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GROUND-WATER RESOURCES OF NORTHERN JUAB VALLEY, UTAH

by L. J. Bjorklund

Hydrologist, U. S. Geological Survey

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ABSTRACT

Northern Juab Valley covers an area of about 120 square miles in the northern half of Juab Valley, a structural trough bounded on the east by the Wasatch Fault. Rocks of Paleozoic, Mesozoic, Tertiary, and Quaternary age are exposed in the mountains adjacent to the valley. The material composing the valley fill is of Quaternary age.

The principal source of recharge to the ground-water reservoir is infiltration from streams that originate in the mountains and flow into the valley. Secondary sources of recharge are infiltration from irrigation and subsurface inflow from adjacent areas. Artificial recharge could be carried out on the eastern side of northern Juab Valley, the best location being on the alluvial fan of Salt Creek near Nephi.

Most of the ground water is in unconsolidated valley fill. Water-table conditions prevail in a 1-3 mile wide strip near the edges of the fill and leaky artesian conditions prevail toward the center of the valley. Perched water-table conditions occur locally. The quantity of water in storage is not known; however, it is estimated that a net change of 6,000 acre-feet in storage would cause a net change of 1 foot in water level in the area where water-table conditions prevail. The maximum depth to water exceeds 300 feet beneath the higher surfaces of alluvial fans, whereas artesian heads are as much as 27 feet above the land surface in the lower parts of the valley.

Water levels in the valley declined during the period 1947-64 due to a combination of below-normal precipitation and pumping for irrigation. The decline has been greatest in the vicinity of Nephi and in the area east of Mount Nebo Reservoir (locally known as the Mona Reservoir).

Alluvial-fan deposits have the greatest water-yielding potential, and coefficients of transmissibility as high as 2,000,000 gpd per ft (gallons per day per foot) were indicated by aquifer tests in wells tapping fan material. Coefficients of transmissibility ranging from 13,000 to 26,000 gpd per ft were indicated by the specific capacities of wells in the lower parts of the valley.

Approximately 12,400 acre-feet of water was pumped from wells in 1965, 13,000 acre-feet in 1964, and 14,600 acre-feet in 1963. The decreased pumpage during 1964 and 1965 is attributed to above-normal precipitation during these years and a shortened irrigation season in 1965. About 2,500 acre-feet of water was discharged from flowing wells during each of these years. Most of the water is used for irrigation.

Springs and seeps discharge water in the lower parts of the valley, mostly near Burriston Ponds, along Currant Creek, and near Mount Nebo Reservoir.

About 18,000 acre-feet of water is consumed annually by evapotranspiration in about 7,000 acres in the lowest part of the valley. A young growth of saltcedar in this area represents a future threat to the ground-water resources.

Most of the ground water in northern Juab Valley contains less than 1,000 ppm (parts per million) of dissolved solids. The freshest ground water is north and east of Mona and along the Wasatch front southward from a point about 2 miles north of Nephi. Slightly saline water was collected at seven wells. The most highly mineralized sample contained 2,200 ppm of dissolved solids and was obtained from a well in Salt Creek Canyon. The relatively high salinity is attributed to solution of the Arapien Shale.

Most of the ground and surface water that is used for irrigation had a low-sodium hazard and either a medium- or high-salinity hazard. There is little danger of sodium damage to irrigated fields in the valley if the fields are drained of excess water. The salinity hazard is not a problem because the crops commonly grown—alfalfa and grains—are moderately tolerant to salinity.

All the wells and springs sampled in the northern part of the valley and also the public supplies for Nephi and Mona yielded water of excellent chemical quality for domestic and public use. Of the samples tested for hardness, 24 were very hard and 2 were hard.

The temperature of ground water at 58 wells and springs ranged from 48° to 68°F, and averaged 54°F.

INTRODUCTION

Purpose and scope of the investigation

This report gives the results of an investigation of the ground-water resources of northern Juab Valley, Utah, that was carried out between June 1964 and July 1966, by the U. S. Geological Survey in cooperation with the Utah State Engineer. The study was made in order to provide water users, administrators, and other interested parties with information on the character and extent of the water-bearing formations and the origin, quantity, movement, availability, chemical quality, and use of ground water in the valley.

Location, extent, and population of the area

Northern Juab Valley is in central Utah at the eastern end of Juab County. (See fig. 1.) The investigation was devoted mainly to the valley floor, which has an area of about 120

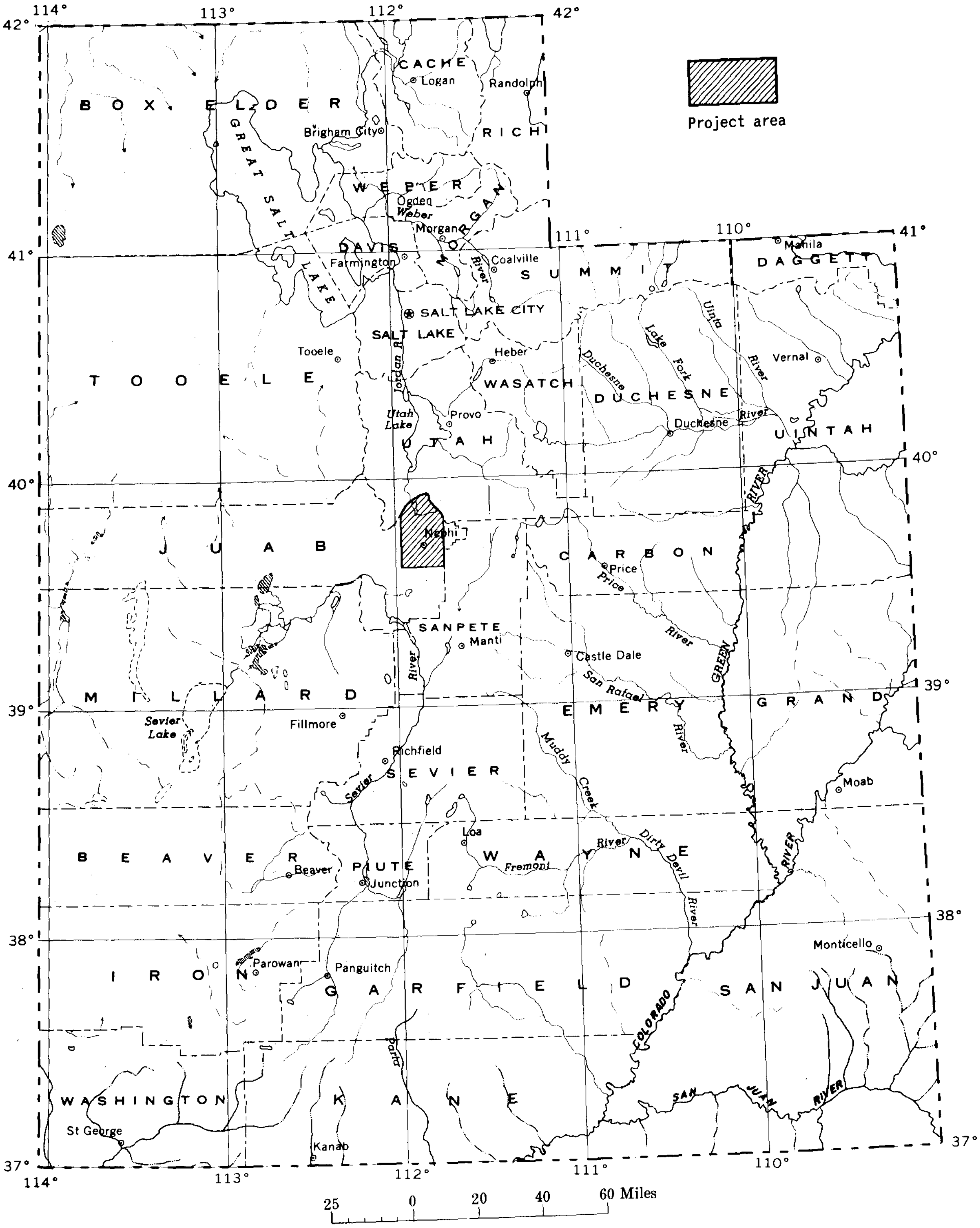

Figure 1. — Location of the project area.

square miles, and only secondarily to the drainage basin of northern Juab Valley, which has an area of about 300 square miles. In this report, reference to northern Juab Valley means the part of the valley underlain by the valley fill, unless specifically stated otherwise. The area of study was extended 4 miles southward into southern Juab Valley in order to show the position of the ground-water divide between northern and southern Juab Valleys.

The population of northern Juab Valley is estimated to be about 3,000. Most of the people live in two communities—Nephi (population in 1960, 2,566) and Mona (347). The economy of the valley is mainly agricultural; and alfalfa, grains, livestock, and poultry are the principal products.

Previous investigations

The ground-water resources of northern Juab Valley were first studied by Meinzer (1911, p. 67-74) as part of a reconnaissance of Juab, Millard, and Iron Counties, Utah.

Ground-water levels have been measured periodically since 1935 in selected wells in northern Juab Valley by the U. S. Geological Survey (1936-57, 1963b).

Streamflow of Salt Creek entering the valley at Nephi has been gaged since 1950, and streamflow of Currant Creek was gaged during 1953-60. These data through 1960 have been published by the U. S. Geological Survey (1963c). Flow data for Salt Creek since 1960 have been published annually by the U. S. Geological Survey (1961, 1962, 1963a, 1964, 1965) in cooperation with the Utah State Engineer and others in a series entitled "Surface water records of Utah."

Several investigations have been made of the geology of parts of the area included in this report and of adjacent areas. Most of these reports are concerned with the stratigraphy, structure, physiography, and economic features of the mountains adjacent to southern Juab Valley. Some of these reports are listed in the section "Selected references."

Methods of investigation

Monthly water-level measurements were made at 14 wells and a continuous water-level recording gage was operated at 1 well during the period of investigation. Past records of water levels at most of these wells, some dating back to 1935, were obtained and included in table 5.

Well records of the Utah State Engineer were consulted and well owners or tenants were interviewed in an attempt to obtain data for all existing wells and major springs in the valley. Records were obtained for 138 wells with principal uses as follows: irrigation, 32; stock, 49; domestic, 12; industrial, 2; and unused, 43. Water-level data were obtained also in 18 shallow augered wells constructed for observation purposes by the U. S. Bureau of Reclamation. Records of these 156 wells and 9 springs are shown in table 4, and their locations are shown on plate 3.

Rates of pump discharge and flow from wells and springs were measured or estimated. Electrically driven pumps at irrigation wells were rated (electrical energy consumption measured concurrently with the amount of water discharged) to facilitate the computing of annual discharge from annual power consumption. Annual discharge from pumped wells not equipped with electric pumps was estimated from discharge measurements and information from the well owner as to the length of the pumping period and the area of the various crops irrigated.

Streams were measured periodically with a Pygmy current meter to determine the relationship of streamflow to ground-water conditions.

Altitudes of the land surface at wells were estimated from topographic maps or determined by hand leveling or spirit leveling. Some altitudes were obtained from records of the Utah State Engineer.

Water samples for chemical analyses were obtained from selected wells and springs. The analyses of samples previously collected by the U. S. Bureau of Reclamation, the Geological Survey, and the Utah State Department of Public Health were obtained and included in table 7.

Well- and spring-numbering system

Wells and springs are numbered in this report using the system of numbering wells in Utah, which is based on the cadastral land-survey system of the Federal Government. The number, in addition to designating the well or spring, locates its position to the nearest 10-acre tract in the land net. By this system the State is divided into four quadrants by the Salt Lake base line and meridian. These quadrants are designated by the uppercase letters A, B, C, and D, thus: A, for the northeast quadrant; B, for the northwest; C, for the southwest; and D, for the southeast quadrant. Numbers designating the township and range, respectively, follow the quadrant letter, and the three are enclosed in parentheses. The number after the parentheses designates the section, and the lowercase letters give the location of the well within the section. The first letter indicates the quarter section, which is generally a tract of 160 acres, the second letter indicates the 40-acre tract, and the third letter indicates the 10-acre tract. The number that follows the letters indicates the serial number of the well within the 10-acre tract. Thus, well (C-13-1)26aad-1, in Juab County, is in the SE¼NE¼NE¼ sec. 26, T. 13 S., R. 1 W., and is the first well constructed or visited in that tract. (See fig. 2.) When the serial number is preceded by an "S," the number designates a spring.

Acknowledgments

The cooperation of the residents of northern Juab Valley and of officials of the State of Utah, of Nephi and Mona, of irrigation and electrical power companies, and others who gave information and permitted measurements at wells and springs is gratefully acknowledged. The U. S. Bureau of Reclamation provided a considerable amount of basic data that are used in this report.

PHYSICAL SETTING

Physiography and drainage

Northern Juab Valley is approximately the northern half of Juab Valley and is in the Great Basin section of the Basin and Range physiographic province (Fenneman, 1931, p. 348-367).

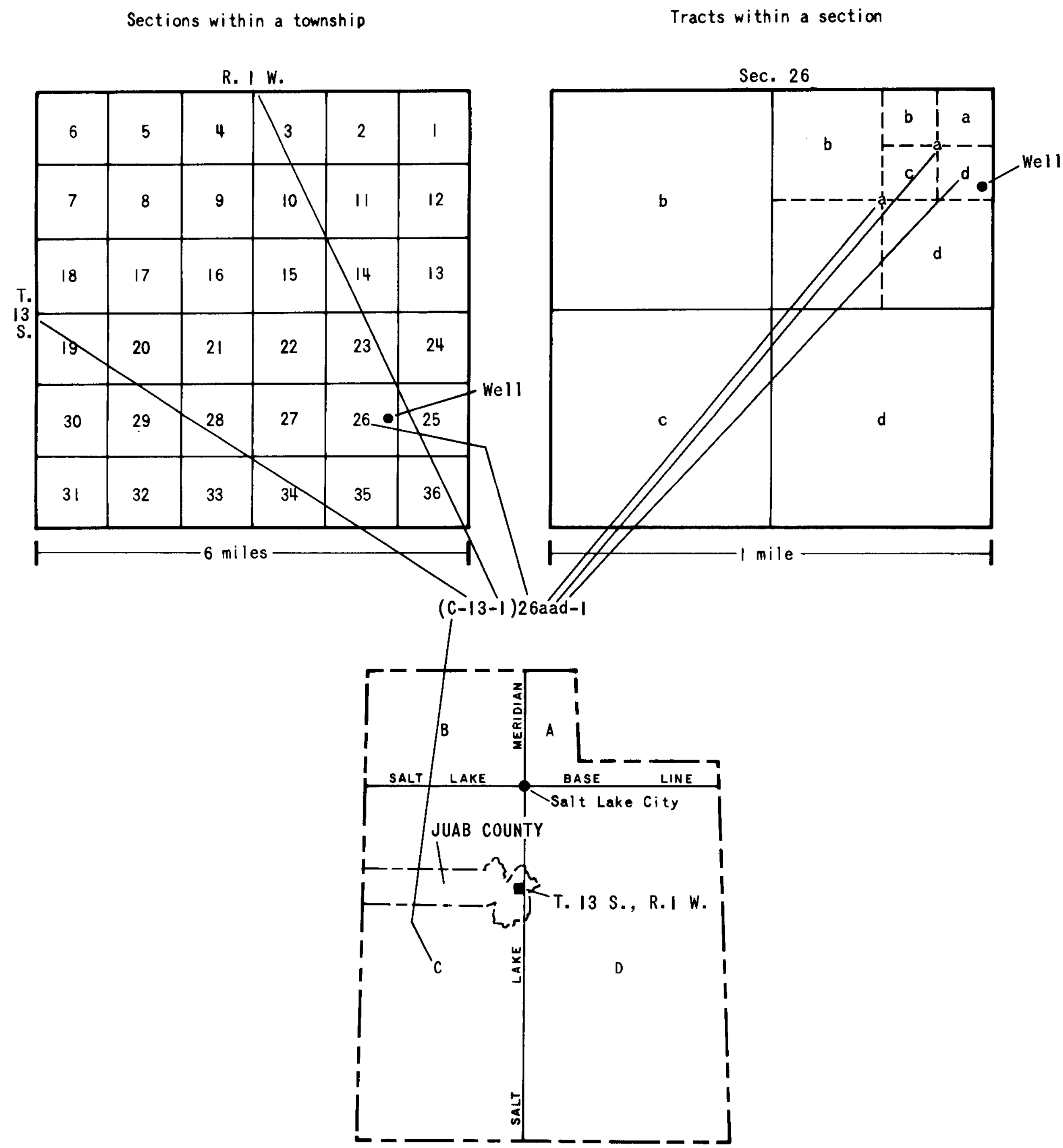

Figure 2. — Well- and spring-numbering system.

The valley is about 22 miles long and 4-6 miles wide and ranges in altitude from about 4,860 feet at Mount Nebo Reservoir (locally known as the Mona Reservoir) to more than 5,600 feet on some of the alluvial fans that extend from mountain canyons. Northern Juab Valley is bounded on the east by the Wasatch Range and the San Pitch Mountains (locally known as the Gunnison Plateau). Levan Ridge, a gentle rise of about 250 feet on the valley floor, separates northern and southern Juab Valleys. The West Hills and Long Ridge form the boundaries to the west and to the north. (See plate 3.) The greatest altitude in the mountains bordering the valley is the north crest of Mount Nebo in the Wasatch Range, 11,928 feet above sea level.

A uniformly flat to gently westward to northwestward sloping area about 8 miles long (north to south) and about 5 miles wide exists in the central part of the valley floor west and northwest of Nephi. The higher parts of this area to the east are farmed, whereas the lower parts to the west and north are covered largely by meadows and are used for pasture. The flatlands are pinched off at both the northern and southern ends by coalescing alluvial fans which extend into the valley from the mountains on both the east and the west. Thus, the northern 10 miles and the southern 5 miles of the valley floor consist largely of moderately sloping areas converging at the valley axis. Because most of the alluvial fill in the valley originated from the Wasatch Range and the San Pitch Mountains to the east, the axis of the valley lies closer to the western side; consequently, the streams that drain the valley are nearer the western side.

Salt Creek, the principal stream entering northern Juab Valley, drains the east and south flanks of Mount Nebo and adjacent areas and the north slopes of the San Pitch Mountains. Several other perennial streams, including North, Bear Canyon, and Willow Creeks, flow into the valley from the west side of Mount Nebo; Fourmile Creek flows into the valley from the west side of the San Pitch Mountains. Only ephemeral streams flow into the valley from the West Hills or Long Ridge.

Northern Juab Valley is drained by West and Currant Creeks. West Creek drains the area west of Nephi and flows northward into meadows and sloughs in sec. 13, T. 12 S., R. 1 W. The creek is perennial only in its northernmost 2 miles. Currant Creek originates in sec. 7, T. 12 S., R. 1 E., in meadows about 1 mile northeast of where West Creek ends. It flows northward, tapping many springs and seeps along the way, to Mount Nebo Reservoir, thence northwestward, via a canyon through Long Ridge, to Goshen Valley, and on to Utah Lake.

Climate

The climate of northern Juab Valley is semiarid. The average annual precipitation is about 14 inches; the mean annual temperature is about 52°F, and the average (frost free) growing season is approximately 148 days. Sunny days, large daily temperature changes, and low humidity are common. The annual precipitation on the adjacent Wasatch Range and San Pitch Mountains to the east is much greater than in the valley, exceeds 30 inches in much of the area, and is the source of most of the water reaching the valley. Graphs showing precipitation at Nephi, cumulative departure from average precipitation, annual flow in Salt Creek at Nephi, and water-level fluctuations in a well in the valley are given in figure 3. The relation of precipitation to water-level fluctuations is discussed in the section on water-level fluctuations.

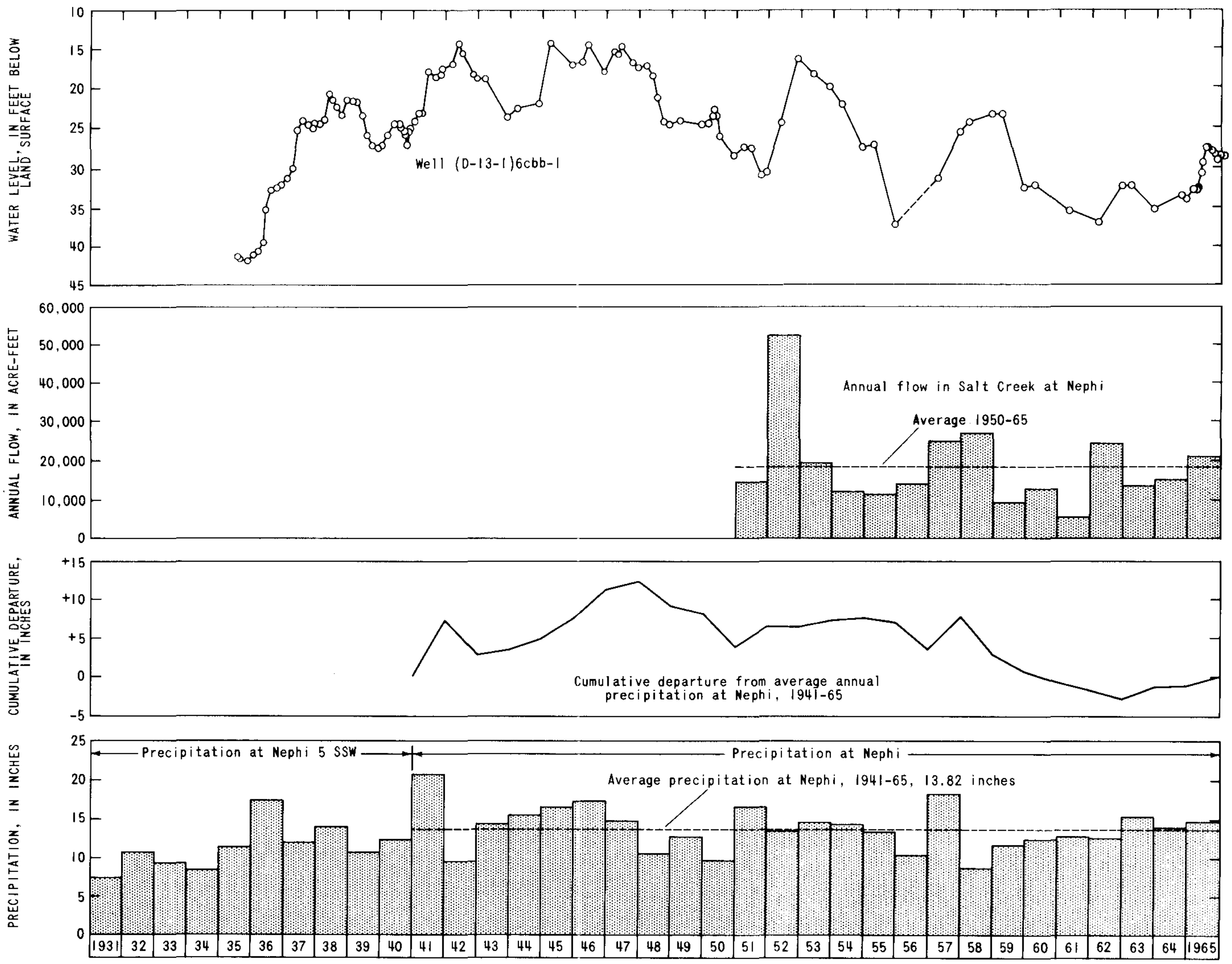

Figure 3. — Precipitation at Nephi 5 SSW (1931-40) and Nephi (1941-65), cumulative departure from average annual precipitation at Nephi (1941-65), annual flow in Salt Creek at Nephi (1951-64), and water levels in well (D-13-1)6cbb-1 (1935-65).

GEOLOGY

Rocks exposed in the area

Rocks of Paleozoic, Mesozoic, and Cenozoic age are exposed in the mountains adjacent to northern Juab Valley. Paleozoic sedimentary rocks, consisting mostly of limestone, but also containing dolomite, quartzite, and shale, make up most of the adjacent parts of the Wasatch Range and the northern part of Long Ridge (plate 1). Mesozoic sedimentary rocks, consisting largely of shale, but also containing beds of limestone and sandstone, make up the southernmost part of the western slope of the Wasatch Range and most of the adjacent western slope of the San Pitch Mountains. Conglomerate of Cretaceous age caps the San Pitch Mountains. Tertiary sedimentary rocks, consisting largely of sandstone, limestone, conglomerate, and siltstone are exposed in the West Hills. Volcanic rocks of Tertiary age cover large areas in Long Ridge and in the West Hills. Shallow alluvial deposits of Quaternary age occur on many mountain slopes and on canyon floors but are not shown at most places on plate 1.

The unconsolidated valley fill of Quaternary age, which is exposed on the valley floor, includes alluvial fans at the margins of the valley. The material composing the valley fill is derived from the rocks of the adjacent mountains.

The generalized stratigraphy of northern Juab Valley and vicinity, adapted in part from Hintze (1962) and Hardy (1962), is presented in table 1. The table briefly describes the formations and their areas of exposure shown on plate 1 and gives an estimate of their water-bearing properties.

Selected geologic formations and their water-bearing properties

Only those geologic formations, or groups of formations, which have the greatest known effects on the ground-water resources of northern Juab Valley are discussed here. These formations include rocks of Paleozoic age, Arapien Shale of Jurassic age, Indianola Group of Cretaceous age, sedimentary and volcanic rocks of Tertiary age, and the valley fill of Quaternary age.

Rocks of Paleozoic age

Many formations of Paleozoic age, including beds of sandstone, quartzite, limestone, dolomite, and shale, are exposed in the Wasatch Range bordering the valley. They include rocks of Cambrian, Mississippian, Pennsylvanian, and Permian age totaling 18,000 to 22,000 feet in thickness. Hintze (1962) lists 25 Paleozoic formations, or geologic units, in the southern Wasatch Range. These rocks constitute the bulk of the Wasatch Range that borders northern Juab Valley. Their outcrops occupy the highest altitudes, receive the most precipitation, and yield a large part of the runoff to the valley. The rocks of Paleozoic age in the mountain mass dip in various directions and angles because of faulting and folding; some of the rocks are inverted at steep angles with the horizontal.

The permeability of the rocks of Paleozoic age varies with the type of formation and its position. The most permeable rocks probably are limestones in which solution channels are

Table 1. — Generalized geologic section in northern Juab Valley

System	Series	Stratigraphic unit	Approximate maximum thickness (feet)	Character of material	Area of exposure	Water-bearing properties
QUATERNARY	Recent and Pleistocene	Valley fill Qal	4,000+	Mostly unconsolidated cobbles, gravel, sand, silt, and clay. Alluvial-fan and lacustrine deposits. Contains some conglomerate and "hardpan" and some boulders.	The valley floor and alluvial fans extending into canyons.	Permeability varies with the degree of sorting of gravel and sand. Gravel and sand beds yield moderate to large quantities of water to springs and wells. Clay and silt store large quantities of water, but yield it slowly to wells.
		Old alluvium Qoa	-	Includes some landslide and old alluvial-fan deposits.	-	Water-bearing properties are not known.
QUATERNARY / TERTIARY		Salt Creek Fanglomerate of Eardley (1933) (Pleistocene) QTsf	-	Fanglomerate composed of boulders, cobbles, and gravel in a red sand and silt matrix.	Foothills of the San Pitch Mountains and on the east flank of the Wasatch Range north of Salt Creek.	Do.
TERTIARY		Volcanic rocks Tvr	1,000	Breccia or agglomerate, volcanic conglomerate, pyroclastics, and flows.	Mostly in Long Ridge and in the West Hills but also in the San Pitch Mountains and Wasatch Range.	Permeability is generally low but high where fractured or jointed; yields water to some springs in Long Ridge.
		Sedimentary rocks Tsr	2,700	Limestone, sandy limestone, sandstone, siltstone, shale, and conglomerate. Includes Crazy Hollow Formation of Spieker (1949), Green River and Colton Formations, Flagstaff Limestone, and North Horn Formation (Paleocene and Upper Cretaceous).	Mostly in the West Hills and in the western part of the San Pitch Mountains but also at the north end of Long Ridge and adjacent parts of the Wasatch Range.	Permeability is generally low but is high where solution channels are developed along cracks, joints, and bedding planes in limestone. Yields small quantities of water to springs in the West Hills. Yields large quantities of water to springs in adjacent areas.
CRETACEOUS	Upper Cretaceous	Price River Formation Kpr	-	Conglomerate, sandstone, and shale.	Eastern side of the Wasatch Range north of Salt Creek Canyon.	Water-bearing properties in the area are not known but yields large quantities of water to springs in other areas.
		Indianola Group Ki	5,000+	Conglomerate of pebbles, cobbles, and boulders with interbeds of sandstone, shale, and limestone.	Forms the caprock of the San Pitch Mountains.	Permeability is generally low except along some bedding planes and where jointed or fractured; solution channels formed in places; yields water to many springs in the San Pitch Mountains.
JURASSIC	Upper and Middle Jurassic	Arapien Shale (includes Twelvemile Canyon and Twist Gulch Members) Ja	4,000+	Red to gray siltstone, sandstone, and limestone; locally contains beds of anhydrite, gypsum, and rock salt.	Western side of the San Pitch Mountains and at the southern end of the Wasatch Range.	Permeability is generally very low but the formation yields water to small springs. The formation and the alluvium derived from it are a source of the chloride and sulfate ions in the ground water in the southern half of the valley.
JURASSIC(?) and TRIASSIC(?)		Nugget Sandstone JTRn	-	Sandstone.	Wasatch Range, north of Salt Creek Canyon.	Water-bearing properties are not known.
TRIASSIC		Triassic rocks TRu	400	Limestone and shale, includes Woodside Formation, Thaynes Limestone, and Ankareh Shale.	North of Salt Creek Canyon in the Wasatch Range.	Do.
PERMIAN, CARBONIFEROUS {PENNSYLVANIAN, MISSISSIPPIAN, and CAMBRIAN		Paleozoic rocks Pzu	22,000	Sandstone, quartzite, limestone, dolomite, and shale. Includes many formations.	Wasatch Range from 2 miles north of Nephi northward.	Permeability varies with geologic formations and places. Some limestones have solution channels formed along cracks, joints, and bedding planes; yields water of excellent chemical quality to springs along the western side of the Wasatch Range.

developed along cracks, joints, and bedding planes; and the least permeable rocks are beds of shale. Rigby (1962, p. 84) reported many small caves and some sinkholes that were developed by the solution of limestone in the southern Wasatch Range. Abundant precipitation at higher altitudes, the complex structure, and the large permeability of some of the rocks are responsible for the existence of many springs along the Wasatch Range front. These springs yield water of excellent chemical quality. Erosion of rocks of Paleozoic age has furnished most of the valley fill from 2 miles north of Nephi northward; and this is a reason for the excellent quality of water in the northern part of the valley. (See section on chemical quality, p. 47.)

Arapien Shale

The Arapien Shale of Jurassic age, which includes the Twelvemile Canyon and Twist Gulch Members, consists of red to gray, and in places mottled, beds of siltstone, sandstone, and limestone, locally including beds of anhydrite, gypsum, and rock salt. It is exposed extensively along the western side of the San Pitch Mountains, at the southern end of the Wasatch Range, and on both sides of Salt Creek Canyon. (See plate 1). The formation is estimated to be more than 4,000 feet thick (Hardy, 1962, p. 53). The permeability of the silt beds in the formation is generally very low, and the formation in many places acts as a barrier, impeding ground-water movement and giving rise to springs at the contact with overlying more permeable formations. A few small springs discharge water locally in the formation. The Arapien Shale and the alluvium derived from it are a source of sulfate and chloride ions in the ground water in the southern half of northern Juab Valley. (See section on chemical quality p. 47.)

Indianola Group

The Indianola Group of Late Cretaceous age consists mostly of a conglomerate of pebbles, cobbles, and boulders with interbeds of sandstone, siltstone, shale, and limestone. It is exposed over a large area as the cap rock of the San Pitch Mountains, dips generally eastward, and in places is more than 5,000 feet thick (Hardy, 1962, p. 54) (plate 1). The permeability probably is generally low; but it is high in places where the formation is jointed or fractured and where solution channels are formed along joints, cracks, or bedding planes. The weathered surface on the Indianola Group evidently is quite permeable and receives considerable ground-water recharge from rain and snowmelt. Many springs flow from the conglomerate on both sides of the San Pitch Mountains. In the project area, springs discharge near the contact of the Indianola Group with the Arapien Shale and other rocks of low permeability. These springs generally yield water of excellent chemical quality. The public supply for the city of Nephi is derived from Bradley Spring, (D-13-2)5cbd-S1, which discharges from conglomerate of the Indianola Group near its contact with an old alluvial fan, which is composed largely of clay.

Rocks of Tertiary age

The rocks of Tertiary age that are exposed in and near northern Juab Valley consist of marine sedimentary rocks, volcanic rocks, and continental fanglomerate.

The sedimentary rocks of Tertiary age consist of limestone, sandy limestone, sandstone, siltstone, shale, and conglomerate and include the Crazy Hollow Formation of Spieker (1949) and the Green River and Colton Formations, Flagstaff Limestone, and North Horn Formation (partly of Cretaceous age). These rocks are exposed mostly in the West Hills, but also in Long Ridge, San Pitch Mountains, and Wasatch Range at the northern end of the valley. The total thickness of the sedimentary rocks in the area is not known, but in the San Pitch Mountains they are about 2,700 feet thick (Hardy, 1962, p. 57-60). The permeability of the rocks is generally low; but it is high where solution channels are developed along cracks, joints, and bedding planes. The most permeable rocks probably are in the Flagstaff and North Horn formations. These sedimentary rocks yield water to a few small springs in the West Hills and to large springs in the Sevier River valley a few miles to the southwest.

The volcanic rocks of Tertiary age consist of breccia or agglomerate, volcanic conglomerate, pyroclastics, and flows. The rocks are exposed mostly on Long Ridge and the northern part of the West Hills; but they are also exposed in the foothills of the San Pitch Mountains, in Salt Creek Canyon, and at the northern end of the valley. Agglomerate on Long Ridge is between 500 and 1,000 feet thick (Hardy, 1962, p. 61). The permeability probably is generally low, but it is high where the rocks are fractured or jointed. The volcanic rocks yield water to some small springs in the Long Ridge area.

Continental fanglomerate, called the Salt Creek Fanglomerate of Quaternary age by Eardley (1933), is composed of boulders, cobbles, and gravel in a red sand and silt matrix. It is exposed along the foothills of the San Pitch Mountains and on the east flank of the Wasatch Range north of Salt Creek Canyon. The total thickness, permeability, and yield of water to wells or springs are not known. However, the Salt Creek Fanglomerate of Eardley probably is fairly permeable; and it absorbs some water as recharge and conducts it toward the valley fill. According to Hintze (1962), the Salt Creek Fanglomerate is of both early Quaternary and late Tertiary age.

Valley fill

The valley fill of Quaternary age consists mostly of unconsolidated boulders, cobbles, gravel, sand, silt, and clay with occasional layers of consolidated or partly consolidated "conglomerate" or "hardpan." Drillers' logs of 45 selected wells and test holes ranging in depth from 25 to 995 feet are presented in table 6. Sections across the valley, based on these logs and other information, are presented on plate 2. None of these wells or test holes completely penetrate the fill, which may be more than 4,000 feet thick (Hintze, 1962, p. 78).

The valley fill in northern Juab Valley covers an area of about 120 square miles and includes alluvial-fan, lacustrine, and flood-plain deposits. The alluvial-fan deposits extend toward the center and lower parts of the valley from mouths of canyons in the surrounding mountains. The deposits contain much gravel and sand and are coarsest and most permeable near the apex of the fans below the canyon mouths; they become progressively finer and contain more intervening beds of silt and clay and fewer and thinner beds of gravel toward the center of the valley. (See plate 2.) The lacustrine deposits were laid down mostly by Lake Bonneville, which occupied parts of the valley (Hardy, 1962, p. 62; Snyder, Hardman, and Zdenek, 1964). The lacustrine deposits consist mostly of beds of clay and silt which are relatively thin and which underlie the low flatlands from west of Nephi northward to and including Mount Nebo Reservoir. The flood-plain deposits occupy a narrow band along West Creek and along Currant Creek above Mount Nebo Reservoir. These deposits are relatively thin and consist of reworked gravel, sand, silt, and clay derived from the alluvial-fan and lacustrine deposits.

The permeability of the valley fill ranges from very high in coarse-graded gravel to very low in clay. The permeability is highest in the alluvial-fan deposits, which are tapped by most of the large wells and springs in the valley. The lacustrine deposits generally have low permeability, overlap the alluvial-fan deposits in places and impede the movement of ground water toward the surface. This confinement of water in the underlying alluvial-fan deposits results in artesian conditions in the lower parts of the valley.

Generalized structure of the valley

Northern Juab Valley is a structural trough formed along the western side of the Wasatch Fault, a normal north-south trending fault with the elevated block to the east and the downdropped block to the west. The western block, which underlies the valley, is evidently tilted eastward toward the fault because many of the rocks in the West Hills and Long Ridge, west of the valley, dip eastward toward the valley (plate 1). The elevated, or upthrown, block to the east is represented by the Wasatch Range and the San Pitch Mountains. The total displacement caused by the fault probably is more than 8,000 feet. Hintze (1962, p. 78) estimated a displacement of 10,000-13,000 feet along the fault in Utah Valley and stated that the displacement was slightly less in Juab Valley. The structural trough is partly filled by alluvial debris consisting of boulders, cobbles, gravel, silt, and clay, eroded from the surrounding mountain slopes. Movement along the fault during recent geologic time is indicated by displacement in alluvial fans which can be observed from U. S. Highway 91 between Mona and Nephi.

GROUND WATER

Source and recharge

The source of almost all the ground and surface water in northern Juab Valley is precipitation within the drainage basin. The precipitation on the valley itself is not sufficient to add significant amounts of water to the ground-water reservoir directly by infiltration from wetted land. Virtually all the water absorbed by the land directly from precipitation is consumed by evaporation and transpiration by plants. Recharge to the ground-water reservoir comes mainly from infiltration from streams, infiltration from irrigation systems and water applied to the land, and subsurface inflow from adjacent areas.

Infiltration from streams

The principal source of recharge to the ground-water reservoir in northern Juab Valley is infiltration from streams that originate in the mountains and flow into the valley. Recharge takes place where the streams flow from canyons onto alluvial fans which are composed largely of sorted and permeable gravel and sand that permit water to infiltrate readily from the stream to the underlying ground-water reservoir. Recharge from perennial streams occurs mostly in the spring during snowmelt when the flow is high, although some infiltration persists throughout the year. Recharge from ephemeral streams occurs during snowmelt or during and following excessive precipitation.

Salt Creek

Salt Creek, the greatest single source of recharge to the ground-water reservoir in northern Juab Valley, flows perennially from Salt Creek Canyon into the valley at Nephi and contributes about half of the recharge to the valley. The large flat alluvial fan over which it flows for several miles consists in part of permeable beds of gravel and sand that allow water to percolate from the stream downward to the ground-water reservoir. Drillers' logs of wells (table 6) were used to construct the sections of the Salt Creek fan (plate 2), which show the materials penetrated by representative wells and the position of the water table. These sections are shown as lines A-A′, C-C′, and D-D′ on plate 2. Drillers' logs of the wells are given in table 6.

The annual flow in Salt Creek during 1951-65 ranged from 5,740 to 50,210 acre-feet of water and averaged 18,530 acre-feet as indicated in the following tabulation.

Year	Acre-feet	Cubic feet per second	Year	Acre-feet	Cubic feet per second
1951	14,440	19.9	1959	9,140	12.6
1952	50,210	69.2	1960	12,320	17.0
1953	19,380	26.8	1961	5,740	7.9
1954	11,910	16.5	1962	24,350	33.6
1955	11,410	15.8	1963	13,850	19.1
1956	14,040	19.4	1964	15,180	20.9
1957	24,860	34.3	1965	20,950	28.9
1958	26,540	36.7	Average	18,530	25.6

Very little of the water in Salt Creek reached West and Currant Creeks by surface flow. The bulk of it was used by crops and other vegetation, evaporated, or percolated into the earth eventually to reach the ground-water reservoir, either directly from the streambed or from canals, ditches, or irrigated fields. The amount of water added to the ground-water reservoir during a year depends in part upon the amount of flow in Salt Creek as is shown by well (D-13-1)6cbb-1, west of Nephi, whose water levels correlate with the annual flow of Salt Creek at Nephi (fig. 3.)

Recharge to the ground-water reservoir from Salt Creek (including subsurface inflow through alluvium in Salt Creek Canyon), from diversions for irrigation from Salt Creek, and from the adjacent area of bedrock amounted to at least 6,000 acre-feet in 1965, a year of slightly above-average precipitation. This figure is based on the fact that ground-water levels in the vicinity of Nephi were several feet higher in the spring of 1966 than in the spring of 1965 (see hydrographs for wells (D-13-1)4ccb-1 and (D-13-1)18bbc-1 on plate 4) despite the fact that approximately 7,600 acre-feet of water was pumped from 10 irrigation wells in the vicinity. About one-fourth of this pumped water probably returned to the ground-water reservoir, which suggests that at least 6,000 acre-feet of recharge was derived from Salt Creek, water diverted from Salt Creek, and subsurface inflow.

Other perennial streams

The principal perennial streams, other than Salt Creek, that discharge into northern Juab Valley are North, Bear Canyon, Willow, and Fourmile Creeks. North, Bear Canyon, and Willow Creeks flow from canyons below towering Mount Nebo in the Wasatch Range and Fourmile Creek flows from the San Pitch Mountains (plate 3). At times all these creeks flowed from canyons onto permeable alluvial fans and most of their flow infiltrated the ground. To reduce this loss and to acquire water for irrigation, concrete flumes were constructed to carry the flow from North, Bear Canyon, and Willow Creeks to irrigated fields on the lower and less permeable parts of the alluvial fans. Water from Fourmile Creek is impounded near the mouth of Fourmile Canyon to irrigate small fields nearby. Probably from one-fourth to one-half of the water diverted from these four creeks seeps to the ground-water reservoir by infiltration, mostly from irrigated fields.

The following tabulation gives the discharge measurements for North, Bear Canyon, Willow, and Salt Creeks on 5 days during April-September 1961. Measurements on North, Bear Canyon, and Willow Creeks were made by the U. S. Bureau of Reclamation; those for Salt Creek were taken from records of the U. S. Geological Survey. Discharge was estimated for Fourmile Creek. A comparison of the data in the table suggests that the combined flow from North, Bear Canyon, Willow, and Fourmile Creeks was roughly 40 percent of the flow from Salt Creek, or about 8,000 acre-feet during a year of average streamflow. (See the tabulation for the annual flow in Salt Creek, 1951-65.) Since probably from one-fourth to one-half of this water seeps to the ground-water reservoir, recharge from these four creeks would range from about 2,000 to 4,000 acre-feet during a year of average streamflow.

Date of Measurement 1961	North Creek	Bear Canyon Creek	Willow Creek	Fourmile Creek	Salt Creek
		CUBIC FEET PER SECOND			
April 11	0.80	0.83	2.10	—	6.4
May 15	1.32	.92	1.69	—	17
June 27	.89	.95	1.69	—	11
Aug. 6	1.11	1.14	1.27	—	9.4
Sept. 12	1.16	1.02	2.04	—	6.1
Total	5.28	4.86	8.79	—	49.9
Average flow	1.06	.97	1.76	0.5 (est)	10.0

Total of average flows of North, Bear Canyon, Willow, and Fourmile Creeks 4.29

Average flow of Salt Creek 10.0

Percentage of average flow from Salt Creek = $\frac{4.29}{10.0}$ = 43 percent (rounded to 40 percent)

Several springs in the lower altitudes of the Wasatch Range discharge water that flows to the valley and adds substantially to the recharge to the valley fill. Water from one of these springs is piped to a farm in sec. 27, T. 10 S., R. 1 E., near the north end of the valley where the water is used in an irrigation sprinkling system. Other perennial springs are reported to discharge about 1 cfs (cubic feet per second) in each of Pole and Couch Canyons. Clover Creek Spring, (D-12-1)3bbc-S1, discharges about 2 cfs into a small canyon immediately north of Willow Creek canyon, where part of the water is piped to an irrigation flume and part to

Mona for public supply. A spring in Gardner Canyon is diverted into a concrete flume to irrigate fields north of Nephi. The total quantity of water entering northern Juab Valley from such springs is not known; but it is probably about 5 cfs (about 4,000 acre-feet a year), of which probably 1,000-2,000 acre-feet recharges the valley fill.

Ephemeral and intermittent streams

Ephemeral streams (those which flow only for brief periods in direct response to precipitation) drain the West Hills and Long Ridge on the west side of northern Juab Valley. Intermittent streams (those which flow for longer periods, such as during and following the season of snowmelt) drain much of the Wasatch Range and San Pitch Mountains. Both types of streams contribute substantial quantities of recharge to the valley. This is indicated by the fact that although the flow in many of these streams is relatively large at times, practically none of the flow reaches the lowlands of the valley. The flow disappears into permeable alluvial fans that are built up in front of the canyons; and most of the water infiltrates to the ground-water reservoir, although some is lost by evaporation or transpiration by vegetation.

Ephemeral streams flowing from the West Hills have contributed much of the ground water in the valley fill southwest of Nephi. This addition is indicated by the difference between the chemical quality of the ground water in this area and the area near Nephi. (See section on chemical quality for a more complete discussion.)

Infiltration from irrigation systems and water applied to fields

The amount of recharge from irrigation systems and water applied to fields varies according to location but probably amounts to between one-fourth and one-half of the water diverted from the streams. Most of the irrigated fields are on the middle to lower parts of the alluvial fans along the east side of the valley. Many irrigated farms are on the broad, relatively flat alluvial fan of Salt Creek, which extends westward from Nephi for about 3 miles. These fans are most permeable near the mountains where they consist largely of coarse, well-sorted gravel. The fan materials become finer toward the center of the valley and the permeability decreases, causing a consequent decrease in infiltration from irrigation systems and irrigated fields. Near the bottom of the fans and on large areas of the valley floor, recharge becomes virtually nonexistent because ground-water movement generally is upward toward the land surface rather than downward toward the ground-water reservoir. Under such conditions all of the water applied to the land either runs off on the surface or is evaporated or transpired.

The amount of water added to the ground-water reservoir by infiltration of irrigation water that is diverted from North, Bear Canyon, Willow, Fourmile, and Salt Creeks is included in estimates made in previous sections of this report.

Subsurface inflow

The ground-water reservoir in the valley fill in northern Juab Valley is recharged by subsurface inflow in three ways: inflow through alluvium in canyons, inflow from rocks of the adjacent mountains, and inflow from southern Juab Valley.

Recharge by subsurface movement of water through canyon alluvium occurs mainly in Salt Creek Canyon, although it also takes place in many other canyons containing perennial, intermittent, or ephemeral streams. The alluvium in Salt Creek Canyon is at least 135 feet thick, as shown by the log for well (D-13-1)1cab-1 (table 6). The alluvium contains beds of permeable gravel, and it yields 895 gpm (gallons per minute) to well (D-13-1)1cab-1. The amount of water moving through the alluvium in the canyon has not been measured, but it is estimated to average about 1 cfs.

Some water probably enters the valley fill directly from rocks of the adjacent mountains, but no estimate of the amount has been made. Several springs flow from the bedrock near the base of the Wasatch Range; and it is reasonable to assume that similar springs, buried by the many alluvial fans that coalesce along the base of the range, still discharge in the subsurface into the alluvial gravels. Such buried springs would be most likely where most of the known springs are located, along the Wasatch Range northward from a point about 2 miles north of Nephi. Buried springs would be least likely south of this point because few known springs exist there, and because most of the bedrock consists of the Arapien Shale, which generally has a low permeability and is more of a ground-water barrier than an aquifer. Neither would buried springs be likely along the West Hills and Long Ridge because these mountains are low, have a semiarid climate like the valley, and few springs discharge on the surface along their sides.

Recharge by subsurface inflow to northern Juab Valley from southern Juab Valley through the alluvium is indicated by the fact that the ground-water divide between the valleys is actually in southern Juab Valley about 2 miles south of the topographic divide at Levan Ridge. (See plate 2.) The amount of inflow was not estimated but is assumed to be small, because no large source of ground-water recharge is apparent in the area between the ground-water divide and the topographic divide.

Potential artificial recharge

The east side of northern Juab Valley could be a site for future artificial ground-water recharge because the highly permeable alluvial fans that extend into the valley from the canyons will accept and transmit applied water readily. Such water would infiltrate to the main ground-water reservoir in the valley. The consequent rising of ground-water levels would not affect most of the people in the valley because they live on the alluvial fans where depths to ground-water levels are generally more than 75 feet. In the lower parts of the valley, however, artesian pressures may increase, resulting in some waterlogged land and in greater discharge from springs and flowing wells.

The best location for artificial recharge probably is on the alluvial fan of Salt Creek near Nephi. There water levels have declined to approximately 150 feet below the land surface because of heavy pumping for irrigation, and they are almost horizontal due to the very high permeability of the water-bearing materials. Another favorable location for artificial recharge would be along the Wasatch front northward from Mona, where water levels have also declined because of heavy pumping for irrigation.

Occurrence

The valley fill

Most of the ground water in northern Juab Valley occurs in spaces between particles of gravel, sand, silt, or clay in the unconsolidated valley fill. The amount of water in storage depends on the porosity of the water-bearing materials, which may range from a few percent in poorly sorted materials to as much as 50 percent in beds of clay, and also on the thickness and extent of the materials. The availability of the water depends on the permeability of the materials (the ability to transmit water). The most available water in the valley fill is stored in permeable well-sorted beds of gravel or sand, both of which transmit water readily and have a porosity of between 20 and 30 percent. The least available water is in beds of clay, which store much water but yield it very slowly because they have very low permeability.

The principal body of ground water in northern Juab Valley, called the ground-water reservoir in this report, underlies the surface of the valley fill. The ground-water reservoir is bounded on the bottom by consolidated rocks. The total thickness of the fill is not known, but it probably exceeds 4,000 feet (Hintze, 1962, p. 78). The reservoir is bounded on the east, west, and north by the consolidated rocks of the adjacent mountains, and on the south by the ground-water divide in the alluvium between northern and southern Juab Valleys. At the top it is bounded by the water table in areas where water-table conditions exist and by confining layers where artesian conditions exist.

Water-table conditions

Water-table conditions prevail in a 1-3 mile wide strip near the edges of the valley fill, particularly in the areas underlain by alluvial fans, and in the general area of Levan Ridge. The actual line where water-table conditions and the artesian conditions begin is difficult to define, and it may actually vary with a change in water level. Isolated bodies of clay or silt may cause local artesian conditions in water-table areas. The probability of encountering strict water-table conditions increases from the center of the valley toward the surrounding mountains, because the number and thickness of fine-grained confining beds decreases in that direction. This is indicated on plate 2 by sections A-A′, B-B′, and F-F′, which are based in part on drillers' logs of wells (table 6).

Artesian conditions

Artesian conditions prevail in the lower parts of northern Juab Valley from west of Nephi to immediately north of Mount Nebo Reservoir. Saturated beds of permeable gravel or sand contain water under artesian pressure where they are overlain by impermeable beds of clay or silt. These impermeable beds extend from the center of the valley toward the alluvial fans. The permeable beds conduct water from the areas of recharge on the fans toward the lower part of the valley. As the water moves downgradient through the permeable beds, it becomes trapped by the confining overlying beds of clay or silt, and hydrostatic pressure develops in the aquifer. When under hydrostatic pressure, the water is said to be under artesian conditions; and the level to which the water will rise is called the piezometric surface. (See sections D-D′, E-E′, and F-F′ on plate 2.) Piezometric heads as much as 27 feet above the land surface were measured in 1965 (See wells (D-11-1)8bcd-1 and (D-11-1)8cba-1 in table 4.), and greater heads have existed in past years. Artesian water levels are discussed at greater length in the section on fluctuation of water levels.

Plate 3 shows an area of about 10 square miles where the piezometric head of the water in the aquifer is above the land surface, indicating that water will flow from wells. The area where artesian conditions exist includes all the area where the piezometric surface of the aquifer is above the land surface and an additional marginal area where the piezometric surface is beneath the land surface. The artesian area probably includes most of the lower part of the valley and extends into the lower parts, and possibly the middle parts, of some of the alluvial fans.

The artesian aquifers in northern Juab Valley are leaky. The confining beds of clay or silt do not form a complete or perfect seal to the underlying aquifer, but merely offer a greater resistance to the movement of water than do the coarser materials in the aquifer itself. Thus the confining beds permit some water under artesian pressure to percolate upward toward the land surface. This upward movement of water, in areas where the piezometric surface of the ground water is above the land surface, results in wet meadowlands in about 10 square miles of the valley (plate 3).

Perched water-table conditions

Perched water-table conditions occur locally in northern Juab Valley where downward percolating water is retarded by a bed of relatively impermeable material (usually clay or silt) which lies between the main water table or the piezometric surface and the land surface. Perched ground water stood at 19 feet below the land surface at well (D-13-1)18acc-1, which is 45 feet deep; whereas the main water level stood at 52 feet below the land surface at well (D-13-1)18acc-2, which is only 11 feet away but is 159 feet deep. The perched ground-water bodies are small and unimportant when compared to the main ground-water body, and the perched water eventually percolates down to the main ground-water body.

Quantity of water in the valley fill

The quantity of water stored in the valley fill is not known but probably amounts to many hundreds of thousands of acre-feet. The fill is saturated from the water table to a depth of possibly more than 4,000 feet. However, only a small percentage of the total water in storage is available for development by wells. The water in beds of gravel or sand will drain readily to wells, but most of the water in the silt and clay is not available to wells in significant quantities.

The quantity of water that can be removed from (or placed in) storage in the ground-water reservoir by lowering (or raising) water levels varies considerably depending on whether the water is under water-table or artesian conditions. Under water-table conditions, lowering of the water level results in a dewatering of the aquifer by gravity drainage. Under artesian conditions, however, lowering the water level results only in a decrease in pressure in the aquifer. Inasmuch as no dewatering of the aquifer is involved, water is released from storage only due to the compressibility of the aquifer material and of the water. The amount of water thus released from storage under artesian conditions is very small.

The net amount of water which would have to be added to or withdrawn from the ground-water reservoir in northern Juab Valley to cause a change of 1 foot in water levels in the entire valley is not precisely known because the areas under water-table and artesian conditions are not precisely known. However, if we assume that water-table conditions exist in a 1 mile wide strip along each side of the valley and that the effective porosity of the water-bearing materials is 20 percent, it would require a net addition or removal of roughly 6,000 acre-feet of water to cause a rise or decline of 1 foot in the strip. The loss or gain in storage in the artesian areas for a change of water level of 1 foot would be negligible.

Configuration of the water surface

The water table and the piezometric surface in northern Juab Valley can be regarded as one continuous surface. This surface is not level or uniform but is warped and sloping. Irregularities in the surface are caused by differences in permeability and saturated thickness of the water-bearing materials and by the addition or withdrawal of water. The contour lines on plates 2 and 4 show the configuration of the surface and, by inference, the direction of movement of ground water. A contour on the surface is a line along which all points have the same altitude, and ground water moves downgradient at right angles to these lines. The ground-water surface is also shown in cross sections of the valley on plate 2. The movement of ground water in the area is discussed in greater detail in the section on movement.

The ground-water surface in northern Juab Valley slopes from the area of recharge at the sides of the valley diagonally downward toward the points of discharge at the lower parts of the valley. The slope of the water surface is in the same direction but generally less than the slope of the land surface. As a result, depths to ground water decrease from the edges of the valley toward the lower parts of the valley.

Irregularities in the configuration of the ground-water surface are caused by the withdrawal of water from wells. An area of water-level depression caused by heavy pumping for irrigation in the vicinity of Nephi is indicated by the contours on plate 2. Some changes in the configuration from 1950 to 1965 can be seen by comparing plate 2 with plate 4. For example, the 4,990-foot contour in 1950 was north and west of Nephi, whereas in 1965 it was south and east of Nephi and almost encircled the city, indicating that water is moving toward the heavily pumped wells in the city from almost every direction.

Ground water in northern Juab Valley stands at the land surface in low-lying artesian areas, where the land is saturated to the surface; it exceeds depths of 300 feet beneath the alluvial fans near the margin of the valley. Plate 3 shows the range in depth to water in wells in the valley. The greatest depth measured during the field investigation was 340 feet at well (D-13-1)9dcd-1 near the top of an alluvial fan southeast of Nephi. A depth to water of 236 feet was measured in well (D-11-1)33cab-1 near the middle part of a large alluvial fan near Mona; a much greater depth to water can be expected higher on the fan.

The maximum artesian head above the land surface in the valley was 27 feet measured at well (D-11-1)8bcd-1. Areas where the artesian heads are above the land surface are shown on plate 3. Most of these lands are wet at the surface.

Fluctuations of water levels

Water levels in wells fluctuate for many reasons—a net addition or reduction of water to the aquifer, changing barometric pressures, earthquakes, tidal effects, and other factors. The various influences may act singly or in combination, and the resulting fluctuations may be long term, seasonal, daily, or brief. Only long-term fluctuations and seasonal fluctuations are discussed further in this report.

Water levels measured monthly at 14 wells during the investigation, water-level data based on the record of a continuous recording gage installed on 1 well, and additional water-level data collected at 2 wells prior to this investigation are presented in table 5. Hydrographs of 11 wells, based on some of these data, are presented in figures 3 and 4.

Under water-table conditions, which presumably are common in the areas underlying the upper parts of the alluvial fans, the cone of depression on the water table around a pumped well expands slowly because the volume of water described by the cone must be removed in order for the cone to develop. Thus, the water level in wells within a few hundred feet of the pumped well may not be affected for hours or even days after pumping begins. Recovery from drawdown in water-table areas is equally slow, because water must migrate from surrounding areas to fill the cone of depression caused by pumping.

Under artesian conditions, the cone of depression on the piezometric surface of the aquifer around a pumped well expands rapidly and causes prompt lowering of water levels in nearby wells. Observations made on May 17, 1965, at a water-level recording gage on well (D-11-1) 8aad-2, 4 miles north of Mona, showed that the water level began to decline after 10 minutes of pumping at 2,450 gpm (gallons per minute) in well (D-11-1)9cca-1, 3,600 feet away. In like manner, a water-level measurement on June 25, 1965, showed that 0.72 foot of drawdown had already taken place at well (D-13-1)4ccb-1 in Nephi, 8 minutes after pumping at 3,200 gpm began in well (D-13-1)4cca-1, 516 feet away. It was estimated from this example and subsequent drawdown data that the water level in well (D-13-1)4ccb-1 probably began to decline less than one-half minute after pumping started in well (D-13-1)4cca-1. Both instances of prompt water-level decline were caused by lowered artesian pressure, indicating local artesian conditions and involved wells situated about midway on alluvial fans. Where artesian conditions exist, water levels in the majority of wells will decline promptly when nearby wells are pumped heavily. Similarly, water levels in artesian areas will recover from drawdown promptly when pumping is stopped. However, total recovery will not occur if the amount of water removed exceeds the amount of water replaced by movement of water from surrounding areas.

Long-term fluctuations

Water levels in the valley generally fluctuate in response to variations in annual precipitation. For example, figure 3 shows that the hydrographs of well (D-13-1)6cbb-1 is roughly similar in shape to the graph showing cumulative departure from average annual precipitation at Nephi. This similarity indicates the long-term relation between precipitation and water levels; lack of correlation between the graphs would indicate that factors other than precipitation were influencing water levels.

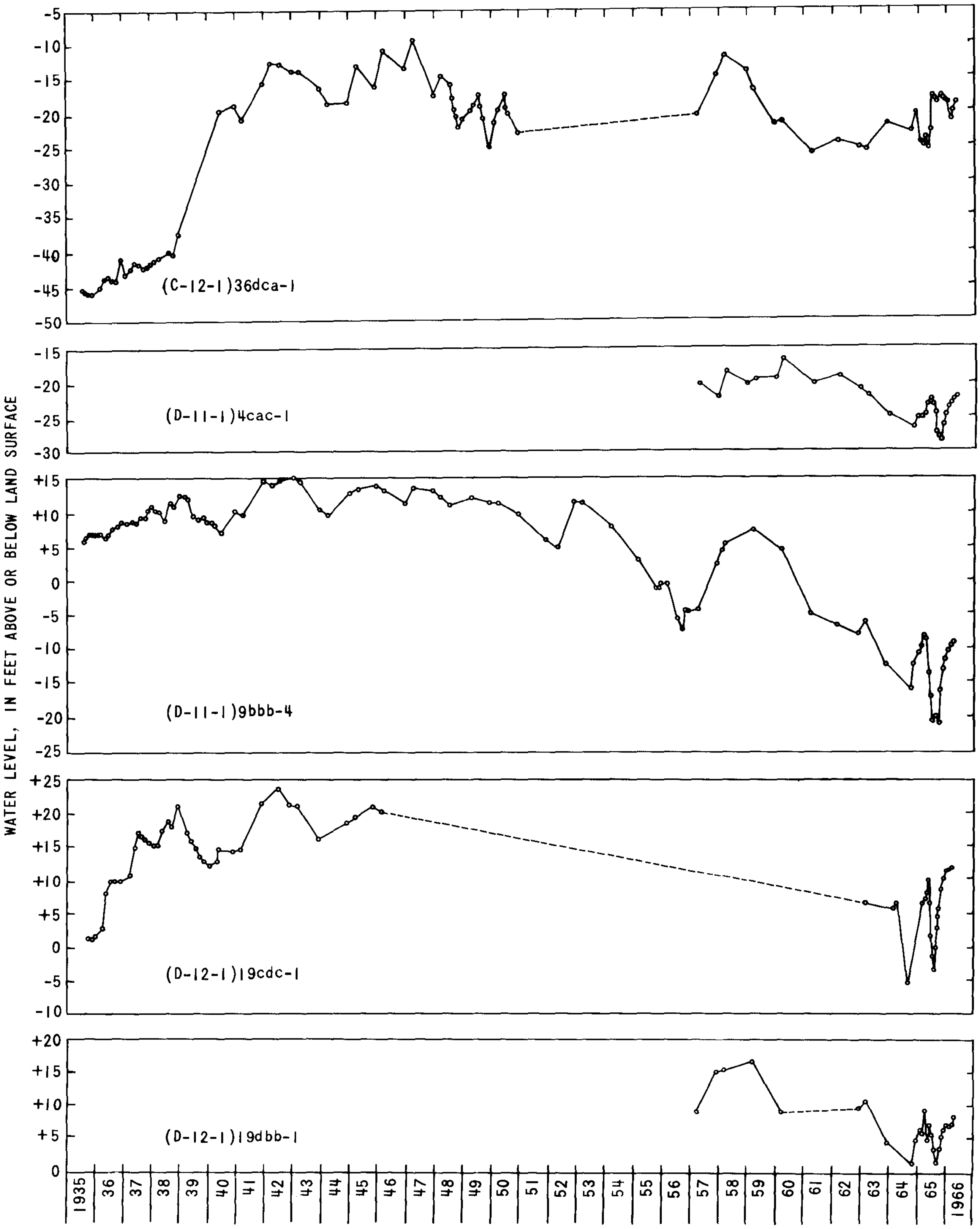

Figure 4. — Hydrographs of selected wells in northern Juab Valley.

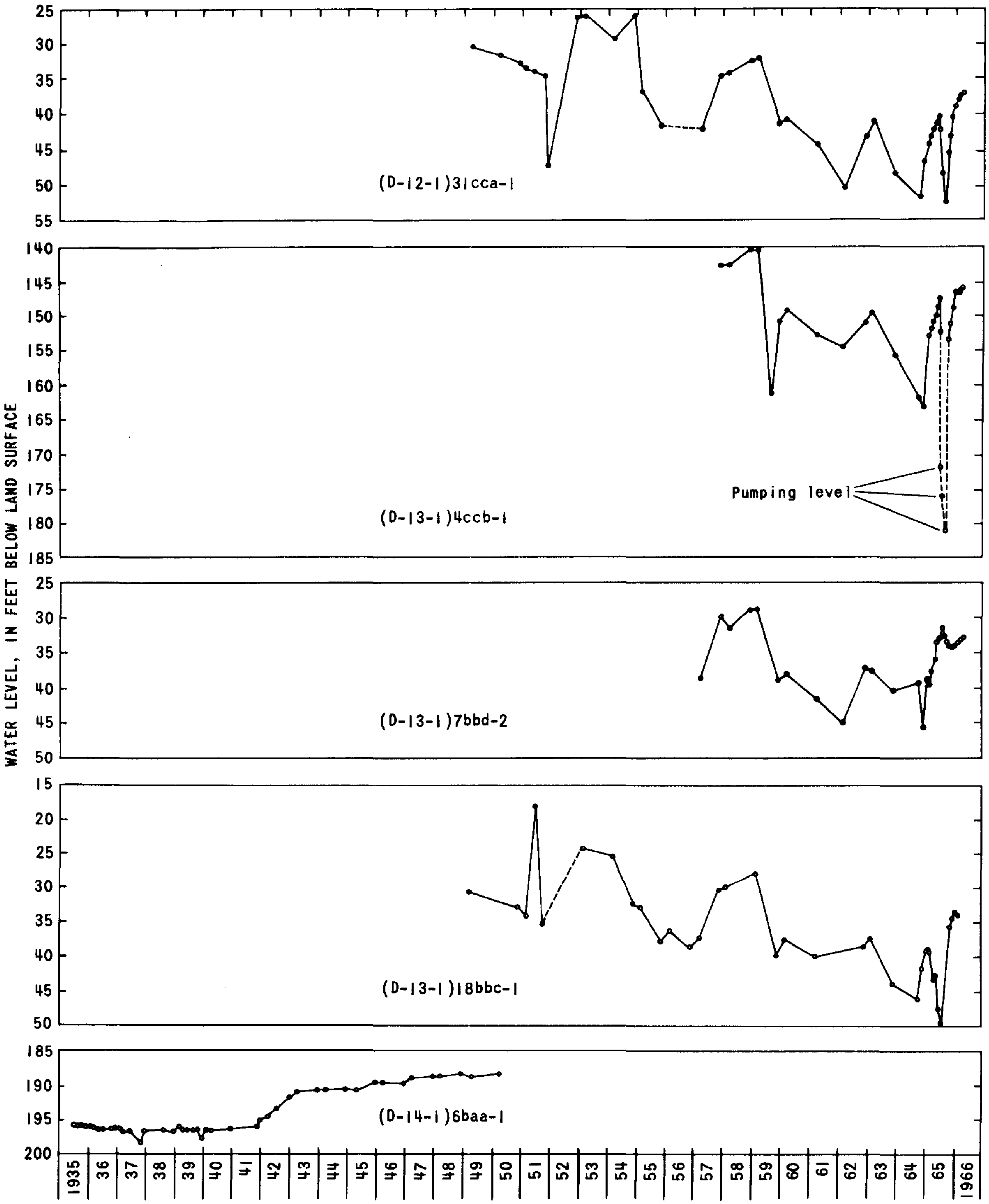

Figure 4. — Hydrographs of selected wells in northern Juab Valley. (Continued)

Declines of water levels are caused mainly by below-normal precipitation and by pumping from wells. The low water levels in wells (C-12-1)36dca-1, (D-11-1)9bbb-4, (D-12-1)19cdc-1, and (D-14-1)6baa-1 (figure 4) and well (D-13-1)6cbb-1 (figure 3) for the year 1935 are the results of below-normal precipitation during several years preceding 1935. As pumping from wells for irrigation did not begin on a large scale until the mid-1940's, the low water levels are attributed to below-normal precipitation only. The 1935 water levels in well (C-12-1)36dca-1 and (D-13-1)6cbb-1 are the lowest of record at those wells.

Although water levels in northern Juab Valley in 1947 were unusually high because of above-average precipitation in 1941 and during the period 1943-47 (figure 3), pumping from wells for irrigation has been a contributing factor in the overall decline of water levels since 1947. (See wells (D-11-1)4cac-1, (D-11-1)9bbb-4, (D-12-1)19cdc-1, (D-12-1)19dbb-1, (D-12-1)31cca-1 (figure 4), and well (D-13-1)6cbb-1 (figure 3).) Pumping for irrigation was the principal cause of the water-level declines in wells (D-11-1)4cac-1 and (D-11-1)9bbb-4 during the period 1963-65 when the precipitation was above normal. (See figure 3.) Water levels in other wells during these 3 years remained about the same or rose slightly. If they had not been affected by pumping, water levels in all the wells would have risen substantially during the 3 years of above-average precipitation.

Annual water-level changes are influenced by current precipitation and also by precipitation during the preceding years. During March 1965-March 1966, water levels in wells rose significantly, even in the heavily pumped areas (figure 5). Rises were noted in 15 of 16 wells observed; changes ranged from −0.3 to +6.0 feet and averaged +2.8 feet. Above-average precipitation for the third year in succession and a shorter-than-usual pumping season were the principal factors in this annual rise. During the preceding year, March 1964-March 1965, water levels rose from 0 to 2 feet in the vicinity and northwest of Nephi and declined from 0 to 1 foot in most of the remaining area (figure 6).

Figure 7 shows the extent of decline in water levels throughout northern Juab Valley during the period 1950-65. The main areas of decline were at and northwest of Nephi and the area east of Mount Nebo Reservoir. In each of these areas water levels declined more than 10 feet.

Seasonal fluctuations

Most of the seasonal fluctuations in ground-water levels in northern Juab Valley are caused by recharge of water from streams, canals, and irrigated fields and by discharge from wells. Fluctuations caused by infiltration of water from streams, canals, and irrigated fields consist of rising water levels (usually beginning in the spring when snowmelt fills many creeks, and continuing through the summer) and declining water levels in the months following the irrigation season. This type of fluctuation is illustrated in the hydrographs of wells (C-12-1)36dca-1 and (D-13-1)7bbd-2 (figure 4) and well (D-13-1)6cbb-1 (figure 3) for those years in which a sufficient number of measurements were made to outline the seasonal changes.

Seasonal fluctuations caused by pumping from wells consist of declining water levels during the pumping or irrigation season, followed by rising water levels during the following seasons. This type of fluctuation has occurred only during recent years since the construc-

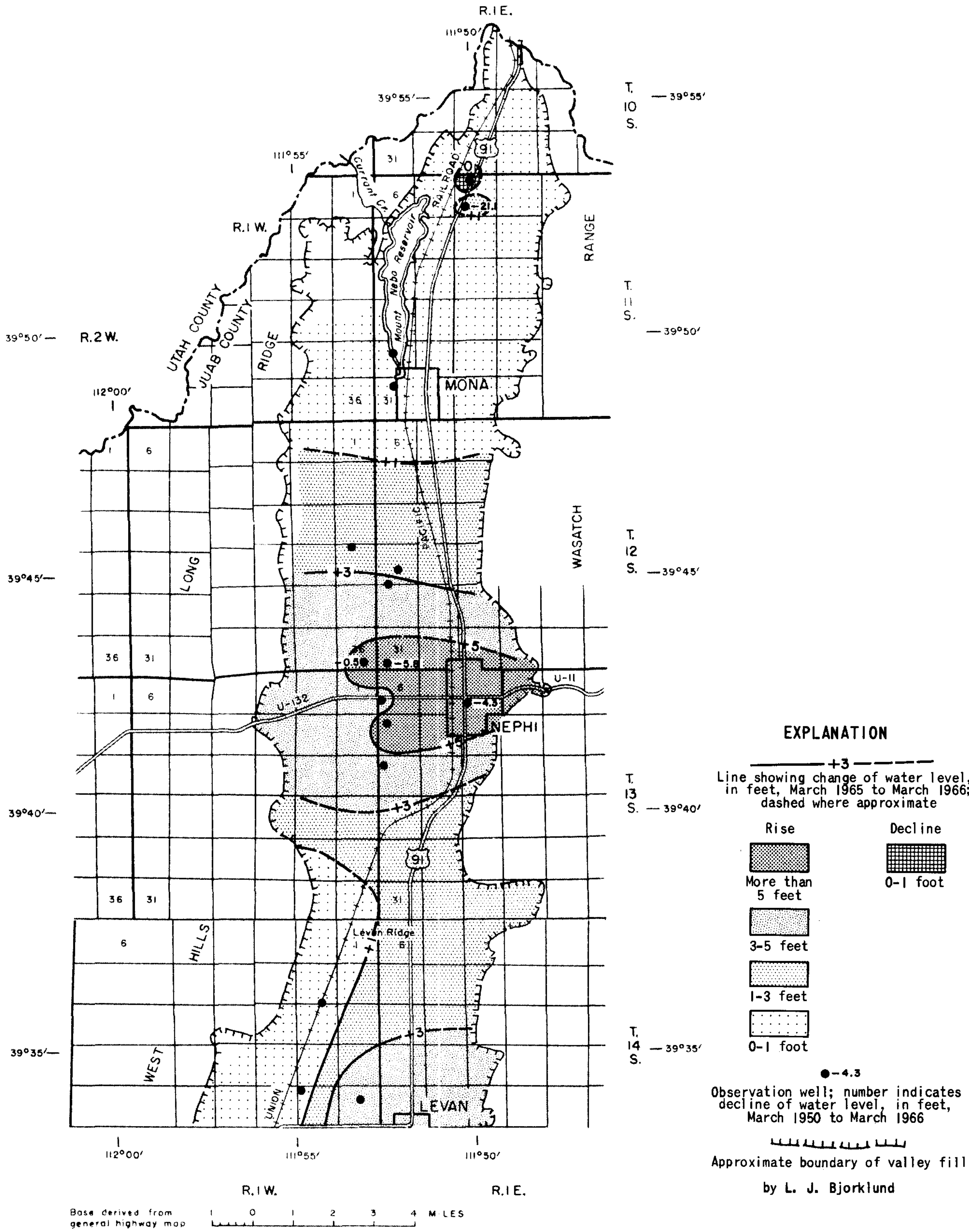

Figure 5. — Change of ground-water levels from March 1965 to March 1966.

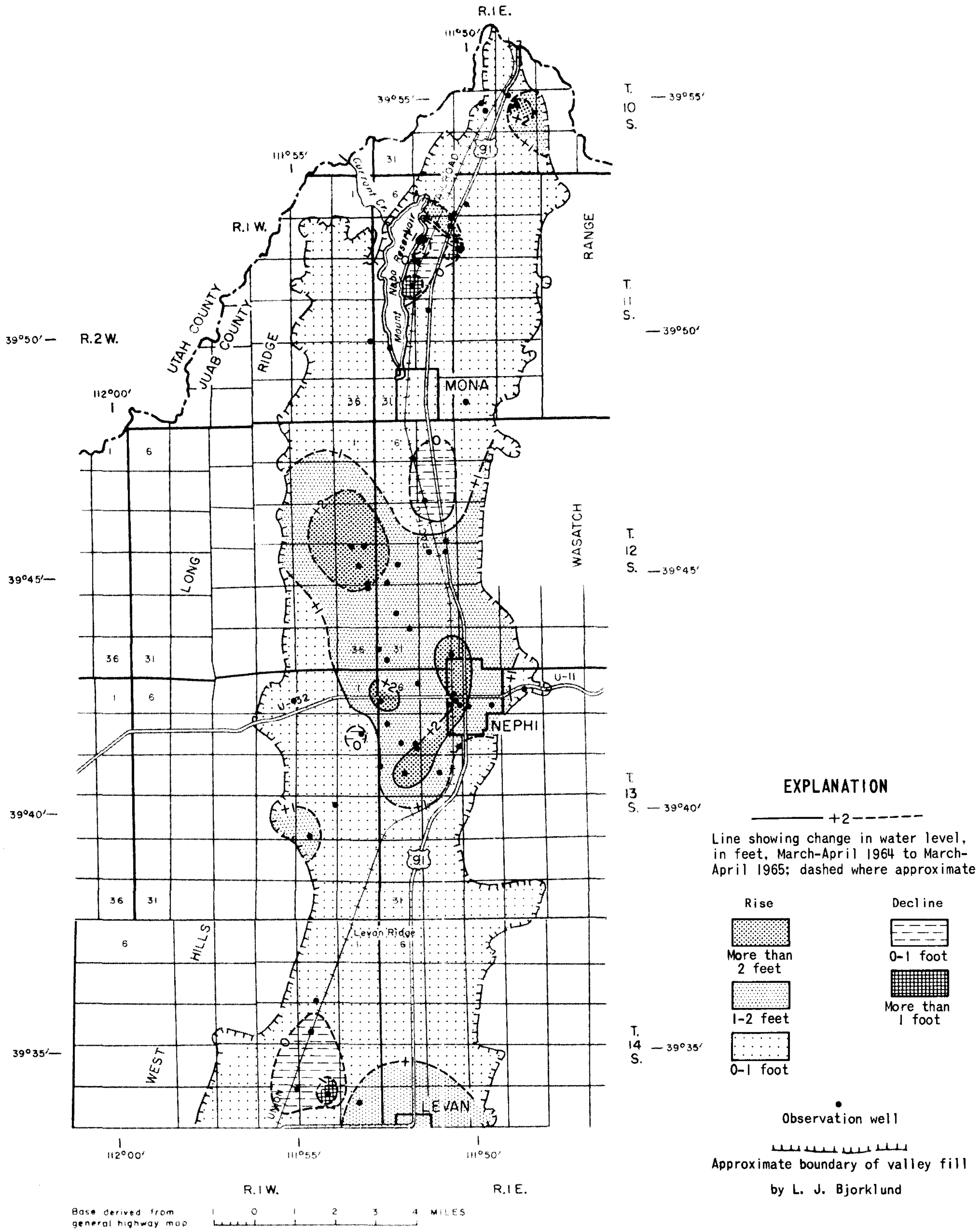

Figure 6. — Change of ground-water levels from March-April 1964 to March-April 1965.

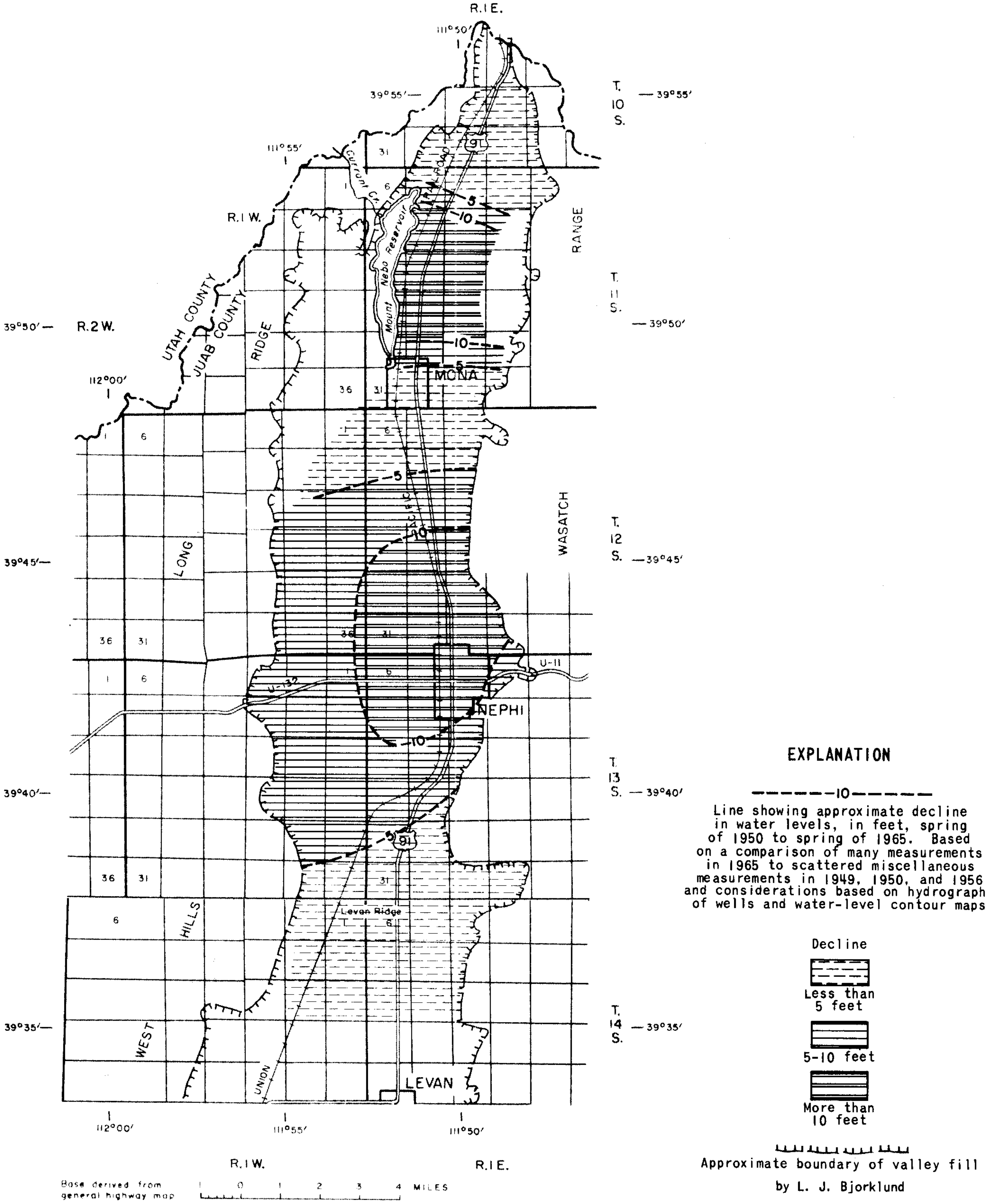

Figure 7. — Approximate change of ground-water levels from spring of 1950 to spring of 1965.

tion of irrigation wells equipped with pumps. These fluctuations are illustrated in the hydrographs of wells (D-11-1)4cac-1, (D-11-1)9bbb-4, (D-12-1)19cdc-1, (D-12-1)19dbb-1, (D-12-1)31cca-1, (D-13-1)4ccb-1, and (D-13-1)18bbc-1 (figure 4) for the year 1965, the only recent year when monthly water-level measurements were made. Before the construction of pumped irrigation wells, the water level in some of these wells rose during the irrigation season and declined following the irrigation season. (See figure 4 for hydrographs of well (D-12-1)19cdc-1 for 1936, 1937, and 1942 and well (D-13-1)18bbc-1 for 1951.)

Heavy pumping from large irrigation wells at and near Nephi affects water levels as far as 3 miles northwest of Nephi. Water-level measurements at relatively short intervals were made at a flowing well, (D-12-1)19cdc-1, shortly after pumping started in wells at and near Nephi on June 25, 1965. A decline of water level began within a few hours and continued until September 17, when irrigation well pumps were stopped because of an early snowstorm and killing frost. The artesian head declined from 10 feet above the land surface on June 25, to slightly more than 3 feet below the land surface on September 15; it recovered to the land surface by September 26, and rose to nearly 12 feet above the land surface by April 7, 1966. The discharge point of the flowing well was 0.2 foot above the land surface, and the well did not flow from about August 12 to September 28, 1965. The fluctuation of artesian head in well (D-12-1)19cdc-1 during the period April 1965-April 1966 is illustrated by the hydrograph in figure 8, and artesian heads on specific dates are given in table 5.

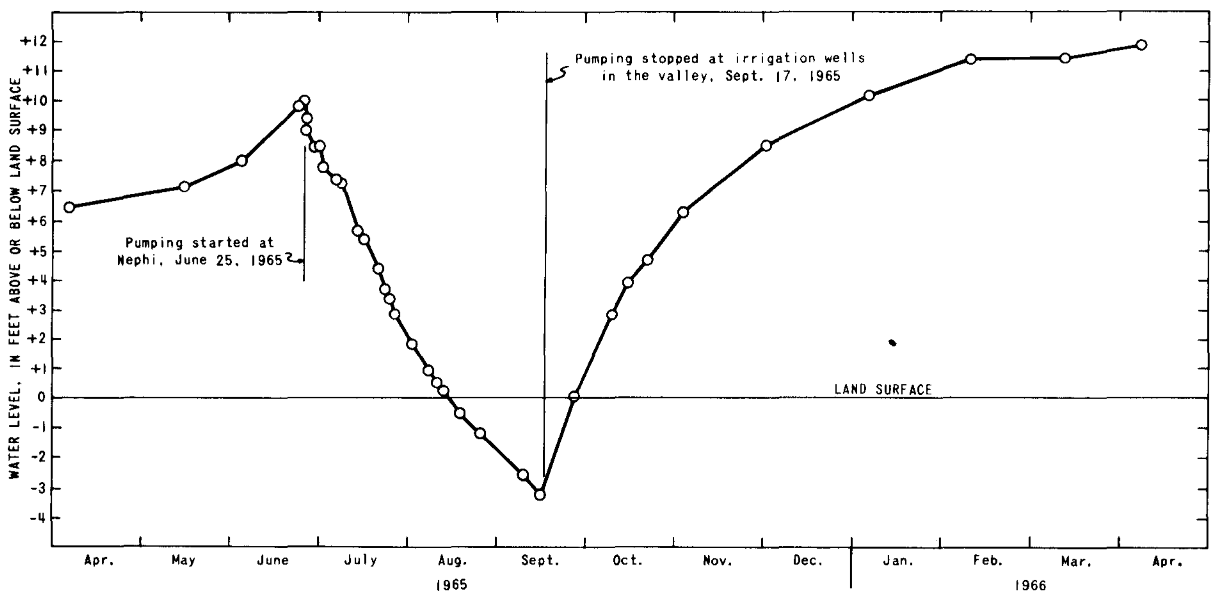

Figure 8. — Effect on well (D-12-1)19cdc-1 of pumping large irrigation wells at and near Nephi, 3 miles to the southeast.

Movement

Ground water is seldom stationary but moves under the force of gravity toward lower altitudes or toward a position of lower hydrostatic pressure. The rate of movement is generally less than a few inches a day; and it depends upon the hydraulic gradient, or slope of the water table or piezometric surface of the aquifer, and on the permeability and effective porosity of the water-bearing materials. The quantity of water moving through the aquifer depends upon these factors and also upon the cross-sectional area of the aquifer.

The general direction of ground-water movement in almost any part of northern Juab Valley can be inferred from the shape and slope of the water surface illustrated on plate 2. The arrows in the figure indicate that the water moves toward lower altitudes in the direction of the greatest hydraulic gradient, which is at right angles to the contours.

Ground water moves from areas or points of recharge toward areas or points of discharge. Most of the ground water in northern Juab Valley moves from the major recharge areas on alluvial fans along the Wasatch-San Pitch mountain fronts on the east side of the valley westward to northwestward into the valley and thence northward toward points of discharge along West and Currant Creeks, which drain the lower parts of the valley. In the northern part of the valley, the water moves generally southwestward or directly westward toward springs and seeps near Mount Nebo Reservoir. Some of the water reaches the creeks and reservoir, but some is diverted along the way by flowing or pumped wells and some comes to or near the land surface in meadows and fields and is consumed by evapotranspiration. The ground water derived from Levan Ridge at the south end of the valley and from alluvial fans along the West Hills and Long Ridge on the west and northwest sides of the valley also moves toward discharge points in the northern end of the valley.

The direction of ground-water movement in several areas in the valley has been altered by heavy pumping for irrigation. An area of depressed water levels covering several square miles has developed in recent years in and around Nephi, causing water to move toward it. This is indicated by the contours on plate 2. During the pumping season, water moves toward the pumped wells from all directions; thus reversing the formerly northward direction of movement on the downgradient (northwesterly) side of the wells. This same effect has been observed east of Mount Nebo Reservoir and west of Nephi. In the latter area, the drawdown caused by pumping is minimized by local recharge from irrigation water diverted from Salt Creek and from water pumped from the wells in Nephi and transported to the irrigated areas.

Aquifer tests

The approximate coefficients of transmissibility[1] were determined at four wells by aquifer tests, using a method described by Wenzel (1942, p. 87-91). Three pumped wells were tested by observing rates of discharge at the pumped well and rates of drawdown of the water levels in other wells. One pumped well was tested by observing the rate of pumping and the recovery of the water level in the pumped well after pumping was stopped. This method is described by Wenzel (1942, p. 94-97) and by Ferris, Knowles, Brown, and Stallman (1962, p. 100-103). Details of these tests are given in table 2.

[1]The coefficient of transmissibility is the rate of flow of water, at the prevailing water temperature, in gallons per day, through a vertical strip of the aquifer 1 foot wide extending the full saturated height of the aquifer under a hydraulic gradient of 100 percent.

Table 2. — Results of aquifer tests in northern Juab Valley

Pumped well	(D-11-1)9cca-1[1]	(D-11-1)21bbb-1[2]	(D-12-1)31aab-1[3]	(D-13-1)4cca-1[4]
Discharge (gallons per minute)	2,450	1,775	900	3,200
Observation wells	(D-11-1)9cbc-1	(D-11-1)20bda-1 (D-11-1)18dda-1	(D-12-1)31aab-1	(D-13-1)4ccb-1
Type of test	Pumping	Pumping	Recovery	Pumping
Date of test	5-18-65	7-1-65	7-22-65	6-25-65
Coefficient of transmissibility (gallons per day per foot)	2,000,000	200,000	500,000	2,000,000
Coefficient of storage	—	0.00527	—	0.00313
Rating of test	Fair	Poor	Good	Fair

[1] The first water-level measurement was made in the observation well, 880 feet from the pumped well, 20 minutes after pumping started. Measurements made during the following 8 hours gave a straight line when plotted against time on semilog graph paper. A stream flowing from the pumped well toward the observed well lost all its flow of 60 gpm in 850 feet and may have affected the test.

[2] Water-level measurements were not started until 73 hours after pumping began, at which time the drawdown in well (D-11-1)20bda-1 was 0.80 foot. Measurements were continued for 41 2/3 hours, during which time an additional 0.38 foot of drawdown developed and the measurements plotted in a straight line on semilog graph paper. Although the plotted results looked good, they were considered to be unreliable because they were based on only a third of the developed drawdown since the beginning of pumping.

[3] This test was made after 40 hours of continuous pumping at approximately 900 gpm, the discharge of 900 gpm being measured immediately before the pump was stopped. A plot on semilog graph paper of the recovery of the water level in the well fell on three straight lines, which covered periods of 3-7 minutes, 7-80 minutes, and 80-250 minutes. The 7-80 minute line was considered to be the most reliable. The 3-7 minute line indicated a value for the coefficient of transmissibility of 1,000,000 gpd per ft and the 80-250 minute line indicated a value for the coefficient of transmissibility of 800,000 gpd per ft.

[4] When the first measurement was made in the observation well, which is 516 feet from the pumped well, 0.72 foot of drawdown had already developed after 8 minutes of pumping. Subsequent measurements were made every few minutes. However, other large pumps in irrigation wells nearby were started at 71 and 170 minutes after the beginning of the test, and this pumping altered and complicated the test. Therefore, the results of only the first 71 minutes of the test were used in interpreting the test.

The approximate coefficients of transmissibility at 20 wells in various parts of the valley were estimated from the specific capacities of wells, using a method described by Theis, Brown, and Meyer (1963, p. 331-340). The specific capacity of a well is determined by dividing the discharge, in gallons per minute, by the drawdown in feet. If the well is flowing, the specific capacity is determined by dividing the discharge, in gallons per minute, by the rise of water level, in feet, when the flow is stopped.

Estimates made by using specific capacities of wells gave coefficients of transmissibility that were smaller in most instances but in the same order of magnitude as those given by the aquifer tests summarized in table 2. Three large wells at Nephi each gave a value for the coefficient of transmissibility of 600,000 gpd per ft as compared to the 2,000,000 gpd per ft determined from the pumping test at well (D-13-1)4cca-1. Two wells on the alluvial fans in the Mona area gave values for the coefficient of transmissibility of 300,000 and 200,000 as compared to the 200,000 gpd per ft determined from the pumping test at well (D-11-1)21bbb-1. Several irrigation wells 1 to 3 miles west and northwest of Nephi gave values for the coefficient of transmissibility ranging from 60,000 to 200,000 as compared to the 500,000 gpd per ft determined from the recovery test at well (D-12-1)31aab-1. Five large flowing wells north of Mona near Mount Nebo Reservoir gave values for the coefficient of transmissibility ranging from 13,000 to 26,000 gpd per ft. Two flowing wells in secs. 13 and 24, T. 12 S., R. 1 W., 5 miles northwest of Nephi, gave values for the coefficient of transmissibility of 13,000 and 14,000 gpd per ft.

The estimates of coefficients of transmissibility based upon the specific capacities of the wells are probably too low for three reasons: (1) in the flowing wells, the head loss in the aquifer at the well would be slightly less than the shut-in head because some head would be required in the well to overcome friction in the discharge pipe; (2) most of the smaller wells penetrate only a small part of the aquifer; and (3) many of the smaller wells are not perforated or developed enough to fully utilize a highly permeable aquifer; for example, wells that have no intake other than the open end of the casing.

Although coefficients of transmissibility based on aquifer tests and estimates in northern Juab Valley varied considerably, some important general conclusions can be made. The transmissibility, permeability, and water-yielding potential of the gravel in the alluvial fans along the eastern side of the valley are extremely large; these factors decrease toward the center and northern parts of the valley, where the transmissibility still is great enough to allow moderate yields of water to wells; the effect of withdrawal of water from wells by pumping and flowing spreads rapidly through the artesian parts of the aquifer. Inasmuch as artesian conditions exist in most parts of the valley, most of the wells are affected to some degree by withdrawal of water from other wells.

Discharge

Ground-water discharge is the withdrawal or loss of water from the ground-water reservoir. In northern Juab Valley ground water is discharged by pumped and flowing wells, springs and seeps, evapotranspiration, and subsurface outflow. These methods of discharge may operate singly or in various combinations. Over a long period of years and under natural conditions, changes in storage are small and discharge is approximately equal to recharge. The withdrawal of water from wells during recent years, however, has disturbed the equilibrium between natural recharge and discharge and has caused a decline of water levels. This is discussed in greater detail in the section on water-level fluctuations.

Wells

Approximately 12,300 acre-feet of water was pumped from wells in northern Juab Valley in 1965; and of that total approximately 12,200 acre-feet was pumped from 19 irrigation wells. About 100 acre-feet of water is discharged annually from pumped and flowing wells for domestic and stock use and about 50 acre-feet is pumped for industrial use. Wells are located on plate 2 and their records are given in table 4.

In 1963 and 1964 approximately 14,600 and 13,000 acre-feet of water respectively, was pumped from irrigation wells (Arnow and others, 1964, p. 51; 1965, p. 49). The year 1965 was one of relatively light pumping because the spring was rainy and cool and irrigation was halted in mid-September by an early snowstorm and killing frost. The most heavily pumped area within the valley is in Nephi where six large irrigation wells are used to supplement the irrigation supply from Salt Creek. Approximately 9,610, 6,920, and 5,450 acre-feet of water were pumped from the six wells in 1963, 1964, and 1965, respectively. Other heavily pumped areas are 1-2 miles southwest of Nephi and about 1 mile east of Mount Nebo Reservoir.

Pumpage from irrigation wells on the alluvial fans cannot be regarded as net discharge from the ground-water reservoir because some of the pumped water infiltrates back to the reservoir from ditches and irrigated fields. The amount of return is not known but probably is between one-fourth and one-half of the water pumped.

About 2,500 acre-feet of water that is used for irrigation is discharged annually from 28 flowing wells in northern Juab Valley. Most of this water is discharged from five 12- to 16-inch flowing wells along the eastern side of Mount Nebo Reservoir in secs. 8, 17, and 18, T. 11 S., R. 1 E. These wells were drilled and developed to augment the water supply in the reservoir. They flow at rates ranging from 150 to 300 gpm and are allowed to flow throughout the year. Several smaller flowing wells also discharge along the eastern side of the reservoir. Another area of large discharge from flowing wells is in secs. 13 and 24, T. 12 S., R. 1 W., where five 4-inch flowing wells each discharge about 80 gpm but are allowed to flow only part of the time. Several smaller wells flow constantly in this area. None of the water that flows from springs and flowing wells in the lower parts of the valley can return to the ground-water reservoir because the piezometric surface is above the land surface and the natural movement of ground water is upward toward the surface. All the water that is discharged remains on the surface to be consumed or flow away in streams.

The discharge of the flowing wells varies with water levels, and some of the wells along the southern margin of the artesian area stop flowing during the pumping season (figure 8). This variation in discharge is discussed further in the section on seasonal water-level fluctuations.

Springs and seeps

Springs and seeps discharge water from the valley fill in northern Juab Valley, from bedrock in the adjacent mountains, and from alluvium in the canyons. The base flow of all the perennial streams flowing into the valley is derived from springs and seeps. Much of this flow, however, infiltrates the valley fill in and immediately below the canyons, recharges the fill, and eventually discharges again from springs and seeps in the valley.

Springs in the mountains and canyons

Only a few of the most representative or important springs in the mountains and canyons adjacent to northern Juab Valley were visited. Clover Creek Spring (D-12-1)3bbc-S1, east of Mona in a small canyon of the Wasatch Range, discharges an average of about 900 gpm of water from brecciated limestone of Paleozoic age near its contact with landslide deposits that override the Manning Canyon Shale of Pennsylvanian and Mississippian age. The water is used for irrigation and for the public supply of Mona. Many other springs discharge into perennial and intermittent streams in the Wasatch Range.

Bradley Spring, (D-13-2)5cbd-S1, is in a tributary canyon to Salt Creek Canyon in the San Pitch Mountains, about 6½ miles east of Nephi. It discharges an average of about 1,800 gpm of water from conglomerate of the Indianola Group of late Cretaceous age near a contact with old alluvium. The water is used for irrigation and for the public supply of Nephi. Lower, Middle, and Upper Fourmile Springs, (D-14-1)10abd-S1, (D-14-1)11bcb-S1, and (D-14-1)11dda-S1, each discharge from about 100 to 200 gpm of water from alluvium in the bottom of Fourmile Canyon in the San Pitch Mountains. The points of discharge are where the underlying bedrock, the Arapien Shale of Jurassic age, is near or at the land surface of the canyon floor. The water is piped to a small reservoir near the mouth of the canyon where it is stored for irrigation and stock use.

Orme Spring, (C-13-1)33cac-S1, in a canyon high in the West Hills, discharges about 2 gpm of water from conglomerate of Tertiary age. The water is piped to a trough for livestock. A larger amount of water than is discharged from Orme Spring itself is discharged by evapotranspiration from the wet canyon wall near the spring. Other springs are reported to exist in Wash, Mendenhall, North Creek, Pole, Bear, Willow, and Gardner Canyons. Some of these springs probably discharge at or near the contacts of rocks of different permeabilities and some probably discharge from alluvium in the canyons.

Springs and seeps in the valley

Springs and seeps discharge in the valley along a 10-mile reach of meadowlands from northwest of Nephi in sec. 25 T. 12 S., R. 1 W., to the north end of Mount Nebo Reservoir in sec. 5, T. 11 S., R. 1 E. This 10-mile reach is essentially the area where the piezometric surface of the ground water is above the land surface (plate 3). The largest springs are near Currant Creek, especially in the vicinity of Burriston Ponds in sec. 6, T. 12 S., R. 1 E., where the rather flat valley floor extending northward from the area west of Nephi is pinched off by alluvial fans on each side of the valley. Springs in this area discharge ground water that has moved westward from the vicinity of Nephi and also water that has moved westward from the vicinity of Willow Creek canyon in the Wasatch Range. North of Burriston Ponds, along Currant Creek and along the east side of Mount Nebo Reservoir, the springs and seeps discharge water that has moved westward from various canyons along the Wasatch front. This movement is discussed in greater detail in the section on movement.

One of the many springs at Burriston Ponds was measured periodically during parts of 1965 and 1966 to determine fluctuations of discharge. The spring discharges at the southeast edge of the southeast pond and in this report is called the southeast spring at Burriston Ponds. The discharge, which was measured at the outlet of the pond, is shown by the hydrograph in figure 9. The hydrograph of the spring shows the same general shape as do several of the water-level hydrographs of wells in the valley for the same period. (See figure 4.) This similarity is to be expected because the rate of discharge from springs and flowing wells in the valley depends upon the ground-water levels and artesian heads. It may be assumed also that the discharges of all the springs at Burriston Ponds fluctuated approximately the same as did that of the southeast spring.

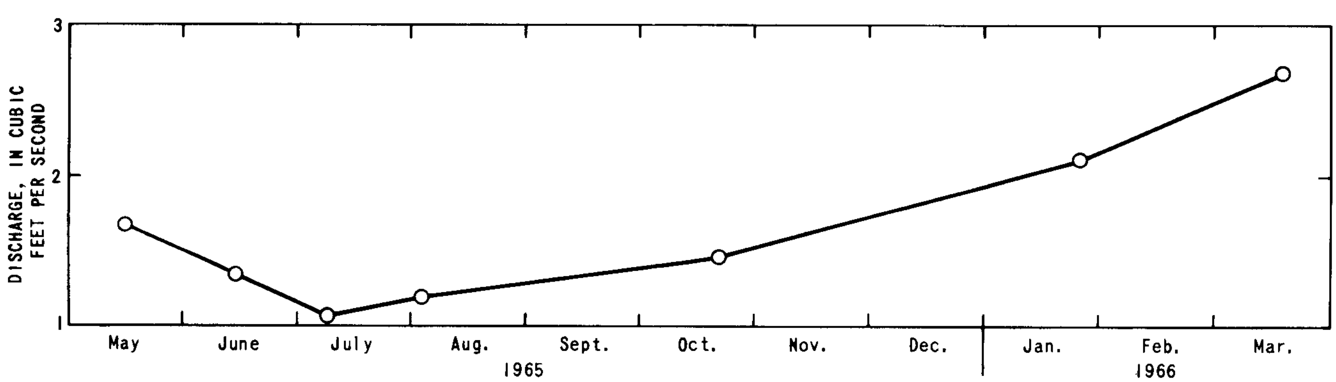

Figure 9. — Discharge from the southeast spring at Burriston Ponds, May 1965-March 1966.

The discharge from a group of springs, including (D-11-1)31aaa-S1, aligned in a north-south direction near the western edge of Mona, fluctuates quite differently from other springs in the valley. According to local landowners, the discharge from these springs increases during the irrigation season when water is applied to fields higher on the alluvial fan in and east of Mona. Furthermore, the springs discharge at altitudes several feet above the water levels in nearby artesian wells, including well (D-11-1)31abc-1. It is believed that the springs discharge at the contact of a bed of gravel and an underlying bed of silt or clay. Irrigation water seeping into the gravelly fields higher on the alluvial fan evidently percolates downward to the silt or clay and then moves westward toward the point of discharge. The largest of these springs, (D-11-1)31aaa-S1, discharges less than 1 cfs before the irrigation season, but nearly 2 cfs during the irrigation season. Estimates of the discharge made at various times during the year ranged from 0.2 to 1.4 cfs; however, all the water could not be measured because it had been diverted in different directions to irrigate meadow pasture. The discharges of the other springs were relatively small and did little more than wet the immediate area around the springs.

Ground-water accretion to Currant Creek. — Virtually all the flow of Currant Creek is derived from ground-water discharge from springs and seeps. A seepage run was made on Currant Creek on March 17-18, 1966, to determine the gains and losses in streamflow in the 3-mile reach of the stream between its source in sec. 7, T. 12 S., R. 1 E., and Mount Nebo Reservoir. The stream was measured at intervals and some of the tributary inflow was measured. Details of the seepage run are given in table 3, and the gains of the stream within the measured reach are shown in figure 10.

The seepage run was made in the spring when streamflow was greater than the annual average. When the seepage run was conducted, the discharge of the southeast spring at Burriston Ponds was measured at 2.68 cfs; but the average of seven measurements made during the period May 1965-March 1966 (figure 9) was only 1.65 cfs, or about 62 percent of its flow at the time of the seepage run. Assuming that all springs feeding Currant Creek would fluctuate in a pattern similar to that of the southeast spring at Burriston Ponds, the average annual flow of the creek 0.2 mile north of Mona Bridge during the period May 1965-March 1966 would be about 62 percent of 19.2 cfs (table 3), or about 12 cfs. The yearly discharge would then be about 9,000 acre-feet of water. Virtually all this water would be derived from ground-water discharge from springs and seeps.

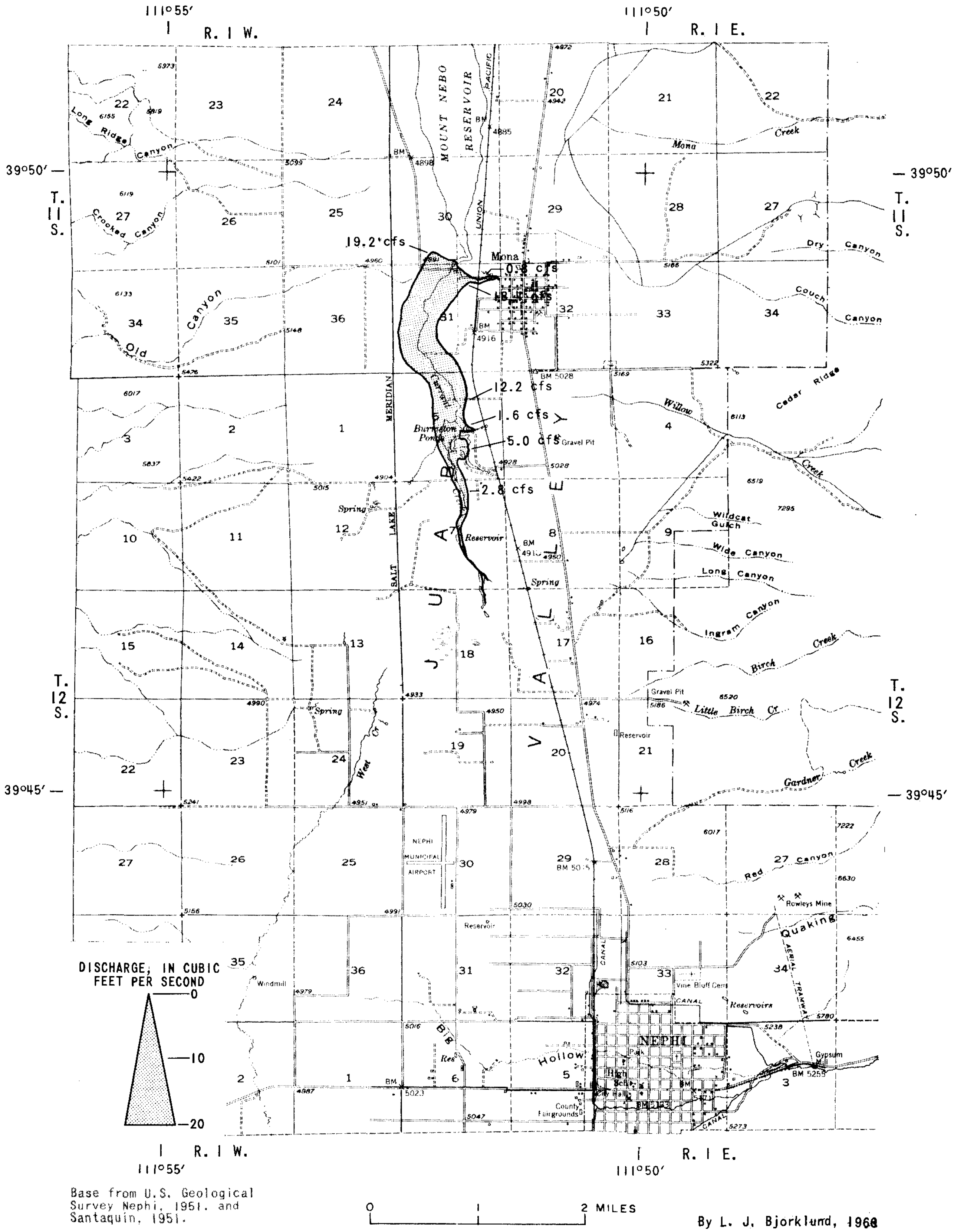

Figure 10. — Cumulative gain in flow in Currant Creek, March 17-18, 1966.

Table 3. — Approximate gain in flow of Currant Creek due to ground-water discharge between its source and Mount Nebo Reservoir, March 17-18, 1966

Location and description of measuring station	Distance from source of Currant Creek (miles)	Flow at measuring station; all is derived from ground-water discharge (cfs)	Net gain in Currant Creek due to ground-water accretion (cfs)	Cumulative gain in Currant Creek due to ground-water discharge (cfs)
NW¼NE¼ sec. 7, T. 12 S., R. 1 E., in Currant Creek	0.8	2.8	2.8	2.8
NW¼SE¼ sec. 6, T. 12 S., R. 1 E., in south outlet from Burriston Ponds	1.3	5.0	—	—
SW¼SE¼NE¼ sec. 6, T. 12 S., R. 1 E., in north outlet from Burriston Ponds	1.6	1.6	—	—
NW¼NE¼ sec. 6, T. 12 S., R. 1 E., in Currant Creek at USBR gaging station	1.8	12.2	9.4	12.2
NW¼NE¼ sec. 31, T. 11 S., R. 1 E., in Currant Creek at Mona Bridge	3.0	18.4	6.2	18.4
NW¼NE¼ sec. 30 T. 11 S., R. 1 E., in drain from spring and meadow where it enters Currant Creek	3.2	.8	—	19.2

The similarity of the pattern of discharge from the southeast spring at Burriston Ponds and the flow in Currant Creek is indicated by a series of comparative measurements. In 1965, five measurements were made of the discharge of Currant Creek in the NW¼NE¼ sec. 6, T. 12 S., R. 1 E., by the U.S. Bureau of Reclamation (written commun., 1966) during the usual period of lowest flow, the irrigation season. These measurements were: 6.90 cfs on May 13, 4.88 cfs on July 15, 5.33 cfs on August 5, 5.51 cfs on August 19, and 4.57 cfs on August 26. The average of these measurements, 5.44 cfs, is nearly 45 percent of the 12.2 cfs measured at the same station during the seepage run in March (table 3). In similar manner, four flow measurements were made at the southeast spring at Burriston Ponds during the period May-August 1965 (figure 9). The average of these measurements, 1.32 cfs, is about 49 percent of the 2.68 cfs measured at the southeast spring at Burriston Ponds at the time of the seepage run.

Ground-water accretion to Mount Nebo Reservoir. Ground water flows directly into Mount Nebo Reservoir from many springs and seeps along its edge. The exact amount of such inflow is not known but can be roughly estimated. Outflow records for the reservoir for the 7 water years 1954-60 show that the annual discharge ranged from 19,390 acre-feet in 1954 to 13,500 acre-feet in 1960 and averaged 15,763 acre-feet (U.S. Geol. Survey, 1963c, p. 100). The total average net discharge from the reservoir would also include evaporation[1] minus precipitation[2] for the same period and would amount to about 17,000 acre-feet. If the annual inflow

[1]Normal annual evaporation is considered to be about the same as determined at Utah Lake by the U.S. Weather Bureau (oral commun., 1967), or about 43 inches per year.

[2]Normal annual precipitation is estimated to be about 14 inches (U.S. Weather Bur., 1963), and the average size of the reservoir is taken to be about 1 square mile.

from Currant Creek at Mona Bridge is about 9,000 acre-feet as estimated in the preceding section, then about 8,000 acre-feet of water must come from other sources. Flowing wells near the reservoir contribute about 2,000 acre-feet, and a small amount is early spring runoff. Almost 6,000 acre-feet of water therefore, enters the reservoir directly from springs and seeps.

Evapotranspiration

Evapotranspiration includes evaporation from the land surface and transpiration by vegetation. Ground water is discharged by evapotranspiration mostly in the wet meadowlands in the lower parts of the valley where the piezometric surface is above the land surface and where depths to ground water are less than 10 feet below the land surface (plate 3). Water-loving plants that commonly extend roots into the ground-water zone and discharge water by transpiration are called phreatophytes. The most common phreatophytes in northern Juab Valley are saltgrass (*Distichlis stricta*), greasewood (*Sarcobatus vermiculatus*), rabbitbrush (*Chrysothamnus* sp.) willow (*Salix* sp.) cottonwood (*Populus* sp.) bulrush (*Scirpus* sp.), saltcedar (*Tamarix gallica*), wild rose (*Rosa carolina*), and alfalfa (*Medicago sativa*). Saltgrass grows mostly in the wet meadows; greasewood and rabbitbrush grow in fringe areas near the wet meadows, and willow, cottonwood, and wild rose grow along streams and irrigation ditches. Saltcedar, which is relatively new in the valley, grows mostly in three areas: (1) along the edge of Mount Nebo Reservoir, especially at the north end and along the west side, (2) along West Creek in secs. 24 and 35, T. 12 S., R. 1 W., and (3) along a drain in the SW¼ sec. 36, T. 12 S., R. 1 W. Subirrigated alfalfa is cultivated in parts of secs. 17-20, T. 12 S., R. 1 E., and secs. 24 and 25, T. 12 S., R. 1 W., and in these areas it is a true phreatophyte because its principal source of water is the ground-water reservoir which it taps with its roots.

The area of greatest evapotranspiration in northern Juab Valley is the lowest part of the valley where the principal vegetation is saltgrass and other meadow grasses, willow, bulrush, saltcedar, and subirrigated alfalfa (plate 4). This area includes virtually all the area where the piezometric surface of the ground-water reservoir is above the land surface and extends part way into the area where the depth to ground water is less than 10 feet (plate 3). The area of high evapotranspiration also includes the southern third of Mount Nebo Reservoir. That part of the reservoir is submerged with water only a small part of the time, thus permitting a dense growth of grasses and some saltcedar. The area shown as the reservoir on plate 4 presumably is the maximum area of inundation and is described by a 4,882-foot contour, which is the altitude of the spillway at the dam.

The area of high evapotranspiration in the valley includes approximately 7,000 acres in which an estimated 30 inches of water per year or about 18,000 acre-feet is consumed. Meadow grasses cover most of the area, but about 700 acres is covered to some degree with saltcedar and about 700 acres is cultivated for subirrigated alfalfa.

Saltcedar could become a threat to future ground-water resources in northern Juab Valley. At the time of the investigation (1965) most of the saltcedar was not mature and was somewhat scattered over a moderate area. However, saltcedar spreads and grows rapidly in wet areas and is capable of consuming a large amount of water. The amount of water it consumes depends upon many factors, including the depth to water, temperature, and the length of the growing season. Robinson (1958, p. 70-75) indicates that a fully developed growth of saltcedar uses from 5 to more than 7 acre-feet of water annually.

The ground-water reservoir in northern Juab Valley is also tapped by phreatophytes outside of the area of high evapotranspiration. Greasewood and rabbitbrush thrive in large areas adjacent to the meadows, but no attempt was made to map these fringe areas nor to estimate the amount of water used by phreatophytes in them. The amount of water consumed annually, however, may be several thousand acre-feet.

Subsurface outflow

Little water leaves northern Juab Valley as subsurface outflow. The lowest water levels in the valley are about 340 feet higher than the ground-water discharge area in neighboring Goshen Valley, 5 miles north of Mount Nebo Reservoir; thus, Long Ridge, which separates the two valleys, apparently acts as a ground-water barrier. A small amount of water, however, probably seeps past the Mount Nebo Reservoir dam and moves through the alluvium in Currant Creek Canyon. Also some small springs that discharge from low volcanic hills into Currant Creek near the center of sec. 1, T. 11 S., R. 1 W., are about 20 feet lower than the valley floor beneath Mount Nebo Reservoir, about 1 mile away, and probably discharge water derived from northern Juab Valley.

Utilization

During the investigation, 138 production wells (all the known production wells in the valley), 9 springs, and 18 shallow non-production wells were visited. Of the 138 production wells, 32 were used mainly for irrigation, 49 mainly for livestock, 12 mainly for domestic use, 2 for industrial use, and 43 wells were not used. Eighteen of the production wells were used by their owners for more than one purpose. Of the 9 springs, 2 were used mainly for public supply (Nephi and Mona), 2 were used mainly for irrigation, 4 were used mainly for livestock, and 1 had no particular use. (See table 4 and plate 3.)

Irrigation supply

By far the greatest use of both surface and ground water in northern Juab Valley is irrigation. All available water flowing into the valley from the Wasatch Range and San Pitch Mountains is utilized, and nine irrigation companies are organized in the area to facilitate the use of water. The three largest organizations—the Nephi Irrigation Co., the Mona Irrigation Co., and the North Canyon Irrigation Co.—each have supplementary irrigation wells equipped with electrically driven pumps to augment their supply during periods of insufficient surface flow. The Nephi Irrigation Co. operates 7 irrigation wells to augment the flow in Salt Creek, 6 within the city limits of Nephi and 1 in Salt Creek Canyon. These 7 wells added 9,080, 7,200, and 5,650 acre-feet of water to the creek in 1963, 1964, and 1965, respectively. Several privately owned wells west of Nephi are also used to supplement the supply of water from Salt Creek. During 1963, 1964, and 1965, a total of about 14,600, 13,000, and 12,200 acre-feet of water, respectively, were pumped from wells to irrigate lands in northern Juab Valley.

The number of wells used mainly for irrigation in northern Juab Valley during the period 1940-65 is shown in figure 11. The wells drilled prior to 1947 had relatively small discharges in comparison to the wells that have been drilled since 1947, when the first successful large-discharge well (900 gpm measured in 1965) was drilled. The large-scale development of ground water in the valley began in 1947. Most of the pumped wells drilled during the 1950's and 1960's yield more than 1,000 gpm and several yield more than 2,000 gpm (table 4).

Some of the springs and irrigation wells in northern Juab Valley supply water that is used in Goshen Valley. The flow from springs at Burriston Ponds, along Currant Creek, and near Mount Nebo Reservoir, and the flow from five large wells in secs. 8, 17, and 18, T. 11 S., R. 1 E., discharge into Mount Nebo Reservoir. During the period 1954-60, it is estimated that these sources supplied an average of about 17,000 acre-feet of water to the reservoir annually, and an average of 15,763 acre-feet of water was delivered annually to Goshen Valley (U.S. Geol. Survey, 1963c, p. 100). Records later than 1960 are not available.

Public supply

Nephi obtains its water supply from Bradley Spring, (D-13-2)5cbd-S1, in a tributary canyon on the south side of Salt Creek Canyon about 6½ miles east of Nephi. The spring is reported to discharge an average of about 1,800 gpm, with its maximum reported flow late in the summer. The water flows from a conglomerate of the Indianola Group of late Cretaceous age. Nephi uses about 60 percent of the average flow of the spring and the remainder is discharged to Salt Creek and is used by the Nephi Irrigation Co. Water for Nephi is piped from collecting works at the spring about 4 miles to a 1 million gallon capacity concrete reservoir near the mouth of Salt Creek Canyon, and thence it is delivered by gravity to the city. Wells (D-13-1)4ccb-1 and (D-13-1)5dab-1 are used almost exclusively for irrigation, but they are connected to the city mains of Nephi and are used for public supply when a sufficient supply is not available from Bradley Spring.

Mona obtains its water supply from Clover Creek Spring, (D-12-1)3bbc-S1, located 2 miles east of the town in a small canyon in the Wasatch Range. The spring, which is owned jointly by the town of Mona and the Mona Irrigation Co., discharges from brecciated limestone of Paleozoic age. The discharge averages about 900 gpm, with the maximum flow reported in the fall, and the town uses about half the total flow. Water is piped from collecting works at the spring to two headhouses located east of Mona and having capacities of 100,000 and 20,000 gallons, and thence it is delivered by gravity to the town.

Domestic and stock supply

Areas not supplied by the water systems of Nephi and Mona obtain water for domestic and stock use from privately owned small-diameter wells. In meadow areas, the stock supplies are obtained largely from springs, ponds, streams, and flowing wells. Water for livestock is hauled to areas where it is not readily available and to some fringe artesian areas when the wells stop flowing during the irrigation season. Most of the stock wells were drilled for cattle but also furnish supplies for other livestock. Most of the domestic wells on farms are also used for livestock, and most of the unused wells in table 6 were originally drilled for domestic or stock use. About 100 acre-feet of water is discharged annually from pumped and flowing domestic and stock wells in northern Juab Valley.

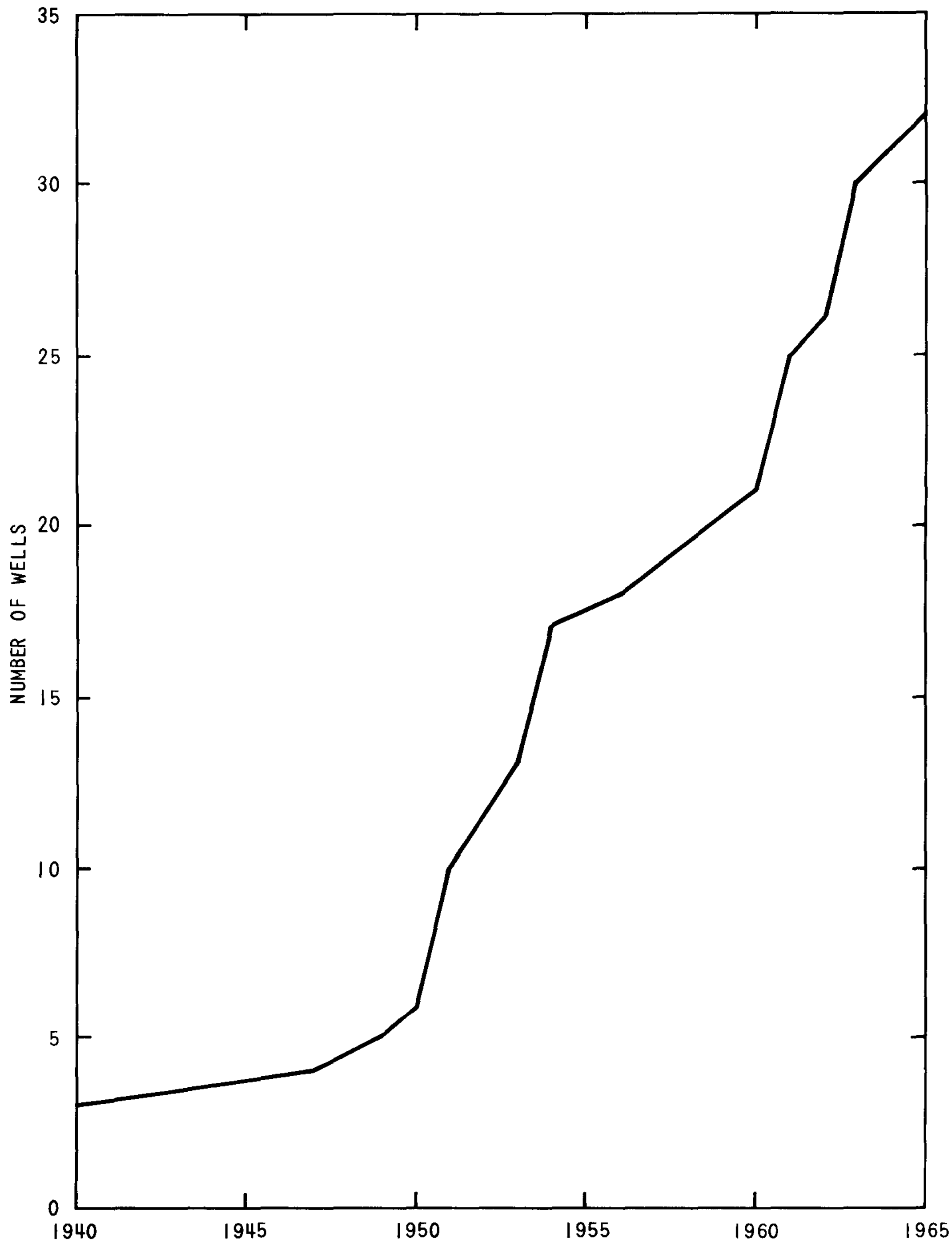

Figure 11. — Number of wells used mainly for irrigation, 1940-65.

Industrial supply

Only two wells in northern Juab Valley supply water for industrial purposes (table 4). Water from well (D-12-1)32dac-1 is used for cooling molds in a large rubber-products plant. The waste water is dumped into a ditch and is used for irrigating nearby fields. Well (D-13-1) 8aac-1 provides water for a turkey processing plant. Accurate records of the amount of water used by the two plants are not available, but it is estimated that together they use about 50 acre-feet of water annually.

Chemical quality

Samples were collected for chemical analysis from 17 wells and springs in northern Juab Valley during the period 1951-63. During 1965, 7 additional samples were collected from sites not previously visited. Other data acquired for the study include 37 analyses of water from wells made by the Bureau of Reclamation during the period 1954-64 and 2 analyses of water from a well and a spring made by the Public Health Service during 1941 and 1955. The results of the chemical analyses are shown in table 7. The locations of sampling sites and the concentrations of dissolved solids are shown on plate 5.

The ground water in northern Juab Valley is considered to be fresh if it contains less than 1,000 ppm (parts per million) of dissolved solids and slightly saline if it contains between 1,000 and 3,000 ppm of dissolved solids. Of the 63 samples analyzed, 56 were fresh and 7 were slightly saline.

The ratio of the concentration of dissolved solids in water to its specific conductance ranges between 0.55 and 0.75 unless the water has an unusual composition (Hem, 1959, p. 40). In northern Juab Valley the average ratio indicated in the samples analyzed was about 0.62, and that factor was used to convert determined specific conductances to approximate concentrations of dissolved solids. The relation between concentration of dissolved solids and specific conductance in the valley is shown graphically in figure 12.

Fresh water

The fresh ground water in northern Juab Valley is divided into three categories on plate 5. The freshest water, which has a dissolved solids concentration of less than 300 ppm, occupies an area of about 30 square miles north and east of Mona and along the Wasatch front southward to a point about 2 miles north of Nephi. The dissolved-solids concentration of 14 samples collected in this area ranged from 172 to 285 ppm and averaged 250 ppm. The ground water in this area is freshest mainly because (1) the major source of recharge to the area is precipitation on the western slope of the Wasatch Range, and this range is made up of the hardest and least soluble rocks (quartzite, sandstone, shale, and limestone rocks of Paleozoic age) in the mountains adjacent to the valley; (2) the valley fill which forms the aquifer is derived from these rocks; and (3) the water flows a short distance from the places of recharge.

The next freshest ground-water, which has a dissolved-solids concentration of 300-600 ppm, is found primarily in two areas in the valley (plate 5). The northernmost area is believed

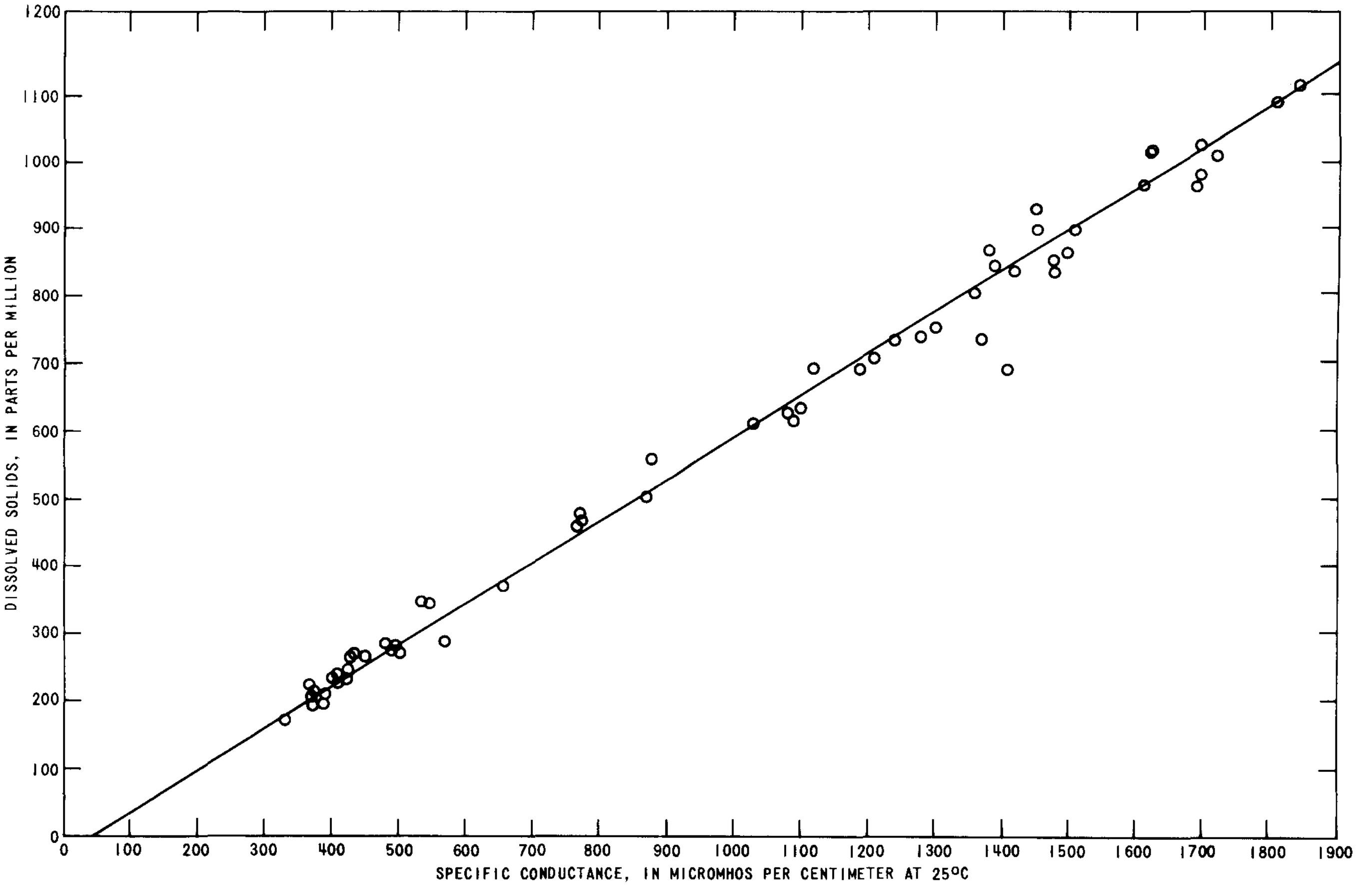

Figure 12. — Relation between concentration of dissolved solids and specific conductance of ground-water samples collected, 1941-65.

to be a transition zone between water to the east and north which contains less than 300 ppm of dissolved solids and water to the south and west which contains between 600 and 1,000 ppm of dissolved solids.

The southernmost area is southwest of Nephi (plate 5) and includes about 4 square miles mostly on the alluvial slope of the West Hills. Recharge to this area is mainly on alluvial fans along the eastern front of the West Hills, but some recharge probably is from precipitation on the general area because the land surface is quite sandy.

The area containing ground water having between 600 and 1,000 ppm of dissolved solids occupies an area of about 30 square miles around Nephi and to the west and northwest. Most of the water in this area infiltrates from Salt Creek into the Salt Creek alluvial fan near Nephi. Much of the alluvium in the fan and in Salt Creek Canyon is derived from the Arapien Shale of Jurassic age, and the relatively high concentration of dissolved solids, particularly chloride and sulfate, is due to the solution of minerals as the water passes through the alluvium. The quality of ground water improves around Burriston Ponds because part of the more mineralized water is discharged near the southern end of the ponds and part of it moves northward and mixes with less mineralized water moving in from the Wasatch front to the east. This is demonstrated by analyses of samples obtained from the various outlets of the ponds. Water sampled in May 1965 from the southeast spring at the ponds, (D-12-1)6ddc-S1, contained 898 ppm of dissolved solids (table 7); the specific conductance of water discharging from the south outlet of the ponds in March 1965 was 985 micromhos per centimeter at 25°C (about 610 ppm of dissolved solids); whereas in March 1965 water discharging from the north pond had a specific conductance of only 420 micromhos per centimeter at 25°C (about 250 ppm of dissolved solids).

Slightly saline water

Slightly saline water was collected from seven wells. The most mineralized water, containing 2,200 ppm of dissolved solids, was from well (D-13-1)1cab-1 in Salt Creek Canyon (plate 5). The main source of the dissolved minerals is attributed to the Arapien Shale which crops out nearby (plate 1). Slightly saline water containing 1,890 ppm of dissolved solids was collected at well (C-14-1)14cac-1, just south of Levan Ridge. The salinity of water from this well is attributed in part to the Arapien Shale which is the source of part of the valley fill in the area. Slightly saline water was also obtained from a well just south of Nephi, three wells about 2 miles southwest of Nephi, and from a well 4 miles north-northwest of Nephi. The wells are in an irrigated or a generally wet area, however, and the slight excess of dissolved solids above 1,000 ppm probably is due to evapotranspiration.

Quality in relation to use

Irrigation

The total concentration of soluble salts and relative proportion of sodium to other cations are among the principal factors in determining the suitability of water for irrigation (U. S. Salinity Lab. Staff, 1954, p. 69).

The total concentration of soluble salts, or salinity, affects plant growth by limiting the ability of the plant to take in water by osmosis. The rate at which water can enter the roots depends on the difference between the salinity of water within the plant and the salinity of the water in the soil. If the salinity of the irrigation water in the soil is appreciably less than the salinity of the water in the plant, the plant will assimilate the water readily. If the difference is small, the plant must be exposed to the water for a longer period of time in order to take in enough water for its needs. If the salinity of the water in the soil is equal to or greater than the salinity of the water in the plant, the plant cannot assimilate the water by osmosis and may even lose water in the process. In this event the plant will die for lack of water. The degree of salinity in irrigation water is called the salinity hazard.

The relative proportion of sodium to other cations in irrigation water affects plant growth by affecting the extent to which a soil will adsorb sodium from the water. The adsorption of the sodium breaks down the flocculation of the soil, making it gummy, less permeable, less fertile, and difficult to reclaim. An index to this sodium hazard is called the sodium adsorption ratio (SAR), and it is expressed as

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

where the concentrations of sodium, calcium, and magnesium are expressed as equivalents per million. The SAR values of most of the samples collected in the valley are included in table 7.

The salinity and sodium hazards of 58 ground-water samples collected in northern Juab Valley are classified in figure 13 according to the method of the U.S. Salinity Laboratory Staff (1954, p. 80). The method graphically identifies a water as belonging to one of four categories of sodium hazard and to one of four categories of salinity hazard. All except two of the samples classified in figure 13 have a low-sodium hazard and all except two have either a medium- or a high-salinity hazard. There is little danger of sodium damage to irrigated fields in the valley if the fields are drained of excess water. The salinity hazard is not a problem because the crops commonly grown—alfalfa and grains—are moderately tolerant to salinity (Hem, 1959, p. 249).

The difference in the chemical quality of the ground water sampled from the northern and southern parts of the valley is indicated in table 7 and figure 13. In figure 13 ground-water samples collected north of Burriston Ponds generally fell into a relatively small area defined by SAR values of less than 1.0 and conductivity values between 250 and 750 micromhos per centimeter at 25°C; on the other hand, samples collected in the valley south of Burriston Ponds generally fell into a larger area defined by SAR values between 1 and 12 and conductivity values between 750 and 5,000. Water collected north of Burriston Ponds is in the low sodium-hazard class and the medium salinity-hazard class and represents the best water for irrigation in the valley. On the other hand, the water collected south of Burriston Ponds is in the low sodium-hazard class and the high salinity-hazard class.

Ground water near the upper limits of the low sodium-hazard class and in the very high salinity-hazard class was sampled from well (C-14-1)14cac-1 near the ground-water divide south of Levan Ridge. Water from wells in the Levan Ridge area, however, is not used for irrigation but is used exclusively for livestock.

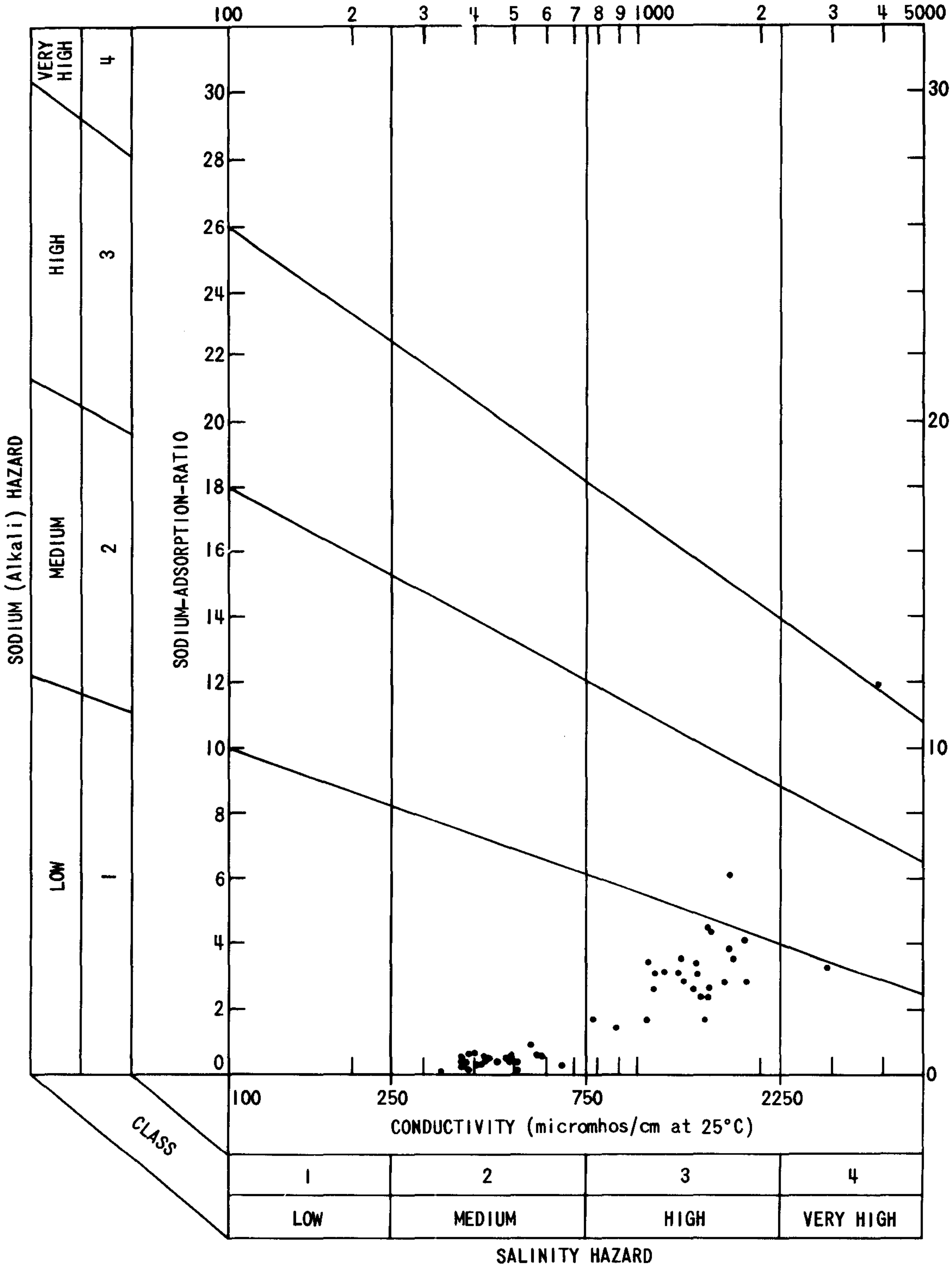

Figure 13. — Sodium (alkali) hazard and the salinity hazard of selected ground-water samples collected from wells and springs.

Spring (C-12-1)12aac-S1 discharges water of the medium sodium-hazard class and the high salinity-hazard class. Water from this spring, which is used for livestock, and other springs in the vicinity flows into sloughs and meadows southwest of Burriston Ponds. The temperature of the water from these springs is 68°F, which is several degrees higher than that of other ground water in the valley. This suggests that the water may be rising along a fault. The water discharged from the springs is largely consumed by evapotranspiration in the meadows and sloughs but some of it reaches Currant Creek during the cooler months of the year.

Well (D-13-1)1cab-1 in Salt Creek Canyon yields water both in the very high sodium-hazard class and the very high salinity-hazard class. The water from the well is pumped directly into Salt Creek, however, where it is diluted with surface water of better quality.

Domestic and public supply

Drinking water standards for domestic and public supply are recommended by the U.S. Public Health Service (1962). The recommended maximum concentrations of some of the more common chemical constituents are:

Substance	Parts per million
Chloride	250
Fluoride	(1)
Iron	.3
Manganese	.05
Nitrate	45
Sulfate	250
Dissolved solids	500

[1]The recommended maximum fluoride concentration depends on the average maximum daily air temperature (U.S. Public Health Service, 1962, p. 8). On the basis of the average maximum daily temperatures for 1961-65, the maximum concentration of fluoride at Nephi should be 1.2 ppm.

In the 63 analyses of ground water in northern Juab Valley listed in table 7, the recommended maximum concentrations of chemical constituents were exceeded in 11 analyses for chloride, 1 analysis for nitrate, 2 analyses for sulfate, 1 analysis for iron, and 35 analyses for dissolved solids.

In the northern part of the valley, all the wells and springs sampled yielded water of excellent chemical quality for domestic and public use. All the samples of water from wells and springs which contained a concentration of chemical constituents exceeding maximum recommended concentrations were collected in the southern part of the valley (plate 5 and table 7).

The sources of public water supply for Mona and Nephi, Clover Creek Spring, (D-12-1) 3bbc-S1, and Bradley Spring, (D-13-2)5cbd-S1, respectively, yielded water of excellent chemical quality for domestic and public use, exceeding none of the maximum recommended concentrations.

The hardness of water should be a consideration in any domestic or public supply because it affects the cleansing properties of water and the amount of soap consumed, and it is related to the incrustation from water (Hem, 1959, p. 145-148). The principal constituents that cause hardness in water are calcium and magnesium. The U.S. Geological Survey classifies water with respect to hardness as follows:

Classification	Hardness (ppm)
Soft	Less than 60
Moderately hard	60-120
Hard	120-180
Very hard	More than 180

Of the 26 samples of ground water that were analyzed for hardness, 2 were hard and 24 were very hard (table 7). The hardness ranged from 171 to 1,010 ppm and averaged 341 ppm.

Livestock use

All the water samples collected from ground-water sources in northern Juab Valley were suitable for use by livestock and poultry. The Officers of the Department of Agriculture and Government Chemical Laboratories of Western Australia (1950) list the following upper limits for concentrations of dissolved solids in water for livestock:

	Dissolved solids (ppm)
Poultry	2,860
Pigs	4,290
Cattle:	
dairy	7,150
beef	10,000
Sheep, adult	12,900

A sample collected in West Creek in the NE¼NW¼ sec. 25, T. 12 S., R. 1 W., contained 3,880 ppm of dissolved solids, but better water is available in wells and springs in the vicinity.

Temperature

The temperature of water is important in considering its use in industry, particularly for cooling. The temperature of ground water in northern Juab Valley at 58 wells and springs ranged from 48 to 68°F and averaged 54°F (table 4). Only one source of ground water had a temperature above 60°F, and that was spring (C-12-1)12aac-S1, which discharges water having a temperature of 68°F, near the toe of the western alluvial slope of the valley. This relatively warm water may be rising from depth along a fault. The temperature of ground water generally is constant throughout the year, whereas the temperature of surface water varies widely according to the season.

SUMMARY AND CONCLUSIONS

Most of the recharge to the ground-water reservoir in the valley fill occurs along the eastern side of the valley by infiltration from streams entering the valley from canyons in the

Wasatch Range and San Pitch Mountains. The largest single source of recharge is Salt Creek and its diversions. Artificial recharge could be practiced effectively at several sites in the valley, and the most favorable site probably is the Salt Creek alluvial fan in the vicinity of Nephi. Such additional recharge would make further ground-water development practical.

Ground water occurs under both water-table and artesian conditions in the valley. The water table or piezometric surface ranges from more than 300 feet below the land surface to about 27 feet above the land surface, and it slopes from the edges of the valley near the bordering mountains toward Burriston Ponds and Mount Nebo Reservoir in the lower (northern) parts of the valley, where most of the natural ground-water discharge occurs.

Water levels in the valley during the period 1947-64 declined due to a combination of below-normal precipitation and pumping for irrigation. Most of this decline has occurred since 1950. Water levels also decline each year during the pumping season and cause some flowing wells to stop flowing during parts of the pumping season. Declining water levels have both adverse and advantageous effects. Adverse effects include increased pumping costs, decreased discharge of some springs and flowing wells, and decreased flow in streams that derive water from the ground-water reservoir through springs and seeps. Advantageous effects include more efficient use of water because less water is wasted by evapotranspiration on phreatophyte-infested wetlands and the possible reclamation of some waterlogged land.

The permeability and water-yielding potential of water-bearing materials in the valley fill are highest in the alluvial fans and decrease toward the center of the valley. Aquifer tests conducted under fair conditions indicate coefficients of transmissibility as large as 2,000,000 gpd per ft in the alluvial-fan deposits. An aquifer test made under good conditions indicates a transmissibility of 500,000 gpd per ft near the toe of the Salt Creek fan.

The principal areas of ground-water discharge by springs and seeps are at Burriston Ponds, along Currant Creek above Mount Nebo Reservoir, and near the reservoir.

About 18,000 acre-feet of water is consumed annually by evapotranspiration in about 7,000 acres in the lowest part of the valley. Most of this area is meadowland, although it includes about 700 acres of subirrigated alfalfa. A growth of saltcedar is developing in parts of the wet area and could add materially to the discharge by evapotranspiration in future years.

During 1963, 1964, and 1965 about 14,600, 13,000, and 12,300 acre-feet of water, respectively, were pumped for irrigation from wells in the valley. During each of these years about 2,500 acre-feet of water was discharged from flowing wells.

Most of the ground water in the valley is classified as fresh; however, 7 of the 63 samples analyzed were slightly saline. Ground water in areas south of Burriston Ponds has a much higher dissolved-solids concentration than ground water north of the ponds. This is due to solution of minerals in the Arapien Shale of Jurassic age and the alluvium derived from it, which adds large amounts of sulfate and chloride salts to the ground water in the southern part of the valley. The ground water is generally satisfactory for irrigating the crops that are raised and also for livestock use. The ground water in the northern part of the valley is of excellent chemical quality for public supply and domestic use, but in some areas in the southern part of the valley the ground water does not meet U.S. Public Health Service standards for public supply. Temperatures of ground water in the valley in 58 wells and springs ranged from 48 to 68°F and averaged 54°F.

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Table 4 — Records of wells and springs in northern Juab Valley

Location: See text for description of well- and spring-numbering system.
Altitude above sea level: Altitudes at land-surface datum estimated from topographic maps or taken from records furnished by the Utah State Engineer. A few altitudes were determined by spirit leveling.
Type of well: B, bored; Dr, drilled or driven; Du, dug; J, jetted.
Depth of well: M, measured; R, reported.
Topographic situation: A, alluvial slope; Af, alluvial fan; C, canyon; Cf, canyon floor; Cm, mouth of canyon, Cs, side of canyon; V, valley floor.
Character of material: Cg, conglomerate; G, gravel; S, sand.
Geologic source: Ki, Indianola Group; Pzu, rocks of Paleozoic age; Qal, valley fill of Quaternary age; Tsr, sedimentary rocks of Tertiary age.
Water level: Measured depths given in tenths of feet; reported depths given in feet.
Method of lift and type of power: First letter - C, centrifugal pump; Cy, cylinder pump; F, flows; J, jet pump; N, none; T, turbine pump; Ts, submersible turbine pump. Second letter - D, diesel; E, electric; G, gasoline; H, hand operated; T, tractor; W, windmill.
Yield (gpm, gallons per minute): E, estimated; M, measured; R, reported.
Use of water: D, domestic, I, irrigation; In, industrial; N, none; O, observation; P, public supply; S, stock.
Remarks and other data available: C, chemical analysis in table 7; Dd, drawdown reported; L, driller's log in files of Utah State Engineer; Ls, driller's log in table 6; TH, test hole; W, water-level measurements in table 5.

Location	Owner or name	Utah State Engineer application or claim No.	Year drilled	Altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Topographic situation	Character of material	Geologic source	Water level: Above(+) or below(-) land-surface datum (feet)	Water level: Date of measurement	Method of lift and type of power	Yield: Rate (gpm)	Yield: Date of measurement	Use of water	Temperature (°F)	Remarks and other data available
(C-11-1)24ddd-1	Louis Pitt	-	1920	4,915	Du	39M	48	A	S,G	Qal	-32.1	3-17-65	Cy,G	-	-	S	-	
(C-12-1)12aac-S1	Ray Lunt	-	-	-	-	-	-	A	-	Qal	-	-	-	1.3M	7-15-65	S	68	Warmest ground water in valley. C.
13dab-1	J. W. Brough	A-34546	1963	4,925	Dr	110R	4	V	G,S	Qal	+20.8	6-15-65	F	80E	6-15-65	I,S	54	L, Ls.
13dba-1	do	A-36547	1963	4,925	Dr	105R	4	V	G,S	Qal	+18.7	4- 6-65	F	80E	4- 6-65	I,S	54	L.
13dcd-1	do	A-32506	1961	4,931	Dr	90R	4	V	G,S	Qal	+15.3	4- 6-65	F	80E	6-23-65	I,S	54	C, L.
14add-1	U.S. Bureau of Land Management	A-13758	1941	5,000	Dr	106R	4	V	G,S	Qal	-59.3	6-22-64	Cy,W	-	-	S	-	L, Ls.
24aab-1	J. W. Brough	-	1910	4,933	Dr	-	4	V	G,S	Qal	+5.7	6-22-65	F	5E	6-22-65	N	-	
24baa-1	do	A-32506	1961	4,935	Dr	66R	4	V	G,S	Qal	+13.9	4- 6-65	F	80E	4- 6-65	S,I,O	55	C, L, Ls, W.
24ccd-1	H. W. Winn	C-10222	1896	4,954	Du	-	120	V	G,S	Qal	-	-	N	-	-	N	-	Destroyed; partly filled in.
24dba-1	J. W. Brough	A-33606	1961	4,935	Dr	100R	4	V	G,S	Qal	+18.9	4- 6-65	F	80E	4- 6-65	S	-	L, Ls.
24ddc-1	do	C-7797	1896	4,955	Dr	150R	2	V	G,S	Qal	+7.8	4- 6-65	F	.5M	4- 6-65	S	58	
24ddc-2	do	-	-	4,955	Dr	59M	4	V	G,S	Qal	-1.8	6-29-64	F	-	-	N	-	Flows part of year; plugged 7-13-65.
24ddc-3	do	-	-	4,955	Dr	-	-	V	G,S	Qal	-	-	F	-	-	N	-	Water seeps around well.
24ddd-1	Leo Bowles	C-4088	1900	4,956	Dr	100R	2	V	G,S	Qal	-	-	F	-	-	S	-	Discharge submerged in pond.
25aaa-2	Carl Bowles	C-18113	1890	4,964	Dr	100R	2	V	G,S	Qal	+.9	7-13-65	N	-	-	N	-	Flows at times.
25aab-1	do	C-18114	1890	4,957	Dr	-	2	V	G,S	Qal	0	4- 5-65	N	-	-	N	-	Do.
25bdd-1	Herbert Winn	-	1965	4,969	Dr	170M	16	V	G,S	Qal	-8.3	11-19-65	N	-	-	I	-	L, Ls.
25cdd-1	U.S. Bureau of Reclamation	-	1955	4,980	B	19M	3	V	-	Qal	-17.0	4- 8-65	N	-	-	O	-	USBR TH W-44.
25daa-1	do	-	1957	4,978	B	17M	3	V	-	Qal	-14.6	4- 8-65	N	-	-	O	-	USBR TH W-25.
35dba-1	W. D. Sperry	-	-	4,974	Dr	-	8	V	-	Qal	-8.0	8-12-65	N	-	-	N	-	Well partly destroyed.
36aaa-1	U.S. Bureau of Reclamation	-	1959	4,991	B	24M	3	V	-	Qal	-19.9	4- 8-65	N	-	-	O	-	USBR TH W-46.
36abd-1	Herbert Winn	A-26779	1963	4,990	Dr	205R	16	V	G,S	Qal	-28.5	4- 1-65	T,D	-	-	I	-	L, Ls.
36caa-1	D. C. Winn	-	1925	4,990	Dr	31M	6	V	G,S	Qal	-24.7	4- 5-65	J,G	-	-	S	-	
36dca-1	Edna Cazier	C-2227	1931	5,005	Dr	36M	6	V	G,S	Qal	-23.8	4- 1-65	N	-	-	O	-	W.
36dcb-1	do	C-2226	1915	4,997	Dr	60R	6	V	G,S	Qal	-19.3	4- 1-65	J,G	-	-	S	-	
36dcc-1	U.S. Bureau of Reclamation	-	1957	4,998	B	24M	3	V	-	Qal	-17.0	4- 8-65	N	-	-	O	-	USBR TH W-21.
(C-13-1)1cdd-1	Ora Lunt	C-2940	1925	5,003	Dr	150R	6	V	G,S	Qal	-	-	Cy,W	-	-	S	-	C.
1daa-1	Sidney Scott	A-23011	1951	5,022	Dr	114R	16	V	G,S	Qal	-31.4	3-31-65	T,D	-	-	I	-	L, Ls.
1dad-1	Douglas Brown	C-13781	1929	5,020	Dr	44R	6	V	G,S	Qal	-	-	J,E	-	-	S,D	-	
3dad-1	M. L. Harmon	A-34433	1964	5,070	Dr	242R	6	A	G,S	Qal	-105.1	4- 1-65	T,G	-	-	S	-	L, Ls.
11bbc-1	H. C. Crane	A-14050	1941	5,038	Dr	133R	3	A	S	Qal	-61.2	3-31-65	J,G	-	-	S	-	C, L, Ls.
11ddc-1	P. C. Hall	-	1941	5,000	Dr	103R	4	V	G,S	Qal	-.2	3-31-65	Cy,W	-	-	S	58	C.
12aad-1	U.S. Bureau of Reclamation	-	1959	5,020	B	30M	3	V	-	Qal	-24.2	4- 8-65	N	-	-	O	-	USBR TH W-38.
12abc-1	do	-	1959	5,008	B	23M	3	V	-	Qal	-10.8	4- 8-65	N	-	-	O	-	USBR TH W-37.
12acc-1	J. R. Hall	A-22080	1950	5,011	Dr	25R	8	V	S	Qal	-9.6	3-31-65	C,G	-	-	S	49	C, L, Ls.
12bbd-1	P. C. Hall	-	-	4,997	Dr	30R	1½	V	G,S	Qal	-1.6	3-31-65	Cy,W	-	-	S	-	
13caa-1	U.S. Bureau of Reclamation	-	1957	5,020	B	10M	3	V	-	Qal	-2.1	4- 8-65	N	-	-	O	-	USBR TH W-16. Water level probably perched.
13cdc-1	do	-	1961	5,033	B	27M	3	A	-	Qal	-20.1	4- 8-65	N	-	-	O	-	USBR TH W-15-A.
13dbc-1	L. T. Ostler	A-16099	1945	5,032	Dr	130R	6	V	G,S	Qal	-12.2	3-29-65	C,G	-	-	S	-	L, Ls.
14bdc-1	P. C. Hall	A-16073	1945	5,042	Dr	135R	6	A	G,S	Qal	-	-	-	-	-	S	56	C, L, Ls.
14dbb-1	A. E. Belliston	C-2159	1945	5,039	Dr	107M	6	A	G,S	Qal	-23.5	4-17-64	Cy,W	-	-	S	58	C.
22acb-1	Sunshine Ranch	A-37260	1965	5,260	Dr	260R	8½	A	G,S	Qal	-80	12-21-65	-	-	-	S	-	L, Ls.
23add-1	Sarah Reid	A-14680	1942	5,048	Dr	99R	4	A	G,S	Qal	-19.7	3-31-65	Cy,N	-	-	N	-	L, Ls.
23cdc-1	J. H. Greenhalgh	C-2941	1923	5,132	Dr	120R	5½	A	G,S	Qal	-99.8	3-31-65	Cy,W	-	-	S	60	C.
23dbb-1	Sarah Reid	C-4706	1921	5,078	Dr	80R	6	A	G,S	Qal	-21.4	3-31-65	N	-	-	N	-	
26aad-1	Evelyn Kendall	C-4084	1913	5,092	Dr	66R	3	A	G,S	Qal	-	-	Cy,N	-	-	N	-	
33cac-S1	Orme Spring	-	-	6,000	-	-	-	Cs	Cg	Tsr	-	-	-	2E	4-25-63	S	50	C.
(C-14-1)11caa-1	J. C. Ingram	-	-	5,240	Dr	96M	-	A	G,S	Qal	-	-	Cy,W	-	-	N	-	

Table 4 — (Continued)

Location	Owner or name	Utah State Engineer application or claim No.	Year drilled	Altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Topographic situation	Character of material	Geologic source	Water level		Method of lift and type of power	Yield		Use of water	Temperature (°F)	Remarks and other data available
											Above(+) or below(-) land-surface datum (feet)	Date of measurement		Rate (gpm)	Date of measurement			
(D-12-1)8ccd-1	Grant Nielson	-	1934	4,925	Dr	167M	6	V	G,S	Qal	+12.3	4- 7-65	F	10E	4- 7-65	S	54	Small springs in vicinity. C.
17bdc-2	E. E. Ingram	C-5248	1920	4,932	-	23M	1½	V	G,S	Qal	+.5	7-20-65	N	-	-	N	-	Flows at times.
17cad-1	Floyd Carter	C-1456	1900	4,940	Dr	160R	2	V	G,S	Qal	+5.5	7-14-65	C,E	5R	7-14-65	D,S	-	Flows if released.
17dcc-1	Howard Clinger	C-10224	1896	4,968	Du	15M	60	A	G,S	Qal	-	-	N	-	-	N	-	Well partly caved in and dry.
17dcd-1	Norman Ostler	C-10225	-	4,987	Dr	70R	6	A	G,S	Qal	-45.6	4- 7-65	Ts,E	-	-	S,D	-	Windmill over well.
19acb-1	Dean Winn	-	1920	4,952	Dr	-	2	V	G,S	Qal	+10.2	6-14-65	F	-	-	S	53	
19acb-2	do	-	1920	4,953	Dr	-	2	V	G,S	Qal	+9.1	4- 7-65	F	2E	-	S	53	
19ccc-1	M. McPherson	-	-	4,963	Dr	100R	2	V	G,S	Qal	+4.0	7-13-65	F	3E	5- 1-65	S	-	Flow stops during last half of irrigation season.
19cdc-1	R. R. Garrett	C-4397	1897	4,971	Dr	246M	2	V	G,S	Qal	+6.5	4- 6-65	F	4E	10-21-65	S,O	57	Head above discharge point on 10-21-65 was +4.5 ft. Flow stops during last half of irrigation season. C, W.
19dab-1	Ronald Jones	C-5270	1887	4,973	Dr	160R	2	V	G,S	Qal	-3.6	7-13-65	N	-	-	S	-	Water flows into excavation pit. C.
19dab-2	U.S. Bureau of Reclamation	-	1957	4,972	B	24M	3	A	-	Qal	-21.4	4- 8-65	N	-	-	O	-	USBR TH W-29.
19dbb-1	Mabel Wilkey Est.	C-4391	1897	4,965	Dr	248R	2	V	G,S	Qal	+9.3	4- 7-65	F	.3M	3- 3-65	S,O	56	Head above discharge point on 3-3-65 was +1.8 ft. C, W.
20abd-1	Allen Tolley	A-28109	1956	4,987	Dr	321R	8	A	G	Qal	-28.7	4- 5-65	J,E	-	-	D	-	L, Ls.
20bac-1	Russell Jackson	C-7747	1961	4,967	Dr	170R	6	V	G,S	Qal	-.3	4- 7-65	Ts,E	50R	-	D,S	55	C, L, Ls.
29acd-1	do	C-7513	1896	5,040	Du	-	60	V	G,S	Qal	-	-	N	-	-	N	-	Well is partly destroyed and dry.
29dcd-1	Victor Cooper	-	-	5,060	Dr	45M	6	V	G,S	Qal	-4.4	7-21-65	N	-	-	N	-	
30aad-1	A. R. Croft	C-10227	1916	5,001	Dr	60R	4	V	G,S	Qal	-	-	N	-	-	N	-	
30aad-2	do	C-21133	1964	5,001	Dr	173R	6	V	G,S	Qal	-42.0	4- 5-65	N	-	-	D,S	-	L, Ls.
30cad-1	City of Nephi	A-17967	1946	4,997	Dr	100R	6	V	G,S	Qal	-31.6	4- 5-65	T,E	15R	-	D	-	L, Ls.
30dcc-1	Staheli Bros.	-	-	5,008	Dr	47M	6	V	G,S	Qal	-40.0	4- 5-65	N	-	-	N	-	
31aab-1	do	A-17950	1947	5,022	Dr	270R	12	V	G,S	Qal	-48.4	4- 5-65	T,D	900M	7-21-65	I	54	Dd 12 ft after pumping 40 hrs. C, L, Ls.
31cbb-1	E. McPherson	C-7554	1916	5,017	Dr	85R	6	V	G,S	Qal	-36.0	4- 5-65	Cy,W	-	-	S	52	Wet around well. C.
31cca-1	do	-	1924	5,031	Dr	335R	6	V	G,S	Qal	-42.1	4- 1-65	J,G	-	-	S,O	-	W.
31dcc-1	U.S. Bureau of Reclamation	-	1959	5,040	B	74M	½	A	-	Qal	-52.9	4- 8-65	N	-	-	O	-	USBR TH W-42
31dcd-1	Allen Ostler	-	-	5,047	Dr	87M	6	V	G,S	Qal	-60.6	8-11-65	J,E	-	-	S	-	Drilled before 1930.
31ddc-1	H. Sedgwick	-	-	5,054	Dr	70R	4	V	G,S	Qal	-	-	Cy,N	-	-	N		
32dac-1	Thermoid Western Co.	A-18853	1947	5,100	Dr	300R	10	Af	G	Qal	-116.6	3-30-65	T,E	500R	-	In	54	Water-level measurement made on 3-30-65 while pumping. C, L, Ls.
(D-13-1)1cab-1	City of Nephi	A-20865	1949	5,490	Dr	136R	12	Cf	G	Qal	-45.4	3-30-65	T,E	895M	7-30-64	I,P	51	C, L, Ls.
3acc-1	Nephi Irrigation Co.	A-26341	1961	5,240	Dr	280R	20	Cm	G	Qal	-37.5	3-30-65	N	-	-	N	-	Drilled for irrigation, low yield. L, Ls.
4cca-1	do	A-26340	1963	5,136	Dr	375R	20	A	G,S	Qal	-154.4	3-30-65	T,E	3,095M	6-25-65	I	52	Pumped 1,350 acre-feet of water in 1964. Dd 12 ft after pumping 1 hr. C, L, Ls.
4ccb-1	City of Nephi	A-25628	1953	5,134	Dr	258R	16	A	G	Qal	-151.3	3-30-65	Ts,E	1,540M	8-12-64	I,P,O	52	Pumped 480 acre-feet of water in 1964. Dd 17 ft. C, L, W.
5dab-1	do	A-25629	1953	5,109	Dr	312R	16	A	G	Qal	-126.9	3-30-65	T,E	2,380M	7- 8-65	I,P	52	Pumped 1,020 acre-feet of water in 1964. Dd 12 ft after pumping 72 hrs. C, L, Ls.
5dda-1	Nephi Irrigation Co.	A-25178	1953	5,121	Dr	336R	16	A	G	Qal	-139.8	3-30-65	T,E	2,530M	6-26-65	I	52	Pumped 1,430 acre-feet of water in 1964. C, L.
5ddb-1	do	A-25227	1954	5,116	Dr	344R	16	A	G	Qal	-136.6	4- 6-64	T,E	2,430M	8-24-65	I	52	Dd 9 ft. C, L.
5ddb-2	do	A-26342	1960	5,116	Dr	352R	18	A	G	Qal	-134.0	3-30-65	T,E	3,240M	8-24-65	I	52	With well (D-13-1)5ddb-1 pumped 2,640 acre-feet of water in 1964. Dd 12 ft after pumping 72 hrs. C, L, Ls.
6ada-1	E. S. Jarrett	C-9931	1932	5,059	Dr	90R	4	V	G,S	Qal	-73.5	4- 1-65	J,E	-	-	D,S	-	
6bdc-1	J. E. Worthington	C-2175	1913	5,040	Dr	80R	4	V	G,S	Qal	-43.2	7- 8-64	J,E	-	-	S	-	
6bdc-2	D. H. Brown	-	1915	5,038	Du, Dr	75R	36, 12	V	G,S	Qal	-	-	N	-	-	N	-	
6bdc-3	do	C-13780	1962	5,038	Dr	200R	6	V	G,S	Qal	-	-	Ts,E	-	-	D	-	
6cbb-1	R. E. Houghton	C-8188	1935	5,022	Dr	150R	12	V	G,S	Qal	-32.5	3-31-65	T,N	500R	-	O	-	Originally drilled to 995 ft but plugged at 150 ft. Used for irrigation until pumping was discontinued because of caving caused by discharge of fine sand. L, Ls, W.

Table 4 — (Continued)

Location	Owner or name	Utah State Engineer application or claim No.	Year drilled	Altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Topographic situation	Character of material	Geologic source	Water level		Method of lift and type of power	Yield		Use of water	Temperature (°F)	Remarks and other data available
											Above(+) or below(-) land-surface datum (feet)	Date of measurement		Rate (gpm)	Date of measurement			
(C-14-1)11cdd-1	H. L. Grace	-	1919	5,222	Dr	113M	6	A	G,S	Qal	-71.9	3-29-65	Cy,W	-	-	S	-	
14cac-1	J. E. Worthington	A-14643	1943	5,215	Dr	120R	5	A	G,S	Qal	-81.7	3-29-65	Cy,W	-	-	S	55	C, L.
23dca-1	E. H. Malmgren	-	1956	5,168	Du	17M	24	V	G,S	Qal	-9.7	4-10-63	C,G	-	-	S	-	
23dca-2	do	A-3139	1956	5,165	Dr	100R	12	V	G,S	Qal	-8.0	4-10-63	Cy,W	-	-	S	-	
(D-10-1)22dcc-1	M. Oldroyd	C-20563	1944	4,995	Dr	110R	4	A	G,S	Qal	-84.0	4-14-65	J,E	20R	6-17-44	S	-	Dd 2 ft. L, Ls.
27acc-1	H. S. Howard	A-28956	1957	4,993	Dr	88R	8	A	S,G	Qal	-33.5	4-14-65	J,E	17R	5-16-57	S,D	55	C, L.
27bac-1	J. G. Steele	-	1952	4,955	Dr	400R	6	A	S,G	Qal	-20.0	3- 3-65	N	-	-	N	-	Plugged at 100 ft.
27dbb-2	M. McPherson	A-21837	1950	4,993	Dr	295R	12	A	G	Qal	-16	7-18-50	N	100R	7-18-50	N	-	Dd 84 ft. L, Ls.
28dab-1	J. G. Steele	A-15727	1944	4,950	Dr	74M	4	A	S	Qal	-49.9	3-17-65	Cy,W	20R	6-11-44	S	-	Dd 10 ft. L, Ls.
33dac-1	Joseph Ambrose	A-19404	1948	5,050	Dr	155R	12	A	G	Qal	-100	2-21-48	N	250R	2-21-48	N	-	Well capped at depth of 15 ft and filled with rocks. Dd 5 ft. L, Ls.
(D-11-1)4bad-1	M. B. Robbins	C-2727, C-2728	1956	4,950	Dr	400R	8	A	S,G	Qal	-15.9	3- 3-65	N	30R	4-27-57	O	-	Dd 68 ft. L, Ls, W.
4cac-1	Gerald Fowkes	C-4392	-	4,939	Dr	150R	6	A	S,G	Qal	-23.7	4- 9-65	J,E	-	-	S,O	-	W.
4cbc-1	Spencer Kay	C-3109	-	4,916	-	13M	2	A	S,G	Qal	+2.4	4-15-65	F	2E	4-15-65	S	-	Dd 2 ft.
4cca-1	Gerald Fowkes	A-3738	1960	4,930	Dr	250R	8,6	A	S,G	Qal	-18.1	5-21-64	Ts,E	13M	-	D	54	C, L.
4ccc-1	M. B. Robbins	A-3738	-	4,923	Dr	84M	8	A	S,G	Qal	-7.0	4-9-65	Ts,E	75R	-	I	54	Dd 22 ft after pumping 200 hrs. C, L.
4ccc-2	do	-	-	4,923	Dr	70M	6	A	S,G	Qal	-6.1	5-19-65	N	-	-	N	54	C.
5acb-1	U.S. Bureau of Reclamation	-	1958	4,897	B	37M	3	A	-	Qal	-32.9	4- 8-65	N	-	-	O	-	USBR TH W-35.
5dbd-1	Gerald Fowkes	C-2729	1919	4,895	Dr	300+M	2	A	S,G	Qal	-10.2	4- 9-65	N	-	-	N	-	Reported to have flowed.
8aad-1	Orvil Andrews	-	-	4,929	Dr	100R	6	A	S,G	Qal	-11.2	5-18-65	N	-	-	O	-	W.
8aad-2	do	C-10642	1908	4,929	Dr	86M	6	A	S,G	Qal	-12.5	2-26-64	N	-	-	N	-	Reported to have flowed.
8add-1	do	-	-	4,947	Dr	121M	6	A	S,G	Qal	-14.7	4- 9-65	J,E	-	-	D	-	
8bcd-1	Currant Creek Irrigation Co.	A-22760	1954	4,885	Dr	505R	12	A	G,S	Qal	+27.3	4- 9-65	F	300M	4- 9-65	I	56	C, L, Ls.
8bda-1	Union Pacific Railroad Co.	C-4266	1910	4,892	Dr	355R	4	A	G,S	Qal	+22.2	4- 9-65	F	20M	4- 9-65	I	55	C, W.
8cab-1	Currant Creek Irrigation Co.	A-22760	1954	4,900	Dr	643R	12	A	G,S	Qal	+14.6	4-14-65	F	150M	4-14-65	I	58	C, L, Ls.
8cad-1	U.S. Bureau of Reclamation	-	1960	4,920	B	20M	3	A	-	Qal	-7.7	4- 8-65	N	-	-	O	-	USBR TH W-52.
8cba-1	Currant Creek Irrigation Co.	A-22760	1951	4,885	Dr	580R	12	A	G,S	Qal	+26.7	4-14-65	F	150M	5-25-64	I	56	L.
8cdb-1	Orvil Andrews	-	-	4,910	-	-	-	A	-	-	-2.7	4- 9-65	N	-	-	N	-	Reported to have flowed.
9bbb-1	Earl Fowkes	C-3096	1912	4,920	Dr	51M	6	A	G,S	Qal	-7.1	5-18-65	N	-	-	N	-	Do.
9bbb-2	Spencer Kay	C-3097	1914	4,923	Dr	70M	6	A	G,S	Qal	-7.0	5-18-65	T,E	96M	6- 4-65	I	53	Reported to have flowed. C.
9bbb-4	do	C-3098	1920	4,923	Dr	90R	3	A	G,S	Qal	-8.6	5-18-65	N	-	-	O	-	W.
9cbc-1	Orvil Andrews	A-21444	1961	4,987	Dr	401R	16, 12	A	G	Qal	-66.8	4- 8-65	T,E	2,700M	8-13-64	I	55	C, L, Ls.
9cca-1	do	A-21443	1951	5,014	Dr	304R	16, 12	A	G,S	Qal	-95.3	4- 8-64	T,E	1,910M	8-13-64	I	55	C, L, Ls.
17bbb-1	Currant Creek Irrigation Co.	A-22760	1951	4,900	Dr	730R	16	A	G	Qal	+14.5	4- 8-65	F	150M	5-20-64	I	58	C, L, Ls.
18aac-1	do	A-22760	1954	4,882	Dr	510R	12	A	G	Qal	+19.5	4-22-64	F	150E	4-22-64	I	-	L, Ls.
18dda-1	M. W. Kay	C-21474	1960	4,895	Dr	500R	8	A	G,S	Qal	-15.9	4- 3-65	T,D	-	-	I	-	L.
18ddb-1	do	A-31414	1959	-	Dr	175R	12	A	G,S	Qal	-	-	N	-	-	N	-	Well is covered up. L.
20bcc-1	Paul Nelson	-	-	4,890	Dr	-	2	A	G,S	Qal	+.3	4- 8-65	F	-	-	S	-	
20bda-1	K. J. Newberry	A-15521	1935	4,939	Dr	165R	4	A	G,S	Qal	-29.0	4- 8-65	J,E	-	-	D	-	
21bbb-1	North Canyon Irrigation Co.	A-28476	1965	5,075	Dr	361R	16	A	G	Qal	-166.6	4- 8-65	T,E	1,775M	7- 6-65	I	54	Dd 18 ft after pumping 72 hrs. L, Ls.
29cba-1	U.S. Bureau of Reclamation	-	1960	4,916	B	20M	3	A	-	Qal	-16.3	11-19-65	N	-	-	O	-	USBR TH W-56.
30baa-1	do	-	1961	4,882	B	16M	3	A	-	Qal	-7.0	4- 8-65	N	-	-	O	-	USBR TH W-7.
30bad-1	Loris Kay	-	1890	4,874	Dr	73M	1½	V	G,S	Qal	+7.4	4- 8-65	F	2E	4- 8-65	S	51	C.
30bba-1	U.S. Bureau of Reclamation	-	1961	4,898	B	27M	3	A	-	Qal	-23.2	4- 8-65	N	-	-	O	-	USBR TH W-4.
30bda-1	Lauren Keyte	-	-	4,875	Dr	34M	2	V	G,S	Qal	+7.3	4- 8-65	F	5E	4- 8-65	S,O	51	C, W.
30daa-1	U.S. Bureau of Reclamation	-	1960	4,900	B	17M	3	A	-	Qal	-5.0	4- 8-65	N	-	-	O	-	USBR TH W-55.
31aaa-S1	Loris Kay	-	-	4,900	-	-	-	A	-	Qal	-	-	-	630E	10-21-65	I	50	C.
31abc-1	Lauren Keyte	-	1899	4,893	J	125R	2	V	G,S	Qal	+.8	5- 5-65	F	.1E	5- 5-65	O	55	C, W.
31abc-2	do	-	1899	4,892	J	75R	2	V	G,S	Qal	+1.2	10-21-64	F	.5M	10-21-64	N	55	
33cab-1	Mona Irrigation Co.	A-28477	1962	5,140	Dr	452R	16	A	G	Qal	-236.1	4- 7-65	T,E	2,820M	7-30-64	I	52	C, L, Ls.
(D-12-1)3bbc-S1	Clover Creek Spring	-	-	-	-	-	-	C	-	Pzu	-	-	-	900R	6-13-65	P,I	48	Public supply for Mona. C.
6ddc-S1	Southeast spring at Burriston Ponds	-	-	4,900	-	-	-	A	G,S	Qal	-	-	-	750M	5-15-65	I	53	C.
6ddd-1	C. Kenner	-	1889	4,930	Du	35R	48	A	G,S	Qal	-28.0	4- 7-65	J,E	-	-	D,S	-	

Table 4 — (Continued)

Location	Owner or name	Utah State Engineer application or claim No.	Year drilled	Altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Topographic situation	Character of material	Geologic source	Water level		Method of lift and type of power	Yield		Use of water	Temperature (°F)	Remarks and other data available
											Above(+) or below(-) land-surface datum (feet)	Date of measurement		Rate (gpm)	Date of measurement			
(D-13-1)7bbd-2	Harriet Brough	C-8189	1934	5,030	Dr	158R	12	V	G,S	Qal	-37.5	3-31-65	T,T	450R	-	I,O	-	L, Ls, W.
7cac-1	D. O. Jarrett	A-21761	1950	5,037	Dr	152R	12	V	G,S	Qal	-	-	N	-	-	N	-	Was irrigation well but discontinued use when it caved due to pumping sand. L.
7cac-2	do	A-21761	1956	5,037	Dr	200R	16	V	G,S	Qal	-52.5	3- 4-64	T,D	1,200R	-	I	-	Pumped about 160 acre-feet of water in 1965. Dd 40 ft. C, L, Ls.
7cac-3	do	-	1940	5,036	Dr	60R	6	V	G,S	Qal	-44.8	3-20-62	J,E	-	-	S,D	-	
7dad-1	Sunrise Ranch, Inc.	A-19657	1948	5,062	Dr	114R	10	V	G,S	Qal	-66.9	3-29-65	N	675R	-	N	51	Dd 25 ft. L.
7dad-2	do	A-20560	1961	5,062	Dr	228R	16	V	G	Qal	-65.3	3-29-65	T,E	1,370M	7-30-64	I	51	Pumped about 640 acre-feet of water in 1964. C, L, Ls.
7dbc-1	D. O. Jarrett	A-27951	1961	5,044	Dr	210R	16	V	G,S	Qal	-60.8	3-31-65	T,E	1,335M	7-30-64	I	52	Do.
7dda-1	Sunrise Ranch, Inc.	A-21607	1950	5,060	Dr	145R	12	V	G,S	Qal	-66.7	3-29-65	T,E	955M	7-30-64	I	51	Pumped about 440 acre-feet of water in 1964. C, L.
8aac-1	Nephi Processing Co.	A-22605	1951	5,111	Dr	258R	8	A	G,S	Qal	-120	10- 1-51	T,E	300R	-	In	-	C, L.
8dda-1	C. L. Wilkay	C-237	1930	5,106	Dr	180R	4	A	G,S	Qal	-111.7	3-29-65	N	-	-	S	-	
9dcd-1	M. L. Harmon	A-25010	1953	5,360	Dr	440R	6	A	G,S	Qal	-339.8	6-22-65	Ts,E	-	-	S	-	L, Ls.
17bdd-1	Orgill Bros.	C-4081	1905	5,064	Dr	90R	6	V	G,S	Qal	-17.6	3-29-65	J,E	-	-	S,D	-	C.
17cab-1	U.S. Bureau of Reclamation	-	1960	5,060	B	22M	3	V	G,S	Qal	-10.8	4- 8-65	N	-	-	O	-	One of the shallow observation holes bored by USBR to study the effects of irrigation on shallow water levels.
18acc-1	Lorenzo Pace	C-4083	1906	5,037	Dr	45M	6	V	G,S	Qal	-19.0	3-29-65	N	-	-	N	-	Local shallow perched water level.
18acc-2	do	C-4083	1956	5,037	Dr	159R	6	V	G,S	Qal	-52.0	3-29-65	Ts,E	-	-	D,S	-	
18bbc-1	Sunrise Ranch, Inc.	A-16108	1948	5,024	Dr	235½R	12, 8	V	G,S	Qal	-39.2	3-29-65	J,E	-	-	S,O	-	L, Ls, W.
18bcc-1	U.S. Bureau of Reclamation	-	1955	5,020	B	10M	3	A	-	Qal	-8.3	4- 8-65	N	-	-	O	-	USBR TH W-12. Perched water level.
18cba-1	J. Ballard	C-2624	1931	5,029	Dr	100R	4	V	G,S	Qal	-	-	Cy,H	-	-	N	-	
(D-13-2)5cbd-S1	Bradley Spring	A-24275	-	-	-	-	-	Cs	Cg	Ki	-	-	-	1,800R	-	P,I	52	Public water supply for City of Nephi; not in base-map area. C.
6bcd-1	City of Nephi	A-20865	1949	-	Dr	136R	12	Cf	G,S	Qal	-	-	N	-	-	N	-	
(D-14-1)6baa-1	Loren Garrett	C-2730	1919	5,313	Dr	250R	6	A	-	-	-188.5	3-31-50	N	-	-	N	-	Top of well is reported to be covered with dirt. Observation well 1935-50. W.
6dbb-1	State of Utah	C-8185	1916	5,353	Dr	306R	6	A	G,S	Qal	-220.7	7- 1-65	Cy,N	-	-	N	-	
10abd-S1	Lower Fourmile Spring	-	-	5,940	-	-	-	C	G,S	Qal	-	-	-	100E	6-18-63	S,I	51	Water diverted into pipeline.
11bcb-S1	Middle Fourmile Spring	-	-	6,020	-	-	-	C	G,S	Qal	-	-	-	200E	6-18-63	S,I	55	Water forced upward by underlying Arapien Shale and diverted into pipeline.
11dda-S1	Upper Fourmile Spring	-	-	6,280	-	-	-	C	G,S	Qal	-	-	-	150E	6-18-63	N	51	Water disappears in gravels within half a mile downstream.

Table 5 — Water levels and artesian pressures in observation wells in northern Juab Valley

Water levels in feet below land-surface datum are designated by a minus (-) sign immediately before the first entry in each column in the table, those above land-surface datum are designated similarly by a plus (+) sign. The sign applied to any water level applies to all succeeding water levels until a change is indicated

(C-12-1)24baa-1. Records available 1964-66

Aug. 3, 1964	+10.5	Sept. 9, 1965	+11.9	Jan. 6, 1966	+15.6
Apr. 6, 1965	13.9	Oct. 14	14.4	Feb. 10	16.4
June 22	14.4	Nov. 3	14.7	Mar. 11	16.4
July 7	13.7	Dec. 1	16.5	Apr. 7	16.3
Aug. 2	12.5				

(C-12-1)36dca-1. Equipped with automatic water-level recording gage, July 11, 1948, to Dec. 5, 1949. Records available 1935-50, 1957-66

Aug. 1, 1935	-45.5	Mar. 24, 1943	-13.8	Apr. 4, 1957	-20.5
Aug. 31	45.6	Dec. 17	16.4	Dec. 9	14.6
Oct. 8	46.0	Mar. 20, 1944	18.6	Mar. 21, 1958	11.9
Nov. 20	45.9	Dec. 2	18.5	Dec. 19	13.9
Mar. 4, 1936	45.2	Apr. 4, 1945	12.9	Mar. 23, 1959	16.8
May 1	43.8	Dec. 4	16.3	Dec. 18	21.8
June 20	43.5	Mar. 11, 1946	10.7	Mar. 24, 1960	21.5
Aug. 8	44.1	Dec. 19	13.5	Apr. 13, 1961	26.0
Oct. 3	44.2	Mar. 28, 1947	9.2	Mar. 8, 1962	24.4
Nov. 30	40.8	Dec. 14	17.6	Dec. 13	25.2
Feb. 4, 1937	43.3	Mar. 8, 1948	14.6	Mar. 4, 1963	25.7
Apr. 13	42.5	July 11	16.0	Dec. 3	21.9
June 10	41.5	Aug. 1	17.9	Oct. 22, 1964	23.1
Aug. 1	41.8	Sept. 5	19.5	Dec. 12	20.2
Sept. 24	42.5	Oct. 1	20.6	Feb. 2, 1965	24.8
Nov. 2	42.2	Oct. 31	22.2	Mar. 3	25.2
Dec. 21	41.8	Dec. 15	20.9	Apr. 1	23.8
Feb. 24, 1938	41.3	Apr. 4, 1949	19.6	May 5	25.6
Apr. 7	40.9	May 6	18.9	June 4	22.6
Aug. 26	40.1	July 18	17.4	July 7	18.1
Oct. 9	40.5	Aug. 6	19.0	Aug. 2	18.5
Dec. 22	37.4	Sept. 1	20.8	Sept. 15	18.6
June 3, 1940	19.7	Dec. 5	25.0	Oct. 14	18.0
Dec. 3	18.8	Feb. 7, 1950	21.4	Nov. 3	18.5
Mar. 18, 1941	20.9	Mar. 31	19.6	Dec. 1	18.5
Dec. 6	15.6	June 6	17.3	Jan. 6, 1966	18.9
Mar. 26, 1942	12.6	June 29	19.3	Feb. 17	21.2
July 20	12.7	Aug. 2	20.1	Mar. 11	20.1
Dec. 26	13.8	Dec. 4	23.0	Apr. 7	18.8

(D-11-1)4bad-1. Records available 1964-66

Nov. 18, 1964	-15.9	June 4, 1965	-16.0	Dec. 1, 1965	-16.6
Dec. 9	15.9	July 6	16.2	Jan. 6, 1966	16.6
Feb. 2, 1965	16.0	Aug. 2	16.3	Feb. 10	16.4
Mar. 3	15.9	Sept. 9	16.5	Mar. 11	16.2
Apr. 15	15.9	Oct. 14	16.7	Apr. 7	16.3
May 5	15.9	Nov. 2	16.6		

(D-11-1)4cac-1. Records available 1957-66

Apr. 4, 1957	-20.4	Mar. 4, 1963	-22.2	Aug. 2, 1965	-27.8
Dec. 9	22.3	Dec. 3	25.2	Sept. 9	28.3
Mar. 21, 1958	18.6	Oct. 21, 1964	27.0	Oct. 14	29.0
Dec. 19	20.3	Dec. 9	25.6	Nov. 2	26.7
Mar. 23, 1959	19.8	Jan. 21, 1965	25.6	Dec. 1	25.1
Dec. 18	19.6	Mar. 3	25.3	Jan. 6, 1966	24.0
Mar. 24, 1960	16.8	Apr. 9	23.7	Feb. 10	23.6
Apr. 13, 1961	20.3	May 5	22.9	Mar. 11	22.9
Mar. 8, 1962	19.4	June 4	23.5	Apr. 7	22.5
Dec. 13	21.2	July 6	25.0		

(D-11-1)8aad-1. Equipped with automatic water-level recording gage, 1956-66. Records available 1935, 1956-66

Aug. 31, 1935	+ 4.9	Mar. 15, 1959	+ 5.2	July 15, 1963	-19.7
Jan. 15, 1956	- .5	Apr. 15	5.3	Aug. 15	20.3
Feb. 15	.8	May 15	3.7	Sept. 15	22.0
Mar. 15	1.1	June 15	+ .4	Oct. 15	17.8
Apr. 15	1.2	Aug. 9	- 2.1	Nov. 15	15.3
May 15	.5	Sept. 15	2.8	Dec. 15	14.3
June 15	4.3	Oct. 15	- 1.2	Jan. 15, 1964	13.5
July 15	5.8	Nov. 15	+ .5	Feb. 15	12.8
Aug. 15	6.3	Dec. 10	.8	Mar. 15	12.4
Sept. 15	7.8	Jan. 14, 1960	1.4	Apr. 15	11.6
Oct. 15	6.7	Mar. 15	1.9	May 15	11.0
Nov. 15	5.3	Apr. 15	+ .8	June 15	16.7
Dec. 15	4.9	May 15	- 3.6	July 15	19.1
Jan. 10, 1957	4.8	July 15	7.9	Aug. 15	19.8
Feb. 20	4.6	Aug. 15	10.2	Sept. 15	22.8
Mar. 15	4.6	Sept. 15	11.4	Oct. 15	19.7
Apr. 15	4.3	Oct. 15	8.0	Nov. 15	15.7
May 14	3.1	Dec. 25	6.8	Dec. 15	14.2
June 15	1.7	Jan. 21, 1961	6.7	Jan. 15, 1965	13.4
July 15	3.4	Feb. 15	6.6	Feb. 15	12.5
Aug. 15	4.5	Mar. 15	6.6	Mar. 15	11.6
Sept. 15	4.7	Apr. 15	7.3	Apr. 15	10.7
Oct. 15	- 2.3	May 5	9.0	May 17	11.2
Nov. 15	+ .3	June 10	12.5	June 15	18.2
Dec. 15	1.8	July 15	13.7	July 15	21.3
Apr. 25, 1958	5.5	Jan. 20, 1962	9.2	Aug. 15	21.5
May 15	5.2	Mar. 21	8.7	Sept. 15	23.2
June 15	2.2	June 19	13.2	Oct. 15	22.2
July 15	2.0	July 20	17.1	Nov. 10	18.1
Aug. 15	1.1	Oct. 15	13.4	Jan. 26, 1966	13.1
Sept. 15	.7	Nov. 15	11.3	Feb. 15	12.5
Oct. 15	3.7	Dec. 15	10.0	Mar. 18	11.5
Dec. 15	3.8	Feb. 15, 1963	8.1	Apr. 7	11.4
Jan. 15, 1959	4.5	Apr. 15	7.7	May 21	17.7
Feb. 15	5.2	May 15	13.2	June 15	22.5

(D-11-1)8bda-1, listed as 8ac in WSP 817. Records available 1935, 1964-65

Aug. 1, 1935	+43.8	Apr. 4, 1964	+20.7	Apr. 9, 1965	+22.2

(D-11-1)9bbb-4, listed as 8aa-4 in WSP 817. Records available 1935-66

Aug. 1, 1935	+ 5.9	June 3, 1940	+ 7.5	July 20, 1956	- 5.5
Aug. 31	6.4	Dec. 3	10.3	Sept. 26	7.3
Oct. 8	6.8	Mar. 8, 1941	9.7	Nov. 8	4.3
Nov. 19	6.8	Dec. 6	14.6	Dec. 3	4.7
Dec. 14	6.8	Mar. 26, 1942	14.0	Apr. 4, 1957	- 4.3
Jan. 23, 1936	6.7	July 20	14.8	Dec. 9	+ 2.6
Mar. 5	6.8	Dec. 26	14.9	Feb. 14, 1958	4.5
May 1	6.4	Mar. 24, 1943	14.5	Mar. 21	5.5
June 20	6.8	Dec. 8	10.5	Mar. 23, 1959	7.5
Aug. 8	7.7	Mar. 20, 1944	9.6	Mar. 24, 1960	+ 4.6
Oct. 3	7.9	Dec. 2	12.8	Apr. 13, 1961	- 4.9
Nov. 30	8.6	Apr. 4, 1945	13.5	Mar. 8, 1962	6.5
Feb. 4, 1937	8.4	Dec. 4	13.8	Dec. 13	7.8
Apr. 13	8.6	Mar. 11, 1946	13.2	Mar. 4, 1963	6.0
June 10	8.2	Dec. 19	11.4	Dec. 3	12.2
Aug. 1	9.2	Mar. 28, 1947	13.6	Oct. 21, 1964	15.8
Oct. 4	9.2	Dec. 14	13.3	Dec. 9	12.1
Nov. 2	10.0	Mar. 18, 1948	12.3	Feb. 2, 1965	10.5
Dec. 12	10.8	July 11	11.2	Mar. 3	9.6
Feb. 25, 1938	10.3	Apr. 4, 1949	12.2	May 5	8.2
Apr. 6	10.2	Dec. 13	11.7	May 18	8.6
June 2	8.7	Mar. 31, 1950	11.5	June 4	13.5
Aug. 26	11.4	Dec. 11	9.8	July 6	16.9
Oct. 9	11.1	Dec. 13, 1951	6.0	Aug. 2	20.3
Dec. 23	12.4	May 6, 1952	4.9	Sept. 9	19.8
Mar. 4, 1939	12.2	Dec. 1	11.7	Oct. 14	20.7
Apr. 14	11.8	Mar. 10, 1953	11.6	Nov. 2	16.0
June 19	9.4	Mar. 27, 1954	8.2	Dec. 1	13.3
Aug. 24	8.8	Mar. 14, 1955	+ 3.0	Jan. 6, 1966	11.5
Oct. 13	9.1	Oct. 26	- 1.2	Feb. 10	10.4
Dec. 1	8.6	Nov. 18	1.1	Mar. 11	9.6
Feb. 6, 1940	8.4	Dec. 28	.5	Apr. 7	9.1
Mar. 27	8.1	Mar. 12, 1956	.4		

(D-11-1)30bda-1. Records available 1965-66

Apr. 8, 1965	+ 7.3	Oct. 14, 1965	+ 7.2	Feb. 10, 1966	+ 7.3
July 8	6.8	Nov. 3	6.8	Mar. 11	7.8
Aug. 3	6.7	Dec. 1	6.0	Apr. 7	7.4
Sept. 9	6.9	Jan. 6, 1966	7.0		

(D-11-1)31abc-1. Records available 1936-50, 1957-66

May 1, 1936	+ 1.4	June 3, 1940	+ 2.0	Mar. 21, 1958	+ 2.1
June 20	1.8	Dec. 3	2.5	Mar. 23, 1959	2.0
Aug. 8	1.8	Mar. 18, 1941	2.6	Mar. 24, 1960	1.2
Oct. 3	1.9	Dec. 6	3.9	Apr. 13, 1961	.7
Nov. 30	2.0	Mar. 26, 1942	2.0	Mar. 8, 1962	.4
Feb. 4, 1937	1.9	July 20	3.3	Dec. 13	1.0
Apr. 13	2.2	Dec. 26	3.1	Mar. 4, 1963	1.0
June 10	2.4	Mar. 24, 1943	3.3	Dec. 3	.2
Aug. 1	2.5	Dec. 18	1.8	Oct. 21, 1964	.1
Sept. 23	2.6	Mar. 20, 1944	1.2	Dec. 9	.3
Nov. 2	2.6	Dec. 2	2.8	Feb. 2, 1965	.5
Dec. 21	2.5	Apr. 4, 1945	2.8	Mar. 3	.7
Feb. 25	2.4	Dec. 4	3.5	May 5	.8
Apr. 6	2.4	Mar. 11, 1946	3.4	June 4	.4
June 2	2.6	Dec. 19	2.3	July 6	.3
Aug. 26	2.6	Mar. 28, 1947	3.3	Aug. 2	.3
Oct. 9	2.8	Dec. 14	3.4	Sept. 9	.2
Dec. 23	2.8	Mar. 18, 1948	3.7	Oct. 14	.3
Apr. 14, 1939	2.8	Dec. 15	2.6	Nov. 3	.3
June 10	2.4	Apr. 4, 1949	2.9	Dec. 1	.7
Aug. 24	1.5	Dec. 13	2.3	Jan. 6, 1966	.7
Oct. 13	1.4	Mar. 31, 1950	2.7	Feb. 10	.9
Dec. 1	1.4	Dec. 11	2.3	Mar. 11	1.0
Feb. 6, 1940	1.8	Apr. 4, 1957	1.5	Apr. 7	1.1
Mar. 27	2.0	Dec. 9	2.2		

(D-12-1)19cdc-1. Records available 1935-46, 1963-66

Nov. 20, 1935	+ 1.1	Mar. 27, 1940	+12.7	July 6, 1965	+ 7.4
Dec. 14	1.1	June 3	14.8	July 8	6.4
Jan. 23, 1936	1.5	Dec. 3	14.3	July 13	5.7
May 1	2.8	Mar. 18, 1941	14.7	July 15	5.4
June 20	8.0	Dec. 6	21.5	July 20	4.4
Aug. 8	10.0	July 20, 1942	23.8	July 22	3.7
Oct. 2	9.9	Dec. 26	21.3	July 24	3.4
Nov. 20	10.1	Mar. 20, 1943	21.2	July 26	2.9
Apr. 13, 1937	10.8	Dec. 18	16.2	Aug. 2	1.9
June 10	14.8	Dec. 2, 1944	18.6	Aug. 7	1.0
Aug. 1	17.2	Apr. 4, 1945	19.5	Aug. 10	.5
Sept. 24	16.6	Dec. 4	21.1	Aug. 12	+ .2
Nov. 2	16.1	Mar. 11, 1946	20.4	Aug. 18	- .5
Dec. 21	15.7	Dec. 19	18.7	Aug. 25	1.2
Feb. 25, 1938	15.3	Apr. 6, 1963	6.5	Sept. 9	2.6
Apr. 7	15.2	Apr. 4, 1964	5.7	Sept. 15	- 3.2
June 2	17.4	May 26	+ 6.6	Sept. 26	.0
Aug. 26	19.0	Oct. 6	- 5.2	Oct. 9	+ 2.9
Oct. 9	17.9	Apr. 6, 1965	+ 6.5	Oct. 14	3.9
Dec. 22	21.2	May 15	7.1	Oct. 21	4.7
Apr. 14, 1939	17.1	June 4	8.0	Nov. 3	6.3
June 19	16.0	June 23	9.8	Dec. 1	8.5
Aug. 24	14.8	June 26	9.4	Jan. 6, 1966	10.1
Oct. 13	13.5	June 28	8.4	Feb. 10	11.4
Dec. 1	12.8	July 1	8.5	Mar. 11	11.4
Feb. 6, 1940	12.2	July 2	7.8	Apr. 7	11.9

Table 5 — (Continued)

(D-12-1)19dbb-1. Records available 1957-66

Apr. 4, 1957	+ 9.1	Dec. 9, 1964	+ 4.7	Sept. 9, 1965	+ 1.4
Dec. 9	15.2	Feb. 2, 1965	6.3	Oct. 14	3.5
Mar. 21, 1958	15.4	Mar. 3	5.8	Nov. 3	5.2
Mar. 23, 1959	16.7	Apr. 7	9.3	Dec. 1	6.4
Mar. 24, 1960	9.0	May 5	4.8	Jan. 6, 1966	7.0
Dec. 13, 1962	9.6	June 4	7.1	Feb. 17	6.8
Mar. 4, 1963	10.6	July 6	5.6	Mar. 11	7.2
Dec. 3	4.4	Aug. 2	3.3	Apr. 7	8.4
Oct. 21, 1964	1.4				

(D-12-1)31cca-1, listed as 31cbd-1 in WSP's 1169, 1195, 1225, 1269, 1325, and 1408.
Records available 1949-66

Apr. 14, 1949	-30.5	Dec. 9, 1957	-34.7	Mar. 3, 1965	-43.2
Apr. 5, 1950	31.8	Mar. 3, 1958	34.3	Apr. 1	42.1
Dec. 13	32.8	Dec. 19	32.5	May 5	41.2
Feb. 23, 1951	33.5	Mar. 23, 1959	32.3	June 4	40.3
June 9	34.0	Dec. 18	41.2	July 7	42.2
Oct. 31	34.7	Mar. 3, 1960	40.9	Aug. 2	47.9
Dec. 13	47.3	Apr. 13, 1961	44.1	Sept. 9	52.5
Dec. 1, 1952	26.1	Mar. 8, 1962	50.5	Oct. 14	45.4
Mar. 10, 1953	25.9	Dec. 13	43.0	Nov. 3	43.0
Mar. 27, 1954	29.4	Mar. 4, 1963	41.0	Dec. 1	40.4
Dec. 3	25.8	Dec. 3	48.2	Jan. 6, 1966	39.0
Mar. 14, 1955	36.8	Nov. 4, 1964	51.6	Feb. 17	38.0
Nov. 28	41.6	Dec. 9	46.5	Mar. 11	37.5
Apr. 4, 1957	42.1	Feb. 2, 1965	44.0	Apr. 7	37.2

(D-13-1)4acb-1. Records available 1957-66

Dec. 9, 1957	-142.6	Dec. 3, 1963	-155.8	July 6, 1965	1/ -171.8
Mar. 21, 1958	142.6	Oct. 22, 1964	161.9	Aug. 3	1/ 176.2
Dec. 19	140.4	Dec. 9	163.4	Sept. 15	1/ 181.2
Mar. 23, 1959	140.5	Feb. 2, 1965	153.0	Oct. 14	153.6
Sept. 18	161.3	Mar. 3	152.1	Nov. 3	151.3
Dec. 18	150.9	Mar. 30	151.3	Dec. 2	148.9
Mar. 24, 1960	149.6	May 12	150.1	Jan. 6, 1966	146.5
Apr. 13, 1961	153.0	June 4	148.8	Feb. 17	146.8
Mar. 8, 1962	154.7	June 23	147.8	Mar. 14	146.3
Dec. 13	151.0	June 25	147.5	Apr. 7	146.0
Mar. 4, 1963	149.6	July 1	152.5		

(D-13-1)6cbb-1, listed as 6cb in WSP 817 and as 6ccb-1 in WSP's 840, 845, 886, 910, 940, 948, 990, 1020, 1027, 1075, 1100, 1130, 1160, 1169, 1195, 1225, 1269, 1325, and 1408.
Records available 1935-55, 1957-66

Aug. 1, 1935	-41.2	Apr. 7, 1938	-24.1	Jan. 28, 1941	-24.4
Aug. 31	41.5	June 2	20.9	Mar. 18	23.2
Oct. 8	41.8	July 10	21.5	Apr. 1	23.3
Nov. 20	41.9	Aug. 26	22.5	June 30	18.0
Dec. 14	41.8	Oct. 9	23.4	Sept. 24	18.8
Jan. 23, 1936	41.0	Dec. 22	21.5	Nov. 11	18.4
Mar. 4	40.8	Feb. 28, 1939	21.8	Dec. 6	17.9
May 1	39.4	Apr. 14	21.9	Mar. 26, 1942	17.0
June 20	35.2	June 19	23.7	June 2	14.3
Aug. 8	32.9	Aug. 24	26.0	July 7	15.7
Oct. 3	32.6	Oct. 13	27.2	Nov. 10	18.4
Nov. 30	32.1	Dec. 2	27.5	Dec. 21	18.5
Feb. 4, 1937	31.2	Feb. 6, 1940	27.1	Mar. 24, 1943	18.9
Apr. 13	30.0	Mar. 27	26.0	Dec. 17	23.9
June 10	25.4	June 3	24.7	Mar. 20, 1944	22.6
Aug. 1	24.1	Aug. 8	24.6	Dec. 2	22.0
Aug. 25	24.3	Aug. 25	25.0	Apr. 4, 1945	14.3
Sept. 24	24.8	Sept. 7	25.3	Dec. 4	17.1
Nov. 2	25.0	Nov. 1	27.1	Mar. 11, 1946	16.8
Dec. 21	24.7	Nov. 26	25.5	June 4	14.6
Feb. 25, 1938	24.5	Dec. 3	25.3	Dec. 19	17.9

1/ Well was being pumped.

(D-13-1)6cbb-1 - Continued

Mar. 28, 1947	-15.4	Dec. 13, 1951	-30.8	Mar. 4, 1963	-32.3
Apr. 25	15.8	May 7, 1952	24.7	Dec. 3	35.3
May 22	14.8	Dec. 1	16.6	Oct. 22, 1964	33.6
Sept. 10	16.4	Mar. 10, 1953	18.7	Dec. 9	34.0
Dec. 14	17.4	Dec. 16	20.1	Feb. 2, 1965	32.8
Mar. 18, 1948	17.3	Mar. 27, 1954	22.6	Mar. 3	32.8
May 19	18.6	Dec. 3	27.8	Mar. 31	32.5
July 11	21.2	Mar. 14, 1955	27.2	May 5	30.8
Oct. 10	24.2	Nov. 28	37.6	June 4	29.7
Dec. 15	24.7	Apr. 4, 1957	31.4	July 7	27.6
Apr. 4, 1949	24.1	Dec. 9	25.7	Aug. 2	27.6
Dec. 5	24.7	Mar. 21, 1958	24.6	Sept. 9	27.8
Feb. 7, 1950	24.7	Dec. 19	23.6	Oct. 14	28.4
Mar. 31	23.9	Mar. 23, 1959	23.6	Nov. 3	28.8
Apr. 5	23.0	Dec. 12	32.6	Dec. 1	28.6
June 29	26.2	Mar. 24, 1960	32.2	Jan. 6, 1966	28.5
Dec. 4	28.5	Apr. 13, 1961	35.5	Feb. 17	28.4
Mar. 22, 1951	27.5	Mar. 8, 1962	37.0	Mar. 14	28.2
June 9	27.8	Dec. 13	32.5	Apr. 7	27.9
Oct. 18	31.0				

(D-13-1)7bbd-2. Records available 1957-66

Apr. 4, 1957	-38.6	Mar. 4, 1963	-37.6	Aug. 3, 1965	-31.4
Dec. 9	30.0	Dec. 3	40.4	Sept. 15	32.6
Mar. 21, 1958	29.7	Oct. 22, 1964	39.2	Oct. 14	33.4
Dec. 19	28.9	Dec. 9	45.5	Nov. 3	33.9
Mar. 23, 1959	28.8	Feb. 2, 1965	38.6	Dec. 2	34.1
Dec. 18	38.8	Mar. 3	39.3	Jan. 6, 1966	33.9
Mar. 24, 1960	38.0	Mar. 31	37.5	Feb. 17	33.8
Apr. 13, 1961	41.4	May 12	35.8	Mar. 14	33.3
Mar. 8, 1962	45.0	June 4	33.4	Apr. 7	32.9
Dec. 13	37.1	July 7	32.7		

(D-13-1)18bbc-1. Records available 1949-51, 1953-66

Apr. 4, 1949	-30.7	Apr. 4, 1957	-37.2	Feb. 2, 1965	-39.2
Dec. 13, 1950	32.7	Dec. 9	30.2	Mar. 3	38.7
Mar. 22, 1951	34.1	Mar. 21, 1958	29.8	Mar. 29	39.2
July 3	18.2	Mar. 23, 1959	27.7	May 12	43.2
Oct. 17	35.1	Dec. 18	38.9	June 4	42.5
Mar. 10, 1953	24.1	Mar. 26, 1960	37.4	July 7	47.6
Mar. 27, 1954	25.3	Apr. 13, 1961	39.9	Aug. 3	49.7
Dec. 3	32.2	Dec. 13, 1962	38.4	Dec. 2	35.5
Mar. 14, 1955	32.8	Mar. 4, 1963	37.2	Jan. 6, 1966	34.3
Nov. 28	37.6	Dec. 3	43.8	Feb. 17	33.5
Mar. 22, 1956	36.6	Oct. 22, 1964	46.1	Mar. 14	33.8
Dec. 3	38.5	Dec. 9	41.6		

(D-14-1)6baa-1. Records available 1935-50

Aug. 8, 1935	-196.0	Aug. 26, 1938	-196.5	Mar. 26, 1943	-191.2
Sept. 20	195.9	Dec. 22	196.8	Dec. 18	190.9
Oct. 8	195.8	Feb. 28, 1939	196.2	Mar. 20, 1944	190.9
Nov. 20	196.1	Apr. 15	196.6	Dec. 2	190.8
Jan. 23, 1936	196.1	June 18	196.6	Apr. 4, 1945	190.9
Mar. 4	196.2	Aug. 24	196.6	Dec. 4	189.8
May 1	196.5	Oct. 13	196.5	Mar. 11, 1946	189.9
June 20	196.5	Dec. 1	197.8	Dec. 19	189.8
Aug. 8	200.0	Feb. 6, 1940	196.6	Mar. 28, 1947	189.2
Oct. 3	196.5	Mar. 27	196.7	Dec. 14	188.9
Nov. 30	196.5	Dec. 3	196.5	Mar. 18, 1948	188.8
Feb. 4, 1937	196.5	Mar. 19, 1941	196.2	Dec. 15	188.5
Apr. 13	196.8	Dec. 6	195.3	Apr. 4, 1949	189.0
June 10	196.7	Mar. 26, 1942	194.7	Dec. 5	178.3
Nov. 2	198.4	July 20	193.6	Mar. 31, 1950	188.5
Dec. 21	196.7	Dec. 21	192.0		

Table 6 — Selected drillers' logs of wells in northern Juab Valley

Altitudes are in feet above sea level for land surface at well.
Thickness in feet.
Depth in feet below the land surface.

Material	Thickness	Depth
(C-12-1)13dab-1. Log by J. E. Larsen. Alt. 4,925 ft.		
Topsoil	4	4
Clay, dark blue	19	23
Gravel, small	16	39
Clay, red and buff	41	80
Gravel, large; water bearing	9	89
Clay, red and buff	3	92
Gravel	6	98
Sand, coarse, red	12	110
(C-12-1)14add-1. Log by L. E. Hale. Alt. 5,000 ft.		
Soil	20	20
Rock and clay	40	60
Gravel	4	64
Clay with layers of fine sand	34	98
Gravel	8	106
(C-12-1)24baa-1. Log by J. C. Peterson. Alt. 4,935 ft.		
Topsoil	3	3
Clay, blue, black, and buff	18	21
Cobbles, gravel, and sand	19	40
Clay, buff	9	49
Cobbles, conglomerate, and clay	11	60
Cobbles, gravel, and sand; water	6	66
(C-12-1)24dba-1. Log by J. C. Peterson. Alt. 4,935 ft.		
Top soil	2	2
Sand and silt	1.5	3.5
Clay	1.5	5
Sand	1	6
Clay, soft, blue	3	9
Silt, buff	1.5	10.5
Clay, blue	19.5	30
Gravel, small, and fine sand	1	31
Gravel, large, and coarse sand	14	45
Clay, blue	1.5	46.5
Sand, fine	1.5	48
Clay, buff	1	49
Gravel, coarse, and buff clay	1	50
Sand and buff clay	5	55
Clay, buff	25	80
Gravel, coarse, and clay	3	83
Gravel, water bearing, with fine sand near top and coarse sand below	17	100
(C-12-1)25bdd-1. Log by Scott Stephenson. Alt. 4,969 ft.		
Surface soil	15	15
Sand, silt, and clay; water at 16 ft	15	30
Gravel, sand, and clay	12	42
Clay	22	64
Gravel and sand; water bearing	31	95
Clay, red	19	114
Gravel	2	116
Gravel, sand, and clay, stratified	4	120
Clay, gray	17	137
Gravel	10	147
Sand and clay, in layers	5	152
Clay, red	23	175
(C-12-1)36abd-1. Log by B. B. Gardner. Alt. 4,990 ft.		
Topsoil	5	5
Clay, red	33	38
Gravel; water bearing	7	45
Clay, red	10	55
Boulders	4	59
Clay, red	5	64
Gravel; water bearing	4	68
Conglomerate	2	70
Gravel; water bearing	6	76
Clay, red	17	93
Gravel and red clay	30	123
Gravel; water bearing	3	126
Conglomerate	5	131
Gravel; water bearing	15	146
Clay, red	33	179
Gravel; water bearing	2	181
Clay, red	9	190
Sand	4	194
Gravel; water bearing	10	204
Clay, red	1	205
(C-13-1)1daa-1. Log by J. S. Lee and Sons. Alt. 5,022 ft.		
Topsoil	3	3
Clay, sandy	33	36
Sand; water bearing	2	38
Clay	34	72
Gravel; water bearing	20	92
Clay	10	102
Gravel; water bearing	4	106
Clay, red	8	114
(C-13-1)3dad-1. Log by Hershel Woodhouse. Alt. 5,070 ft.		
Topsoil	3	3
Boulders	22	25
Gravel and clay mixture	30	55
Gravel and red clay	15	70
Clay, brown, contains boulders and hard layers	45	115
Gravel; water bearing	2	117
Boulders and brown clay	38	155
Gravel; water bearing	3	158
Clay, contains boulders and hard layers	32	190
Sand and clay	5	195
Gravel	5	200
Boulders, gravel, and clay	38	238
Gravel and sand; water bearing	4	242
(C-13-1)11bbc-1. Log by Thomas Woodhouse. Alt. 5,038 ft.		
Clay, red	110	110
Sand; water bearing	2	112
Clay	18	130
Sand; water bearing	3	133
(C-13-1)12acc-1. Log by J. R. Hall. Alt. 5,011 ft.		
Topsoil	2	2
Sand	1	3
Clay	1	4
Sand	6	10
Clay	15	25
(C-13-1)13dbc-1. Log by J. T. Woodhouse. Alt. 5,032 ft.		
Topsoil	3	3
Clay, brown	7	10
Gravel	18	28
Gravel, pea size; water bearing	7	35
Clay, red	90	125
Gravel, pea size, and sand; water bearing	5	130
(C-13-1)14bdc-1. Log by J. T. Woodhouse. Alt. 5,042 ft.		
Topsoil	2	2
Sand and yellow clay	15	17
Gravel	13	30
Gravel and red clay mixed	70	100
Sand and yellow clay	20	120
Hardpan, calcareous	10	130
Gravel, pea size	5	135
(C-13-1)22acb-1. Log by Scott Stephenson. Alt. 5,260 ft.		
Boulders	78	78
Clay, red and brown	32	110
Gravel, small, and clay; water at 124 ft	14	124
Sand and clay	11	135
Boulders and clay in layers	10	145
Gravel, small, and clay; water bearing	40	185
Gravel and yellow clay	20	205
Gravel and red clay mixed	25	230
Conglomerate, very hard	30	260
(C-13-1)23add-1. Log by C. W. Anderson. Alt. 5,048 ft.		
Topsoil	2	2
Clay	16	18
Gravel	23	41
Hardpan	26	67
Clay	14	81
Gravel and sand	18	99
(D-10-1)22dcc-1. Log by J. T. Woodhouse. Alt. 4,995 ft.		
Topsoil	3	3
Clay, red	12	15
Gravel and sand	5	20
Clay, brown, slightly sandy	75	95
Gravel, fine, and coarse sand; water bearing	15	110
(D-10-1)27dbb-2. Log by J. S. Lee and Sons. Alt. 4,993 ft.		
Clay, brown	25	25
Gravel; water bearing	5	30
Clay, brown	15	45
Clay, red	10	55
Clay, gray	27	82
Gravel; water bearing	8	90
Hardpan	45	135
Gravel; water bearing	4	139
Clay, brown	31	170
Gravel	1	171
Clay, red, blue, and gray	124	295
(D-10-1)28dab-1. Log by J. T. Woodhouse. Alt. 4,950 ft.		
Topsoil	4	4
Clay, brown	66	70
Sand, water bearing, between layers of hardpan	10	80
(D-10-1)33dac-1. Log by J. S. Lee and Sons. Alt. 5,050 ft.		
Gravel and cobbles	16	16
Clay, red	3	19
Conglomerate	46	65
Clay, brown	2	67
Conglomerate	6	73
Clay, brown	2	75
Conglomerate, hard	55	130
Gravel; water bearing	20	150
Clay, brown	5	155
(D-11-1)4bad-1. Log by Thomas Woodhouse. Alt. 4,950 ft.		
Top soil	3	3
Clay-rock mixture, brown	23	26
Sand; water bearing	2	28
Clay and gravel mixture	42	70
Sand and gravel; water bearing	3	73
Rock and clay mixture	327	400
(D-11-1)8bcd-1. Log by J. S. Lee and Sons. Alt. 4,885 ft.		
Clay, sandy	7	7
No record	28	35
Clay	52	87
Sand and clay	76	163
Gravel; water bearing	4	167
Clay	34	201
Hardpan	3	204
Clay	41	245
Clay, sandy	8	253
Gravel; water bearing	7	260
Clay	7	267
Sand and clay	18	285
Clay	45	330
Gravel; water bearing	6	336
Clay and sand	19	355
Clay	50	405
Clay, sandy	8	413
Gravel; water bearing	14	427
Gravel, water bearing, and layer of clay	43	470
Gravel; water bearing	25	495
Hardpan	10	505
(D-11-1)8cab-1. Log by J. S. Lee and Sons. Alt. 4,900 ft.		
Soil	5	5
Clay, blue	23	28
Sand	2	30
Clay	15	45
Sand and gravel; water bearing	27	72
Clay	33	105
Gravel; water bearing	5	110
Clay	4	114
Gravel; water bearing	4	118
Clay	119	237
Hardpan and small layer of gravel	28	265

Table 6 — (Continued)

Material	Thickness	Depth
(D-11-1)8cab-1 - Continued		
Clay	81	346
Hardpan	37	383
Clay and hardpan	20	403
Gravel, in small layers, water-bearing, and clay	124	527
Clay	38	565
Sand and gravel; water bearing	2	567
Clay	25	592
Gravel; water bearing	5	597
Clay	46	643
(D-11-1)9cbc-1. Log by B. B. Gardner. Alt. 4,987 ft.		
Gravel	5	5
Clay	20	25
Gravel	5	30
Clay	55	85
Gravel	40	125
Clay	5	130
Gravel	55	185
Conglomerate	55	240
Gravel	11	251
Conglomerate	32	283
Gravel	14	297
Conglomerate	73	370
Clay	10	380
Conglomerate	15	395
Gravel	6	401
(D-11-1)9cca-1. Log by J. S. Lee and Sons. Alt. 5,014 ft.		
Soil and boulders	10	10
Clay, brown	3	13
Boulders and clay	32	45
Clay, brown	29	74
Gravel and clay	5	79
Conglomerate	6	85
Gravel and clay	9	94
Gravel; water bearing	11	105
Conglomerate	9	114
Clay	7	121
Gravel; water bearing	64	185
Gravel and clay	5	190
Gravel; water bearing	7	197
Gravel and clay	15	212
Sand	5	217
Gravel; water bearing	9	226
Conglomerate	8	234
Gravel; water bearing	5	239
Conglomerate	33	272
Gravel; water bearing	8	280
Conglomerate	8	288
Clay, red	4	292
Clay and gravel	12	304
(D-11-1)17bbb-1. Log by J. S. Lee and Sons. Alt. 4,900 ft.		
Topsoil	4	4
Clay	4	8
Gravel; water bearing	1	9
Conglomerate	26	35
Hardpan	4	39
Clay, gray, and water-bearing gravel	12	51
Clay, blue	14	65
Gravel; water bearing	2	67
Clay, blue	68	135
Clay, yellow	54	189
Hardpan	8	197
Gravel; water bearing	2	199
Hardpan	3	202
Gravel; water bearing	5	207
Clay, blue	39	246
Gravel; water bearing	5	251
Clay	101	352
Hardpan	1	353
Gravel; water bearing	12	365
Clay, brown, sticky	55	420
Hardpan	2	422
Gravel; water bearing	3	425
Clay, brown	6	431
Gravel; water bearing	6	437
Conglomerate	11	448
Clay, brown, sticky	20	468
Gravel; water bearing	12	480
Clay	3	483
Gravel; water bearing	6	489
Clay	50	539
Gravel; water bearing	6	545
Hardpan	2	547
Gravel; water bearing	5	552
Clay	28	580
(D-11-1)17bbb-1 - Continued		
Gravel; water bearing	24	604
Clay, red, sticky	110	714
Shale, gray	4	718
Clay, red, sticky	12	730
(D-11-1)18aac-1. Log by J. S. Lee and Sons. Alt. 4,882 ft.		
Clay	21	21
Gravel; water bearing	5	26
Clay	12	38
Gravel	17	55
Clay	138	193
Gravel; water bearing	14	207
Clay	21	228
Gravel	4	232
Clay	38	270
Gravel; water bearing	26	296
Clay	8	304
Gravel; water bearing	4	308
Clay	29	337
Clay and gravel	23	360
Clay	40	400
Gravel; water bearing	18	418
Clay	56	474
Gravel; water bearing	6	480
Clay	30	510
(D-11-1)21bbb-1. Log by C. M. Stephenson. Alt. 5,075 ft.		
Topsoil	2	2
Boulders	68	70
Boulders and gravel	30	100
Gravel	40	140
Gravel, large	20	160
No record	15	175
Gravel; water bearing	37	212
Gravel and clay	3	215
Gravel	40	255
Conglomerate	20	275
Gravel	6	281
Conglomerate	29	310
Gravel	25	335
Clay and gravel	3	338
Conglomerate	4	342
Gravel and conglomerate	19	361
(D-11-1)33cab-1. Log by B. B. Gardner. Alt. 5,140 ft.		
Silt	5	5
Gravel, large	35	40
Conglomerate	80	120
Gravel and clay	20	140
Boulders, gravel, and clay	50	190
Conglomerate	35	225
Gravel and clay	30	255
Gravel; water bearing	6	261
Gravel and clay	5	266
Gravel; water bearing	5	271
Gravel and clay streaks; water bearing	23	294
Gravel; water bearing	21	315
Conglomerate	3	318
Gravel; water bearing	10	328
Conglomerate; water bearing in places	18	346
Conglomerate	5	351
Conglomerate; water bearing in places	14	365
Conglomerate	7	372
Gravel and clay	4	376
Conglomerate	16	392
Clay; water bearing in places	12	404
Gravel and clay	9	413
Gravel and clay; water bearing	22	435
Boulders; water bearing	17	452
(D-12-1)20abd-1. Log by H. S. Peterson. Alt. 4,987 ft.		
Clay	27	27
Gravel; water bearing	1	28
Clay	12	40
Gravel	2	42
No record	16	58
Clay	47	105
Gravel	2	107
Clay	26	133
Gravel and clay	4	137
Clay	51	188
Gravel	1	189
Gravel, big, and clay	51	240
Clay	54	294
Gravel and clay; water bearing	2	296
(D-12-1)20abd-1 - Continued		
Clay	25	321
(D-12-1)20bac-1. Log by Thomas Woodhouse. Alt. 4,967 ft.		
Clay	38	38
Gravel and clay	22	60
Sand; water bearing	5	65
Gravel and clay	35	100
Gravel; water bearing	5	105
Clay	30	135
Gravel and sand; water bearing	1	136
Clay	29	165
Gravel and sand; water bearing	5	170
(D-12-1)30aad-2. Log by Hershel Woodhouse. Alt. 5,001 ft.		
Topsoil	2	2
Gravel and brown clay	8	10
Silt and clay, red	30	40
Cobbles and clay	27	67
Cobbles and clay, layers of water-bearing gravel	43	110
Clay, red	20	130
Gravel and sand; water bearing	1	131
Gravel and red clay	42	173
(D-12-1)30cad-1. Log by Thomas Woodhouse. Alt. 4,997 ft.		
Topsoil	3	3
Clay, brown, and sand	29	32
Sand, fine, brown, with thin gravel layers	60	92
Gravel, pea size; water bearing	8	100
(D-12-1)31aab-1. Log by Thomas Woodhouse. Alt. 5,022 ft.		
Soil	5	5
Clay, red	35	40
Sand and pea-size gravel; water bearing	1	41
Clay, red	10	51
Hardpan, fine	7	58
Hardpan, rock	13	71
Clay, red	5	76
Gravel with streaks of red clay	16	92
Clay, brown	13	105
Gravel	13	118
Clay, brown	42	160
Gravel and clay mixed	34	194
Sand and pea-size gravel; water bearing	20	214
Gravel and clay mixed	11	225
Clay, brown, water-bearing gravel at bottom	45	270
(D-12-1)32dac-1. Log by Thomas Woodhouse. Alt. 5,100 ft.		
Topsoil	2	2
Clay, brown	3	5
Gravel	1	6
Clay, brown	5	11
Boulders; water bearing	114	125
Gravel; water bearing	25	150
Gravel, loose; water bearing	15	165
Gravel with large rocks	35	200
Gravel; water bearing	50	250
Rocks, large	50	300
(D-13-1)1cab-1. Log by J. S. Lee and Sons. Alt. 5,490 ft.		
Conglomerate	51	51
No record	4	55
Gravel; water bearing	5	60
Sand	10	70
Gravel; water bearing	5	75
Gravel and clay	8	83
Gravel; water bearing	52	135
Shale	1	136
(D-13-1)3acc-1. Log by J. S. Lee and Sons. Alt. 5,240 ft.		
Clay, brown, and sand	4	4
Clay and boulders	25	29
Gravel	2	31
Clay, gravel, and boulders	28	59
Clay, brown, and gravel	72	131
Gravel; a little water	4	135
Clay, brown, and gravel	131	266
Shale, blue	14	280

Table 6 — (Continued)

Material	Thickness	Depth
(D-13-1)4cca-1. Log by C. M. Stephenson. Alt. 5,136 ft.		
Topsoil	10	10
Gravel and clay	35	45
Gravel, large	15	60
Gravel, large, and boulders	65	125
Gravel and clay	45	170
Gravel, large	10	180
Clay, sandy, red	5	185
Gravel	10	195
Gravel and boulders	6	201
Gravel, sand, and clay	39	240
Conglomerate	17	257
Gravel	4	261
Gravel, cemented	9	270
Gravel and boulders	14	284
Gravel, large	61	345
Conglomerate, hard	12	357
Gravel, large, and boulders	3	360
Conglomerate	15	375
(D-13-1)5dab-1. Log by J. S. Lee and Sons. Alt. 5,109 ft.		
Topsoil	37	37
Gravel	73	110
Clay, red	10	120
Sand and gravel	8	128
Conglomerate	7	135
Clay, red	5	140
Gravel; yields small amount of water	19	159
Gravel; water bearing	22	181
Conglomerate	24	205
Gravel; water bearing	55	260
Hardpan	5	265
Gravel; water bearing	20	285
Clay	6	291
Gravel; water bearing	17	308
No record	4	312
(D-13-1)5ddb-2. Log by J. S. Lee and Sons. Alt. 5,116 ft.		
Sand and gravel fill	2	2
Clay, red, with gravel streaks	49	51
Conglomerate	71	122
Clay and gravel	12	134
Conglomerate	7	141
Gravel; water bearing	2	143
Conglomerate	7	150
Gravel; water bearing	7	157
Clay and gravel	10	167
Gravel; water bearing	17	184
Clay, red	3	187
Gravel; water bearing	8	195
Clay, red	3	198
Conglomerate	17	215
Gravel; water bearing	26	241
Conglomerate	7	248
Gravel; water bearing	42	290
Clay, gravel, and boulders	4	294
Gravel; water bearing	6	300
Conglomerate	19	319
Gravel; water bearing	33	352
(D-13-1)6cbb-1. Log by Utah Emergency Drought Relief. Alt. 5,022 ft.		
Surface dirt	16	16
Clay, brown, and hardpan	41	57
Clay, blue	4	61
Gravel, fine, and sand	36	97
Conglomerate, clay, sand, and gravel	138	235
Conglomerate, coarse gravel, clay, and sand	55	290
Clay, gray	8	298
Conglomerate, hardpan, clay, and gravel	37	335
Sand, fine, red; water bearing	7	342
Conglomerate, gravel, clay, and hardpan	108	450
Clay, yellow	4	454
Conglomerate, streaks of red clay	46	500
Clay, conglomerate, and gravel	24	524
Conglomerate, red, and fine sand; water bearing	34	558
Conglomerate, about 60 percent gray clay	32	590
Conglomerate, sand, gravel, and gray clay	20	610
Sand, gray white, and clay	2	612
Conglomerate, reddish	36	648
Clay, red	24	672
Clay, reddish gray	44	716
No record	279	995
(D-13-1)7bbd-2. Log by Utah Emergency Drought Relief. Alt. 5,030 ft.		
Clay, sandy, red; some water at 45 ft	52	52
Gravel, sand, and small amount of clay	3	55
Gravel, hard; water bearing	5	60
Gravel and sand; water bearing	5	65
Gravel and sand, loose; water bearing	9	74
Sand and gravel, hard; water bearing	5	79
Clay, sandy, red	3	82
Gravel and sand, loose; water bearing	13	95
Clay, sandy, red	59	154
Clay and gravel, sandy	4	158
(D-13-1)7cac-2. Log by B. B. Gardner. Alt. 5,037 ft.		
Hardpan	5	5
Clay, sandy	41	46
Sand; water bearing	4	50
Clay	8	58
Gravel	32	[illegible]
Clay	18	108
Gravel and sand; water bearing	1	109
Hardpan, in streaks; water bearing	7	116
Hardpan	5	121
Hardpan and sand; water bearing	28	149
Hardpan	20	169
(D-13-1)7cac-2 - Continued		
Gravel; water bearing	29	198
Clay	2	200
(D-13-1)7dad-2. Log by J. G. Lee. Alt. 5,062 ft.		
Clay	10	10
Sand and gravel	3	13
Clay	48	61
Clay and gravel	29	90
Gravel; water bearing	15	105
Clay	42	147
Gravel; water bearing	18	165
Clay and gravel	13	178
Gravel; water bearing	3	181
Clay and gravel	17	198
Gravel; water bearing	9	207
Clay and gravel	10	217
Gravel; water bearing	4	221
Clay	7	228
(D-13-1)7dbc-1. Log by Robinson Drilling Co. Alt. 5,044 ft.		
Sod	3	3
Clay, sandy	57	60
Gravel, large	4	64
Clay	12	76
Gravel and sand; small amount of water	9	85
Gravel	5	90
Gravel and clay	10	100
Clay	18	118
Sand and clay	3	121
Sand, soft	4	125
Sand, hard	5	130
Gravel, sand, and clay	5	135
Gravel	30	165
Clay	3	168
Gravel	37	205
Gravel and clay	5	210
(D-13-1)9dcd-1. Log by J. S. Lee and Sons. Alt. 5,360 ft.		
Boulders	105	105
Boulders and clay	130	235
Gravel, dry	115	350
Clay	2	352
Gravel and sand; water bearing	88	440
(D-13-1)18bbc-1. Log by J. T. Woodhouse. Alt. 5,024 ft.		
Topsoil	3	3
Clay, red	22	25
Sand, fine; water bearing	4	29
Clay, red	10.5	39.5
Gravel; water bearing	2.5	42
Clay, red	28	70
Clay, red, and gravel	64	134
Gravel; water bearing	2	136
Clay, red	20	156
Gravel; water bearing	3	159
Clay, red, and gravel	45	204
Gravel	2	206
Clay, red	28	234
Gravel; water bearing	1.5	235.5

Table 7 — Chemical analyses of water from selected wells and springs in northern Juab Valley

Sodium and potassium: Where no potassium value is shown, sodium plus potassium is calculated and reported as sodium.
Dissolved solids: Residue on evaporation unless indicated by c (sum of determined constituents).
Agency making analysis: BR, U.S. Bureau of Reclamation; GS, U.S. Geological Survey; PH, Utah State Department of Public Health.

Location No.	Date of collection	Temperature (°F)	Parts per million															Percent sodium	Sodium-adsorption ratio	Specific conductance (micromhos/cm at 25°C)	pH	Agency making analysis
			Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$					
(C-12-1)12aac-S1	7-15-65	68	38	69	27	232		222	0	81	368	-	2.8	-	962	284	102	64	6.0	1,690	7.2	GS
13dcd-1	6-24-64	54	-	115	40	130	4.3	303	0	195	203	-	-	-	738	-	-	38	2.7	1,370	7.7	BR
24baa-1	6-23-64	55	-	64	42	114	4.3	154	4.5	181	185	-	-	-	618	-	-	42	2.7	1,090	8.3	BR
(C-13-1)1cdd-1	10-18-51	-	28	72	37	97		291	0	73	158	0.2	5.6	0.09	614c	332	93	39	1.7	1,030	7.9	GS
11bbc-1	10-17-51	-	24	110	44	185		423	0	114	278	.4	.6	.12	964c	456	109	47	-	1,610	7.7	GS
11ddc-1	7-13-64	58	-	37	30	30	2.4	163	8.4	25	78	-	-	-	345	-	-	23	.9	546	8.5	BR
12acc-1	7- 9-64	49	-	169	50	170	3.1	498	0	155	308	-	-	-	1,120	-	-	37	2.9	1,840	7.4	BR
14bdc-1	10-18-51	56	37	50	33	70		279	0	50	93	.2	.7	.11	471c	260	32	37	1.9	771	8.0	GS
14dbb-1	8-15-51	58	54	52	29	69		266	0	46	92	.2	3.4	.11	477c	248	30	38	1.8	772	-	GS
	6-11-64	57	-	55	27	65	5.0	234	15	49	92	-	-	-	467	-	-	36	1.8	767	8.5	BR
23cdc-1	8-15-51	60	36	58	36	66		210	0	65	136	.2	6.5	.07	504c	292	120	33	1.7	869	-	GS
	6-11-64	-	-	59	38	59	3.1	173	14	61	149	-	-	-	560	-	-	29	1.5	880	8.7	BR
33cac-S1	4-25-63	50	24	114	52	94		223	0	68	308	-	15	-	936	496	313	29	1.8	1,450	7.7	GS
(C-14-1)14cac-1	5-17-65	55	35	132	165	244		244	0	395	630	-	50	-	1,890	1,010	810	34	3.3	2,930	7.7	GS
(D-10-1)27acc-1	6- 1-64	55	-	55	29	7.8	.8	257	0	32	22	-	-	-	270	-	-	6.2	.2	501	8.0	BR
(D-11-1)4cca-1	6- 3-64	54	-	49	25	21	1.6	246	0	36	23	-	-	-	285	-	-	16	.6	498	7.9	BR
4ccc-1	8-15-51	54	19	49	26	16		250	0	23	22	.8	2.8	.09	282c	230	24	13	.4	481	-	GS
4ccc-2	10- 9-51	54	19	46	27	13		249	0	21	18	.1	1.6	.07	268c	226	22	11	.4	454	8.0	GS
(1/)	2-19-57	54	17	50	25	16	1.6	245	0	23	23	.1	3.3	.04	281	228	27	13	.5	491	7.4	GS
8bcd-1	5-25-64	56	-	31	23	13	1.2	143	5.1	57	12	-	-	-	209	-	-	14	.5	376	8.5	BR
8bda-1[2/]	2-19-57	55	20	42	23	10	1.4	229	0	20	9.0	.1	1.8	.04	236	199	11	10	.3	405	7.3	GS
	5-25-64	55	-	44	23	10	1.2	227	0	29	7.8	-	-	-	232	-	-	9.7	.3	410	7.8	BR
8cab-1[2/]	2-19-57	58	19	40	24	14	1.4	219	0	32	9.0	.1	1.8	.03	252	198	18	13	.4	427	7.5	GS
	5-20-64	58	-	43	24	14	1.6	193	10	43	13	-	-	-	236	-	-	12	.4	424	8.4	BR
9bbb-2	6- 3-64	53	-	59	27	21	.8	252	0	41	41	-	-	-	285	-	-	15	.6	571	7.7	BR
9cbc-1	6- 1-64	55	-	28	26	12	1.2	145	10	45	16	-	-	-	222	-	-	12	.1	384	8.4	BR
9cca-1	8-27-63	-	-	33	22	11	.8	154	3.6	47	12	-	-	-	197	-	-	12	.4	378	8.1	BR
	6- 3-64	55	-	57	23	12	1.2	246	0	41	15	-	-	-	269	-	-	10	.3	501	7.7	BR
17bbb-1[3/]	2-19-57	58	18	37	19	18	1.6	196	0	34	11	.1	1.8	.04	236	171	10	18	.6	401	7.6	GS
	5-20-64	58	-	35	21	18	1.6	165	7.8	50	11	-	-	-	213	-	-	19	.6	393	8.5	BR
30bad-1	5-26-64	51	-	49	17	16	3.9	247	0	13	13	-	-	-	261	-	-	15	.5	429	8.0	BR
30bda-1	5-26-64	51	-	53	21	25	4.7	222	0	29	46	-	-	-	342	-	-	-	-	539	7.8	BR
31aaa-S1	5-14-65	50	11	72	38	13		360	0	40	12	-	15	-	371	338	43	8	.3	658	8.1	GS
31abc-1	5-14-65	55	27	47	22	13		226	0	39	9.1	-	0.0	-	262	210	25	12	.4	437	8.1	GS
33cab-1	6- 1-64	52	-	45	19	6.7	.8	195	0	32	8.9	-	-	-	195	-	-	7.1	.2	386	8.1	BR
(D-12-1)3bbc-S1	6-21-41	-	21	44	18	6.9		155	-	24	15	.8	0	-	204	184	-	-	-	-	7.4	PH
	5-13-65	48	5.6	42	17	2.4		188	0	18	2.7	.5	1.7	-	172	174	20	3	.1	334	7.9	GS
6ddc-S1	5-15-65	53	14	107	54	123		328	0	179	205	-	15	-	898	490	221	35	2.4	1,450	8.0	GS
8ccd-1	5-25-64	54	-	125	38	192	4.3	296	0	232	290	-	-	-	1,034	-	-	46	3.9	1,700	7.6	BR
19cdc-1	8-15-51	57	34	86	37	147		262	0	102	248	.2	20	.07	802c	366	152	47	3.0	1,360	-	GS
	5-26-64	56	-	107	32	149	7.8	252	0	165	252	-	-	-	868	-	-	44	3.2	1,380	8.1	BR
19dab-1	10-18-51	-	27	118	38	135		425	0	89	205	.0	18	.11	839c	450	102	39	2.6	1,420	7.9	GS
19dbb-1	10-18-51	56	29	75	34	132		252	0	88	223	.2	2.2	.11	708c	327	120	47	3.2	1,210	8.1	GS
20bac-1	6- 8-64	52	-	105	31	137	3.9	279	0	169	199	-	-	-	753	-	-	43	3.0	1,300	7.8	BR
31aab-1	6-14-63	54	-	60	41	137	5.1	187	0	166	210	-	-	-	692	-	-	48	3.3	1,188	8.0	BR
31cbb-1	6- 8-64	52	-	68	23	131	3.5	202	0	112	194	-	-	-	621	-	-	51	3.5	1,080	8.2	BR
32dac-1[4/]	2- 8-50	-	22	134	38	118		446	0	86	190	.2	30	.02	874	490	125	34	2.4	1,480	7.5	GS
(5/)	8-15-50	-	26	142	40	131		484	0	93	202	-	31	.02	903c	519	122	35	2.5	1,510	7.7	GS
	6- 8-54	54	-	122	36	149	3.5	378	18	154	198	-	-	-	844	-	-	42	3.1	1,390	8.8	BR
(D-13-1)1cab-1	7-13-64	51	-	68	34	715	7.0	119	7.2	252	1,066	-	-	-	2,200	-	-	83	12	3,820	8.3	BR
4cca-1	6- 8-64	52	-	73	34	134	4.3	193	0	151	214	-	-	-	736	-	-	47	3.3	1,240	8.1	BR
4ccb-1	8-27-63	52	-	38	37	131	5.1	154	0	125	198	-	-	-	696	-	-	-	-	1,120	8.0	BR
5dab-1	6-29-64	51	-	156	35	144	3.9	480	0	163	206	-	-	-	866	-	-	36	2.7	1,500	7.4	BR
5dda-1	6- 8-64	52	-	66	34	150	4.7	213	0	147	219	-	-	-	739	-	-	51	3.7	1,280	8.2	BR
5ddb-1	6-24-64	52	-	81	39	154	4.3	271	0	166	218	-	-	-	692	-	-	48	3.5	1,410	7.9	BR
5ddb-2	6- 3-63	52	-	151	44	156	4.7	422	0	218	234	-	-	-	1,020	-	-	38	2.9	1,621	7.8	BR
7cac-2	9- 6-62	-	-	131	40	182	3.9	474	3.0	120	265	-	-	-	1,018	-	-	44	3.6	1,719	7.7	BR
7dad-2	8- 9-61	51	-	128	40	180	3.1	434	9.9	138	258	-	-	-	986	-	-	44	3.6	1,699	7.9	BR
7dbc-1	6- 9-64	51	-	51	40	127	3.1	187	7.5	125	197	-	-	-	635	-	-	48	3.2	1,100	8.3	BR
7dda-1	6- 9-64	51	-	66	42	191	3.5	212	8.7	174	275	-	-	-	854	-	-	55	4.5	1,480	8.3	BR
8aac-1[6/]	5-16-55	-	10	115	48	-	-	616	-	-	221	.0	-	36	852	488	-	-	-	-	7.2	PH
17bdd-1	8- 9-61	-	-	101	55	210	1.2	483	5.7	190	237	-	-	-	1,096	-	-	49	4.2	1,806	8.0	BR
(D-13-2)5cbd-S1	5-13-65	52	11	63	8.8	8.9		234	0	8.6	8.2	.4	.2	-	213	194	2	9	.3	379	7.7	GS

1/ Analysis includes 0.00 ppm iron and 0.01 ppm manganese.
2/ Analysis includes 0.00 ppm iron and 0.00 ppm manganese.
3/ Analysis includes 0.03 ppm iron and 0.00 ppm manganese.
4/ Analysis includes 0.05 ppm iron.
5/ Analysis includes 0.09 ppm iron.
6/ Analysis includes 6.05 ppm iron.

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(*) — Out of Print

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No. 2. The Ogden Valley artesian reservoir, Weber County, Utah, by H. E. Thomas, U.S. Geological Survey, 1945.

*No. 3. Ground water in Pavant Valley, Millard County, Utah, by P. E. Dennis, G. B. Maxey, and H. E. Thomas, U.S. Geological Survey, 1946.

*No. 4. Ground water in Tooele Valley, Tooele County, Utah, by H. E. Thomas, U.S. Geological Survey, in Utah State Eng. 25th Bienn. Rept., p. 91-238, pls. 1-6, 1946.

*No. 5. Ground water in the East Shore area, Utah: Part I, Bountiful District, Davis County, Utah, by H. E. Thomas and W. B. Nelson, U.S. Geological Survey, in Utah State Eng. 26th Bienn. Rept., p. 53-206, pls. 1-2, 1948.

*No. 6. Ground water in the Escalante Valley, Beaver, Iron, and Washington Counties, Utah, by P. F. Fix, W. B. Nelson, B. E. Lofgren, and R. G. Butler, U.S. Geological Survey, in Utah State Eng. 27th Bienn. Rept., p. 107-210, pls. 1-10, 1950.

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*No. 8. Consumptive use of water and irrigation requirements of crops in Utah, by C. O. Roskelly and Wayne D. Criddle, 1952.

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No. 13. Ground-water resources of selected basins in southwestern Utah, by G. W. Sandberg, U.S. Geological Survey, 1966.

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No. 16. Ground-water conditions in Cedar Valley, Utah County, Utah, by R. D. Feltis, U. S. Geological Survey, 1967.

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No. 1. Ground water in the Jordan Valley, Salt Lake County, Utah, by Ted Arnow, U. S. Geological Survey, 1965.

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No. 3. Ground-water data, central Sevier Valley, parts of Sanpete, Sevier, and Piute Counties, Utah, by C. H. Carpenter and R. A. Young, U. S. Geological Survey, 1963.

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No. 5. Selected hydrologic data, Pavant Valley, Millard County, Utah, by R. W. Mower, U.S. Geological Survey, 1963.

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No. 8. Selected hydrologic data, upper Sevier River basin, Utah, by C. H. Carpenter, G. B. Robinson, Jr., and L. J. Bjorklund, U.S. Geological Survey, 1964.

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No. 12. Hydrologic and climatologic data, 1965, Salt Lake County, Utah, by W. V. Iorns, R. W. Mower, and C. A. Horr, U.S. Geological Survey, 1966.

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*No. 1. Plan of work for the Sevier River Basin (Sec. 6, P.L. 566), United States Department of Agriculture, 1960.

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No. 10. Effects on the shallow artesian aquifer of withdrawing water from the deep artesian aquifer near Sugarville, Millard County, Utah, by R. W. Mower, United States Geological Survey, 1963.

No. 11. Amendments to plan of work and work outline for the Sevier River basin (Sec. 6, P.L. 566), United States Department of Agriculture, 1964.

No. 12. Test drilling in the upper Sevier River drainage basin, Garfield and Piute Counties, Utah, by R. D. Feltis and G. B. Robinson, Jr., United States Geological Survey, 1963.

No. 13. Water requirements of lower Jordan River, Utah, by Karl Harris, Irrigation Engineer, Agricultural Research Service, Phoenix, Arizona, prepared under informal cooperation approved by Mr. William W. Donnan, Chief, Southwest Branch (Riverside, California) Soil and Water Conservation Research Division, Agricultural Research Service, U.S.D.A. and by Wayne D. Criddle, State Engineer, State of Utah, Salt Lake City, Utah, 1964.

*No. 14. Consumptive use of water by native vegetation and irrigated crops in the Virgin River area of Utah, by Wayne D. Criddle, Jay M. Bagley, R. Keith Higginson, and David W. Hendricks, through cooperation of Utah Agricultural Experiment Station, Agricultural Research Service, Soil and Water Conservation Branch, Western Soil and Water Management Section, Utah Water and Power Board, and Utah State Engineer, Salt Lake City, Utah, 1964.

No. 15. Ground-water conditions and related water administration problems in Cedar City Valley, Iron County, Utah, February, 1966, by Jack A. Barnett and Francis T. Mayo, Utah State Engineer's Office.

No. 16. Summary of water well drilling activities in Utah, 1960 through 1965, compiled by Utah State Engineer's Office, 1966.

No. 17. Bibliography of U. S. Geological Survey Water Resources Reports for Utah, compiled by Olive A. Keller, U. S. Geological Survey, 1966.

No. 18. The effect of pumping large-discharge wells on the ground-water reservoir in southern Utah Valley, Utah County, Utah, by R. M. Cordova and R. W. Mower, U. S. Geological Survey, 1967.

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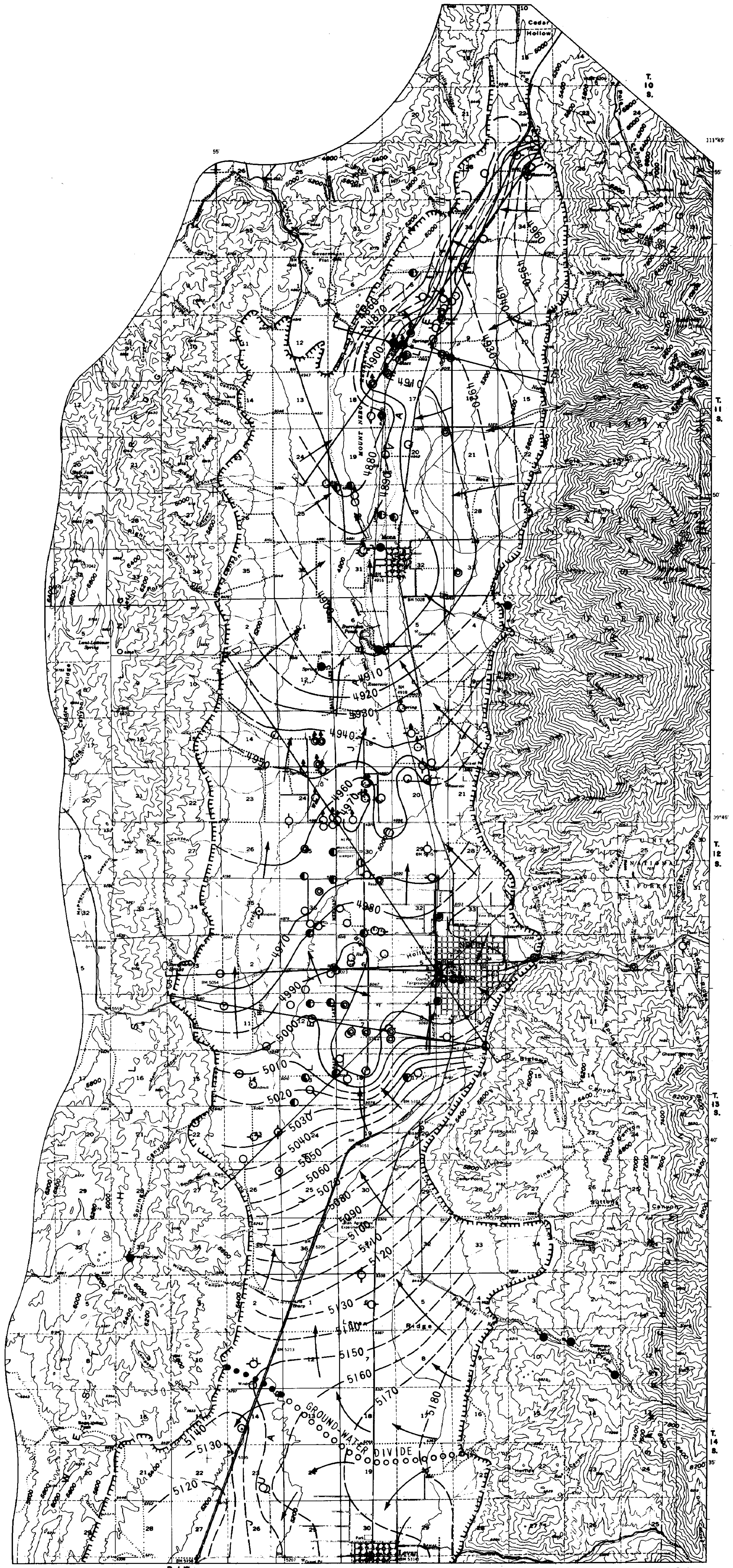
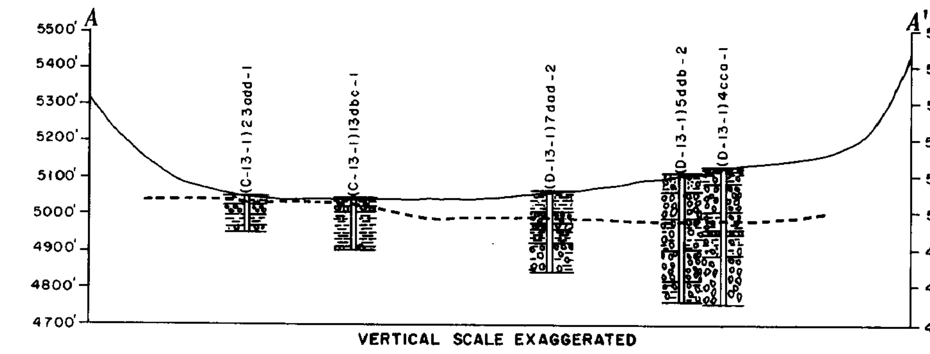
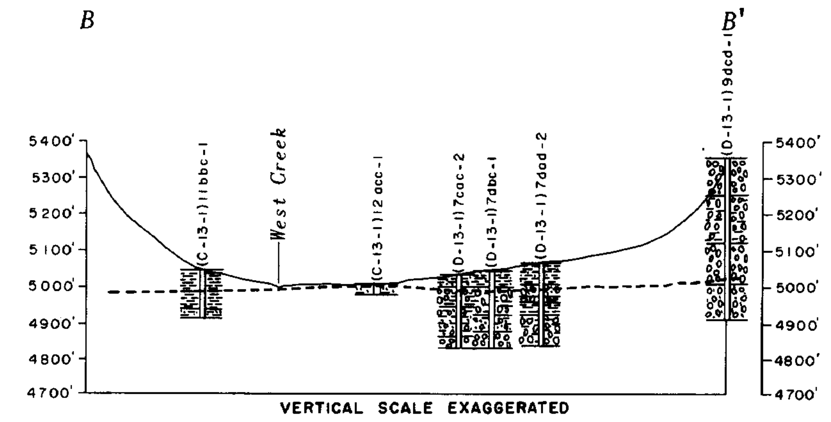
TECHNICAL PUBLICATION NO. 17
PLATE 2 1967

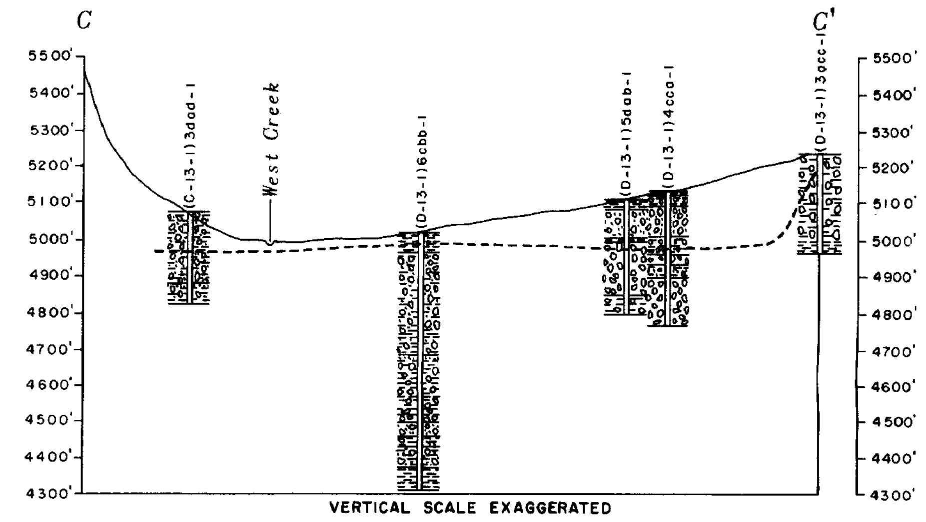


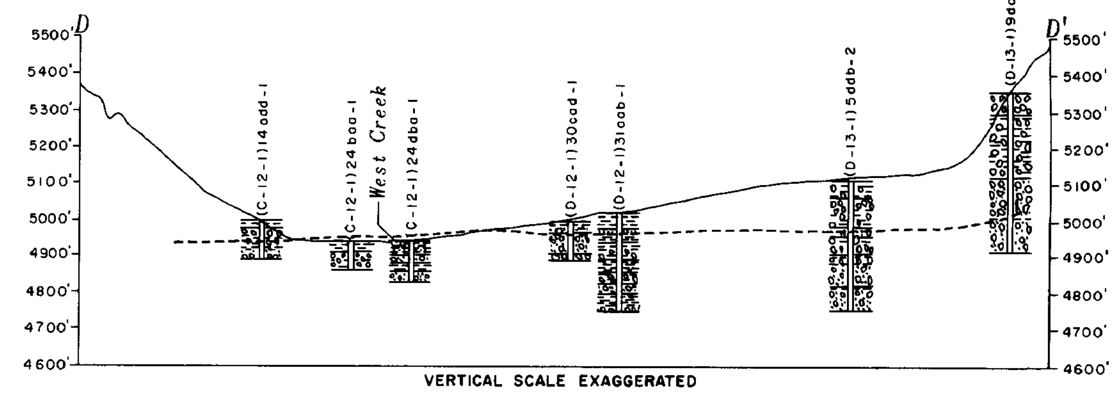
Base from U.S. Geological Survey
Nephi, 1951, and Santaquin, 1951.

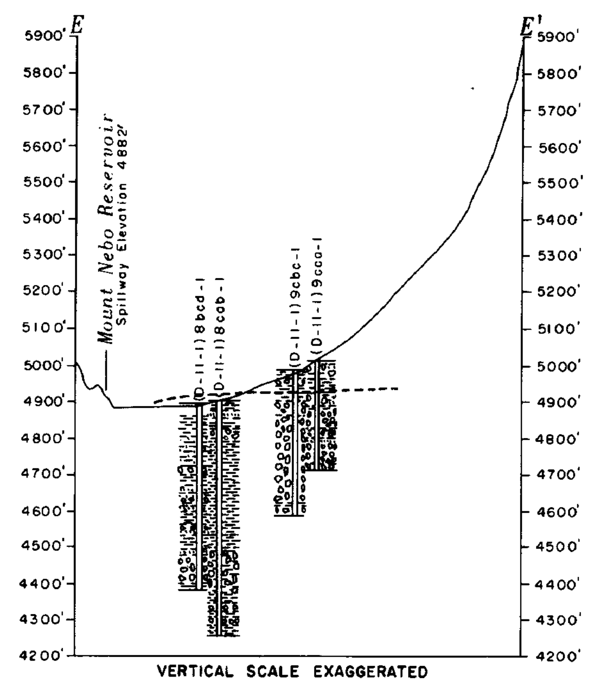
CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL

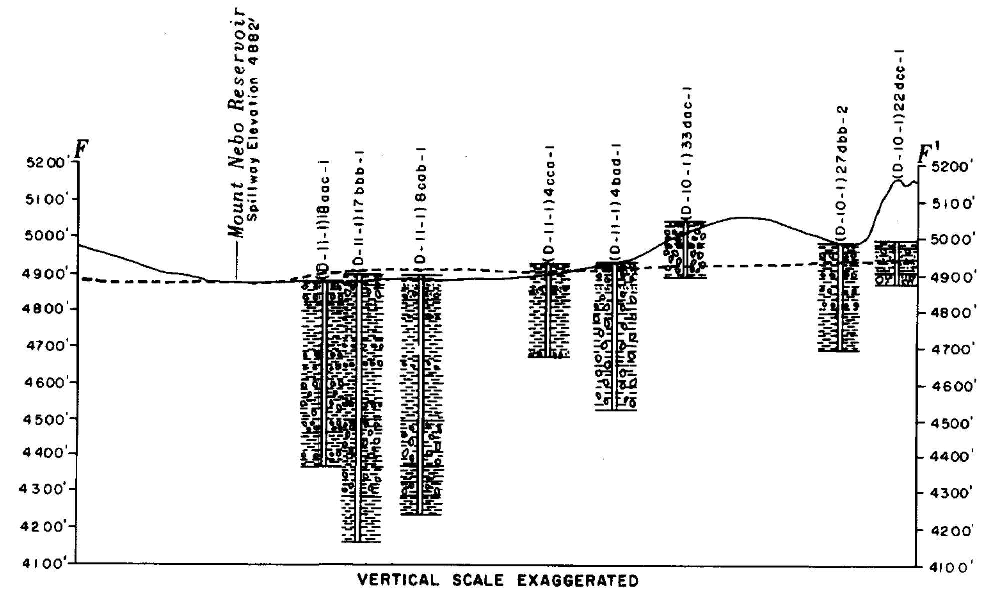


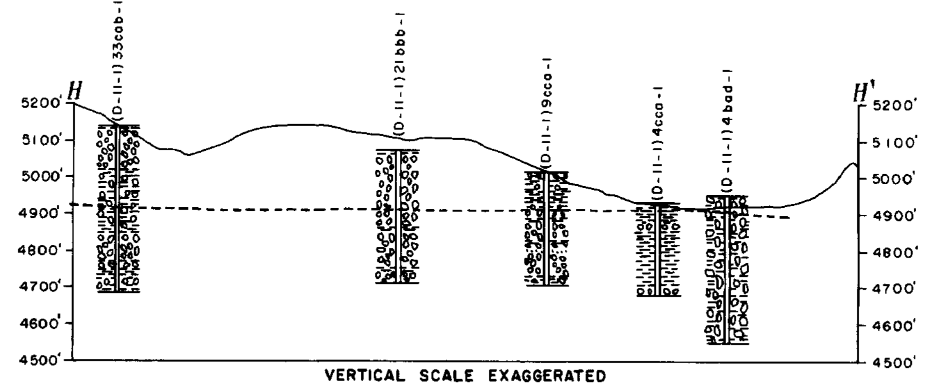












EXPLANATION

Domestic or stock well

Irrigation well

Industrial well

Shallow test well

Arrow above symbol indicates that the well flows

Dry destroyed well

Unused or abandoned well

Spring

4930
Water-level contour
Shows altitude of water level; dashed where approximate. Contour interval 10 feet. Datum is mean sea level. Arrow indicates direction of ground-water movement

Water table or piezometric surface in lithologic section

A A'
Line of lithologic section

Soil, silt, clay, or "hardpan"

Sand

Gravel, cobbles, boulders, and "conglomerate"

Approximate boundary of valley fill

Hydrology by L. J. Bjorklund, 1966

MAP OF NORTHERN JUAB VALLEY, UTAH, SHOWING LOCATIONS OF WELLS AND SPRINGS, WATER-LEVEL CONTOURS, DIRECTION OF GROUND-WATER MOVEMENT, AND LITHOLOGIC SECTIONS ACROSS THE VALLEY DURING THE SPRING OF 1965

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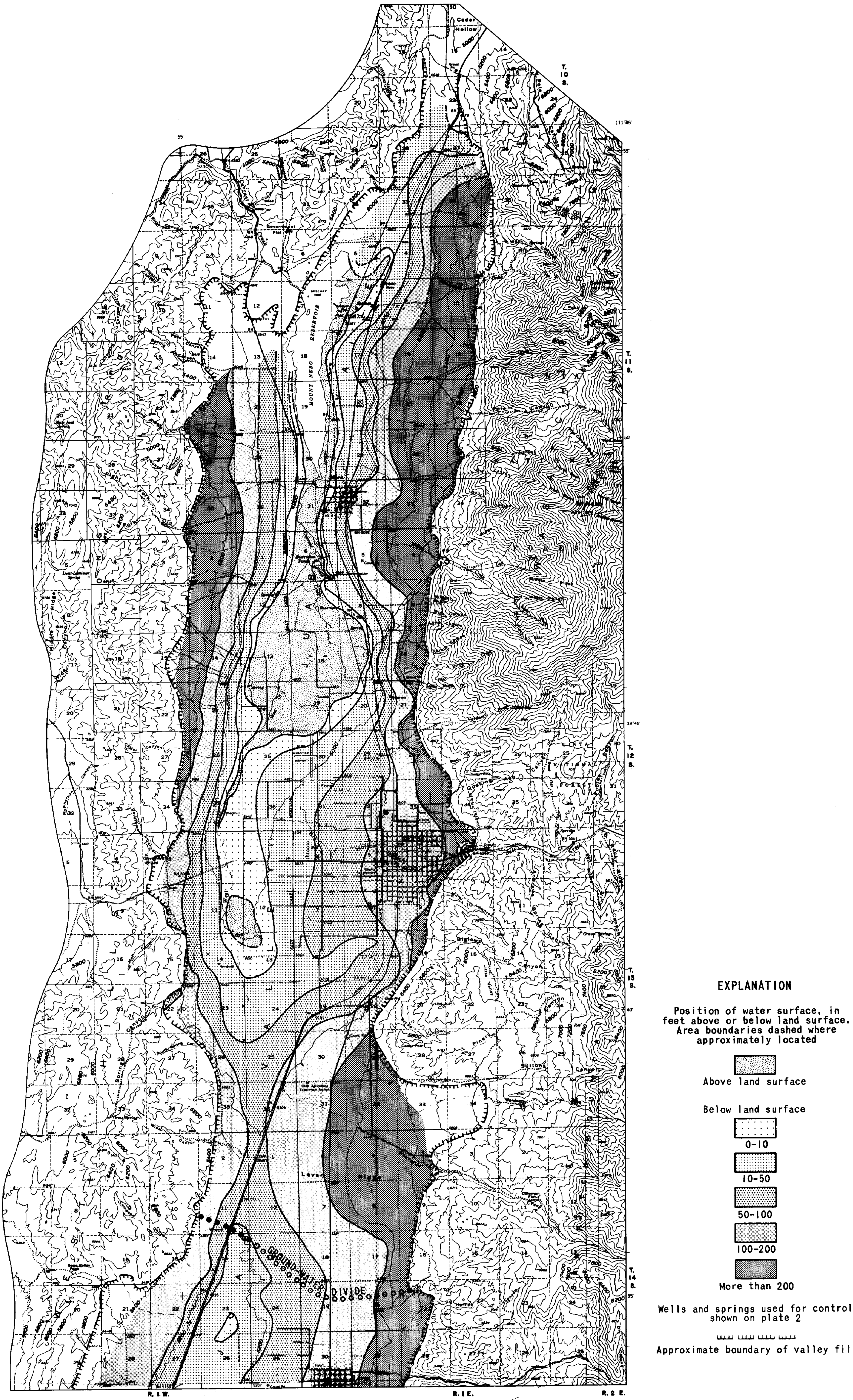

Base from U.S. Geological Survey Nephi, 1951, and Santaquin, 1951.

CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL

Hydrology by L. J. Bjorklund, 1966

MAP OF NORTHERN JUAB VALLEY, UTAH, SHOWING POSITION OF THE GROUND-WATER SURFACE IN THE SPRING OF 1965

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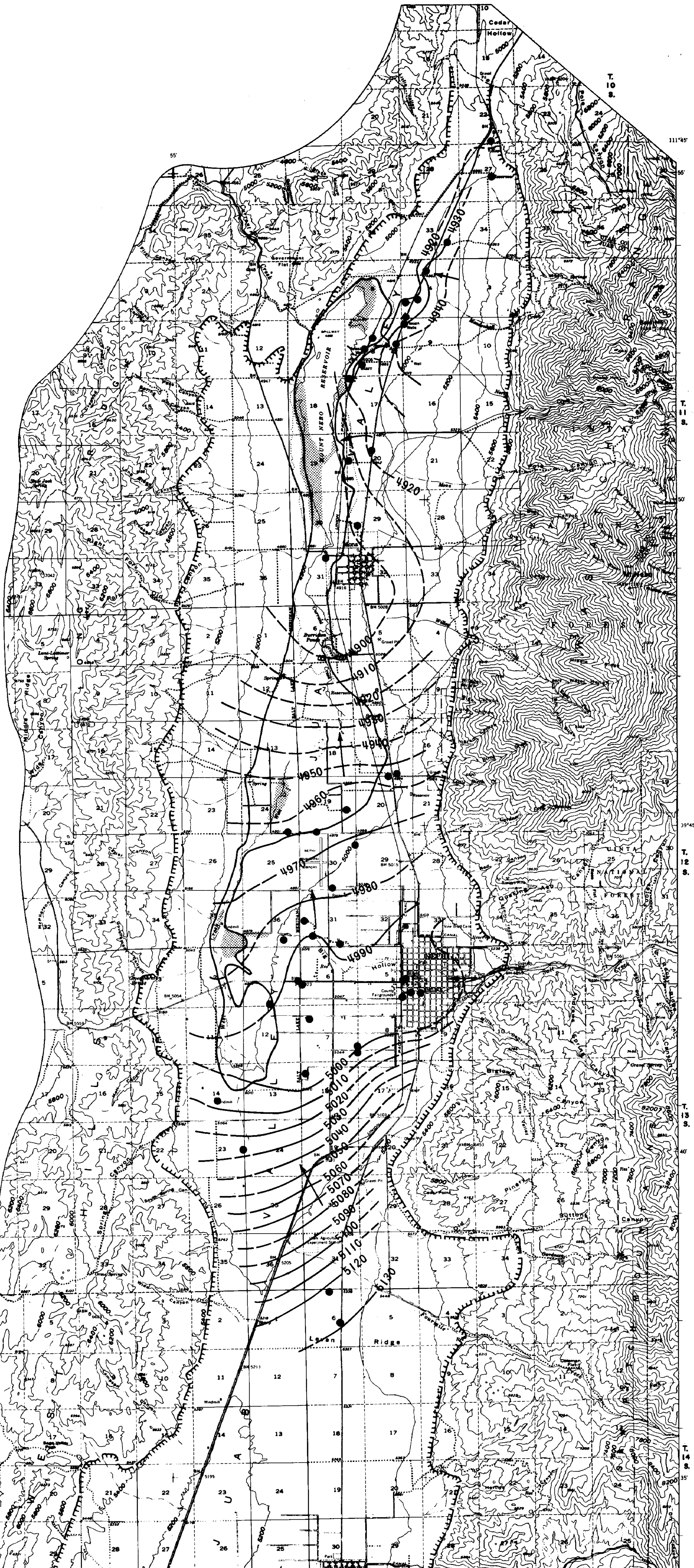
PLATE 4 1967



EXPLANATION

Well used for control

5060

Water-level contour

Shows altitude of water level; dashed where approximate. Contour interval 10 feet. Datum is mean sea level. Arrow indicates direction of ground-water movement. Contours based on miscellaneous springtime water-level measurements during 1949, 1950, and 1956 and on considerations of hydrographs of wells and of the more detailed water-level contour map for the spring of 1965 (pl.2)

Edge of area of greatest evapotranspiration

Areas of saltcedar growth

Approximate boundary of valley fill

Base from U.S. Geological Survey Nephi, 1951, and Santaquin, 1951.

MILES

KILOMETERS

CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL

Hydrology by L. J. Bjorklund, 1966

MAP OF NORTHERN JUAB VALLEY, UTAH, SHOWING GENERALIZED WATER-LEVEL CONTOURS DURING THE SPRING OF 1950 AND AREA OF GREATEST EVAPOTRANSPIRATION

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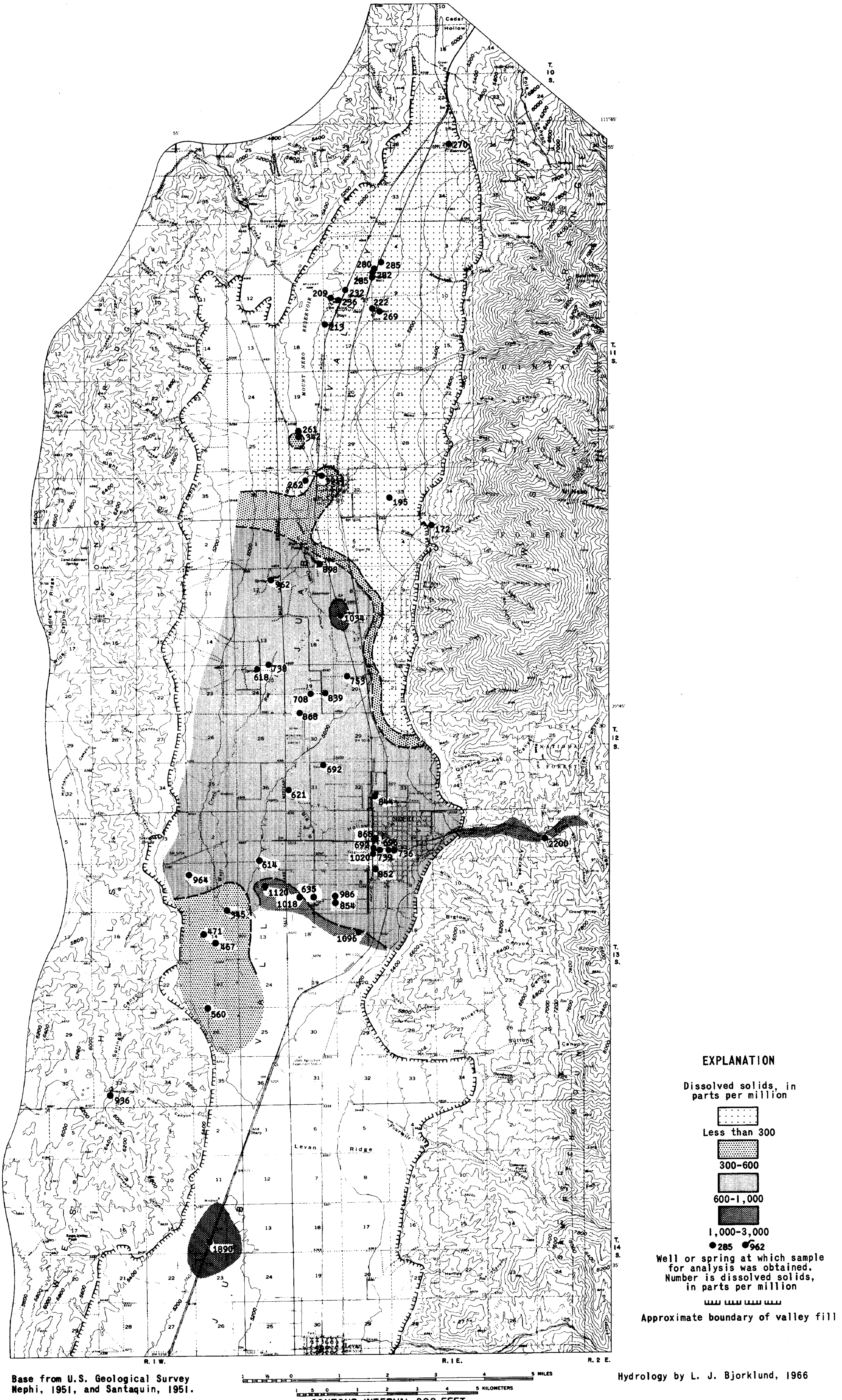
PLATE 5 1967



MAP OF NORTHERN JUAB VALLEY, UTAH, SHOWING THE CONCENTRATION OF DISSOLVED SOLIDS IN GROUND WATER

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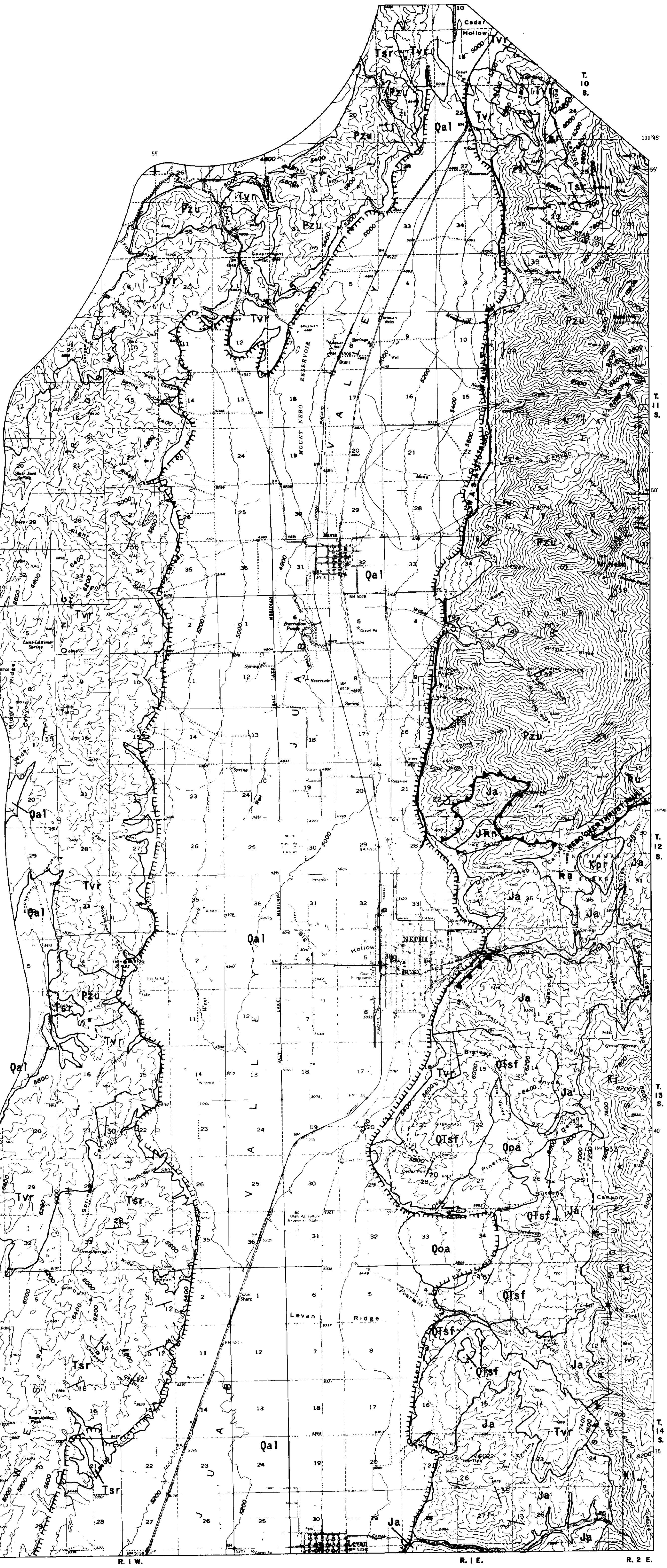
TECHNICAL PUBLICATION NO. 17
PLATE 1 1967



EXPLANATION

Qal
Qoa

Valley fill

Qal *Alluvial-fan, lacustrine, and flood-plain deposits of clay, silt, sand, and gravel, mostly unconsolidated; includes some landslide deposits; yields moderate to large quantities of water to wells and springs in the valley.*

Qoa *Old alluvial-fan deposits of material similar to Qal; water-bearing properties in the area are not known.*

QUATERNARY

QTsf

Salt Creek Fanglomerate of Eardley (1933)
Fanglomerate composed of boulders, cobbles, and gravel in a red sand and silt matrix; water-bearing properties are not known.

Tvr

Tertiary volcanic rocks
Pyroclastics and flows; permeability generally low but high where fractured or jointed; yields water to some springs in Long Ridge.

TERTIARY

Tsr

Tertiary sedimentary rocks
Limestone, sandy limestone, sandstone, siltstone, shale, and conglomerate; includes Crazy Hollow of Spieker (1949), Green River, Colton, Flagstaff, and North Horn formations (in part Upper Cretaceous); yields water to springs in the West Hills.

Kpr

Price River Formation
Conglomerate, sandstone, and shale; water-bearing properties in the area are not known, but yields large quantities of water to springs in other areas.

Ki

Indianola Group
Conglomerate of pebbles, cobbles, and boulders with interbeds of sandstone, siltstone, shale, and limestone; yields water to many springs in the San Pitch Mountains.

CRETACEOUS

Ja

Arapien Shale
Red to gray siltstone, sandstone, and limestone, locally contains beds of anhydrite, gypsum, and rock salt; permeability generally is low; is a source of sulfate and chloride ions to the ground water in the southern part of the valley.

JURASSIC

J̄R̄n

Nugget Sandstone
Sandstone; water-bearing properties are not known.

JURASSIC(?) and TRIASSIC(?)

R̄u

Triassic rocks, undifferentiated
Limestone and shale; includes Woodside Formation, Thaynes Limestone, and Ankareh Shale; water-bearing properties are not known.

TRIASSIC

Pzu

Paleozoic rocks, undifferentiated
Many formations of sandstone, quartzite, limestone, dolomite, and shale; permeability varies with formations and places; yields water of excellent chemical quality to springs along the western side of the Wasatch Range.

CAMBRIAN, CARBONIFEROUS (PENNSYLVANIAN, MISSISSIPPIAN), and PERMIAN

Contact
Dashed where approximately located

Normal fault

Thrust fault
Saw-toothed on side of upper plate

40
Strike and dip of beds

29
Strike and dip of overturned beds

Approximate boundary of valley fill

Base from U.S. Geological Survey Nephi, 1951, and Santaquin, 1951.

1 ½ 0 1 2 3 4 5 MILES
1 .5 0 1 2 3 4 5 KILOMETERS
CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL

Geology adapted from Hintze (1962)

MAP SHOWING GENERALIZED GEOLOGY OF NORTHERN JUAB VALLEY AND VICINITY, UTAH