12.20
Aug. 14	11.47	Sept. 11	12.16	Feb. 12	12.13
Aug. 21	12.02				
13-53-22bac2 (III CI1)					
July 31, 1950	14.55	Aug. 28, 1950	14.60	Jan. 15, 1951	14.63
Aug. 7	14.36	Sept. 5	14.60	Feb. 12	14.60
Aug. 14	14.26	Sept. 11	14.62	July 10	14.66
Aug. 21	14.58	Jan. 3, 1951	14.62		
13-53-22bad (III CI3)					
July 31, 1950	12.22	Aug. 28, 1950	12.27	Jan. 15, 1951	12.39
Aug. 7	11.98	Sept. 5	12.31	Feb. 12	12.30
Aug. 14	11.33	Sept. 11	12.30	July 10	9.28
Aug. 21	12.16	Jan. 3, 1951	12.25		

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA III—Continued

Date	Water level	Date	Water level	Date	Water level
13-54-6cbd (III G3)					
May 7, 1951	10.87	Aug. 6, 1951	9.35	Oct. 16, 1951	8.58
May 21	10.63	Aug. 20	8.67	Oct. 29	8.36
June 4	10.50	Sept. 5	8.56	Nov. 26	8.85
June 18	10.35	Sept. 18	8.60	Dec. 27	9.22
July 9	9.46	Oct. 1	8.38	Feb. 1, 1952	9.59
July 23	9.26				

AREA IV

13-54-4bb1 (IV B6)					
Jan. 3, 1951	14.66	Apr. 30, 1951	14.88	Aug. 20, 1951	10.95
Jan. 22	14.52	May 14	14.90	Sept. 5	11.50
Feb. 5	14.61	May 28	14.68	Sept. 18	11.89
Feb. 19	14.68	June 11	14.02	Oct. 16	12.62
Mar. 5	14.70	June 25	13.78	Oct. 29	12.89
Mar. 19	14.76	July 9	13.22	Nov. 26	13.48
Apr. 2	14.58	July 23	12.56	Dec. 27	13.86
Apr. 16	14.82	Aug. 6	11.95		
14-54-27bc1 (IV CI1)					
Jan. 3, 1951	11.89	June 25, 1951	7.79	Aug. 20, 1951	7.95
May 14	11.92	July 9	8.17	Sept. 5	8.90
May 28	8.23	July 23	7.18	Sept. 18	9.49
June 11	8.71	Aug. 6	7.59	Oct. 1	9.13
14-54-27bc2 (IV CI2)					
Jan. 3, 1951	9.24	June 25, 1951	3.30	Aug. 20, 1951	4.68
May 14	7.41	July 9	5.09	Sept. 5	6.59
May 28	1.72	July 23	2.10	Sept. 18	7.40
June 11	5.12	Aug. 6	4.23	Oct. 1	6.58
14-54-27bc3 (IV CI3)					
Jan. 3, 1951	7.59	June 25, 1951	1.88	Sept. 5, 1951	4.23
May 14	5.02	July 9	2.86	Sept. 18	5.23
May 28	.72	Aug. 6	2.02	Oct. 1	4.59
June 11	2.95	Aug. 20	2.46		
14-54-27bc4 (IV CI4)					
Jan. 3, 1951	12.52	June 25, 1951	7.67	Aug. 20, 1951	7.87
May 14	11.34	July 9	8.48	Sept. 5	9.18
May 28	7.56	July 23	6.43	Sept. 18	10.02
June 11	9.17	Aug. 6	7.57	Oct. 1	9.71
14-54-28cd1 (IV E1)					
Jan. 3, 1951	3.02	Apr. 30, 1951	5.43	Aug. 20, 1951	1.82
Jan. 22	3.61	May 14	4.84	Sept. 5	1.83
Feb. 5	3.68	May 28	3.78	Sept. 18	1.75
Feb. 19	4.67	June 11	1.45	Oct. 15	1.84
Mar. 5	5.07	June 25	1.56	Oct. 31	2.02
Mar. 19	5.49	July 9	1.37	Nov. 26	2.40
Apr. 2	5.70	July 23	1.58	Dec. 28	2.55
Apr. 16	5.62	Aug. 6	1.64	Feb. 1, 1952	2.71

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA IV—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-28cd2 (IV H1)					
Jan. 3, 1951	26.50	June 25, 1951	22.33	Oct. 1, 1951	24.35
Jan. 22	26.68	July 9	23.19	Oct. 15	25.00
Feb. 5	26.71	July 23	21.30	Oct. 31	25.05
Feb. 19	26.80	Aug. 6	22.71	Nov. 26	25.97
May 14	24.52	Aug. 20	23.29	Dec. 28	26.25
May 28	21.03	Sept. 5	24.39	Feb. 1, 1952	26.59
June 11	20.39	Sept. 18	24.87		
14-54-28cd3 (IV H2)					
Jan. 3, 1951	24.75	June 25, 1951	20.88	Oct. 1, 1951	22.85
Jan. 22	Dry	July 9	22.05	Oct. 15	23.73
Feb. 5	Dry	July 23	19.56	Oct. 31	23.70
Feb. 19	Dry	Aug. 6	21.55	Nov. 26	24.33
May 14	22.72	Aug. 20	22.10	Dec. 28	24.70
May 28	18.77	Sept. 5	23.16	Feb. 1, 1952	24.37
June 11	18.14	Sept. 18	23.64		
14-54-28dc2 (IV G2)					
Jan. 3, 1951	3.80	Apr. 30, 1951	5.34	Sept. 5, 1951	1.71
Jan. 22	4.84	May 14	4.91	Sept. 18	2.42
Feb. 5	4.90	May 28	3.91	Oct. 1	2.50
Feb. 19	6.16	June 11	1.78	Oct. 15	2.38
Mar. 5	6.40	June 25	1.80	Nov. 26	2.90
Mar. 19	6.83	July 9	1.78	Dec. 28	4.07
Apr. 2	6.68	July 23	1.93	Feb. 1, 1952	6.09
Apr. 16	7.16	Aug. 20	2.24		
14-54-28dd (IV G3)					
Jan. 13, 1951	11.11	Apr. 30, 1951	12.46	Aug. 20, 1951	11.54
Jan. 22	11.53	May 14	12.22	Sept. 5	10.72
Feb. 5	11.60	May 28	11.08	Sept. 18	12.16
Feb. 19	11.30	June 11	9.60	Oct. 15	12.80
Mar. 5	11.43	June 25	8.95	Nov. 26	13.30
Mar. 19	11.43	July 9	9.63	Dec. 28	12.39
Apr. 2	9.60	July 23	9.86	Feb. 1, 1952	12.31
Apr. 16	11.63	Aug. 6	11.09		
14-54-31ca1 (IV Cb1)					
Jan. 3, 1951	7.64	May 14, 1951	6.75	Sept. 5, 1951	6.58
Jan. 22	7.85	May 28	5.12	Sept. 18	7.02
Feb. 5	7.89	June 11	5.88	Oct. 1	6.74
Feb. 19	7.80	June 25	6.53	Oct. 16	7.35
Mar. 5	7.98	July 9	6.24	Oct. 29	7.06
Apr. 2	7.70	July 23	5.01	Nov. 26	7.67
Apr. 16	7.65	Aug. 6	5.82	Dec. 28	8.07
Apr. 30	7.77	Aug. 20	6.18	Feb. 1, 1952	8.12
14-54-31ca2 (IV Cb2)					
Jan. 3, 1951	7.43	May 14, 1951	6.72	Sept. 5, 1951	6.18
Jan. 22	7.63	May 28	6.43	Sept. 18	6.41
Feb. 5	7.70	June 11	5.51	Oct. 1	6.55
Feb. 19	7.73	June 25	5.78	Oct. 16	6.81
Mar. 5	7.71	July 9	5.83	Oct. 29	7.02
Apr. 2	7.70	July 23	5.71	Nov. 26	7.34
Apr. 16	7.65	Aug. 6	5.68	Dec. 28	7.72
Apr. 30	7.64	Aug. 20	5.93	Feb. 1, 1952	7.79

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA IV—Continued

14-54-31db (IV Cb3)

Date	Water level	Date	Water level	Date	Water level
Jan. 3, 1951	16.74	May 14, 1951	16.70	Sept. 18, 1951	15.72
Jan. 22	17.20	June 11	13.23	Oct. 1	15.73
Feb. 5	17.24	June 25	14.53	Oct. 16	16.12
Feb. 19	17.71	July 9	14.86	Oct. 29	16.24
Mar. 5	17.62	July 23	13.45	Nov. 26	16.75
Apr. 2	17.55	Aug. 6	14.74	Dec. 28	17.22
Apr. 16	17.02	Aug. 20	15.09	Feb. 1, 1952	17.59
Apr. 30	16.90	Sept. 5	15.25		

14-54-31dd (IV Cb4)

Date	Water level	Date	Water level	Date	Water level
Jan. 3, 1951	25.47	May 14, 1951	26.45	Sept. 5, 1951	24.81
Jan. 22	25.48	May 28	26.38	Sept. 18	24.87
Feb. 5	25.54	June 11	25.96	Oct. 2	24.97
Feb. 19	25.71	June 25	25.71	Oct. 16	25.09
Mar. 5	25.71	July 9	25.35	Oct. 29	25.13
Apr. 2	26.09	July 23	24.54	Nov. 26	25.29
Apr. 16	26.26	Aug. 6	24.71	Dec. 28	25.44
Apr. 30	26.37	Aug. 20	24.80	Feb. 1, 1952	25.73

14-54-32ac (IV A1)

Date	Water level	Date	Water level	Date	Water level
Jan. 3, 1951	20.88	May 14, 1951	21.41	Sept. 5, 1951	20.99
Jan. 22	20.98	May 28	21.15	Sept. 18	20.92
Feb. 5	21.06	June 11	21.12	Oct. 1	20.95
Feb. 19	21.11	June 25	20.87	Oct. 16	21.01
Mar. 3	21.23	July 9	20.86	Oct. 29	21.08
Apr. 2	21.30	July 23	20.80	Nov. 26	21.19
Apr. 16	21.34	Aug. 6	20.83	Dec. 27	21.27
Apr. 30	21.38	Aug. 20	20.93	Feb. 1, 1952	21.38

14-54-32ca (IV A2)

Date	Water level	Date	Water level	Date	Water level
June 25, 1951	*27.62	Sept. 5, 1951	25.19	Oct. 29, 1951	26.05
July 9	26.65	Sept. 18	25.34	Nov. 26	26.59
July 23	25.83	Oct. 1	25.55	Dec. 27	27.09
Aug. 6	25.03	Oct. 16	25.85	Feb. 1, 1952	27.55
Aug. 20	25.11				

*Dry from 1-3-51 to 6-11-51.

14-54-33aa2 (IV F3)

Date	Water level	Date	Water level	Date	Water level
Jan. 3, 1951	14.82	Apr. 30, 1951	15.86	Aug. 20, 1951	15.26
Jan. 22	15.09	May 14	15.97	Sept. 5	14.90
Feb. 5	15.16	May 28	15.18	Sept. 18	15.52
Feb. 19	15.08	June 11	14.54	Oct. 15	16.24
Mar. 5	14.94	June 25	13.53	Oct. 29	16.22
Mar 19	15.15	July 9	14.18	Nov. 26	16.57
Apr. 2	13.87	July 23	14.36	Dec. 28	16.31
Apr. 16	15.09	Aug. 6	14.93	Feb. 1, 1952	15.80

14-54-33ab3 (IV E2)

Date	Water level	Date	Water level	Date	Water level
Jan. 3, 1951	4.77	Mar. 19, 1951	5.38	May 28, 1951	4.23
Jan. 22	5.19	Apr. 2	5.65	June 11	4.03
Feb. 5	5.27	Apr. 16	5.21	June 25	4.76
Feb. 19	5.80	Apr. 30	4.67	July 9	4.94
Mar. 5	5.63	May 14	4.58	July 23	5.44

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA IV—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-33ab3 (IV E2)—Continued					
Aug. 6, 1951	6.20	Sept. 18, 1951	5.24	Nov. 26, 1951	4.60
Aug. 20	6.23	Oct. 15	5.31	Dec. 28	4.73
Sept. 5	5.35	Oct. 29	4.98	Feb. 1, 1952	5.42
14-54-33ab8 (IV F2)					
Jan. 3, 1951	3.54	Apr. 30, 1951	3.46	Aug. 20, 1951	4.00
Jan. 22	3.93	May 14	3.57	Sept. 5	2.72
Feb. 5	4.04	May 28	2.14	Sept. 18	3.11
Feb. 19	4.17	June 11	2.12	Oct. 15	3.53
Mar. 5	4.10	June 25	3.08	Oct. 29	1.73
Mar. 18	4.18	July 9	3.33	Nov. 26	2.41
Apr. 2	4.10	July 23	2.69	Dec. 28	2.93
Apr. 16	3.85	Aug. 6	3.84	Feb. 1, 1952	3.68
14-54-33ac4 (IV D3)					
Jan. 3, 1951	7.65	Apr. 30, 1951	8.14	Aug. 20, 1951	7.39
Jan. 22	7.77	May 14	7.83	Sept. 5	6.97
Feb. 5	7.84	May 28	6.99	Sept. 18	7.00
Feb. 19	8.34	June 11	7.23	Oct. 5	7.19
Mar. 5	8.39	June 25	8.54	Oct. 31	6.80
Mar. 19	8.50	July 9	7.70	Nov. 26	6.83
Apr. 2	8.66	July 23	7.86	Dec. 28	7.15
Apr. 16	8.50	Aug. 6	7.67	Feb. 1, 1952	7.39
14-54-33ac5 (IV E3)					
Jan. 3, 1951	8.20	Apr. 30, 1951	9.06	Aug. 20, 1951	8.42
Jan. 22	8.43	May 14	8.89	Sept. 5	7.66
Feb. 5	8.52	May 28	7.56	Sept. 18	7.78
Feb. 19	8.93	June 11	7.55	Oct. 15	8.08
Mar. 5	8.99	June 25	7.92	Oct. 29	7.36
Mar. 19	9.08	July 9	8.19	Nov. 26	7.22
Apr. 2	9.16	July 23	8.24	Dec. 28	7.69
Apr. 16	9.13	Aug. 6	8.14	Feb. 1, 1952	8.03
14-54-33ad2 (IV E4)					
Jan. 3, 1951	9.92	Apr. 30, 1951	11.04	Sept. 5, 1951	8.06
Jan. 22	10.12	May 14	11.08	Sept. 18	8.56
Feb. 5	10.21	May 28	10.18	Oct. 15	9.43
Feb. 19	10.54	June 11	9.38	Oct. 29	9.46
Mar. 5	10.76	June 25	9.39	Nov. 26	9.33
Mar. 19	10.72	Aug. 6	8.29	Dec. 28	9.58
Apr. 2	10.82	Aug. 20	8.79	Feb. 1, 1952	9.08
Apr. 16	10.78				
14-54-33ba6 (IV D1)					
Jan. 3, 1951	9.18	Apr. 30, 1951	11.49	Aug. 20, 1951	9.89
Jan. 22	9.74	May 14	11.18	Sept. 5	9.62
Feb. 5	9.79	May 28	10.98	Sept. 18	9.47
Feb. 19	10.85	June 11	10.46	Oct. 15	9.65
Mar. 5	11.28	June 25	9.99	Oct. 31	9.69
Mar. 19	11.68	July 9	9.70	Nov. 26	9.69
Apr. 2	11.83	July 23	9.70	Dec. 28	10.17
Apr. 16	11.70	Aug. 6	9.71	Feb. 1, 1952	11.42

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA IV—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-33ba9 (IV D2)					
Jan. 3, 1951	2.94	Apr. 30, 1951	3.13	Aug. 20, 1951	6.13
Jan. 22	3.22	May 14	3.01	Sept. 5	5.06
Feb. 5	3.29	May 28	4.08	Sept. 18	5.05
Feb. 19	4.12	June 11	3.96	Oct. 15	4.92
Mar. 5	4.03	June 25	4.52	Oct. 31	4.66
Mar. 19	4.20	July 9	4.72	Nov. 26	4.38
Apr. 2	4.09	July 23	5.13	Dec. 28	4.50
Apr. 16	3.67	Aug. 6	6.03	Feb. 1, 1952	5.17

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA IV—Continued

14-54-33ba10 (IV P)

Water level at 2:00 a.m. in feet below land-surface datum (from recorder charts)

Day	1950				1951												1952	
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
1	.....	3.45	3.19	3.00	3.56	4.32	4.64	5.02	3.74	3.58	4.38	5.42	4.82	4.71	4.48	3.98	.....	5.00
2	.....	3.43	3.18	3.19	3.55	4.34	4.72	4.99	3.76	3.40	4.40	5.53	4.86	4.61	4.32	3.96	.....	4.74
3	.....	3.37	3.21	3.22	3.29	4.28	4.68	4.85	3.80	3.19	3.85	5.58	4.88	4.65	4.40	4.06	4.50	5.01
4	.....	3.22	2.99	3.35	3.77	4.50	4.52	4.80	3.73	3.21	3.77	5.54	4.83	4.71	4.29	3.96	4.48	4.86
5	.....	3.15	2.86	3.64	3.78	4.33	4.47	4.80	3.67	3.27	3.90	5.63	4.71	4.81	4.36	3.87	4.58	4.98
6	.....	3.03	3.18	3.52	3.87	4.67	4.82	4.92	3.74	3.29	4.02	5.69	4.74	4.75	4.37	4.06	4.54	4.91
7	.....	3.24	3.06	3.31	3.85	4.66	4.82	4.89	3.58	3.31	4.08	5.66	4.72	4.68	4.27	4.22	4.48	4.86
8	.....	3.24	3.15	3.41	3.65	4.41	4.86	4.76	3.48	3.45	4.17	5.76	4.66	4.71	4.16	4.31	4.54	4.89
9	.....	3.20	3.29	3.62	3.74	4.48	4.79	4.63	3.65	3.58	4.30	5.75	4.76	4.62	4.19	4.21	4.76	4.83
10	.....	3.26	3.15	3.48	3.87	4.49	4.84	4.87	3.60	3.58	4.40	5.83	4.70	4.63	4.24	4.09	4.57	4.82
11	.....	3.28	3.11	3.48	3.81	4.59	4.96	4.83	3.51	3.62	4.40	5.81	4.71	4.57	4.03	4.14	4.61	4.80
12	.....	3.23	3.16	3.53	3.87	4.76	4.99	4.78	3.43	3.64	4.44	5.77	4.83	4.53	3.99	4.07	4.73	4.68
13	.....	3.18	3.05	3.50	3.97	4.79	4.78	4.50	3.34	3.71	4.45	5.83	4.80	4.60	4.09	4.10	4.54	4.76
14	.....	3.26	2.92	3.51	3.85	4.61	4.91	4.63	3.44	3.79	4.47	5.72	4.89	4.61	4.11	4.26	4.44	4.77
15	.....	3.07	3.03	3.53	[a]3.76	4.57	4.90	4.70	3.51	3.80	4.57	5.72	4.96	4.44	4.23	4.29	4.72	.....
16	.....	3.33	3.24	3.61	3.75	4.49	4.60	4.62	3.54	3.97	4.68	5.63	4.81	4.72	4.33	4.01	4.75	.....
17	.....	3.12	3.07	3.71	3.83	4.65	5.05	4.36	3.43	3.99	4.74	5.69	4.86	4.65	4.30	3.99	4.58	.....
18	.....	3.19	3.02	3.68	4.02	4.57	5.15	4.56	3.43	4.00	4.79	5.72	4.81	4.67	4.05	.....	4.69	.....
19	.....	3.29	3.09	3.66	4.15	4.77	5.04	4.56	3.58	3.99	4.77	5.74	4.75	4.44	4.05	.....	4.66	.....
20	.....	3.10	3.21	3.58	4.29	4.69	4.99	4.55	3.60	4.04	4.76	5.87	4.80	4.44	3.99	.....	4.79	.....
21	.....	3.22	3.23	.....	4.10	4.70	4.88	4.45	3.66	4.03	4.95	5.86	4.93	4.51	4.18	[a]4.27	4.65	.....
22	.....	3.18	3.11	.....	3.93	4.86	4.80	4.49	3.68	4.04	5.00	5.79	4.75	4.48	4.19	.....	4.88	.....
23	.....	3.02	3.38	.....	4.28	4.65	5.11	4.35	3.62	4.07	5.02	5.79	4.85	4.50	4.20	.....	4.86	.....
24	.....	3.20	3.26	.....	4.29	4.55	4.99	4.34	3.72	4.08	4.98	5.93	4.78	4.37	4.11	.....	[b]4.75	.....
25	.....	3.02	3.26	.....	4.15	4.54	5.10	4.30	3.75	4.21	5.07	5.83	4.71	4.50	4.09	.....	4.63	.....
26	3.50	2.98	3.18	.....	4.07	4.65	4.81	4.17	3.87	4.17	5.18	5.70	4.70	4.58	4.14	.....	.....	.....
27	3.60	3.03	3.14	3.42	4.40	4.79	4.86	4.05	3.90	4.39	5.21	5.65	4.95	4.41	4.10	.....	.....	.....
28	3.66	3.10	3.25	3.47	4.37	4.64	5.11	4.07	3.80	4.33	5.20	5.63	4.76	4.39	4.03	[a]4.17	.....	.....
29	3.67	3.10	3.12	3.54	[a]4.31		5.00	3.84	4.07	4.36	5.24	5.64	4.62	4.36	4.15	4.26	.....	.....
30	3.57	3.06	3.16	3.45	4.34		4.93	3.74	4.00	4.38	5.42	4.75	4.64	4.53	4.07	4.30	.....	
31		3.16		3.32	4.45		5.01		3.85		5.39	4.97		4.46		4.49	4.84	

[a] Tape measurement.
[b] Estimated.

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA IV—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-33bb4 (IV B1)					
Jan. 3, 1951	28.75	Apr. 30, 1951	30.33	Aug. 20, 1951	26.26
Jan. 22	29.24	May 14	30.56	Sept. 5	25.71
Feb. 5	29.33	May 28	30.30	Sept. 18	26.10
Feb. 19	30.08	June 11	29.97	Oct. 15	27.08
Mar. 5	30.22	June 25	29.80	Oct. 29	27.29
Mar. 19	30.48	July 9	29.16	Nov. 26	27.82
Apr. 2	30.26	July 23	27.99	Dec. 27	28.61
Apr. 16	30.25	Aug. 6	26.74	Feb. 1, 1952	29.60
14-54-33bb5 (IV C1)					
Jan. 3, 1951	18.52	Apr. 30, 1951	20.03	Aug. 20, 1951	15.40
Jan. 22	19.15	May 14	20.24	Sept. 5	14.66
Feb. 5	19.53	May 28	19.79	Sept. 18	15.52
Feb. 19	20.10	June 11	19.73	Oct. 15	16.64
Mar. 5	20.21	June 25	19.52	Oct. 29	16.90
Mar. 19	20.44	July 9	18.76	Nov. 26	17.83
Apr. 2	19.73	July 23	17.59	Dec. 27	18.80
Apr. 16	19.98	Aug. 6	16.25	Feb. 1, 1952	19.68
14-54-33bc4 (IV B2)					
Jan. 3, 1951	8.69	Apr. 30, 1951	9.32	Aug. 20, 1951	8.03
Jan. 22	8.84	May 14	9.54	Sept. 5	7.52
Feb. 5	8.92	May 28	8.97	Sept. 18	7.49
Feb. 19	9.45	June 11	9.20	Oct. 15	7.84
Mar. 5	9.41	June 25	9.25	Oct. 29	7.70
Mar. 19	9.56	July 9	9.00	Nov. 26	7.94
Apr. 2	9.58	July 23	8.00	Feb. 1, 1952	8.91
Apr. 16	9.42	Aug. 6	8.01		
14-54-33bc6 (IV C2)					
Jan. 3, 1951	3.36	Apr. 30, 1951	2.52	Aug. 20, 1951	4.84
Jan. 22	3.68	May 14	3.27	Sept. 5	3.95
Feb. 5	3.77	May 28	3.68	Sept. 18	3.63
Feb. 19	4.14	June 11	3.79	Oct. 15	3.28
Mar. 5	3.82	June 25	4.17	Oct. 29	2.97
Mar. 19	4.02	July 9	4.30	Nov. 26	2.96
Apr. 2	3.89	July 23	4.49	Dec. 27	3.19
Apr. 16	3.42	Aug. 6	4.95		
14-54-33bc7 (IV C3)					
Jan. 3, 1951	3.49	Apr. 30, 1951	2.73	Aug. 20, 1951	4.78
Jan. 22	3.76	May 14	3.35	Sept. 5	3.88
Feb. 5	3.84	May 28	3.67	Sept. 18	3.57
Feb. 19	4.21	June 11	3.52	Oct. 15	3.30
Mar. 5	3.93	June 25	4.17	Oct. 29	3.00
Mar. 19	4.12	July 9	4.27	Nov. 26	3.00
Apr. 2	3.99	July 23	4.43	Dec. 27	3.20
Apr. 16	3.51	Aug. 6	4.88	Feb. 1, 1952	3.67
14-54-33bc9 (IV C4)					
Jan. 3, 1951	5.78	Mar. 19, 1951	6.63	May 28, 1951	5.76
Jan. 22	6.13	Apr. 2	6.63	June 11	5.76
Feb. 5	6.27	Apr. 16	6.42	June 25	6.02
Feb. 19	6.51	Apr. 30	6.13	July 9	6.12
Mar. 5	6.45	May 14	5.84	July 23	5.54

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA IV—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-33bc9 (IV C4)—Continued					
Aug. 6, 1951	6.09	Sept. 18, 1951	4.89	Nov. 26, 1951	4.88
Aug. 20	5.23	Oct. 15	4.91	Dec. 27	5.22
Sept. 5	4.80	Oct. 29	4.85	Feb. 1, 1952	5.80

14-54-33bd6 (IV R)

Water level at 2:00 a.m. in feet below land-surface datum (from recorder charts)

Day	1950							1951			
	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	.....	5.68	6.92	7.18	6.89	6.86	7.02	7.32	7.70	8.00	8.23
2	.....	5.73	6.93	7.19	6.88	6.87	7.02	.....	7.70	8.00	8.24
3	.....	5.79	6.94	7.20	6.88	6.93	7.03	.....	7.70	8.01	8.24
4	.....	5.88	6.99	7.21	6.84	6.85	7.03	.....	7.72	8.00	8.24
5	.....	5.94	7.02	7.22	6.78	6.79	7.15	.....	7.74	8.00	8.23
6	.....	5.97	7.04	7.22	6.74	6.89	7.16	.....	7.77	8.00	8.23
7	.....	6.00	[a]7.16	7.22	6.77	6.88	7.10	.....	7.81	8.03	8.23
8	.....	6.05	7.12	7.22	6.83	6.90	7.09	[a]7.40	7.81	8.05	8.23
9	.....	6.11	7.17	7.20	6.76	6.96	7.15	7.40	7.83	8.07	8.22
10	.....	6.13	7.18	7.14	6.81	6.90	7.18	7.41	7.83	8.06	8.23
11	.....	.....	7.18	7.10	6.79	6.90	7.17	7.43	7.84	8.10	8.23
12	.....	.....	7.18	7.07	6.82	6.91	7.17	7.44	7.88	8.13	8.24
13	.....	.....	7.11	7.05	6.81	6.92	7.17	7.45	7.92	8.14	8.24
14	.....	.....	[a]7.04	7.02	6.81	6.86	7.17	7.47	7.93	8.13	8.22
15	.....	.....	7.05	7.00	6.79	6.87	7.18	7.48	7.93	8.13	8.22
16	.....	.....	7.04	6.97	6.82	6.97	7.19	7.47	7.92	8.12	8.22
17	.....	[a]6.46	7.08	6.95	6.80	6.91	7.20	7.48	7.93	8.13	8.20
18	.....	.....	7.03	6.92	6.79	6.90	7.21	7.48	7.94	8.16	8.19
19	[a]5.66	.....	7.08	6.92	6.84	6.93	7.23	7.50	7.95	8.18	8.19
20	5.67	.....	7.04	6.90	6.80	7.00	7.23	7.53	7.96	8.18	.....
21	5.73	.....	7.05	6.92	6.81	6.99	7.24	7.55	7.97	8.19	.....
22	5.76	.....	.....	6.90	6.82	6.98	7.26	7.55	7.98	8.17	.....
23	5.83	.....	.....	6.87	6.82	7.05	7.27	7.56	7.99	8.18	.....
24	5.91	[a]6.78	[a]7.11	6.87	6.84	7.05	7.29	7.58	7.98	8.19	.....
25	5.89	.....	7.14	6.85	6.81	7.02	7.30	7.60	7.97	8.20	.....
26	5.59	6.72	7.12	6.83	6.78	7.02	7.31	7.61	7.97	8.20	.....
27	5.48	6.74	7.12	6.86	6.80	7.02	7.32	7.63	7.99	8.20	.....
28	5.52	6.76	7.12	6.88	6.78	7.03	7.31	7.65	7.99	8.21	.....
29	5.57	6.79	7.14	6.89	6.80	7.04	7.31	7.67		8.22	.....
30	5.61	6.84	7.16	6.87	6.82	7.04	7.32	7.67		8.22	.....
31		[a]6.88	7.17		6.84		7.31	7.69		8.23	

[a]Tape measurement.

14-54-33ca2 (IV C5)

Jan. 3, 1951	8.83	Apr. 30, 1951	9.23	Aug. 20, 1951	4.03
Jan. 22	9.01	May 14	9.13	Sept. 5	4.48
Feb. 5	9.11	May 28	9.01	Sept. 18	5.07
Feb. 19	9.19	June 11	9.04	Oct. 5	5.96
Mar. 5	9.26	June 25	9.01	Oct. 31	6.40
Mar. 19	9.32	July 9	8.99	Nov. 26	6.77
Apr. 2	9.38	July 23	6.70	Dec. 27	7.30
Apr. 16	9.30	Aug. 6	2.30	Feb. 1, 1952	8.10

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA IV—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-33cb2 (IV B3)					
Jan. 3, 1951	5.60	Apr. 30, 1951	5.42	Aug. 20, 1951	5.09
Jan. 22	5.72	May 14	5.50	Sept. 5	4.35
Feb. 5	5.84	May 18	5.30	Sept. 18	4.50
Feb. 19	6.14	June 11	5.40	Oct. 15	4.51
Mar. 5	6.01	June 25	5.40	Oct. 29	4.12
Mar. 19	6.15	July 9	5.65	Nov. 26	4.75
Apr. 2	6.06	July 23	4.60	Dec. 27	5.10
Apr. 16	5.80	Aug. 6	5.30	Feb. 1, 1952	5.59
14-54-33cb4 (IV B4)					
Jan. 3, 1951	7.37	Apr. 30, 1951	7.78	Aug. 20, 1951	4.84
Jan. 22	7.58	May 14	7.34	Sept. 5	4.46
Feb. 5	7.65	May 28	6.31	Sept. 18	5.07
Feb. 19	7.88	June 11	6.69	Oct. 15	5.58
Mar. 5	7.90	June 25	5.88	Oct. 29	5.18
Mar. 19	8.02	July 9	6.50	Nov. 26	6.07
Apr. 2	7.99	July 23	3.45	Dec. 27	6.69
Apr. 16	7.94	Aug. 6	4.86	Feb. 1, 1952	7.27
14-54-33cb5 (IV BC)					
Jan. 3, 1951	5.61	Apr. 30, 1951	5.55	Aug. 20, 1951	4.83
Jan. 22	5.82	May 14	5.39	Sept. 5	4.23
Feb. 5	5.91	May 28	5.28	Sept. 18	4.28
Feb. 19	6.12	June 11	5.25	Oct. 15	4.35
Mar. 5	5.89	June 25	5.44	Oct. 29	4.18
Mar. 19	6.15	July 9	5.56	Nov. 26	4.57
Apr. 2	6.07	July 23	4.99	Dec. 27	4.75
Apr. 16	5.83	Aug. 6	5.58	Feb. 1, 1952	5.37
14-54-33cc3 (IV B5)					
Jan. 3, 1951	11.12	Apr. 30, 1951	11.79	Aug. 20, 1951	7.23
Jan. 22	11.25	May 14	11.71	Sept. 5	7.59
Feb. 5	11.33	May 28	11.71	Sept. 18	8.08
Feb. 19	11.54	June 11	10.64	Oct. 15	8.90
Mar. 5	11.66	June 25	9.97	Oct. 29	8.92
Mar. 19	11.76	July 9	10.03	Nov. 26	9.68
Apr. 2	11.80	July 23	8.18	Dec. 27	10.13
Apr. 16	11.80	Aug. 6	7.93	Feb. 1, 1952	10.75
14-54-33cd1 (IV C6)					
Jan. 3, 1951	12.07	Apr. 30, 1951	12.84	Aug. 20, 1951	8.14
Jan. 22	12.22	May 14	12.94	Sept. 5	8.29
Feb. 5	12.30	May 28	12.24	Sept. 18	8.53
Feb. 19	12.46	June 11	12.25	Oct. 15	9.24
Mar. 5	12.57	June 25	12.24	Oct. 29	9.38
Mar. 19	12.66	July 9	12.36	Nov. 26	10.10
Apr. 2	12.72	July 23	11.80	Dec. 28	10.53
Apr. 16	12.79	Aug. 6	8.61	Feb. 1, 1952	11.12
14-54-33cd2 (IV C7)					
Jan. 3, 1951	12.08	Mar. 5, 1951	12.80	Apr. 30, 1951	12.86
Jan. 22	12.28	Mar. 19	12.75	May 14	12.96
Feb. 5	12.34	Apr. 2	12.69	June 11	11.36
Feb. 19	12.50	Apr. 16	12.77		

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA IV—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-33da2 (IV E5)					
Jan. 3, 1951	16.45	Apr. 30, 1951	17.25	Aug. 20, 1951	15.37
Jan. 22	16.69	May 14	17.48	Sept. 5	16.22
Feb. 5	16.74	May 28	17.22	Sept. 18	16.62
Feb. 19	16.93	June 11	16.35	Oct. 15	17.26
Mar. 5	16.68	June 25	16.01	Oct. 29	16.22
Mar. 19	16.90	July 9	15.95	Nov. 26	17.40
Apr. 2	16.30	July 23	15.84	Dec. 28	17.38
Apr. 16	16.58	Aug. 6	15.99	Feb. 1, 1952	17.21
14-54-33db1 (IV D4)					
Jan. 3, 1951	9.65	Apr. 30, 1951	10.85	Aug. 20, 1951	8.89
Jan. 22	9.84	May 14	10.83	Sept. 5	8.67
Feb. 5	10.08	May 28	9.92	Sept. 18	8.72
Feb. 19	10.28	June 11	9.42	Oct. 15	9.09
Mar. 5	10.40	June 25	9.16	Oct. 29	8.43
Mar. 19	10.57	July 9	9.48	Nov. 26	8.57
Apr. 2	10.72	July 23	9.34	Dec. 28	9.05
Apr. 16	10.80	Aug. 6	8.70	Feb. 1, 1952	9.72
14-54-33db3 (IV D5)					
Jan. 3, 1951	10.11	Apr. 30, 1951	11.72	Sept. 5, 1951	7.51
Jan. 22	10.58	May 28	9.17	Sept. 18	8.12
Feb. 5	10.64	June 11	7.96	Oct. 15	9.14
Feb. 19	11.05	June 25	8.27	Oct. 31	6.61
Mar. 5	11.22	July 9	9.17	Nov. 26	8.72
Mar. 19	11.39	July 23	7.33	Dec. 28	9.64
Apr. 2	11.50	Aug. 6	6.80	Feb. 1, 1952	10.37
Apr. 16	11.60	Aug. 20	8.00		
14-54-33dc (IV CD)					
Jan. 3, 1951	17.48	Mar. 19, 1951	18.24	May 28, 1951	17.50
Jan. 22	18.08	Apr. 2	16.55	June 11	16.70
Feb. 5	18.14	Apr. 16	18.18	June 25	16.00
Feb. 19	17.86	Apr. 30	17.86	July 9	16.66
Mar. 5	17.95	May 14	18.97	July 23	16.48

AREA V

14-54-23aba (V B1)					
Oct. 2, 1950	12.66	Jan. 3, 1951	13.95	July 9, 1951	12.85
Oct. 9	13.28	Jan. 22	14.10	July 23	12.31
Oct. 16	12.97	Feb. 12	14.20	Aug. 6	11.74
Oct. 23	13.11	Feb. 26	14.26	Aug. 20	11.70
Oct. 30	13.23	Mar. 12	14.34	Sept. 18	12.22
Nov. 6	13.36	Mar. 26	14.26	Oct. 1	12.48
Nov. 13	13.40	Apr. 9	14.32	Oct. 15	12.74
Nov. 20	13.53	Apr. 23	14.34	Oct. 29	12.91
Nov. 27	13.59	May 7	14.44	Nov. 26	13.26
Dec. 4	13.68	May 21	14.50	Dec. 28	13.58
Dec. 18	13.80	June 18	13.53	Jan. 31, 1952	13.88
14-54-23bbd (V A1)					
Oct. 2, 1950	8.30	Oct. 16, 1950	8.41	Oct. 30, 1950	8.58
Oct. 9	8.38	Oct. 23	8.47	Nov. 6	8.61

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA V—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-23bbd (V A1)—Continued					
Nov. 13, 1950	8.66	Mar. 12, 1951	9.60	Aug. 6, 1951	6.75
Nov. 20	8.74	Mar. 26	9.66	Aug. 20	6.84
Nov. 27	8.83	Apr. 9	9.72	Sept. 5	7.35
Dec. 4	8.87	Apr. 23	9.77	Sept. 18	7.48
Dec. 18	9.00	May 7	9.77	Oct. 1	7.73
Jan. 1, 1951	8.60	May 21	9.18	Oct. 15	7.92
Jan. 22	9.21	June 4	8.72	Oct. 29	8.08
Jan. 29	9.29	June 18	8.07	Nov. 26	8.34
Feb. 12	9.39	July 9	8.13	Dec. 28	8.56
Feb. 26	9.52	July 23	6.06	Jan. 31, 1952	9.96
14-54-23bdc (V A2)					
May 7, 1951	2.57	Aug. 20, 1951	0.99	Oct. 15, 1951	1.42
May 21	2.81	Sept. 5	1.05	Oct. 29	1.74
June 18	1.78	Sept. 18	1.16	Nov. 26	2.87
July 9	1.57	Oct. 1	1.32	Dec. 28	2.08
Aug. 6	.93				
14-54-23cab (V A3)					
May 7, 1951	10.48	Aug. 6, 1951	7.53	Oct. 29, 1951	7.18
May 21	9.99	Sept. 5	6.32	Nov. 26	7.80
June 18	8.29	Sept. 18	6.82	Nov. 27	7.93
July 9	7.53	Oct. 1	6.96	Dec. 28	8.71
July 23	6.74	Oct. 15	7.19	Jan. 31, 1952	10.08
14-54-23cad (V A4)					
May 7, 1951	10.09	Aug. 6, 1951	6.50	Oct. 15, 1951	6.73
May 21	9.33	Sept. 5	5.58	Oct. 29	6.76
June 18	6.98	Sept. 18	6.14	Nov. 26	7.12
July 9	6.59	Oct. 1	6.34		
14-54-23dad (V B2)					
May 7, 1951	12.37	Sept. 5, 1951	7.50	Oct. 29, 1951	9.74
May 21	12.41	Sept. 18	8.18	Nov. 26	10.26
June 18	9.36	Oct. 1	8.82	Dec. 28	10.79
July 9	9.76	Oct. 15	9.42	Jan. 31, 1952	11.72
14-54-23dba (V AB)					
May 7, 1951	5.55	Sept. 5, 1951	1.33	Oct. 29, 1951	2.11
May 21	4.91	Sept. 18	2.02	Nov. 26	2.70
June 18	3.24	Oct. 1	2.00	Dec. 28	3.76
July 9	3.43	Oct. 15	2.21	Jan. 31, 1952	5.24
Aug. 6	3.22				

AREA VI

14-54-1daa (VI I1)

Sept. 27, 1948	17.87	May 23	19.49	Oct. 30, 1949	17.05
Nov. 26	18.26	June 29	17.23	Dec. 1	17.72
Dec. 22	18.42	July 27	17.81	Dec. 29	18.29
Jan. 21, 1949	18.67	Aug. 31	16.76	Jan. 29, 1950	18.80
Apr. 26	19.65	Sept. 28	16.87	Feb. 28	19.12

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VI—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-1daa (VI I1)—Continued					
Mar. 31, 1950	19.44	Mar. 29, 1951	20.38	Aug. 20, 1951	17.65
May 28	19.75	Apr. 30	20.61	Sept. 5	17.83
June 28	19.67	May 21	20.63	Sept. 18	17.88
July 31	18.92	June 4	20.37	Oct. 1	18.70
Aug. 31	18.61	June 11	20.30	Oct. 15	18.15
Nov. 2	20.08	June 18	19.86	Oct. 29	18.22
Dec. 5	19.59	July 9	19.07	Nov. 26	18.56
Jan. 2, 1951	19.53	July 23	17.69	Dec. 28	18.67
Feb. 2	19.75	Aug. 6	17.73	Jan. 31, 1952	19.42
Mar. 5	20.23				
14-54-12acc (VI E2)					
Aug. 20, 1951	10.81	Oct. 1, 1951	13.11	Oct. 29, 1951	Dry
Sept. 5	12.43	Oct. 15	Dry		
14-54-12cca (VI D1)					
Aug. 20, 1951	7.55	Oct. 1, 1951	7.62	Nov. 26, 1951	7.92
Sept. 5	7.57	Oct. 15	7.67	Dec. 28	8.10
Sept. 18	7.50	Oct. 29	7.75	Jan. 31, 1952	8.33
14-54-12daa (VI F1)					
Aug. 20, 1951	10.77	Oct. 1, 1951	11.06	Nov. 26, 1951	11.06
Sept. 5	10.95	Oct. 15	11.03	Dec. 28	11.05
Sept. 18	10.98	Oct. 29	11.15	Jan. 31, 1952	11.17
14-54-12dcb (VI E3)					
Aug. 20, 1951	8.46	Oct. 1, 1951	7.99	Nov. 26, 1951	8.65
Sept. 5	7.97	Oct. 15	8.39	Dec. 28	9.06
Sept. 18	8.24	Oct. 29	7.79	Jan. 31, 1952	9.48
14-54-12dcc (VI D2)					
Aug. 20, 1951	4.64	Oct. 1, 1951	4.45	Nov. 26, 1951	4.48
Sept. 5	4.48	Oct. 15	4.43	Dec. 28	4.35
Sept. 18	4.47	Oct. 29	4.43		
14-54-13aaa (VI E4)					
Oct. 2, 1950	10.65	Jan. 22, 1951	11.95	July 9, 1951	10.50
Oct. 9	10.73	Jan. 29	11.98	July 23	9.56
Oct. 16	10.80	Feb. 12	12.17	Aug. 6	9.57
Oct. 23	10.91	Feb. 26	12.22	Aug. 20	9.47
Oct. 30	11.06	Mar. 12	12.33	Sept. 5	9.86
Nov. 6	11.05	Mar. 26	12.40	Sept. 18	10.05
Nov. 13	11.17	Apr. 9	12.47	Oct. 1	10.27
Nov. 20	11.29	Apr. 23	12.51	Oct. 15	10.50
Nov. 27	11.34	May 7	12.55	Oct. 29	10.46
Dec. 4	11.37	May 21	12.51	Nov. 26	10.92
Dec. 18	11.60	June 4	11.37	Dec. 28	11.28
Jan. 3, 1951	11.74	June 18	11.28	Jan. 31, 1952	11.70

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VI—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-13abb (VI D3)					
Aug. 6, 1951	8.89	Oct. 1, 1951	8.79	Nov. 26, 1951	8.80
Aug. 20	8.87	Oct. 15	8.73	Dec. 28	8.85
Sept. 5	8.85	Oct. 29	8.78	Jan. 31, 1952	8.86
Sept. 18	8.72				
14-54-13bba (VI CD)					
Aug. 20, 1951	3.50	Oct. 1, 1951	3.61	Nov. 26, 1951	4.24
Sept. 5	3.32	Oct. 15	3.70	Dec. 28	4.38
Sept. 18	3.54	Oct. 29	3.78		
14-54-13bdd (VI C2)					
Oct. 2, 1950	16.35	Jan. 22, 1951	17.55	July 9, 1951	17.45
Oct. 9	16.39	Jan. 29	17.65	July 23	16.68
Oct. 16	16.45	Feb. 12	17.80	Aug. 6	16.36
Oct. 23	16.52	Feb. 26	17.96	Aug. 20	15.78
Oct. 30	16.58	Mar. 12	18.13	Sept. 5	15.86
Nov. 6	16.65	Mar. 26	18.24	Sept. 18	15.88
Nov. 13	16.72	Apr. 9	18.39	Oct. 1	15.86
Nov. 20	16.84	Apr. 23	18.51	Oct. 15	16.01
Nov. 27	16.93	May 7	18.63	Oct. 29	15.96
Dec. 4	17.01	May 21	18.02	Nov. 26	16.39
Dec. 18	17.18	June 4	18.00	Dec. 28	16.84
Jan. 3, 1951	17.32	June 18	17.90	Jan. 31, 1952	17.33
14-54-13cca (VI A2)					
Oct. 9, 1950	23.70	Jan. 29, 1951	24.04	July 23, 1951	23.38
Oct. 16	23.63	Feb. 12	24.18	Aug. 6	22.98
Oct. 23	23.45	Feb. 26	24.23	Aug. 20	23.02
Oct. 30	23.67	Mar. 12	24.30	Sept. 5	22.90
Nov. 6	23.71	Mar. 26	24.36	Sept. 18	23.00
Nov. 13	23.72	Apr. 9	24.41	Oct. 1	23.07
Nov. 20	23.79	Apr. 23	24.46	Oct. 15	23.12
Nov. 27	23.80	May 7	24.51	Oct. 29	23.16
Dec. 4	23.86	May 21	24.29	Nov. 26	23.26
Dec. 18	23.92	June 4	24.12	Dec. 28	23.50
Jan. 3, 1951	23.94	June 18	24.19	Jan. 31, 1952	23.88
Jan. 22	24.00				
14-54-13cdd (VI A3)					
Oct. 2, 1950	18.83	Jan. 29, 1951	19.58	July 23, 1951	19.20
Oct. 9	18.78	Feb. 12	19.68	Aug. 6	18.63
Oct. 16	18.85	Feb. 26	19.72	Aug. 20	17.90
Oct. 23	18.97	Mar. 12	20.60	Sept. 5	17.84
Oct. 30	19.02	Mar. 26	19.77	Sept. 18	18.06
Nov. 6	19.10	Apr. 9	19.89	Oct. 1	18.19
Nov. 13	19.11	Apr. 23	19.98	Oct. 15	18.18
Nov. 20	19.20	May 7	20.00	Oct. 29	18.33
Nov. 27	19.23	May 21	19.94	Nov. 26	18.64
Dec. 18	19.35	June 18	19.57	Dec. 28	18.99
Jan. 3, 1951	19.53	July 9	19.37	Jan. 31, 1952	19.31
14-54-13dbd (VI C3)					
Oct. 2, 1950	15.65	Oct. 23, 1950	16.17	Jan. 3, 1951	17.00
Oct. 9	15.92	Oct. 30	16.22	Jan. 29	17.10
Oct. 16	15.95	Nov. 6	16.32	Feb. 26	17.35

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA IV—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-13dbd (VI C3)—Continued					
Mar. 26, 1951	17.50	July 23, 1951	17.12	Oct. 15, 1951	16.03
Apr. 9	17.57	Aug. 6	16.80	Oct. 29	16.22
May 7	17.65	Aug. 20	16.45	Nov. 26	16.49
May 21	17.68	Sept. 18	15.99	Dec. 28	16.76
June 18	16.95	Oct. 1	15.97	Jan. 31, 1952	16.87
July 9	17.25				
14-54-14aaa (VI C1)					
Oct. 30, 1950	2.96	Mar. 12, 1951	3.41	Aug. 20, 1951	2.56
Nov. 13	3.09	Mar. 26	3.40	Sept. 5	2.60
Nov. 20	3.12	Apr. 9	3.33	Sept. 18	2.83
Nov. 27	3.14	Apr. 23	3.35	Oct. 1	2.80
Dec. 4	3.21	May 7	3.34	Oct. 15	2.99
Jan. 3, 1951	3.23	May 21	2.94	Oct. 29	2.99
Jan. 22	3.28	June 18	1.20	Nov. 26	3.23
Jan. 29	3.29	July 9	2.51	Dec. 28	3.35
Feb. 12	3.32	July 23	1.42	Jan. 31, 1952	3.42
Feb. 26	3.35	Aug. 6	1.87		
14-54-14daa (VI A1)					
Oct. 30, 1950	20.70	Feb. 26, 1951	21.87	Aug. 6, 1951	20.37
Nov. 13	20.91	Mar. 26	Dry	Aug. 20	20.26
Nov. 20	21.03	Apr. 9	Dry	Sept. 5	20.47
Nov. 27	21.09	Apr. 23	Dry	Sept. 18	20.80
Dec. 4	21.09	May 7	Dry	Oct. 1	20.90
Jan. 3, 1951	21.30	June 18	21.43	Oct. 15	21.00
Jan. 22	21.70	July 9	21.00	Oct. 29	Dry
Jan. 29	21.70	July 23	19.98	Nov. 26	Dry
Feb. 12	21.74				

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VI—Continued

14-54-24abc (VI A4)

Water level at 2:00 a.m. in feet below land-surface datum (from recorder charts)

Day	1950				1951							
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1	.....	8.36	8.22	8.63	9.05	9.50	9.90	10.23	[b]9.24	7.73	7.96	8.26
2	.....	8.31	8.23	8.69	9.06	9.50	9.93	10.24	9.19	7.54	7.99	8.30
3	.....	8.28	8.28	8.71	9.02	9.48	9.93	10.22	9.15	7.32	7.78	8.34
4	.....	8.22	8.21	8.73	9.12	9.55	9.89	10.23	9.08	7.20	7.49	8.34
5	.....	8.15	8.16	8.84	9.14	9.55	9.90	10.24	9.00	7.15	7.40	8.37
6	.....	8.10	8.25	8.86	.....	9.61	9.97	10.28	8.97	7.12	7.39	8.42
7	.....	8.13	8.23	8.82	.....	9.64	9.98	10.28	8.89	7.12	7.41	8.46
8	.....	8.17	8.25	8.86	[a]9.14	9.59	10.01	10.23	8.80	7.15	7.42	8.50
9	.....	8.10	8.32	8.92	9.16	9.63	9.98	10.19	8.79	7.20	7.50	8.55
10	.....	8.15	8.32	8.96	9.21	9.63	9.98	10.23	8.74	7.23	7.60	8.59
11	.....	8.13	8.30	8.94	9.21	9.66	10.05	10.23	8.64	7.25	7.64	8.63
12	.....	8.15	8.35	8.96	9.22	9.70	10.07	10.19	8.57	7.29	7.66	8.65
13	.....	8.13	8.37	8.96	9.25	9.74	10.00	10.11	8.50	7.32	7.68	8.67
14	.....	8.15	[b]8.34	8.96	9.26	9.72	10.02	10.07	8.48	7.37	7.73	8.68
15	.....	8.11	[b]8.36	8.99	9.29	9.72	10.04	10.09	8.45	7.38	7.81	8.66
16	.....	8.17	[b]8.39	8.99	9.20	9.71	9.94	10.06	8.44	7.41	7.87	8.61
17	.....	8.14	[b]8.41	9.02	9.25	9.75	10.07	9.96	8.37	7.46	7.87	8.61
18	[a]8.53	8.14	[b]8.43	9.02	9.28	9.75	10.13	9.96	8.30	7.49	7.86	8.60
19	8.49	8.18	[b]8.45	9.05	9.32	9.79	10.12	9.92	8.28	7.51	7.79	8.63
20	8.46	8.14	[a]8.49	9.04	9.35	9.82	10.11	9.88	8.25	7.55	7.78	8.66
21	8.46	8.17	8.55	9.06	9.36	9.83	10.09	9.81	8.18	7.55	7.84	8.70
22	8.43	8.17	8.55	9.06	9.29	9.87	10.06	9.76	8.11	7.56	7.91	.....
23	8.41	8.14	8.64	9.07	9.35	9.85	10.14	9.69	8.00	7.59	7.96	.....
24	8.40	8.16	8.64	9.10	9.37	9.83	10.14	9.65	7.95	7.62	7.96	.....
25	8.39	8.13	8.62	9.02	9.38	9.84	10.14	9.59	7.94	7.69	8.02	.....
26	8.36	8.10	8.65	9.10	9.37	9.87	10.11	9.53	7.96	7.72	8.08	.....
27	8.37	8.13	8.65	9.03	9.42	9.91	10.12	9.46	7.97	7.79	8.13	.....
28	8.39	8.12	8.67	9.00	9.44	9.90	10.19	9.42	7.91	7.84	8.12	.....
29	8.39	8.14	8.67	9.01	[a]9.47		10.20	9.33	7.93	7.88	8.14	.....
30	8.38	8 15	8.69	9.03	9.47		10.18	9.27	7.90	7.93	8.20	.....
31	.....	8.19	.....	8.96	9.49	.....	10.21	.....	7.85	.....	8.23	.....

[a]Tape measurement.
[b]Estimated.

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VI—Continued

Date	Water level	Date	Water level	Date	Water level
14-54-24abc (VI A4)—Continued					
Sept. 5, 1951	7.30	Oct. 15, 1951	7.80	Dec. 28, 1951	8.83
Sept. 18	7.41	Oct. 29	7.88	Jan. 31, 1952	9.33
Oct. 1	7.70	Nov. 26	8.14		
14-54-24adb (VI A5)					
Oct. 2, 1950	6.04	Jan. 22, 1951	7.13	July 23, 1951	5.40
Oct. 9	6.07	Feb. 12	7.36	Aug. 6	6.05
Oct. 16	6.16	Feb. 26	7.49	Aug. 20	6.25
Oct. 23	6.25	Mar. 12	7.55	Sept. 5	6.07
Oct. 30	6.34	Mar. 26	7.67	Sept. 18	6.23
Nov. 6	6.47	Apr. 9	7.78	Oct. 1	6.43
Nov. 13	6.52	Apr. 23	7.72	Oct. 15	6.51
Nov. 20	6.63	May 7	7.50	Oct. 29	6.59
Nov. 27	6.72	May 21	7.07	Nov. 26	6.81
Dec. 4	6.73	June 4	6.85	Dec. 28	6.99
Dec. 18	7.72	June 18	5.90	Jan. 31, 1952	7.46
Jan. 3, 1951	7.00	July 9	6.48		
14-55-6add (VI I4)					
June 4, 1951	19.01	Aug. 6, 1951	19.90	Oct. 15, 1951	20.00
June 11	20.59	Aug. 20	19.98	Oct. 29	20.02
June 18	20.60	Sept. 5	19.91	Nov. 26	20.31
July 9	20.10	Sept. 18	19.93	Dec. 28	19.84
July 23	20.05	Oct. 1	20.02	Jan. 31, 1952	20.67
14-55-6baa (VI K1)					
Aug. 20, 1951	10.30	Oct. 1, 1951	11.86	Nov. 26, 1951	12.65
Sept. 5	11.36	Oct. 15	12.16	Dec. 28	12.73
Sept. 18	11.76	Oct. 29	12.48	Jan. 31, 1952	13.45
14-55-6bdc (VI I2)					
Aug. 20, 1951	5.38	Oct. 1, 1951	5.19	Nov. 26, 1951	6.13
Sept. 5	5.54	Oct. 15	5.79	Dec. 28	6.31
Sept. 18	5.67	Oct. 29	5.66	Jan. 31, 1952	6.89
14-55-6bdd1 (VI I3a)					
May 21, 1951	19.95	Aug. 6, 1951	18.97	Oct. 15, 1951	18.72
June 4	19.01	Aug. 20	18.84	Oct. 29	18.79
June 11	19.12	Sept. 5	18.91	Nov. 26	18.98
June 18	19.14	Sept. 18	18.88	Dec. 28	19.18
July 9	19.04	Oct. 1	18.78	Jan. 31, 1952	19.48
July 23	18.75				
14-55-6bdd2 (VI I3b)					
Aug. 6, 1951	3.74	Oct. 1, 1951	2.15	Nov. 26, 1951	3.59
Aug. 20	2.66	Oct. 15	3.51	Dec. 28	4.48
Sept. 5	3.18	Oct. 29	3.36	Jan. 31, 1952	5.38
Sept. 18	4.45				

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VI—Continued

Date	Water level	Date	Water level	Date	Water level
14-55-6cac (VI H1)					
Sept. 5, 1951	10.13	Oct. 15, 1951	10.36	Dec. 28, 1951	10.45
Sept. 18	10.15	Oct. 29	10.35	Jan. 31, 1952	10.83
Oct. 1	10.22	Nov. 26	10.55		
14-55-6ccc (VI G1)					
Sept. 5, 1951	10.57	Oct. 15, 1951	10.89	Dec. 28, 1951	11.57
Sept. 18	10.64	Oct. 29	10.93	Jan. 31, 1952	11.90
Oct. 1	10.67	Nov. 26	11.42		
14-55-6dbc (VI H2)					
Sept. 5, 1951	3.72	Oct. 15, 1951	3.38	Dec. 28, 1951	3.34
Sept. 18	3.25	Oct. 29	3.36	Jan. 31, 1952	3.44
Oct. 1	3.29	Nov. 26	3.34		
14-55-6ddc (VI H3)					
Aug. 20, 1951	12.93	Oct. 15, 1951	12.92	Dec. 28, 1951	12.96
Sept. 5	12.92	Oct. 29	12.91	Jan. 31, 1952	12.99
Sept. 18	12.90	Nov. 26	12.98		
14-55-7aca (VI G4)					
Sept. 18, 1951	8.62	Oct. 29, 1951	9.01	Dec. 28, 1951	9.49
Oct. 1	8.76	Nov. 26	9.26	Jan. 31, 1952	9.83
Oct. 15	8.90				
14-55-7add (VI G5)					
Aug. 20, 1951	4.83	Oct. 1, 1951	5.77	Nov. 26, 1951	6.26
Sept. 5	5.01	Oct. 15	5.97	Dec. 28	6.58
Sept. 18	5.50	Oct. 29	5.90	Jan. 31, 1952	7.07
14-55-7bad (VI G2)					
Sept. 5, 1951	4.30	Oct. 15, 1951	4.33	Dec. 28, 1951	4.60
Sept. 18	4.40	Oct. 29	4.41	Jan. 31, 1952	4.69
Oct. 1	4.38	Nov. 26	4.56		
14-55-7bda5 (VI G3)					
Oct. 1, 1951	7.18	Oct. 29, 1951	7.31	Dec. 28, 1951	7.55
Oct. 15	7.26	Nov. 26	7.48	Jan. 31, 1952	7.80
14-55-7cac (VI F2)					
Oct. 2, 1950	2.19	Dec. 18, 1950	3.00	May 21, 1951	3.59
Oct. 9	2.30	Jan. 3, 1951	3.08	June 4	3.77
Oct. 16	2.38	Jan. 22	3.20	June 18	.97
Oct. 23	2.49	Jan. 29	3.23	July 9	.10
Oct. 30	2.54	Feb. 12	3.32	July 23	.24
Nov. 6	2.64	Feb. 26	3.37	Aug. 6	.03
Nov. 13	2.68	Mar. 12	3.42	Aug. 20	.81
Nov. 20	2.78	Apr. 23	3.48	Sept. 18	1.59
Nov. 27	2.84	May 7	3.55	Oct. 1	1.85
Dec. 4	2.86				

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VI--Continued

Date	Water level	Date	Water level	Date	Water level
14-55-7cdd (VI F3)					
Oct. 2, 1950	6.19	Jan. 29, 1951	9.10	July 23, 1951	6.68
Oct. 9	7.17	Feb. 12	9.26	Aug. 6	6.44
Oct. 16	7.31	Feb. 26	9.41	Aug. 20	6.53
Oct. 23	7.47	Mar. 26	9.56	Sept. 5	6.55
Oct. 30	7.61	Apr. 9	9.79	Sept. 18	6.82
Nov. 6	7.78	Apr. 23	9.88	Oct. 1	6.54
Nov. 13	7.88	May 7	9.98	Oct. 15	6.85
Nov. 20	8.03	May 21	8.50	Oct. 29	7.16
Dec. 4	8.11	June 4	8.80	Nov. 26	7.72
Dec. 18	8.52	June 18	8.84	Dec. 28	8.20
Jan. 3, 1951	8.75	July 9	7.76	Jan. 31, 1952	8.60
Jan. 22	8.98				
14-55-7dda (VI FG)					
Aug. 20, 1951	5.64	Oct. 1, 1951	5.51	Nov. 26, 1951	6.16
Sept. 5	5.38	Oct. 15	5.78	Dec. 28	6.52
Sept. 18	5.65	Oct. 29	5.86	Jan. 31, 1952	6.92
14-55-18bad (VI EF)					
Aug. 20, 1951	11.61	Oct. 1, 1951	11.56	Nov. 26, 1951	12.93
Sept. 5	11.90	Oct. 15	12.18	Dec. 28	13.35
Sept. 18	12.11	Oct. 29	12.46	Jan. 31, 1952	13.73
14-55-18caa (VI E5)					
Oct. 9, 1950	18.50	Aug. 20, 1951	18.08	Oct. 15, 1951	18.60
Oct. 16	18.80	Sept. 5	18.18	Oct. 29	Dry
Aug. 6, 1951	18.20	Sept. 18	18.10	Nov. 26	Dry
14-55-18ccc4 (VI C4, 1W1)					
Oct. 2, 1950	6.05	Jan. 22, 1951	7.58	July 23, 1951	6.36
Oct. 9	6.11	Jan. 29	7.72	Aug. 6	6.75
Oct. 16	6.46	Feb. 12	7.87	Aug. 20	7.31
Oct. 23	6.42	Feb. 26	8.00	Sept. 5	6.00
Oct. 30	6.52	Mar. 12	7.98	Sept. 18	6.56
Nov. 6	6.68	Mar. 26	8.00	Oct. 1	6.54
Nov. 13	7.24	May 7	6.79	Oct. 15	6.82
Nov. 20	6.83	May 21	6.67	Oct. 29	6.72
Nov. 27	6.94	June 4	4.71	Nov. 26	6.78
Dec. 4	6.94	June 18	4.74	Dec. 28	7.45
Dec. 18	7.40	July 9	6.15	Jan. 31, 1952	8.01
Jan. 3, 1951	7.25				
14-55-18cda (VI E6)					
May 21, 1951	3.73	Oct. 1, 1951	3.32	Dec. 3, 1951	3.43
June 18	3.42	Oct. 8	3.38	Dec. 10	3.48
Aug. 7	3.88	Oct. 15	3.39	Dec. 17	3.51
Aug. 20	3.72	Oct. 18	3.37	Dec. 21	3.55
Aug. 21	3.75	Oct. 22	3.44	Dec. 28	3.57
Aug. 27	3.56	Oct. 30	3.47	Jan. 2, 1952	3.66
Aug. 31	3.63	Nov. 8	3.30	Jan. 9	3.67
Sept. 5	3.45	Nov. 19	3.40	Jan. 16	3.65
Sept. 10	3.36	Nov. 26	3.44	Jan. 24	3.62
Sept. 17	3.46	Dec. 1	3.43	Jan. 31	3.65
Sept. 24	3.45				

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VI—Continued

Date	Water level	Date	Water level	Date	Water level
14-55-18cdd (VI D4)					
Aug. 20, 1951	7.20	Oct. 1, 1951	7.71	Nov. 26, 1951	8.03
Sept. 5	7.37	Oct. 15	7.85	Dec. 28	8.17
Sept. 18	7.57	Oct. 29	7.83	Jan. 31, 1952	8.41
14-55-19bda (VI C5)					
Oct. 2, 1950	17.03	Jan. 22, 1951	17.57	July 9, 1951	16.68
Oct. 9	17.28	Jan. 29	17.66	July 23	16.23
Oct. 16	17.41	Feb. 12	17.31	Aug. 6	16.30
Oct. 23	17.40	Feb. 26	17.29	Aug. 20	16.46
Oct. 30	17.45	Mar. 12	17.75	Sept. 5	16.58
Nov. 6	17.49	Mar. 26	17.00	Sept. 18	16.94
Nov. 13	17.52	Apr. 9	17.47	Oct. 1	17.00
Nov. 20	17.55	Apr. 23	17.75	Oct. 15	17.00
Nov. 27	16.98	May 7	18.05	Oct. 29	16.98
Dec. 4	17.62	May 21	18.19	Nov. 26	17.54
Dec. 18	16.97	June 4	17.70	Dec. 28	17.67
Jan. 3, 1951	16.35	June 18	16.39	Jan. 31, 1952	17.88

AREA VII

15-54-36aca1 (VII B1)					
May 21, 1951	17.63	Aug. 6, 1951	11.63	Oct. 15, 1951	13.98
June 4	16.67	Aug. 20	12.18	Oct. 29	14.46
June 11	16.29	Sept. 5	12.67	Nov. 26	15.45
June 18	13.84	Sept. 18	13.07	Dec. 28	16.21
July 9	13.06	Oct. 1	13.50	Jan. 29, 1952	17.11
July 23	13.07				
15-55-30add (VII E3)					
June 4, 1951	13.73	Aug. 6, 1951	12.05	Oct. 15, 1951	12.51
June 11	13.71	Aug. 20	11.83	Oct. 29	12.75
June 18	13.65	Sept. 5	11.80	Nov. 26	13.13
July 9	13.10	Sept. 18	12.08	Dec. 28	13.55
July 23	12.41	Oct. 1	12.26	Jan. 29, 1952	13.99
15-55-30bdc1 (VII E1a)					
June 4, 1951	11.71	Aug. 6, 1951	11.05	Oct. 15, 1951	12.89
June 11	12.02	Aug. 20	11.95	Oct. 29	12.99
June 18	11.90	Sept. 5	12.38	Nov. 26	13.03
July 9	11.44	Sept. 18	12.59	Dec. 28	13.06
July 23	12.23	Oct. 1	12.80	Jan. 29, 1952	12.43
15-55-30bdc2 (VII E1b)					
June 4, 1951	3.22	Aug. 6, 1951	7.18	Oct. 15, 1952	9.06
June 11	3.89	Aug. 20	8.13	Oct. 29	9.12
June 18	5.02	Sept. 5	8.53	Nov. 26	9.04
July 9	6.40	Sept. 18	8.79	Dec. 28	7.37
July 23	7.40	Oct. 1	9.01		
15-55-30cda (VII D2)					
June 4, 1951	6.83	June 18, 1951	6.32	Aug. 6, 1951	3.24
June 11	6.98	July 23	4.17	Aug. 20	3.65

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VII—Continued

15-55-30cda (VII D2)—Continued

Date	Water level	Date	Water level	Date	Water level
Sept. 5, 1951	3.85	Oct. 15, 1951	4.66	Nov. 26, 1951	5.65
Sept. 18	5.27	Oct. 29	5.02	Dec. 28	6.14
Oct. 1	3.92				

15-55-30cdb1 (VII D1)

June 4, 1951	20.75	Aug. 20, 1951	15.06	Oct. 29, 1951	17.70
June 11	20.27	Sept. 5	15.76	Nov. 26	18.50
July 9	18.33	Sept. 18	16.20	Dec. 28	19.17
July 23	16.15	Oct. 1	16.60	Jan. 29, 1952	19.90
Aug. 6	14.48	Oct. 15	17.21		

15-55-30dba (VII E2)

June 4, 1951	14.55	Aug. 6, 1951	9.80	Oct. 15, 1951	11.50
June 11	13.28	Aug. 20	10.62	Oct. 29	11.94
June 18	13.38	Sept. 5	10.49	Nov. 26	12.63
July 9	11.35	Sept. 18	11.00	Dec. 28	13.28
July 23	11.60	Oct. 1	10.81	Jan. 29, 1952	13.04

15-55-30ddc (VII D3)

May 21, 1951	0.81	July 23, 1951	0.32	Oct. 1, 1951	+0.05
June 4	.62	Aug. 6	.03	Oct. 15	.01
June 11	.71	Aug. 20	.05	Oct. 29	.02
June 18	.61	Sept. 5	+.09	Nov. 26	.30
July 9	.13	Sept. 18	.00		

15-55-30ddd (VII D4)

June 4, 1951	9.03	Aug. 6, 1951	7.44	Oct. 15, 1951	8.46
June 11	9.05	Aug. 20	7.98	Oct. 29	8.66
June 18	8.89	Sept. 5	8.08	Nov. 26	8.80
July 9	7.25	Sept. 18	8.27	Dec. 28	8.95
July 23	7.59	Oct. 1	8.42	Jan. 29, 1952	9.17

15-55-31aab (VII C1)

Oct. 5, 1951	4.49	Oct. 29, 1951	4.63	Dec. 28, 1951	5.31
Oct. 15	4.55	Nov. 26	4.91	Jan. 29, 1952	5.45

15-55-31aca (VII B4)

May 21, 1951	4.08	Aug. 6, 1951	1.63	Oct. 15, 1951	2.94
June 4	3.04	Aug. 20	2.86	Oct. 29	3.08
June 11	3.52	Sept. 5	2.42	Nov. 26	3.25
June 18	3.80	Sept. 18	2.77	Dec. 28	3.46
July 9	2.63	Oct. 1	2.76	Jan. 29, 1952	2.62
July 23	2.56				

15-55-31ada (VII B5)

May 21, 1951	6.89	June 18, 1951	6.63	Aug. 6, 1951	5.80
June 4	6.44	July 9	5.40	Aug. 20	6.13
June 11	6.50	July 23	5.51	Sept. 5	5.60

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VII —Continued

Date	Water level	Date	Water level	Date	Water level
15-55-31ada (VII B5) —Continued					
Sept. 18, 1951	5.97	Oct. 29, 1951	6.62	Dec. 28, 1951	7.68
Oct. 1	6.28	Nov. 26	7.14	Jan. 29, 1952	8.27
Oct. 15	6.20				
15-55-31bcb (VII B2)					
May 21, 1951	20.94	Aug. 6, 1951	16.34	Oct. 15, 1951	16.73
June 4	20.69	Aug. 20	15.92	Oct. 29	17.15
June 11	20.44	Sept. 5	15.54	Nov. 26	17.86
June 18	20.24	Sept. 18	15.77	Dec. 28	18.40
July 9	19.20	Oct. 1	16.29	Jan. 29, 1952	19.01
July 23	18.17				
15-55-31bdb (VII B3)					
May 21, 1951	14.10	Aug. 6, 1951	10.49	Oct. 15, 1951	10.79
June 4	13.44	Aug. 20	10.23	Oct. 29	11.10
June 11	13.18	Sept. 5	9.90	Nov. 26	11.60
June 18	13.28	Sept. 18	10.16	Dec. 28	12.15
July 9	12.22	Oct. 1	10.46	Jan. 28, 1952	12.61
July 23	11.62				
15-55-31caa1 (VII A2a)					
May 31, 1951	6.53	Aug. 6, 1951	5.19	Oct. 15, 1951	5.18
June 4	5.74	Aug. 20	5.11	Oct. 29	5.05
June 11	6.06	Sept. 5	4.69	Nov. 26	5.41
June 18	6.25	Sept. 18	4.95	Dec. 28	5.52
July 9	5.24	Oct. 1	5.07	Jan. 29, 1952	5.70
July 23	5.30				
15-55-31caa2 (VII A2b)					
June 11, 1951	5.97	Aug. 20, 1951	5.04	Oct. 29, 1951	4.96
June 18	6.07	Sept. 5	4.60	Nov. 26	5.30
July 9	5.15	Sept. 18	4.87	Dec. 28	5.44
July 23	5.22	Oct. 1	4.97	Jan. 29, 1952	5.65
Aug. 6	5.11	Oct. 15	5.10		
15-55-31cbc (VII A1)					
June 11, 1951	23.33	Aug. 20, 1951	19.93	Oct. 29, 1951	20.36
June 18	22.60	Sept. 5	19.50	Nov. 26	20.78
July 9	22.50	Sept. 18	20.55	Dec. 28	21.25
July 23	22.00	Oct. 1	19.84	Jan. 29, 1952	21.92
Aug. 6	20.92	Oct. 15	20.14		

Table 10.—Measurements of depth to water in observation wells—*Continued*

AREA VII—Continued

14-55-31daa1 (VII A3a)

Water level at 2:00 a.m. in feet below land-surface datum (from recorder charts)

Day	1951									1952	
	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
1	.....	9.82	8.99	8.25	8.13	8.39	8.88	9.22	9.42	.....	9.50
2	.....	9.76	8.90	8.22	8.26	8.42	8.85	9.16	9.39	[a]9.96	9.40
3	.....	9.75	8.85	8.13	8.33	8.45	8.87	9.16	9.46	9.94	9.45
4	.....	9.73	8.82	8.06	8.34	8.48	8.93	9.16	9.42	9.87	9.40
5	.....	9.67	8.84	8.09	8.45	8.46	9.02	9.22	9.40	9.87	9.40
6	.....	9.65	8.84	8.12	8.50	8.51	9.01	9.21	9.50	9.83	9.39
7	.....	9.58	8.84	.....	8.45	8.51	8.98	9.10	9.57	9.78	9.35
8	.....	9.53	8.90	.....	8.52	8.48	9.02	8.99	9.62	9.76	9.33
9	.....	9.52	8.99	[a]8.32	8.55	8.56	.....	9.00	9.61	9.83	9.30
10	.....	9.50	8.98	8.36	8.61	8.55	.....	9.00	9.58	9.75	9.28
11	.....	9.44	8.98	8.42	8.59	8.56	.....	8.92	9.63	9.71	9.26
12	.....	9.38	8.96	8.45	8.57	8.68	.....	8.89	9.62	9.76	9.22
13	.....	9.32	8.99	8.48	8.54	8.70	.....	8.97	9.66	9.68	9.22
14	.....	9.32	9.05	8.50	8.40	8.78	.....	9.03	0.72	9.63	9.26
15	.....	9.32	9.04	8.58	8.42	8.85	[a]9.02	9.14	9.75	9.72	.....
16	.....	9.31	9.09	8.69	8.39	8.80	9.11	9.25	9.71	9.73	.....
17	.....	9.25	9.06	8.74	8.49	8.85	9.11	9.27	9.68	9.65	.....
18	.....	9.20	9.02	8.77	8.55	8.81	9.15	9.18	9.78	9.66	.....
19	.....	9.20	8.86	8.64	8.63	8.78	9.01	9.23	9.76	9.62	.....
20	.....	9.18	8.76	8.48	8.74	8.83	9.01	9.22	9.82	9.69	.....
21	.....	9.15	8.77	8.43	8.78	8.82	[b]9.04	9.33	[a]9.82	9.60	.....
22	.....	9.14	8.74	8.36	8.78	8.81	[b]9.08	9.36	9.81	9.66	.....
23	[a]10.09	9.10	8.70	8.23	8.78	8.90	9.12	9.39	9.90	9.64	.....
24	10.09	9.10	8.66	8.04	8.85	8.85	9.05	9.38	9.90	[a]9.53	.....
25	10.06	9.07	8.65	8.00	8.69	8.80	9.15	9.38	9.91	9.52	.....
26	10.02	9.12	8.57	8.05	8.54	8.74	9.19	9.42	9.98	9.54	.....
27	9.97	9.12	8.60	8.02	8.37	8.95	9.08	9.42	[b]9.91	9.55	.....
28	9.96	9.15	8.48	7.99	8.38	8.89	9.07	9.41	9.86	9.54	.....
29	9.89	9.12	8.38	8.03	8.42	8.77	[b]9.04	9.47	9.85	9.51	.....
30	9.85	9.08	8.32	8.14	8.29	8.88	9.19	9.46	9.88	9.48	
31		9.04		8.09	8.42		9.19		9.98	9.43	

[a]Tape measurement.
[b]Estimated.

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VII—Continued

Date	Water level	Date	Water level	Date	Water level
15-55-31daa2 (VII A3b)					
July 9, 1951	11.72	Sept. 5, 1951	8.92	Oct. 29, 1951	9.37
July 23	8.51	Sept. 18	9.14	Nov. 26	9.70
Aug. 6	8.87	Oct. 1	9.18	Dec. 28	10.11
Aug. 20	9.13	Oct. 15	9.32	Jan. 29, 1952	9.72
15-55-32bdb (VII B6)					
July 9, 1951	5.00	Sept. 5, 1951	6.39	Oct. 29, 1951	6.70
July 23	6.48	Sept. 18	6.49	Nov. 26	6.77
Aug. 6	6.39	Oct. 1	6.57	Jan. 29, 1952	7.04
Aug. 20	6.42	Oct. 15	6.14		

AREA VIII

15-55-4caa (VIII J2)					
June 11, 1951	15.50	Aug. 20, 1951	12.63	Oct. 30, 1951	16.34
June 25	15.45	Sept. 5	14.72	Nov. 27	16.83
July 9	14.57	Sept. 18	14.33	Dec. 27	17.50
July 23	14.50	Oct. 1	14.66	Jan. 28, 1952	18.04
Aug. 6	14.63	Oct. 15	15.47		
15-55-4cbb (VIII J1)					
June 25, 1951	14.18	Sept. 5, 1951	13.20	Oct. 30, 1951	13.71
July 9	13.43	Sept. 18	13.18	Nov. 27	13.95
July 23	13.22	Oct. 1	13.33	Dec. 27	14.00
Aug. 6	12.77	Oct. 15	13.54	Jan. 28, 1952	14.35
Aug. 20	12.92				
15-55-8aba (VIII I1)					
June 25, 1951	34.24	Sept. 5, 1951	34.54	Oct. 30, 1951	34.68
July 9	34.45	Sept. 18	34.80	Nov. 27	34.70
July 23	33.89	Oct. 1	34.57	Dec. 27	34.64
Aug. 6	34.14	Oct. 15	34.60	Jan. 28, 1952	34.71
Aug. 20	34.30				
15-55-8acd (VIII H1)					
June 25, 1951	36.25	Sept. 5, 1951	34.17	Oct. 30, 1951	34.22
July 9	36.09	Sept. 18	34.20	Nov. 27	34.46
July 23	35.30	Oct. 1	34.14	Dec. 27	34.90
Aug. 6	34.86	Oct. 15	34.00	Jan. 28, 1952	35.37
Aug. 20	34.22				
15-55-8add (VIII H2)					
June 25, 1951	8.56	Sept. 5, 1951	7.40	Oct. 30, 1951	7.28
July 9	8.55	Sept. 18	7.33	Nov. 27	7.37
July 23	8.19	Oct. 1	7.18	Dec. 27	7.58
Aug. 6	8.00	Oct. 15	7.16	Jan. 28, 1952	7.83
Aug. 20	7.65				
15-55-8dcc (VIII G1)					
June 11, 1951	39.63	July 9, 1951	38.20	Aug. 6, 1951	36.46
June 25	39.39	July 23	37.78	Aug. 20	35.45

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VIII—Continued

Date	Water level	Date	Water level	Date	Water level
15-55-8dcc (VIII G1)—Continued					
Sept. 5, 1951	36.50	Oct. 15, 1951	35.62	Dec. 27, 1951	37.50
Sept. 18	35.62	Oct. 30	36.18	Jan. 28, 1952	38.00
Oct. 1	35.79	Nov. 27	36.86		
15-55-8ddd (VIII G2)					
June 11, 1951	10.33	Aug. 20, 1951	9.61	Oct. 30, 1951	9.99
June 25	10.60	Sept. 5	9.51	Nov. 27	10.16
July 9	10.14	Sept. 18	9.65	Dec. 27	10.42
July 23	9.65	Oct. 1	9.61	Jan. 28, 1952	11.05
Aug. 6	9.83	Oct. 15	9.78		
15-55-9bbb (VIII I2)					
June 11, 1951	11.53	Aug. 20, 1951	11.77	Oct. 30, 1951	11.36
June 25	11.68	Sept. 5	11.59	Nov. 27	11.27
July 9	11.52	Sept. 18	11.50	Dec. 27	11.33
July 23	11.74	Oct. 1	11.37	Jan. 28, 1952	11.46
Aug. 6	11.72	Oct. 15	11.35		
15-55-9cab (VIII H3)					
June 11, 1951	8.15	Aug. 20, 1951	9.26	Oct. 30, 1951	9.36
June 25	9.26	Sept. 5	9.20	Nov. 27	9.34
July 9	9.28	Sept. 18	9.21	Dec. 27	9.14
July 23	9.35	Oct. 1	9.22	Jan. 28, 1952	9.48
Aug. 6	9.17	Oct. 15	9.29		
15-55-9cdc (VIII G3)					
June 11, 1951	7.30	Aug. 20, 1951	6.92	Oct. 30, 1951	7.60
June 25	7.30	Sept. 5	6.92	Nov. 27	7.63
July 9	7.03	Sept. 18	7.21	Dec. 27	7.74
July 23	7.19	Oct. 1	7.38	Jan. 28, 1952	8.03
Aug. 6	7.30	Oct. 15	7.57		
15-55-16bab2 (VIII FG)					
Oct. 1, 1951	8.17	Oct. 30, 1951	8.36	Dec. 27, 1951	8.58
Oct. 15	8.31	Nov. 27	8.53	Jan. 28, 1952	8.95
15-55-16bbc (VIII Fa2)					
Sept. 27, 1948	5.91	Oct. 30, 1949	5.85	Mar. 29, 1951	9.78
Nov. 27	7.57	Dec. 1	6.47	Apr. 30	9.84
Dec. 24	5.83	Dec. 29	6.02	May 25	8.45
Jan. 20, 1949	5.85	May 28, 1950	7.85	June 28	8.61
Feb. 23	7.70	June 28	7.82	July 30	8.17
Mar. 29	8.35	July 31	7.85	Aug. 30	7.10
Apr. 26	8.15	Aug. 31	7.82	Sept. 26	8.32
May 23	7.12	Nov. 2	8.43	Oct. 30	8.57
June 29	7.10	Dec. 5	7.42	Nov. 30	8.74
July 27	6.96	Jan. 2, 1951	8.95	Dec. 26	9.15
Aug. 31	5.58	Mar. 5	9.58	Jan. 25, 1952	9.23
Sept. 30	5.58				

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VIII—Continued

Date	Water level	Date	Water level	Date	Water level
15-55-16bbd (VIII F2)					
June 11, 1951	2.55	Aug. 20, 1951	2.10	Oct. 30, 1951	2.46
June 25	1.73	Sept. 18	2.12	Nov. 27	2.62
July 9	2.35	Oct. 1	2.21	Dec. 27	2.81
July 23	2.48	Oct. 15	2.36	Jan. 28, 1952	3.25
Aug. 6	2.82				
15-55-16bdd (VIII E5)					
June 11, 1951	4.83	Aug. 20, 1951	4.15	Oct. 30, 1951	4.58
June 25	3.53	Sept. 5	3.77	Nov. 27	4.70
July 9	4.24	Sept. 18	4.35	Dec. 27	4.83
July 23	3.61	Oct. 1	4.43	Jan. 28, 1952	5.48
Aug. 6	4.31	Oct. 15	4.54		
15-55-16cbb2 (VIII Fa1)					
Sept. 27, 1948	7.92	Dec. 1, 1949	6.38	Mar. 5, 1951	9.72
Nov. 27	7.26	Dec. 29	6.82	Mar. 29	9.89
Dec. 24	7.68	Jan. 29, 1950	8.08	Apr. 30	9.86
Jan. 20, 1949	7.82	Feb. 28	8.11	May 25	8.68
Feb. 23	8.52	Mar. 31	8.49	June 28	8.53
Mar. 29	8.55	May 28	7.90	July 30	8.29
Apr. 26	8.34	June 28	7.84	Aug. 30	8.01
May 23	7.65	July 31	7.85	Sept. 26	8.49
June 29	6.80	Aug. 31	8.59	Oct. 30	8.74
July 27	6.57	Nov. 2	8.20	Nov. 30	8.91
Aug. 31	5.36	Dec. 5	8.53	Dec. 26	9.26
Sept. 28	5.63	Jan. 2, 1951	8.85	Jan. 25, 1952	9.57
Oct. 30	6.00	Feb. 2	9.28		
15-55-16cbd (VIII D2)					
July 23, 1951	1.15	Sept. 18, 1951	1.76	Nov. 27, 1951	2.27
Aug. 6	1.47	Oct. 1	1.90	Dec. 27	2.68
Aug. 20	1.53	Oct. 15	2.05	Jan. 28, 1952	3.11
Sept. 5	1.38	Oct. 30	2.16		
15-55-16ccd1 (VIII C4)					
June 11, 1951	5.94	Aug. 20, 1951	4.32	Oct. 30, 1951	5.45
June 25	5.28	Sept. 5	4.44	Nov. 27	5.56
July 9	5.48	Sept. 18	4.98	Dec. 27	5.85
July 23	5.18	Oct. 1	5.12	Jan. 28, 1952	6.35
Aug. 6	4.23	Oct. 15	5.30		
15-55-16dcb (VIII D3)					
July 23, 1951	5.19	Sept. 18, 1951	4.60	Nov. 27, 1951	5.10
Aug. 6	3.86	Oct. 1	4.82	Dec. 28	5.40
Aug. 20	3.97	Oct. 15	4.93	Jan. 28, 1952	5.64
Sept. 5	4.24	Oct. 30	4.99		
15-55-17aac (VIII F1)					
June 25, 1951	15.31	Sept. 5, 1951	13.36	Oct. 30, 1951	14.29
July 9	14.60	Sept. 18	13.56	Nov. 27	14.44
July 23	13.94	Oct. 1	13.60	Dec. 27	14.85
Aug. 6	13.59	Oct. 15	13.89	Jan. 28, 1952	15.53
Aug. 20	13.33				

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VII—Continued

Date	Water level	Date	Water level	Date	Water level
15-55-17bdd (VIII E3)					
June 11, 1951	22.90	Aug. 20, 1951	20.46	Oct. 30, 1951	21.19
June 25	22.48	Sept. 5	20.38	Nov. 27	21.48
July 9	21.82	Sept. 18	20.54	Dec. 27	21.63
July 23	20.62	Oct. 1	20.40	Jan. 28, 1952	22.50
Aug. 6	20.73	Oct. 15	20.73		
15-55-17cbb (VIII E2)					
June 11, 1951	29.81	Aug. 20, 1951	23.17	Oct. 30, 1951	24.26
June 25	29.73	Sept. 5	23.18	Nov. 27	25.41
July 9	28.39	Sept. 18	23.32	Dec. 27	26.22
July 23	24.78	Oct. 1	23.32	Jan. 28, 1952	27.78
Aug. 6	23.68	Oct. 15	23.76		

15-55-17daa1 (VIII E4, P1)

Water level at 2:00 a.m. in feet below land-surface datum (from recorder charts)

Day	1951									1952	
	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
1	.....	11.24	10.23	9.89	9.37	9.20	9.57	9.88	10.09	.....	10.83
2	.....	11.28	10.21	9.88	9.42	9.18	9.56	.....	10.08	[a]10.43	10.78
3	.....	11.29	10.19	9.85	9.46	[b]9.19	9.65	.....	10.12	10.43	10.85
4	.....	11.30	10.16	9.82	9.46	[b]9.21	9.65	.....	10.10	10.43	10.84
5	.....	11.30	10.13	9.79	9.48	[a]9.21	9.68	[a]9.89	10.08	[b]10.45	10.86
6	.....	11.30	10.12	9.80	9.52	9.22	9.69	9.89	10.12	[b]10.46	10.87
7	.....	11.29	10.10	9.78	9.54	9.22	9.69	9.89	10.17	[b]10.47	10.87
8	.....	11.22	10.12	9.75	9.55	9.21	9.70	9.85	10.21	[b]10.49	10.90
9	.....	11.23	10.16	9.79	9.47	9.24	9.69	9.86	10.20	10.53	10.90
10	.....	11.24	10.16	9.82	9.47	9.25	9.68	9.90	10.16	10.48	10.91
11	.....	11.21	10.16	9.84	9.46	9.25	9.69	9.86	10.20	10.50	10.91
12	.....	11.16	10.16	9.83	9.44	9.30	9.67	9.82	10.17	10.54	10.91
13	.....	11.12	10.17	9.77	9.44	9.32	9.68	9.84	10.21	10.51	10.94
14	.....	11.14	10.18	9.73	9.43	9.37	9.71	9.87	10.25	10.50	10.97
15	.....	11.14	10.14	9.70	9.43	9.41	9.68	9.92	.....	10.57	.....
16	.....	11.15	10.15	9.70	9.39	9.41	9.78	9.96	.....	10.59	.....
17	.....	11.12	10.15	9.70	9.36	9.43	9.79	9.98	[a]10.27	10.66	.....
18	.....	11.09	10.14	9.70	9.37	9.44	9.80	9.91	10.28	10.70	.....
19	.....	11.00	10.12	9.65	9.39	9.43	9.73	9.91	10.24	10.70	.....
20	.....	10.90	10.10	9.60	9.40	9.46	9.72	9.89	10.30	10.75	.....
21	.....	10.68	10.08	9.60	9.38	9.53	9.75	9.95	10.29	10.72	.....
22	.....	10.48	10.03	9.57	9.32	9.50	9.76	9.99	10.28	10.78	.....
23	.....	10.36	9.98	9.49	9.29	9.55	9.76	10.00	10.35	.....	.....
24	[a]11.27	10.28	9.94	9.43	9.30	9.55	9.73	10.00	10.35	[a]10.75	.....
25	11.27	10.24	9.92	9.38	9.22	9.53	9.79	9.99	10.36	.....	.....
26	11.26	10.23	9.88	9.35	9.18	9.49	9.83	10.02	10.41	.....	.....
27	11.24	10.22	9.89	9.33	9.17	9.60	9.79	10.02	10.40	.....	.....
28	11.26	10.18	9.88	9.29	9.15	9.57	9.77	10.07	10.38	.....	.....
29	11.22	10.18	9.89	9.29	9.18	9.51	9.78	10.10	10.38	.....	.....
30	11.23	10.17	9.90	9.34	9.16	9.56	9.85	10.10	.....	.....	
31		10.21		9.35	9.19		9.86		.....	[a]10.80	

[a]Tape measurement.
[b]Estimated.

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VIII—Continued

Date	Water level	Date	Water level	Date	Water level
15-55-17daa2 (VIII 1E1)					
June 11, 1951	9.70	Sept. 5, 1951	8.77	Oct. 30, 1951	9.36
July 9	9.34	Sept. 18	8.94	Nov. 27	9.60
Aug. 6	9.11	Oct. 1	9.09	Dec. 27	9.85
Aug. 20	8.96	Oct. 15	9.23	Jan. 28, 1952	10.40
15-55-17dad (VIII D1)					
July 9, 1951	9.64	Sept. 5, 1951	9.03	Oct. 30, 1951	9.65
July 23	9.17	Sept. 18	9.22	Nov. 27	9.86
Aug. 6	9.08	Oct. 1	9.39	Dec. 27	10.10
Aug. 20	8.98	Oct. 15	9.53	Jan. 28, 1952	10.64
15-55-18dab (VIII E1)					
June 11, 1951	16.40	Aug. 20, 1951	12.76	Oct. 15, 1951	16.70
June 25	14.27	Sept. 5	13.75	Oct. 30	18.27
July 9	13.47	Sept. 18	15.19	Nov. 27	19.29
July 23	13.14	Oct. 1	14.75	Dec. 27	20.18
Aug. 6	12.36				
15-55-19daa (VIII B1)					
June 11, 1951	25.88	Aug. 20, 1951	22.43	Oct. 30, 1951	22.82
June 25	25.08	Sept. 5	22.20	Nov. 27	23.29
July 9	23.79	Sept. 18	22.33	Dec. 27	24.02
July 23	22.75	Oct. 1	22.28	Jan. 28, 1952	25.04
Aug. 6	22.66	Oct. 15	22.50		
15-55-20aaa (VIII C3)					
June 11, 1951	10.29	Aug. 20, 1951	8.41	Oct. 30, 1951	9.42
June 25	9.32	Sept. 5	8.71	Nov. 27	9.64
July 9	9.64	Sept. 18	8.97	Dec. 27	9.94
July 23	8.66	Oct. 1	9.03	Jan. 28, 1952	10.46
Aug. 6	8.30	Oct. 15	9.19		
15-55-20add (VIII B3)					
June 11, 1951	8.16	Aug. 20, 1951	7.39	Oct. 30, 1951	7.37
June 25	8.23	Sept. 5	7.25	Nov. 27	7.62
July 9	7.98	Sept. 18	7.29	Dec. 27	8.04
July 23	7.87	Oct. 1	6.59	Jan. 28, 1952	8.55
Aug. 6	7.50	Oct. 15	7.09		
15-55-20baa (VIII C2)					
June 11, 1951	15.83	Aug. 20, 1951	13.73	Oct. 30, 1951	13.89
June 25	15.39	Sept. 5	13.46	Nov. 27	14.47
July 9	15.17	Sept. 18	13.63	Dec. 27	15.00
July 23	14.65	Oct. 1	13.24	Jan. 28, 1952	15.87
Aug. 6	14.24	Oct. 15	13.45		
15-55-20bba (VIII C1)					
June 11, 1951	24.86	Aug. 20, 1951	22.19	Oct. 30, 1951	22.35
June 25	24.50	Sept. 5	21.72	Nov. 27	22.98
July 9	24.38	Sept. 18	21.86	Dec. 27	23.67
July 23	23.76	Oct. 1	21.10	Jan. 28, 1952	23.59
Aug. 6	23.25	Oct. 15	21.56		

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA VIII—Continued

Date	Water level	Date	Water level	Date	Water level
15-55-20caa (VIII B2)					
June 11, 1951	14.91	Aug. 20, 1951	12.92	Oct. 30, 1951	13.38
June 25	14.53	Sept. 5	13.13	Nov. 27	13.87
July 9	15.18	Sept. 18	13.31	Dec. 27	14.36
July 23	14.11	Oct. 1	12.47	Jan. 28, 1952	15.03
Aug. 6	13.25	Oct. 15	12.98		
15-55-20ccd (VIII A1)					
June 11, 1951	21.87	Aug. 20, 1951	19.56	Oct. 30, 1951	19.70
June 25	21.58	Sept. 5	19.53	Nov. 27	20.44
July 9	21.07	Sept. 18	19.73	Dec. 28	20.98
July 23	20.73	Oct. 1	19.95	Jan. 28, 1952	21.45
Aug. 6	19.93	Oct. 15	20.11		
15-55-20cdd (VIII A2)					
June 11, 1951	15.27	Aug. 20, 1951	13.30	Oct. 30, 1951	13.75
June 25	14.94	Sept. 5	13.22	Nov. 27	14.05
July 9	14.60	Sept. 18	13.30	Dec. 27	14.48
July 23	14.16	Oct. 1	13.42	Jan. 28, 1952	14.89
Aug. 6	13.57	Oct. 15	13.53		
15-55-20ddd (VIII A3)					
June 11, 1951	14.89	Sept. 5, 1951	13.67	Oct. 30, 1951	14.57
June 25	15.04	Sept. 18	13.95	Nov. 27	14.89
July 9	14.63	Oct. 1	14.03	Dec. 27	15.16
July 23	13.80	Oct. 15	14.19	Jan. 28, 1952	15.44
Aug. 6	13.46				
15-55-21bdc (VIII B4)					
Aug. 6, 1951	6.85	Oct. 1, 1951	6.73	Nov. 27, 1951	7.04
Aug. 20	6.91	Oct. 15	6.78	Dec. 27	7.09
Sept. 5	6.68	Oct. 30	6.91	Jan. 28, 1952	7.62
Sept. 18	6.66				
AREA IX					
16-55-33add (IX A1)					
June 25, 1951	9.38	Sept. 5, 1951	10.76	Oct. 30, 1951	10.02
July 9	10.07	Sept. 18	9.68	Nov. 27	9.67
July 23	9.93	Oct. 1	9.75	Dec. 27	10.19
Aug. 6	9.88	Oct. 15	9.88	Jan. 28, 1952	10.35
Aug. 20	9.78				
AREA X					
16-55-22cdd (X D1)					
July 23, 1951	36.90	Aug. 6, 1951	37.38	Aug. 20, 1951	Dry
16-55-23aab (X F1)					
June 25, 1951	8.90	Aug. 6, 1951	8.34	Sept. 18, 1951	9.13
July 9	9.19	Aug. 20	8.98	Oct. 1	9.26
July 23	6.65	Sept. 5	9.17	Oct. 15	9.57

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA X—Continued

Date	Water level	Date	Water level	Date	Water level
16-55-23aab (X F1)—Continued					
Oct. 30, 1951	9.76	Dec. 27, 1951	9.86	Jan. 28, 1952	10.20
Nov. 27	9.84				
16-55-23aad (X F2)					
June 25, 1951	7.33	Sept. 5, 1951	6.81	Oct. 30, 1951	8.12
July 9	7.11	Sept. 18	7.26	Nov. 27	8.38
July 23	6.39	Oct. 1	7.58	Dec. 27	8.54
Aug. 6	5.51	Oct. 15	7.90	Jan. 28, 1952	8.71
Aug. 20	4.92				
16-55-23acc (X E2)					
June 25, 1951	5.88	Sept. 5, 1951	7.24	Oct. 30, 1951	7.96
July 9	6.60	Sept. 18	7.31	Nov. 27	8.11
July 23	5.20	Oct. 1	7.48	Dec. 27	8.21
Aug. 6	6.38	Oct. 17	7.77	Jan. 28, 1952	8.49
Aug. 20	6.92				
16-55-23bdd (X E1)					
June 25, 1951	16.66	Sept. 5, 1951	19.00	Oct. 30, 1951	19.45
July 9	18.65	Sept. 18	19.08	Nov. 27	19.65
July 23	19.13	Oct. 1	19.14	Dec. 27	19.93
Aug. 6	19.01	Oct. 15	19.31	Jan. 28, 1952	20.26
Aug. 20	19.04				
16-55-23cdc (X D2)					
Apr. 25, 1951	11.67	July 23, 1951	10.54	Oct. 15, 1951	11.70
May 7	11.72	Aug. 6	11.25	Oct. 30	11.69
May 21	11.74	Aug. 20	11.62	Nov. 27	11.68
June 11	10.61	Sept. 5	11.62	Dec. 27	10.71
June 25	8.91	Sept. 18	11.67	Jan. 28, 1952	10.10
July 9	10.04	Oct. 1	11.68		
16-55-24bcb (X F3)					
July 23, 1951	8.72	Sept. 18, 1951	10.99	Nov. 27, 1951	11.49
Aug. 6	8.90	Oct. 1	11.88	Dec. 27	10.85
Aug. 20	8.80	Oct. 15	11.25	Jan. 28, 1952	10.80
Sept. 5	10.45	Oct. 30	12.37		
16-55-26cba (X C3)					
June 25, 1951	10.44	Sept. 5, 1951	11.28	Oct. 30, 1951	11.77
July 9	10.78	Sept. 18	11.34	Nov. 27	12.01
July 23	10.04	Oct. 1	11.51	Dec. 27	11.99
Aug. 6	10.96	Oct. 15	11.63	Jan. 28, 1952	11.42
Aug. 20	11.16				
16-55-26ccc4 (X B2, 1S1)					
Oct. 15, 1951	7.53	Nov. 27, 1951	8.07	Jan. 28, 1952	8.56
Oct. 30	7.75	Dec. 27	8.38		

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA X—Continued

16-55-26ccd (X B3)

Date	Water level	Date	Water level	Date	Water level
June 25, 1951	11.45	Aug. 20, 1951	11.40	Oct. 15, 1951	11.99
July 9	11.44	Sept. 5	11.51	Oct. 30	11.98
July 23	11.07	Sept. 18	10.80	Nov. 27	11.97
Aug. 6	10.56	Oct. 1	11.60		

16-55-27cad (X C1)

Apr. 25, 1951	30.01	June 4, 1951	29.88	July 2, 1951	29.67
Apr. 30	29.99	June 11	29.84	July 8	29.63
May 7	30.36	June 18	29.73	July 15	29.58
May 14	30.31	June 25	29.80	July 23	29.52
May 21	30.37				

16-55-27daa (X C2)

June 25, 1951	3.15	Sept. 5, 1951	2.29	Oct. 30, 1951	4.59
July 9	3.70	Sept. 18	3.23	Nov. 27	4.98
July 23	2.40	Oct. 1	3.37	Dec. 27	5.71
Aug. 6	2.37	Oct. 15	4.13	Jan. 28, 1952	6.15
Aug. 20	2.35				

16-55-27ddc (X B1)

June 25, 1951	4.50	Sept. 5, 1951	3.60	Oct. 30, 1951	4.86
July 9	4.84	Sept. 18	3.94	Nov. 27	5.22
July 23	3.69	Oct. 1	4.24	Dec. 27	5.60
Aug. 6	3.52	Oct. 15	4.60	Jan. 28, 1952	6.19
Aug. 20	2.96				

16-55-34aaa (X A2)

June 6, 1949	10.40	July 31, 1950	10.23	June 28, 1951	9.33
Sept. 30	12.02	Aug. 30	11.36	July 30	10.24
Oct. 31	10.57	Sept. 30	10.92	Aug. 30	11.14
Nov. 30	10.39	Nov. 2	10.75	Sept. 18	11.22
Dec. 29	10.43	Dec. 5	9.72	Oct. 1	10.01
Jan. 31, 1950	10.71	Jan. 2, 1951	9.40	Oct. 15	10.83
Feb. 28	10.92	Feb. 2	9.60	Oct. 30	10.65
Mar. 31	9.23	Mar. 5	9.63	Nov. 27	10.50
May 11	8.10	Mar. 29	9.56	Dec. 27	10.41
May 31	10.33	Apr. 30	10.17	Jan. 28, 1952	9.67
June 30	8.86	May 25	11.14		

Table 10.—*Measurements of depth to water in observation wells*—Continued

AREA X—Continued

16-55-34aba (X A1)

Water level at 2:00 a.m. in feet below land-surface datum (from recorder charts)

Day	1951						1952
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	7.06	6.43	7.24	7.72	7.96	.....
2	.....	7.13	6.47	7.22	7.66	7.94	[a]8.45
3	.....	7.18	6.51	7.27	7.62	8.10	.....
4	.....	7.16	6.53	7.32	7.65	7.96	.....
5	.....	7.21	6.56	7.40	7.71	7.94	.....
6	.....	7.27	6.62	7.39	7.73	8.02	.....
7	.....	7.32	6.62	7.36	7.71	8.10	.....
8	.....	7.36	6.58	7.40	7.65	8.16	.....
9	.....	7.09	6.66	7.36	7.69	8.13	[a]8.57
10	.....	6.48	6.66	7.38	7.75	8.06	.....
11	.....	5.96	6.67	7.37	7.65	8.11	.....
12	.....	5.30	6.76	7.35	7.60	8.09	.....
13	.....	4.57	6.81	7.40	7.66	8.12	.....
14	.....	4.32	6.88	7.44	7.71	8.20	.....
15	.....	4.00	6.97	7.35	7.79	8.22	.....
16	.....	3.64	6.94	7.49	7.86	8.17	.....
17	.....	4.00	7.00	7.49	7.86	8.14	.....
18	.....	4.71	7.00	7.52	7.75	8.20	.....
19	.....	5.13	6.99	7.41	7.75	8.15	.....
20	.....	5.48	7.07	7.39	7.75	8.22	.....
21	.....	5.68	7.16	7.46	7.85	[a]8.20	.....
22	.....	5.78	7.07	7.48	7.90	8.18	.....
23	.....	5.90	7.15	7.51	7.92	8.22	.....
24	.....	6.09	7.14	7.45	7.90	[b]8.24	.....
25	.....	6.12	7.13	7.55	7.89	[b]8.25	.....
26	.....	6.24	7.09	7.61	7.94	[b]8.27	.....
27	.....	6.30	7.28	7.53	7.93	[a]8.30	.....
28	.....	6.38	7.22	7.53	7.93	.....	.....
29	.....	6.45	7.13	7.52	7.99	.....	[a]8.74
30	.....	6.36	7.22	7.64	7.99	.....	.....
31	7.02	6.50		7.68		.....	.....

[a]Tape measurement.
[b]Estimated.

Table 11.—*Record of wells and test holes*

[Well number: See text for description of well-numbering system.
Driller: BR, U. S. Bureau of Reclamation; GS, U. S. Geological Survey; P, private or commercial driller.
Type of well: B, bored; BJ, bored and jetted; D, dug; Dr, drilled; J, jetted.
Depth of well: Measured depths are given in feet and tenths; reported depths are given in feet.
Type of casing: G, galvanized; N, none; S, steel; W, wood.
Measuring point: Bp, base of pump; Ls, land surface; Tcu, top of well curb; Tp, top of pipe; Tsf, top of shelter floor.
Altitude above sea level: Altitudes determined from topographic maps are given in feet; all others were determined by instrumental leveling.
Depth to water: Measurements in wells are given in feet, tenths, and hundredths; measurements in test holes are given in feet and tenths.
Remarks: Ca, sample collected for chemical analysis; F, flowing; L, log in table 9; WL, water-level measurements in table 10.]

Well no.		Driller	Date drilled	Type of well	Depth of well below land-surface datum (feet)	Diameter of well (inches)	Type of casing	Depth to gravel (feet)	Measuring point			Depth to water above (+) or below land surface (feet)	Date of measurement	Remarks
Coordinate system	Field								Description	Height above land surface (feet)	Altitude above mean sea level (feet)			
AREA I														
13-52-24dca	I Cb1	BR	4-27-50	B	13.0	10	N	.....	Ls	0.0	2,224.5	.....	.....	L
25bda	I Fa1	P	1951	Dr	611	10	S	.....	.....	.....	.....	.....	.....	Ca, F, L
53-19cba	I Cb2	BR	4-27-50	B	10.0	10	N	.....	Ls	.0	2,224.5	.....	.....	L
19dba	I Cb3	BR	4-27-50	B	13.0	10	N	4.5	Ls	.0	2,221.9	.....	.....	L
19ddc	I C1	GS	7-17-51	BJ	19.9	3/4	G	12.0	Tp	4.0	2,201.40	15.28	9- 5-51	L, WL
29acb	I E1	GS	7-13-51	BJ	18.1	3/4	G	11.5	Tp	3.5	2,164.11	9.85	9- 5-51	Ca, L, WL
29acc	I D1 2/3	BR	8- 7-51	.....	.....	.....	.....	8.0	Ls	.0	2,150	.....	.....	Bank cut, L
29bbc	I C2	GS	7-13-51	BJ	12.0	3/4	G	5.5	Tp	3.4	2,189.24	7.52	9- 5-51	L, WL
29bcd1	I C3a	GS	7- 6-51	BJ	23.5	3/4	G	21.0	Tp	4.8	2,171.03	3.71	9- 5-51	L, WL
29bcd2	I C3b	GS	8- -51	B	6.1	3/4	G	.....	Tp	4.4	2,170.68	3.49	9- 5-51	L, WL
29bcd3	I C3 1/3	BR	7-31-51	B	9.0	3	N	8.0	Ls	.0	2,160	7.0	7-31-51	L
29bda	I D1 1/3	BR	8- 7-51	B	13.0	3	N	13.0	Ls	.0	2,160	.....	.....	L
29bdb	I D1	GS	7-13-51	BJ	16.5	3/4	G	8.0	Tp	5.0	2,170.80	2.74	9- 5-51	L, WL
29cab	I C3 2/3	BR	6-21-51	B	10.0	3	N	10.0	Ls	.0	2,158.5	.....	.....	L
29cbb	I B1 1/3	BR	7-31-51	B	10.0	3	N	9.2	Ls	.0	2,163.5	.....	.....	L

29cbc	I B1 2/3	BR	7-31-51	....	.....	.....	.....	15	Ls	.0	2,159	.....	.....	Bank cut, L
30add	I B1	GS	7-11-51	BJ	23.4	3/4	G	19.0	Tp	3.0	2,172.25	6.63	9- 5-51	L, WL
30bbb	I A1	GS	7-17-51	BJ	33.2	3/4	G	23.0	Tp	4.0	2,214.19	25.88	9- 5-51	L, WL
30bdd	I A2	GS	7-17-51	BJ	18.3	3/4	G	9.5	Tp	4.0	2,195.11	10.42	9- 5-51	L, WL
30dac	I A3	GS	7-10-51	BJ	19.0	3/4	G	15.0	Tp	5.1	2,172.56	9.13	9 -5-51	L, WL
30ddb	I A3 1/2	BR	7-31-51	.....	.....	.....	.....	7.0	Ls	.0	2,160±	6.0	7-31-51	Bank cut, L
	AREA II													
13-53-15ccb	II D2	GS	7- 5-51	BJ	18.4	3/4	G	11.5	Tp	4.0	2,171.49	7.65	9- 5-51	L, WL
16baa	II D1	GS	7- 5-51	BJ	18.2	3/4	G	5.0	Tp	4.0	2,203.66	11.02	9- 5-51	L, WL
16bdb	II C1	GS	6-27-51	BJ	25.0	3/4	G	21.0	Tp	3.9	2,204.44	10.97	9- 5-51	L, WL
16dbc	II C2	GS	7- 6-51	BJ	17.6	3/4	G	10.0	Tp	4.0	2,179.09	2.98	9- 5-51	L, WL
16ddb	II C3	GS	7- 5-51	BJ	15.6	3/4	G	4.0	Tp	4.0	2,170.54	3.90	9- 5-51	L, WL
17aaa	II Cb6	BR	4-26-50	B	11.0	10	N	.....	Ls	.0	2,223.8	.....	.....	L
17adb	II Cb5	BR	4-27-50	B	10.0	10	N	.....	Ls	.0	2,222.7	.....	.....	L
17ccd	II A 1/2	GS	6-27-51	BJ	36.0	2	N	35.0	Ls	.0	2,212	.....	.....	L
17dbb	II Cb4	BR	4-27-50	B	11.0	10	N	.....	Ls	.0	2,222.4	.....	.....	L
20aac	II B	GS	7- 5-51	BJ	18.5	3/4	G	7.5	Tp	4.7	2,190.23	9.78	9- 5-51	L, WL
20dca	II A1	GS	7- 6-51	BJ	16.4	3/4	G	12.0	Tp	4.0	2,182.16	4.74	9- 5-51	L, WL
	AREA III													
13-53-1aac	III G1	GS	5- 4-51	BJ	51.4	3/4	G	19.9	Tp	4.0	2,207.49	25.13	9- 5-51	L, WL
1add	III G2	GS	5- 4-51	BJ	22.9	3/4	G	4.5	Tp	4.5	2,186.06	8.71	9- 5-51	L, WL
1cbc	III F1	GS	5- 2-51	BJ	31.7	3/4	G	28.0	Tp	4.4	2,211.67	20.40	9- 5-51	L, WL
1cdc	III F2	GS	5- 2-51	BJ	22.9	3/4	G	13.0	Tp	3.5	2,197.29	10.38	9- 5-51	L, WL
9dad	III A 1/2	BR	3-27-51	BJ	19.5	2	N	13.4	Ls	.0	2,213.9	.....	.....	L
10acd	III Cb9	BR	4-26-50	B	13.0	10	N	10.5	Ls	.0	2,218.8	.....	.....	L
10ada	III D1	GS	10-20-50	BJ	39.9	3/4	G	32.0	Tp	2.6	2,220.91	32.57	9- 5-51	L, WL
10cab	III Cb8	BR	4-26-50	B	11.0	10	N	.....	Ls	.0	2,219.1	.....	.....	L
10cbb	III Cb7	BR	4-26-50	B	10.0	10	N	.....	Ls	.0	2,219.6	.....	.....	L
10ccc	III A1	GS	7-17-50	BJ	19.0	3/4	G	8.7	Tp	2.8	2,191.06	7.23	9- 5-51	L, WL
10cdb	III B1	GS	7-17-50	BJ	29.7	3/4	G	28.7	Tp	3.3	2,205.52	24.45	9- 5-51	L, WL
10cdd	III B1 1/2	BR	10-25-50	B	12.5	3	N	12.5	Tp	.0	2,190	.....	.....	L
10dbb	III C1	GS	7-17-50	BJ	38.1	2	S	30.5	Tp	.9	2,217.07	33.90	9- 5-51	L, WL
10dbc1	III Fa1	P	.....	Dr	40	4	S	35.0	Ls	.0	2,211	30.35	.....	Ca, L
10dbc2	III Fa2	P	1943	Dr	540	7	S	.....	.....	.....	2,210	.....	.....	Ca, F

Table 11.—*Record of wells and test holes*—Continued

Well no.		Driller	Date drilled	Type of well	Depth of well below land-surface datum (feet)	Diameter of well (inches)	Type of casing	Depth to gravel (feet)	Measuring point			Depth to water above (+) or below land surface (feet)	Date of measurement	Remarks
Coordinate system	Field								Description	Height above land surface (feet)	Altitude above mean sea level (feet)			
AREA III—Continued														
13-53-10dca	III C1 1/2	BR	10-25-50	B	18.5	3	N	18.5	Ls	0.0	2,195	.....	.....	L
10ddc	III C2	GS	7-18-50	BJ	17.5	3/4	G	10.0	Tp	4.1	2,181.92	9.97	9- 5-51	L, WL
11accl	III E2	GS	10-18-50	BJ	17.7	3/4	G	11.7	Tp	3.9	2,197.78	14.70	9- 5-51	L, WL
11acc2	III Fa3	P	.....	Dr	772	2	S	.....	.....	.....	2,194	.....	.....	Ca, F
11baal	III E1	GS	7-31-50	BJ	37.2	2	S	26.0	Tp	5.0	2,221.82	31.23	9- 5-51	L, WL
11baa2	III Cb11	BR	4-28-50	B	6.0	10	N	1.5	Ls	.0	2,117	.....	.....	L
11cbb	III D1 1/2	BR	10-26-50	B	15.5	3	N	15.5	Ls	.0	2,192.75	.....	.....	L
11cca	III D2	BR	.....	BJ	17.0	3/4	G	10.0	Ls	.0	2,182.7	.....	.....	L
11ccd	III D3	GS	10-25-50	BJ	25.0	3/4	G	20.0	Tp	2.0	2,166.40	5.80	9- 5-51	L, WL
11daa	III Fa4	P	1943	Dr	41	4	S	.....	Ls	.0	2,192	8.0	9-20-48	Ca
11ddb	III E21/2	BR	10-26-50	B	6.7	3	N	6.7	Ls	.0	2,178	.....	.....	L
11ddd	III E3	GS	10-20-50	BJ	11.4	3/4	G	4.0	Tp	4.5	2,166.95	8.57	9- 5-51	L, WL
12abb	III F3	GS	5- 3-51	BJ	17.5	3/4	G	2.5	Tp	4.0	2,188.52	13.71	9- 5-51	L, WL
12aca	III F4	GS	5- 4-51	BJ	10.8	3/4	G	2.0	Tp	4.8	2,171.25	2.35	9- 5-51	L, WL
12acbl	III P3	BR	5- 7-51	Dr	20.1	4	S	5.9	Tp	1.0	2,165.79	2.37	9- 5-51	Ca, L, WL
12acb2	III 3E1	GS	9-12-51	J	7.2	3/4	G	6.0	Tp	4.0	2,168.54	2.98	9-18-51	L
12acb3	III 3N1	GS	9-14-51	J	9.9	3/4	G	6.5	Tp	4.0	2,168.57	2.78	9-18-51	L
12accl	III 3S1	GS	9-12-51	J	13.3	3/4	G	2.0	Tp	4.0	2,170.81	5.37	9-18-51	L
12acc2	III 3W1	GS	9-12-51	J	8.9	3/4	G	6.0	Tp	4.0	2,169.57	3.49	9-18-51	L
13bbd	III E4	GS	10-20-50	BJ	19.0	3/4	G	9.0	Tp	4.9	2,144.03	11.28	9- 5-51	L, WL
14bab	III D3 1/2	BR	10-26-50	B	17.0	3	N	.....	Ls	.0	2,151.6	1.5	10-26-50	L
14bacl	III D4	GS	5-15-51	J	23.0	3/4	G	18.5	Tp	1.0	2,151.98	1.25	9- 5-51	L, WL

14bac2	III D4 1/2	BR	10-26-50	B	14.0	3	N	14.0	Ls	.0	2,153	8.0	10-26-50	L
14bdb	III D5	GS	10-25-50	BJ	18.7	3/4	G	12.0	Tp	3.0	2,147.82	5.78	9- 5-51	L, LW
14bdc	III D5 1/4	BR	10-26-50	B	10.0	3	N	10.0	Ls	.0	2,143.3	7.0	10-26-50	L
14caa	III D5 1/2	BR	10-26-50	B	7.5	3	N	.....	Ls	.0	2,143.7	.....	.....	L
14cba	III CD	GS	6-28-50	BJ	13.5	3/4	G	12.0	Tp	3.9	2,149.09	7.46	9- 5-51	L, WL
14cbb	III C5	GS	7- 7-50	BJ	23.9	3/4	G	12.0	Tp	3.6	2,151.14	5.35	9- 5-51	L, WL
14cbc1	III 2N1	GS	8-24-51	J	16.9	3/4	G	11.5	Tp	4.0	2,149.85	4.62	9- 5-51	L
14cbc2	III 2E1	GS	8-27-51	J	17.2	3/4	G	12.5	Tp	4.0	2,149.54	4.76	9- 5-51	L
14cbc3	III C6	GS	7-10-50	BJ	21.5	3/4	G	11.3	Tp	3.0	2,148.87	6.90	9- 5-51	L, WL
14cbd	III C6 1/2	BR	10-26-50	B	12.0	3	N	12.0	Ls	.0	2,144.5	8.0	10-26-50	L
14cca	III C7	GS	7-10-50	BJ	15.1	3/4	G	9.8	Tp	4.0	2,147.80	10.44	9- 5-51	L, WL
14cdb	III C8	GS	7-11-50	BJ	17.8	3/4	G	12.0	Tp	3.5	2,147.10	15.53	9- 5-51	L, WL
14dbc	III D5 3/4	BR	.....	B	9.7	3	N	9.7	Ls	.0	2,142	.....	.....	L
15aab1	III 1N1	GS	7-26-51	J	35.6	3/4	G	30.0	Tp	3.0	2,170.50	5.64	9- 5-51	L, WL
15aab2	III 1N2	GS	7-26-51	J	35.2	3/4	G	28.0	Tp	5.0	2,172.61	4.27	9- 5-51	L, WL
15aab3	III C2 1/2	BR	10-25-50	B	15.0	3	N	.....	Ls	.0	2,173	7.0	10-25-50	L
15aac1	III C3 1/2	BR	10-25-50	B	17.0	3	N	17.0	Ls	.0	2,159	3.5	10-25-50	L
15aac2	III C3, 1S1	GS	7-12-50	BJ	26.0	3/4	G	26.0	Tp	2.5	2,166.04	2.68	9- 5-51	L, WL
15aac3	III P1	BR	4-11-51	Dr	52.9	4	S	23.0	Tp	1.5	2,167.46	3.68	9- 5-51	Ca, L, WL
15aac4	III 1W1	GS	7-20-51	J	22.3	3/4	G	26.2	Tp	4.0	2,168.99	3.34	9- 5-51	L, WL
15aac5	III 1W2	GS	7-20-51	J	35.4	3/4	G	27.0	Tp	4.0	2,169.43	3.31	9- 5-51	L
15aac6	III 1S2	GS	7-20-51	J	29.6	3/4	G	22.0	Tp	4.0	2,166.15	1.82	9- 5-51	L, WL
15aac7	III 1E1	GS	7-24-51	J	35.7	3/4	G	26.0	Tp	4.0	2,168.74	3.90	9- 5-51	L, WL
15abc	III B3	GS	7-14-50	BJ	27.0	3/4	G	24.0	Tp	3.5	2,171.93	2.70	9- 5-51	L, WL
15aca	III B3 1/2	BR	10-25-50	B	22.0	3	N	.....	Ls	.0	2,164	1.0	10-25-50	L
15acd	III B4	GS	7-19-50	BJ	14.5	3/4	G	10.0	Tp	4.0	2,158.26	7.19	9- 5-51	L, WL
15ada	III C4	GS	7- 7-50	BJ	24.2	3/4	G	8.5	Tp	4.5	2,155.41	6.27	9- 5-51	L, WL
15add1	III C4 1/2	BR	10-25-50	B	12.0	3	N	.....	Ls	.0	2,149	5.5	10-25-50	L
15add2	III DI11	GS	8-17-51	J	17.0	2	S	14.0	Tp	4.5	2,154.43	3.50	9- 5-51	L, WL
15baa	III B2	GS	7-14-50	J	16.7	3/4	G	7.2	Tp	5.0	2,184.83	10.17	9- 5-51	L, WL
15bba	III A1 1/3	BR	10-25-50	B	12.0	3	N	11.0	Ls	.0	2,180	10.5	10-25-50	L
15bca	III A1 2/3	BR	7-17-50	B	11.0	3	N	11.0	Ls	.0	2,178.5	10.5	7-17-50	L
15bdc	III A2	GS	7-17-50	BJ	36.6	3/4	G	11.3	Tp	4.0	2,177.67	10.32	9- 5-51	L, WL
15cab1	III TE4	GS	7-31-51	J	25.0	2	N	23.5	Ls	.0	2,170	9.98	7-31-51	L
15cab2	III TE3	GS	7-31-51	J	25.0	2	N	23.0	Ls	.0	2,170	.....	.....	L
15cab3	III TE2	GS	7-31-51	J	24.0	2	N	8.0	Ls	.0	2,170	9.58	7-31-51	L

Table 11.—*Record of wells and test holes*—Continued

Well no.		Driller	Date drilled	Type of well	Depth of well below land-surface datum (feet)	Diameter of well (inches)	Type of casing	Depth to gravel (feet)	Measuring point			Depth to water above (+) or below land surface (feet)	Date of measurement	Remarks
Coordinate system	Field								Description	Height above land surface (feet)	Altitude above mean sea level (feet)			
AREA III—Continued														
13-53-15cab4	III TE1	GS	7-31-51	J	14.0	2	N	8.5	Ls	0.0	2,170	.....	.....	L
15cad	III A3	GS	7-21-50	BJ	30.1	3/4	G	24.0	Tp	3.7	2,164.90	2.56	9- 5-51	L, WL
15cda	III A3 1/2	BR	10-25-50	B	5.0	3	N	5.0	Ls	.0	2,157.5	.....	.....	L
15daa	III DI10	GS	8-17-51	J	14.2	2	S	12.0	Tp	3.3	2,152.61	2.17	9- 5-51	L, WL
15dab1	III BC1	GS	7-12-51	J	19.0	2	S	.0	Tp	3.5	2,150.98	4.25	7-18-51	In drain ditch, L
15dab2	III BC2	GS	7-11-51	J	27.2	3/4	G	10.0	Tp	4.0	2,156.47	6.39	9- 5-51	L, WL
15dab3	III DI9	GS	8-17-51	J	11.9	2	S	9.7	Tp	3.7	2,153.19	4.64	9- 5-51	L, WL
15dac1	III DI7	GS	8-17-51	J	16.6	2	S	15.0	Tp	1.0	2,151.62	6.61	9- 5-51	L, WL
15dac2	III DI8	GS	8-17-51	J	12.1	2	S	5.0	Tp	3.8	2,154.26	5.57	9- 5-51	L, WL
15dad1	III P2	GS	8-24-51	J	20.2	2	S	12.0	Tp	5.2	2,150.2	3.69	9- 5-51	Ca, L
15dad2	III P2a	GS	8-28-51	J	19.4	3/4	G	12.0	Tp	2.0	2,147.01	3.69	9- 5-51	L, WL
15dad3	III 2S1	GS	8-28-51	J	16.9	3/4	G	11.0	Tp	4.7	2,150.30	4.32	9- 5-51	L
15dad4	III 2W1	GS	8-24-51	J	16.9	3/4	G	10.0	Tp	4.0	2,149.88	3.79	9- 5-51	L
15dbd	III B5	GS	7-21-50	BJ	20.5	3/4	G	7.5	Tp	3.2	2,155.46	6.21	9- 5-51	L, WL
15dca	III DI6	GS	7- -50	J	19.2	3/4	G	.....	Tp	2.3	2,152.12	5.59	9- 5-50	L, WL
15dcc1	III A4	GS	7-19-50	BJ	26.7	3/4	G	24.0	Tp	5.0	2,163.54	11.19	9- 5-51	L, WL
15dcc2	III A5	GS	7- -50	BJ	22.5	3/4	G	17.5	Tp	4.3	2,157.57	8.02	9- 5-51	L, WL
15ddb1	III DI1	GS	7- -50	J	19.0	2	S	14.0	Tp	4.0	2,145.98	2.46	7- 9-51	In drain ditch, L
15ddb2	III DI2	GS	7- -50	J	20.4	3/4	G	14.0	Tp	1.2	2,152.07	7.98	9- 5-50	L, WL
15ddb3	III DI3	GS	7- -50	J	19.0	3/4	G	13.5	Tp	2.5	2,152.69	7.17	9- 5-50	L, WL
15ddb4	III B6	GS	7-21-50	BJ	20.1	3/4	G	12.5	Tp	4.3	2,153.16	5.87	9- 5-51	L, WL

15ddb5	III DI5	GS	7- -50	J	18.9	3/4	G	.....	Tp	2.5	2,151.34	5.51	9- 5-50	L, WL
15ddb6	III Rf	GS	7-11-51	J	14.0	2	S	4.0	Tp	1.0	2,141.04	.....	7-11-51	In drain ditch, F, L
15ddc	III B6 1/2	BR	10-26-50	B	9.5	3	N	9.5	Ls	.0	2,147	9.5	10-26-50	L
22aab	III B7	GS	7- -50	BJ	15.6	3/4	G	9.7	Tp	3.4	2,149.70	10.46	9- 5-51	L, WL
22abc	III A5 1/2	BR	10-25-50	B	13.0	3	N	13.0	Ls	.0	2,151	11.5	10-25-50	L
22abd	III A6	GS	7-17-50	BJ	12.5	3/4	G	10.5	Tp	4.2	2,148.59	.....	.....	L
22baa1	III CI6	GS	7- -50	J	25.9	3/4	G	20.0	Tp	5.7	2,160.45	9.34	9- 5-50	L, WL
22baa2	III CI5	GS	7- -50	J	31.6	3/4	G	26.0	Tp	4.1	2,158.79	10.11	9- 5-50	L, WL
22baa3	III CI4	GS	7- -50	J	17.7	3/4	G	13.5	Tp	4.0	2,158.38	11.82	9- 5-50	L, WL
22bac1	III CI2	GS	7- -50	J	20.5	3/4	G	12.0	Tp	5.1	2,158.37	12.18	9- 5-50	L, WL
22bac2	III CI1	GS	7- -50	J	18.4	3/4	G	13.5	Tp	3.2	2,158.60	14.60	9- 5-50	L, WL
22bad	III CI3	GS	7- -50	J	21.1	3/4	G	13.3	Tp	5.3	2,159.62	12.31	9- 5-50	L, WL
54- 6cbd	III G3	GS	5- 4-51	BJ	21.5	3/4	G	14.0	Tp	4.0	2,179.03	8.56	9- 5-51	L, WL

AREA V

14-54-14cab	V Cb12	BR	4-28-50	B	10.5	10	N	.....	Ls	0.0	.....	4±	4-28-51	L
22abb	V Cb10	BR	4-28-50	B	11.5	10	N	.....	Ls	.0	2,208.3	.....	.....	L
23aba	V B1	GS	9-26-50	BJ	18.0	3/4	G	4.0	Tp	3.5	2,155.74	12.22	9-18-51	L, WL
23bbd	V A1	GS	9-26-50	BJ	17.2	3/4	G	9.0	Tp	4.5	2,174.94	7.35	9- 5-51	L, WL
23bdc	V A2	GS	5- 2-51	J	8.9	3/4	G	.0	Tp	2.7	2,164.42	1.05	9- 5-51	Ca, L, WL
23cab	V A3	GS	4-26-51	BJ	21.3	3/4	G	18.0	Tp	4.0	2,118.52	6.32	9- 5-51	L, WL
23cad	V A4	GS	4-27-51	BJ	21.6	3/4	G	14.0	Tp	4.0	2,116.26	5.58	9- 5-51	L, WL
23dad	V B2	GS	4-26-51	BJ	21.5	3/4	G	16.0	Tp	4.0	2,112.69	7.50	9- 5-51	L, WL
23dba	V AB	GS	4-27-51	BJ	22.6	3/4	G	13.0	Tp	4.0	2,113.13	1.33	9- 5-51	L, WL

AREA VI

14-54- 1ccc	VI E1	BR	5- 7-51	Dr	65.5	4	S	1.0	Tp	1.0	2,235.63	65.5	5- 7-51	L
1daa	VI I1	P	.....	Dr	37.4	4	S	14.0	Tp	1.0	2,169.11	17.83	9- 5-51	L, WL
1dbb	VI I1 1/2	BR	5- 3-51	B	17.0	3	N	.....	Ls	.0	2,186	11.5	5- 8-51	L
12acc	VI E2	GS	8-15-51	BJ	14.3	3/4	G	3.0	Tp	3.8	2,182.20	12.43	9- 5-51	L, WL
12cca	VI D1	GS	8- 8-51	BJ	13.5	3/4	G	5.0	Tp	4.0	2,181.63	7.57	9- 5-51	L, WL
12daa	VI F1	GS	8-15-51	BJ	16.6	3/4	G	8.5	Tp	4.0	2,153.15	10.95	9- 5-51	L, WL
12dcb	VI E3	GS	8- 9-51	BJ	15.5	3/4	G	7.5	Tp	4.0	2,165.44	7.97	9- 5-51	L, WL
12dcc	VI D2	GS	8- 9-51	BJ	6.8	3/4	G	3.5	Tp	3.1	2,158.23	4.48	9- 5-51	L, WL
13aaa	VI E4	GS	9-27-50	BJ	18.1	3/4	G	5.8	Tp	3.3	2,152.47	9.86	9- 5-51	L, WL
13abb	VI D3	GS	7-18-51	BJ	17.6	3/4	G	6.0	Tp	4.0	2,160.66	8.85	9- 5-51	L, WL
13bba	VI CD	GS	8- 8-51	BJ	10.0	3/4	G	2.2	Tp	3.8	2,163.80	3.32	9- 5-51	L, WL

Table 11.—*Record of wells and test holes*—Continued

Well no.		Driller	Date drilled	Type of well	Depth of well below land-surface datum (feet)	Diameter of well (inches)	Type of casing	Depth to gravel (feet)	Measuring point			Depth to water above (+) or below land surface (feet)	Date of measurement	Remarks
Coordinate system	Field								Description	Height above land surface (feet)	Altitude above mean sea level (feet)			
AREA VI—Continued														
14-54-13bdd	VI C2	GS	9-26-50	BJ	33.2	3/4	G	7.0	Tp	4.4	2,161.66	15.86	9- 5-51	L, WL
13cca	VI A2	GS	9-26-50	BJ	27.7	3/4	G	6.5	Tp	4.0	2,166.11	22.90	9- 5-51	L, WL
13cdd	VI A3	GS	9-29-50	BJ	21.2	2	S	10.5	Tp	5.3	2,158.09	17.84	9- 5-51	L, WL
13dbb	VI Fa3	P	.....	Dr	703	2	S	.....	.....	.....	2,156	.....	.....	Ca, F
13dbd	VI C3	GS	9-27-50	J	18.5	3/4	G	6.0	Tp	3.0	2,156.51	15.99	9-18-51	L, WL
13dcd	VI B 1/4	BR	8- 2-51	B	24.5	3	N	24.5	Ls	.0	2,111±	4.5	8- 4-51	L
14aaa	VI C1	GS	10-12-50	J	6.6	3/4	G	3.8	Tp	4.0	2,177.45	2.60	9- 5-51	L, Wl
14daa	VI A1	GS	10-12-50	BJ	22.0	3/4	G	7.0	Tp	4.6	2,173.91	20.47	9- 5-51	L, WL
24aab	VI B 1/2	BR	8- 1-51	B	12.0	3	G	12.0	Ls	.0	2,110	8.0	8- 1-51	L
24aac	VI A4 1/2	BR	8- 1-51	B	9.0	3	N	9.0	Ls	.0	2,112	6.7	8- 1-51	L
24abb	VI A3 1/2	BR	8- 2-51	B	7.0	3	N	7.0	Ls	.0	2,115	2.6	8- 3-51	L
24abc	VI A4	GS	9-12-50	BJ	27.0	3/4	G	18.5	Tp	4.0	2,121.34	7.30	9- 5-51	L, WL
24ada	VI B3/4	BR	8- 1-51	B	10.5	3	N	10.5	Ls	.0	2,107±	10.5	8- 1-51	L
24adb	VI A5	GS	9-29-50	BJ	16.5	3/4	G	15.0	Tp	5.2	2,113.48	6.07	9- 5-51	L, WL
55- 6abc	VI J1/2	BR	8- 9-51	B	18.0	3	N	18.0	Ls	.0	2,147	5.2	8- 9-51	L
6acd	VI I3 1/2	BR	9-12-51		18.0	3	N	.....	Ls	.0	2,136	.....	.....	L
6add	VI I4	GS	5-10-51	BJ	25.7	3/4	G	14.1	Tp	4.0	2,131.63	19.91	9- 5-51	L, WL
6baa	VI K1	P	.....	D	24.0	24	G	15.0	Tp	.6	2,149.57	11.36	9- 5-51	L, WL
6bdc	VI I2	GS	8-14-51	BJ	17.9	3/4	G	7.5	Tp	3.5	2,157.54	5.54	9- 5-51	L, WL
6bdd1	VI I3a	GS	5-10-51	BJ	44.3	3/4	G	25.0	Tp	4.0	2,151.17	18.91	9- 5-51	L, WL
6bdd2	VI I3b	GS	5-10-51	J	6.8	3/4	G	.....	Tp	3.5	2,151.01	3.18	9- 5-51	L, WL
6cac	VI H1	GS	8-23-51	BJ	18.0	3/4	G	12.5	Tp	3.4	2,157.89	10.13	9- 5-51	L, WL
6ccc	VI G1	GS	8-14-51	BJ	17.9	3/4	G	4.0	Tp	3.7	2,162.14	10.57	9- 5-51	L, WL
6dad	VI Fa1	P	8-23-51	Dr	27.0	4	S	20±	Ls	.0	2,128	.....	.....	L
6dbc	VI H2	GS	8-23-51	BJ	15.3	3/4	G	2.0	Tp	5.0	2,148.72	3.72	9- 5-51	L, WL

6ddc	VI H3	GS	8-14-51	BJ	15.6	3/4	G	5.0	Tp	4.0	2,142.92	12.92	9- 5-51	L, WL
7aca	VI G4	GS	8- 9-51	BJ	17.0	3/4	G	3.5	Tp	4.4	2,143.32	8.62	9-18-51	L, WL
7add	VI G5	GS	8-10-51	BJ	12.6	3/4	G	4.0	Tp	3.6	2,139.25	5.01	9- 5-51	L, WL
7bad	VI G2	GS	8- 9-51	BJ	15.5	3/4	G	2.5	Tp	3.6	2,139.47	4.30	9- 5-51	L, WL
7bda1	VI P2a	GS	10- 3-51	J	13.7	2	S	3.5	Tp	1.1	2,138.33	5.60	10- 3-51	L
7bda2	VI P2b	GS	10- 3-51	J	14.2	2	S	3.5	Tp	1.2	2,138.42	5.60	10- 3-51	Ca, L
7bda3	VI 2N1	GS	10- 4-51	J	13.1	3/4	G	3.5	Tp	3.7	2,141.10	5.93	10- 4-51	L
7bda4	VI 2S1	GS	10- 4-51	J	13.8	3/4	G	3.8	Tp	4.3	2,141.77	5.70	10- 4-51	L
7bda5	VI G3, 2W1	GS	9-20-51	J	17.0	3/4	G	4.0	Tp	4.5	2,143.59	7.18	10- 1-51	L, WL
7cac	VI F2	GS	9-27-50	BJ	15.6	3/4	G	2.5	Tp	5.7	2,144.90	2.19	10- 2-50	L, WL
7cdd	VI F3	GS	9-20-50	BJ	15.6	3/4	G	7.0	Tp	4.5	2,143.34	6.55	9- 5-51	L, WL
7dcb	VI Fa2	P	.....	Dr	42	4	S	.....	Tp	.7	2,140	7.11	9-27-48	Ca, L
7dda	VI FG	GS	8-10-51	BJ	12.6	3/4	G	4.0	Tp	4.4	2,138.05	5.38	9- 5-51	L, WL
18bad	VI EF	GS	8-10-51	BJ	18.1	3/4	G	4.5	Tp	3.3	2,144.51	11.90	9- 5-51	L, WL
18caa	VI E5	GS	9-20-50	J	19.1	3/4	G	14.0	Tp	2.2	2,144.64	18.18	9- 5-51	L, WL
18ccb	VI D3 1/3	BR	8- 3-51	B	13.0	3	N	11.0	Ls	.0	2,108	2.1	8- 3-51	L
18ccc1	VI P1	GS	10- 4-51	J	21.1	2	S	13.0	Tp	.2	2,110.81	6.24	10- 4-51	Ca, L
18ccc2	VI 1N1	GS	10- 5-51	J	19.0	3/4	G	12.0	Tp	2.6	2,112.75	5.59	10- 5-51	L
18ccc3	VI 1E1	GS	10- 5-51	J	15.7	3/4	G	14.0	Tp	4.4	2,114.82	6.25	10- 5-51	L
18ccc4	VI C4, 1W1	GS	9-18-50	BJ	13.9	3/4	G	9.0	Tp	4.5	2,115.72	6.00	9- 5-51	L, WL
18ccd	VI D3 2/3	BR	8- 2-51	B	8.5	3	N	7.0	Ls	.0	2,107	6.5	8- 2-51	L
18cda	VI E6	BR	5- 7-51	Dr	13.3	4	S	7.5	Tp	2.1	2,104.99	3.45	9- 5-51	Ca, L, WL
18cdd	VI D4	GS	9- 7-51	BJ	17.4	3/4	G	10.0	Tp	3.7	2,109.96	7.37	9- 5-51	L, WL
18ddc	VI E6 1/2	GS	9-29-50	BJ	13.0	2	N	9.0	Ls	.0	2,106.3	.....	.....	L
19baa	VI D4 1/2	BR	8- 3-51	B	12.0	3/4	G	12.0	Ls	.0	2,106	8.5	8- 3-51	L
19bbd	VI C4 1/4	BR	8- 3-51	B	7.8	3	N	7.8	Ls	.0	2,109	.....	.....	L
19bda	VI C5	GS	9-20-50	BJ	25.5	3/4	G	10.0	Tp	3.6	2,111.37	16.58	9- 5-51	L, WL

AREA VII

15-54-25daa	VII Cb16	BR	5-10-50	B	10.5	10	N	5.0	Ls	0.0	2,200.8	.....	.....	L
25dda	VII Cb15	BR	5-10-50	B	13.5	10	N	6.0	Ls	.0	2,202.1	.....	.....	L
36aab	VII D 1/2	GS	9- 4-51	B	8.8	6	N	8.6	Ls	.0	2,197±	.....	.....	L
36aac1	VII C 1/3	GS	9- 4-51	B	7.0	6	N	5.4	Ls	.0	2,196±	4.4	9- 4-51	L
36aac2	VII C 2/3	GS	9- 4-51	B	14.0	6	N	13.7	Ls	.0	2,177±	.....	.....	L
36aca1	VII B1	GS	5-17-51	BJ	30.9	3/4	G	13.0	Tp	3.7	2,192.36	12.67	9- 5-51	L, WL
36aca2	VII Cb14	BR	5- 3-50	B	12.0	10	N	4.5	Ls	.0	2,202.2	.....	.....	L
36caa	VII A 1/2	BR	5- 8-51	B	5.0	3	N	5.0	Ls	.0	2,205	.....	.....	L

Table 11.—*Record of wells and test holes*—Continued

Well no.		Driller	Date drilled	Type of well	Depth of well below land-surface datum (feet)	Diameter of well (inches)	Type of casing	Depth to gravel (feet)	Measuring point			Depth to water above (+) or below land surface (feet)	Date of measurement	Remarks
Coordinate system	Field								Description	Height above land surface (feet)	Altitude above mean sea level (feet)			
					AREA VII—Continued									
15-54-36cad	VII Cb13	BR	5-10-51	B	5.0	10	N	2.5	Ls	0.0	2,201	.....	.....	L
55-30add	VII E3	GS	5-22-51	BJ	16.4	3/4	G	3.5	Tp	4.0	2,149.87	11.80	9- 5-51	L, WL
30bdc1	VII E1a	GS	5-22-51	BJ	31.7	3/4	G	23.5	Tp	3.8	2,173.70	12.38	9- 5-51	L, WL
30bdc2	VII E1b	GS	5-22-51	BJ	11.7	3/4	G	.....	Tp	2.0	2,171.94	8.53	9- 5-51	L, WL
30cda	VII D2	GS	5-21-51	BJ	22.3	3/4	G	4.5	Tp	3.5	2,150.14	3.85	9- 5-51	L, WL
30cdb1	VII D1	GS	5-23-51	BJ	26.0	3/4	G	16.0	Tp	5.5	2,167.60	15.76	9- 5-51	L, WL
30cdb2	VII D1½	BR	5- -51	B	13.0	3	N	13.0	Ls	.0	2,158	.....	.....	L
30dba	VII E2	GS	5-23-51	BJ	27.9	3/4	G	9.8	Tp	3.7	2,155.65	10.49	9- 5-51	L, WL
30ddc	VII D3	GS	5-16-51	BJ	14.5	3/4	G	2.0	Tp	4.0	2,138.00	+.09	9- 5-51	L, WL
30ddd	VII D4	GS	5-23-51	BJ	19.7	3/4	G	3.5	Tp	4.0	2,141.86	8.08	9- 5-51	L, WL
31aab	VII C1, 1N1	GS	10- 5-51	J	13.9	3/4	G	2.5	Tp	3.8	2,146.07	4.49	10- 5-51	L, WL
31aac	VII P1	GS	10- 5-51	J	14.6	2	S	9.0	Tp	.6	2,142.57	4.23	10- 5-51	L
31abd1	VII 1W1	GS	10- 5-51	J	14.0	3/4	G	10.0	Tp	4.3	2,147.51	5.31	10- 5-51	L
31abd2	VII 1S1	GS	10- 5-51	J	16.9	3/4	G	9.5	Tp	4.6	2,146.30	3.95	10- 5-51	L
31aca	VII B4	GS	5-22-51	BJ	19.5	3/4	G	6.0	Tp	4.2	2,145.15	2.42	9- 5-51	L, WL
31ada	VII B5	GS	5-11-51	BJ	21.2	3/4	G	15.0	Tp	5.0	2,120.98	5.60	9- 5-51	L, WL
31bcb	VII B2	GS	5-18-51	BJ	28.8	3/4	G	16.5	Tp	3.9	2,168.62	15.54	9- 5-51	L, WL
31bdb	VII B3	GS	5-18-51	BJ	22.5	3/4	G	10.5	Tp	3.8	2,159.35	9.90	9- 5-51	L, WL
31caa1	VII A2a	GS	5-16-51	BJ	17.9	3/4	G	6.0	Tp	3.5	2,149.92	4.69	9- 5-51	L, WL
31caa2	VII A2b	GS	6- 7-51	BJ	13.4	3/4	G	6.0	Tp	4.5	2,150.83	4.60	9- 5-51	L, WL
31cbb	VII Fa1	P	.....	Dr	55	4	S	.....	Tp	.9	2,167	18.75	9-27-48	Ca

31cbc	VII A1	GS	6- 7-51	BJ	26.5	3/4	G	23.0	Tp	5.0	2,173.97	19.50	9- 5-51	L, WL
31daa1	VII A3a	GS	4-12-51	Dr	45.6	4	S	16.4	Tp	1.0	2,120.60	8.46	9- 5-51	Ca, L, WL
31daa2	VII A3b	GS	4- 3-51	BJ	24.1	3/4	G	16.0	Tp	4.3	2,121.96	8.92	9- 5-51	L, WL
32bdb	VII B6	GS	5-24-51	BJ	11.4	3/4	G	7.0	Tp	4.0	2,106.10	6.39	9- 5-51	L, WL

AREA VIII

15-55- 4caa	VIII J2	GS	6- 8-51	BJ	21.0	3/4	G	6.2	Tp	4.0	2,115.52	14.72	9- 5-51	L, WL
4cbb	VIII J1	GS	6-13-51	BJ	24.7	3/4	G	15.0	Tp	5.3	2,136.64	13.20	9- 5-51	L, WL
8aba	VIII I1	GS	6-15-51	J	37.0	3/4	G	6.3	Tp	5.8	2,174.56	34.54	9- 5-51	L, WL
8acd	VIII H1	GS	6-13-51	BJ	37.6	3/4	G	2.0	Tp	5.2	2,167.10	34.17	9- 5-51	L, WL
8add	VIII H2	GS	6-12-51	BJ	19.3	3/4	G	5.0	Tp	4.0	2,136.69	7.40	9- 5-51	L, WL
8dcc	VIII G1	BR	5- 8-51	Dr	40.6	3/4	G	9.5	Tp	1.4	2,170.40	36.50	9- 5-51	L, WL
8ddd	VIII G2	GS	6- 5-51	BJ	19.5	3/4	G	10.0	Tp	4.0	2,140.25	9.51	9- 5-51	L, WL
9bbb	VIII I2	GS	6- 8-51	BJ	21.2	3/4	G	5.2	Tp	3.3	2,134.16	11.59	9- 5-51	L, WL
9cab	VIII H3	GS	6- 8-51	BJ	16.2	3/4	G	9.3	Tp	5.0	2,122.57	9.20	9- 5-51	L, WL
9ccd	VIII G2 1/2	BR	9-14-51	B	3.5	3	N	3.5	Ls	.0	2,125	2.0	9-14-51	L
9cdc	VIII G3	GS	6- 5-51	BJ	14.0	3/4	G	3.5	Tp	4.0	2,123.12	6.92	9- 5-51	L, WL
16bab1	VIII P2	GS	9-19-51	J	17.5	2	S	8.5	Tp	.5	2,121.81	6.93	10- 1-51	Ca, L
16bab2	VIII FG, 2N1	GS	9-20-51	J	15.9	3/4	G	7.0	Tp	4.0	2,125.33	8.17	10- 1-51	L, WL
16bab3	VIII 2W1	GS	9-19-51	J	19.0	3/4	G	9.0	Tp	5.0	2,126.18	6.40	10- 1-51	L
16bab4	VIII 2E1	GS	9-19-51	J	17.4	3/4	G	5.0	Tp	4.0	2,124.91	7.78	10- 1-51	L
16bac	VIII 2S1	GS	9-20-51	J	18.0	3/4	G	5.5	Tp	3.4	2,124.78	7.38	10- 1-51	L
16bbc	VIII Fa2	P	.....	D	20.8	6	S	.....	Bp	.4	2,138	5.91	9-27-48	WL
16bbd	VIII F2	GS	6- 7-51	BJ	18.0	3/4	G	13.0	Tp	3.6	2,127.83	2.12	9-18-51	L, WL
16bca	VIII F1 1/2	BR	9-12-51	B	3.0	3	N	3.0	Ls	.0	2,128	2.0	9-13-51	L
16bda1	VIII F2 2/3	BR	9-13-51	B	4.8	3	N	4.8	Ls	.0	2,119	.....	.....	L
16bda2	VIII F2 1/3	BR	9-13-51	B	4.0	3	N	3.6	Ls	.0	2,122	.....	.....	L
16bdd	VIII E5	GS	5-29-51	BJ	17.4	3/4	G	5.5	Tp	4.2	2,127.65	3.77	9- 5-51	L, WL
16caa	VIII E5 1/2	BR	9-13-51	B	7.5	3	N	7.5	Ls	.0	2,120	5.2	9-14-51	L
16cad	VIII D2 1/2	BR	9-13-51	B	6.0	3	N	6.0	Ls	.0	2,124	3.0	9-14-51	L
16cba	VIII E4 1/2	BR	9-13-51	B	8.6	3	N	8.0	Ls	.0	2,129	2.2	9-14-51	L
16cbb1	VIII 1E2	GS	7-27-51	J	15.3	3/4	G	7.0	Tp	3.8	2,139.69	8.67	9- 5-51	L
16cbb2	VIII Fa1	P	.....	D	17.4	36	W	.....	.....	1.3	2,137	7.92	9-27-48	Ca, L, WL
16cbd	VIII D2	GS	7- 9-51	BJ	14.1	3/4	G	10.5	Tp	4.0	2,131.40	1.38	9- 5-51	L, WL
16ccd1	VIII C4	GS	5-29-51	BJ	19.9	3/4	G	8.0	Tp	4.0	2,132.82	4.44	9- 5-51	L, WL
16ccd2	VIII C3 1/2	GS	9-13-51	B	4.0	3	N	4.0	Ls	.0	2,130	.....	.....	L
16cdd	VIII C4 1/2	BR	5-23-51	B	4.2	3	N	3.5	Ls	.0	2,126	.....	.....	L

Table 11.—*Record of wells and test holes*—Continued

Well no.		Driller	Date drilled	Type of well	Depth of well below land-surface datum (feet)	Diameter of well (inches)	Type of casing	Depth to gravel (feet)	Measuring point			Depth to water above (+) or below land surface (feet)	Date of measurement	Remarks
Coordinate system	Field								Description	Height above land surface (feet)	Altitude above mean sea level (feet)			
AREA VIII—Continued														
15-55-16dcb	VIII D3	GS	7-19-51	BJ	15.8	3/4	G	7.0	Tp	4.0	2,124.56	4.24	9- 5-51	L, WL
17aac	VIII F1	GS	6-12-51	BJ	28.1	3/4	G	15.5	Tp	4.7	2,149.52	13.36	9- 5-51	L, WL
17add	VIII 1N1	GS	8-22-51	J	17.9	3/4	G	9.5	Tp	3.5	2,140.26	9.22	9- 5-51	L
17bdd	VIII E3	GS	6- 5-51	BJ	32.5	3/4	G	26.0	Tp	4.0	2,158.41	20.38	9- 5-51	L, WL
17cbb	VIII E2	GS	6- 5-51	BJ	41.0	3/4	G	3.0	Tp	4.0	2,193.14	23.18	9- 5-51	L, WL
17daa1	VIII E4, P1	GS	4-16-51	Dr	51.6	4	S	7.0	Tp	2.9	2,139.64	9.21	9- 5-51	Ca, L, WL
17daa2	VIII 1E1	GS	4- 4-51	J	15.3	3/4	G	9.0	Tp	4.0	2,140.13	8.77	9- 5-51	L, WL
17daa3	VIII 1S1	GS	8-22-51	J	17.4	3/4	G	9.0	Tp	4.0	2,140.87	8.25	9- 5-51	L
17daa4	VIII 1W1	GS	7-27-51	J	17.4	3/4	G	7.5	Tp	4.2	2,141.80	9.80	9- 5-51	L
17daa5	VIII 1W2	GS	7-27-51	J	17.4	3/4	G	10.0	Tp	4.0	2,141.88	9.93	9- 5-51	L
17dad	VIII D1	GS	6-26-51	BJ	17.5	3/4	G	5.5	Tp	4.0	2,140.20	9.03	9- 5-51	L, WL
18add	VIII Cb20	BR	5-11-50	B	8.9	10	N	6.5	Ls	.0	2,197.4	.....	.....	L
18dab	VIII E1	BR	5- 8-51	Dr	21.6	3/4	G	19.8	Tp	4.5	2,203.48	13.75	9- 5-51	L, WL
18dad	VIII Cb19	BR	5-11-51	B	12.0	10	N	10.0	Ls	.0	2,198.1	.....	.....	L
18ddc	VIII Cb18	BR	5-10-50	B	10.0	10	N	.....	Ls	.0	2,195.4	.....	.....	L
19daa	VIII B1	GS	6- 6-51	BJ	33.7	3/4	G	9.5	Tp	4.2	2,164.55	22.20	9- 5-51	L, WL
19dab	VIII Cb17	BR	5-10-50	B	11.0	10	G	7.5	Ls	.0	2,195.6	.....	.....	L
20aaa	VIII C3	GS	5-25-51	BJ	19.8	3/4	G	5.0	Tp	3.9	2,139.78	8.71	9- 5-51	L, WL
20add	VIII B3	GS	5-25-51	BJ	18.5	3/4	G	8.0	Tp	3.1	2,135.31	7.25	9- 5-51	L, WL
20baa	VIII C2	GS	5-24-51	BJ	19.7	3/4	G	12.0	Tp	4.0	2,150.94	13.46	9- 5-51	L, WL

20bba	VIII C1	GS	5-24-51	BJ	34.0	3/4	G	23.8	Tp	4.0	2,162.02	21.72	9- 5-51	L, WL
20caa	VIII B2	GS	5-29-51	BJ	17.9	3/4	G	9.5	Tp	3.6	2,148.80	13.13	9- 5-51	L, WL
20ccd	VIII A1	GS	5-25-51	BJ	40.9	3/4	G	16.0	Tp	4.0	2,157.85	19.53	9- 5-51	L, WL
20cdd	VIII A2	GS	5-25-51	BJ	19.1	3/4	G	9.0	Tp	4.4	2,147.56	13.22	9- 5-51	L, WL
20ddd	VIII A3	GS	5-29-51	BJ	21.9	3/4	G	6.5	Tp	4.0	2,137.27	13.67	9- 5-51	L, WL
21bdc	VIII B4	GS	8- 1-51	BJ	17.5	3/4	G	9.0	Tp	5.0	2,131.08	6.68	9- 5-51	L, WL

AREA IX

16-55-28dca	IX A1/2	BR	6-19-51	B	11.5	3	N	11.5	Ls	0.0	2,129	.....	.....	L
33add	IX A1	GS	6-22-51	BJ	23.5	3/4	G	6.5	Tp	4.0	2,104.51	10.76	9- 5-51	L, WL

AREA X

16-55-22cdd	X D1	BR	5- 9-51	Dr	38.5	3/4	G	33.8	Tp	4.0	2,136.88	31.90	7-23-51	L, WL
22ddd	X D1 1/2	GS	4- 4-51	J	25.0	3/4	G	4.0	Ls	.0	2,114	.....	.....	L
23aab	X F1	GS	6-21-51	BJ	19.3	3/4	G	17.5	Tp	4.0	2,055.53	9.17	9- 5-51	L, WL
23aad	X F2	GS	6-21-51	BJ	16.9	3/4	G	11.2	Tp	3.7	2,052.32	6.81	9- 5-51	L, WL
23acc	X E2	GS	6-21-51	BJ	17.8	3/4	G	15.0	Tp	4.0	2,054.67	7.24	9- 5-51	L, WL
23bdd	X E1	GS	6-20-51	BJ	24.0	3/4	G	6.3	Tp	4.5	2,070.91	19.00	9- 5-51	L, WL
23cdc	X D2	GS	4-13-51	BJ	15.2	3/4	G	7.0	Tp	4.0	2,057.33	11.62	9- 5-51	L, WL
24bcb	X F3	P	.....	Dr	49.2	6	S	.....	Bp	.4	2,051.05	10.45	9- 5-51	L, WL
26cba	X C3	GS	6-15-51	BJ	15.5	3/4	G	7.0	Tp	4.0	2,060.17	11.28	9- 5-51	L, WL
26ccc1	X P1	GS	10- 8-51	J	11.9	2	S	8.0	Tp	1.7	2,056.91	7.30	10- 8-51	Ca, L
26ccc2	X 1N1	GS	10- 8-51	J	13.4	3/4	G	9.0	Tp	3.5	2,057.90	6.48	10- 8-51	L
26ccc3	X 1E1	GS	10- 9-51	J	15.8	3/4	G	6.0	Tp	3.7	2,057.94	6.57	10- 9-51	L
26ccc4	X B2, 1S1	GS	10- 9-51	J	12.7	3/4	G	6.0	Tp	4.8	2,060.15	7.53	10-15-51	L, WL
26ccd	X B3	GS	6-19-51	BJ	13.2	3/4	G	8.0	Tp	4.4	2,062.36	11.51	9- 5-51	L, WL
27bad	X CD1/2	GS	4- 5-51	J	19.0	2	N	.....	Ls	.0	2,122	.....	.....	L
27cad	X C1	BR	4-17-51	Dr	45.2	4	S	8.8	Tp	.9	2,115.73	30.01	4-25-51	Ca, L, WL
27daa	X C2	GS	6-19-51	BJ	17.9	3/4	G	4.5	Tp	3.6	2,056.03	2.29	9- 5-51	L, WL
27dcd	X B1/2	P	.....	B	23.4	24	G	.....	Tp	2.0	.....	8.80	12- 3-51	L
27ddc	X B1	GS	6-19-51	BJ	18.5	3/4	G	13.0	Tp	3.0	2,058.34	3.60	9- 5-51	L, WL
34aaa	X A2	P	.....	Dr	135	4	S	5.5	Tp	.0	2,058.53	11.22	9-18-51	L, WL
34aba	X A1	P	.....	B	22.8	30	W	.....	Tsf	1.0	2,059.43	6.56	9- 5-51	L, WL
34abb	X A 2/3	P	.....	B	32.7	36	W	.....	Tcu	1.0	.....	8.35	12- 3-51	L
34bba	X A1/3	GS	6-26-51	J	14.0	3/4	G	1.5	Tp	4.0	2,106.78	.....	.....	L

Table 12.—*Field numbers and corresponding coordinate-system numbers of wells and test holes*

Field no.	Coordinate-system no.	Field no.	Coordinate-system no.
		AREA I	
I A1	13-53-30bbb	I C3 1/3	13-53-29bcd3
I A2	30bdd	I C3 2/3	29cab
I A3	30dac	I Cb1	13-52-24dca
I A3 1/2	30ddb	I Cb2	13-53-19cba
I B1	30add	I Cb3	19dba
I B1 1/3	29cbb	I D1	29bdb
I B1 2/3	29cbc	I D1 1/3	29bda
I C1	19ddc	I D1 2/3	29acc
I C2	29bbc	I E1	29acb
I C3a	29bcd1	I Fa1	13-52-25bda
I C3b	29bcd2		
		AREA II	
II A1/2	13-53-17ccd	II Cb4	13-53-18dbb
II A1	20dca	II Cb5	17adb
II B	20aac	II Cb6	17aaa
II C1	16bdb	II D1	16baa
II C2	16dbc	II D2	15ccb
II C3	16ddb		
		AREA III	
III A1/2	13-53- 9dad	III Cb8	13-53-10cab
III A1	10ccc	III Cb9	10acd
III A1 1/3	15bba	III Cb11	11baa2
III A1 2/3	15bca	III CD	14cba
III A2	15bdc	III CI1	22bac2
III A3	15cad	III CI2	22bac1
III A3 1/2	15cda	III CI3	22bad
III A4	15dcc1	III CI4	22baa3
III A5	15dcc2	III CI5	22baa2
III A5 1/2	22abc	III CI6	22baa1
III A6	22abd	III D1	10ada
III B1	10cdb	III D1 1/2	11cbb
III B1 1/2	10cdd	III D2	11cca
III B2	15baa	III D3	11ccd
III B3	15abc	III D3 1/2	14bab
III B3 1/2	15aca	III D4	14bac1
III B4	15acd	III D4 1/2	14bac2
III B5	15dbd	III D5	14bdb
III B6	15ddb4	III D5 1/4	14bdc
III B6 1/2	15ddc	III D5 1/2	14caa
III B7	22aab	III D5 3/4	14dbc
III Bc1	15dab1	III DI 1	14ddb1
III Bc2	15dab2	III DI2	15ddb2
III C1	10dbb	III DI3	15ddb3
III C1 1/2	10dca	III DI5	15ddb5
III C2	10ddc	III DI6	15dca
III C2 1/2	15aab3	III DI7	15dac1
III C3, 1S1	15aac2	III DI8	15dac2
III C3 1/3	15aac1	III DI9	15dab3
III C4	15ada	III DI10	15daa
III C4 1/2	15add1	III DI11	15add2
III C5	14cbb	III E1	11baa1
III C6	14cbc3	III E2	11acc1
III C6 1/2	14cbd	III E2 1/3	11ddb
III C7	14cca	III E3	11ddd
III C8	14cdb	III E4	13bbd
III Cb7	10cbb	III F1	1cbc

Table 12.—*Field numbers and corresponding coordinate-system numbers of wells and test holes*—Continued

Field no.	Coordinate-system no.	Field no.	Coordinate-system no.
AREA III—Continued			
III F2	13-53- 1cdc	III TE3	13-53-15cab2
III F3	12abb	III TE4	15cab1
III F4	12aca	III 1E1	15aac7
III Fa1	10dbc1	III 1N1	15aab1
III Fa2	10dbc2	III 1N2	15aab2
III Fa3	11acc2	III 1S1	(See C3, 1S1)
III Fa4	11daa	III 1S2	15aac6
III G1	1aac	III 1W1	15aac4
III G2	1add	III 1W2	15aac5
III G3	13-54- 6cbd	III 2E1	14cbc2
III P1	13-53-15aac3	III 2N1	14cbc1
III P2	15dad1	III 2S1	15dad3
III P2a	15dad2	III 2W1	15dad4
III P3	12acb1	III 3E1	12acb2
III Rf	15ddb6	III 3N1	12acb3
III TE1	15cab4	III 3S1	12acc1
III TE2	15cab3	III 3W1	12acc2
AREA V			
V A1	14-54-23bbd	V B1	14-54-23aba
V A2	23bdc	V B2	23dad
V A3	23cab	V CB10	22abb
V A4	23cad	V CB12	14cab
V AB	23dba		
AREA VI			
VI A1	14-54-14daa	VI F2	14-55- 7cac
VI A2	13cca	VI F3	7cdd
VI A3	13cdd	VI Fa1	6dad
VI A3 1/2	24abb	VI Fa2	7dcb
VI A4	24abc	VI Fa3	14-54-13dbb
VI A4 1/2	24aac	VI FG	14-55- 7dda
VI A5	24adb	VI G1	6ccc
VI B1/4	13dcd	VI G2	7bad
VI B1/2	24aab	VI G3, 2W1	7bda5
VI B3/4	24ada	VI G4	7aca
VI C1	14aaa	VI G5	7add
VI C2	13bdd	VI H1	6cac
VI C3	13dbd	VI H2	6dbc
VI C4, 1W1	14-55-18ccc4	VI H3	6ddc
VI C4 1/2	19bbd	VI I 1/2	14-54- 1dbb
VI C5	19bda	VI I1	1daa
VI CD	14-54-13bba	VI I2	14-55- 6bdc
VI D1	12cca	VI I3a	6bdd1
VI D2	12dcc	VI I3b	6bdd2
VI D3	12abb	VI I3 1/2	6acd
VI D3 1/3	14-55-18ccb	VI I4	6add
VI D3 2/3	18ccd	VI J 1/2	6abc
VI D4	18cdd	VI K1	6baa
VI D4 1/2	19baa	VI P1	18ccc1
VI E1	14-54- 1ccc	VI P2a	7bda1
VI E2	12acc	VI P2b	7bda2
VI E3	12dcb	VI 1E1	18ccc3
VI E4	13aaa	VI 1N1	18ccc2
VI E5	14-55-18caa	VI 1W1	(See C4, 1W1)
VI E6	18cda	VI 2N1	7bda3
VI E6 1/2	18ddc	VI 2S1	7bda4
VI EF	18bad	VI 2W1	(See G3, 2W1)
VI F1	14-54-12daa		

Table 12.—*Field numbers and corresponding coordinate-system numbers of wells and test holes*—Continued

AREA VII

Field no.	Coordinate-system no.	Field no.	Coordinate-system no.
VII A1/2	15-54-36caa	VII Cb15	15-54-25dda
VII A1	15-55-31cbc	VII Cb16	25daa
VII A2a	31caa1	VII D1/2	36aab
VII A2b	31caa2	VII D1	15-55-30cdb1
VII A3a	31daa1	VI D1 1/2	30cdb2
VII A3b	31daa2	VII D2	30cda
VII B1	15-54-36aca1	VII D3	30ddc
VII B2	15-55-31bcb	VII D4	30ddd
VII B3	31bdb	VII E1a	30bdc1
VII B4	31aca	VII E1b	30bdc2
VII B5	31ada	VII E2	30dba
VII B6	32bdb	VII E3	30add
VII C 1/3	15-54-36aac1	VII Fa1	31cbb
VII C 2/3	36aac2	VII P1	31aac
VII C1, 1N1	15-55-31aab	VII 1N1	(See C1, 1N1)
VII Cb13	15-54-36cad	VII 1S1	31abd2
VII Cb14	36aca2	VII 1W1	31abd1

AREA VIII

VIII A1	15-55-20ccd	VIII F2	15-55-16bbd
VIII A2	20cdd	VIII F2 1/3	16bda2
VIII A3	20ddd	VIII F2 2/3	16bda1
VIII B1	19daa	VIII Fa1	16cbb2
VIII B2	20caa	VIII Fa2	16bbc
VIII B3	20add	VIII FG, 2N1	16bab2
VIII B4	21bdc	VIII G1	8ddc
VIII C1	20bba	VIII G2	8ddd
VIII C2	20baa	VIII G2 1/2	9ccd
VIII C3	20aaa	VIII G3	9cdc
VIII C3 1/2	16ccd2	VIII H1	8acd
VIII C4	16ccd1	VIII H2	8add
VIII C4 1/2	16cdd	VIII H3	9cab
VIII Cb17	19dab	VIII I1	8aba
VIII Cb18	18ddc	VIII I2	9bbb
VIII Cb19	18dad	VIII J1	4cbb
VIII Cb20	18add	VIII J2	4caa
VIII D1	17dad	VIII P1	(See E4, P1)
VIII D2	16cbd	VIII P2	16bab1
VIII D2 1/2	16cad	VIII 1E1	17daa2
VIII D3	16dcb	VIII 1E2	16cbb1
VIII E1	18dab	VIII 1N1	17add
VIII E2	17cbb	VIII 1S1	17daa3
VIII E3	17bdd	VIII 1W1	17daa4
VIII E4, P1	17daa1	VIII 1W2	17daa5
VIII E4 1/2	16cba	VIII 2E1	16bab4
VIII E5	16bdd	VIII 2N1	(See FG, 2N1)
VIII E5 1/2	16caa	VIII 2S1	16bac
VIII F1	17aac	VIII 2W1	16bab3
VIII F1 1/2	16bca		

AREA IX

IX A1/2	16-55-28dca	IX A1	16-55-33add

Table 12.—*Field numbers and corresponding coordinate-system numbers of wells and test holes*—Continued

Field no.	Coordinate-system no.	Field no.	Coordinate-system no.
		AREA X	
X A 1/3	16-55-34bba	X D1	16-55-22cdd
X A 2/3	34abb	X D1 1/2	22ddd
X A1	34aba	X D2	23cdc
X A2	34aaa	X E1	23bdd
X B1/2	27dcd	X E2	23acc
X B1	27ddc	X F1	23aab
X B2, 1S1	26ccc4	X F2	23aad
X B3	26ccd	X F3	24bcb
X C1	27cad	X P1	26ccc1
X C2	27daa	X 1E1	26ccc3
X C3	26cba	X 1N1	26ccc2
X CD 1/2	27bad	X 1S1	(See B2, 1S1)

INDEX

U. S. GOVERNMENT PRINTING OFFICE : 1958 O - 458513