UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

GROUND-WATER ASPECTS OF THE LOWER

HENRYS FORK REGION, IDAHO

By

E. G. Crosthwaite, M. J. Mundorff, and E. H. Walker

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CONTENTS

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ABSTRACT

The lower Henrys Fork region includes the plains and low benches between Ashton and the junction of Henrys Fork and Snake River in eastern Idaho. The northwestern and western parts of the area are part of the Snake River lava plain. The central part of the area is occupied by alluvial plains of the Snake, Teton, and Falls Rivers, and Henrys Fork. The southeastern part of the area is a bench (Rexburg Bench), chiefly on silicic and basaltic volcanic rocks, which rises gradually to mountain peaks southeast of the area.

The basalt, and the sand and gravel under the alluvial plains are good aquifers and yield large amounts of water with small drawdowns. The silicic volcanic rocks and the interbedded ash, pyroclastics, and sedimentary deposits generally yield much less water than the basalt and alluvium.

1

The regional water table slopes southwestward beneath the basalt and alluvial plains. Seepage from stream channels and irrigated tracts has resulted in an extensive body of ground water perched above the regional water table. The perched water in part moves vertically down to the regional water table and in part laterally to the streams. Ground water beneath the Rexburg Bench moves generally northwestward to join the regional ground-water body beneath the alluvial plain. The regional water table is below the level of the streams in the area and ground water in the main aquifer, therefore, is not tributary to the streams. Recharge to the regional water table is estimated to average 725,000 acre-feet annually.

Pumping from the regional ground-water reservoir for irrigation or other uses would have no effect on streamflow or surface-water rights within the study area. However, depletion of the underflow would eventually reduce the inflow to American Falls Reservoir unless the depletion was offset by additional recharge.

Total withdrawals of ground water for irrigation in 1962 were estimated to be 25,000 acre-feet and caused no significant decline in the water table.

In the Ashton area surface-water irrigation has caused water to be perched in basalt above the silicic volcanic rocks and much of this perched water contributes to streamflow. The flow of Henrys Fork would be decreased by the amount of pumped ground water consumed by crops.

Ground-water prospects for irrigation in the Falls River area are not encouraging.

This report describes the geologic and hydrologic setting of the lower Henrys Fork region to provide a base of knowledge upon which to found decisions for future development and management of the regional water resources. The study was made in cooperation with the U.S. Bureau of Reclamation to provide preliminary data for planning their Lower Teton Division of the Teton Basin Project and also in cooperation with the Idaho Department of Reclamation to provide information to aid in administering the water resources.

The study area is largely in southern Fremont and western Madison Counties, Idaho (fig. 1). It includes the lowlands and benchlands north of the Snake River in the lower drainages of Henrys Fork, Teton, and Falls Rivers. The Bureau of Reclamation designates the report area as the lower Teton basin, although the study area is better known as a part of the lower Henrys Fork basin.
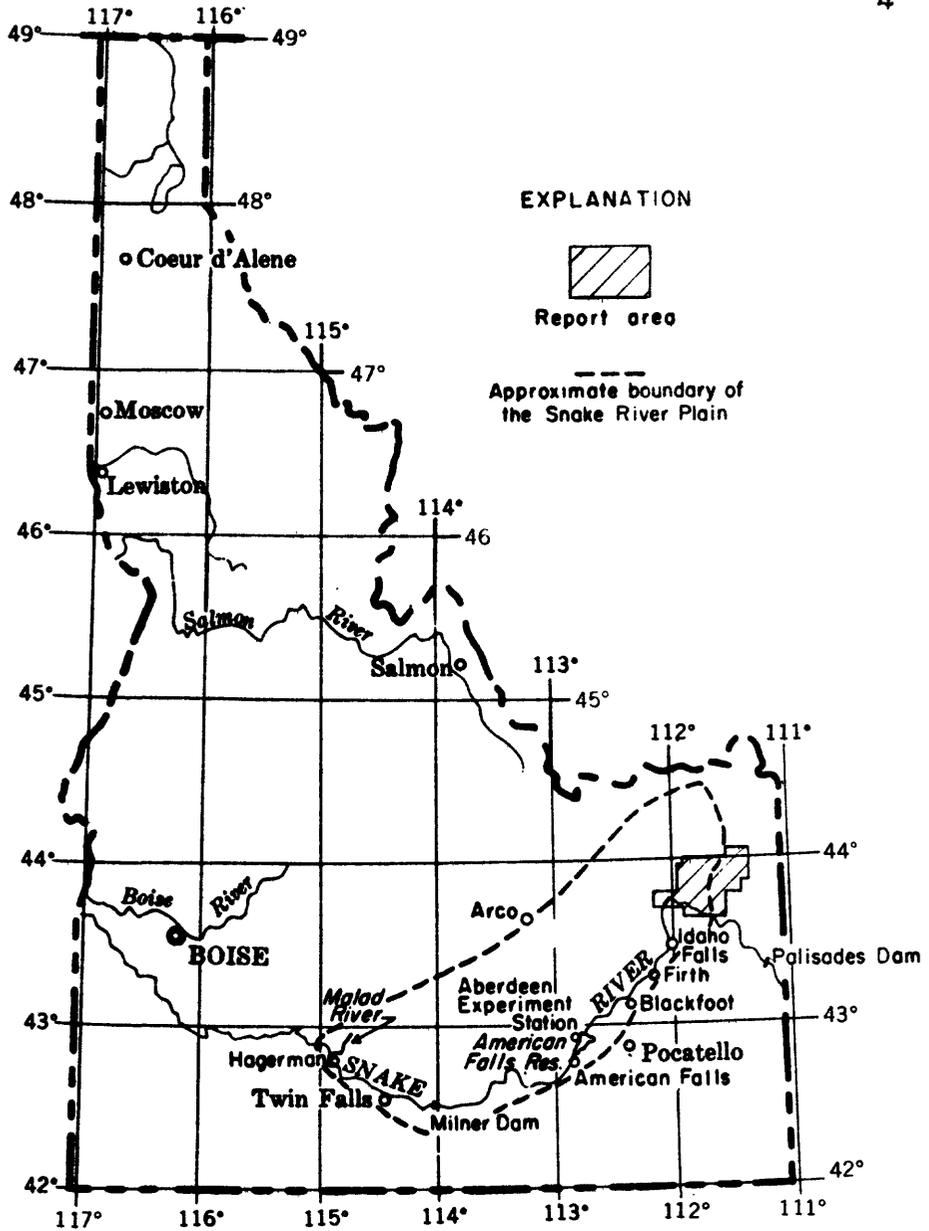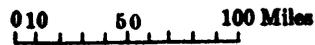
Figure 1.--Map of Idaho showing location of report area.

Previous Investigations

Bradley (1873) and St. John (1879) briefly studied the geology of parts of the area during the survey of the territories. Stone (Lee, Stone, Gale, and others, 1915) described some of the geologic features along the railroad from Thornton to beyond Ashton. Mansfield (1920) compiled a reconnaissance geologic map of the area. Kirkham (1927) mentioned the volcanic rocks southeast of Rexburg and Stearns, Crandall, and Steward (1938) and Stearns, Bryan, and Crandall (1939) mapped the volcanic rocks west of Henrys Fork. Most of these studies were used in compiling the part of the geologic map of Idaho that covers the area of this report (Ross and Forrester, 1947, 1958).

A special study of the Lower Teton Division of the Teton Basin Project by the U.S. Bureau of Reclamation (1962) outlined a plan to use water from a proposed reservoir to develop new land for irrigation and to obtain ground water from within the area as supplemental supply for lands presently developed. A report by Mundorff, Crosthwaite, and Kilburn (1964) briefly described the geology and ground water in the lower Henrys Fork basin and provided a map showing water-table contours and flow lines in the lowland part of the project area. Mundorff (1962) also studied the feasibility of artificially recharging the Snake Plain aquifer adjacent to and west of the Egin Bench, which is adjacent to the western border of this project.

6

Measurements of streamflow were begun in 1890 on the Henrys Fork near Ashton, Falls River at Canyon, and Teton River near St. Anthony (Wells, 1956). Since 1890, 33 other gaging stations and reservoir-stage gages have been operated for varying intervals in the Henrys Fork basin. The streamflow data are available in the annual reports of surface-water records of the Geological Survey.

<u>Geographic Setting</u>

The region may be divided into three parts, each with distinctive physiographic character. The northwestern and western parts of the area are a gently rolling plain, veneered in places with windblown sediments and underlain by basalt (fig. 2). The central part is an area of low relief, slightly lower in elevation than the basalt plain. It consists of alluvial fans and flood plains of the Snake, Teton, and Falls Rivers, and of Henrys Fork. The southeastern part of the area is a bench or upland which rises gradually to the Big Hole Mountains southeast of the project area.

The basalt plain in the northwestern part of the area rises gradually from the alluvial lowland toward centers of lava extrusion a few miles to the northwest. Although it does not have great topographic relief, the surface of the plain is generally very rough and irregular in detail and has many closed depressions. Two prominent cinder cones, the Menan Buttes, rise 500 to 600 feet above the plain just west of the confluence of Henrys Fork with the Snake River.

The central alluvial lowland slopes southwestward about 12 feet per mile from an altitude of about 5,000 feet near St. Anthony to about 4,800 feet near the junction of Henrys Fork and Snake River, a distance of 17 miles. The lowland averages about 8 miles in width. The central alluvial lowland and the western basaltic lava plain are hydrologically and topographically part of the Snake River Plain which extends southwestward from near Ashton to southcentral Idaho.
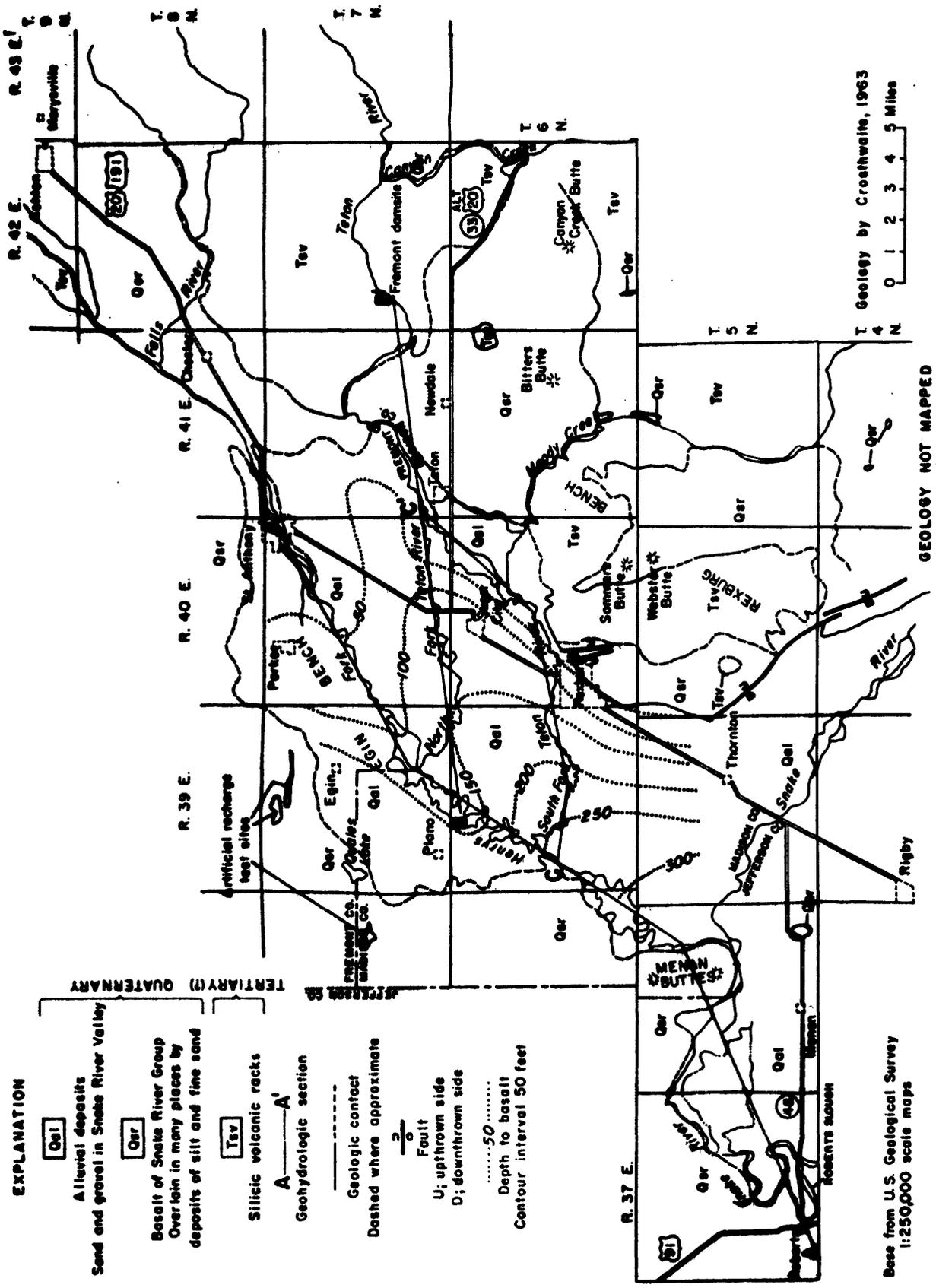
Figure 2.—Generalized geologic map of the lower Henrys Fork region showing depth to basalt and artificial recharge test sites.

The southeastern part of the area is a segment of a regional upland that borders the Snake River Plain along its southeastern flank. This upland slopes northwestward from the mountain ranges toward the plain. The slope is steepest near the mountains. The upland reaches its greatest width in the Newdale-Rexburg area where it extends about 15 miles from the base of the Big Hole Mountains to the margin of the Snake River Plain. The segment southwest of Moody Creek is called the Rexburg Bench. Its altitude at the base of the mountains is about 6,500 feet, and at its lower outer margin about 5,000 feet. South of Rexburg, the bench is separated from the plain by a fault scarp as much as 300 feet high. The bench is dissected by the deep canyons of Moody and Canyon Creeks, and Teton River.

Almost all the drainage in the area is tributary to Henrys Fork which, in turn, discharges into the Snake River in the southwest part of the area. Henrys Fork rises near the Wyoming-Montana-Idaho border, flows southward to near Ashton, then southwestward to the Snake River. It emerges from a canyon near Ashton and, at St. Anthony, its channel is incised only a few feet below the general land surface. Below St. Anthony the river flows in a valley as much as a mile wide, cut 10 to 50 feet into the flood-plain deposits.

Falls River rises in Wyoming and flows westerly to join the Henrys Fork between Ashton and St. Anthony. The river flows in a deep, narrow valley through most of its course, but about six miles

from the river's mouth the valley walls decrease in height and the river flows in a shallow channel cut in the lava plain.

The Teton River is similar to the Falls River in that it also flows in a deep valley, then emerges onto a broad flood plain before emptying into Henrys Fork. The canyon of Teton River averages about three-fourths of a mile wide, and extends upstream from near Newdale to above the river's junction with the East Fork outside the report area.

Climate

The area is characterized by cold winters and hot summers. Precipitation in the area ranges from a maximum of about 25 inches on the Rexburg Bench to about 8 inches at the west end of the lowland plain. However, precipitation in the headwaters of the streams is as much as 60 inches a year. The precipitation is greater and the temperatures are lower on the benchlands than on the alluvial and basaltic plains. The areal distribution of precipitation in the drainage basin is shown on the isohyetal map (fig. 3). Precipitation and temperature data recorded in the area are shown in the following table. The lowest and highest temperatures in the area, -44 and +104°F, have been recorded at the town of Sugar City.

Average annual precipitation, snowfall, and mean annual temperature at Weather Bureau stations in the lower Henrys Fork basin for period of record through 1961
(From records of the U.S. Weather Bureau)

Station	Altitude (feet)	Precipitation (inches)	Years of record	Snowfall (inches)	Years of record	Temperature (F°)	Years of record
Ashton	5,220	17.04	54	74.7	54	41.5	54
St. Anthony	4,968	a13.96	48	49.5	48	42.4	17
Sugar City	4,890	11.05	49	-	-	42.5	32

a Partly estimated.

Annual precipitation has ranged from 8.97 to 24.18 inches at Ashton for the period 1897 to 1961 and from 6.52 to 19.24 inches at Sugar City for the period of 1908 to 1961. Precipitation is chiefly snow during December, January, and February.
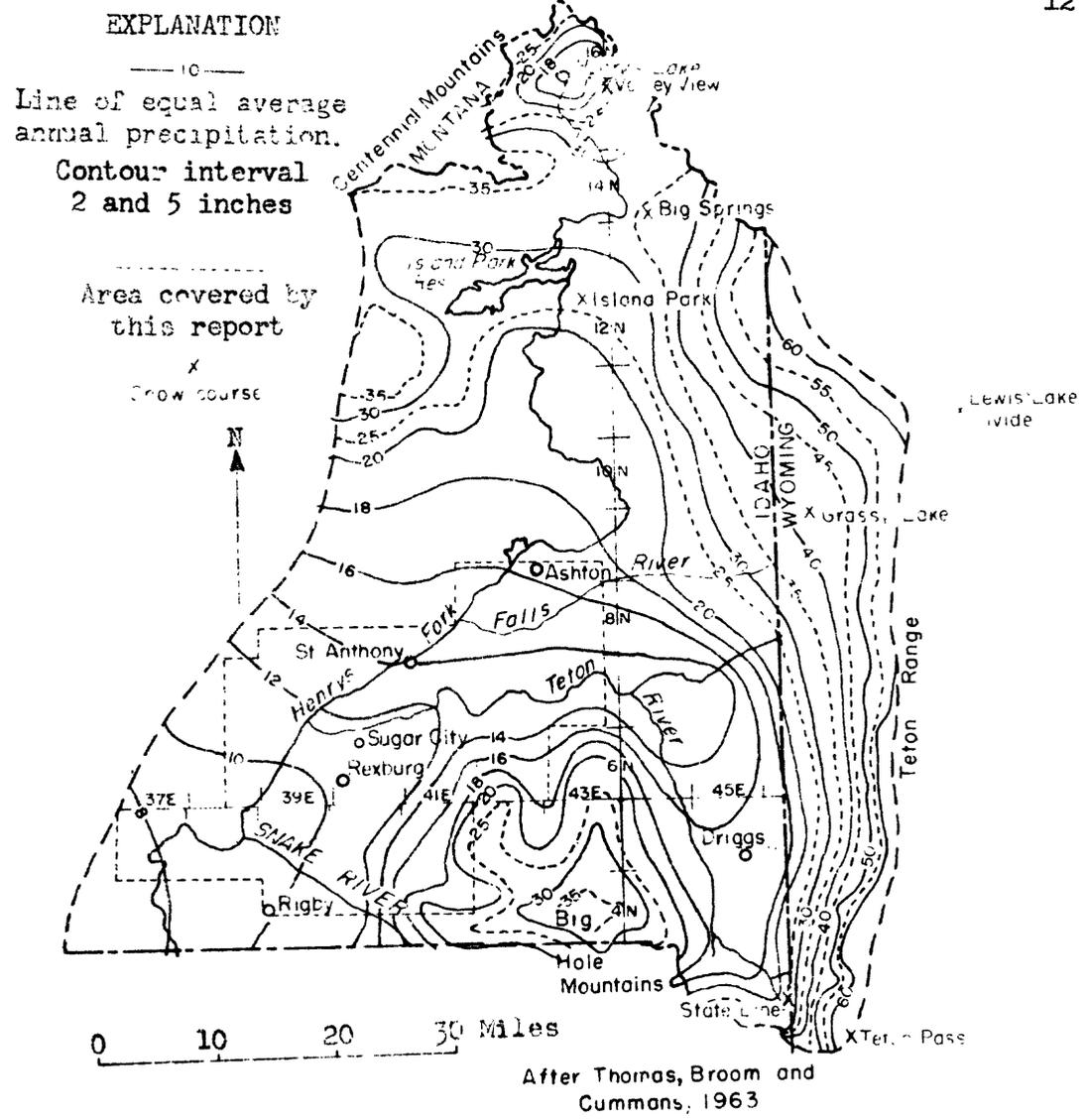
Figure 3.—Isohyetal map of the Henrys Fork basin.

Much of the precipitation in the mountains and at the higher
elevations, which comprise the headwaters areas of the perennial
streams, is in the form of snow. The largest average annual snow-
fall recorded within the area is 203.1 inches at Island Park Dam
on Henrys Fork. Data collected by the Soil Conservation Service,
U.S. Department of Agriculture, at snow measuring stations in the
upper Snake River drainage basin are as follows:

Snow course	Drainage	Altitude (feet)	Average water content[a] (inches)
Big Springs	Henrys Fork	6,500	23.6
Grassy Lake	Falls River	7,230	36.7
Island Park	Henrys Fork	6,315	17.8
Lewis Lake Divide	Falls-Snake Rivers	7,900	48.4
State Line	Teton River	6,400	16.4
Teton Pass	do	8,500	40.6
Valley View	Henrys Fork	6,500	16.4

a Generally measured near end of March, occasionally at beginning
of April. Average water content for the period 1943-57.

Monthly precipitation at Ashton and Sugar City is shown in
figure 4. The months of December, January, February, and June have
above average precipitation; April, and July-October have below
average precipitation; the other months are near average.

The frost-free growing season ranges from about 105 days on
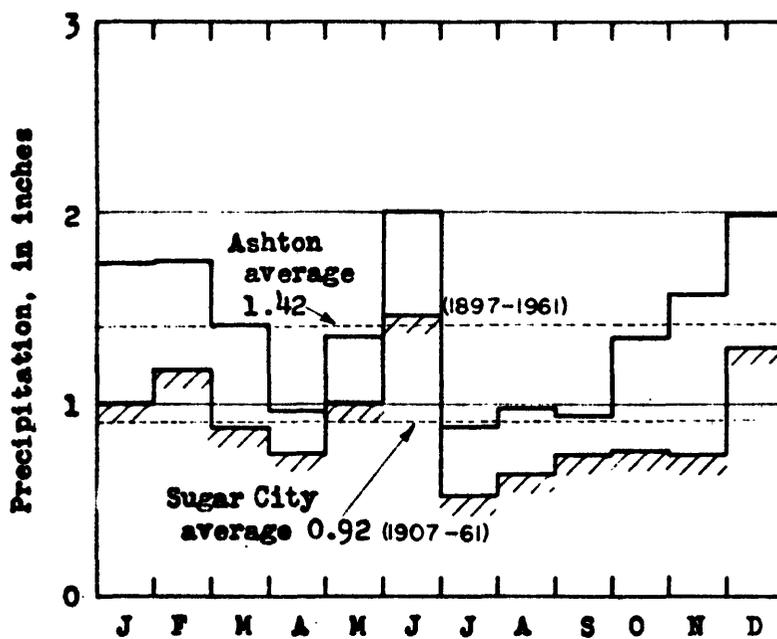the alluvial lowlands to about 95 days on the benchlands.

Figure 4.—Average monthly precipitation, in inches, at
          Ashton and Sugar City for the period of record
          through 1961.(From records of the U.S.
          Weather Bureau).

The nearest U.S. Weather Bureau stations at which evaporation
has been measured by Class-A land pans are at Aberdeen Experiment
Station, 80 miles southwest of Rexburg, and at Palisades Dam, 30
miles southeast of Rexburg. Evaporation averaged 41.64 inches at
Aberdeen Experiment Station for the 6-month period May to October
for the years 1937-60, and 35.32 inches at Palisades Dam for the
5-month period May to September for the years 1948-60. Average
annual lake and reservoir evaporation in the lower Henrys Fork region
is shown on maps prepared by Kohler, Nordenson, and Baker (1959,
pl. 2) to be about 32 inches.

The amount of water consumed by native and cultivated vegetation
is variable. Native vegetation is sparse. Using the method devised
by Blaney and Criddle (1949), consumptive use (evapotranspiration)
by sparse native vegetation, in an area where the annual precipita-
tion varies from 11 to 17 inches, ranges from 6 to 9 inches per year.
The higher value probably applies to the lower Teton basin where there
is a scattered growth of juniper trees on the benchlands that have
not been cleared for cultivation. Juniper trees require more moisture
than that which will support a growth of sagebrush and native grasses.

Net consumptive use by vegetation on irrigated land, including
precipitation during the growing season, has been estimated to range
from about 20 inches for alfalfa to about 11 inches for truck crops
(Jensen and Criddle, 1952, p. 12). Simons (1953, p. 62) estimated
net consumptive use, not including growing-season precipitation, to
average about 17 inches for all crops. The actual net consumptive
use of irrigation water by crops is not known so a value of 18 inches

was selected for use in this report because it lies between the esti-

mate of Jensen and Criddle and the estimate of Simons.

The prevailing wind is from the southwest with sustained veloc-

ities of 15 to 20 miles per hour. Gusts of much higher rate are

common; however, winds of destructive force are rare. Some wind

erosion occurs on newly plowed and seeded land, especially on the bench-

lands where loessial soils are easily transported by the wind.

Agricultural Development

The local economy is based on irrigation agriculture and industry related to agriculture. Potatoes, sugar beets, alfalfa, and small grains are the principal crops. Beef and dairy cattle are the chief livestock. About 115,000 acres of land is irrigated with water diverted from Henrys Fork, Falls and Lower Teton Rivers. Irrigation-water use in the area is high because much of the area is subirrigated. Diversion of as much as 15 acre-feet per acre per year is not uncommon in parts of the area.

The benchlands are partly dry farmed, wheat being the most common crop. The first irrigation well was drilled on the benchlands in about 1953, and, in 1962, about 9,000 acres was irrigated from 50 wells. The principal irrigated crop on the benchlands is potatoes.

Rexburg is the largest city in the area with a population (1960) of 4,767. St. Anthony and Ashton also are important towns. Newdale, Teton, Sugar City, Chester, and Parker are small villages.

Well-Numbering System

The well-numbering system used by the Geological Survey indicates the locations of wells within the official rectangular subdivisions of the public lands, with reference to the Boise base line and meridian. The first two segments of a number designate the township and range. The third segment gives the section number, followed by two letters and a numeral, which indicate the quarter section, the 40-acre tract, and the serial number of the well within the tract, respectively. Quarter sections are lettered a, b, c, and d in counterclockwise order, from the northeast quarter of each section (fig. 4a). Within the quarter sections, 40-acre tracts are lettered in the same manner. Well 5N-40E-12cd1 is in the SE¼SW¼ sec. 12, T. 5 N., R. 40 E., and is the well first visited in that tract.

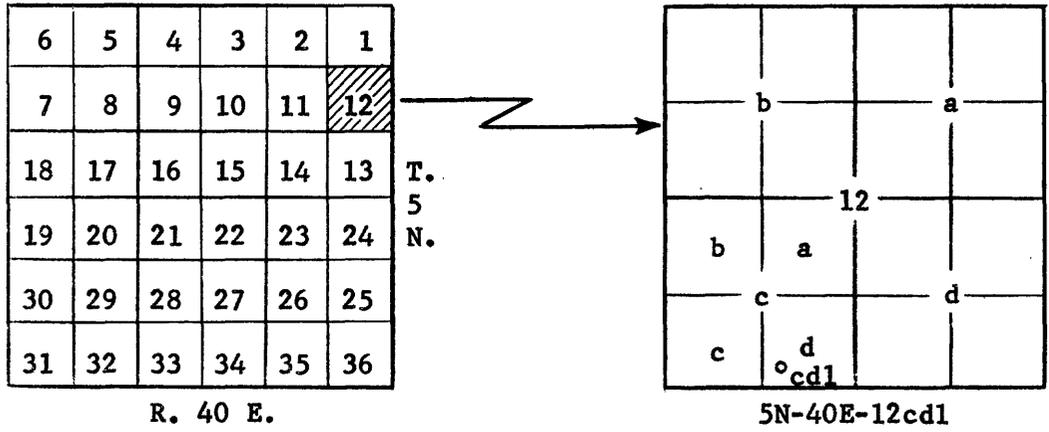Figure 4a.--Sketch showing well-numbering system.

THE GEOHYDROLOGIC FRAMEWORK

The rolling plain and lowland (p. 7) are underlain by stream alluvium and basaltic lava flows of the Snake River Group. The benchlands, which form a broad transition zone from the lowlands to the broad plateaus and mountains to the north and east, are underlain by silicic volcanic rocks. The mountains and plateaus, which are outside the area of study, are composed of many types of volcanic and consolidated sedimentary rock. The mountains and plateaus are water-yielding areas and supply surface runoff and ground-water recharge to the plain, lowland, and benchland which are water-using areas.

The alluvial deposits and basaltic lavas lie in a broad structural depression. The silicic volcanic rocks rise to the east and southeast, above the depression. To the southeast, the silicic volcanics form an apron on the northwest and north flanks of the Big Hole Mountains (fig. 2). In the southeast part of the area, the basalt and silicic volcanic rocks are separated from the alluvial deposits by a fault scarp. The areal distribution of the geologic formations is shown on figure 2.

Silicic Volcanic Rocks

The oldest rocks in the area are silicic volcanic rocks of late Tertiary(?) age. They consist of massive rocks of light gray, pink, or lavender color, and they vary from lightly compacted tuff to well indurated rock that appears to be welded tuffs or welded ash flows. Logs of wells and core holes show that ash, gravel, sand, conglomerate, and basalt flows are interbedded with the silicic volcanic rocks at depth; but none of these interbedded rocks crop out at the surface.

The silicic volcanic rocks are exposed in the eastern part of the area (fig. 2), underlying much of the Rexburg Bench and the upland south of Ashton. The regional geology indicates that these rocks underlie the entire area at depth, but wells in the basalt and alluvium in the central and west part of the area are not deep enough to penetrate them.

Water is contained in and obtained from sand, gravel, conglomerate, ash, cinders, and similar granular materials interbedded in the silicic volcanic rocks and from joints and other fractures in silicic volcanic flow rocks and welded ash flows.

Well yields range from a few hundred to several thousand gallons per minute; however, the drawdowns generally are large. Specific capacities of wells usually range from about 2 to 300 gpm per foot of drawdown. Thus, a well that yields 1,000 gpm probably has a drawdown of between 50 to 100 feet. However, several wells a few miles east of Rexburg have yields and specific capacities comparable to those in the basalts of the Snake River Group; that is, they have yields of

several thousand gallons per minute and drawdowns of about 1 foot.
There are beds of volcanic ash and layers of basalt of very high
permeability interbedded with the massive silicic volcanic rocks in
this area. North and east of Newdale, however, these highly per-
meable zones have not been found in wells.

Basalt

Gray to dark-gray vesicular basalt flows of the Snake River
Group overlie much of the silicic volcanic rocks in the benchlands
and also occur at or near the surface in the western part of the
area, west of Henrys Fork (fig. 2). Basalt also underlies the allu-
vial deposits in the central lowland part of the area.

Most of the basalt underlying the Rexburg Bench originated from
the buttes shown on the geologic map (fig. 2). Individual flows
appear to have an areal extent of only a few square miles. Outcrops
and well logs show that much of the basalt underlying the benchlands
is only one flow thick, except in a topographic low near Newdale and
in the southwest part of the Rexburg Bench. In those two places,
the aggregate thickness of the flows is several tens to several
hundreds of feet. At the buttes the basalt is a few hundred feet
thick, but it thins rapidly away from the vents and is a few feet
thick at the edges of the flows.

Basalt of the Snake River Group, of unknown but great thick-
ness, underlies the lowlands and is a part of the series of flows
which, with associated alluvium, constitutes the Snake Plain aqui-
fer (Mundorff, and others, 1964, p. 142). Basalt underlies much of
the alluvium in the St. Anthony-Rexburg area at depths of as much
as 300 feet (fig. 2), but west of the irrigated area, it is only
thinly mantled by windblown deposits, and in many places it is ex-
posed at the surface. In the thinly mantled area, alluvial deposits
as much as 140 feet thick underlie the uppermost flow.

In general, the basalt underlying the Snake River Plain is an excellent aquifer, but not all parts of it are equally permeable. The major water-bearing zones in the basalt occur at the contacts between flows, where open spaces and rubbly zones at the top of one flow were not filled completely by the succeeding flow. Scoriaceous materials, cinders, and gravel also add to the peremeability of the interflow zones. Water-bearing interflow zones occur primarily where two or more lava flows occur in succession. At some places along the margins of the alluvium, where individual basalt flows interfinger with fine-grained sediments, the basalt is not a good aquifer. However, where 100 feet or more of basalt is penetrated below the water table, wells generally yield several thousand gallons per minute with only a few feet of drawdown.

Alluvial Deposits

25

Alluvial deposits composed of clay, silt, sand, and gravel occupy
almost all the central lowland from near St. Anthony southwestward to
beyond the Snake River (fig. 2). Also, much of the basalt between
Ashton and St. Anthony is veneered with silt, sand, and gravel which
probably does not exceed 25 feet in thickness. The alluvial deposits
become progressively thicker southwestward from St. Anthony. Near
the confluence of the South Fork Teton River with Henrys Fork, they
are about 250 feet thick and they may be as much as 350 feet thick
near the mouth of Henrys Fork. Logs of well 7N-38E-23db1 indicate
that as much as 140 feet of alluvial deposits underlie basalt that is
younger than the basalt of the Snake Plain aquifer.

Logs of several wells suggest that the alluvial deposits west of
Henrys Fork are predominantly sand; whereas the alluvial deposits in
the remainder of the area contain a large amount of gravel.

Coarse sand and gravel, which predominate in the alluvium, form
an excellent aquifer. Clay and silt strata, interbedded with the sand
and gravel, are individually thin and collectively form a small per-
centage of the total thickness. The sand and gravel ordinarily do not
have as high a coefficient of transmissibility as the basalt, but yields
of several thousand gallons per minute with little drawdown probably
can be obtained from properly constructed wells.

THE PERCHED WATER TABLE

Surface-water irrigation has resulted in a perched water table in the alluvial deposits in the Fremont-Madison Irrigation District (fig. 5). The perched water extends as far west as Menan Buttes. The perched table is only a few feet below land surface and in parts of the area, particularly on the Egin Bench, subirrigation of crops is practiced. The perched water table fluctuates 2 to 40 feet annually depending on the amount of irrigation water applied and the local nature of the alluvial deposits.

Part of the perched water on the south side of Henrys Fork moves downward to the regional water table and part moves to Henrys Fork, either directly or after entering Teton River and other drainage channels. Perched water north of Henrys Fork forms a ground-water ridge from which there are two components of flow. One component is downward to the regional water table and the other is laterally to the north, west, and south away from the ridge. Henrys Fork receives water from the southward lateral component of flow, but the remaining components eventually descend to the regional water table.

An average (for the period 1928-57) of about 865,000 acre-feet of water was diverted each season (May to September inclusive) to irrigate 112,400 acres in the Fremont-Madison Irrigation District. Forty canals which head in Henrys Fork and Falls and lower Teton Rivers carry the water. As much as 15 acre-feet per acre is diverted in some of the canal-system areas, but the average diversion per acre for all irrigated land is about 7.7 acre-feet. Falls and Teton
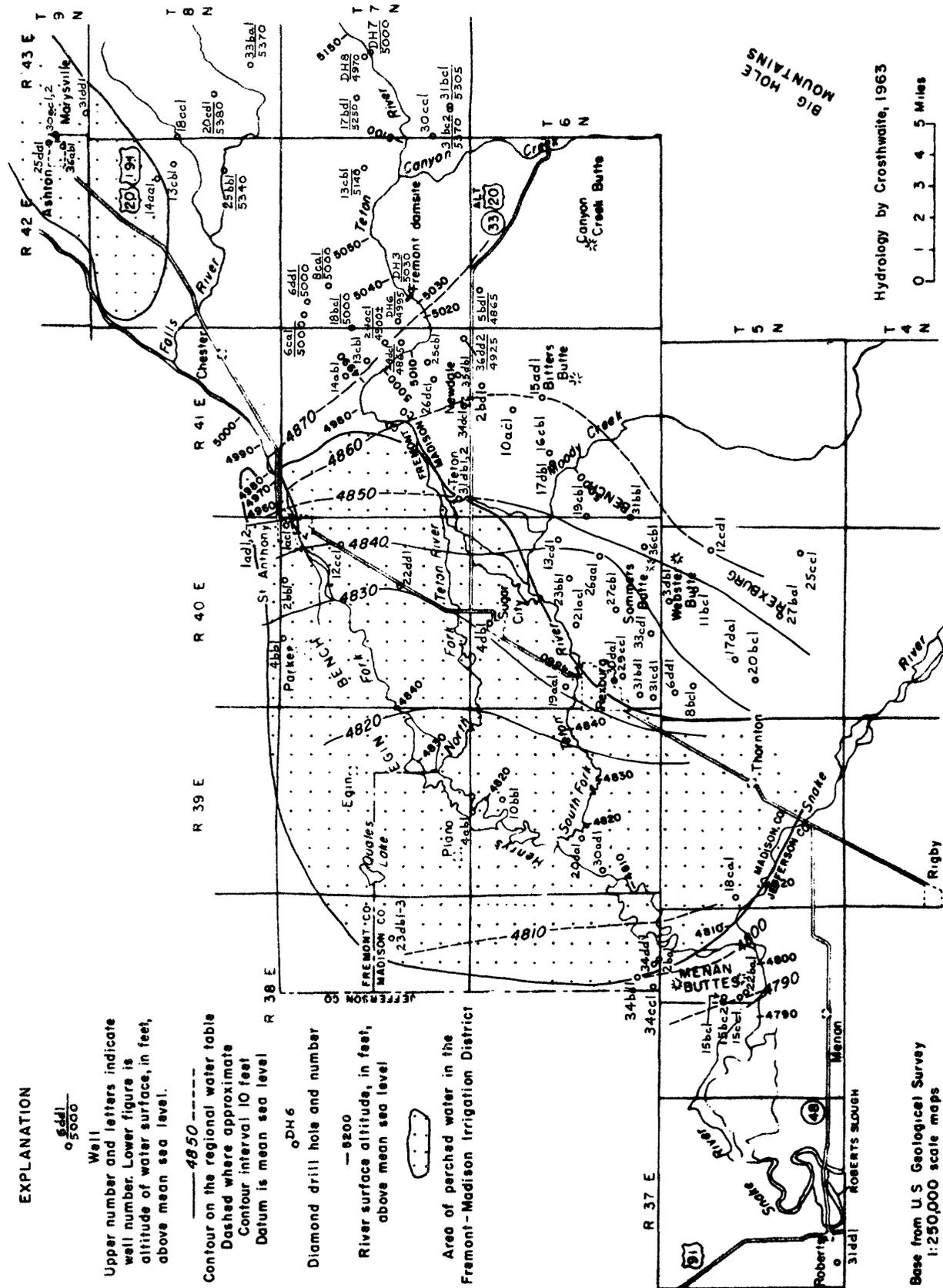
Figure 5.—Map showing water-level contours and location of selected wells in the lower Henrys Fork region.

Rivers and Henrys Fork gain, from discharge of perched water and irrigation return flows, an average of about 190,000 acre-feet per irrigation season in the reaches adjacent to the irrigated area. Loss of water to evapotranspiration (crop use) is estimated to be about 170,000 acre-feet annually (112,400 acres X 1.5 acre-feet per acre). Thus about 500,000 acre-feet of the water entering the perched water table percolates downward to the regional water table.

Data on winter diversions to the canal system are available for only the 1942-43 winter when they totalled about 235,000 acre-feet. The gain in streamflow from the perched water body during the same winter period was 135,000 acre-feet. For estimation purposes, the foregoing values are assumed to be representative of the average annual winter diversions for this area. Because evapotranspiration rates are low during the winter months, a figure of 0.5 acre-foot per acre was used to compute a total evapotranspiration loss of about 56,000 acre-feet from October to April inclusive. Calculations using these data and the irrigation season data suggest that the perched water table contributes a total of about 550,000 acre-feet annually to the Snake Plain aquifer.

In the Ashton part of the Fremont-Madison Irrigation District, 20 to 100 feet of basalt overlies the silicic volcanic rocks. Irrigation with water from Falls River has built up a water table in the basalt that is perched above the regional water table. The perched water lies at shallow depth beneath the land surface and has formed many swampy areas. Although some of the perched water may percolate downward through the silicic volcanic rocks to the main water table, much of the discharge is to Henrys Fork.

Contours drawn on the regional water table are shown in figure 5.
In general, the water table beneath the Rexburg Bench slopes north-
westward toward the alluvial plain. The water table slopes westward
and southwestward beneath the central alluvial plain and the Snake
River Plain. In the western part of the report area, the water-table
gradient is mostly less than 1.5 feet per mile. The gradient is
greater in the eastern part and is as much as 5 feet per mile east of
Newdale and St. Anthony.

In the proposed reservoir area and in the adjacent uplands, the
position of the water table cannot be determined satisfactorily from
the available data. Diamond drill holes on the upland at the Fremont
damsite (fig. 5) indicate that ground water occurs at about 5,030 feet
above mean sea level on the south side of the Teton River and at about
4,995 feet on the north side of the river. The altitude of the river
surface at the damsite is about 5,030 feet. The water level in drill
hole 7 (fig. 5), about 10 miles upstream from the damsite and on the
south side of the river stands at about 5,000 feet; and the water
level in drill hole 8, on the north side of the river, opposite drill
hole 7, stands at about 4,970 feet.

Water levels in irrigation wells 2 to 3.5 miles north of the
damsite stand at about 5,000 feet in the wells farthest from the river,
and at 4,865 (in well 7N-41E-24dc1) to 4,900 feet in the wells nearest
the river. These wells were drilled from 235 to 640 feet below the
water level (altitude at bottom of deepest well, 7N-42E-6dd1, is 4,355

feet). Water levels in stock and domestic wells north of the reservoir site range from about 5,140 feet near the river to about 5,380 feet several miles northeast of the reservoir site.

The altitude of water levels in four wells south of the reservoir site ranges from 4,865 to 5,370 feet. Water-level altitudes, rounded to the nearest 5 feet, are shown on the water-table contour map (fig. 5).

The data suggest that the water levels in wells 7N-41E-24dc1, 6N-42E-5bd1, 7N-43E-32bc1, and drill hole 8 coincide with the altitude of the regional water table, but the water in most wells and drill holes is perched above the regional water table, and that the river also is perched above the regional water table. If these indications are correct, then the river is perched an average of about 150 feet above the regional water table from the damsite at least as far upstream as drill hole 8. The foregoing suggests that interconnection between the perched water table and the regional water table must be very poor.

The regional water table is below the water surfaces of all canals and streams in the Fremont-Madison Irrigation District and in the Rexburg Bench and other upland areas. Near the mouth of Henrys Fork, the water table is only a few feet below river level; and in early autumn when the water table is the highest and the river level is low, the water table may be at or very near river level. The geologic and hydrologic sections along Henrys Fork and North and South Forks Teton River (figs. 6, 7, and 8) show that the water table
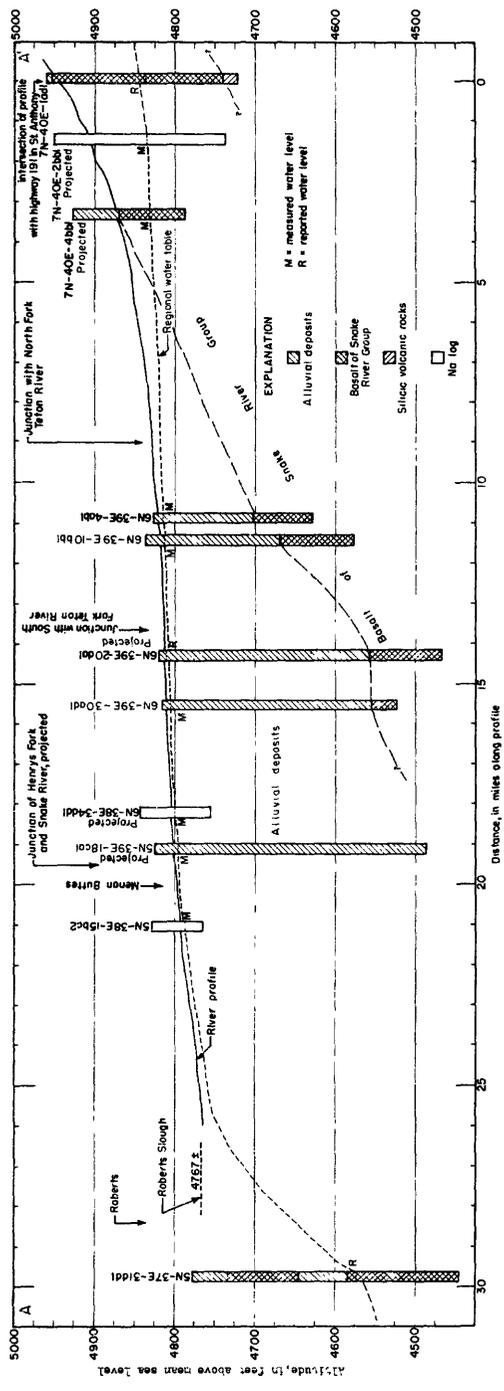
Figure 7.—Geohydrologic section along Henrys Fork and Snake River (section A-A', figure 2).
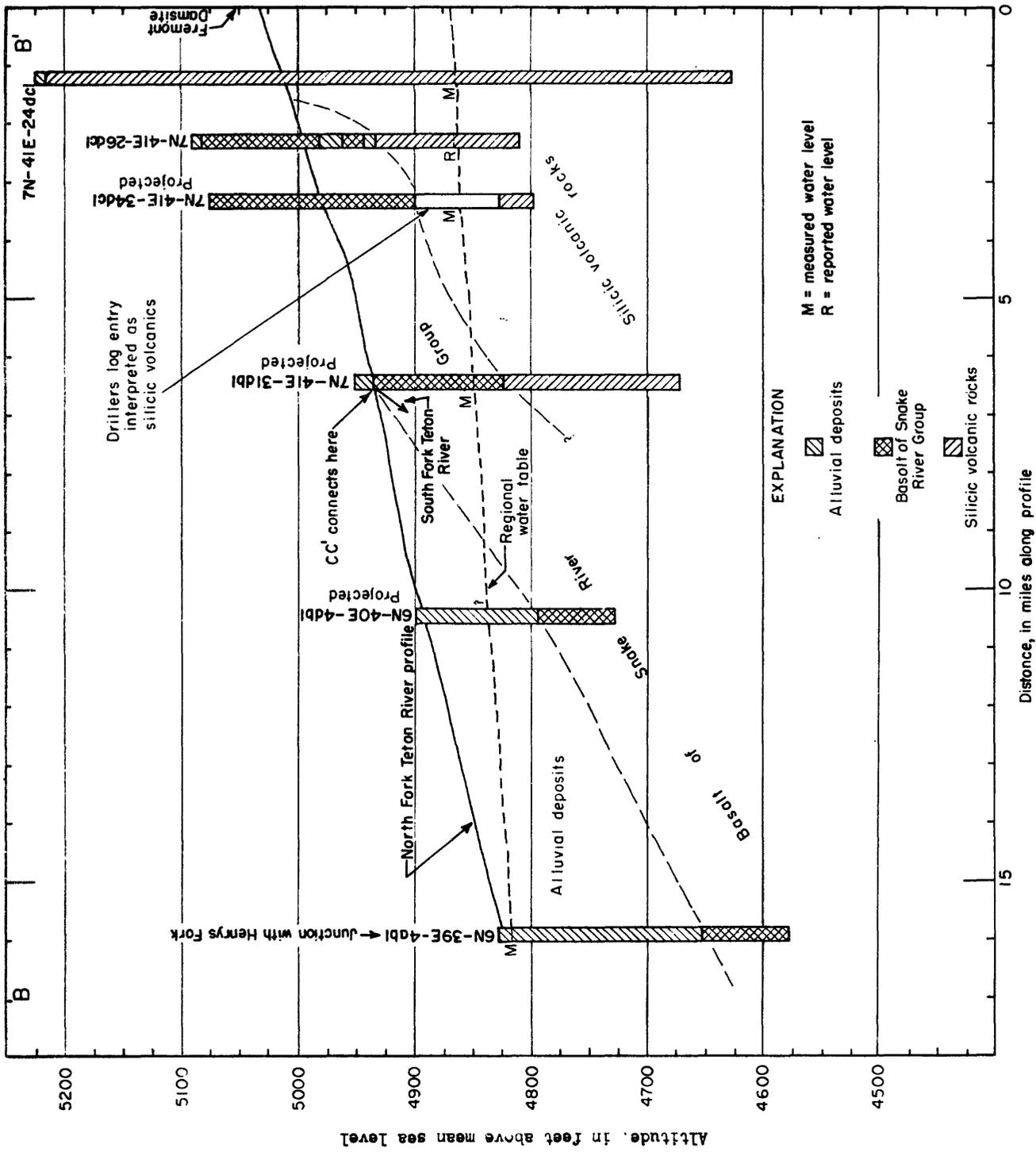
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Figure 7.—Geohydrologic section along North Fork Teton River (section B-B' figure 2).
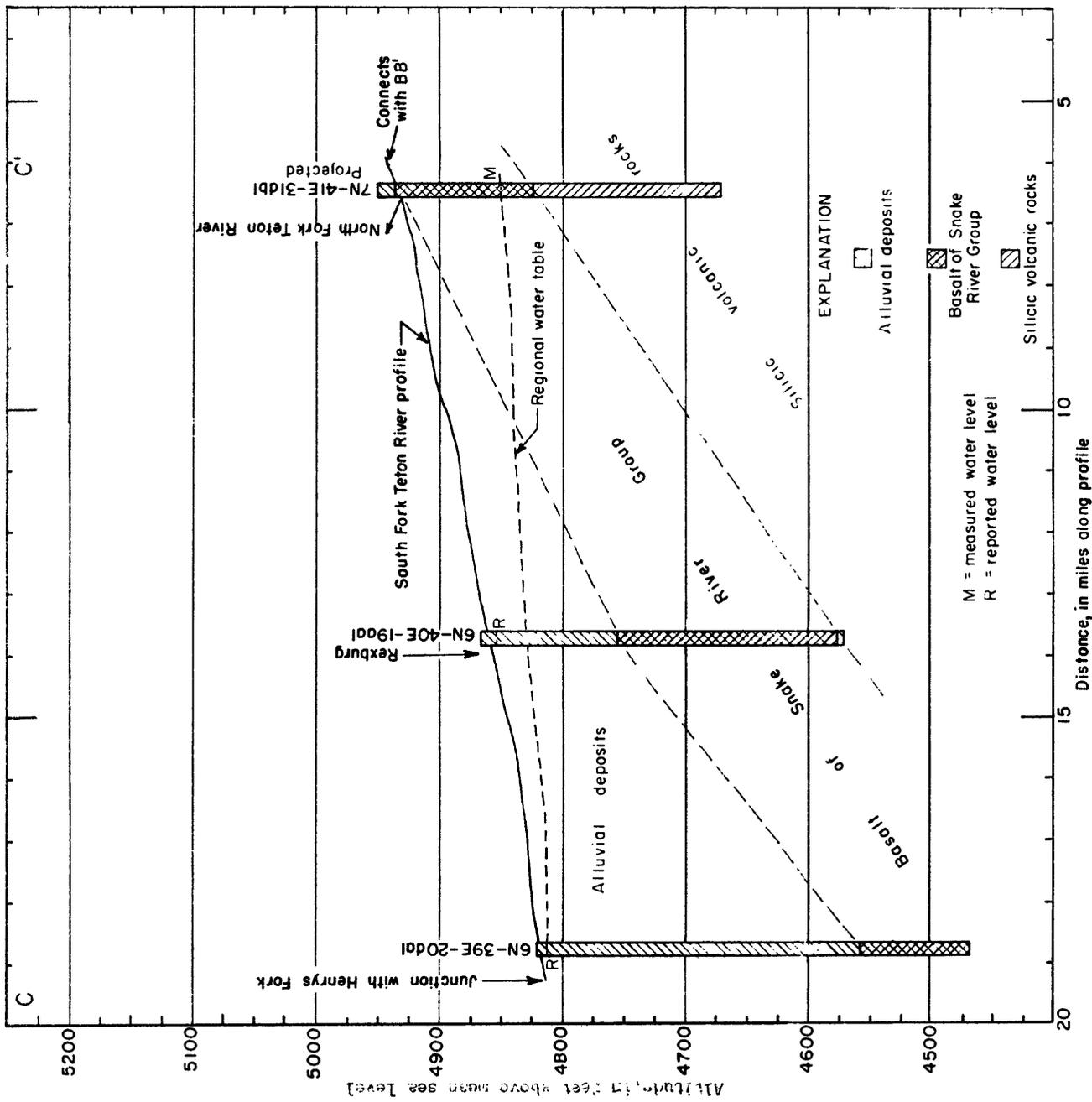
33

Figure 8.—Geohydrologic section along South Fork Teton River (section C-C' figure 2).

becomes progressively farther below river level in the upstream direction. Henrys Fork at St. Anthony and the Teton River near Teton are perched about 100 feet above the regional water table. As mentioned above, the Teton River is about 150 feet above the regional water table at the Fremont damsite.

The annual range in fluctuation of the regional water table is about 5 feet in the western part of the Fremont-Madison Irrigation District and 8 to 10 feet in the St. Anthony-Teton area. Water levels are lowest in April and highest in the latter part of September or the early part of October (fig. 9).

The annual cycle of fluctuation in the Rexburg Bench and other upland areas is not as great as in the Fremont-Madison Irrigation District and the dates of the high- and low-water levels are slightly different. The annual range in fluctuation is 3 to 6 feet, the low being in May and the high being in late October or early November.

The regional water table in the Fremont-Madison Irrigation District is strongly influenced by surface-water irrigation whereas this same regional water table in the silicic volcanic rocks is little influenced by irrigation and only slightly influenced by local precipitation.

Mundorff (1962, p. 24) estimated that the average annual amount of ground water leaving the lower Henrys Fork region is on the order of 725,000 acre-feet a year. About 550,000 acre-feet of this amount originates in the Fremont-Madison Irrigation District, as explained in the preceding section. The lesser part (175,000 acre-feet) is precipitation that infiltrates into the ground in the headwaters of Henrys Fork, Falls, and Teton Rivers and moves southwestward beneath the lower Henrys Fork region.
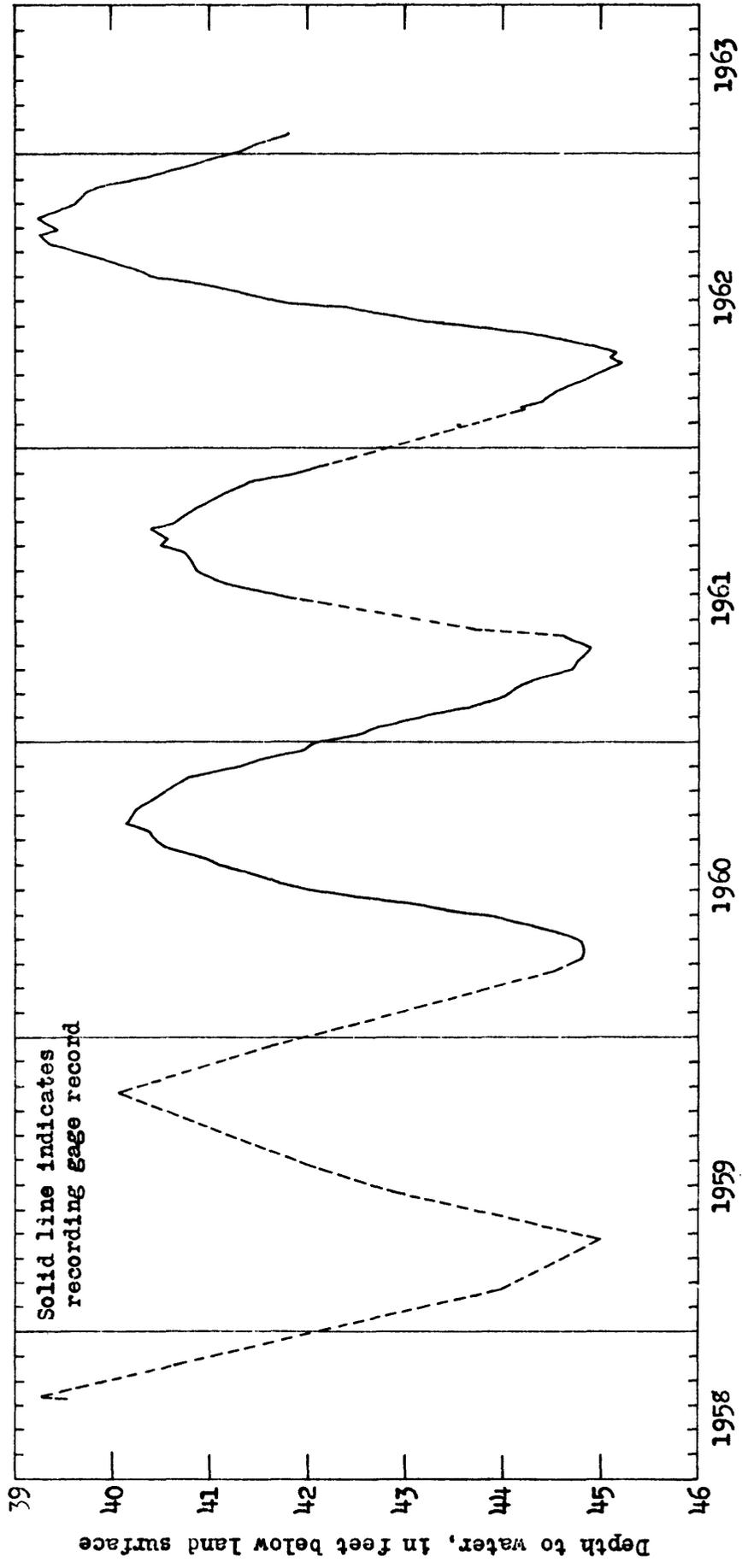
Figure 9.—Hydrograph of well 7N-38E-23db1, Madison County

REGIONAL AVAILABILITY OF GROUND WATER

Rexburg Bench and Other Upland Areas

The silicic volcanic rock aquifers beneath the Rexburg Bench and extending to the northeast a few miles past Moody Creek toward Newdale generally yield large quantities of water to wells. Calculations using specific capacity data from irrigation wells suggest that coefficients of transmissibility range from about 15,000 to 4 million gpd per foot. These coefficients must be used with caution because most of the specific capacity information is from wells that were pumped at several rates for a total time of from only 2 to 4 hours. Nevertheless general conclusions can be made from the data.

In general, wells in the southeast quarter of T. 6 N., R. 40 E., have the highest yields with least drawdown; that is, wells in this part of the Rexburg Bench have the largest specific capacities which indicate that the coefficient of transmissibility of the silicic volcanic rocks is higher here up to 4 million gpd per foot than it is in other places where exploration for ground water has occurred. Specific capacities of more than 2,000 gpm per foot of drawdown have been measured in wells 6N-40E-23bb1 and 6N-40E-26aa1.

Northeast and southwest of the southeast quarter of T. 6 N., R. 40 E., specific capacities are much smaller and the coefficient of transmissibility of the silicic volcanic rocks probably ranges between 15,000 and 250,000 gpd per foot. However, tests on some of the wells just east of Rexburg indicate coefficients of transmissibility in the range from 100,000 to 400,000 gpd per foot.

In the uplands northeast of Newdale and extending toward Ashton, wells drilled for irrigation have not been very successful. North of Falls River and in the Ashton area, irrigation and public-supply wells obtain relatively small amounts of water from silicic volcanic rocks because the rocks have a very low permeability.

Wells just south of Rexburg in basalt of the Snake River Group have specific capacities which indicate coefficients of transmissibility of 500,000 to 1,000,000 gpd per foot. With the exception of the Ashton area (see p. 39) and the area just south of Rexburg, the basalt of the Snake River Group in the Rexburg Bench and other upland areas is not known to contain significant quantities of water.

Pumping of ground water from silicic volcanic rocks beneath the Rexburg Bench has caused no significant decline in water levels. Total pumpage in 1962 is estimated to be 25,000 acre-feet.

The silicic volcanic rocks of the Rexburg Bench are recharged from precipitation on the area of outcrop principally at higher elevations and by seepage from streams along the northwest flank of the Big Hole Mountains. The area contributing recharge to this unit is roughly 300 square miles or about 200,000 acres. According to the relationship between water yield (all water leaving a basin by surface or underground flow) and average annual precipitation given in the report by Mundorff, Crosthwaite, and Kilburn (1964, fig. 7), the average annual water yield based on an estimated average annual precipitation of 16 inches is about 4½ inches over the area. Total water yield for the area of the Rexburg Bench would be about 75,000 acre-feet annually. On the basis of the few available streamflow records,

about 40,000 to 50,000 acre-feet of this quantity runs off annually in Canyon and Moody Creeks, leaving about 25,000 to 35,000 acre-feet annual recharge to the Rexburg Bench. Thus, estimated annual withdrawals are approaching the estimate of annual recharge.

In the Rexburg Bench ground-water flow is estimated to be small, and withdrawal of ground water in those parts of the Bench where the coefficient of transmissibility is low, the water table eventually will decline considerably with the pumping of significant amounts of water. At places where the coefficient of transmissibility, as inferred from the hydraulic gradient and specific capacities, is high, the decline in the water table will be correspondingly small. The present (1962) withdrawal rate should cause a measurable decline in the water table within the next few years. However, if surface water is used to irrigate an extensive part of the Rexburg Bench, seepage losses from irrigation will more than offset ground-water depletion and cause a rise in the water table.

If the surface- and ground-water relationships are as postulated, pumping generally will not affect streamflow within the Rexburg Bench. However, part of the water in the aquifer discharges into the reach of the Snake River from Blackfoot to American Falls. Depletion of ground water by pumping will be reflected by a reduction of inflow in that reach unless seepage from applied surface water increases sufficiently to offset the depletion. Additional seepage could be obtained either by artificial recharge or by irrigating additional land with surface water, or by both methods.

Ashton Area

Some ground water can be pumped from the basalt aquifer in the area around Ashton and Marysville and in an area extending a few miles southwestward from Ashton. Sparse data about water levels and geology suggest that the water in the basalt is perched upon the underlying silicic volcanic rocks. Many swampy areas, seeps, and springs discharge into natural channels which drain to Henrys Fork. Some of the land is waterlogged. Pumping could alleviate some drainage problems and, at the same time, provide supplemental water.

Well data indicate that a satisfactory ground-water supply is not available for irrigation in the remainder of the Ashton area of the Fremont-Madison Irrigation District.

The quantities of ground water that can be pumped for supplemental irrigation cannot be estimated satisfactorily until further work is done in the area. Pumping of supplemental ground water will deplete the flow of Henrys Fork to the extent that the supplemental water is consumed by evapotranspiration, because the perched water that would be pumped is tributary to Henrys Fork.

Falls River

A brief examination was made of the Falls River drainage from east of Chester to the Idaho State line. Nothing was found to suggest that a significant amount of ground water could be developed for irrigation.

Wells on the Rexburg Bench and other upland area produce mostly

from silicic volcanic rocks. Yields range from a few hundred to

several thousand gallons per minute, but the large yields are restric-

ted to the southeast part of T. 6 N., R. 40 E. In a small part of the

Rexburg Bench and in the lowlands, wells in the basalt of the Snake

River Group generally yield several thousand gallons per minute with

only a few feet of drawdown. The sand and gravel in the alluvial

deposits generally do not have as high a coefficient of transmissi-

bility as the basalt, but yields of several thousand gallons per

minute with little drawdown can probably be obtained from properly

constructed wells.

Surface-water irrigation has resulted in a perched water table

in the alluvial deposits in the Fremont-Madison Irrigation District.

It is estimated that downward leakage of the perched water contributes

550,000 acre-feet annually to the regional water table and the perched

water and irrigation return flows contribute an estimated 325,000

acre-feet annually to streamflow. In the Ashton part of the irriga-

tion district, perched water lies at shallow depth in basalt. Some

of the perched water may percolate downward to the regional water

table, but much of it discharges to Henrys Fork.

In general, the regional water table slopes southwestward and

westward, but beneath the Rexburg Bench it slopes northwestward. Near

the mouth of Henrys Fork, the regional water table is only a few feet

below river level, but the water table becomes progressively farther

below river level in an upstream direction, at St. Anthony it is about
100 feet below the Henrys Fork. At the Fremont damsite on the Teton
River, the regional water table is about 150 feet below stream level.
It is estimated that about 725,000 acre-feet of ground water leaves
the lower Henrys Fork region annually. About 550,000 acre-feet of
this amount originates in the Fremont-Madison Irrigation District and
175,000 acre-feet infiltrates into the ground in the headwaters of
the Henrys Fork, Falls, and Teton Rivers and moves southwestward
beneath the lower Henrys Fork region.

Aquifers beneath the Rexburg Bench generally yield large quanti-
ties of water to wells, but northeast of Newdale and extending to
Ashton only small amounts of water can be developed from the regional
ground-water body. Withdrawals were about 25,000 acre-feet in 1962.
This withdrawal caused no significant lowering of the water table.
Ground-water pumping generally will not affect streamflow within the
Rexburg Bench. However, depletion by ground-water pumping will be
reflected by a reduction in discharge of the regional ground-water
body many miles downstream from the lower Henrys Fork region.

In the Ashton area, some water can be pumped from the basalt
aquifer. Pumping from this aquifer would deplete the flow of Henrys
Fork to the extent that the water pumped is consumed by evapotrans-
piration.

There is no evidence to indicate that a significant amount of
ground water can be developed in the Falls River area for irrigation.

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