Geology and Ground Water of the Tualatin Valley Oregon

By D. H. HART *and* R. C. NEWCOMB

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GEOLOGY AND GROUND WATER OF THE TUALATIN VALLEY, OREGON

By D. H. Hart and R. C. Newcomb

ABSTRACT

The Tualatin Valley proper consists of broad valley plains, ranging in altitude from 100 to 300 feet, and the lower mountain slopes of the drainage basin of the Tualatin River, a tributary of the Willamette River in northwestern Oregon. The valley is almost entirely farmed. Its population is increasing rapidly, partly because of the expansion of metropolitan Portland.

Structurally, the bedrock of the basin is a saucer-shaped syncline almost bisected lengthwise by a ridge. The bedrock basin has been partly filled by alluvium, which underlies the valley plains.

Ground water occurs in the Columbia River basalt, a lava unit that forms the top several hundred feet of the bedrock, and also in the zones of fine sand in the upper part of the alluvial fill. It occurs under unconfined, confined, and perched conditions. Graphs of the observed water levels in wells show that the ground water is replenished each year by precipitation. The graphs show also that the amount and time of recharge vary in different aquifers and for different modes of ground-water occurrence. The shallower alluvial aquifers are refilled each year to a level where further infiltration recharge is retarded and water drains away as surface runoff. No occurrences of undue depletion of the ground water by pumping are known. The facts indicate that there is a great quantity of additional water available for future development.

The ground water is developed for use by some spring works and by thousands of wells, most of which are of small yield. Improvements are now being made in the design of the wells in basalt and in the use of sand or gravel envelopes for wells penetrating the fine-sand aquifers.

The ground water in the basalt and the valley fill is in general of good quality, only slightly or moderately hard and of low salinity. Saline and mineralized water is present in the rocks of Tertiary age below the Columbia River basalt. Under certain structural and stratigraphic conditions this water of poor quality contaminates the fresh-water aquifers.

Detailed hydrologic and geologic conditions are presented in 5 tables, 7 pictures, and 17 graphic figures and plates.

INTRODUCTION

PURPOSE OF THE INVESTIGATION

Historically, the Tualatin Valley has been a difficult area in which to obtain good supplies of water from wells. Many landowners have found it necessary to plan thier expenditures, and drillers to drill, without knowing what earth materials would be penetrated. The lack of information on the geology, on the probable position, quantity, and character of water-bearing units of the substrata, and on the chemical quality of the ground water has been a deterrent to the efficient and economical development of good supplies of water from wells. This investigation attempts to fill some of these needs for information, and was made by the U.S. Geological Survey in cooperation with the office of the State Engineer of Oregon.

Since about 1940 there has been a great increase in population and development of the Tualatin Valley. Much of the eastern part of the Tualatin Valley is rapidly becoming a part of metropolitan Portland. Along with this suburban encroachment has come the need for more irrigation water, required to secure larger returns per acre. Growth of suburban areas has increased the demand for domestic and public water supplies. In addition, the manufacturing and processing plants in the area require substantial supplies of water.

LOCATION AND EXTENT OF THE AREA

The Tualatin Valley is the northwestern part of the Willamette Valley of Oregon. It consists of the low-lying plains and the lower slopes of the Tualatin River drainage basin, which extend across the boundary between two physiographic sections—the Puget Trough section and the Oregon Coast Range section of the Pacific Border physiographic province (Fenneman, 1931).

The Tualatin River drainage basin ranges in altitude from about 60 feet near the river's mouth at the southeasternmost point to about 3,000 feet at its western limits along the divide of the Coast Range. The lower part, which lies in the Puget Trough section, is commonly termed the "Tualatin Valley." As used in this report, however, the term "Tualatin Valley" includes the slopes and interstream divides up to about 1,500 feet altitude, as well as the main valley plains.

The Tualatin River drainage basin has a total area of about 712 square miles. Of that area, the main valley plain includes nearly 350 square miles in a rudely rectangular shape about 30 miles long and 10 miles wide. The area described in this report overlaps slightly into the adjacent drainage basins. An important part of the overlapping area extends southward from Tonquin station to the Willamette River at Wilsonville (pl. 1) and was included because hydrologically and topographically it is nearly continuous with the Tualatin Valley area.

The general location and extent of the area are shown on figure 1; the locations of wells and springs and the areal geology are shown on plate 1.

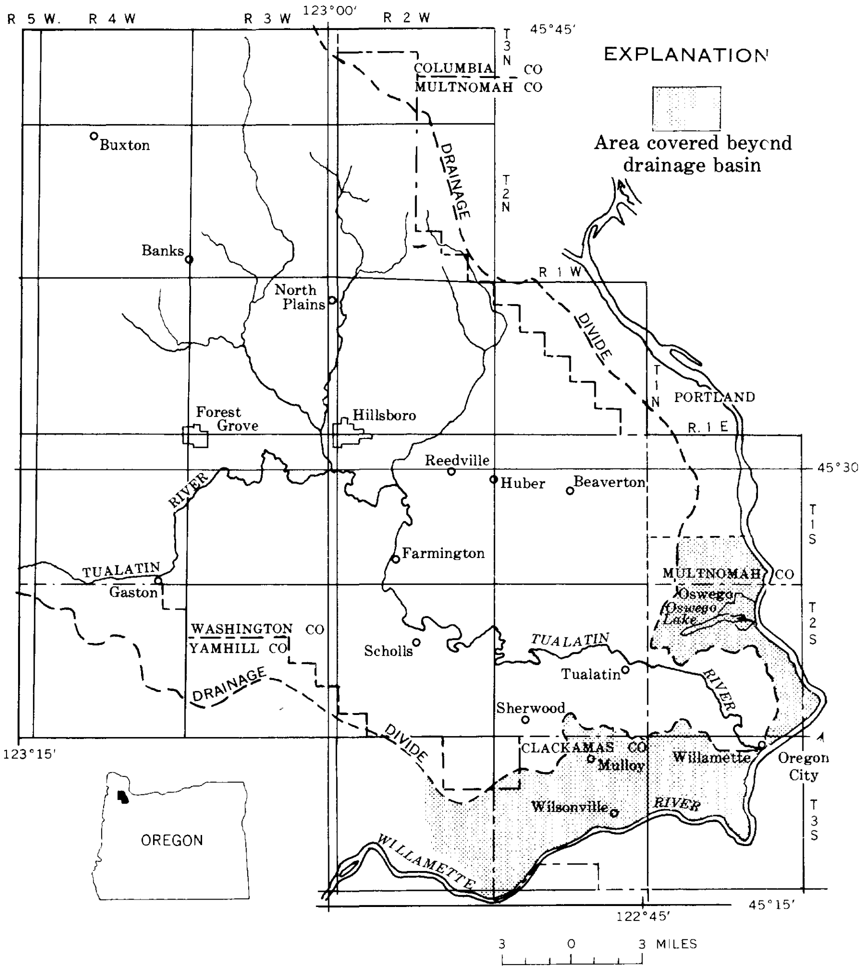


FIGURE 1.—Map showing location of the area covered by this investigation.

NATURAL RESOURCES AND CULTURAL FEATURES

Since the original settlement of the area, during the period from 1834 to 1850, the fertile soils of the Tualatin Valley plain and the adjacent gentle hill slopes have been the outstanding natural resource. Originally the plain was partly open prairie, and the margins of the valley and the adjoining slopes and mountains were forested. The forests have been logged off so that they are now confined mostly to the steeper slopes. Lumbering and processing of forest products are now secondary industries, generally located adjacent to the timber stands in the Coast Range.

Until the coming of rapid transportation, the valley was rural. Since 1940 the eastern part of the valley has been undergoing urbanization and is now a part of metropolitan area of Portland. In 1950 Hillsboro, the largest city in the valley and the county seat of Washington County, had a population of 5,142. Forest Grove had 4,343 and Beaverton had 2,512. North Plains, Banks, Helvetia, Verboort, Orenco, and Gaston, each had a population of less than 1,000. Much of the recent suburban growth in the eastern part of the valley lies outside incorporated communities. Cedar Mill, West Slope (near Cedar Mill), Bonny Slope, Raleigh Hills (near Raleigh), and other centers are rapidly growing communities.

The area is crossed by two main east-west highways from Portland to the coast, U.S. Highway 26 and State Highway 6. Two main north-south highways, U.S. 99 and U.S. 99W, traverse the southeastern part, and a network of secondary and local roads cover the area. Two branchline railroads cross the area.

HISTORY OF THE INVESTIGATION

The Tualatin Valley is a small part of the area covered in a report by Piper (1942), in which the area was briefly described and data for a few wells were presented. The general geologic features of the Tualatin River basin were shown on a map by Warren and others (1945).

This investigation was started in 1951. It consisted of canvassing the area for water facts, collecting water data from organizations and individuals, mapping and describing the geology, and studying the hydrology. In the canvassing for ground-water data, the entire area was studied in detail, and wells and springs that afforded the most reliable information were selected for location on the map (pl. 1). Additional data were collected from well drillers, public water-supply officials, State and county agencies, and managers of industrial plants.

The geologic work consisted of compiling the geologic map, principally from field-checked parts of previous maps (Piper, 1942; Trimble, 1957; Treasher, 1942; Warren and others, 1945), constructing geologic sections, and compiling a structural contour map from records of subsurface materials. Some additional data were obtained from a few electric and gamma-ray logs of drill holes.

The hydrologic study consisted of distinguishing between the different types of occurrence of the ground water—unconfined (water table), confined (artesian), and perched—and of collecting data regarding the characteristics and behavior of the ground water in each type of occurrence and in each type of aquifer.[1] Records of water

[1] An aquifer is a saturated unit or earth material from which ground water can be extracted in usable amounts.

level and well yield were compiled for each type of aquifer. These data indicate the capacity of an aquifer to transmit water to a well. Periodic observations of the water level in selected wells were made to determine the time and manner in which water enters (recharges) and leaves (discharges from) the ground-water reservoirs.

The fieldwork was done during 1951 and 1952. A report was written in 1954 and released in duplicated form in 1956. The present report includes streamflow and water-level records through 1958.

ACKNOWLEDGMENTS

The help of well owners and operators is gratefully acknowledged. Well drillers and pump companies were universally cooperative in giving access to their records of ground water and subsurface data and in granting their time and facilities to aid the investigation.

Municipal and public water-supply district officials and operating personnel contributed data on their areas. The Portland General Electric Co. made available the ground-water records compiled by Clyde Walker, agricultural engineer specialist. Drillers' logs of subsurface materials were furnished by the Oregon State Department of Geology and Mineral Industries, and records of chemical analyses of ground water were furnished by Charlton Laboratories, Inc., of Portland.

F. J. Frank of the U.S. Geological Survey assisted in the collection of the basic data and in the geologic interpretations.

Concurrently with this investigation the Engineering Geology Branch of the Survey mapped the adjacent metropolitan Portland area. Geologic data were exchanged with Donald E. Trimble, geologist in charge of the mapping project. Part of the results of that investigation have been published (Trimble, 1957 and 1963).

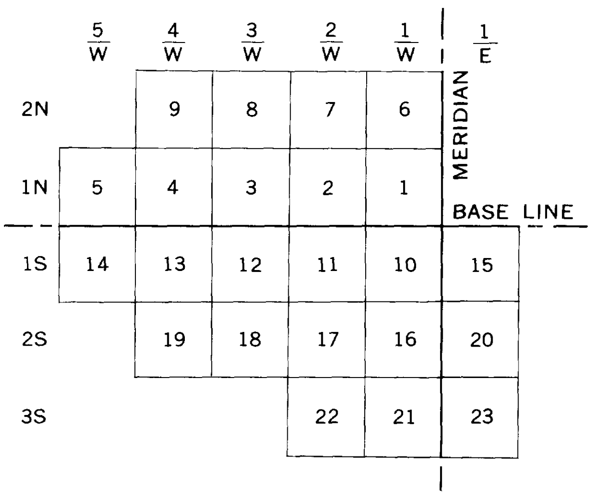
WELL AND SPRING NUMBERING SYSTEM

In this report, wells and springs are designated by symbols which indicate their locations according to the official rectangular survey of public lands. (See diagrams on p. 6.) For example, in the well 2/3-W–26J1, the two numerals before the hypen indicate the township and range south and west of the Willamette base line and meridian (T. 2 S., R. 3 W.), respectively; in those townships north of the base line and west of the meridian, the respective numbers are followed by the letters "N" and "W." The number after the hyphen indicates the section (sec. 26); the letter denotes the 40-acre subdivision of the section, according to the following diagram; and the final digit is the serial number of the well or spring in that particular 40-acre tract. Thus, well 2/3W–26J1 is the first well listed in the NE¼SE¼ sec. 26, T. 2 S., R. 3 W.

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

The original metes and bounds of the donation land claims prevail as the land boundary system in parts of the valley. The authors have projected the township, range, and section system of land subdivision across those donation land claim areas and numbered the wells and springs in these parts in the same manner as in the rest of the drainage basin. This projection allows uniformity in the numbering of wells and springs and affords ready location on the map of any well or spring from the number.

In table 1 these location symbols are not given in full for each well. Rather, the symbols are grouped by townships under appropriate subheads and only that part of the symbol is tabulated which indicates the section, 40-acre tract, and serial number. In tables 1–5 the order of listing the townships is as shown numerically on the following diagram. All wells and springs listed in the tables are located on plate 1.



GEOGRAPHY

CLIMATE

The Tualatin Valley has an equable climate—a long frost-free growing season and a mild winter. The seasons are characterized by marked differences in precipitation: the winters are wet and cloudy, the summers are generally dry and clear. In the winter most of the storms move in from the west, but occasionally subarctic air from the east or north brings freezing and even near-zero temperatures to the valley. The summer climate is more of a continental type, driest and hottest during periods of high barometric pressure. Occasionally dry air from the east brings conditions of low humidity for short periods.

PRECIPITATION

The average annual precipitation at the Forest Grove station of the Weather Bureau during the climatic years (October through September) 1921–45 was 43.56 inches (fig. 2). The annual precipitation varies somewhat from place to place in the valley and is much greater on the higher divides of the drainage basin, as shown by the Timber station (fig. 3) located in the Nehalem River basin 6 miles northwest of Buxton. The records for Forest Grove given in figure 2 shows that the annual precipitation ranged from as little as 28 to as much as 58 inches over the period 1891–1958. The long-term trends are shown by a curve of cumulative departure from average precipitation, which indicates a period of excess precipitation from 1891 through 1911, near-normal precipitation from 1912 through 1923, generally deficient precipitation from 1924 through 1931, and slightly greater-than-average precipitation from 1937 to 1958.

The precipitation occurs mainly in the winter months; its monthly distribution is shown for two stations on figure 3. Generally, December is the wettest month and July is the driest. About 80 percent of the annual precipitation falls during the 6-month period, October through March.

In the valley areas nearly all the precipitation occurs as rain, but some snow falls on the higher parts of the watershed. The snow accumulation on the Coast Range seldom reaches great depth; in most years it does not exceed 2 or 3 feet and does not remain long after the rainy season begins in the spring. There are some years when the valley floor receives as much as a foot of snow. The last year in which a great amount of snow was received was 1937, when Hillsboro had a total snowfall of 31.3 inches and Forest Grove had 34.4 inches.

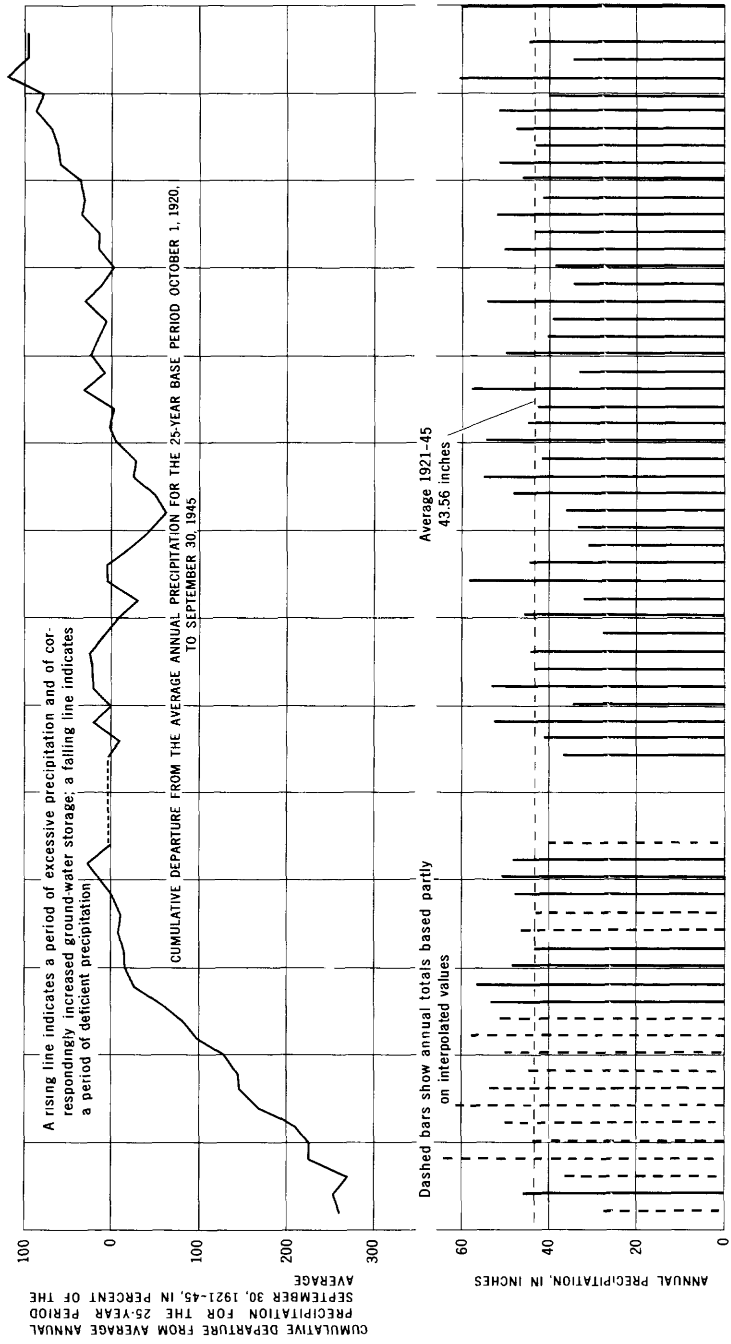


FIGURE 2.—Annual precipitation and the cumulative departure from the average annual precipitation at Forest Grove, 1891–1958.

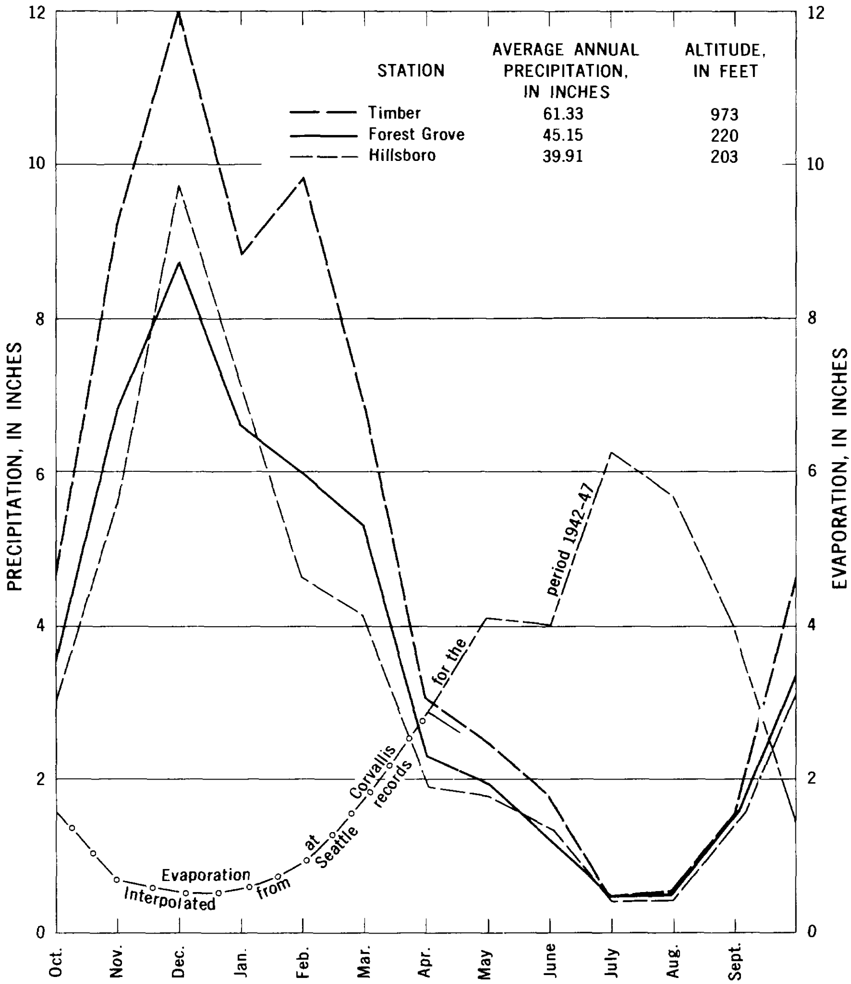


FIGURE 3.—Average monthly precipitation at two stations in the Tualatin River basin and at Timber farther northwest, and average evaporation at Corvallis, Oreg.

OTHER CLIMATIC FEATURES

The monthly average evaporation at the State College station in Corvallis, a terrain roughly comparable to that of the Tualatin Valley, is shown on figure 3. The total average evaporation recorded only for the 6-month growing season at Corvallis, and—by correlation—in the Tualatin Valley, is about 27 inches. If the additional evaporation for the winter months, as approximated from annual records of stations having complete data, is included, the total annual evaporation for the Tualatin Valley is estimated to be about 30 to 32 inches.

The average annual temperature for the 16-year period 1937 through 1952 was 52.6° F. at the Hillsboro station according to records of the U.S. Weather Bureau. The temperature is generally uniform and comfortable; extreme cold and hot weather occur only with uncommon movement of airmasses from the north and east, respectively. During the same 16-year period the extreme high and low temperatures observed were 104° F. and −10° F. The average of the 13 annual maximum temperatures was 99.5° F, and the average of the annual minimum temperatures was 13° F. January was the coldest, and July was the warmest month of the year.

In general, there is little strong movement of air across the valley floor; extremely high or property-damaging winds are rare, and tornadoes are practically unknown. The prevailing air movement is from the southwest in winter and from the northwest in summer. Occasionally, a high-pressure airmass centered in the east moves west through the Columbia River Gorge or across the Cascade Range in such strength as to cause the so-called east winds in the Tualatin Valley. These east winds are predominantly cold and dry in winter, hot and dry in summer.

During the 10-year period 1938–47, annual averages of 118 clear, 79 partly cloudy, and 168 cloudy days were recorded; however, periods of sunshine and cloudiness vary greatly from year to year. For example, the clear days during the period 1938–47 ranged from 78 to 167 days per year. Cloudy days predominate in the winter and the sunny days in the summer.

LANDFORMS

The Tualatin Valley comprises a broad extensive valley plain, the adjacent slopes and side valleys, and a few minor hills.

The main valley plain is about 30 miles long and 10 miles wide, extending around the Cooper Mountain-Bull Mountain hill land, which is a few miles southeast of the geographic center of the plain. The plain has an average altitude of about 200 feet, but ranges from 120 to 250 feet. It extends up the tributary valleys for several miles at a much steeper gradient than that of the main valley floor.

The hill slopes that rise from the valley floor are gentle ramplike surfaces, and are steep only in some streams canyons and areas of structural deformation. The marginal slopes rise gradually to reach mountainous heights on the drainage divides at the north, west, and southwest sides of the valley. On the east and southeast the valley is separated from the floor of the lower Willamette Valley by low ridges (fig. 4) such as Palatine Hill, Petes Mountain, and an unnamed upland sometimes called "West Linn Heights" extending between West Linn and Oswego. The upland north of the Tualatin Valley is formally

FIGURE 4.—Aerial view of the northeastern part of the Tualatin Valley, looking northeast.

named the Tualatin Mountains which extend southeast as far as Oswego Lake, though this extension is better known locally as the Portland Hills or as the West Portland Hills.

Cooper and Bull Mountains are gentle dome-shaped hills that rise 500 to 600 feet above the valley plain just southeast of the center of the valley. The valley plain, although broad and uniform in altitude over large areas, has a few wide terraces which slope gently toward the Tualatin River.

DRAINAGE

STREAMS

The upper reaches of the Tualatin River, above Gaston, drain a part of the east slope of the Coast Range. The river flows eastward through a mountainous terrain for about 13 miles before reaching the extension of the Tualatin Valley at Gaston, where it is joined by Wapato Creek. Flowing 4 miles northward, the Tualatin River is joined by Scoggin Creek and Gales Creek before turning eastward onto the main Tualatin Valley plain, at an altitude of about 120 feet. While flowing 45 sinuous miles across the valley plain, the river descends only 20 feet in altitude before meeting the bedrock reef in the gap 4 miles north of the town of Willamette. Within that gap the river drops 40 feet in 4 miles and empties into the Willamette River at an altitude of about 60 feet.

During the 21-year period, July 1928 to September 1949, the Tualatin River (including diversion to Lake Oswego) discharged at an average rate of 1,376 cfs (cubic feet per second) (Paulsen and others, 1951). In the 19-year period 1940–58, shown in figure 5, the flow at the town of Williamette ranged from an average wintertime maximum of about 5,370 cfs to less than 50 cfs during the late summer of most years.

Wapato, Scoggin, Gales, Dairy, Rock, McFee, Chicken, and Fanno Creeks are the larger tributaries of the Tualatin River. Wapato, Scoggin, and Gales Creeks drain part of the Coast Range; Dairy and Rock Creeks drain the mountainous spur of the Coast Range that extends north of the Tualatin valley plain as well as part of the valley floor; and McFee, Chicken, and other creeks drain the northeast slopes of the Chehalem Mountains, whereas Fanno Creek arises largely as drainage from the valley floor and the southwest slope of the Portland Hills. The first five creeks named above have deeply dissected the slope of the Coast Range to a mature topography. Their profiles have steep gradients in the higher catchment areas, moderate gradients through the intermediate, canyon zones, and relatively low gradients over their lower, aggraded courses that merge with the

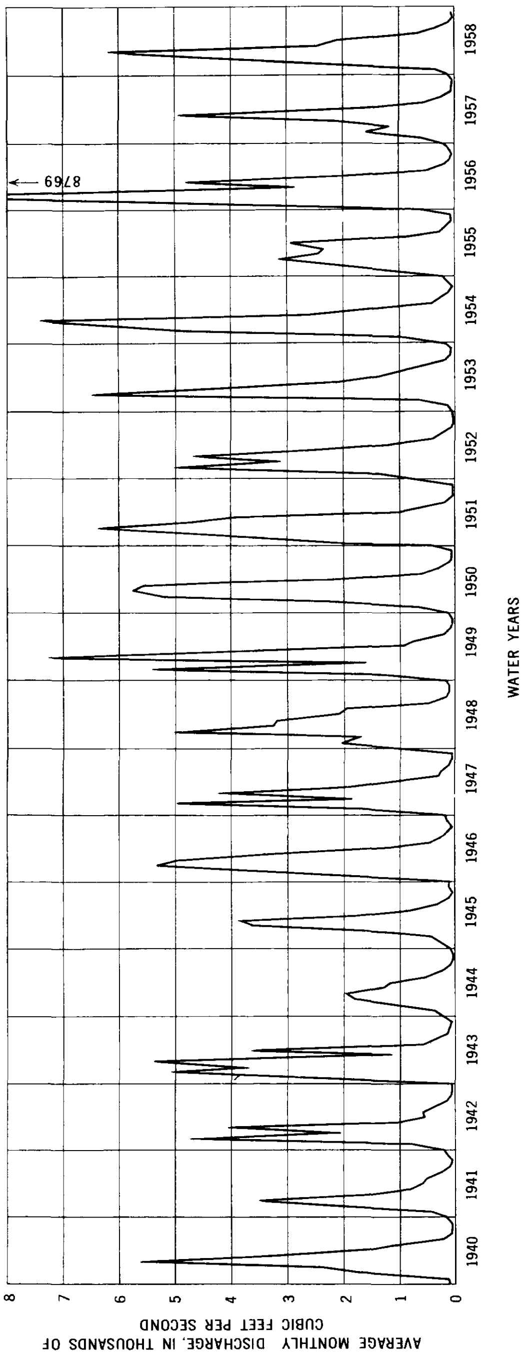


FIGURE 5.—Flow of the Tualatin River near Willamette, Oreg., including the Oswego Canal diversion. (The water year is a 12-month period ending on September 30 of the calendar year for which it is numbered.)

Tualatin Valley plain. Because of those characteristics, the secondary streams have a strong tendency to flood along their lower reaches and are actively aggrading the side valleys and the parts of the Tualatin Valley plain near their channels.

The secondary streams draining the Chehalem Mountains, Portland Hills, and Cooper Mountain are not so deeply incised and seem to be less subject to flooding.

All the drainage basin of the Tualatin River, except the highest headwater areas at the west and north, is shown on plate 1.

LAKES AND MARSHES

Wapato Lake, near Gaston, a shallow lake which covered a considerable area during wet years, was the only large natural lake in the Tualatin River basin. Now, largely diked and drained, its floor furnishes more than a square mile of rich farmland.

The only large lake in the area of this investigation is Oswego Lake. Its shape and position indicate that it was formerly a channel of the Tualatin River or possibly of the Willamette River. The lake has been enlarged by a dam, and manmade diversions from the Tualatin River keep it at controlled levels for scenic, recreation, and hydroelectric power purposes.

Marshy areas are confined to the lowlands near the Tualatin River and its tributaries on the valley floor. These areas are wettest in the winter and spring; one of the largest marshy areas is near the east fork of Dairy Creek in the vicinity of Verboort.

In the parts of the valley where the slope of the valley floor is gentlest, such as along Wapato Creek and the main stem of the Tualatin River north nearly to Forest Grove and in the embayment of the valley plain northwest of Verboort, the land was marshy and waterlogged until drainage was provided. Some of that land is subject to overflow or backwater during times of excessive rainfall and is still characterized by the shallowness of the water table.

GEOLOGY

OCCURRENCE AND RELATIONSHIPS OF THE STRATIGRAPHIC UNITS

VOLCANIC AND SEDIMENTARY ROCKS OF EOCENE AGE

As shown on plate 1, the mountain slopes in the western part of the Tualatin drainage basin are underlain by igneous and sedimentary rocks that originated in the Eocene epoch of the Tertiary period of geologic time.

The oldest rock unit is composed of lava interbedded with tuff. It underlies the highest part of the Tualatin River basin; the main areas occur south of Gales Creek and west of the general locality of Cherry Grove. These volcanic rocks consist mainly of a sequence of basaltic lavas and tuffs that apparently includes the continuation of the rocks mapped as the Siletz River volcanics 20 miles to the southwest of the Tualatin basin (Baldwin and Roberts, 1952), but they may include some strata that are being mapped in later work as separate units. The volcanic rocks are a thick unit, but only the top part of these rocks is exposed in the Tualatin Basin.

The volcanic unit is overlain by a sequence of sedimentary rocks, also of Eocene age, consisting largely of shale, claystone, sandstone, and siltstone. In places, the sedimentary sequence contains a basal conglomerate composed of basaltic cobbles and gravel. These Eocene sedimentary rocks likewise may be the equivalent of several formations (such as the Burpee and Nestucca formations of Baldwin and Roberts, 1952) mapped separately in studies of neighboring areas. The sedimentary rocks are not thick; probably no more than 1,000 feet of strata is exposed in the band that underlies the lower mountain slopes of the western part of the Tualatin River headwater catchment area. That band of sedimentary rocks broadens out beneath the rolling hill lands and plains in the Yamhill River basin farther south.

Both the Eocene volcanic rocks and the overlying sedimentary rocks have a general dip of about 6° to the east. Where they continue to the east, the Eocene rocks underlie younger rocks and are at great depth beneath the main part of the Tualatin Valley. Their continuation beneath the valley may be the strata penetrated below a depth of about 8,000 feet in the Texas-Cooper Mountain oil test (well 1/2W-25J1).

Basaltic lava flows exposed in the Willamette River Gorge at the southeast end of Petes Mountain underlie the Columbia River basalt. This older lava dips 20°–40° NE., makes the strike-ridge reefs in the river 2½ to 4 miles above Oregon City, and passes beneath the more nearly horizontal Columbia River basalt. Only the pre-Columbia River basalt aspect of this rock's age was determined. For lack of more precise correlation, this exposure of older lavas was mapped (pl. 1) as volcanic rocks of possible Eocene age.

These older rocks are more altered and more impregnated with zeolites and secondary minerals than the Columbia River basalt; hence, they would probably afford poorer yields of water to wells.

SEDIMENTARY ROCKS OF OLIGOCENE AND MIOCENE(?) AGES

Sedimentary rocks of Oligocene and Miocene(?) ages occur in the belt of hill land extending northward into the Wapato Creek Valley. They continue along both slopes of the Tualatin River valley from Gaston to Forest Grove. These sedimentary rocks make up the west slope of David Hill and form the broad expanse of mountainous slopes that comprises the headwater areas of the two forks of Dairy Creek. They are also exposed beneath a small area in the canyon of McKay Creek.

The sedimentary rocks of Oligocene and Miocene(?) ages extend upward from the top of the Eocene rocks to the base of the overlying Columbia River basalt. As grouped on Warren's (1945) map and on plate 1, this sequence may contain strata equivalent to several formations described in more detailed treatises.

The sedimentary beds consist of shaly and tuffaceous sandstone, sandy shale and tuff, and some conglomeratic material. The beds consist of marine sediments and contain minor amounts of near-shore brackish and possibly fresh-water deposits. The beds that crop out in McKay Creek near the bridge in the SW¼ sec. 18, T. 2 N., R. 2 W., are massive medium-hard blue-gray tuffaceous sandstone containing many marine shells. The rock is composed largely of rounded siliceous medium and coarse sand grains; interstitial filling consists of tufaceous and pumiceous material.

The beds dip inward toward the center of the Tualatin Valley from the southwest, west, and north (pl. 1). They also are presumed to dip into the syncline, at depth, from the anticlinal ridges along the east side of the valley. A period of subaerial erosion must have occurred between the deposition of these sedimentary rocks and the outflow of the lavas of the Columbia River basalt. However, where the stratification of the Oligocene and Miocene(?) sedimentary rocks can be observed close below the basalt (in the Dairy Creek, McKay Creek, David Hill, and Chehalem Mountain exposures), the bedding of the sedimentary rocks is in general accordance with the base of the basalt and the layers within it; at least, any discordance in these exposures is too small to be conspicuous. The contact between the sedimentary rocks of Oligocene and Miocene(?) age and the overlying Columbia River basalt indicates that the sedimentary rocks had been eroded to a low-lying, gentle plain (probably having a southward slope) when extrusion of the Columbia River basalt took place in Miocene and Pliocene(?) time.

COLUMBIA RIVER BASALT

Overlying the sedimentary rocks of Oligocene and Miocene(?) ages is a series of lava flows known collectively as the Columbia River basalt. This basalt sequence is an aggregation of lava flows that lie layer on layer without appreciable interflow sediments. These flows consist largely of blocky, jointed lava and contain only very small amounts of breccia. The basalt is a brown, black, or dark-gray dense rock that has a pronounced vesicular structure near the tops of most of the individual lava flows.

Each flow has its own system of joints and cracks, resulting largely from contraction during cooling. The most common joint systems are columnar, cubic, and sheeting. Columnar jointing separates the flows into rudely hexagonal columns, which extend perpendicular to the cooling faces—generally at the top and bottom of the flow. Rectangular jointing separates some flows into rudely cubic blocks that commonly range from 2 to 12 inches in dimension. Both the columnar and cubic systems of jointing exist in some flows, but in most flows one is more extensive than the other. Sheeting joints occur in some flows and are conspicuous near the top and bottom of the flows, whose surfaces they roughly parallel.

The Columbia River basalt ranges in thickness from zero in the northern part to about 1,000 feet beneath the central and southern parts of the drainage basin. The main mass in its vast occurrence east of the Cascade Mountains in central Washington is regarded as belonging to the Miocene epoch and possibly also to the early part of the Pliocene epoch. West and north of the Tualatin Valley, its supposed extensions are interbedded with the upper part of the Astoria formation and are therefore considered to be of Miocene age in that locality. This Miocene age is probably applicable to at least a major part of the Columbia River basalt in the Tualatin River basin.

The base of the basalt is a regular and consistent plane in most of the basin, although it has some irregularities. The thickness of the basalt changes evenly and gradually. Presumably, before deformation and erosion took place, the top of this accumulation of highly fluid lava was a fairly level plain. Now mildly warped, the top of the basaltic lava, deeply weathered and moderately eroded, forms the surface in many of the upland slopes, such as the slopes in the Chehalem Mountains, Cooper and Bull Mountains, Parrett and Petes Mountains, and the highest ridges of the Portland Hills (fig. 8 and pl. 3).

Eastward from the rim of the Chehalem Mountains near Gaston and the rim of David Hill, the Columbia River basalt forms the general bedrock, the uppermost consolidated rock of the whole basin area—except in places along the west slope of the Portland Hills where the younger Boring lava lies above it and in areas of sedimentary rock in upper McKay and Dairy Creeks from which the basalt has been stripped by erosion. The basalt itself is visible in only a few places other than in the steepest cliffs or stream bluffs and in artificial exposures, such as quarries and roadcuts.

In most of the upland areas, the top 20 to 200 feet of the basalt is weathered to residual lateritic soil. This deeply weathered material forms some of the distinctive "red land" soils of the area. In places, the laterite also forms an important low-grade deposit of aluminum ore (Libbey and others, 1945). A similar thickness of weathered material at the top of the basalt extends beneath most of the valley-fill deposits.

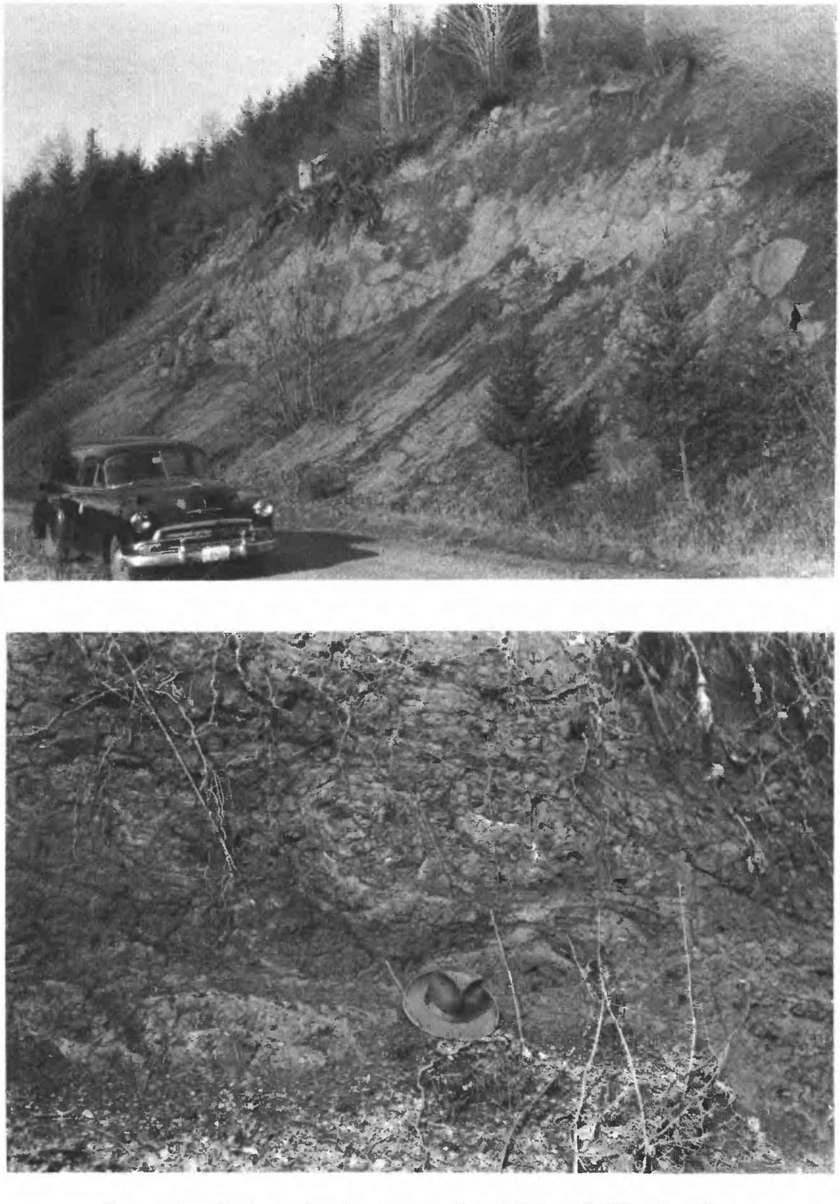


FIGURE 6.—Photographs showing weathered Columbia River basalt.

TROUTDALE FORMATION

Overlying the downwarped parts of the Columbia River basalt is a deposit of semiconsolidated silt, clay, and sand, chiefly of lacustrine origin. Part of the deposit has been correlated (Treasher, 1942) with the Troutdale formation of Pliocene age, an old alluvial fan deposit that is extensive along the western front of the Cascade Mountains 20 miles east of the Tualatin River basin.

The Troutdale formation occurs in the linear downwarps (synclines) of the bedrock in the Portland Hills (pl. 1) and can be traced northward and westward beneath the later Boring lava to the edge of the Tualatin Valley plain. West of where it is capped by the Boring lava, the Troutdale formation is overlapped by younger valley fill, and is not differentiated west of the Metzger and Raleigh localities. Undoubtedly an extension of the Troutdale formation makes up much of the deep sedimentary fill beneath the main valley plain. Deposits similar to the Troutdale formation are included in the broad classification "Tertiary and Quaternary sediments, undifferentiated" that is used (pl. 1) to designate all the main body of older unconsolidated deposits that underlie the Tualatin Valley plain and that extend down to the basalt bedrock. The detailed studies necessary to differentiate the sediments of Troutdale age from younger deposits are beyond the scope and immediate needs of this report.

The Troutdale formation in the Tualatin Valley consists of clay and silt and contains some sand and a few gravel beds. On the whole, the materials are finer grained than in the type locality of the Troutdale formation in the eastern part of the terraces east of Portland, but the deposits here have an otherwise similar lithology, stratigraphic position, structural relationship, and erosional history. Though deposits of the Troutdale occur in a few places at altitudes as great as 600 feet and possibly even 700 feet, they probably did not at any time overlie the Columbia River basalt, where it now forms the crest of the higher ridges of the Portland Hills. In a few places along these hills the thickness of the Troutdale formation exceeds 500 feet; however, the total maximum stratigraphic thickness is unknown. The deposition apparently was entirely in fresh water; at least no evidence of marine fossils and no traces of saline connate [2] water are known to the writers.

Truncating the Troutdale strata is an old erosion surface, parts of which are preserved at the base of the Boring lava. It had a general slope toward the Tualatin Valley plain. A cross section of Boring lava that flowed downslope in a rill of that old erosion surface is

[2] The term "connate" is applied to the water trapped in a sedimentary rock when it was deposited. Newly deposited clays, silts, and sands commonly contain 20 to 50 percent pore space which can hold water. In places, this connate water is retained for a long time, especially in the clay and silts.

shown in figure 7. Undoubtedly the erosion that produced this surface on the Troutdale formation, in the uplifted belt along the Portland Hills, contributed much sediment to the alluvial fill that covers the deposits of Troutdale age beneath the main Tualatin Valley plain.

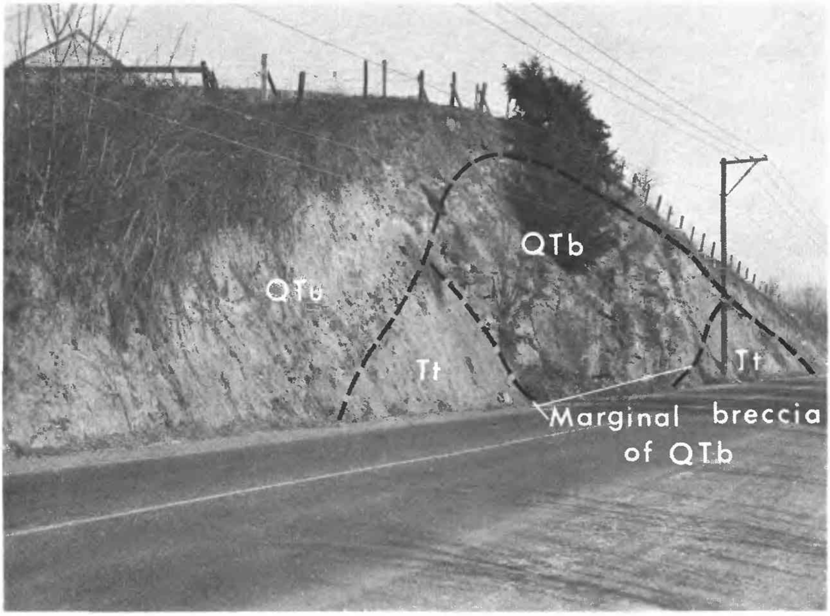
BORING LAVA

A later volcanic extrusive rock, named by Treasher (1942) the Boring lava, lies upon the Troutdale formation and the Columbia River basalt in a roughly linear band along the west flank of the Portland Hills. The known occurrences of this lava extend southward from the ridge crest east of Cedar Mill through Sylvan and Multnomah to Mount Sylvania. Farther south and east these rocks occur outside the Tualatin Valley in Mount Scott and the hill lands of the Beaver Creek, Damascus, and Boring (city) areas. Apparently the lava was extruded from local fissures and from central vents, such as Mount Sylvania and Mount Scott.

The Boring lava is a gray basaltic rock containing nearly microscopic phenocrysts of olivine and plagioclase feldspar in a rather stony and, in part, microcrystalline groundmass. It has a distinctive bluish-gray color and, in places, a porous appearance. In some places a widely spaced columnar jointing has formed and in others, closely spaced flagstonelike platy jointing. The rock is not known to have been deformed tectonically in the Tualatin Valley area.

In its original extrusion the Boring lava was probably not much more extensive in the Tualatin Valley than it is at present (pl. 1). The fact that its outflow on the surface followed the details of the erosional surface is proof that some time elapsed between the deposition of the Troutdale formation of Pliocene age and the extrusion of the Boring lava. Whether that time lapse was sufficient to place the Boring lava in the Quaternary period is not known; hence, the nonspecific age assignment of late Pliocene to late (?) Pleistocene to the Boring lava (pl. 1). Logs of wells, such as 1N/1W–20H1, –35M1, and 1/1W–11L1 (table 2), show the Boring lava over the deposits of the Troutdale formation. Apparently the Boring lava flowed from many small vents along linear structural fractures. Some of the outlets, such as Mount Sylvania and the twin hills southeast of Cedar Mill, acquired and still retain the conical shape commonly associated with vents of explosive extrusion or with orifices from which highly viscous lava flowed. Only in one place (West Burnside Road, sec. 6, T. 1 S., R. 1 E.) did the lava accumulate high enough to flow eastward over the divide and be preserved downslope on the Willamette River side.

There has been but little erosion of the Boring lava. Consequently, the areas where it occurs still depict many of its original depositional



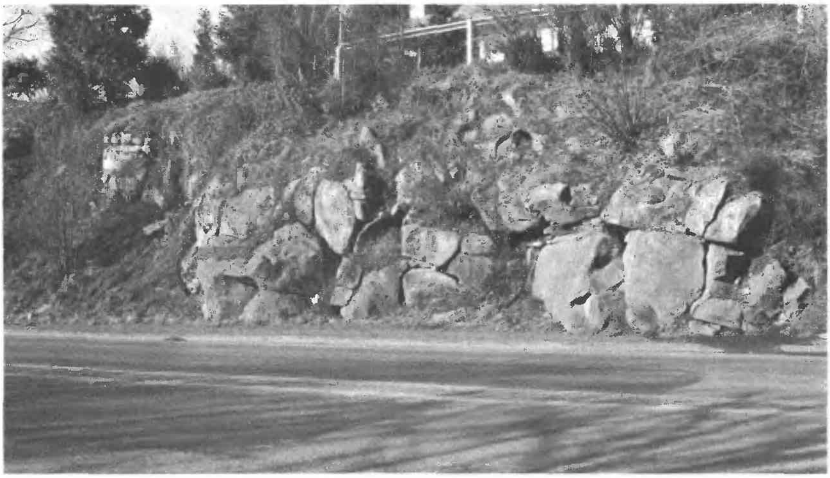


FIGURE 7.—Photographs showing features of the Boring lava.

details. Where the Boring lava abutted against the mountain slopes of the Columbia River basalt, which had 50 to 200 feet of residual and alluvial soil cover, and where it abutted against a layer of Troutdale age that thinly covered parts of the basalt, stream entrenchment has removed the intervening soft material. Thus, narrow stream valleys now isolate many of the areas of Boring lava from the slopes against which it originally abutted. Because the higher parts of the areas of Boring lava are covered with 5 to 30 feet of soil and alluvial material, the lava crops out in only a few places, except where it is artificially exposed. Along the Portland Hills the base of the Boring lava occurs at an altitude of about 300 to 350 feet, and at its western extremity it extends to a minimum altitude of 150 to 160 feet, some 50 feet below the present general plain on the valley fill. The down-slope edges of the Boring lava are now covered with as much as 30 to 50 feet of the undifferentiated valley fill.

TERTIARY AND QUATERNARY VALLEY FILL UNDIFFERENTIATED

Beneath the main part of the valley plain, and lapping up along the margins, are unconsolidated sediments that cover the irregularities in the bedrock surface and underlie a smooth valley plain. This fill ranges from a featheredge at the margins to a common thickness of 300 to 600 feet beneath the lowest parts of the valley plain. The fill also extends at many places to a depth of 900 feet and has a maximum known depth of 1,480 feet at Hillsboro in the deeper trough that lies north of Cooper and Bull Mountains.

The valley fill includes deposits that range in age at least from the time of the earliest warping of the Columbia River basalt (in pre-Troutdale or Troutdale time) to the present time, as the alluvium is still accumulating in places (pl. 1).

The undifferentiated sediments of the valley fill have been arbitrarily separated from the Troutdale formation where the two abut in the Raleigh and Metzger districts. Elsewhere in the valley the age of any part of the undifferentiated valley fill is not known to be equivalent to the Troutdale formation. It is possible that only along the flank of the Portland Hills uplift does the Troutdale formation occur at such a high level. Through the rest of the undifferentiated fill, the equivalents of the Troutdale formation must lie at considerable depth.

Because of the difficulty in distinguishing the deposits of Troutdale age from the alluvium and because the hydrologic features and lithologic characteristics of the two materials are similar, most of the deposits were grouped together in this report as Tertiary and Quaternary valley fill, undifferentiated (pl. 1). The older alluvium was mapped separately only along the Willamette River, the east fork of Dairy Creek, and the Tualatin River near Forest Grove. The younger alluvium was differentiated in the flood plains of most of the larger streams of the area. Elsewhere alluvial deposits of comparable age were grouped in the undifferentiated valley fill.

The undifferentiated fill is largely clay and silt. Sand beds occur at widely separated vertical intervals, and a few of these sand zones seem to have widespread though not universal extent. The sand is mostly very fine grained, well sorted, and lacustrine in character. Very few gravel beds have been found in the valley fill except beneath the area where Gales Creek passes onto the valley plain; there, some long gravel lenses occur, diminishing in thickness and extent eastward from Forest Grove. Some sand zones occur in the valley fill beneath the Hillsboro district and, to a lesser extent, beneath the Beaverton district. At these two places the sand zones have been drilled sufficiently to establish their local continuity.

The best known of the gravelly beds occurs at a depth of 95 feet in a number of wells at Forest Grove and at a depth of 110 to 120 feet in some wells, such as 1/3W–4Q1 and –5F1, farther east. Apparently a 10-foot thick marginal phase of this gravelly sand bed was reached at about 120 feet in a well just northeast of Cornelius in the NW¼SW¼ sec. 34, T. 1N., R. 3W., in 1960.

The following size analysis was obtained by screening a bailed sample of the gravelly sand from the well in sec. 34:

Openings per inch—	*Percent of sample*
Retained on—	
8M	14
16M	24
30M	26
42M	17
50M	5
80M	7
Passed through—	
80M	7

The pebbles and coarse gravel are composed of fine-grained sandstone and siltstone, basalt, quartzite, nodules of cemented shale, or chert, quartz, and other silicas. The sand grains are composed of the same materials, but quartz and other silicas are more abundant and compose about 20 percent of the grains.

The undifferentiated fill of the Tualatin Valley is probably entirely a fresh-water deposit. None of the many wells are known to have encountered saline water that could be considered connate and therefore indicative of marine or brackish water deposition. Because fine-grained materials tend to retain some part of the water in which they were deposited, the absence of marine-type water indicates that fresh water was the most likely environment of this valley fill. Moreover, no marine fossils are known to have been found in the valley fill. Samples from well 1N/3W–7A2 at 660 feet and well 1/1W–17A2 at 750–800 feet were examined by Dr. Weldon W. Rau (oral communication) who found no micro-organic fossils. Furthermore, the fact that much uncarbonized wood has been found in the upper 300 feet of the deposits during the construction of many wells in the valley fill suggests fresh-water deposition.

In the main valley, only the deposits underlying the flood plains and channels of the present streams are mapped separately (pl. 1) from the main body of the valley fill; however, other parts of the undifferentiated valley fill may be as young as the older alluvium that is distinguished at other places in the valley.

ALLUVIUM

The flood plains of the present streams and the slightly higher areas of former flood deposition, as well as a few pocketlike areas where water-borne debris has accumulated, are the principal sites underlain by alluvium sufficiently thick to map. The older alluvium lies generally above the level of present deposition. Younger alluvium is still being deposited during periods of flood. In most parts of the basin the alluvium is relatively thin. The alluvium along Gales Creek averages less than 20 feet in thickness, and most of the younger alluvium along the channels of Dairy and McKay Creeks across the valley plain is less than 10 feet thick. The alluvium along the flood plain of the main stem of the Tualatin River from Gaston and Forest Grove downstream may be considerably thicker, in places as much as 30 feet thick. Along the Willamette River, at the south edge of the area covered in this report, the younger alluvium is 40 to 50 feet thick.

The alluvium below the flood plains in the Tualatin Valley is almost all fine-grained material—silt, clay, fine sand, and peaty material. The younger alluvium of the smaller Creeks (Dairy and others) consists of a shallow deposit of reworked material and a transient channel bedload. The large lowland northeast of David Hill, which is poorly drained by the West Fork of Dairy Creek, appears to be underlain by a thick deposit of younger alluvium deposited in an area of subsidence. An area in Wapato Creek valley just southeast of Gaston is poorly drained because of the damming effect of the alluvial fan of the Tualatin River where that river enters the broader Wapato Creek valley. The younger alluvium along Gales Creek and the main stem of the Tualatin River is a backfill and flood deposit that accumulated as the streams swept their channel beds laterally across the valley plains. This younger alluvium consists entirely of fine-grained materials and underlies wet, poorly drained land.

In general, the older alluvium is composed of similar fine-grained materials except along the Willamette River, where gravels and sands are present. Great quantities of older alluvium, which accumulated largely in Pleistocene time, are part of the extensive deposits of the Willamette River.

Where the alluvium abuts against the mountainous slopes, it is overlain by some slope-washed detritus. The overlying accumulations at the landward edge and erosion at the streamward edge have given a pronounced slope to most of the terrace surfaces on the older alluvium; in some places this steepening has accentuated the original terrace slope. The areas of older alluvium along Chehalem, Wapato, and Gales Creeks are remnants of former valley plains that now remain as terraces along the sides of the present flood plains. These deposits of older alluvium are thin and rest on eroded bedrock surfaces. Southward through Tonquin to Mulloy, a train of rock rubble extends from a former spillway across the bedrock divide. That rubble train is included with the older alluvium of the Wilsonville plain of the Willamette Valley proper.

STRUCTURE OF THE ROCKS

IMPORTANCE OF ROCK STRUCTURE

Because most of the rocks in the Tualatin River basin were originally sedimentary deposits, volcanic lava flows, or sedimentary accumulations of volcanic fragmentary debris, we know the original bedding of each rock unit was nearly horizontal. The present position and inclination of these beds are measures of the earth's deformation since the rocks were formed. A knowledge of the condition and attitude of the rocks affords a means by which their continuity and depth can be determined. Thus, the exploitation of any resources in a rock formation requires that the structure of the rock be known. This need for structural information is particularly vital to the development of ground water known to occur in some of the lava-rock units. At places the availability of ground water can be determined if the position of certain rock units is known underground. This determination can be made by graphic projection of the rock units from places where they are exposed, if their structure and continuity are reasonably well known.

INCLINATION OF THE ROCKS

The Eocene and other Tertiary sedimentary and volcanic rocks that crop out in the mountain slopes of the west side of the Tualatin River basin dip generally eastward. Those same rock units exposed on the north side of the basin dip generally southward. Some of the observed dips are shown on plate 1.

The Columbia River basalt is inclined generally in accordance with the underlying Tertiary rocks. It dips northward off the Chehalem Mountains north of Newberg and eastward off the extension of the Chehalem Mountains and David Mountain, south and north of Forest Grove, respectively. The Columbia River basalt dips southward in the mountains near North Plains and Helvetia, westward in the western part off the Portland Hills, and outward away from the center of Cooper and Bull Mountains. The upper surface of the basalt is, in general, a subdued replica of its original constructional surface, which has been modified slightly by weathering and erosion and deformed by folding and faulting.

There are very few places where the structure can be observed in the beds of the Troutdale formation. The presence of the Troutdale, almost exclusively in the structural sag of the Columbia River basalt, indicates that its deposition followed part of the folding of the basalt but that it may have been involved in later moderate displacements (pl. 3). Mr. Robert Murphy (oral commun.) reported that he found steeply inclined beds of semiconsolidated clay and siltstone below a depth of 12 feet while digging a well some years ago at his house near Fanno Creek in the NE$\frac{1}{4}$NW$\frac{1}{4}$ sec. 27, T. 1 S., R. W. That location is near a known displacement in the underlying Columbia River basalt, and the inclined beds may represent deformed beds of Troutdale age along that structural lineament. The actual deformation of the Troutdale formation may be more extensive than can be inferred from the few exposures of it.

The Boring lava and the alluvial deposits are not tectonically deformed.

MASTER SHAPE OF THE TECTONIC STRUCTURES

The main structural feature of the Tualatin Basin is a shallow bowl-shaped syncline which contains an interior, centrally located anticlinal ridge—the Cooper Mountain-Bull Mountain ridge. The form of that structure, at least as it affects the water resources, is shown on the geologic map (pl. 1) and the structural contour map of the Columbia River basalt (pl. 2). The basinwide synclinal structure is divided by the Cooper Mountain-Bull Mountain ridge, so that the bedrock lies in separate synclinal troughs to the north and the south of that ridge.

Over broad areas of the basin the general structure is a gently sloping part of the overall synclinal fold, but locally there are abrupt changes to steeply dipping folds and fault displacements. The major known fault displacements include the northeast-trending fault that separates Parrett Mountain from the east end of the Chehalem Mountains and the southwest-trending fault followed by Gales Creek (pl. 1).

By comparing the altitude of the surface as shown on the topographic map (pl. 1) with the altitude of the bedrock beneath the valley floor (pl. 2) the general depth to bedrock can be calculated at a proposed well site. The bedrock contour map is generalized and later refinements may be warranted as more information is obtained from additional wells. For example, a shallow buried ridge in the bedrock surface is reported to extend north from Cooper Mountain to Huber but was omitted because of the lack of data on it. It is apparent that many minor irregularities of the bedrock surface beneath the valley fill are not adequately shown by the information now at hand.

SECONDARY TECTONIC ELEMENTS

The major deformation which produced the bowl-shaped structure in the bedrock of the Tualatin Valley also produced many subordinate structural features that affect the occurrence and development of ground water.

Structurally, the Portland Hills are mainly an assemblage of separate linear folds extending from Oregon City to where they merge with the uplands north of Portland. As shown on plate 1, the deposits of Troutdale age and the Boring lava have filled some of the linear synclines; so, the topography is gentle between the higher parts of some of these en echelon anticlinal ridges.

The Bull Mountain-Cooper Mountain upland is ringed in part by linear topographic sags that apparently represent lines of steep folding or steplike fault displacements. A similar linear depression separates Bull Mountain and Cooper Mountain. Other such displacements of the bedrock are visible on the topography.

Within the Tualatin River basin, the Chehalem Mountains consist mainly of the Columbia River basalt dipping monoclinally inward. Near the northwest end the mountain is a tilted block whose western limb, if any ever existed, had been upfaulted and subsequently eroded in the Gaston area.

The course of Fanno Creek roughly parallels the axis of a complex and moderately steep syncline between the Portland Hills and the Cooper Mountain-Bull Mountain anticline. A buried "high" in the Columbia River basalt extends westward through Progress (pl. 2) and bisects the complex north-south syncline beneath the Fanno Creek valley. The steeply dipping beds of probable Troutdale age, found in the Murphy dug well as previously mentioned, and the badly fractured basalt in the saline-water well (1/1W–27C1) lie along the north edge of this bedrock "high."

The low bedrock ridge which connects the north ends of Parrett Mountain and Petes Mountain is an anticlinal warp between the sharp syncline under the main stem of the Tualatin River to the north and the southeastward-plunging synclinal basin in which Wilsonville is located.

Although the major structures of the bedrock are more readily apparent, many minor structures are particularly significant to the

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development of the ground-water resources because, in many places, their structure controls the vertical position and horizontal extent of the water-bearing rocks.

TYPES OF DISPLACEMENTS

Most of the major bedrock structures of tectonic origin are due to folding, though some, such as Parrett Mountain and the highlands south of Gales Creek, are largely due to displacement along faults. Of the minor structures, both folds and faults are known. The earth stresses that produced the major structures undoubtedly produced many minor displacements, only a small part of which can be delineated on the basis of the present information.

Some steplike displacements are present in the bedrock below the valley fill, as indicated by steep linear slopes shown on the bedrock contour map (pl. 2). Particularly significant is the bedrock displacement that trends east-west just north of Farmington and seems to form the northern limit of an area of flowing wells; also significant is the displacement that trends generally east-west through well 1/1W–27C1 just west of Progress. Apparently the bedrock is similarly displaced, between wells 1/1W–33P1 and –P2, in the depression that separates Bull Mountain from Cooper Mountain. Many of those sharp changes in the level of the bedrock surface may be due to sharp folds, but some are known to occur at fault zones such as that penetrated by well 1/1W–27C1.

EFFECTS OF TECTONIC STRUCTURES ON THE GROUND-WATER RESOURCES

The sand aquifers in the alluvium and the upper part of the valley-fill deposits are virtually horizontal and have not been affected by tectonic movement. However, tectonic structures do largely control the availability of ground water in the Columbia River basalt, which is the most productive aquifer in much of the Tualatin Valley. Whether the basalt is economically within reach beneath the valley plains or whether it stands so high above the water table in the uplands that all but meager pockets of perched water are drained out is determined by its position in the tectonic structures.

The ease with which fresh water can enter the porous zones in the basalt is largely controlled by the tectonic structures. Water can most readily enter and recharge these porous zones through the gravelly beds of streams which flow across the beveled edges of the basalt layers. Recharge is poorest in flat-lying basalt which is deeply covered by relatively impervious beds of valley fill. Some areas of good recharge are along the margins of the Tualatin Valley plain;

some of the areas of poorest recharge are in deep parts of the synclines beneath the central part of the valley plains.

Because of the layered arrangement and the irregular continuity of the porous zones in the basalt, a progressive decline in the volume of water transmission can be expected away from the points where fresh water recharges to the basalt. However, wells downdip from and relatively near points of recharge may be advantageously located for large sustained yields of water from the basalt.

Other investigations have revealed that lines of severe flexure, resulting from both tight folding and faulting, may act as barriers to the lateral transmission of ground water in the basalt (Newcomb, 1959, p. 10–12). In some places such barriers may be responsible for the high levels of the ground water found on the updip side and the nearby lower water levels on the downdip side of a fault. Locally, parts of some fault zones in basalt may provide a vertical passage for small amounts of ground water. Such vertically permeable parts of the fault zones may serve as discharge routes from the basalt to the overlying alluvial materials or to the surface. Likewise, permeable parts of fault zones may allow some water of poor quality to rise from the older rocks that underlie the basalt. Such may be the situation in the shattered rock, in which saline water was tapped by well 1/1W–27C1, as described in the section on "Chemical quality of the ground water" (p. 52).

GROUND WATER

GENERAL HYDROLOGIC FEATURES

Beneath a given level, not far below the surface of the valleys, all the materials of the outer part of the earth's crust are saturated with water. The upper surface of this water-saturated zone of the earth is called the water table, except where that surface lies within an impermeable body. The water in the rocks below the water table is said to occur under water-table conditions and is called unconfined ground water. Despite the fact that all the rocks below the water table are saturated, only certain parts of some rock units have sufficiently large and interconnected pores to transmit water readily. Ground water in the Tualatin Valley occurs chiefly under water-table conditions.

In some places, extensive layers of rock in the zone of saturation consist of tight, impermeable materials of sufficient lateral extent to deny the ground water ready passage upward. Ground water below such an impervious layer is under a hydrostatic pressure, which is determined by the altitude of the water table beyond the edges of the confining layer. Where such a confining stratum is perforated and an aquifer below is tapped by a well, the ground water rises to an altitude equal to the hydrostatic pressure in the aquifer. Such ground water is said to be confined or artesian.[3] Some confined water exists in the Tualatin Valley, as described in the sections below.

In some places, layers or zones of impermeable material hold the infiltrated water above the regional water table. Such conditions result in small areas of saturation and are called "perched" ground water. At many places in the higher parts of the Tualatin Valley, perched ground water occurs, as described in later sections.

The availability of ground water occurring under unconfined, confined, or perched conditions, and the uses that can be made of it are determined largely by: (1) physical character of materials in which the ground water occurs, (2) the manner and place of recharge, (3) the characteristics of movement or transmission of water through the rock material, (4) the place of discharge—either natural (springs and seeps) or artificial (wells), and (5) the chemical and physical changes that take place during the water's passage underground.

UNCONFINED GROUND WATER

Throughout the greater part of the Tualatin Valley plain, the ground water, in both the valley fill and the underlying older rocks, stands in wells at a uniform level. The water table lies not far beneath the surface of the main valley plain and slopes generally toward the Tualatin River and its tributaries at about the same rate as the land surface. Beneath the hill and mountain slopes around the margins of the valley and the Cooper Mountain-Bull Mountain hill land, the level of the water table is continuous with the level of the water table beneath the valley plains. It is a level of saturation that cuts across geologic units of different lithology.

The unconfined ground water is tapped by several thousand wells, many of which are listed in table 1. Water-level records for some of these wells are shown graphically on figures 9–14.

The water table fluctuates in conformity with the annual rainfall cycle. The hydrographs (such as figs. 11 and 14) show that the level of the water in the shallower wells of the valley fill fluctuates as much as 15 to 20 feet. Apparently, recharge during the months of heavy rainfall is so great that it fills all the available pore space of the valley-fill deposits nearly to the land surface. The water tapped by deeper wells in the valley fill is partly confined. This water does not show so great an annual fluctuation, ranging from 5 to 10 feet per year (fig. 13).

[3] Most hydrologists apply the term "artesian" to any ground water that rises above its confining layer. Some dictionaries, however, use the older definition of "artesian," applying it to ground water that flows at the land surface.

CONFINED GROUND WATER

Some of the deeper strata of the valley fill and, in places, the Columbia River basalt at depth beneath the valley fill contain ground water that rises in wells above the level of the water table. In general, wells that tap the confined water with the greatest head above the water table are located around the sides of the valley floor. Water flows from several of these wells near Cedar Mill, North Plains, Helvetia, Kansas City, Farmington, and Mulloy (on the Willamette slope south and outside the Tualatin Valley proper). The wells with the greatest confined water pressure are the Hartung well (1N/1W–28P2) and the Gent well (1N/4W–15C1), in which the pressure is sufficient to raise water about 50 feet above land surface.

PERCHED GROUND WATER

Beneath the slopes and uplands around the margins of the Tualatin Valley, ground water occurs above the regional water table in relatively small quantities. Ground water percolating downward toward the water table in places encounters impermeable layers which impede its movement and produce relatively small saturated zones above the regional water table. Such water is perched on impermeable layers in the soil zones and in relatively high parts of valley-fill deposits, as well as on impermeable layers in the Columbia River basalt and the Boring lava.

These pockets of perched water are especially important for providing household supplies in areas where the water table lies at great depth or lies in impermeable materials from which little water of good quality can be extracted. Places like Petes Mountain, the Portland Hills, the Chehalem Mountains, and the north slope of the Tualatin Valley (north of Helvetia and North Plains) are characterized by many perched-water bodies. Many small seeps and springs that provide household and stock water are outlets for perched water in the Chehalem Mountains. Ground water in the basal part of the Boring lava, such as that tapped by well 1/1–31C1, and in isolated porous streaks of the Columbia River basalt, such as that tapped by well 2/1–31P1, is perched and is developed for household use.

In some circumstances, perched ground water occurs under semiconfined or confined conditions. Where the perched water fills a porous zone below a local inclined confining layer, the water in the lower end of that water body is confined, even though the whole body is perched above the regional water table. Such is probably the situation in wells like 1N/2W–3K1.

PRINCIPAL AQUIFERS

In addition to the classification based on the hydraulic conditions under which ground water occurs, aquifers are classified on the basis of the geologic unit in which the ground water is found. Because the water-bearing characteristics are somewhat different in the various geologic units, this system of classification also includes a general evaluation of the yields of water that can be obtained by wells. The surface extent of the geologic units is shown on plate 1. Their subsurface continuation is shown on plate 3 and is described in the text and the data tables.

VALLEY FILL

As described previously under "Geology," the unconsolidated materials that have been deposited within the Tualatin Valley structural syncline are largely clay, silt, and fine sand. Thin beds of fine to very fine, well-sorted sand occur in the upper 300 to 400 feet of the valley fill throughout much of the area.

Beneath some places in the western part of the valley floor, sand beds, and even a few beds of granular gravel, make up an unusually large part of the valley-fill material. In an area of several square miles centered around Hillsboro, sand beds are present at depths of about 40, 100, 200, and 300 feet beneath the surface. Not all these zones are present beneath any one place, but the general sequence has been found in enough wells to indicate its presence under a fairly extensive area. Those sand beds supply most of the water now pumped from wells in this area. The number of producing wells in the 40-foot sand indicates that the zone is relatively widespread and continuous in the Hillsboro area.

A sand and granular gravel stratum, about 10 feet thick, occurs in limited extent at a depth of about 95 feet beneath the north and east edges of Beaverton but is not penetrated by wells in the St. Marys district, a mile to the west. Wells 1/1W–16A1 and –22F1 tapped water in that sand-and-gravel bed, which contains some black volcanic lapilli, BB-sized volcanic ejecta.

A number of gravel layers occur in the valley fill of the Forest Grove district, where presumably, they were deposited by an ancestral Gales Creek. Some of these gravel layers may be traced in wells through Forest Grove and east nearly to Hillsboro, where they seem to be alined with sand zones. Those gravel strata lie at depths of about 50 feet in Gales Creek valley (well 1/4W–2H1) and at about 100 feet below land surface at Forest Grove.

Aside from extensive sand zones beneath the Hillsboro area, the beds of fine sand that serve as water-bearing strata cannot now be related to sources or to definite stratigraphic positions in the valley fill. The fine-sand beds seem to represent deposition by the shifting and vagrant currents of a lake, and they occur at irregular and unrelated places and positions within the great mass of valley fill, most of which is clay and silt.

Nearly all of the valley fill is below the level of the water table, and most of the ground water therein is unconfined. However, confined ground water occurs at a few places in the valley fill. Many of the fine-sand strata that lie deep beneath clay and silt layers in the valley fill contain water under a small confining pressure. When these strata are reached by wells, the water rises slightly above the local water table and in low areas may even flow at land surface.

The part of the valley fill at relatively high altitude along the west side of the Portland Hills, shown on the geologic map (pl. 1) as the Troutdale formation, contains ground water in a few gravelly or sandy zones and in a position that definitely is perched above the regional water table (see wells 1N/1W-23N1 and -26E1).

COLUMBIA RIVER BASALT

The Columbia River basalt lies deep below the Tualatin Valley plain and crops out in the adjacent slopes and hills. The basalt consists of a series of individual lava flows. Between some of the successive flows are zones of breccia, "cinders" or broken rock, which are porous enough to permit a comparatively free movement of water. It is mostly in these interflow zones that the percolation of ground water takes place in the Columbia River basalt. Cracks and fissures in the dense part of a lava flow may contain some ground water and, in a few places, may act as passages for water moving vertically between interflow zones; but in general those cracks and joints within the centers of individual lava flows yield little water to wells. Any particular interflow zone, even one that is highly permeable, may contain isolated sections or pockets of impermeable material. For this reason, even wells drilled close together may obtain water from different interflow zones and may have slightly different static water levels.

Ground water occurs under water-table conditions in the Columbia River basalt at Cooper Mountain, Bull Mountain, and some of the slopes along the margins of the valley. Well 1/1W-30L1 (table 1) illustrates water-table conditions. In this well, drilled almost on the summit of Cooper Mountain at an altitude of 790 feet, water was first found at the regional water table, at about 215 feet altitude. Many other wells in this area and the Bull Mountain area are reported to have static water levels at about that altitude (table 1).

Confined ground water in the Columbia River basalt occurs mostly under a pressure head, depending on the altitude of the regional water table either nearby or at some place upslope from the well. Consequently, wells tapping water in the Columbia River basalt below the valley fill in most areas have a static water level that stands at about the level of the valley floor. Wells of this type are common in most parts of the valley; examples listed in table 1 include the north well of the city of Beaverton (1/1W–11L1), the city wells of North Plains (1N/3W–1K1 and –K2), the Al Peters well (1N/3W–8E1), and the S. R. Rotchstrom well (2/2W–6D1).

Only a few wells have been drilled into the Columbia River basalt where it lies more than 1,000 feet below the valley floor. Two such deep wells, the Birdseye Cannery well (1N/3W–36R3) and the Oregon Nursery Co. well (1N/2W–34H1), were drilled many years ago and were abandoned after penetrating less than 200 feet of basalt. The authors believe this penetration was not enough for an adequate test of the water-bearing properties of the Columbia River basalt. The latest deep well (1/1W–17A2), for St. Mary's School near Beaverton, entered the basalt after penetrating 1,170 feet of valley fill; it produced 115 gpm (gallons per minute) at a drawdown of 200 feet. However, the water was saline as described in the section on "Chemical quality of the ground water."

Locally, along the margins of the valley in the Portland Hills, in the Helvetia area, and in the vicinity of Kansas City, perched artesian water occurs in wells penetrating the Columbia River basalt. The water in these wells stands considerably above the regional water table. Partial stratigraphic traps, in which some of the permeable interflow zones within the basalt have become thin or have pinched out, are the probable cause of these occurrences of perched artesian water.

Structural displacement due to faulting or sharp folding, which causes permeable interflow zones to terminate against less permeable rock, is another possible cause for confined water found by wells at some places in the basalt. Examples of such wells are the Lindow Bros. well (1N/1W–28E1) north of Cedar Mill and the Goff well (1N/4W–23R1) south of Kansas City.

Most of the wells that tap large supplies of water in the Columbia River basalt penetrate at least 200 feet of the basalt. The large-capacity wells in the Farmington area obtain most of their water by penetrating about 300 to 400 feet of basalt. The Schallberger well (1/2W–29P1), known as the "old Dalby well," penetrated about 300 feet of rock before obtaining a flow of about 120 gpm. Mr. Schallberger (oral communication) reports that the well can be pumped at 600 gpm with a drawdown of less than 25 feet. On the south side of Cooper Mountain, the Bierly Bros. well (2/2W–1J1) penetrated about 550 feet of Columbia River basalt before obtaining a yield of about 600 gpm (fig. 8).

An aquifer test at well 2/2W–1J1 indicated a coefficient of transmissibility[4] of 23,000 gpd per ft for the Columbia River basalt in that vicinity. At present, only wells in Columbia River basalt have yields greater than 200 gpm.

BORING LAVA

The Boring lava underlies large parts of the eastern slopes and uplands of the Tualatin Valley (pl. 1). It is similar in many respects to the Columbia River basalt, but its lava flows are more irregularly layered than those of the older basalt. Because most of the Boring lava is about 200 feet in altitude, the greater part of it lies above the regional water table. This high position and the lack of permeable material in the small, irregular interflow zones give it only limited importance as an aquifer. In places the lava contains small amounts of perched (both confined and unconfined) ground water. Several

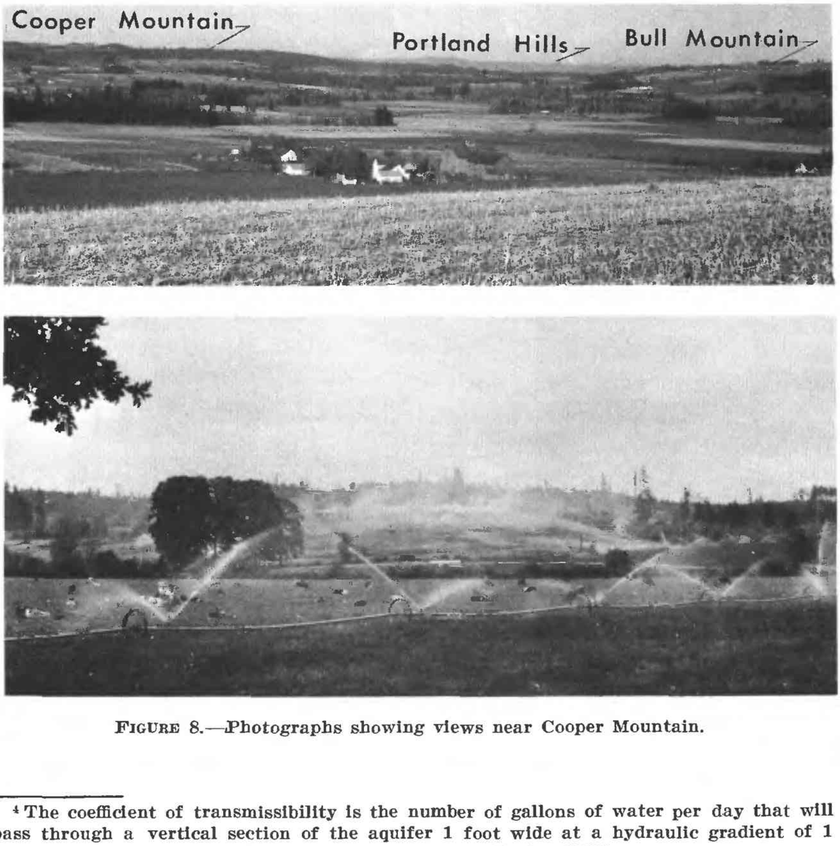

FIGURE 8.—Photographs showing views near Cooper Mountain.

[4] The coefficient of transmissibility is the number of gallons of water per day that will pass through a vertical section of the aquifer 1 foot wide at a hydraulic gradient of 1 foot per foot at the prevailing water temperature (Theis, 1935).

wells—1/1–29N1, –30J1, and –31C1—near Mount Sylvania tap perched water. Ground water that is both perched and confined within the Boring lava north of Cedar Mills is tapped by a few wells, such as 1N/1W–34D2, that produce enough water to supply a household. One well (1N/1W–21J1) tapping the lava is at an altitude low enough to allow the water to flow at the surface.

The confined and perched bodies of water in the Boring lava are probably caused by stratigraphic traps, as are many similar water bodies in the Columbia River basalt. These saturated layers, however, are less extensive than are the similar zones in the Columbia River basalt. Because of the erratic distribution of the water-bearing zones, it is difficult to predict at what level ground water will stand if found in the younger lava.

In most places the Boring lava is underlain by the Troutdale formation—a series of interstratified clay, sand, and gravel beds. At the contact between these two formations, some ground water was obtained in a few wells. A well, such as 1N/1W–26E1, tapping the perched water in these aquifers, produces enough water for one domicile.

North of Beaverton, two large springs known as Johnson Spring (1/1W–4H1) and Wessinger Spring (1/1W–10H1) flow either directly from the Boring lava or from its contact with the Troutdale formation. These two springs each had a discharge of about 340 gpm on April 4, 1951.

RECHARGE AND DISCHARGE OF THE GROUND WATER

RECHARGE

The records of the water levels in wells show that the ground-water levels start to rise as the precipitation and infiltration become greater during November and December, continue at a high level during the rainy winter months, and decline as rainfall diminishes and evaporation and transpiration increase during the spring and summer months (see figs. 9–14 and table 5). The ground-water levels in most wells reach the low part of their annual range in the summer and their lowest points in September or October of each year. The levels of the unconfined ground water beneath the valley floor agree well with the annual rainfall cycle. There is little lag between the time of the increase and decrease in rainfall and the corresponding response in the levels of the unconfined ground water. Such correlation strongly indicates that the source of the unconfined ground water in most of the Tualatin Valley is from the precipitation that has infiltrated in the immediate vicinity.

The confined water in the Columbia River basalt, and possibly in the deeper parts of the unconsolidated deposits, percolates laterally in the direction of the hydraulic gradient from either nearby or distant areas of recharge toward areas of discharge. The levels of this confined water fluctuate in general conformity with the precipitation (see figs. 9, 10, and 13). The recharge to the confined water may

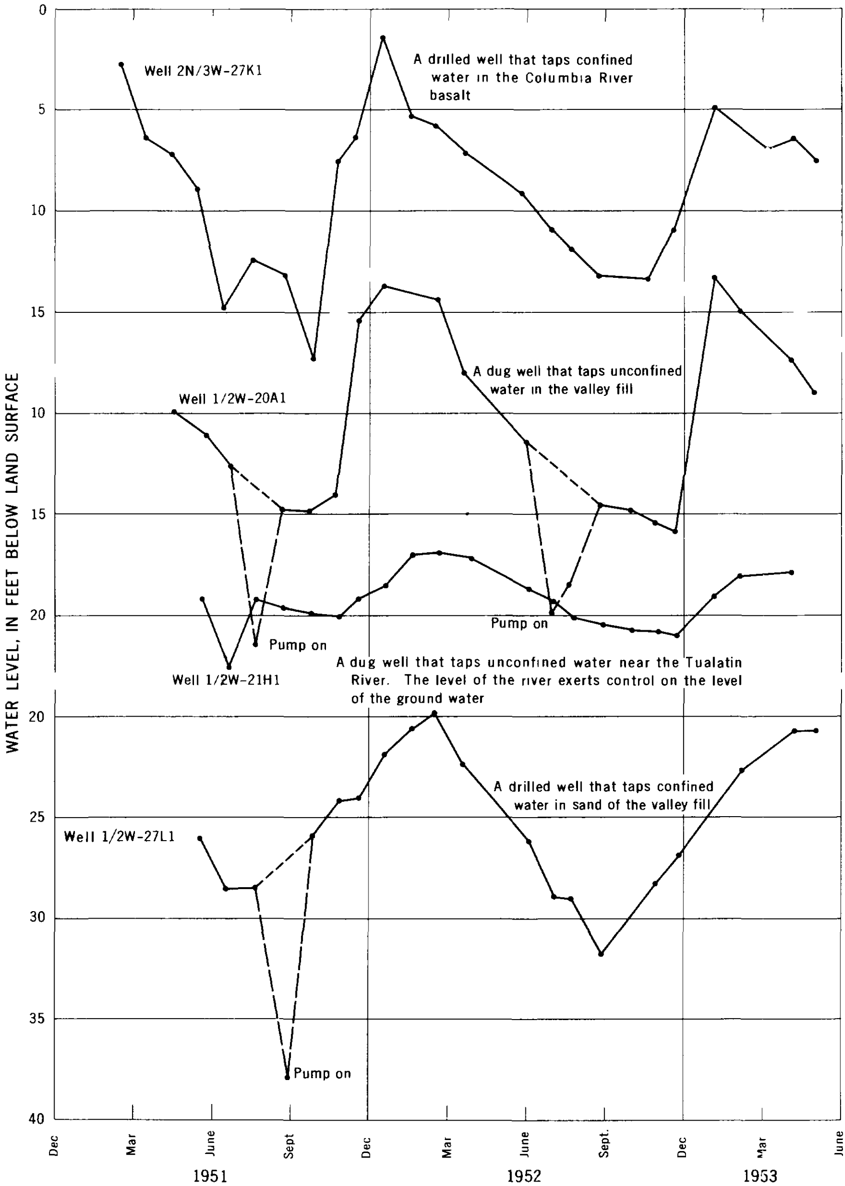

FIGURE 9.—Graphs of water levels measured in four wells showing seasonal recharge and local controls of water levels.

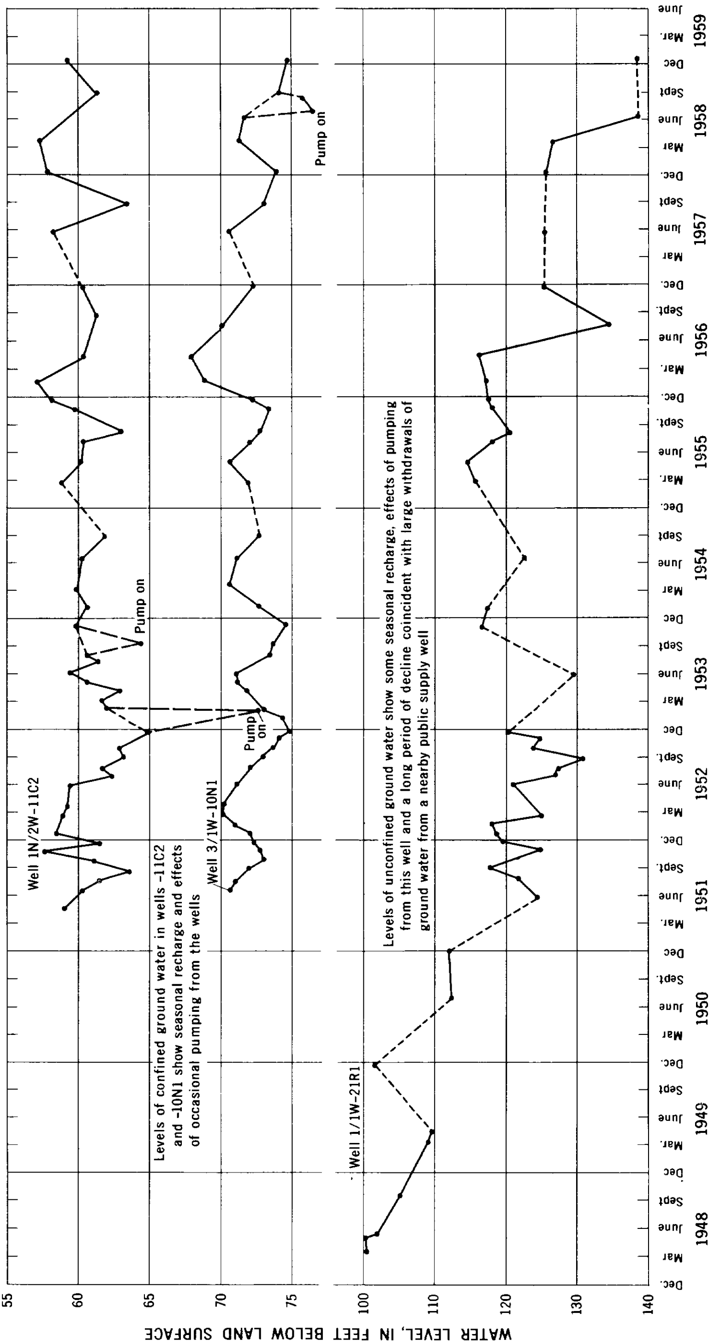

FIGURE 10.—Graphs of water levels measured in three wells tapping water in the Columbia River basalt.

accrue directly to a water table at some distance from the observed wells and by pressure transfer cause the water level to rise in the observed wells. Probably a main source of recharge to the deep sand aquifers in the valley fill is water from the unconfined zone leaking through the clay and silt layers between the aquifers. Well 1N/3W-13F3 taps water which is probably recharged by this interaquifer transfer; however, part of its annual fluctuation (table 5) may be caused by pressure due to the loading and unloading of the overlying deposits with water in the zone of unconfined ground water.

The water levels in wells that tap perched water (see table 5) also vary in general with the annual cycle of precipitation.

As previously described in the section on "Geology," the slopes and uplands at the north and west ends of the Tualatin Valley are underlain chiefly by impermeable rocks. Such a condition precludes the transfer of significant amounts of ground water to the valley from those directions and also renders improbable the interbasin transfer of ground water into or out of the Tualatin Valley.

The soils, the valley-fill deposits, the Boring lava, the Columbia River basalt, and parts of the Troutdale formation are the main rock units that are sufficiently permeable to yield water to wells and to accept recharge for the ground-water body. The valley fill is recharged directly by precipitation and also by infiltration of water running off across the valley floor. The volcanic rocks and the Troutdale formation are recharged directly by infiltration of precipitation where those rocks are near land surface in the slopes around the edges of the valley; also, they are recharged indirectly by water percolating downward through soils and overlying alluvial deposits. However, a large part of the precipitation runs off the slopes and uplands and the recharge to the volcanic rocks and the Troutdale formation is only a small part of the precipitation in those areas.

Much of the precipitation that falls on the valley floor infiltrates and descends to the water table. After the first autumn rains replenish the summer-depleted moisture content of the soils, some of the rain percolates through the soils. By December or January the water table has risen high enough that its hydraulic gradient is steep toward the nearest surface drainage. This steepened gradient may induce lateral discharge until it equals the rate of recharge and the water table will rise no higher. If the recharge predominates, the water table may rise to the land surface. Such a waterlogged condition, with some of the subsequent precipitation standing rejected on the surface, is characteristic of many of the flattest parts of the valley plains in late winter.

Comparison of rainfall records at Forest Grove with the ground-water levels given on figure 11 and in table 5 shows that 22.37

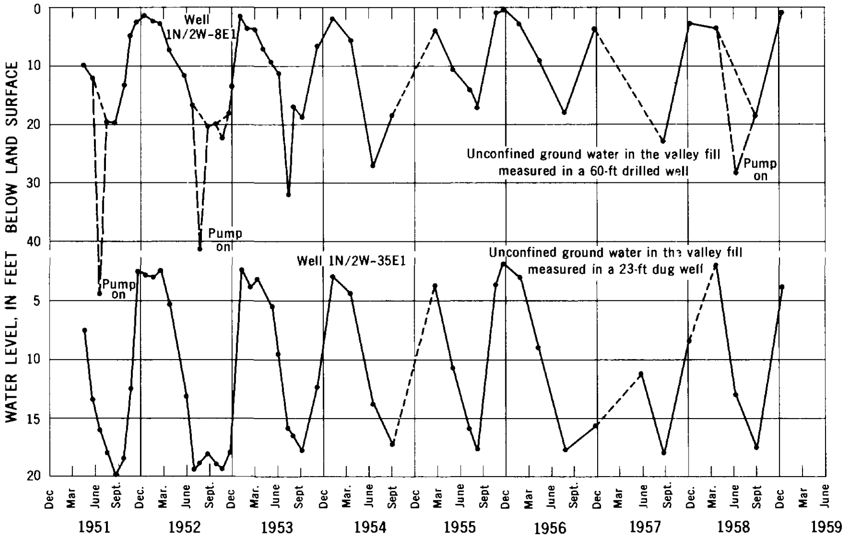

FIGURE 11.—Graphs of water levels in two wells tapping water in the valley fill, showing effects of seasonal recharge and drainage of water and local drawdown by pumping.

inches of rain during October, November, and December of 1951 coincided with a 25-foot rise of the water level in well 1N/3W–8P1 and about 17 feet in well 1N/2W–35E1. In addition, the levels show that the water table did not rise farther during the ensuing 3 months, when an additional 16.79 inches of rain fell, and that the water table declined thereafter during the spring and summer months until it stood near the level of the previous summer.

During the months October to December the average evaporation from open water bodies (fig. 3) totals only 2.8 inches, and the transpiration probably is even less. Well 1N/3W–8P1, in particular, lies in a flat area where little or no runoff occurs during the fall months. Consequently, after allowing about 6 inches for evaporation, transpiration, and the small amount of runoff, it may be assumed that a minimum of 16 inches of rainfall produced the 25-foot rise in the water level shown in figure 11. Such a rise from 16 inches of infiltration would indicate an effective porosity of 5.3 percent for the valley-fill deposits and the soils in this zone of water-level rise.

The average annual fluctuation during 1951 and 1952, measured in 12 valley-floor wells tapping unconfined water to the valley fill, was 17.7 feet. (See figs. 9 and 11–14.) If it is assumed that the 5.3-percent effective porosity indicated by well 1N/3W–8P1 is representative of the valley fill, then the average annual fluctuation indicates that an average of about 11 inches of water recharged the valley

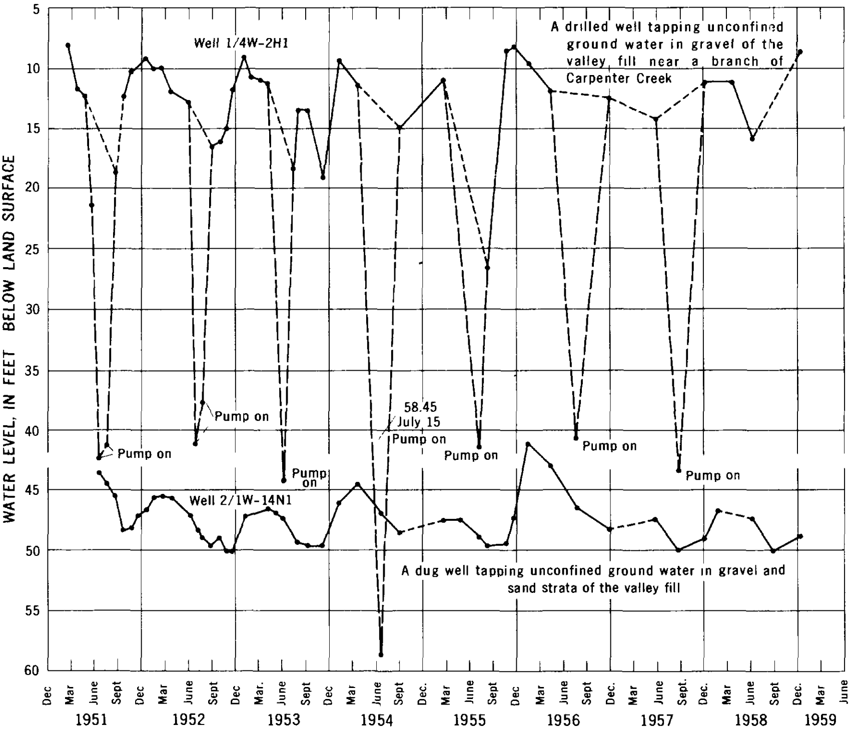

FIGURE 12.—Graphs of levels of ground water in two wells, showing seasonal fluctuations and great drawdown during pumping.

fill during the 3-month period October to December, 1951. The water-level records show that the water table approximately reached the surface at some of the wells. The water levels also indicate that part of the precipitation that fell on the valley plain could not percolate into ground-water storage because the storage space was full during the ensuing 3-month period, January to March.

Though these estimates of the average annual recharge are rough, they show that a large amount of water infiltrates to the valley-fill deposits under natural conditions and that still larger amounts might infiltrate if the ground-water levels in the valley fill were lowered by pumping. The average amount of water that recharges naturally the ground-water reservoir in the valley fill may be equivalent to, or greater than, the 18 inches of water that is considered to be the annual requirement for irrigation in this valley.

The means by which the unconfined water in the basalt beneath the Cooper Mountain-Bull Mountain upland is recharged is not entirely known. The water table there is roughly continuous with that in the valley fill and the basalt beneath the valley floor on both sides of this upland. The ground water in the basalt of this upland is of good quality, though saline water is present at places in the upper part of the basalt in the synclinal troughs to the north and south. Thus, the quality of the water beneath the upland suggests either that some recharge percolates vertically through the basalt beneath the upland or that water of good quality was present before the saline water entered the basalt in the synclinal areas north and south of Cooper and Bull Mountains.

DISCHARGE

Some of the precipitation that infiltrates to the soil of the upland slopes is discharged to the surface through small seeps and springs that abound in ravines and other irregularities of the upland surfaces. Many of the small upland creeks, such as Tryon (north of Oswego) and Chicken Creeks, are fed during the summer months by this type of ground-water discharge. Small and moderate-sized springs, having discharges of as much as 100 gpm, occur in the uplands where ravines and escarpments intersect perched or unconfined water bodies in the porous zones of the lava rocks and the Troutdale formation. A line of such springs, one of which is spring 2/3W-4F1 discharges at the base of the Columbia River basalt in the escarpment of the Chehalem Mountains east of Gaston.

The ground water in the Boring lava is largely perched above the level of the regional water table. Small springs from perched water

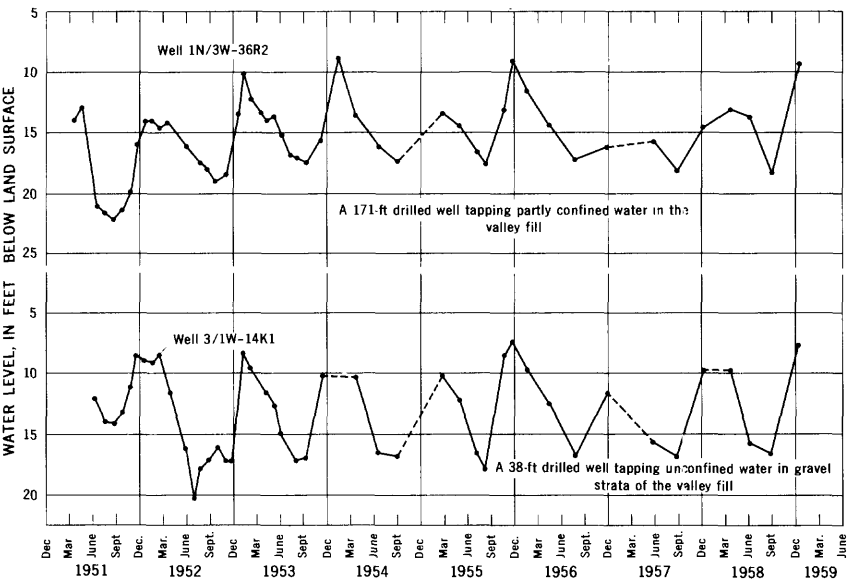

FIGURE 13.—Graphs of water levels measured in two wells, showing annual variations in the amount of seasonal recharge and drainage.

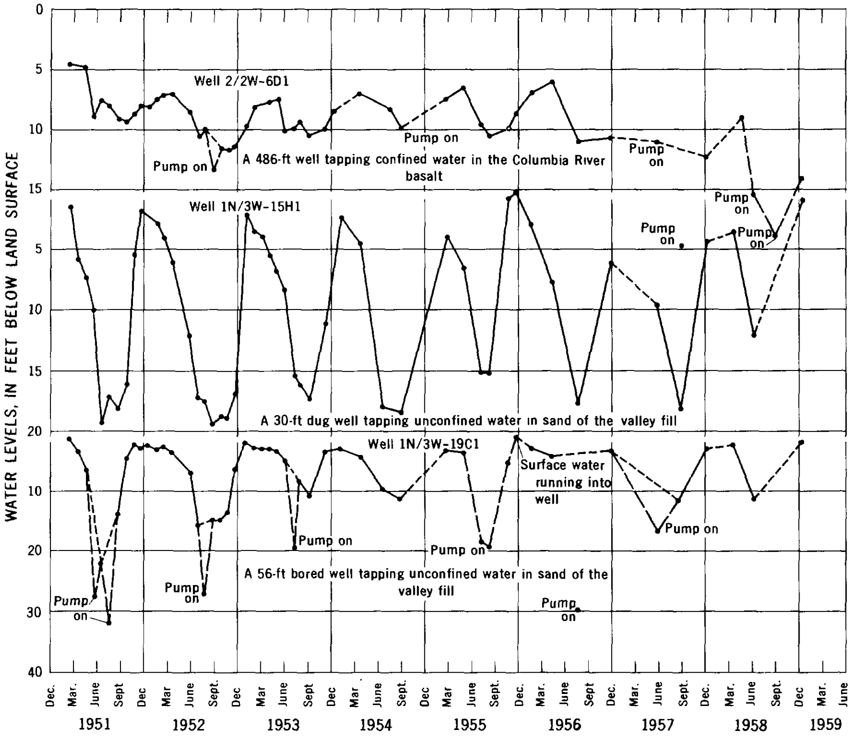

Figure 14.—Graphs showing the magnitude and timing of seasonal recharge and drainage of ground water at shallow and deep positions.

bodies flow into the ravines and creeks along the west slope of the Portland Hills. Also, large springs, such as 1/1W–4H1 and –10H1 (table 3), flow from the lower ends of the westernmost extensions of the Boring lava. Apparently the lava moved down former valleys and, in at least these two points, lies below the altitude of the water table. These long extensions of the lava serve as drains for the ground water in the Boring lava, as well as for that in the adjacent unconsolidated deposits.

The ground water which percolates through the aquifers of the Columbia River basalt toward the central part of the basin presumably has outlets to the surface, as its piezometric surface, in most places, is close to the level of the water table. Possibly, the ground water moves from the basalt up into permeable zones of the overlying unconsolidated deposits, discharges to the surface streams, or both, through vertical fracture zones like that penetrated by well 1/1W–27C1.

Along the east side of the Tualatin Valley the piezometric surface of the ground water in the Columbia River basalt stands at an altitude of about 200 feet in the wells near Lake Grove, 185 feet just west of

Sylvan and 215 feet just east of Bethany. Just east of the Portland Hills and outside the Tualatin River basin, the water level in the basalt stands at an altitude of about 40 feet in the wells at Oswego and at altitudes of 9 feet and 1 foot in the wells of the Equitable Building in downtown Portland and the Pennsylvania Salt Co. at St. Johns, respectively. This drop of about 160 feet in the altitude of the water in the basalt coincides with the location of the anticlinal axis of the Portland Hills ridge. Though shale beneath the basalt is probably high enough to form a subsurface dam more than 200 feet in altitude beneath much of this anticline, the low sags undoubtedly contain routes for passage of the water underground across this structural divide and out of the Tualatin Basin. Similarly, ground water may also pass through the basalt across the low ridge along the south side of the Tualatin Basin between Parrett Mountain and Petes Mountain.

The water recharged to the unconsolidated deposits underlying the valley plains is discharged principally by seepage to the streams. Although the amount of discharge by evaporation from the land surface (as capillary draft) and by the transpiration of plants is minor, it is nevertheless significant. A large part of the valley plain is planted to crops that do not draw large amounts of water directly from the zone of saturation. The summertime base water level observed in most wells is practically equivalent to the altitude of the local stream drainage. Usually, the low part of the annual water-level cycle is approached in July. An average of 11 inches of recharge during the preceding fall and early winter, as well as a lesser but unknown amount of late winter and spring recharge, ordinarily has been discharged to the local streams and transpired or evaporated by July.

USE OF WATER

GROUND WATER

The principal uses of ground water in the valley are: (1) irrigation, (2) public supply, (3) domestic supply, and (4) industrial supply. Of the 3,680 acre-feet of water estimated as the total annual withdrawal of ground water in 1952 and 1953, irrigation accounted for 1,700, public supply 1,200, domestic supply 630, and industrial supply 150 acre-feet.

There has been little change in the pattern for the withdrawal of ground water during the ensuing years. Some suburban homes, public supply systems, and industrial establishments have added wells; others have obtained water from the expanding service connections of the city of Portland and decreased their use of ground water. A few new irrigation wells have been added in various parts of the valley, but the increase in irrigation use has been slight during these years when generally above-average precipitation prevailed.

IRRIGATION

Most of the ground water withdrawn for irrigation is used for dairy pasture and field crops, but the irrigation of vegetables and berries for fresh-market produce and frozen-food processing plants is becoming of major importance. The latter use probably will increase as more successful irrigation wells are constructed in the valley-fill materials. The water is applied exclusively by means of sprinkler systems (fig. 8). On the farms using ground water for irrigation, the number of acres irrigated ranges generally from 1 to 50. Of 75 farms irrigating 3 acres or more in 1953, the average area irrigated was about 15 acres. In addition, 100 acres of a large golf course was irrigated from two wells.

In 1953 an estimated 1,125 acres of land was irrigated with ground water in the Tualatin Valley. That figure includes all the farms on which an acre or more was irrigated. Irrigation experts agree that the average application of irrigation water required for most crops in this area is about 18 inches per growing season. That amount of irrigation approximately doubles the yield of field and row crops and much more than doubles the pasture production (Marvin N. Shearer, Irrigation Specialist, Oregon State College, oral communication, 1959).

From the acreage and the duty of water, the total withdrawal of ground water for irrigation is estimated to have been nearly 1,700 acre-feet during 1953, or about 46 percent of all the ground water used in the valley. The following wells supplied water to irrigate 5 acres or more during 1953:

Well	*Acres irrigated*	*Well*	*Acres irrigated*	*Well*	*Acres irrigated*
1N/1W-28E1	35	1/1W-2L2	10	1/1-6C1	} 15
28P2	10	2P1	35	6D1	
1N/2W-1G2	15	6F1	5	8E1	5
2N1	15	24D1	} 100	31M1	10
3R1	30	24D3		2/1W-4B1	40
5R2	50	24F1	30	17B1	30
21P1	11	25M1	6	18J1	20
26P1	6	1/2W-8C3	20	2/2W-1J1	50
30G1	7	8K1	10	6D1	10
1N/3W-7E1	10	8L1	7	2/3W-1R1	15
25A1	14	11F2	10	2/1-14C1	} 50
29M1	5	18P1	8	14F1	
31G1	7	19A1	20	3/1W-2Q1	20
32P1	12	23Q2	40	10K1	15
32P2	5	26A1	8	14K1	10
1N/4W-23R1	7	31C1	30	23A1	6
2N/3W-25M1	8	1/3W-5F1	5	3/1-7E1	25
1/1W-1B1	10	22E1	16	7H1	15
2J1	20	24R1	35	18C1	15
2L1	20	1/4W-1N1	10		

The large-capacity irrigation wells, such as 1N/1W-28E1 and 2/2W-1J1, obtain water from the Columbia River basalt. Most of the wells that tap water in the basalt are near the outer margins of the valley plain or near Cooper and Bull Mountains. At those places, the basalt is so near to the surface that drilling is economically feasible, the water level is so high that pumping costs are low, and the distance to points of recharge is so short that the water is generally of good quality. However, some irrigation wells centrally located in the valley plain also draw water from the Columbia River basalt. These wells are especially numerous in the Farmington area, where the basalt is at moderate depth (see pl. 2).

In many places smaller irrigation wells produce 25 to 50 gpm from the valley fill. Very few of these wells are more than 300 feet deep, and the majority are less than 150 feet. The extent of the known sand zones in the valley fill has been discussed on pages 22 and 23.

PUBLIC SUPPLY

Seven small cities and towns and one private water district are supplied principally by ground water from 19 wells and 2 springs. The total quantity of ground water used in 1962 by these communities, which had a population of about 18,000, is estimated to have been about 1,200 acre-feet. This amount is about 33 percent of the total quantity of ground water used in the valley. All 19 wells draw water from the Columbia River basalt. Their depths range from 188 to 980 feet and their yields, from as little as 35 gpm to more than 500 gpm.

The cities of Beaverton and Oswego have water mains connecting with the Bull Run supply of the city of Portland. The West Slope and Metzger Water Districts use Bull Run water to serve most of the suburban area in the eastern part of the valley. The Wolf Creek Water District uses Bull Run water to supplement its supply from Johnson Spring (1/1W–4H1).

Table at top of page 47 gives incorporated cities and towns that use ground water as their main source of supply. It shows the estimated amount of ground water used by each in 1952, and the amount which went to industrial establishments. These figures show an average daily use per capita of about 60 gallons in 1952.

DOMESTIC SUPPLY

The rural population, which depends on private wells for its water supply, is estimated at 23,400 as of 1952 (based in part on the U.S. Census of 1950). Domestic water was pumped from about 5,000 to 6,000 wells.

If an average per capita consumption of 30 gallons per day is assumed, then the amount of water used for domestic purposes in 1952 was about 630 acre-feet, or 211 million gallons. This is about 17 percent of the total estimated ground-water withdrawal from the valley.

Use of ground water in 1952 by cities, towns, and water districts

City, town, or water district	Total amount used (millions of gallons)	Source of supply	Estimated population served	Industrial use	
				Industry	Millions of gallons
Banks	6.30	2 springs	700		
Beaverton	85.12	2 wells	4,500		
North Plains	4.33	2 wells	400		
Oswego	130.06	4 wells	4,000		
Sherwood	45.93	2 wells	1,060	Cannery Tannery	13.84 8.92
Tigard	40.00	2 wells	2,240		1.34
Tualatin	7.65	2 wells	460	Cannery Dairy	2.70 .23
Lake Oswego Water District	93.44	3 wells	5,000		
Total	412.83		18,360		27.03

Most of the domestic wells tap shallow sand strata of the valley fill; however, along the margins of the valley where sand strata are not found, many domestic wells draw water from the Columbia River basalt. These wells are generally deeper than those in the valley fill. Most of the rock wells obtain sufficient water for household use by penetrating 50 to 100 feet of basalt below the water table.

INDUSTRIAL SUPPLY

Outside the incorporated cities and towns, the use of ground water for industry is relatively small. Sawyers, Inc., a camera-manufacturing and film-processing plant at Progress reported a withdrawal of 27 million gallons in 1953 from a well tapping the Columbia River basalt. This plant is probably the largest industrial establishment that uses ground water entirely.

Other industrial users include: the Portland Gas & Coke Co., which uses 2 million gallons per year for cooling purposes at two gas-pumping stations; two meat packing plants near Hillsboro; two sawmills; a pickle cannery northwest of Oswego; a horseradish-processing plant at Beaverton; and numerous greenhouses and refrigerator-storage rooms. The total use of ground water by industry, not supplied from public systems, is estimated to be about 50 million gallons per year (150 acre-feet), or about 4 percent of the total ground water in the valley.

SURFACE WATER

The amount of ground water used in the valley in 1952 was compared with the quantity of surface water used by municipalities and water districts and for irrigation.

IRRIGATION

According to records of the Portland General Electric Co., 8,640 acres was irrigated with surface water in 1952. If an application of about 12 inches per year (lower than full irrigation requirements because of some shortages of water) is assumed, the total diversion of surface water for irrigation was about 8,600 acre-feet, or about five times the volume furnished by ground water.

At present, all the available surface water is being used; hence, no further expansion of surface-water irrigation can take place unless additional storage is provided or interstream diversions are made.

A plan to construct storage dams is now under discussion as a means of providing water to irrigate about 44,800 acres, nearly 4½ times the area irrigated in 1952. If such a project were placed in operation, it would still leave some 60,000 to 70,000 acres dependent on irrigation from ground water or from other sources.

PUBLIC SUPPLY

The two largest cities in the valley, Hillsboro and Forest Grove, are supplied entirely by surface water. At present, the supplies are said to be taxed to the limit, and other sources may be needed in the near future.

The amount of surface water used by each city or water district in 1952 is shown below. The average daily use per capita was about 80 gallons.

Use of surface water in 1952 by cities, towns, and water districts

City, town, or water district	Total amount used (millions of gallons)	Source of supply	Estimated population served	Industrial use	
				Industry	Millions of gallons
Hillsboro	420.92	Seine Creek and Tualatin River.	11,000	Cannery	260
				Milling Co.	103.8
				Railroad	8.85
Forest Grove	235.06	Clear Creek and Gales Creek	6,000	Cannery	187.25
Gaston	28.00	Hillsboro system	500		
Aloha-Huber	80.66	do	3,000		
West Slope Water District	166.29	Bull Run-Portland	6,400		
Wolf Creek Water District	140.47	do	7,925		
Metzger Water District	69.45	do	4,775		
Total	1,140.85		39,600		559.90

DEPENDABILITY OF THE GROUND-WATER SUPPLY

PAST RECORDS

Only within one small area (or possibly two) have the water levels been lowered substantially by withdrawals of ground water from wells. In the Sexton Mountain district south of Beaverton, the pumping of the Beaverton municipal well 2 lowers the water level in some nearby wells that also tap water in the Columbia River basalt. Figure 10 shows the effect on the water level in one such well. The water-level decline in this well (1/1W–21R1) was about 20 feet in the 3-year period 1948–51 and was about 30 feet during the 10-year period 1948–58. A decline is reportedly occurring also in wells near Tigard well 3 (2/1W–4G1). The Farmington artesian area is the only other area in which a decline below the normal water level is known to have occurred. The water-level in well 2/2W–6D1 (table 5) has lowered about 2 feet in 3 years. This decline may be temporary, reflecting a lower-than-average recharge in some past year, or may be due to other causes. Longer records of the water levels in wells of this area should permit better evaluation of the long-range effect of precipitation and other factors on the ground-water levels.

Even though long-term records are not available for the wells drawing water from the valley fill, it is reasonable to assume that no appreciable decline in the ground-water level has occurred as a result of pump withdrawals of water. Present records show that much of the water-bearing material fills each year nearly to the surface and rejects further recharge.

PROSPECTS FOR THE FUTURE

The records of the wells indicate that ground water in both the Columbia River basalt and the unconsolidated valley fill, is available for further development without serious danger of depleting the resources. Along the north and south sides of the valley the Columbia River basalt is at relatively shallow depths and will yield several hundred gallons of water per minute to properly constructed wells penetrating it a few hundred feet. Typical wells tapping this unit include 1N/3W–1K2 at the town of North Plains, 1N/3W–5Q1 at Roy, 1/2W–29Q1 in the Farmington artesian area, and 2/1W–23N1 near the town of Tualatin. Contours showing the approximate altitude at which the top of the basalt occurs are shown on plate 2. Plate 1 gives the land-surface contours from which the altitude of any proposed drilling site may be determined approximately. Thus, the depth to the basalt can be readily computed by comparison of the two maps.

The sedimentary deposits underlying the main valley plains are chiefly lacustrine. Except for some layers of coarse sand and fine gravel beneath the Forest Grove-Hillsboro district, the most permeable materials are uniform fine sand and very fine sand. Nevertheless, a great quantity of water can be extracted from these fine-grained deposits if wells are properly constructed for that purpose. This source of water is now tapped for domestic use by wells of small capacity. The newer method for the construction of wells by packing fine gravel or coarse sand around well screens set in these deposits is described below in the section on "Construction of wells." If ground water is drawn from the fine-sand aquifiers of the valley fill, a large quantity of additional water can be developed for use. As shown under the subsection on "Recharge," the amount of precipitation that becomes available for recharging the ground water beneath the valley floor in the fall, winter, and spring months of the year generally ranges from 11 to 20 inches. Thus, the water withdrawal for irrigating a tract on the valley floor need not exceed the in situ infiltration. Any lowering of the water table by pumping might have additional beneficial results, inasmuch as late winter and spring runoff may be diverted to become ground water, thus easing land-drainage problems. The possible salvage for use of 11 to 20 inches of additional water over the whole valley plain is sufficient to warrant extensive research for developing suitable wells to tap this resource.

CONSTRUCTION OF WELLS

WELLS IN VALLEY FILL

The common domestic wells that tap the sand units of the valley fill are 6 inches in diameter and are cased with standard welded or coupled steel pipe. The casing is either perforated or left only with an open end in the water-bearing zone. In either type of construction, the finishing and development of the well consists of removing the adjacent sand until an opening or pocket has been formed in the water-bearing material. Many wells finished only in this manner have been damaged by collapse of the sand walls and of unsupported silt or clay strata immediately above the aquifer. Many such collapsed wells and wells producing excessive amounts of sand were seen during examination of wells in the valley fill. To alleviate such sand pumping, many drillers have tried improvisations, such as filling the pocket and the bottom of the casing with pea-sized gravel. As with other improvisations, few benefits have resulted from placing gravel in the casing. In most wells, such gravel fill has been penetrated by the fine sand as the pump drew down the level of the water in the well and induced a hydraulic lift on the gravel filling. Thus, the sand-filled gravel plugged the casings and reduced the yield of the wells without lessening the amount of sand in the water.

In recent years, as the demand has increased for more irrigation water, some drillers have been installing wells equipped with a partly effective gravel pack, or gravel envelope. In general, these wells are drilled at 18 or 20 inches diameter and are finished with a pack of ⅛- to ¼-inch gravel around a 6-, 8-, or 10-inch perforated casing. One of these wells, 1/2W—8C3, 196 feet deep, reportedly produced 200 gpm of sand-free water on test after completion. The average productivity of the first few wells is about 100 gpm. Gravel-packed wells are developed by gentle surging or pumping until the fine-gravel envelope has subsided compactly in support of the fine-sand walls of the aquifer as the larger casing is withdrawn. Gravel is then added until the well will take no more packing material. The gravel envelope around the perforated casing holds the fine sand of the aquifer in place during development and use of the well. As most of these gravel-packed wells have been in production for only a short period, this method of constructing wells in these fine-sand aquifers still is in the experimental stage. Many construction factors, such ts the hydraulic conditions that might cause the fine sand to penetrate the gravel pack and to clog its interstices, are just now being determined. According to the common methods of calculating the correct grain size of a granular envelope for wells in these fine-sand aquifers, the proper size of envelope material lies in the coarse-sand sizes.

Several drilling companies are experimenting with sand-packed wells that utilize a well screen instead of a perforated casing. A coarse sand or very fine gravel can be used for the pack, the correct grain size being selected to hold the aquifer material in place and to prevent the penetration of the coarse-sand envelope by large quantities of fine sand. Also, the support of the aquifer sand in its original position is desirable in order to retain the horizontal permeability of the water-bearing formation. The facts collected so far indicate that permanent wells yielding 100 gpm or more will commonly be obtained from sand aquifers of the valley fill when this method of well construction is perfected.

WELLS IN THE COLUMBIA RIVER BASALT

While the hole is being made, drillers drive casing through the residual soils and the unconsolidated sediments and as far as possible into the basalt. Then, an open hole is drilled into the basalt until the desired quantity of water is obtained or the planned depth is reached. Other things being equal, the greater the number of permeable interflow zones that are cut by the well, the greater the yield.

Most domestic wells drilled in basalt are 6 inches in diameter, although 8-inch-diameter wells are becoming popular. Many domestic wells do not open up a sufficient thickness of the basalt below the water table to insure an adequate supply if the water table declines. Stopping the drilling when only 20 or 30 feet below the water level results in false economy, paid for by low well yields, excessive pumping lifts, or expensive deepening work at a later date.

Most irrigation wells in basalt are about 12 inches in diameter. In addition to the larger diameter required to accommodate an irrigation pump, the heavy string of 12-inch tools probably helps to fracture the rock in the vicinity of the well, thus increasing its effective diameter and its yield.

It is not easy to drill a straight well of uniform diameter in the basalt. The section of a well in which a vertical-shaft pump is to be set is the part of the well for which alinement requirements are most necessary. Straightness requirements commonly are incorporated in contract specifications, and wells are tested by alinement surveys. Drillers prevent a well bore from drifting out of vertical by stopping the drilling at the first sign that the drilling cable is leaving the center of the hole at the surface. The deviating section is then filled with hard rock and carefully redrilled until the bit is cutting new hole plumb with the upper part of the well bore.

Wells in the basalt must be cleaned and developed in much the same manner as wells in sand aquifers.

CHEMICAL CHARACTER OF THE GROUND WATER

OVERALL QUALITY OF THE GROUND WATER

Comprehensive chemical analyses of water samples from 13 wells and 2 springs and partial analyses of water from 18 wells are presented in table 4. In addition, the hardness and chloride content of water from practically all the wells inventoried were determined by field methods (table 1). Figure 15 is a graphical presentation of the analyses of the water from 13 representative wells.

In general, the quality of the ground water is good. The formations younger than the sedimentary rocks of Oligocene and Miocene (?) ages contain fresh water of good chemical quality, little color, and nongaseous nature. Where saline water has been found, the geologic and ground-water conditions suggest that it came from rocks older than the Columbia River basalt. These older rocks contain water of connate origin. The saline ground water, and the places it has intruded into the younger rocks, can be avoided by the proper location and construction of wells.

HARDNESS

Calcium, magnesium, and other soap-consuming constituents in water cause hardness, which is commonly expressed as an equivalent quantity of calcium carbonate in parts per million and is an indication of the soap-consuming capacity of the water. A commonly used scale for expressing the relative hardness of water is as follows (U.S. Geol. Survey, 1953):

Hardness as $CaCO_3$ *(parts per million)*	*Classification*
0–60	Soft.
61–120	Moderately hard.
121–200	Hard.
201	Very hard.

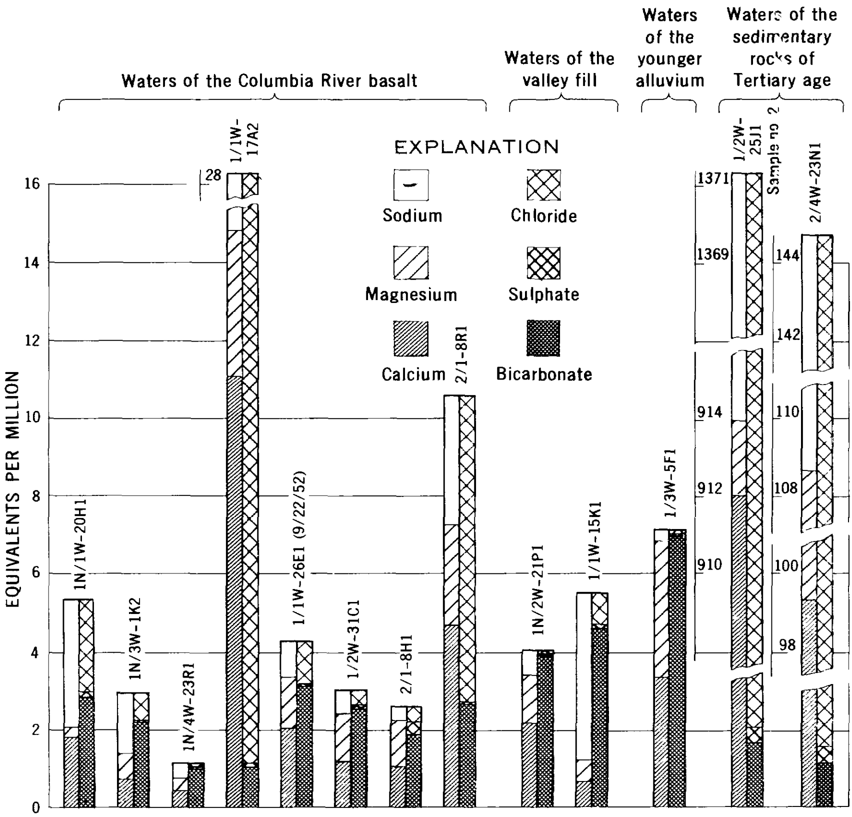

Figure 15.—Comparison of chemical constituents in ground water of the Tualatin Valley, Oreg.

The average hardness of the water from 500 wells tapping all the known fresh water aquifers is about 115 ppm. According to the above scale, such water would be moderately hard.

Water from the Columbia River basalt has an average hardness of about 100 ppm (from 342 wells) and ranges from 800 (well 1N/1W–28E1) to less than 10 ppm. No single area contains all hard or all soft water, but the most highly mineralized ground water in the basalt occurs in areas having unusual geologic relations (fig. 16). Basalt wells that yield hard water, as well as those that yield soft water, are scattered throughout the valley. Thus, in some places, a well that yields hard water may be very close to one that yields soft water. For example, the water from well 2/3W–11C1, 183 feet deep, has a hardness of 352 ppm, whereas water from well 2/3W–11K1, about half a mile away and 150 feet deep, has a hardness of only 46 ppm.

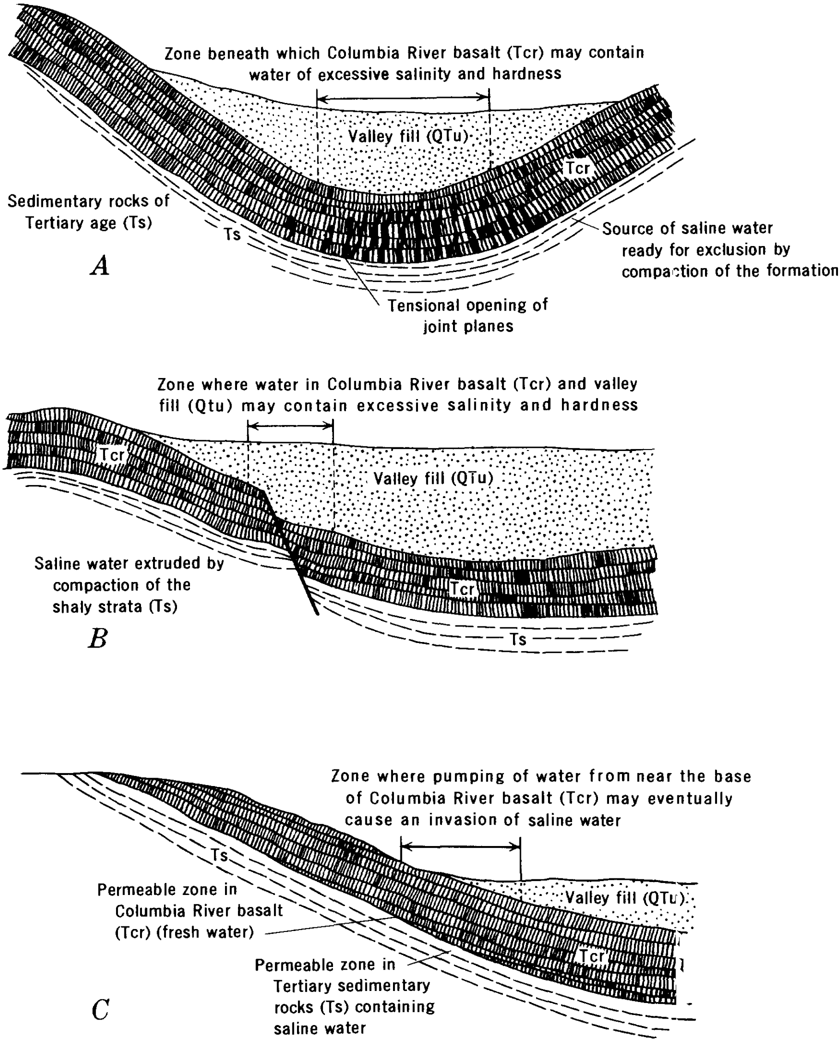

FIGURE 16.—Sketches show (*A*) upward migration of ground water from sedimentary rocks, by way of tension cracks in a syncline, (*B*) upward migration through basalt along broken rock of a fault zone, (*C*) stratigraphic connection of basalt to saline aquifers that permit saline ground water to migrate into the Columbia River basalt and younger deposits.

Field tests of water from 259 wells tapping the uppermost 100 feet of the valley fill show an average hardness of 97 ppm. Water having this hardness is classed as moderately hard, but the hardness of water in individual wells ranges from 334 ppm (well 1/1W–34A1) to only a few parts per million.

Fifty-seven of the deeper type of wells in the valley fill, ranging in depth from 100 to 400 feet, yield water having an average hardness of 124 ppm, which is hard according to the above scale. The hard waters in the valley fill are not restricted to any one particular area but are scattered throughout the valley.

The average hardness of the water from the basalt is similar to that of water from the valley fill probably because the water-bearing sands in the valley fill consist partly of fragments of basaltic and other volcanic material.

CHLORIDE, SULFATE, AND NITRATE

In general, the chloride content of waters in the Columbia River basalt does not exceed 20 ppm. There are places, however, under certain geologic conditions, where saline water from rocks underlying the basalt (see fig. 16) moves into parts of the basalt. An example of such an occurrence of saline water in the basalt is the Murphy well (1/1W-27C1), which apparently was drilled into a fault zone. It tapped water having a chloride content of 1,840 ppm. Another example is the well drilled at the St. Mary's of The Valley Academy. This well (1/1W-17A2), which is 1,500 feet deep, tapped water having a chloride content of 960 ppm. The water has probably worked upward along tension cracks along the axis of the sharp synclinal fold in the bedrock beneath that part of the valley.

To date, the saline waters obtained at places in the basalt are predominantly of the calcium chloride type, but some waters contain nearly equal amounts of calcium chloride and sodium chloride. These are similar to the waters in the underlying sedimentary rocks. Water from well 1/1W-17A2 (fig. 15) illustrates a sodium and calcium chloride type.

Water from the valley fill is generally low in chloride. The range of chloride content in most waters is 5 to 50 ppm, but a few well waters have as much as 100 ppm, and one water (from well 1N/1W-30P1) contains 307 ppm chloride (table 1).

The 14 analyses of water from the basalt show negligible amounts of sulfate and nitrate, except for the saline water which has 15 to 25 ppm sulfate—considerably higher than most water in the basalt but still a low concentration. Analyses of water from four wells (table 4) tapping the valley fill at varying depths show the sulfate and nitrate content to be negligible.

MINOR CONSTITUENTS

FLUORIDE

A concentration of about 1.0 ppm fluoride in drinking water lessens the incidence of dental cavities in children's teeth, but amounts greater than about 1.5 ppm may cause a dental defect known as mottled enamel (Dean, 1943, p. 1161–86). The analysis of water from well 2/1–8R1, tapping water in the basalt, shows a fluoride content of 0.9 ppm. All the other analyses show fluoride content ranging from 0.1 to 0.3 ppm. (See table 4.)

IRON

A concentration of about 0.3 ppm iron is considered the allowable limit in water of good quality for domestic use. Greater concentrations may stain laundry and plumbing fixtures. Almost any concentration is permissible for irrigation water. Iron occurs in ground water usually as a bicarbonate, although it may also occur as a sulfide and sulfate. Owners of several wells located in different parts of the valley report undesirable amounts of iron in their well water. In many wells excessive iron has been found to be entering from one particular stratum, and the iron content of the well water has been decreased by casing off or cementing off that stratum. Improvised or simple commercial iron-removal equipment, if built and operated properly, should be sufficient to remove excess concentration of iron where they are present in ground waters of the valley.

SUITABILITY OF WATER FOR IRRIGATION

The principal chemical characteristics that govern the suitability of a water for irrigation are, according to the Department of Agriculture (U.S. Salinity Laboratory Staff, 1954), (1) the total concentration of soluble salts, (2) the relative proportion of sodium to other cations, and (3) the concentration of boron.

The electrical conductivity is the simplest measure of the approximate concentration of soluble salts in water. It is generally called the specific conductance and is expressed in micromhos per centimeter at 25°C.

According to the classification proposed by the U.S. Salinity Laboratory Staff (1954), the sodium (alkali) hazard of an irrigation water is the proportion of sodium to the other principal cations, calcium and magnesium. Before the sodium-adsorption-ratio (SAR) was used, the relative proportion of sodium to other cations in irrigation water was expressed in terms of the soluble-sodium percentage (percent sodium). The sodium-adsorption-ratio of a soil solution is simply related to the adsorption of sodium by the soil; consequently, this ratio has certain advantages over percent sodium as an index of the sodium (or alkali) hazard of the water. It is defined by the following equation where all cations are expressed in equivalents per million:

$$SAR = \frac{Na^{+1}}{\sqrt{\frac{Ca^{+2}+Mg^{+2}}{2}}}.$$

If the proportion of sodium to calcium and magnesium is high, the sodium (alkali) hazard is high.

Figure 17 shows the classification of water in terms of the sodium-adsorption-ratio and the electrical conductivity. This diagram classifies irrigation waters from low salinity (C1) and low sodium (S1) to very high salinity (C4) and very high sodium (S4). Water classified as C1–S1 is excellent for irrigation and can be used on practically all soils and crops with little danger of damage. Water classified as C4–S4, however, is generally unsuitable for irrigation except under special conditions. The suitability of waters which fall into one of the other 14 classifications depends on the permeability of the soil, the drainage conditions, the type of crops to be grown, and other factors.

Of the analyses made of the water from irrigation wells, only four were comprehensive enough to permit classification of the water on the basis of the sodium-adsorption-ratio. Three of these waters, two from wells tapping water in the valley fill (1N/2W–21P1 and 1/3W–5F1) and one from a well tapping water in the basalt (1/2W–31C1), were classified as C2–S1. Waters having this classification can be used on plants having moderate salt tolerance if a moderate amount of leaching occurs. The other water from the basalt (well 1N/4W–23R1) was classified as C1–S1. This type of water can be used on most soils and crops with little danger of damage to soil or crops.

The other waters, for which the analyses were sufficiently comprehensive for only approximate classification, were classified as either C1–S1 or C2–S1, except the waters from wells 1/1W–17A2 and 2/4W–23N1. Waters from these wells were classified as C4–S2 and C4–S1, respectively. Well 2/4W–23N1 taps water in the sedimentary rocks of Oligocene and Miocene(?) ages, and the water from well 1/1W–17A2 is from the Columbia River basalt but apparently is contaminated by water that has migrated upward from the underlying sedimentary rocks. These two waters are generally unsuitable for irrigation but may be used occasionally if drainage is adequate, if very salt-tolerant crops are grown, and if the soils have a high permeability.

Boron is necessary in small amounts for the growth of all plants, but is injurious when present in amounts only slightly greater than optimum. The permissible boron concentrations vary with each type of plant. The plants most sensitive to boron may be damaged by a concentration slightly greater than 0.33 ppm, whereas the most tolerant plants will be undamaged by a concentration as high as 3.75 ppm (Scofield, 1936).

Of the five waters in which boron was analyzed (table 4), only one has a boron content of more than 0.33 ppm. Water from well 2/4W–23N1, tapping the sedimentary rocks of Oligocene and Miocene (?) ages, contains 2.1 ppm boron.

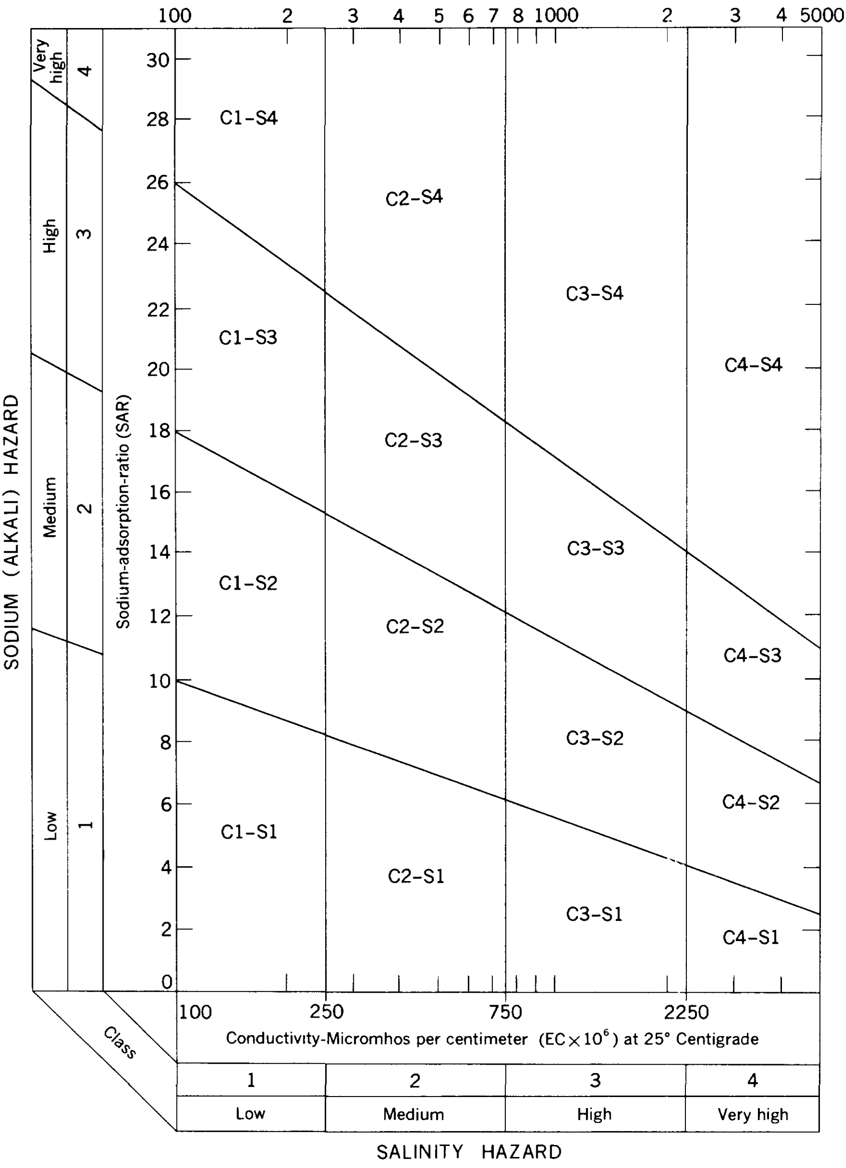

FIGURE 17.—Diagram for the classification of irrigation waters.

TEMPERATURE

The temperature of ground water is fairly constant throughout the valley and differs only slightly from the mean annual air temperature (52°F), if the earth-temperature gradient is taken into consideration. The "normal" earth temperature increases about 1.8°F for each 100 feet below the first 100 feet of depth.

Water from four wells that tap basalt at various depths from 314 to 585 feet ranges in temperature from 55° to 58°F. The deepest water from a well tapping the basalt (1/1W–17A2) has a temperature of 73°F, which is only 2°F lower than the temperature calculated from the earth's temperature gradient for the depth at which the water enters the well.

The water from well 1N/4W–14Q1, 132 feet deep, drilled in the valley fill, has a temperature of 58°F, which is about 5°F warmer than that calculated from the normal-earth-temperature gradient.

RECORDS OF WELLS, SPRINGS, AND QUALITY OF WATER

Detailed information collected in the course of the investigation is given in five tables containing pertinent data on the representative wells and springs. Table 1 gives descriptions of representative wells and table 2, the stratigraphic information contained in drillers' logs. Table 3 lists the data on springs and table 4, the chemical analyses of the ground water. Table 5 gives water levels measured periodically in 32 wells from 1951 to 1953. Other measurements of water levels are shown graphically on figures 9–14.

The listed depth of most wells (table 1) is based on reports by owners or drillers because only part of the wells could be entered for measurement. Those depths shown to the nearest tenth of a foot were measured by the U.S. Geological Survey.

Water levels are expressed in feet below a land-surface datum, a plane of reference at each well which coincides with the general level of the land immediately adjacent. Those levels given to the nearest tenth of a foot were measured by the Geological Survey; those given to the nearest foot were reported and are considered dependable within a few feet.

Except for those wells for which drillers' logs were available, the character of the water-bearing material (table 1) is generally that reported by the owner.

Statements on occurrence of the ground water at each well (table 1) have been interpreted from the record of that particular well and may seem to involve some inconsistencies. For example, for certain wells that tap the regional body of unconfined water, the occurrence may be listed as "confined" because beds of clay or silt slightly confined the water locally or excluded water from the well until it extended some depth below the normal water table in the vicinity.

All data on capacity of the pump (table 1) are approximate. They do not indicate the maximum possible yields of all the wells, some of which have permanent capacities that are much greater or less than the current rate of use.

The chemical analyses of ground water listed in table 4 were made by the Geological Survey and by other laboratories as indicated in the footnotes.

TABLES 1–5

Table 1.—*Records of wells*

Well: See text for description of system.
Topography at well: P, plain; S, slope; U, upland. Altitude interpolated from topographic maps.
Type of well: Bd, bored; Dg, dug; Dn, driven; Dr, drilled.
Ground-water occurrence: C, confined; P, perched; U, unconfined.
Water level: Depths and water levels expressed in feet and decimals measured by the Geological Survey; those in whole feet were reported by owner or driller. F indicates flowing.
Type of pump: B, bucket; C, centrifugal; J, jet; P, plunger; T, turbine.
Use of water: D, domestic; Ind, industrial; Irr, irrigation; N, none; O, observation; PS, public supply; S, stock.
Chemical character: Determinations made by field methods.
Remarks: Ca, chemical analysis of water in table 4; dd, drawdown; ft, feet or foot; gpm, gallons per minute; H figure, hydrograph on figure indicated; L, log in table 2; ppm, parts per million by weight; temp, temperature of water in degrees Fahrenheit; W, water-level record in table 5.

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 1 N., R. 1 W.								
4L1	J. E. Kielhorn	U,1,020	Dr	495	6	31	359	136	Basalt	P	450	9- -51	P,5	D	128	6	Reported 105 ft of clay and 254 ft of rock above aquifer.
5B1	J. Kesswetter	U,830	Dr	310+	4	----	----	----	do	P	----	----	P,3	D	130	4	
5C1	S. Luethe	U,820	Dr	407	6	64	64	343	do	U	345	9- -51	P,3	D,S	78	5	Used by two families.
5D1	Multnomah County	U,750	Dr	550	10	185	485	38	do	C	323	3- -47	T,20	Ind	----	----	L; supplies rock quarry.
5J1	Edwin G. Boynton	U,910	Dr	110	6	----	100	10	do	C	----	----	P,10	D,Irr	82	5	Used for irrigating garden.
6E1	Paul Boeckli	S,370	Dr	186	8	184	184	2	do	C	90	9- -51	P,10	D,Irr	100	5	
6H1	Harry Frace	U,695	Dr	350	8	10	340	10	----	C	225	9- -51	P,3	D,S	44	4	Small yield. Aquifer reported to be gravel.

7L1	George Dickson	S,230	Dr	130	6	100	----	----	Basalt	C	20	4- -51	J,20	D,Irr	377	144	Reported never pumped dry.
8E1	Frieburg and Carlson.	S,435	Dr	110	6	110	95	15	do	C	90	9- -51	J,5	D,S	110	4	Provides water for two families.
9A1	A. W. Anderson	U,1,050	Dr	65	6	----	----	----	do	C	----	----	J,8	D	----	----	
9E1	R. D. Congdon	S,560	Dr	240	6	----	----	----	----	---	----	----	P,5	D,Irr	92	5	Used for irrigating garden.
9E2	F. D. Welsh	S,560	Dr	105	6	68	100	5	Basalt	C	----	----	J,10	D	80	6	Reported 5 ft of clay, then rock to 105 ft.
9Q1	H. Granat	S,650	Dr	245	8	38	195	45	do	U	235	9- -51	P,5	D	112	4	
10D1	Don Allen	U,900	Dr	733	6	77	717	----	do	U	580	4- -57	T,5	D	----	----	Obtained water near base of the basalt.
10E1	K. M. Bartlett	U,1,050	Dr	180	6	115	110	70	do	C	----	----	J,3	D	76	5	Excellent supply of water reported.
10M1	Skyline Store	U,900	Dr	320	4	----	120	200	do	U	----	----	----	----	----	----	Inadequate; abandoned.
10M2	A. J. Koeps	U,920	Dr	85	6	81	81	4	do	C	----	----	P,3	D	74	5	
10N1	Skyline Tavern	U,975	Dr	85	4	85	70	15	Pebbles	C	50.11	9- 6-51	J,5	D	68	4	Casing perforated near bottom.
15H1	Dale Stahl	U,1,070	Dr	75	6	----	60	15	Basalt	U	----	----	J,3	D	----	----	
16D1	John Hahn	S,350	Dr	100	6	----	75	25	do	C	----	----	J,5	D	130	4	
16E1	Ted Dobbs	S,410	Dr	386	6	37	350	36	do	C	108	9- -51	P,10	D,S	152	20	Penetrated Boring lava 37–287 ft, blue clay 287–350 ft, and basalt 350–386 ft.
17B1	Wilbur Meenen	S,295	Dr	160	6	----	----	----	----	---	----	----	P,5	D	----	----	
17E1	Walter Nichol	S,330	Dr	130	6	30	30	100	Basalt	C	----	----	P,3	D,S	38	5	
17L1	Bethany Presbyterian Church.	S,325	Dr	400	8	----	----	----	do	C	62.06	7-15-54	----	----	----	----	Entered basalt at 224 ft.
17N1	B. D. Graf	S,270	Dg	62.5	40	63	----	----	----	U	24.71	4-11-51	J,8	D,S	78	8	Aquifer reported to be clay.
18G1	J. W. Dixon	S,275	Dr	97	6	----	----	----	Basalt	U	----	----	J,3	D	172	5	
18J1	Sam Joss	S,260	Dr	162	6	162	155	7	do	C	36.92	4-11-51	P,5	S	142	7	Water reported to contain some iron; casing perforated 144–162 ft.
18J2	do	S,260	Dg	70.7	48	71	65	6	Quicksand	U	51.68	4-11-51	J,8	D	122	14	W.
18P1	C. Schindler	S,255	Dr	160	6	150	----	----	----	C	49	4- -51	P,5	D	----	----	Aquifer reported to be clay.
19B1	B. D. Graf	S,260	Dr	276	4	246	246	30	Rock	C	----	----	P,5	D	----	----	Reported 213 ft of clay overlies aquifer.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Thickness (feet)	Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chloride	Remarks
	T. 1 N., R. 1 W.—Continued																
19K2	Julius Jacroeni ----	S,260	Dr	114	6	-----	-----	-----	Sand----	U	------	-------	J,15	D,S	116	8	
19M1	S. R. Berger-------	P,215	Dr	115	8	115	-----	-----	--do----	C	42.97	4-19-51	P,3	D	372	6	Water carries fine sand; casing perforated near bottom.
19P1	Ed East ----------	P,240	Dr	354	6	338	338	16	Gravel and sand.	C	40	1944	P,5	D	----	----	Reported 338 ft of clay overlies aquifer.
20H1	C. E. Wismer------	S,350	Dr	480	4	398	396	84	Basalt --	C	100	4- -51	P,5	D,S	120	45	Ca, L.
20J1	E. Waerner, Jr.----	S,350	Dg	40	36	-----	-----	-----	--------	U	------	-------	J,5	D,S	78	11	Reportedly gives inadequate water in dry season.
20J2	Bethany Baptist Church.	S,320	Dg	40	48	-----	-----	-----	Rock----	U	19	4-10-51	J,5	D	56	5	W; well bottomed on boring Boring lava.
20N1	John Morty --------	S,250	Dr	100	6	-----	-----	-----	Basalt --	C	------	-------	P,5	D,S	124	10	Nearby 85 ft well did not reach basalt.
21J1	M. A. Kirkpatrick --	S,280	Dr	28	8	16	16	12	--do----	C	F	4-10-51	J,5	D	202	38	
21K1	H. Olson ----------	S,280	Dr	134	6	123	129	5	--do----	C	3	7- -50	J,20	D	142	9	Bailed at 15 gpm without lowering water level.
21L1	C. C. Schaefer -----	S,300	Dr	390	6	47	47	53	Boring lava.	U	7.99	4-14-53	J,12	Irr	----	----	Materials reported as soil 0–47 ft; Boring lava 47–100 ft; clay of Troutdale

																	formation 100–390 ft; caved back to 250 ft.
21Q1	George Finley	S,335	Dr	365	6	363	363	2	Basalt	C	F	4-	9-50	J,15	D,S	104	14 Flowed about 2 gpm in April 1951.
22P1	J. Strope	S,500	Dr	385	6		300	85	do	C				P,5	D	148	4
22R1	H. M. Valentine	S,700	Dr	129	5		40	89	do	P				P,8	D	144	4 Reportedly yields insufficient water.
23E1	Northwest Memorial Gardens Association.	U,1,050	Dr	552	12-10		431	121	do	P	431	5-	-54				Well no. 3; test pumped 224 gpm for $33\frac{1}{2}$ hr with 40 ft of drawdown.
23K1	Richfield Oil Co	U,1,030	Dr	7,885	12-8	811								N	N		L; oil test well.
23M1	Northwest Memorial Gardens Association.	S,1,000	Dr	515	12									N			Basalt 30–465 ft, sandstone 465–515 ft; well abandoned.
23N1	E. Stahly	U,750	Dr	292	6	292	272	20		P	282	11-	-50	N	N		Not used; materials reported as clay and gravel for entire depth; casing perforated 272–292 ft.
23R1	Alfred H. Corbett	U,1,100	Dr	960	6	89			Sandstone (?)	P	396	11-	-48		N		L.
26A1	F. C. McDonald	U,1,065	Dr	400	6	98	314	86	Basalt	P	200	1-	-46	P,5	D	92	4 Reported 100 ft of clay and 214 ft of rock overlies aquifer.
26D1	C. D. Brisum	S,650	Dr	90										P	Irr		Used for irrigating two lawns.
26D2	Northwest Memorial Gardens Association.	S,650	Dr	525	8												No basalt found; platy coal 510–524 ft, sandstone 524–525 ft, contained shell fragments.
26E1	C. E. Olson	S,610	Dr	168	6	168	167	1	Gravel	P	68	9-	-51	J,15	D,S	70	5 Casing perforated near bottom.
27B1	F. Prohaska	S,560	Dr	95			45	50	Rock	U				P,3			
27D1	V. Richardson	S,485	Dr	182	6		162	20	Basalt	C	162	9-	-51	P,8	D	64	5
27M1	E. H. Haskell	S,490	Dr	80	6	80	79	1	Gravel	U	20	9-	-51	J,5	S		A 42-ft dug well furnishes domestic water; casing perforated near bottom.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Thickness (feet)	Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chloride	Remarks
									T. 1 N., R. 1 W.—Continued								
27R1	Mrs. Sutton	S,500	Dr	250	4.5	190	80	10	Boring lava.	U	----	----	P,3	----	98	8	Materials reported as clay to 30 ft, Boring lava to 93 ft, and clay of Troutdale formation to 250 ft; casing perforated 80–190 ft.
28E1	Lindow Bros	S,290	Dr	576	12	481	470	106	Basalt	C	F	3- 1-52	T,230	Irr	800	908	Reported 470 ft of clay and sand above aquifer; flow is 80 gpm; when pumped at 230 gpm dd is to 145 ft.
28M1	Clifford Bauer	P,260	Dr	350	6	330	330	20	--do--	C	10	4- -51	T,30	D,S	156	24	Blue clay overlies aquifer.
28P1	Harry Burton	S,270	Dg	37	48	----	----	----	----	U	----	----	J,10	D	100	10	
28P2	Fred E. Hartung	S,260	Dr	755	6	600	650	105	Basalt	C	+50.6	4-13-53	J,20	D,Irr	148	65	Flows 40 gpm; drilled in basalt 595–755 ft.
28R1	J. Peterkort	S,455	Dr	250	5	----	----	----	--do--	C	----	----	P,5	D,S	----	----	
29D1	Ed Lehman	S,255	Dr	105	6	100	100	5	Sand	C	30	4- -51	J,10	D	210	5	
29H1	V. H. Potter	S,250	Dr	175	6	175	170	5	--do--	U	----	----	P,8	Irr	----	----	Used for irrigating lawn; water carries some sand; dd is 110 ft when pumping 10 gpm.

30P1	Albert Maier	S,185	Dr	266	6	153	100	166	Sandy clay.	U	20	1949	J,10	S	324	307	Materials reported as 160 ft of sand and silt, 100 ft of sticky clay; well has been plugged back to 100 ft; water from 266 ft "brackish."
31B1	F. J. Zuercher	P,240	Dr	148	6				do	C			P,8	S	260	7	Pumps dry in summer.
31D1	Jesse Hansen	P,200	Dr	152	6					C	14	4- -51	P,10	D,S	286	98	
31E1	G. E. Thompson	P,210	Dr	76	6	75			Sand	U			J,10	D	268	5	Water has an iron taste; casing perforated near bottom.
31L1	S. Ferrell	P,210	Bd	65	9	65	20	45		U			J,5	D	90	3	Has tile casing.
31Q1	Emil Trachsel	P,180	Dr	400	6	85	75	10	Sand	U	10	4- -51	J,15	D,S	158	67	Casing pulled back to 85 ft and perforated 75–85 ft; water below 85 ft carried sand.
31R1	E. L. Pritchett	P,180	Dg	25.8	48				do	U	10.5	4-20-51	J,5	D	166	6	W.
32B1	H. G. Reeb	P,230	Dr	600	6	398			Gravel, fine.	C	35	1952	J	D			Casing pulled back to 398 ft; hole filled with pea gravel below casing; material reportedly fine sand 550–600 ft.
32C1	Ernest Lehman	S,240	Dr	100	18	100			Sand	U	15	4- -51	J,15	D	152	12	
32J1	Luker	P,230	Dr	530	6	240	240	3	do	U	38.0	2- 4-51	J,20	D	52	8	
32L1	D. L. Cason	P,230	Dr	427	6				do	C	48	1- -51	J,3	D,S	105	32	Pumps dry in 2 hours at 3 gpm.
32P1	Emil Schlottmann	S,210	Dr	128	6	123			do	C	23	12- -50	P,10	D,S	204	6	
33A1	S. H. Bloedon	S,420	Dr	447	6	411	410	37	Basalt	C	103	6- -53		O			Drilled gravel and boulders 0–35 ft; Boring lava 35–90 ft; clay (Troutdale formation) 90–410, basalt 410–447 ft.
33F1	Herman Jenne	P,255	Dr	107	6								P,8	D	216	5	
34C1	John Christianson	S,395	Dr	110	6				Basalt	C			P,5	D	110	3	
34D1	S. H. Bloedon	S,450	Dg	33	40				Alluvium	U	6.78	4-10-51	C,15	Irr			W.
34D2	do	S,450	Dr	140	6	60	60	80	Boring lava.	C	42.48	5- 4-53	T				Well abandoned; insufficient supply.
34L1	Alfred Teufel	S,310	Dr	200	6				Basalt	C			T,175	D,Irr	154	4	Dd 160 ft pumping 175 gpm for 36 hours.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (Feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 1 N., R. 1 W.—Continued								
35H1	W. M. Perrault	S,650	Dr	633	8-6	624	597	35	Conglomerate.	C	200	11- -48	----	----	----	----	L.
35K1	Leahy Greenhouses	S,550	Dr	238	8	145	230	8	Rock	C	60	9- -51	P,20	Irr,D	84	5	
35M1	West Hills Nursery	S,455	Dr	527	6	70	80	20	do	C	----	----	P,5	Irr	32	5	L; reportedly can be pumped dry.
36E1	Portland Gas and Coke Co.	S,720	Dr	421	12	65	406	6	Basalt	C	265	----	----	Ind	----	----	L; pumps 350 gpm with 35 ft of dd.
36N1	W. Strowger	S,780	Dr	432	6	----	----	----	do	C	----	----	P,10	D	66	5	
									T. 1 N., R. 2 W.								
1A1	Ben Thomas	S,460	Dr	140	8	20	139	1	Basalt	C	80	1951	P,8	D	----	----	
1B1	C. E. Shine	S,425	Dr	79	6	10	----	----	do	C	----	----	P,5	D	108	5	Soft rock 6–70 ft; hard rock 70–79 ft.
1G1	J. G. Densen	P,230	Dr	155	12	----	----	----	do	C	34.81	10-5 -51	N	N	----	----	
1G2	do	P,230	Dr	120	8	110	110	10	do	C	22.7	10-5 -51	T,100	Irr	----	----	Reportedly 20 ft of clay and 90 ft of rock above aquifer; irrigates 15 acres.

2A2	A. K. Borgeson	S,440	Dr	160	6	35	120	20	do	C	----	----	P,5	D	120	4	Pumps dry with heavy use; penetrated 34 ft of clay and 86 ft of rock above aquifer.
2N1	D. Hebeisen	S,320	Dr	543	6	175	250	293	do	C	90	1952	T,80	Irr	----	----	Basalt from 175 ft down.
3D1	Helvetia Church	S,410	Dr	228	6	177	157	20	do	C	102	7- -49	P,5	D	108	8	Reportedly 104 ft of clay above rock; casing perforated 157–177 ft.
3K1	Mrs. Nussbaumer	S,285	Dr	145	6	----	----	----	do	C	F	4-11-51	P,5	D	110	6	Flows about 3 gpm; only the overflow is used.
3R1	Ben Nussbaumer	S,300	Dr	397	8	165	387	10	do	C	80	8- -53	T	Irr	----	----	Struck basalt at 160 ft; used for irrigating 30 acres of pasture; reported 190 ft dd pumping 110 gpm.
4A1	Conrad Pieren	S,380	Dr	101	6	----	59	42	do	C	36	1939	P,5	S	108	8	
5M1	Clyde Lincoln	P,205	Dg	30	48	30	0	30	Sand, silty.	U	12	7- -50	J,15	D	100	10	Holes drilled laterally near bottom; never dry; used for irrigating garden.
5N1	Irene Jackson	P,205	Dr	80	6	----	----	----	Sand and gravel.	U	----	----	J,5	Irr	----	----	Water used for lawn and garden.
5R2	E. Batchelder	P,220	Dr	547	6	345	449	98	Basalt	C	19	8- -53	T,250	Irr	----	----	Basalt entered at 342 ft; pumped 300 gpm with 86 ft dd.
6M1	John A. VanDomelen	P,170	Dr	452	6	327	327	125	do	C	F	11- -50	J,15	D,S	68	21	Flows about 4 gpm; main flow 451–452 ft.
7E1	----	P,170	Dr	960?	8	----	----	----	Sand	U	----	----	----	----	----	----	Clay and sand entire depth; gravel packed upper 200 ft; lower part of hole plugged.
8E1	T. R. Connell	P,200	Dr	60	6	60	20	40	Quick-sand.	U	4.55	4- 2-51	J,15	D,S	----	----	H figure 11; drilled in blue clay 50–102 ft; no water below 50 ft; casing perforated 23–60 ft.
9D1	W. Batchelder	S,210	Dr	110	6	----	----	----	----	C	23	8- -50	J,15	D,S	160	7	
9Q1	R. D. Hays	P,205	Dr	85	4	85	----	----	Sand	C	20	10- -49	J,5	S	----	----	Casing perforated near bottom.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Thickness (feet)	Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chloride	Remarks
						T. 1 N., R. 2 W.—Continued											
10N1	Al Grossen	S,230	Dr	180	6	-----	-----	-----	---------	C	------	-------	J,10	D,S	176	12	
11B1	------------------	S,250	Dr	127	6	-----	-----	-----	---------	C	33.23	4-11-51	N	----	----	----	
11C1	Ralph Kind	S,260	B	74	6	-----	-----	-----	---------	C	9.7	4-11-51	N	----	----	----	
11C2	Albert Zander	S,250	Dr	125	6	105	105	20	Basalt	C	57.14	5-17-51	J,5	D	300	4	H figure 10.
11K1	F. J. Schmidt	S,255	Dg	40	48	40	0	40	Sandy clay.	U	12	4- -51	C,5	D	----	----	Easily pumped dry in summer and fall.
11L1	Leroy Barker	S,270	Dr	195	6	-----	-----	-----	Basalt	---	55	-------	P,5	D	164	7	Water used for garden.
12J1	Claude Davison	S,305	Dr	196	5	140	190	6	Sandy gravel.	C	50	6- -47	J,5	D,S	88	4	
12P1	Louis Zurcker	S,240	Dr	160	6	120	120	40	Rock	C	33	9- -50	J,15	D,S	258	9	
12Q1	Chris Reichen	S,300	Dr	173	6	60	163	10	Pea gravel.	C	35	4- -51	J,10	D,S	96	6	Drilled in red clay and red "shot soil" to 1[illegible]3 ft.
13F1	Jaggi Brothers	S,250	Dr	225	6	215	215	10	Sand	C	50	4- -51	P,3	D,S	138	3	
13H1	J. L. Copeland	S,225	Dr	44	10	44	-----	-----	---------	U	12.05	4- 4-51	J,10	D	----	----	
14F1	John Caravatta	S,245	Dr	40	6	40	-----	-----	---------	U	------	-------	J,5	D	86	8	Dry in summer.
14Q1	John Babcock	S,240	Dr	315	6	315	312	3	Pea gravel.	C	40	8- -45	P,15	D,S	138	14	Casing perforated 307–315 ft.
14R1	Alvin Hergert	S,225	Dr	102	6	102	102	-----	---do---	C	52	4- -51	J,10	Ind	216	5	Used by service station; clay and silt over and clay under aquifer.

15C1	West Union School	P,210	Dr	560	6	330	330	230	Basalt	C	35	1948	P,40	PS	72	7	L; pumps large amounts of fine silt.
16P1	Walt Erdman	S,200	Dr	230	6	230	220	10	Sand and gravel.	C	50.67	4- 2-51	J,10	D	88	18	Produced sufficient water from 195 ft but continually pumped sand; reported 220 ft of clay and sand above aquifer; bottom 6 ft of casing perforated.
16R1	W. F. Evans	P,185	Dr	108	6	----	----	----	Sand	C	4.86	4- 2-51	N	----	----	----	
17F1	Ernest Zurcker	P,200	Dg	53	60	53	----	----	----	U	7.2	4- 2-51	J,8	D	132	9	W.
17F2	----do	P,200	Dr	98	12	98	70	15	Sand	U	25	10- -52	J,4	D	----	----	Concrete tile casing; every third tile perforated; blue clay reportedly above and below aquifer.
17J1	R. Kauer	P,175	Dr	125	6	----	----	----	--do	C	45	8- -50	J,5	D,S	134	16	
18A1	R. Scherrer	P,190	Dg	28	60	28	----	----	--do	U	25	1950	J,8	D,S	120	9	
18E1	W. J. Smith	P,160	Dr	60	6	----	----	----	----	U	----	----	J,5	D, Irr	132	6	Water used for garden; drilled much wood and vegetation.
18J1	W. J. Vanderzanden	P,190	Dr	150	6	150	----	----	----	C	71.97	3-28-51	J,15	S	----	----	
19R1	Joe Vanderzanden	P,185	Dg	25	12	25	----	----	Sand	U	6.56	3-28-51	P,5	D,S	106	8	
20P1	Ben Coussens	P,180	Dr	45	6	38	38	7	--do	U	6.59	3-28-51	P,20	D, Irr	94	6	Irrigates garden.
21D1	G. P. Frost	P,170	Bd	35	6	35	----	----	--do	U	5.27	3-28-51	P,25	D, Irr	240	8	W.
21P1	Scotty LeFore	P,195	Bd	40	6	15	15	25	--do	U	34	8- -50	J,50	Irr	----	----	Ca; irrigates 11 acres of pasture.
22D1	Carl Voges	P,200	Dr	85	6	----	----	----	--do	C	34.0	4- 2-51	J,10	D,S	178	5	Waters 40 head of cattle.
22N1	Perry Stream	P,215	Dr	24	48	25	0	25	Alluvium	U	2.46	4- 5-51	P,10	D	120	13	Reported never dry.
23F1	Carl G. Bechen	P,220	Dr	290	6	290	120	169	Sand	C	45	4- -51	P,10	S	230	7	Penetrated clay 0–120 ft; water-bearing blue sand 120–289 ft; "shale" 289–290 ft; casing perforated 270–290 ft.
23K1	Bonneville Power Adm.	P,225	Dr	270	8	270	----	----	Sand, very fine.	U	----	----	J,10	Ind	----	----	Casing gravel-packed in 20-inch hole.
24H1	F. N. Jeffries	P,190	Dg	32	48	32	----	----	Sand	U	5.0	4- 4-51	J,10	D	118	6	

Table 1.— *Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitued (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardnes as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
	T. 1 N., R. 2 W.—Continued																
24J1	Marie Berger	P,230	Dr	160	6	----	----	----	--------	---	-----	--------	P,5	D,S	266	5	Reportedly a good well.
25N1	G. Krautscheid	P,180	Dr	118	6	88	78	10	Gravel and sand.	C	15	11- -49	J,10	D,S	106	9	Reported 78 ft of clay above and 30 ft below aquifer; casing perforated 78–38 ft.
26G1	Berger Brothers	P,210	Dr	140	6	140	120	20	Sand	C	30	1950	P,8	D,S	302	4	Casing perforated 120–140 ft.
26P1	Rich and Sons Nursery.	P,210	Dr	339	6	290	----	----	do	C	31.0	4-16-51	P,30	Irr	----	----	Casing perforated near bottom.
26R1	R. E. Klinger	P,170	Bd	55	8	55	----	----	do	U	16	1951	J,5	D	126	8	
28K1	James A. Gibbs	P,185	Dr	84	6	----	----	----	do	U	-----	-------	P,3	D	146	5	
28K2	do	P,185	Dg	26	48	26	0	26	Alluvium	U	7.8	4- 5-51	J,5	D	110	5	
29G1	Gus Johnson	P,195	Dn	32	----	----	----	----	Sand	U	4.45	4- 2-51	J,5	D,Irr	150	6	Irrigates garden.
29Q2	N. A. Seidel	P,195	Bd	45	6	37	38	7	do	U	1.29	3-28-51	J,5	D	216	9	
30G1	C. W. Wright	P,190	Bd	38	6	30	30	8	do	U	3	3- -51	J,20	Irr	----	----	Water used on 7 acres of pasture.
30R1	Henry Arp	P,185	Dr	35	----	----	----	----	do	U	7	8- -50	J,5	D	104	5	
32C1	C. J. Wojahn	P,190	Bd	23	6	----	----	----	do	U	1.96	3-27-51	J,5	D,Irr	142	6	W.
32R1	Don Chapman	P,180	Bd	31	6	27	28	4	do	U	4	3- -51	J,3	D	112	12	Water contains some sand.

33M1	Jesse Gallop	P,195	Dr	37	6	----	----	----	do	U	9	3- -51	J,5	D	----	----	
33R1	Robert Rice	P, 150	Dr	42	6	----	----	----	do	U	24.0	3-30-51	J,5	D	154	7	W.
34G1	E. F. Brauer	P,200	Dg	25	36	25	----	----	do	U	----	----	J,5	D	118	14	
34H1	E. M. Johnson	P,205	Dr	1,385	8	500	----	----	----	----	----	----	----	----	----	----	Reportedly entered basalt at 1,335 ft; some water in sand at 50 ft, none 50–1,385 ft; hole caved 500–1,385 ft; drilled for Oregon Nursery Co.
35E1	E. L. Lewis	P,195	Dg	23	36	23	17	6	Sand	U	4.8	4- 5-51	J,3	D	166	16	H figure 11.
35P1	C. E. Hines	P,150	Dr	200	6	200	196	4	do	C	2.73	4-16-51	J,5	Irr	366	102	Nearby 28-ft dug well supplies house.
35R1	W. L. Steed	P,180	Dr	135	4	133	----	----	----	C	----	----	J,8	D,S	286	61	
36B1	F. Rofinot	P,220	Dr	120	6	120	----	----	Sandy clay.	C	40	4- -50	J,10	D	256	23	Casing perforated near bottom.
36R1	H. E. Scruggs	P,205	Dg	40	44	38	34	4	do	U	9.83	4-20-51	P,10	D,S	78	4	Inadequate supply.
									T. 1 N., R. 3 W.								
1G1	M. V. Jackson	P,210	Dr	654	6	509	600	4	Basalt	C	37.0	8-10-53	N	----	----	----	Entered basalt at 509 ft; reported that sand is coming in above basalt; produces 8 gpm with 280 ft of drawdown.
1K1	North Plains Water District.	P,190	Dr	506	6	360	360	146	do	C	18	11- -50	P,20	PS	----	----	Drilled in 1903; now standby well.
1K2	do	P,190	Dr	710	6	386	386	324	do	C	18	8- -48	T,35	PS	70	23	Ca, L.
1M1	C. M. Bates	P,185	Dr	440	6	324	325	115	Basalt	C	F	9-13-51	----	----	72	13	Flows about 5 gpm; pumped at 75 gpm with 150 ft of dd.
2D1	W. C. Baugh	P,210	Dr	147	6	----	----	----	Sand	C	----	----	J,10	D	114	6	Iron precipitates from water after exposure to air.
2J1	Damon Leonard	P,170	Dg	24	36	24	0	24	Silty clay clay.	U	12	11- -50	P,5	D	----	----	Reported to go dry in summer; 83 ft drilled well 60 ft to west yield iron-bearing water.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitued (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Fleet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardnes as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
T. 1 N., R. 3 W.—Continued																	
5A1	George Corey	P,205	Dr	449	6	----	----	----	Basalt	C	F	11-21-50	J,15	S,Irr	116	3	Flowing about 1 gpm; used for garden irrigation.
5A2	----do----	P,205	Dg	41	48	41	0	41	--------	U	5.68	11-21-50	P,5	D	38	3	Water level low in summer.
5H1	Joe Duyck	P,200	Dr	600	6	475	475	125	Basalt	C	F	12- 4-50	J,15	D,S	46	4	Flowing about ½ gpm.
5K1	William Meeuwsen	P,205	Dr	104	8	----	----	----	Rock	C	24	11- -50	P,10	S,Irr	46	5	Water contains large amount of iron and has sulfur taste.
5K2	----do----	P,205	Bd	51	18	51	----	----	Sand	C	10.82	11-21-50	J,5	D	92	9	
5Q1	J. J. Moore	P,175	Dr	523	6	512	513	10	Basalt	C	F	12-12-51	J,20	D	----	----	Flowing about 3–5 gpm; water from 335-ft sand has sulfur taste, a hardness of 20 ppm and chloride of 3 ppm.
5R1	Roy Catholic School	P,175	Dr	406	6	359	387	19	Sand	C	F	11-27-50	J,40	PS	40	4	L; well destroyed; pumped much sand.
5R2	----do----	P,175	Dr	633	6	528	528	105	Basalt	C	F	12-18-52	20	PS	----	----	
6B1	William Herinchx	P,200	Bd	65	6	65	45	20	Sand	C	20	11- -50	J,10	D,S	40	5	Casing perforated 45–65 ft.
6E1	August Vandehey	P,200	Bd	70	24	70	----	----	Sand	U	20	8- -50	C,5	D,S	102	10	Ca; pumps dry in summer.

6E2	----do----	P,200	Dr	125	6	----	----	----	Quick-sand.	C	7	11- -50	C,10	S,Irr	138	7	Sand in water.
7A1	G. P. Vandehey	P,190	Dg	43	60	43	0	43	Sand	U	8	11- -50	J,5	D,S	92	9	Water level low in summer.
7A2	L. J. Spiering	P,175	Dr	946	6-4	907	900	46	Basalt	C	F	4- -51	J,40	D	24	7	L.
7E1	Glen P. Ireland	P,170	Bd	100	18	100	36	4	----	U	F	11- -50	J,50	Irr	----	----	Water level about 14 ft from surface in summer.
7H1	Leo Akerman	P,165	Bd	85	12	85	----	----	Quick-sand.	U	2.5	11-21-50	J,5	D,S	76	6	
8B1	Julius Duyck	P,180	Dr	376	6	372	372	4	Gravel	C	20	11- -50	J,20	D,S	----	----	Water carries some sand.
8E1	Al Peters	P,190	Dr	965	6	930	930	35	Basalt	C	F	11-21-50	P,25	D,S	----	----	Estimated flow about 1/60 gpm; entered basalt at 910 ft.
8P1	G. H. Vander-Zanden.	P,170	Dg	33	36	33	0	33	Aluvium	U	3.75	11-21-50	J,5	D,S.	----	----	W.
10F1	James Vander-Zanden.	P,180	Dg	25	48	25	0	25	--do--	U	2.72	11-17-50	J,5	D	143	6	Similar well nearby goes dry in summer.
11A1	R. N. Shearer	P,195	Dr	102	6	----	100	2	----	C	18	1938	P,10	D,S	76	4	Iron precipitates from water after exposure to air; water from shallow well nearby contains 208 ppm hardness and 12 ppm chloride.
11J1	Clarence Dykes	P,195	Dg	29	48	29	----	----	----	U	2.55	11-17-50	J,5	D	----	----	Water level low in summer.
12E1	Floyd Beach	P,205	Dr	645	6	553	553	92	Basalt	C	----	----	P,10	D,S	276	13	Drill penetrated charred wood and "fir" cones at 300 ft depth.
13F1	Marie Starkey	P,195	Dg	24	36	24	0	24	Alluvium	U	4.68	11-24-50	P,3	D	162	10	
13F2	Edwin Simantel	P,195	Dr	104	6	----	89	15	Sand	C	----	----	J,5	D,S, Irr	122	4	Used for irrigating lawn and garden.
13F3	----do----	P,195	Dr	340	4	340	----	----	--do--	C	21.83	11-24-50	N	----	49	6	W; reportedly pumps sand.
15H1	Art Salzwedel	P,185	Dg	30	36	30	----	----	----	U	2.92	11-17-50	----	D	242	7	H figure 14.
15H2	J. L. Cawrse	P,180	Dr	100	12	100	70	30	Sand	U	6.06	4-22-52	J,100	Irr	----	----	Gravel packed well; concrete casing perforated 0–100 ft; pumped 100 gpm for 90 hours with 25 ft of dd; use for irrigating 15 acres of pasture.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
	T. 1 N., R. 3 W.—Continued																
18J1	Clarence VanDyke	P,170	Bd	70	6	70	50	20	Sand	U	8	1949	J,10	D,S	162	3	Test pumped at 10 gpm for 7 days; casing perforated 50–70 ft; a "dry hole" 260 ft deep drilled 50 ft to north.
19C1	A. J. Giesbers	P,180	Bd	56	6	54	54	2	do	U	2.5	11-22-50	J,10	D	106	6	H figure 14.
20H1	Bill Marsh	P,170	Dr	320	6	320											Abandoned; reported black clay entire depth.
20P1	W. M. Hermens	P,185	Dg	27	30	27			Quicksand.	U	4.74	11-22-50	P,5	D	88	2	Pumps dry in summer.
21L1	Bill Marsh	P,180	Dr	220	6-5	220	219	1	Gravel	C	15	1947	J,20	D			Penetrated clay 0–70 ft, black, sticky clay 70–150 ft, whitish clay 150–219 ft, and gravel 219–220 ft.
22G1	A. F. Delplanche	P,185	Bd	45	8	45			Sand	U			J,30	D,S	106	2	Test pumped 50 gpm for 7 hours.
22R1	Martin Vander-Zanden.	P,180	Bd	40	4	38			do	U	7.0	11-24-50	J,10	Irr	88	2	Used for irrigating lawn and garden; water has slight sulfur odor.
23R1	VanDomelen	P,185	Dg	22	48	22	0	22		U	4.1	11-24-50	P,5	D,S	116	7	

24C1	A. Griffing	P,195	Bd	57	12	57	----	----	Sand	U	2.0	11-24-50	----	Irr	----	----	
25A1	Clarence Rice	P,185	Bd	60	8	50	40	20	--do--	U	3	3- -51	J,50	Irr	----	----	Water used for irrigating 14 acres; reported 40 ft of clay above aquifer.
26G1	Dale Sheller	P,190	Dg	22	36	22	----	----	----	U	3.59	11-24-50	P,3	D,S	133	8	
27G1	A. F. Steinke	P,150	Dr	101	6	85	95	6	Pea gravel.	C	20	11- -50	J,10	D,S	98	4	Some iron in water at 101 ft; materials penetrated were sand to 75 ft, cemented gravel 75–95 ft, pea gravel 95–101 ft.
28K2	J. N. Jepson	P,180	Bd	54	12	54	----	----	Silt	U	4.87	11-29-50	J,5	D	164	4	W.
29M1	M. C. Mathison	P,180	Dr	125	6	125	103	22	Gravel and silt.	C	20	8- -50	J,20	Irr	----	----	Water reported to contain much iron.
30D1	George Spiesschaert.	P,180	Bd	73	12	70	70	3	Sand	C	----	----	J,20	D,S	106	16	
30L1	Rod Vander-Zanden.	P,170	Dr	195	6	----	----	----	--do--	C	66	8- -50	P,15	Irr	68	5	W; water carries sand and contains iron.
30L2	----do----	P,170	Bd	32	12	32	----	----	Silt	U	5.08	11-29-50	J,5	D	180	12	W.
31G1	H. D. Stites	P,185	Dr	119	6	119	106	13	Gravel	C	----	----	J,20	Irr	----	----	Water used for irrigating 7 acres; materials reported as clay, silt and sand to 106 ft.
32B1	G. L. Moeller	P,175	Dg	25	36	25	----	----	----	U	3.6	11-27-50	J,20	D	190	4	
32P1	Masonic and Eastern Star Home.	P,175	Dr	177	10-8	177	141	5	Gravel	C	25	1929	J,60	Irr	224	4	Well 22 of Piper (1942); lower 50 ft of 8-inch casing perforated; pumped 50 gpm with 5 ft dd.
32P2	Fowles	P,175	Dr	288	12	----	----	----	Sand	U	23.22	12-13-50	----	Irr	----	----	Ca; originally owned by Hillsboro.
34M2	Arrow Meat Co	P,175	Dr	100	6	100	97	3	Sand and gravel.	U	----	----	----	Ind	----	----	Replaced 65-foot well that pumped sand. Nearby 1,000-foot well did not reach bedrock basalt.
35M1	Vincent Henrich	P,150	Dr	72	6	62	62	10	Sand	U	20	8- -48	J,10	S	174	10	Water irrigates lawn and garden.
35P1	Fred Gordon	P,160	Bd	65	6	45	50	15	--do--	U	----	----	J,20	Irr	----	----	Water used for irrigating lawn, garden and 2 acres of pasture.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Thickness (feet)	Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardnes as $CaCO_3$	Chloride	Remarks
	T. 1 N., R. 3 W.—Continued																
36R1	Birdseye Cannery	P,185	Dr	50	12	----	----	----	Sand	U	12.85	12- 5-50	N	----	106	3	Not used; insufficient water.
36R2	----do	P,185	Dr	171	12	----	----	----	--do	U	10.14	12- 5-50	N	----	124	17	H figure 13.
36R3	----do	P,185	Dr	1,619	18	----	170	5	Sand and gravel.	U	----	----	----	----	----	----	L; well 23 of Piper (1942); casing removed; only water was at 175 ft.
	T. 1 N., R. 4 W.																
1C1	Ray Dierickx	P,190	Dr	239	6	239	139	100	Sand(?)	C	13	2- -51	J,10	D,S	72	4	Bailed 15 gpm with a 55-ft drawdown.
3B1	Henry W. Stafford	S,360	Dr	57	6	----	----	----	--do	U	40.75	12-13-50	N	----	----	----	Never used; water from nearby spring has hardness of 10 ppm and chloride of 3 ppm.
3R1	Wayne Hensley	P,175	Dr	341	6	311	309	32	Basalt	C	F	12-13-50	J,15	D,Irr	56	4	Flowing 25 gpm; materials reported as sand, clay, and gravel to 309 ft; temp. 56°.
5K1	A. B. Dober	U,710	Dr	167	6	124	----	----	--do	U	100	12- -50	P,5	D	6	4	Believed to have entered top part of basalt.

5M1	Lars Larson	P,290	Dr	417	8	100	0	30	Gravel	U	----	----	J,10	D	----	----	Casing pulled back to 30 ft; reported 387 ft of shale (dry) below aquifer.
6G1	Emil Jossy	P,300	Dr	75	6	----	----	----	do	U	5	12- -50	P,10	D,S	62	6	
7C1	Albert Jesse	S,350	Dr	38	5	36	34	4	do	U	15.54	11-17-51	J,10	D	20	4	Water becomes cloudy after a rain.
8M1	Tom Heisler	P,300	Dg	15	12	----	----	----	Gravel(?)	U	6.2	11-29-50	C,5	D	40	6	
9M1	Jennsen	S,240	Dr	212	6	212	----	----	Fine sand.	C	F	12- 4-50	P,15	D,S	----	----	Started flowing 4 or 5 years after drilling in 1929.
10A1	John C. Aydelott	P,170	Dr	211	6	211	200	11	Sand	C	F	12-13-50	J,10	D,S	78	4	Flowing ½ gpm; clay 0–200 ft; temp. 54°.
11D1	Vernon Lyda	P,175	Dr	410	6-4	356	356	54	Basalt	C	F	4- -53	N	D	----	----	Flows 10 gpm.
12A1	Lester Susbauer	P,185	Dr	260	6	----	----	----	----	C	F	11-21-50	J	D	62	5	Flows when not used; some iron reported in water.
12Q1	Agnes Malensky	P,175	Dr	240	6	----	----	----	----	C	F	11- -50	P,5	D,S	27	4	Flow ½ gpm when not in use.
14B1	L. J. Heesacker	P,165	Dr	585	6	380	500	79	Basalt	C	F	11-29-50	J,25	D,S	74	4	L; flows 8 gpm; temp. 56°.
14J1	Ernest Heesacker	P,170	Dr	260	6	----	----	----	----	C	F	----	N	N	----	----	Capped; reported "saline" water.
14J2	do	P,170	Dg	60	12-36	----	----	----	----	U	7.9	11-29-50	P,10	D	66	9	
14L1	George Hostyneh	S,180	Dr	420	6	237	363	57	Basalt	C	F	11- -50	J,10	D,Irr	58	4	Drill penetrated wood at 137 ft; 225 ft of clay above aquifer; flows 2 gpm.
14P1	N. S. Willis	S,185	Bd	85	6	85	----	----	----	U	----	----	J,10	D,S	92	8	Gravel packed on outside of casing 15–85 ft.
14Q1	R. Lepschat	S,170	Dr	132	6	----	----	----	Sand and silt.	C	F	11- -50	J,10	D,S	58	4	Flows 3 gpm; temp. 58°.
15C1	B. W. Gent	S,175	Dr	343	6	324	323	23	Basalt	C	F	12- -50	N	D,S	84	4	Flows 8 gpm and has 57 ft of pressure head; yield reported same with 200-ft drawdown.
21C1	George McDonald	S,255	Dr	201	6	36	36	165	do	C	----	----	J,10	D,Irr	5	12	Water reportedly has sulfur taste.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
	T. 1 N., R. 4 W.—Continued																
23R1	Arnold Goff	S,245	Dr	301	6	165	261	1	Basalt	C	F	11- -50	T,35	Irr	38	2	Ca, L; flows 15 gpm; test pumped 35 gpm with dd 166 ft below surface.
24D1	M. H. Lull	P,180	Dr	173	6	115	----	----	Silt	C	F	----	J,10	Irr	----	----	Flows in winter; water level about 12 ft in summer.
26J2	Frank Russel	S,250	Dr	57	6	----	----	----	----	----	----	----	J,8	D	16	3	Water contains iron; supplies three houses.
35F1	E. A. Rueter Est.	S,200	Dr	225	6	158	140	1	Rock (shale)	U	----	----	T,5	D	60	4	Readily pumped dry; casing perforated 138–158 ft.
	T. 1 N., R. 5 W.																
1R1	John Wilson	S,460	Bd	47	12	47	30	17	Soapstone (shale)	U	32	11- -51	J,15	D,S	----	----	Readily pumped dry in summer.
12Q1	F. S. Rohr	U1,100	Dg	50	22	----	40	10	----	U	----	----	P,3	D	16	4	Do.

T. 2 N., R. 1 W.

31L1	Alex Linden ------	S,600	Dr	156	6	52	101	55	Basalt --	U	102	9- 5-51	P,8	D	138	6	Reported 45 ft of clay and 10 ft of hard rock just above aquifer.
31M1	L. Stieger ----------	U,745	Dr	592	6	100±	-----	-----	--do----	P	300	1951	P,8	D	120	6	
31Q1	Plainview School ---	S,710	Dr	417	8	70	256	161	--do----	U	332	1938	P,10	D	134	5	L; supplies water for two families.

T. 2 N., R. 2 W.

20A1	Otto Solberger -----	U,910	Dr	545	6	----	-----	-----	--------	---	-----	--------	----	----	---	-----	L; well destroyed.
20A2	----do-----------	U,910	Dg	88	40	12	81	7	Basalt --	U	65.5	8-24-51	J,5	D	80	4	
22K1	Glen Minshall -----	U,980	Dr	140	6	10	-----	-----	--do----	P	-----	--------	P,3	D,S	36	4	
22M1	C. Christiansen ----	U,830	Dr	200	6	----	170	30	--do----	P	-----	--------	P,5	D,S	138	5	Entered basalt at 100 ft.
23P1	J. S. Harris -------	U,930	Dr	200	6	----	-----	-----	--------	---	-----	--------	P,5	D,S	---	-----	
24M1	Bessie M. Flanegan.	U,975	Dr	150	6	77	-----	-----	Basalt --	P	-----	--------	P,5	D	104	7	
25N1	W. L. Nelson ------	U,720	Dr	110	6	----	-----	-----	--------	U	-----	--------	J,8	D,S	52	5	Readily pumped dry; water sometimes has a reddish color.
26B1	E. T. Folkenbergh -	U,930	Dr	86	6	----	80	6	Basalt --	P	-----	--------	J,5	D,S	30	3	
27E1	Joe Meyer --------	U,810	Dr	200	6	----	-----	-----	--------	---	-----	--------	P,5	D,S	82	6	Water sometimes has a reddish color.
27Q1	C. Ritter ----------	U,780	Dg	90	48	90	-----	-----	--------	U	54.4	8-29-51	P,5	D,S	104	5	
28E1	G. A. Weisenbach --	U,730	Dr	180	6	80	80	100	Basalt --	P	90	1951	P,5	D,S	70	4	
29N1	H. Brewer --------	S,210	Dg	45	48	----	-----	-----	--------	U	-----	--------	P,3	D,S	58	6	Yield is small.
29R1	I. W. Lucas -------	S,400	Dr	154	6	----	104	2	Basalt --	U	-----	--------	---	----	---	-----	Entered basalt at 70 ft; small yield.
30J1	W. H. Wainscott ---	P,165	Bd	55	6	45	40	15	--------	U	5	1951	J,5	D	94	4	
31K1	John Vanmoock ----	S,210	Dr	157	4	157	127	30	Basalt --	U	7	1951	P,5	D	70	4	Reported 127 ft of clay overlying aquifer.
32L1	Walter VanDer-Zanden.	S,225	Dr	625	8	300	-----	-----	--------	C	38.7	9- 3-52	N	----	---	-----	Shells found in blue shale at 625 ft.
33G1	Ed Meyer ---------	S,480	Dr	346	8	256	256	90	Basalt --	U	120	1951	P,8	D,S	---	-----	
33N1	Emile York -------	S,345	Dr	130	4	----	130	20	--do----	C	65	1942	P,5	D,S	88	4	Reported 160 ft of clay above aquifer.
34G1	Jim Dixon ---------	U,535	Dr	156	6	----	152	2	--do----	C	-----	--------	P,8	D,S	---	-----	Entered rock at 70 ft.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitued (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 2 N., R. 2 W.—Continued								
34R1	Ed Meier	U,550	Dr	370	6	----	----	----	Basalt	C	60	1951	P,8	D,S	98	5	Water sometimes has a reddish color.
35A1	G. W. Bentley	S,450	Dr	23	6	5	5	19	--do--	U	----	----	J,5	D	72	4	
									T. 2 N., R. 3 W.								
2P1	John Hurnesh	U1,175	Dg	65	60	65	----	----	Basalt	P	15	1- -51	J,10	D	14	8	
4F1	Bradford Fowles	P,350	Dr	61	6	57	50	11	----	C	9	1953	----	D	----	---	Aquifer reported as "sand-stone."
10Q1	N. H. Welch	S,585	Dr	500	6	300	300	200	Basalt	C	----	----	P,10	D	70	4	
11F1	Jack Ness	U1,175	Dg	78	54	0	----	----	Silt	P	48	6- -50	J,5	D	14	4	Water level reportedly 68 ft in August 1950; pumps dry in summer.
11G1	Charles Adams	U1,050	Dg	32	60	0	----	----	Basalt	P	58.63	1- 9-51	B	D,S	9	6	W.
12N1	A. A. Griffels	U,970	Dg	83	48	83	0	83	--do--	P	----	----	P,3	D,S	12	5	
14J1	O'Connor and Corriery.	U,800	Dr	165	6-5	165	160	5	--do--	C	87.84	1- 6-51	P,5	D	100	4	W; casing perforated 152–165 ft.
15K1	Chris Johnson	S,250	Dg	25	36	25	0	25	Sand and gravel.	U	----	----	P,1	D	----	---	
15N1	D. Denison	P,215	Dr	89	8	88	88	1	Gravel	C	7	8- -50	P,20	D,Irr	48	12	Yields 20 gpm with 40 ft of dd; used for irrigating 2 acres.

16A1	Dennis Hall	P,275	Dr	150	6	33	34	21	Gravel and boulders.	U	5.3	1- 3-51	---	Irr	---	---	W; material 55–150 ft possibly marine shale. Used for irrigating about 1 acre.
16H1	J. H. Powers	P,225	Dr	65	8	65	---	---	---	U	40	8- -47	J,5	D,S	94	12	
19Q1	Hubert Davies	S,680	Dr	260	6	---	---	---	---	---	---	---	---	---	---	---	Dry hole; "basalt" at 80–90 ft; "sandstone" from 200–260 ft.
22E1	S. A. Appleton	S,200	Dr	300	6	208	280	20	---	---	8.4	4-19-51	J,5	D	---	---	Aquifer reported as "sandstone".
23E1	Martin Stadelman	S,380	Dr	275	4	125	125	150	---	C	40	1951	P,10	D.S	62	3	Reported 125 ft of clay above aquifer called sandstone.
24P1	A. M. Anderson	S,640	Dr	457	6	201	201	4	Basalt	C	---	---	P,5	D,S	158	5	L.
25J1	Roy Bills	S,460	Dr	140	6	122	90	32	do	C	30	10- -50	J,15	D,S	64	4	Water has a reddish color during times of little pumpage.
25M1	Fred Miller	S,240	Dr	80	6	79	79	1	do	C	F	1- 9-51	T,25	D,Irr	70	4	Flows about 3 gpm; used for irrigating 8 acres of pasture.
25P1	Charles Huber	S,325	Dr	177	6	170	170	7	do	C	35	1951	P,5	D	80	5	Water contains some iron.
27K1	G. C. Connelly	P,185	Dr	86	6	85	85	1	do	C	2.89	3-16-51	P.6	D	130	9	H figure 9; produces about 6 gpm with 8 ft dd.
27L1	C. B. Henderson	P,200	Dg	54	48	35	0	35	Alluvium	U	---	---	J,15	D,S	146	6	Inadequate during dry season.
29J1	Schlegel Bros	U,450	Dr	622	6	---	---	---	---	U	250	1950	---	N	---	---	Produced 35 gpm; not used because of high lift.
31R1	David Vandehey	P,205	Dr	55	6	55	---	---	---	U	13	10- -48	C,3	D	58	4	Casing perforated from 15–55 ft; 18-inch drill hole, gravel packed.
32B1	W. H. Rufner	P,200	Dr	150	6	140	140	10	Sand	C	F	1- 3-51	J,10	D,S, Irr	58	4	Flows about 8 gpm; clay for 140 ft above aquifer.
32J1	Rieben Bros.	S,200	Dr	160	6	---	---	---	do	C	18.64	11-22-50	J,5	D,S	58	3	
36A1	J. Ryan	S,350	Dg	60	36	2	---	---	Rock	U	40.07	11- 8-51	J,5	D	72	13	Easily pumped dry in summer.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurence	Water Level: Fleet below or above (+) land surface	Water Level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 2 N., R. 4 W.								
4E1	R. B. Powers	S,290	Dg	30	48	----	----	----	--------	U	8.21	12- 8-50	P,4	D	28	7	Water level low in September.
4P1	Sun Valley Gas Station.	P,250	Dr	100	8	----	----	----	Gravel	C	------	-------	J,10	D,Ind	102	3	Water is slightly murky.
5H1	McCall	P,270	Dg	16	36	16	0	16	Alluvium	U	3.77	12- 8-50	P,5	D,S	90	6	
10F1	----------	S,320	Dg	22	48	22	0	22	do	U	2.22	12- 8-50	J,5	D,S	10	4	Water level low in summer.
14L1	----------	P,220	Dg	14	36	14	0	14	do	U	5.6	12- 8-50	C,5	D	10	3	
15B1	N. H. Baker	P,240	Dg	18	48	18	0	18	do	U	8.18	12- 8-50	----	D	20	6	
24D1	Charles Schmidlin	S,210	Dg	37	48	37	0	37	do	U	0.00	12- 8-50	N	N	---	---	
26E1	Morgan Brothers	U,420	Dr	396	6	----	----	----	--------	C	156.5	12- 8-50	P,5	D,S	70	4	Pentrated log at 200 ft, aquifer called "sandstone."
26E2	do	S,415	Dg	34	36	----	----	----	Colluvium.	U	8.16	12- 8-50	N	N	6	5	Water level low in late summer.
33G1	Julius G. Winterfield.	S,240	Dr	116	8-6	116	95	21	do	C	60	1950	J,15	D,S	90	3	Bottom 25 ft of casing perforated.
35A1	Noby Eberly	S,280	Dg	200	48	N	----	----	do	U	24.30	12- 8-50	B	D	13	3	
35A2	William Eberly	S,280	Dg	68	48	----	----	----	do	U	21.0	12- 8-50	B	D	20	4	
35E1	W. C. Weber	S,250	Dr	305	6	----	----	----	Basalt	C	50	1950	P,5	D,S	52	3	

T. 1 S., R. 1 W.

1B1	Thompson Nursery	U,895	Dr	402	8	116	370	32	Basalt	C	30	1951	50	D,Irr	---	---	Materials penetrated were soil 0–21 ft; Boring lava 21–40 ft; clay (Troutdale formation) 40–114 ft; Columbia River basalt 114–402 ft.
1Q1	Sunnyslope Cemetery Assoc.	S,700	Dr	900	8	---	---	---	---	---	---	---	---	---	---	---	"Dry" hole.
2J1	J. R. Dant	S,530	Dr	904	8	777	885	16	Basalt	C	341.0	4-10-53	T, 100	Irr	---	---	Water level measured with air line; when drilled April 10, 1942, water level was 322 ft. Rock entered at 774 feet.
2L1	J. Peterkort	S,415	Dr	580	8	---	---	---	---	C	120	1951	T, 100	Irr	64	5	Water also used for irrigation in greenhouse.
2L2	do	S,425	Dr	208	8	50	---	---	Boring lava.	C	140	1951	T, 50	Irr	72	5	Do.
2P1	Commonwealth, Inc.	S,420	Dr	875	8-6	728	854	18	Basalt	C	235.99	11-12-53	N, 175	Irr	---	---	L; test pumped 175 gpm with 68 ft dd; temp 59°.
3J1	J. Peterkort	S,375	Dr	292	6	227	---	---	Boring lava.	C	---	---	T,25	D	---	---	Previously drilled to 170 ft; no additional water 170–292 ft.
5J1	Windolph	P,190	Dr	165	6	---	---	---	Sand	C	---	---	J,10	D,S	144	10	
5L1	R. R. Cornelius	P,225	Dr	195	6	195	---	---	do	C	---	---	P,8	D	288	5	Water occasionally carries sand.
5L2	Gus Draheim	P,225	Dg	22	48	---	---	---	---	U	15	9- -50	J,5	D	334	13	
6B1	L. C. Houk	P,195	Dg	27	60	27	0	27	Alluvium	U	6.4	4-20-51	C,5	D	122	6	
6F1	Alan Moore	P,200	Bd	70	12	70	61	9	Sand	U	2.7	4-20-51	J-25	Irr	230	6	Gravel packed; water used for greenhouse irrigation.
6G1	J. A. McKnight	P,205	Dr	380	6	360	---	---	do	C	---	---	J,5	D	264	7	Small supply of water.
7A1	N. Bue	P,200	Dr	120	6	---	---	---	Sand	U	---	---	J,8	D,Irr	208	8	
10F1	Dan Ryan	S,235	Dr	70	6	---	---	---	---	---	40.15	9-28-51	J,8	D,Irr	138	3	
10G1	D. Hirschberger	S,230	Dr	500	6-4	500	485	10	Basalt	C	75	4- -49	---	D	---	---	Reportedly 485 ft of clay above aquifer.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
	T. 1 S., R. 1 W.—Continued																
10H2	Ivan Clark	S,245	Dr	468	4	464	460	8	Basalt	C	101	1946	10	D	---	---	Dd 34 ft while bailing 10 gpm.
11L1	City of Beaverton	S,350	Dr	735	10-8	610	650	85	do	C	174.98	1-29-54	T,420	P,S	95	48	L; City well no.1.
11Q1	M. B. Hinds	P,270	Dr	415	6	401	---	---	---	---	---	---	---	---	---	---	Materials penetrated were clay and sand to 401 ft, and basalt 401–415 ft; bottom of casing deformed while blasting rock to straighten hole; well destroyed.
12N1	Allen	S,300	Dr	480	6	420	420	60	Basalt	C	90	7- -49	---	---	---	---	Dd is 200 ft after 1 hour bailing 30 gpm.
14H1	Jesuit High School	P,245	Dr	1,080	---	---	770	310	do	C	10	8-18-58	---	---	---	---	Hit basalt bedrock at 707; best water zones in rock at 750 and 850 ft. Tested at 190 gpm with 250 ft dd.
14K1	Kieser Engineering, Inc.	S,265	Dr	102	6	102	---	---	Silt and sand.	C	---	---	J,25	---	---	---	
14Q1	Denny	S,255	Dr	76	6	76	---	---	do	C	---	---	P,10	D	120	5	
15G1	O. R. Nicholson	P,185	Dr	90	8	---	---	---	---	C	11.15	8-22-51	P,8	D	148	12	Supplies three families.

15K1	Southern Pacific Co.	P,180	Dr	390	8	-----	-----	----	Sand-----	C	F	3- -48	-----	N	40	16	Ca.
16A1	Horseradish Processing Co.	P,190	Dr	340	8	340	313	27	Silty sand	C	35	5- -50	10	Ind	---	-----	Pumped 15 gpm with 110 ft dd; materials reported as sand and clay entire depth; well deepened after unsupported aquifer (sand) at 103 ft depth collapsed.
16M1	Carmen Gallucci---	P,210	Dr	310	6	297	189	121	Sand------	C	20	1945	J,10	D	170	4	Drilled through layers of fine sand and clay for entire depth.
16N1	Harry Hanson -----	S,225	Dr	64	8	63	63	1	Gravel----	C	30.8	5-11-51	J,5	D	118	9	Reported clay and sand above aquifer.
17A1	St. Mary's of the Valley Academy.	P,205	Dr	220	8	-----	215	5	Sand------	C	56.9	5-14-51	T,30	Irr	---	-----	Bailed at 25 gpm with 35 ft dd; one of three similar wells; pumped sand; destroyed in May 1954.
17A2	----do-----------	P,205	Dr	1,507	8 6	700 1100	1,270	235	Basalt ----	C	17.65	1-18-54	----- 115	N	740	960	Ca, L; water sample taken when well was 1,374 ft deep.
17H1	C. J. Redfield -----	P,200	Dg	20	36	20	-----	----	Sand------	U	6.05	5-11-51	P,3	D	---	-----	
17L1	L. F. Pike --------	P,210	Dr	90	6	-----	-----	----	----------	---	------	--------	J	D	134	17	
17R1	Moe Gollock-------	P,225	Dr	222	6-4	222	220	2	Sand------	C	41.95	5-11-51	T,10	D	160	50	Caved after being improperly finished in sand at 95 ft; drilled to deeper sand; casing perforated 218–22 ft.
17R2	E. P. Headberg ----	P,230	Dr	101	6	-----	-----	----	Quicksand	C	46.95	5-11-51	J,8	D	146	5	
18J1	L. R. Martyn ------	P,200	Dr	66	6	66	56	5	Gravel----	C	20	4- -51	J,10	Irr	220	7	Reported 56 ft of clay above aquifer; when completed was bailed at 30 gpm; casing perforated 46–66 ft.
18Q1	George Heitzman --	P,245	Dr	101	5-4	101	98	3	Sand and gravel.	C	------	--------	J,8	D	104	6	Reported 98 ft of sand and clay above aquifer; casing perforated 60–68 ft and 94–101 ft.

Table 1.--*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
T. 1 S., R. 1 W.—Continued																	
19A1	Henry Nielson	S,250	Dr	200	6	-----	------	----	---------	---	------	--------	P,8	Irr	100	7	Adequate to irrigate a few acres.
19D1	Paul Leopold	P,235	Dr	127	6	-----	------	----	Sand	C	------	--------	P,5	S	146	8	
19E1	K. Amstad	S,270	Dr	145	6	14	------	----	Rock	C	------	--------	P,10	D,S	100	7	
19J1	Barron	S,300	Dr	312	6	-----	------	----	Basalt	C	100	1- -49	----	---	-----	-----	Reportedly the most productive well in vicinity; has been pumped at 95 gpm.
19R1	Cooper Mountain School Dist. 3.	S,325	Dr	150	---	-----	140	10	do	C	------	--------	3	P,S	-----	-----	
20R1	O. C. Norvell	S,265	Dr	138	---	-----	------	----	---------	---	------	--------	P,8	D	75	10	Water has reddish stain after standing.
21K1	R. M. Steward	S,265	Dr	96	6	45	------	----	Basalt	U	73.04	2- 3-48	J,10	D	70	10	
21P1	City of Beaverton	S,330	Dr	800	16	63	90	760	do	C	155.23	3-12-48	T	P,S	95	26	L; test pumped 950 gpm with dd of 80 ft; city well 2.
21Q1	A. E. Hansen	S,305	Dr	124	6	40	111	13	do	U	99.5	1-20-48	P,8	D	60	10	Inadequate supply of water; well 49 of Piper (1942).
21Q2	Guy Woodworth	S,345	Dr	164	6	162	84	80	do	U	153.16	1-23-48	----	---	70	10	Materials reported as 18 ft of clay and 146 ft of rock.
21R1	Mrs. W. H. Shively	S,290	Dr	141	6	21	------	----	do	U	100.21	2-26-48	P,10	D,S	95	11	H; figure 10.

22F1	Ralph Beck	P,230	Dr	98	6	90	90	8	Sand	C	15	6- -49	J,15	Ind	100	5	Bailed 18 gpm for 2 hours with 55 ft dd.
22K1	Tony Ghiglietti	S,205	Dr	90	6	---	---	---	do	C	29.04	8-23-51	---	N	---	---	Partly filled with sand.
23F2	L. Milne	P,195	Dr	367	6-5	367	358	9	do	C	35	10- -47	P,5	D	140	70	Bailed at 5 gpm for 1 hour with 60 ft dd; casing perforated 346–367 ft; reported 358 ft of clay and sand above aquifer.
23P1	E. B. Helfrich	S,235	Dr	60	4	---	---	---	do	U	---	---	J,8	N	---	---	Can readily be pumped dry.
23P2	do	S,235	Dr	195	---	---	191	4	Basalt	C	---	---	J,8	D,S	---	---	
24D1	Portland Golf Club	P,220	Dr	400	8	---	300	100	do	C	25	5- -36	T,450	Irr	---	---	Used for grounds and pond; well 51 of Piper (1942) temp 56°.
24D2	do	P,230	Dr	515	12	---	---	---	do	C	---	---	---	Irr	---	---	
24D3	do	P,220	Dr	500	14-12	500	410	90	do	C	30.17	4- 8-51	N	Irr	---	---	L; casing perforated 410–430 ft and 460–500 ft; test pumped 1,000 gpm with 190 ft dd.
24F1	Aaron Frank	P,265	Dr	520	8	---	450	70	Basalt	C	53.0	5-14-53	T,500	S, Irr	---	---	W; water contains iron; well 52 of Piper (1942) temp 58°. Entered basalt at 350 ft.
24F2	do	P,220	Dr	800	8	470	470	330	do	C	28.16	6- 4-53	N	N	---	---	Reported 460 ft of clay above basalt; well 53 of Piper (1942).
24N1	M. Murugg	S,245	Dr	200	6	160	160	40	do	C	---	---	P,3	N	---	---	Inadequate supply of water.
25M1	Warren Forsythe	S,200	Dr	253	6	134	236 242	2 11	do	C	14 16	3- -49 11- -60	T,30	D, Irr	152	4	L; used for irrigating 6 acres; yields 105 gpm for 48 hours with 110 ft dd.
26E1	Sawyers, Inc	P,250	Dr	162	12	18	14	148	do	C	---	---	T,300	Ind	---	---	Ca.
26G1	L. E. Byrne	P,230	Dr	70	6	62	48	22	do	C	15	1949	J,8	D, Irr	140	4	Reported 48 ft of clay above aquifer.
26M2	Henry Erickson	S,255	Dr	102	6	20	20	82	do	C	40	1951	J,10	D	130	6	Water reportedly contains some iron.
26Q1	James Gordon	S,250	Dr	128	6	---	28	100	do	C	60	1951	J,5	Irr	120	5	Used for irrigating garden.
27C1	Robert Murphy	P,170	Dr	314	16-8	280	288	15	do	C	F	3- -52	N	N	1,485	1,839	Ca, L; Sealed with cement; temp. 55°.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
	T. 1 S., R, 1 W.—Continued																
27R1	R. J. Thomas	S,200	Dr	124	6	120	120	4	Basalt	C			J,15	D,S	170	8	Water sometimes has a reddish color.
28A1	G. G. Brinsley	S,285	Dr	310	6	234	159	151	do	C	2	6- -43	C,20	D	45	10	Materials reported as clay for 159 ft; hard and soft rock for 151 ft; well 54 of Piper (1942).
28B1	B. F. Blethen	P,275	Dr	105	6	64	90	15	do	C	83.6	1-21-48	P,5	D,S	70	9	Reported 30 ft of clay, 40 ft decomposed basalt, 20 ft hard basalt above aquifer.
28C1	G. C. Carr	S,325	Dr	158	6	20			do	C	139.30	1-21-48	P,2	D,S	50	10	
28G1	Fred Brandt	S,290	Dr	126	6	35			do	C	96	1- -48	J,5	D	60	8	Yield is small; clay 0–35 ft and rock 35–126 ft.
28M1	George Davies	S,280	Dg						Silt	U	11.37	1-27-48	N				Inadequate during dry season.
28M2	do	S,290	Dr	60	6	20			Basalt	U	38.91	1-27-48	J,8	D,S	65	9	Dd 15 ft after 10 minutes pumping 6 gpm.
29P1	Wheeler	S,325	Dr	182	6		175	7	do	C				D			Dd 15 ft after 1 hour pumping 15 gpm; solid basalt entered at 115 ft.

29R1	Adam Miller	S,260	Dr	294	6	279	279	15	Basalt	C	30	1951	P,3	D	84	5	Bailed 3 gpm for 1 hour with 170 ft dd; reported 279 ft of clay above aquifer.
30F1	Reed	S,615	Dr	450	6	----	----	----	do	U	390	7- -50	T,5	D	----	----	
30L1	J. D. Kemmer	U,775	Dr	592	6	----	----	----	do	U	575	5- -51	P,12	D,S	106	6	Reportedly "soft" rock entire depth.
33H1	E. H. Hite	S,230	Dg	40	36	40	----	----	----	U	20	6- -51	P,2	D,S	70	8	
33N1	George N. Clark	S,210	Dr	390	6	383	380	3	Basalt	C	30.85	5-18-52	J,20	D	300	46	L; reportedly bailed 25 gpm for 1 hour with 90 ft dd.
33P1	Kirk Freeman	S,260	Dr	157	----	----	150	7	do	C	142	1949	J,10	D,S	----	----	
33P2	S. J. Dahlen	S,190	Dr	445	6	438	438	7	do	C	F	1949	----	D	----	----	Flows 3 gpm.
34A1	William Robinson	S,170	Dr	60	6	----	----	----	Sand	C	F	6-11-51	J,5	D	334	200	Flows 2 gpm.
34C1	do	S,180	Dg	25	42	----	20	5	Quick sand.	U	20	9- -50	C,5	D	188	53	Water level low in summer.
34C2	do	S,180	Dr	250	6	250	245	5	Basalt	C	F	6- -51	P,10	S	412	450	Flows when not pumped for 3–4 days; water has sulfur taste.
34L1	R. H. Savage	S,230	Dr	90	6	----	----	----	do	C	----	----	J,8	D,S	126	6	
34L2	W. A. Butler	U,240	Dg	20	60	----	----	----	Sand	U	15.92	8-13-51	J,5	D,S	78	9	Readily pumps dry in summer.
35A1	Ben Carsh	P,185	Dr	128	6	30	75	53	Basalt	C	16	1951	J,8	D	162	6	Entered basalt at 14 ft below surface.
35B1	Doty and Dorner Nursery.	P,190	Dr	200	----	----	----	----	do	C	----	----	T,25	Irr	346	120	Used for greenhouse.
36L1	E. C. Hall Co.	S,230	Dr	600	6-4	510	145	3	Gravel	C	----	----	J,10	Irr	----	----	Casing perforated 142–150 ft; penetrated clay 0–145 ft, gravel 145–148 ft, clay 148–412 ft, basalt 412–600 ft; used for irrigating 2 acres of lawn.
36Q1	Schen	S,215	Dr	165	----	----	----	----	Sand	C	----	----	P,8	D	----	----	Clay overlying aquifer.
36Q2	Tower	S,215	Dr	465	6	----	----	----	Basalt	C	----	----	J,15	D	----	----	

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones			Ground-water occurrence	Water level		Type of pump and yield (gpm)	Use	Chemical character (ppm)		Remarks
							Depth to top (feet)	Thickness (feet)	Character of material		Feet below or above (+) land surface	Date			Hardness as $CaCO_3$	Chloride	
									T. 1 S., R. 2 W.								
1H1	E. Beshore	P,175	Dr	198	6	198	50	148	Sand	U	-----	---------	J,25	D, Ind	124	57	Used for potato-processing plant; casing perforated near bottom.
1L1	R. Schoales	P,180	Dg	20	48	20	0	20	Alluvium.	U	5.8	4-17-50	J,3	D	62	8	Water level reported low in dry season.
1N1	A. F. Fisher	P,185	Dr	300	4	---	-----	-----	Sand	C	-----	---------	J,4	D,S	134	5	
2C1	A. Milligan	P,170	Dr	125	6	---	-----	-----	Quicksand.	C	-----	---------	J,3	D	360	104	
2H1	John Walters	P,175	Bd	55	6	52	52	3	Sand	C	20	7- -48	J,5	D	98	4	
2P1	C. W. Sinclair	P,185	Dr	75	6	75	65	10	do	C	34	8- -50	J,5	D	156	4	Reported 40 ft of silt and 25 ft of clay above aquifer; casing perforated 65–75 ft.
3A1	Don Wick	P,170	Dr	115	6-5	115	92	12	Sand and gravel.	C	F	3-30-51	J,3	D, Irr	170	27	Reported 92 ft of sand and clay above aquifer and 11 ft of clay below aquifer; casing perforated 90–115 ft; flows about $\frac{1}{2}$ gpm.
3K1	E. F. Bonegard	P,175	Dr	141	6-5	141	130	11	Sand	C	5	6-29-51	-----	D	----	---	Materials reported as clay and sand entire depth; 5-inch casing perforated 125–141 ft.

3Q1	L. C. Johnson	P,175	Dg	28	40	28	0	28	Alluvium.	U	11.38	4- 3-51	J,5	Irr	142	14	Pumps dry in summer, but reported to recover in 20 minutes.
4B1	Albert A. Lewis	P,175	Bd	55	6	45	35	10	Sand	U	20	7- -50	J,5	D	126	7	
4D1	sawmill	P,180	Dr	30	6	30	---	---	do	U	2.82	3-30-51	J,15	Ind	---	---	Used for filling small mill pond.
4R1	D. O. Kimberling	P,170	Dr	42	6	---	---	---	do	U	---	---	J,10	D	92	6	Water level is low in summer.
5C1	A. Mohr	P,155	Dr	42	6	---	---	---	Quicksand.	U	4.96	3-27-51	J,5	Irr	---	---	
5F2	H. E. Susbauer	P,180	Dr	62	6	62	---	---	do	U	---	---	J,5	Irr	112	7	
5P1	E. Johnson	P,170	Dr	98	6	87	66	32	do	U	15	2- -51	---	S	---	---	Reported clay and sand entire depth.
6A1	Hughes and Son	P,180	Dr	85	6	85	15	70	do	U	10	8- -51	J,5	Ind	154	13	Gravel packed.
6H1	City of Hillsboro	P,178	Dr	200	6	---	---	---	---	---	---	---	---	---	---	---	"Dry" hole; casing removed.
8C1	H. Freudenthal	P,170	Dr	55	12	---	---	---	Sand	U	---	---	J,10	D	160	4	Well caved in; abandoned; nearby 120 ft well also caved.
8C3	do	P,170	Dr	196	10	196	---	---	do	U	20	1953	T, 190	Irr	---	---	Penetrated alternating layers of sand and clay; 20-inch rotary hole gravel packed to surface with 3/4-inch minus gravel around perforated 10-inch casing.
8K1	A. Hornecker	P,155	Dr	32	4	---	---	---	do	U	2.82	2-23-51	J,25	Irr	118	3	W; used for irrigating 10 acres.
8L1	R. M. Alden	P,170	Dr	55	6	43	40	15	do	U	5	9- -50	J,25	Irr	---	---	Used for irrigating 7 acres.
9Q1	Joan Waters	P,160	Dr	39	6	39	---	---	do	U	10	10- -50	J,5	D	60	3	Supplies two families.
10B1	M. Baughman	P,190	Dr	88	6	88	77	11	do	C	---	---	J,10	D	144	3	Ca; reported clay and sand entire depth; casing perforated 77–88 ft.
10F1	Clyde Yount	P,180	Bd	38	6	38	---	---	do	U	4.18	4- 3-51	C,3	Irr	110	4	
10R1	C. C. Johannensen	P,195	Dg	22	42	42	12	10	Quicksand.	U	7.7	4-24-51	J,5	D	100	5	Water level is low in summer and fall.
11F1	Community Water Co.	P,210	Dr	112	6	---	---	---	---	---	---	---	J,25	D	158	3	Used by four families.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 1 S., R. 2 W.—Continued								
11F2	Reedville Dairy	P,200	Dr	100	18 8	77 105	65	32	Sand	U	25	11-30-49	T,50	Irr	----	----	Gravel packed around 18-inch casing; 8-inch casing perforated 65–105 ft; used for irrigating 10 acres; reported clay and sand entire depth.
11R1	A. C. Lange	P,225	Dr	66	4	----	----	----	do	U	----	----	J,5	D	180	4	Reported clay and sand entire depth.
13C1	D. J. Rogers	P,225	Dg	24	36	24	0	24	Alluvium	U	9.42	5- 7-51	N	N	----	----	
13H1	L. Kinnaman	P,225	Dr	93	6	93	92	1	Sand	C	30	9- -50	J,15	D,S	134	6	
13M1	R. A. Ruth	P,195	Dr	185	6	----	----	----	do	C	----	----	J,15	D, Irr	98	6	Ca; water carries much sand.
13Q1	Morrison	P,215	Dr	960	6-4	700	900	60	Basalt	C	3	Reported	T, 100	D,S	100	4	Supplied several farms a few years ago; reportedly drilled in weathered basalt 700–900 ft and basalt 900–960 ft.
14A1	B. J. Kassebaum	P,230	Dr	90	6	----	----	----	----	C	----	----	J,10	D, Irr	146	3	Used for irrigating 1 acre.
14K1	do	P,205	Dr	230	6	215	215	15	Sand	C	30	4- -51	J,20	D, Irr	----	----	Used for irrigating 1 acre; casing perforated 215–270 ft.

14K2	Oscar Hagg	P,195	Dr	225	4	225	225	2	Sand and gravel.	C	-----	--------	J,10	D,S	120	5	Casing perforated 216–225 ft; reportedly test pumped 12 gpm.
14L1	----do	P,195	Dr	735	6	----	-----	----	------	----	-----	--------	-----	----	-----	----	Reported clay and sand entire depth; well destroyed.
15A1	Preston Young	P,205	Dr	90	6	----	-----	----	------	----	-----	--------	J,15	D	190	5	
15R1	Pete Bilos	P,190	Dg	11	----	----	-----	----	Alluvium	U	5.84	4-24-51	J,5	D	122	5	
16M1	Albert Geener	P,155	Dg	32	48	32	-----	----	Sand	U	3	2- -51	J-15	D,S	164	11	
17C1	R. J. Perkins	P,175	Dr	55	6	45	45	5	--do	U	20	10- -46	J,5	D, Irr	68	4	Pump tested at 16 gpm for 2 days.
18L1	R. J. Maier	P,180	Dr	145	6	144	140	4	Sand and gravel.	C	-----	-------	J,15	D	180	3	Reported 140 ft of sand, silt and clay above aquifer; bailed 10 gpm for 1 hour with 144 ft dd.
18P1	Louis Malensky	P,185	Dr	70	6	----	-----	----	Sand	U	3.6	1-30-51	J,50	Irr	153	2	W; used for irrigating 8 acres.
19A1	Louis Hilleke	P,185	Dr	903	10-4	269 822	232 822	37 81	--do Basalt	C	40 21	9-23-50 1953	T, 100	Irr	-----	----	Ca, L; test pumped 100 gpm for 1 hour with 200 ft dd; casing perforated 232–269 ft.
19K1	R. C. Enschede	P,150	Dg	23	40	22	-----	----	Sand	U	10.8	2-26-51	C,5	D	36	3	
20A1	J. W. Wolf	P,170	Dg	37	36	----	-----	----	--do	U	4.05	2-26-51	J,5	D	132	7	H figure 9.
20P1	John Kamna	P,180	Dr	450	10	140	140	310	Basalt	C	11	11- -53	N, 100	Irr	-----	----	Reported 140 ft of clay above aquifer; test pumped at 100 gpm with 150 ft dd.
20Q1	Ole Erickson	P,180	Dg	20	48	----	-----	----	Quicksand.	U	-----	-------	J,5	D,S	178	7	Water level is low in fall.
20Q2	John Cavanaugh	P,180	Dr	425	10	172	-----	----	Basalt	C	80	9- -55	N, 100	Irr	-----	----	Reported 170 ft of sand and clay above aquifer.
21H1	O. Slater	P,160	Dg	24	48	----	-----	----	Alluvium	U	15.6	2-27-51	J,5	D	82	5	H figure 9.
21H2	E. F. Gonty	P,150	Dr	780	----	----	-----	----	Sand	C	-----	--------	-----	----	-----	----	Ca; water-bearing sand at 175, 300, and 780 ft; all water reported unfit for human consumption or irrigation; well destroyed
21H3	----do	P,150	Dg	20	48	----	-----	----	Alluvium	U	-----	--------	J,3	D	-----	----	Ca.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 1 S., R. 2 W.—Continued								
22G1	Jose Churchley	P,190	Dr	85	6	85	------	----	Sand	C	16	1946	J,5	D	212	5	Water has reddish color; reported sand and clay entire depth.
22M1	O. G. Grove	P,180	Dr	106	6	100	100	6	do	C	------	--------	J,15	D	194	3	Water reported to carry sand when pumped heavily.
23C1	A. O. Neal	P,215	Dr	165	6	----	------	----	Gravel	C	------	--------	J,5	D	128	5	
23E1	Santoro Brothers	P,180	Dr	175	6	----	------	----	Sand	C	------	--------	J,10	D,S	182	5	
23F1	R. H. Kincheloe	P,190	Dr	300	8	----	------	----	Basalt(?)	C	47.4	4-24-51	P,10	D,S	76	6	Water reported to contain iron.
23Q1	L. W. Taute	S,255	Dr	115	6	65	65	50	Basalt	C	60	6- -49	J,10	D	68	6	Test pumped 20 gpm for 1 hr with 100 ft dd.
23Q2	Santoro Brothers	S,215	Dr	139	12	42	------	----	do	C	F	11- -52	----	Irr	124	4	Entered basalt at 40 ft; test pumped 220 gpm.
24H1	C. W. Koch	S,225	Dr	214	4	210	210	4	do	C	------	--------	J,8	Irr	102	5	Penetrated 210 ft of brown clay above aquifers; used for irrigating garden.
24H2	W. A. Hayes	S,240	Dg	49	36	----	------	----	do	U	38.56	5- 7-51	P,5	D	108	11	
24J1	A. D. Keller	S,285	Dr	140	6	130	130	10	do	C	------	--------	P,5	D	102	5	
24J2	M. Falb	S,310	Dr	220	4	----	------	----	do	C	------	--------	P,10	D	80	5	
24J3	Aloha-Huber Water Dist.	S,320	Dr	720	16-10	250½	**250**	444	do	C	138	7-18-58	T,500	P,S	----	----	L; Temp 55°.

24M1	George Altishin	S,330	Dr	180	6		110	70	do	C	90	1951	P,10	D,S	124	6	Aquifer is alternating hard and soft rock.
25F1	O. Pierson	S,600	Dr	459	6	18	444	15	do	U	444	7- -41	P,10	D	84	6	Supplies two families.
25J1	Jane S. Hackman	U,765	Dr	9,263	20-7	7,862							N	N			Ca, L; drilled as oil test.
25K1	R. Ferrier	U,740	Dr	662	6	47	560	102	Basalt	U	542	7- 1-58		D			
25M1	A. Gronlund	S,600	Dr	600	6	15	390	210	do	U			P,20	D	82	7	Supplies five families; entered rock at 10 ft.
25N1	Fred Kelly	S,525	Dr	345	4		335	10	do	U			P,5	D,S	92	6	Reported to have penetrated 2 ft top soil, 343 ft hard and soft rock.
26A1	R. H. Jenkins	S,460	Dr	400	6		270	130	do	U			T,40	D, Irr	122	19	
26L1	J. K. Frazer	S,275	Dr	145	8				do	C			P,20	D,S	80	6	Drilled in rock 10–145 ft.
26M1	W. P. Brisbine	P,215	Dr	90	6	29	89	1	do	C	20.[illegible]	4-25-51	J,10	D	114	4	Penetrated clay to 22 ft and rock 22–88 ft.
27J1	A. VanPoucke	S,190	Dr	95	6		60	35	Basalt(?)	C			J,10	S	130	5	Reported 60 ft of clay above aquifer.
27K1	Edwin C. Lux	P,185	Dr	90	6	50	50	40	Basalt	C	12	3- -51	T,10	D	122	5	Pumped 10 gpm for 24 hours with 60 ft dd.
27L1	E. H. Butcher	P,185	Dr	365	4	350	350	15	Sand	C	19.97	4-24-51	J,5	D	78	8	H figure 9; water obtained near top of basalt bedrock.
27P1	N. M. Prodehl	P,185	Dr	60	6				do	U			J,10	D	140	8	
28H1	G. E. Garrison	P,175	Dg	24	4	24			do	U	7.55	4-24-51	C,5	D,S	84	11	W.
28P1	C. Rosenow	P,165	Dr	400	6	371	302	33		C	22	8- -37	P,10	D,S	74	17	Sand and clay entire depth.
29C1	E. Lorenrehse	S,205	Dr	102	6	40	90	12	Basalt	C	27	4- -51	J,10	D	130	7	Entered rock at 30 ft below surface.
29P1	W. Schallberger	P,165	Dr	750	6		450	300	do	C	F	2- 9-51	J,50	D	168	38	Had 18 ft shut-in presure when drilled; test pumped 600 gpm with less than 30 ft dd.
29Q1	W. T. Putnam	P,155	Dr	505	6	445	445	60	do	C	F	2-27-51	C,50	D,S	162	4	L; reportedly flows 100 gpm.
30C1	E. Burkhalter	S,170	Dr	99	6	5	73		do	C	15	1- -51	P,15	D,S	118	17	
30N1	R. H. Schnoor	P,180	Dr	60	6				Sand	U			J,5	D	118	3	Water has a yellow color.
30R1	S. Dalby	P,155	Dr	373	6		353	20	Basalt	C	F	2- 9-51	J,10	D	168	29	Water flows 3 gpm.
31C1	C. E. Asbahr	P,175	Dr	715	6	266	266	449	do	C	2.5	11- -49	C, 300	D, Irr	144	11	Ca, L; used for irrigating 30 acres.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zones or zones: Depth to top (feet)	Water-bearing zones or zones: Thickness (feet)	Water-bearing zones or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 1 S., R. 2 W.—Continued								
31F1	Julius Christenson	P,175	Dr	620	6	425	425	195	Basalt	C	5	7- -50	J,20	D	2	3	Reported 364 ft of sand and clay, 256 ft of rock.
31H1	J. C. Jones	P,160	Dg	27	60	27	----	----	Sand	U	10.06	2- 9-51	J,3	D	68	7	W.
31R1	F. O. Erickson	P,170	Dr	578	6	463	463	115	Basalt	C	F	2- 8-51	J,30	D	100	4	Supplies two families; reported 464 ft of clay and sand above aquifer; flows about 3 gpm.
32D1	Edwin Jesse	P,140	Dr	330	6	----	----	----	do	C	F	2- 9-51	J,10	D	142	23	Flows about 3 gpm.
33A1	Emily Boge	P,175	Dg	19	72	19	0	18	Alluvium	U	6.63	4-24-51	P,5	D	----	----	
33C1	Loyal Davis	P,175	Dr	345	6-4	319	340	5	Sand(?)	C	5	8- -37	P,3	D	74	17	Tested 3 gpm with 217 ft dd.
33E1	Lloyd Bellamy	P,150	Dr	375	6	355	365	10	Basalt	C	22.3	4-24-51	J,10	D,S	56	11	Well flowed ½ gpm in 1937; bailed 20 gpm with 180 ft dd.
34C1	F. M. Thomas	P,185	Dr	640	12-6	610	600	40	do	C	3.13	4-20-54	----	----	----	----	Reportedly test pumped 75 gpm with 210 ft dd.
34E1	W. F. Gembella	S,170	Dr	113	6-5	113	80	30	Gravel	U	4	2- -51	J,5	D,S	80	5	Reported 80 ft of sand above aquifer; casing perforated 96–113 ft.

35D1	C. J. Wollertz	S,235	Dr	55	4	20	54	1	Basalt	C	32.57	5- 9-51	J,10	D,S	82	6	
35N1	Ann Algesehimer	P,175	Dr	200	6	----	----	----	Basalt(?)	C	2.43	5-14-51	J,5	D,S	118	6	
35N2	----do	P,175	Dg	23	36	23	0	23	Alluvium	U	8.11	5-14-51	N	N	----	----	Barely adequate in summer; replaced by drilled well.
35P1	E. L. Cox	P,185	Dr	86	4	27	----	----	Basalt	C	----	----	J,8	D	----	----	
36D1	William Wenzel	S,410	Dr	222	6	20	----	----	--do	U	170	1950	P,10	D,S	106	5	
									T. 1 S., R. 3 W.								
2B1	A. Hadley	P,180	Dg	28	36	28	20	8	Quick-sand.	U	1.0	3-14-51	J,10	D,S	44	7	
2G1	W. F. Robinson	P,180	Dr	101	6	98	98	3	Sand and gravel.	C	35.74	3-14-51	J,15	D,S	82	5	
4H1	J. F. Sunko	P,160	Bd	50	12	50	----	----	Sand	U	0	3- -51	J,15	Irr	----	----	Water level in summer is about 5 ft below surface; water used for irrigating $1\frac{1}{2}$-acre nursery.
4Q1	D. W. McBeth	P,155	Dr	120	6	120	114	6	Gravel	C	12	3- -51	J,15	D,S	86	5	Used for irrigating garden.
5C1	W. E. Stevens	P,170	Dr	130	6	126	126	4	--do	C	30	11- -50	J,15	Irr	----	----	Bailed at 30 gpm with 35 ft dd.
5F1	West and Scott	P,165	Dr	112	6	112	96	16	--do	C	14.58	3-14-51	T,30	D, Irr	293	2	Ca; used for irrigating 5 acres of pasture.
8L1	J. W. Nelson	S,170	Dg	24	48	24	0	24	Alluvium	U	.55	1-25-51	C,3	D	16	3	W.
9M1	A. Duncalf	P,155	Dg	21	60	21	10	11	Sand	U	----	----	P,10	D,S	37	5	
10A1	E. F. McCormacke	P,155	Bd	47	12	47	8	39	--do	U	6.25	3-14-51	J,10	Irr	----	----	W; gravel packed 6–47 ft; used for irrigating garden.
11J1	Kummer Meat Co.	P,150	Dr	78	8-7	78	65	13	Sand	C	18	7- -50	J,20	Ind	----	----	Bailed 30 gpm with 20 ft dd; used for slaughter house.
12R1	R. A. Furby	P,180	Dr	148	6	148	----	----	--do	C	----	----	J,10	D	143	3	
14G1	W. Demmin	P,175	Dg	20	48	20	----	----	--do	U	3.3	1- -51	----	D,S	82	4	W.
15D1	F. Krahmer	P,185	Dg	24	60	24	----	----	--do	U	2.5	1- -51	P,5	D,S	81	6	Barely adequate in dry season.
15D1	D. Miller	P,165	Dr	65	6	----	----	----	----	----	----	----	J,5	D	157	4	
15M1	Forest Hills Golf Course.	P,185	Dr	320	6	----	----	----	----	----	----	----	----	----	----	----	Reportedly drilled in shale; dry hole.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 1 S., R. 3 W.—Continued								
16E1	V. Lorenz	P,310	Dr	161	6	88	88	73	Basalt	U	112	9- -50	J,30	D	114	14	
16N1	F. J. Brandaw	S,200	Dg	31	48	48			Quicksand.	U	25	9- -50	J,10	D,S	15	5	Water level reported low in summer.
17B2	L. Newburg	S,340	Dg	65	48				Alluvium	U	46.68	1-29-51	P,5	D	18	5	W.
17D1	B. Grimson	S,190	Dr	302	6-4	145	103	40	Clay and sand.	U			J,15	D	192	4	Reportedly in shale for 157 ft below aquifer; casing perforated 97–145 ft.
18K1	P. L. Liebeck	P,180	Dr	125	6	100			Sand	C	18	1950	J,15	D,S	80	5	Used for irrigating garden and lawn.
20E1	Kant	S,660	Dr	200					Shale				N	N			Water reported to have saline taste; well destroyed.
20M1	R. P. Nixon	S,560	Dg	60	60	48			Residual soil.	U	48	1- -51	J,10	D	72	4	Water level reportedly varies little during summer.
21C1	E. Meyer	P,200	Dg	28	60					U	23	9- -50	P,5	D,S	43	6	
21C2	----do	P,200	Dr	610	8-6	400	600	10	Basalt	C	F	1-18-56	80	Irr			Pumped 80 gpm with 200 ft dd when well was 529 ft deep. Entered basalt bedrock at 300 ft.

22E1	R. Meyer	S,220	Dr	161	6	116	100	61	do	C	F	1- -51	T,80	D, Irr	102	3	Used for irrigating 16 acres of pasture; flows about ½ gpm.
23A1	G. Kennel	P,200	Dg	42	60	---	---	---	---	---	---	---	J,10	D,S	77	6	
24K1	Simpson Brothers	P,180	Dr	460	6-4	459	459	1	Basalt	C	7	1- -51	J,20	D, Irr	156	4	Yielded 76 gpm with 150 ft dd.
24R1	F. McDonald	P,160	Dr	604	6	106	160	200	do	C	F	1-30-51	T, 200	Irr	125	12	Reported 160 ft of clay above aquifer; flows about 8 gpm; used for irrigating about 35 acres.
25P1	E. Simantel	P,210	Dr	565	8	65	---	---	do	C	45.33	2-14-51	J,10	D,S	144	4	W; rock reported 60–565 ft.
25Q1	J. T. Roberts	S,200	Dr	180	6-4	180	175	5	Basalt	C	---	---	---	D	---	---	Materials reported, 75 ft of clay, 100 ft of rock above aquifer.
25R1	Nettie DeFord	P,185	Dr	178	6	149	140	38	do	C	14	1946	T,25	D	122	4	Reported 140 ft of clay and sand above aquifer; test pumped 40 gpm with 100 ft dd.
26E1	Beevor	S,410	Dr	110	6	---	---	---	do	C	---	---	P,8	D, Irr	---	---	Used by two familes and for irrigation of lawn and garden.
26P1	W. L. Redding	S,220	Dg	43	48	43	0	43	Alluvium	U	---	---	P,8	D	32	3	Inadequate.
26R1	B. L. DeFord	P,200	Dr	128	6-5	128	83	45	Basalt	C	F	2-14-51	P,5	D	100	3	Reported 83 ft of clay and sand above aquifer; liner perforated 88–128 ft; flows about ½ gpm.
27A1	J. Dober	P,365	Dr	55	6	50	42	13	do	C	---	---	J,10	D,S	---	---	Reported 42 ft of clay above aquifer.
30C1	Frank Winners	S,210	Dg	20	18	20	0	20	do	U	---	---	J,8	D	28	4	Casing perforated and gravel packed.
31B1	W. R. Withycombe	S,265	Dg	53	48	---	8	42	Shale	U	---	---	N	N	---	---	Inadequate supply of water.
31J1	George Withycombe	S,405	Dr	110	4	80	80	30	Basalt	C	40	1951	J,15	S,Irr	60	4	Water contains iron.
31M1	Tony Hardebeck	S,375	Dr	128	5	128	108	20	---	C	---	---	J,15	D	58	4	Casing perforated 108–128 ft and gravel packed.
32Q1	J. W. Dixon	U,700	Dr	78	6	---	---	---	Basalt	C	15.1	2- 5-51	J,20	Ind	---	---	Used for sawmill.
33M1	do	U,910	Dr	80	6	---	---	---	do	C	50	2- 5-51	J,15	D	---	---	

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing Zone or zones: Depth to top (feet)	Water-bearing Zone or zones: Thickness (feet)	Water-bearing Zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
	T. 1 S., R. 3 W.—Continued																
35L1	I. Van Derbon	S,360	Dr	261	6	116	257	4	Basalt	C	-----	---------	J,15	D	90	4	Reported 116 ft of clay and 141 ft of rock above aquifer.
36L1	J. W. Twigg	P,190	Dr	135	6	---	-----	----	Sand	C	20	9- -50	J,8	---	----	---	
36R1	C. Wood	R,190	Dr	200	6	---	-----	----	Basalt	C	10	1951	J,15	D,S	116	4	Water said to contain small amount of iron.
	T. 1 S., R. 4 W.																
1N1	G. C. Coe	P,190	Dr	60	8-6	60	44	16	Gravel	U	15	7- -50	J,40	Irr	60	6	Used for irrigating 10 acres; reported 44 ft of clay above aquifer; casing perforated 44–60 ft.
2H1	Miran Sheelar	P,180	Dr	78	6	---	48	30	do	U	10.18	1-12-51	J,10	Irr	154	26	H figure 12 used for irrigating lawn and garden.
2H2	do	P,170	Dg	28	42	---	0	28	Alluvium	U	11.38	1-12-51	J,5	D,S	100	11	
2L1	Paul Ritchey	P,200	Dg	42	42	42	-----	----	Rock	U	7.58	1-12-51	J,8	D,S	82	9	Reportedly has a water level of 35 ± ft in summer.
2L2	do	P,200	Dr	230	---	---	-----	---	Shale	----	-----	--------	N	N	----	---	Dry hole; well destroyed.

2N1	R. Curtis Ritchey	P,200	Dr	100	6	90	85	15	Sand and gravel.	C	5	12- -50	J,8	S	136	215	Water reportedly has saline taste; casing perforated 80–90 ft.
2N2	R. Ritchey	P,190	Dr	92	6	73	65	27	Shale and sandstone.	C	8.02	1-12-51	N	N	88	228	L; W.
3B1	Fred Lunger	S,235	Dr	112	6	111	109	3	Gravel	C	30	12- -50	J,8	D,S	----	----	Reportedly sand and clay entire depth to aquifer.
3G1	A. A. Rogers	S,240	Dr	480	6	408	----	----	Silt	C	50	9- -46	P,3	D	38	5	Barely adequate during dry season.
3Q1	V. E. Koshi	S,230	Dg	45	48	45	0	45	Alluvium	U	3.38	1-12-51	P,3	N	34	6	
3Q2	----do	S,240	Dr	140	6	----	----	----	----	C	18.4	1-12-51	N	N	----	----	Insufficient supply of water.
17E1	Charlie Scott	S,260	Dg	25	48	25	0	25	Alluvium	U	----	----	C,3	D	42	3	
23F1	V. Stowell	S,260	Dr	84	6	80	----	----	----	C	F	1-24-51	J,8	Irr	4	3	Barely adequate during dry season.
23H1	E. F. Blackmore	P,200	Dg	46	48	----	36	10	Sandstone	U	----		J,5	D	22	4	Pumps dry during summer.
24A1	Virginia Bridges	S,250	Dr	90	6	90	----	----	----	----	----	----	J,8	D, Irr	16	4	
28R1	E. P. Hoodenpyl	S,260	Dg	11	48	----	----	----	Rock	U	----	----	J,5	D	8	3	Inadequate supply of water.
36K1	George V. Heagy	P,180	Dg	20	52	20	16	4	Sand	U	15	9- -50	J,5	D	34	4	Easily pumped dry in September; recovers in about 12 hours.
									T. 1 S., R. 5 W.								
25K1	Earl Wells	S,340	Dr	73	6	18	51	22	Basalt of the Tillamook volcanic series.	C	12	9- -50	J,5	D	----	----	Reported 15 ft of soil and 57 ft of rock above aquifer.
25Q1	Dorand	S,360	Dr	71	6	26	23	48	--do	C	F	1-29-51	J,5	D	56	3	Flows in winter; water level about 12 ft below surface in summer.
25R1	Wicklund	S,350	Dr	105	6	16	41	----	Basalt	C	3.15	1-24-51	N	----	----	----	Water reported to come from fractured zone in basalt at depth of 41 ft.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 1. S., R. 1 E.								
6C1	Mt. Calvary Cemetery Assoc.	S,975	Dr	832	12	---	------	----	Basalt ---	P	------	--------	----	Irr	----	----	Penetrated 59 ft of clay, 211 ft broken rock and 562 ft of basalt.
6D1	----do ----------	U,1,025	Dr	896	16-10	520	829	9	--do -----	P	423	8- -54	----	Irr	280	----	Penetrated 92 ft of clay and 804 ft of basalt; pumped 280 gpm with 62 ft dd.
7A1	W. L. Corbin ------	S,800	Dr	515	6	179	480	35	--do -----	U	400	9- -48	----	D	----	----	Materials reported as clay 0–50 ft, rock 50–515 ft.
7K1	Columbia Preparatory School.	S,385	Dr	499	----	---	------	----	--do -----	C	------	--------	T, 100	D, Irr	106	4	Reportedly once used for irrigating 15 acres; now used for school and to irrigate 4 acres.
8E1	Robert Dant -------	S,610	Dr	502	12-10	---	500	2	--do -----	C	350	8- -29	80	Irr	----	----	Used for irrigating 5 acres; basalt at 40 to 502 ft; well 61 of Piper (1942).
8N1	Kaufman Mortgage Co. (former).	S,375	Dr	169	8	110	110	59	--do -----	C	75	10- -47	----	D	----	----	Entered basalt at 100 ft.

17Q1	Doty Nursery, Inc.	S,400	Dg	15	86	15	0	15	Alluvium	U	2	1951	P,5	Irr	90	8	Pumps dry with heavy use.
18N1	Alpenrose Dairy	S,330	Dr	400	12-10	---	---	---	Basalt(?)	C	---	---	T, 60	S, Ind	130	5	
19P1	R. C. Coffell	S,435	Dr	557	8 6	43 99	500	57	do	C	250	1946	T, 80	D	---	---	L.
20D1	Ann Tannler	S,400	Dr	200	---	---	---	---	do	C	---	---	P,5	S	98	5	Water reportedly stains porcelain yellow.
27D1	Riverview Cemetery.	U,450	Dr	700	12	412	300	395	do	U	300	8-10-54	T, 200	Irr	---	---	Materials penetrated were basalt 60–695 ft; shale 695–700 ft.
29N1	John J. Wojcik	S,600	Dr	80	6	---	70	10	Boring lava.	C	---	---	J, 10	Irr	114	4	Used for irrigating lawn and garden.
30F1	First Federal Savings and Loan.	S,500	Dr	450	6	---	---	---	---	---	---	---	---	---	---	---	Never used; drilled to drain surface water; reportedly penetrated only clay.
30J1	L. Rosellini	S,610	Dr	150	6	73	72	78	Boring lava.	C	30	8- -51	J, 10	Irr	102	3	Used for irrigating lawn and garden.
31C1	Mrs. Francis Connolly.	S,425	Dr	175	6	---	136	5	do	P	80	8- -51	T, 10	D	120	4	L; bailed 28 gpm for ½ hour with 10 ft of drawdown.
31D1	Cathryns Charcoal Broiler Restaurant.	S,400	Dr	610	6	396	396	214	Basalt	C	210	11- -53	N	---	---	---	L; test pumped 35 gpm for 12 hours with 30 ft dd.
31M1	Earl Gunther	S,475	Dr	218	8-6	---	---	---	---	C	---	---	T, 75	D, Irr	60	6	Materials reported, 138 ft of rock (Boring lava) over 80 ft of "Shale" (Troutdale formation?); operates 14 irrigation sprinklers.
31P1	Charles E. Kern	S,460	Dr	97	6	20	50	47	Boring lava.	C	23	11- 1-51	J, 10	D	102	4	Used by two families.
32B1	McKinney	S,500	Dr	265	6	---	---	---	---	---	---	---	---	---	---	---	No water to 265 ft; reported clay entire depth.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
								T. 1 S., R. 1 E.—Continued									
32K1	Alto Park Water Dist.	S,680	Dr	1,033	----	----	------	----	Lava ----	U	190	1961	----	----	----	----	Apparently followed down volcanic eruptive conduit and found mostly mixed types of lava. Yielded about 50 gpm.
33E1	----do-----------	S,545	Dr	312	6	300	------	----	Basalt---	---	------	--------	----	---	----	----	
33M1	Dickinson Family Preserves Co.	S,525	Dr	344	6	31	256	88	--do ----	C	260	1945	----	Ind	----	----	Entered rock (Boring lava) at 25 ft; struck basalt at 256 ft.
								T. 2 S., R. 1 W.									
1B1	Ann Raymond-----	S,230	Dr	180	6	----	------	----	Quick-sand.	C	------	--------	P,8	D	----	----	Water carries much sand.
1D1	E. C. Hunziker ----	P,175	Dg	20	36	20	0	20	Alluvium-	U	------	--------	P,8	D,S	----	----	Water supply for two families.
1K1	E. C. Metzger ----	S,255	Dr	100	6	----	10	100	Boring lava.	C	------	--------	J,5	D	----	----	
1L1	L. H. Nichols ----	S,230	Dr	125	6	----	------	----	Sand ----	C	------	--------	P,8	----	----	----	Filled back to 100 ft to shut off running sand.

1L2	Raymond Ems	S,250	Dr	340	6	----	----	----	--do	C	----	----	P,8	D,S	----	----	
1M1	J. A. Wiley	P,145	Dr	753	6-4	680	678	75	Basalt	C	F	9-20-61	---	Ind	----	----	Entered basalt at 610 ft; flow was $7\frac{1}{2}$ gpm.
1Q1	Gus Greco	S,215	Dr	148	6-5	148	125	7	Boring lava.	C	31	4- -51	T, 10	D	----	----	Reportedly pumped 5 gpm for 1 hr with 145 ft dd.
1Q3	Kertis	S,230	Dr	625	10	----	----	----	Basalt	C	----	----	T, 15	S	----	----	Supplies large poultry farm; nearby 350-foot well entered basalt.
2A1	Tigard High School	S,185	Dr	660	----	----	----	----	None	----	----	----	----	----	----	----	Drilled 660 ft through clay; destroyed; well 68 of Piper (1942).
2M1	Tigard Public School.	S,210	Dr	260	6	260	252	8	Sand	C	65	8- -29	P,5	P,S	----	----	Well 69 of Piper (1942).
2M2	E. W. Bredmeier	S,230	Dr	510	6	362	496	14	Basalt	C	23	7- -53	J,8	D	----	----	
2R1	O. H. Herbig	P,180	Dr	110	6	----	----	----	Sand	C	F	8- 1-51	J, 15	N	----	----	Well readily pumped dry.
3N1	Loomis	S,335	Dr	190	6	----	----	----	Basalt	C	----	----	P,8	D,S	82	4	
4B1	R. Sunamoto	S,250	Dr	385	8	----	----	----	--do	C	----	----	T, 300	Irr	----	----	Reportedly entered basalt 135–385 ft.
4C2	Sandness	S,300	Dr	170	6	42	----	----	--do	C	142	7- -49	T, 10	D,S	----	----	
4G1	City of Tigard	S,350	Dr	494	12	91	215	279	--do	U	215	7-17-58	T	P,S	----	----	L; city well 3; test pumped 380 gpm with 153 ft dd after 24 hours.
5N1	Frank Roshak	S,350	Dr	230	6	20	125	105	--do	U	195	1924	P,8	D,S	114	7	Drilled in basalt 8–230 ft.
6J1	C. R. Walstrom	S,325	Dr	198	6	32	181	17	Basalt	C	143	9- -48	P, 10	D	160	14	Reported 29 ft of clay and 152 ft of rock above aquifer.
6R1	Ed Roshak	S,255	Dg	30	48	30	0	30	Silt	U	8	1951	J,8	D,S	136	8	
8G1	John J. Bushnell	U,600	Dr	500	6	13	395	105	Basalt	U	397	----	P,8	D	128	9	L.
8K1	M. H. Bishop	S,480	Dr	339	6	18	300	39	--do	U	200+	1949	P,8	D,S	130	5	Reported 15 ft of top soil and 285 ft of "rock" above aquifer.
9G1	Paul Haberfeld	S,530	Dr	500	6	----	----	----	--do	U	----	----	P,8	D	100	6	
9Q2	H. H. Foskett	S,300	Dr	265	10	10	130	125	--do	U	130	1950	T, 35	D	110	13	
10C1	City of Tigard	S,340	Dr	453	10	342	192	255	--do	C	190	4-30-49	T, 500	P,S	----	----	Ca; city well 2; test pumped 400 gpm for 1 hr with 90 ft of dd.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 2 S., R. 1 W.—Continued								
10E1	Stewart	S,475	Dr	400	6	----	----	----	Basalt	C	----	----	T,10	D	100	5	
10F1	R. V. Jenkins	S,365	Dr	220	6	210	210	10	do	C	200	1946	P,8	D	118	7	
10G1	J. V. Chandler and Co.	S,315	Dr	183	6	10	10	173	do	C	70	4- -48	T,35	Ind	124	6	Has dd of 60 ft after several hours pumping 35 gpm.
10N1	John Lindley	S,235	Dg	28	42	----	----	----	Sand	U	14.69	6-14-51	J,5	D	88	4	Entered sold "rock" at 28 ft.
11E1	City of Tigard	S,375	Dr	381	12	71	260	121	Basalt	C	188	4- -47	T, 200	P,S	----	----	L; city well 1.
11F1	Olson	S,315	Dr	135	6	----	----	----	----	C	----	----	P,4	D	64	5	Reportedly supplies inadequate water.
11J1	Mrs. Sattler	P,200	Dg	16	60	----	----	----	Sand	U	----	----	P,8	D,S	130	10	
11K1	F. A. Stephenson	S,225	Dr	114	6	----	80	34	do	C	----	----	J,10	D	128	4	Used by two families.
11L1	N. C. Kable	S,265	Dr	132	6	68	76	56	Basalt	C	50	1947	J,10	D,S	70	6	Reported 66 ft of sand clay and 10 ft of basalt above aquifer; bailed 25 gpm for 1 hr with 30 ft dd.
11Q1	Albert Scheihla	S,210	Dg	15	48	----	6	9	Sand	U	11.1	8-4 -51	P,5	D	162	18	
11R1	John A. Sattler	P,190	Dr	87	6	----	----	----	Gravel	U	----	----	J,8	D,S	162	4	

12E1	J. R. Ridgeway	P,180	Dg	32	36	32	-----	----	--do	U	------	---------	J,8	D,S	136	6	
12G1	Carl Huber	P,145	Dr	274	6-5	274	257	17	Sand	C	.5	8- -51	J,3	D	74	4	Reported materials, clay and sand entire depth; casing perforated 257–274 ft.
12N1	G. L. Sternes	P,180	Dr	96	5	87	89	7	Gravel	C	------	---------	J,8	D	------	----	
13B1	Pilkington Nursery.	P,160	Dr	640	8-6	640	630	2	Sand	C	2	1929	----	----	------	----	Ca; penetrated gravel and boulders 0–80 ft, black clay 80–640 ft with sand seam at 630 ft; well had small yield; abandoned because of high chloride water; well 71 of Piper (1942).
13B2	----do	P,160	Dr	162	---	92	90	2	--do	C	------	---------	J,15	D, Irr	92	12	Ca; reported sand, clay, and boulders 0–60 ft, blue clay 60–90 ft, sand 90–92 ft, clay 92–162 ft; casing pulled back to 92 ft.
13D1	Durham School	P,170	Dr	150	6	142	135	13	Gravel	U	------	---------	J,8	P,S	136	8	L; reported water-bearing sand 65–135 ft and clay 148–150 ft.
13L2	M. Eastham	P,185	Dr	120	8	110	80	25	--do	U	80	1941	J,30	P,S	60	7	L; supplies 7 families; casing perforated 80–104 ft.
13P1	Otto P. Boeckel	P,180	Dr	84	6	83	50	34	--do	U	66	1950	J,15	D	60	7	Reported 2 ft topsoil, 48 ft gravel and boulders above aquifer.
14A1	Tigard Senior High School.	P,190	Dr	680	10	664	667	3	Basalt	C	7	8- -53	T,20	P,S	------	----	L.
14N1	A. J. Martinazzi	P,160	Dg	51	36	51	41	10	Sand and gravel.	U	44.0	6-24-51	J,5	D,S	58	7	H figure 12.
15K1	C. E. Dean	P,140	Dr	22	8	22	-----	----	Sand	U	------	---------	P,5	D,S	102	9	
15P1	R. Van Mere	P,160	Dg	42	36	42	-----	----	--do	U	------	---------	J,5	D,S	290	9	Penetrated layers of clay and sand.
16D1	V. Aguino	S,215	Dr	121	6	15	15	121	Basalt	C	------	---------	J,10	D	94	5	Reported rock 15–121 ft.
16F1	R. E. Woods	P,175	Dr	188	6-5	188	175	13	--do	C	40	8- -49	---	D	------	----	Penetrated 175 ft of clay and gravel above aquifer; casing perforated 168–188 ft.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
T. 2 S., R. 1 W.—Continued																	
16G1	W. G. Boehmer ----	P,160	Dr	161	6	71	71	90	Basalt---	C	40	5- -51	J,10	D	-----	----	Penetrated clay and sand 0–20 ft, sand 20–69 ft and rock 69–161 ft.
16K1	R. C. Holmes ------	P,135	Dr	42	2	42	40	2	Pea gravel.	U	10	1951	P,5	D	96	6	
16M1	E. C. Walls--------	P,150	Dr	105	6	54	58	47	Basalt---	C	30	8- -49	J,10	D	-----	----	Log reported as clay 0–18 ft, gravel 18–40 ft, clay and rock 40–58 ft, and rock 58–105 ft.
17A1	N. E. Holmgren ----	S,250	Dr	130	6	----	126	4	--do ----	U	126	12- -50	J,5	D	114	8	Reported rock 10–130 ft; insufficient supply of water.
17B1	T. Hasuike---------	S,275	Dr	293	12	12	------	----	--do ----	U	218	1953	T	Irr	----	----	Owner to irrigate about 30 acres of berries and vegetables; drill entered basalt at 8 ft.
17H1	W. K. Scott --------	S,200	Dr	85	6	10	70	5	Basalt---	U	69	1951	J,5	D	130	6	Reported rock from 10 ft down.
17L2	Stewart B. Strong --	P,135	Dr	208	6	183	165	43	--do ----	C	34	1946	----	D	-----	----	Reported 165 ft of clay and sand above aquifer; test pumped 20 gpm with 107 ft dd.

18J1	James Hasuike	P,150	Dr	161	10	48	-----	----	--do	C	.41	10- 5-53	T, 150	Irr	-----	----	Used for irrigating about 20 acres of berries and vegetables; struck basalt at 40 ft.
18Q1	R. Livingston	P,160	Dr	406	6-4.5	364	364	42	--do	C	11.8	10- 5-53	J,10	D	190	53	Entered basalt at 350 ft.
19F1	E. Schlichting	P,170	Dg	26	48	26	-----	----	Aluvium	U	14.94	6-14-51	J,15	D,S	80	8	
20K1	Eoff Brothers	S,150	Dg	30	48	30	-----	----	Sand	U	23.35	8-13-51	J,10	D,S	80	8	
21A1	Oregon State Highway Dept.	P,175	Dr	500	6	404	415	2	Gravelly clay.	C	80	7- -48	J,3	D	-----	----	No rock found, material all clay, sand and silt.
21F1	Chester Feschbuch	S,140	Dg	30	48	30	-----	----	Quick-sand.	U	26	1951	P,5	D,S	50	55	
22A1	F. F. Eberly	S,160	Dr	253	6	220	-----	----	Basalt	C	50	1- -46	J,20	D, Irr	82	5	
22H1	R. F. Brink	P,135	Dg	18	36	18	-----	----	Sand	U	-----	-----	C,3	D	78	9	
23C1	W. Pickens	S,140	Dg	30	48	30	-----	----	--do	U	4.90	6-24-51	P,3	D	118	11	
23N1	G. Kogiso	S,150	Dr	125	6	65	65	60	Basalt	C	6.0	11-27-51	J,30	D, Irr	120	6	W; used for irrigating 10 acres.
24C1	E. T. Schultz	P,130	Dr	165	6	----	-----	----	-----	----	-----	-----	P,5	D	196	132	Water has a sulfur odor.
24M1	City of Tualatin	P,120	Dr	278	8	78	78	200	Basalt	C	3	1951	T, 150	P,S	-----	----	Reportedly test pumped 110 gpm with 35 ft of drawdown after pumping 11 hours; city well 1.
24M2	----do	P,120	Dr	325	8	172	273	52	--do	C	17.40	7-11-51	T, 250	P,S	-----	----	L.
24Q1	A. E. Dunstan	S,200	Dr	204	8	204	190	14	Gravel	C	80	1951	P,8	D,S	152	4	
25D1	-----	S,200	Dg	31	60	31	-----	----	-----	U	10.02	6-28-51	J,8	D,S	62	5	
25D2	G. W. Avery and Son.	S,225	Dr	400	6-4	400	385	15	Basalt	C	90	10- -43	P,8	D,S	52	11	Reported materials, sand and blue clay entire depth to aquifer; water reported to contain iron.
25P1	Alice S. Peterson	S,220	Dr	240	6	240	190	50	Gravel	C	55.81	6-28-51	J,15	D,S	-----	----	Water level dd is 140 ft after 1 hour pumping 10 gpm.
26B1	J. F. Johnston	S,215	Dg	20	36	20	-----	----	Quick-sand.	U	18	1951	C,3	D	82	9	
26B2	Portland Gas and Coke Co.	P,225	Dr	450	6-4	450	433	17	Basalt	C	40	1947	P,10	Ind	62	34	L; casing perforated 424–450 ft.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
	T. 2 S., R. 1 W.—Continued																
26F1	J. W. Demke	S,220	Dg	15	36	15	-----	-----	Sand	U	6.33	6-28-51	J,8	D	60	5	
26G1	Sunde	S,250	Dr	435	6	435	-----	-----	--do--	C	80	1951	P,10	D	70	9	
26Q1	G. E. Berry	S,280	Dr	110	6	51	50	60	Basalt	C	52	1949	J,8	D	110	6	Reported 50 ft of clay above aquifer.
27E1	Joe Itel	S,195	Dr	119	6	45	95	24	--do--	C	70	10- -50	J,10	D,S	204	9	Materials reported were 12 ft of soil and 83 ft of basalt above aquifer.
27G1	C. L. George	P,180	Dg	32	48	32	-----	-----	Sand	U	24.08	7- 2-51	J,5	D,S	24	7	
27H1	Bryan Tykeson	P,205	Dr	323	6	245	242	81	Basalt	C	20	1948	J,10	D,S	102	5	L; bailed 21 gpm for 1 hr with 80+ ft of drawdown.
28F1	A. S. Peterson	P,170	Dg	32	48	32	23	9	Sand	U	27.52	6-26-51	J,8	D,S	196	21	Can be pumped dry but recovers in a few hours.
28H1	Glen Orr	S,200	Dg	31	36	31	-----	-----	---------	U	19.27	7-23-51	J,10	D	64	9	
28L1	James R. McPoland.	S,210	Dr	104	6	30	88	16	Basalt	C	60	1947	J,10	D,S	74	8	Reported 10 ft of soil, 78 ft of rock above aquifer.
29M1	Fred Langer	P,215	Dg	30	60	30	-----	-----	Sand	U	19.79	6-26-51	P,10	D,S	120	11	Used by five families.
30B1	Arthur Rupprecht	P,190	Dg	43	48	43	-----	-----	--do--	U	37	1951	J,8	D,S	62	7	
30E1	LeRoy Hornschuh	P,185	Dr	366	6	366	354	12	Silt	C	20	11- -50	J,15	D	132	6	Casing perforated near bottom.
30H1	Arnold Borchers	P,205	Dg	35	36	35	-----	-----	Quick-sand.	U	25.30	6-21-51	J,5	D	70	6	

30M1	Labahan	P,190	Dr	140	6	140	35	80	--do--	U	35	1951	P,5	D,S	116	4,	Pumps dry in about an hour; casing perforated.
30Q1	Albert Johnson	S,180	Dg	26	48	26	----	----	----	----	24.5	8-13-51	P,4	D	124	12	Inadequate in summer.
31C1	H. H. Unger	S,210	Dr	101	6	49	53	48	Basalt	C	----	----	J,10	D,S	104	5	Reported 48 ft of soil above basalt.
31N1	Elmer Lewis	S,250	Dr	80	6	46	60	20	--do--	C	----	----	J,10	D	----	----	Reported 40 ft of soil and 20 ft of rock above aquifer.
32D1	City of Sherwood	P,190	Dr	339	16-12	113	137	202	Basalt	C	38	7- -46	T, 500	P,S	34	2	L; test pumped at 500 gpm with dd of 42 ft; city well 3.
32F1	----do----	P,190	Dr	275	6	90	130	145	--do--	C	29	7- -51	T, 125	P,S	----	----	City well 1; well 73 of Piper (1942).
32F2	----do----	P,190	Dr	281	4	120	130	151	--do--	----	----	----	T, 125	P,S	----	----	City well 2, about 14 ft from well 1.
32R1	R. Schlarbaum	S,300	Dr	92	6	----	----	----	--do--	C	----	----	J,8	D	94	4	Reportedly inadequate.
33E1	G. Lampart	S,230	Dr	165	----	----	----	----	--do--	C	60	1951	P,5	D,S	68	6	
34A2	E. R. Hughes	S,350	Dr	85	6	39	35	50	--do--	C	39.41	6-28-51	J,10	D	50	5	Log reported as 35 ft of soil and decomposed rock; 55 ft of rock.
34H1	G. E. Bradley	S,350	Dr	115	6	70	70	75	--do--	C	45.98	6-29-51	J,5	D	64	6	
34J2	----do----	S,320	Dg	23	60	12	12	11	Weathered basalt.	U	10.5	7- 2-51	P,4	D,S	44	6	
34P1	J. T. Curtis	S,235	Dg	18	36	18	16	2	Weathered basalt.	U	12	1951	P,4	D	42	7	Inadequate during dry months.
35E1	Charles Manewell	S,285	Dr	100	6	7	89	11	Basalt	C	38	1943	J,10	D,S	74	4	Reported rock entire depth.
35F2	Dr. Pennington	S,300	Dr	123	6	24	111	12	--do--	U	82	1947	J,15	D	82	5	Basalt 18–123 ft; can be pumped dry.
35K1	Ben Andrews	S,340	Dr	200	6	49	150	48	--do--	U	125	1947	P	D,S	82	5	L; used by two families.
36C1	Betty Mitchell	S,300	Dr	65	6	----	----	----	--do--	U	15	1951	P,5	D,S	82	5	
36D1	D. C. Rumrey	S,295	Dg	18	36	18	----	----	Sand	U	6	1951	J,8	D	110	5	
36E1	Howard Ellman	S,325	Dr	112	6	----	----	----	Basalt	C	----	----	J,5	D	84	5	Basalt reported 21–112 ft.
36R1	E. A. Eligsen	S,470	Dr	224	6	12	----	----	--do--	P	----	----	P,8	D,S	74	4	Pumps dry in about an hour; basalt 12–224 ft.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
							T. 2 S., R. 2 W.										
1D1	Bert Sparks	S,240	Dr	65	6	----	----	----	Basalt	C	----	----	J,5	D,S	188	6	
1J1	Bierly Brothers	S,285	Dr	588	12	57	368	220	do	C	112.0	9-20-51	T, 590	Irr	----	----	L; used for irrigating 50 acres of pasture; pumped at rate of 588 gpm with 45 ft of dd after 4 hours.
1N1	Alice E. Richards	S,265	Dr	126	6	20	----	----	do	C	----	----	P,8	D	92	7	
2B1	C. H. Thompson	S,200	Dr	90	6	40	38	52	do	C	----	----	J,8	D,S	144	4	Reported 38 ft of clay above aquifer.
2N1	H. L. Flint	P,165	Dg	29	36	5	----	----	Sand	U	13.98	5-15-51	C,10	D,S	110	11	Water supply for three families.
2P1	Waldo B. Flint	P,160	Dr	196	6	158	160	33	Basalt	C	10	1953	J,15	D	----	----	Materials reported; clay and sand to 86 ft, rock to 91 ft, clay to 150 ft, rock to 193 ft, clay to 196 ft.
3K1	Fred Groner	S,175	Dr	400	10-6	250	----	----	do	C	F	5-15-51	C,10	D,S	82	5	Plugged at 250 ft.
3R1	E. Hesse	P,175	Dr	68	6	15	65	3	do	C	31	1948	J,10	D,S	94	6	Materials reported, clay 17 ft, hard and soft rock 51 ft; bailed 18 gpm for 1 hour with 37 ft dd.

5G1	Christianson Brothers.	P,140	Dr	64	6	60	60	4	Gravel	C	5	1950	J,10	D,S	108	5	
5Q1	William Waibel	P,140	Dr	50	6	50	-----	----	Sand	C	F	2-23-51	J,10	S	158	4	Flowing $\frac{1}{2}$ gpm.
6A1	J. E. Hiatt	P,175	Dr	165	6	-----	158	7	Basalt	C	F	2- 8-51	J,10	D	122	4	Flowing 3 gpm.
6D1	S. R. Rotchstrom	P,180	Dr	486	6	250	482	4	do	C	4.56	2-23-51	C, 100	Irr	78	5	H, figure 14; L; used for irrigating 10 acres; reportedly pumped 150 gpm with little dd.
6M1	Ernest Losli	P,175	Dg	24	48	24	20	4	Quick-sand.	U	7.30	2-23-51	P,3	S	122	17	Water level low during summer.
6P1	J. Spiering	P,180	Dr	437	6	218	218	219	Basalt	C	F	2-23-51	J,8	D,S	98	2	Reported 218 ft of clay above aquifer; flows $\frac{1}{2}$ gpm.
7Q1	E. H. Taylor	S,350	Dr	193	6	40	120	73	Basalt	U	150	--------	P,5	D	54	7	
8E1	Robert Hiatt	P,185	Dr	215	6	195	195	20	do	C	18	1945	J,10	D	106	4	Water reported to contain iron.
8K1	C. Armitage	P,190	Dg	27	48	27	17	10	Quick-sand.	U	4	1950	C,8	D	52	5	Used by three families and a store.
8L1	John Raymond	P,190	Dr	260	6	-----	-----	----	Basalt	C	------	--------	J,10	D	90	4	Ca.
9D1	F. H. Mott	P,125	Dr	612	8	227	310 585	75 27	do	C	10	7- 5-56	----	Irr	-----	----	Sand and silt drilled to basalt at 234 ft.
10L1	J. A. Rowell	P,150	Dg	23	72	23	-----	----	do	U	12.04	5-15-51	C,10	D	-----	----	
10P1	Scholls Methodist Church.	P,135	Dr	553	4	513	152	15	do	C	F	7-31-51	J,10	P,S	-----	----	Reported materials, 512 ft of clay and sand; 41 ft of rock; flows about 2 gpm.
11C1	Waldo B. Flint	P,145	Dg	22	60	22	-----	----	Sand	U	12.3	5-15-51	C,8	D,S	100	6	
12B1	J. Winiger	S,235	Dr	104	6	18	85	19	Basalt	U	86	5- -51	P,5	D,S	118	11	
12L1	A. O. Oleson	P,155	Dr	300	6	300	-----	----	Sand	C	------	--------	T,75	S	84	11	Reportedly found no rock.
12P1	Ed Mulenburgh	P,135	Dg	20	36	36	-----	----	Quick-sand.	U	5	5- -51	P,5	D,S	50	5	
13A1	H. Unger	P,135	Dr	426	6	418	410	16	Basalt	C	------	--------	----	D,S	-----	----	Materials reported, 410 ft of sand and silt above aquifer.
13Q1	E. T. Sheppart	P,180	Dr	67	6	20	20	47	do	C	------	--------	J,10	D,S	84	7	

Table 1—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
	T. 2 S., R. 2 W.—Continued																
14D1	Jesse Snyder ------	P,170	Dg	27	36	27	-----	--	Quick-sand.	U	24	6- -51	J,5	D	50	5	
14Q1	F. E. Jewett -------	S,265	Dg	26	36	26	-----	--	Alluvium--	U	13.48	6-26-51	C,10	D	44	3	Basalt found at bottom.
15B1	Fred Barker-------	P,175	Dg	31	36	31	-----	---	Sand------	U	14.37	6-26-51	P,5	D	120	12	Readily pumped dry in summer.
15E1	W. T. Jackson -----	P,175	Dr	344	6	330	-----	---	Basalt----	C	10	8- -53	----	D	-----	----	Reportedly bailed 15 gpm with 55 ft dd.
16E1	C. R. Seiffert ------	S,265	Dr	130	4	76	-----	---	--do -----	C	90	2- -51	P,5	D	56	3	
16H1	Scholls Store-------	S,175	Dr	500	6	----	-----	---	--do -----	C	------	--------	J,15	D	74	4	Reported plugged back to 175 ft.
16J1	E. J. Bartlett ------	S,185	Dr	86	6	----	80	6	--do -----	C	20	12- -46	J,10	D	142	6	Water has slight yellow color.
17E1	D. E. Mann --------	S,225	Dr	70	---	40	-----	---	--do -----	C	50	1950	J,5	D	90	3	Water reportedly contains iron.
17F1	Charles Newton ----	S,165	Dr	272	6	140	140	132	--do -----	C	F	2-28-51	C,12	D	80	4	Water reported to flow 3 gpm from December to July.
17R1	R. N. McClur ------	S, 350	Dr	100	5	30	-----	---	--do -----	C	60.4	8- 2-51	J,15	D,S	22	3	Water sometimes has reddish color.
18D1	R. Lorenz ---------	S,410	Dr	103	6	59	70	11	--do -----	C	F	2-28-51	J,10	D,S	48	5	Small flows in winter only.

19E1	C. V. Jackson	U,590	Dg	45	60	45	0	45	Silt	U	----	----	J,8	D,S	46	5	Easily pumped dry in summer.
19G1	Homer Flynn	U,580	Dr	190	6	----	50	140	Basalt	P	----	----	P,8	D,S	50	4	
23L1	Dallas Crawford	S,525	Dg	48	36	48	0	48	Silt	U	31.43	6-27-51	J,8	D,S	44	5	Stopped on rock.
24D1	Weerre Brothers	S,275	Dr	190	6	40	----	----	Basalt	C	30	6- -51	P,10	D,S	56	6	
24H1	L. McLoughlin	S,200	Dg	23	48	23	0	23	Alluvium	U	4.04	6-14-51	J,8	D	38	4	Easily pumped dry.
24J1	Paulin	S,255	Dr	50	6	42	42	3	Basalt	U	----	----	J,8	D	30	4	Reported materials, 39 ft of clay and boulders, 11 ft of basalt.
24M1	Wm. Stenek	S,340	Dr	88	6	22	72	16	do	P	51.0	6-27-51	J,8	D,S	34	6	W; Reported 10 ft of clay, 62 ft of rock above aquifer.
25A1	O. Krouse	S,200	Dr	153	6	31	----	----	do	C	----	6- -51	P,8	D,S	72	4	Reported 32 ft of clay and 122 ft of rock.
25K1	E. W. Rehwalt	S,190	Dg	52	36	52	----	----	----	----	40.68	6-27-51	P,5	D,S	32	6	
26E1	C. Allen	U,675	Dr	83	6	66	60	23	Basalt	P	49	6- -46	J,15	D,S	20	4	Reported 49 ft of soil and 34 ft of rock.
26H1	Mrs. A. Smith	S,475	Dr	89	6	72	40	49	do	P	----	----	J,8	D	160	5	Reported 40 ft of clay over aquifer.
28H1	J. G. Toomey	U,650	Dr	180	6	----	----	----	do	P	----	----	P,10	D	105	4	Water has a reddish color.
30G1	James McConn	U,830	Dg	80	48	----	----	----	----	P	61.79	8- 6-51	P,3	N	----	----	Inadequate yield.
31A1	L. Clark	U,1,200	Dr	155	6	----	80	75	Basalt	P	----	----	J,10	D,S	78	5	Adequate for domestic use only.
33K1	W. M. Strickland	U,1,070	Dg	----	48	8	----	----	Clay	P	19.31	8- 2-51	P,5	D,S	8	3	Inadequate during summer.
34E1	Stretcher	U,920	Dr	429	6	90	329	100	Basalt	P	329	----	P,10	D,S	70	4	Barely adequate; basalt 90–429 ft.
35A1	Oliver Coleman	S,470	Dr	225	6	56	170	55	do	C	130.25	7-30-51	N	----	----	----	Reported 55 ft of clay and 115 ft of rock above aquifer.
35N1	R. B. Joyce	U,770	Dr	128	6	----	----	----	----	P	68	1951	P,8	D,S	10	3	Water sometimes has reddish color.
36E1	Carl Schaltenbrand.	S,425	Dr	232	6	49	50	182	Basalt	U	122	1947	P,2	D	58	4	Yield inadequate; materials reported as 35 ft of soil, 100 ft of soft basalt and 97 ft of hard basalt.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
							T. 2 S., R. 2 W.—Continued										
36J1	Don Holmes	S,310	Dg	48	48	35	18	30	Basalt	U	------		J,8	D	32	5	Pumps dry in summer.
							T. 2 S., R. 3 W.										
1A1	Harold Haase	P,180	Dr	405	6	289	286	119	Basalt	C	1.68	2-23-51	J,5	D	78	3	L; dd reported to be 13 ft when pumped at 45 gpm for 5 hours; flowed 10 gpm in 1948 .
1C1	Richard Kiefer	P,230	Dr	369	6	160	168	201	--do--	C	45	3- -50	J,15	D,S	124	5	L; reportedly test pumped 240 gpm with 55 ft dd.
1F1	Walter Schmidt	P,210	Dr	170	6	153	155	15	--do--	C	20	1945	J,8	D,S	44	3	Water reported to contain carbon dioxide; test pumped 8 gpm with 70 ft dd.
1R1	Charles E. Schmidt	S,175	Dr	264	8	95	120	101	--do--	C	F	10- -51	T,80	Irr	-----	----	Reported to flow 3 gpm at times.
1Q1	Herman Egger	P,175	Dg	25	48	25	0	25	Alluvium	U	17	7- -50	J,8	D,S	-----	----	
2Q1	John Will	S,600	Dg	52	48	52	0	52	Alluvium(?)	P	22.93	3- 2-51	J,8	D,S	26	9	W.
5L1	Andress	S,210	Dr	63	6	----	60	3	Gravel	U	------	---------	J,8	D,S	90	5	Used by two families; water reported to have mineral taste.

6L1	C. E. Jorrgen	S,210	Dg	34	48	----	----	----	Shale(?)	U	----	----	J,8	D	50	----	Inadequate during dry season.
6R1	J. N. Strever	P,210	Dr	150	6	----	----	----	Shale	C	12.5	5-18-51	N	---	271	1,000	Not used.
7Q1	A. W. King	S,225	Dg	10	48	----	----	----	Basalt	U	----	----	----	---	24	3	Used by three families; water said to come from "crevice" in rock.
10B1	S. A. Whitmore	U,1,020	Dr	108	6	50	50	58	--do--	P	20	6- -48	J,8	D	50	4	Water level reported to draw down considerably under normal use.
10N1	Earl Baker	U,1,180	Dg	25	48	----	----	----	Alluvium	P	----	----	----	N	----	----	
11C1	Max Reeher	S,775	Dr	183	6	----	----	----	Basalt	P	----	----	P,8	D	352	5	
11K1	A. Vendegan	S,690	Dr	250	6	72	72	78	--do--	P	45	7- -50	P,5	D	46	4	"Upper water" lost in crevices; back-filled to 150 ft; basalt 72–250 ft.
11R1	M. J. Murphy	S,790	Dr	112	6	106	103	9	--do--	P	52	9- -49	J,10	D	46	4	Some water reported at 70 ft in gravel.
12A1	Fred Schmidt	P,175	Dr	135	6	112	110	25	--do--	C	F	2-21-51	J,8	D	110	3	Materials penetrated were: 68 ft of clay, 14 ft of boulders, 28 ft of broken rock and clay, 25 ft of lava rock. Flows 3 gpm.
12H1	M. Cady	S,200	Dg	35	48	35	----	----	----	U	----	----	J,8	D,S	84	3	Water said to have reddish color.
13A1	E. R. Tompkins	S,455	Dr	93	8	----	----	----	----	P	----	----	J,15	D,S	60	6	
13D1	John R. Thorp	S,730	Dr	120	6	----	----	----	----	P	35	7- -50	J,10	D,S	11	4	Water reported to contain iron.
26J1	O. J. Ornduff	U,1,275	Dr	396	6	----	20	376	Basalt	P	360	3- -50	J,15	D	190	6	Can be readily pumped dry.

T. 2 S., R. 4 W.

1B1	R. B. McBurney	S,190	Bd	30	18	30	----	----	Sand	U	1.53	1-26-51	J,10	D	82	3	W; water carries sand.
1J1	Walter Cate	S,260	Dr	300	---	----	----	----	----	--	----	----	----	---	----	----	Dry hole; reportedly drilled through blue clay and shale.
2M1	H. L. Beck	S,500	Dr	480	6	----	----	----	----	--	----	----	----	---	----	----	Dry hole; shale entire depth.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
									T. 2 S., R. 4 W.—Continued								
2M2	S. G. Matheson	S,400	Dr	96	6	45	82	14	Basalt(?)	P	16	9- -50	P,10	D,S	24	4	
2Q1	James Saunders	S,280	Dr	85	4	35	72	13	do	C	25	7- -50	J,10	D	60	6	Readily pumped dry.
3G1	T. H. Johnson	S,400	Dg	45	36	----	----	----	----	P	14.8	2-12-51	J,5	D	124	10	Water level low in summer.
3H1	E. Eddings	S,380	Dg	12	33	12	----	----	Alluvium	P	3	9- -50	N	D	----	----	
4R1	S. R. Bristow	U,700	Dg	24	48	24	0	24	Alluvium(?)	P	5	1951	J,5	D	30	7	Readily pumped dry in summer.
10N1	W. R. Conn	S,725	Dg	38	48	38	0	38	do	P	12	----	P,8	D	12	3	Do.
11R1	K. D. Etter	S,450	Dr	92	6	32	72	20	----	P	32.5	2-12-51	N	---	----	----	
12L1	Kuemin	S,200	Dr	200	6	----	----	----	----	---	----	----	J,12	D	18	5	
12N1	August J. Lange	S,400	Dr	100	6	18	----	----	----	---	29	7- -50	J,10	D	58	4	
14A1	R. S. Hudson	S,525	Dr	87	6	19	84	3	----	P	----	----	J,10	D	36	3	
16C1	Harold Jefferis	P,560	Dg	43	48	N	0	43	Alluvium(?)	P	26.4	2-13-51	B	D	----	----	
22K1	R. R. Oester	S,375	Dr	120	6	----	----	----	Sandstone(?)	U	60	1951	J,10	D	258	35	Inadequate during summer.
23N1	Lillie Bangs	P,255	Dr	92	6	----	----	----	"Shale"	C	1	9- -45	J,8	D	5,400	5,010	Ca.
									T. 2 S., R. 1 E.								
2N1	City of Oswego	P,80	Dr	225	12	25	----	----	Basalt	C	20	1951	T, 375	P,S	----	----	City well 3.

2N2	do	P,60	Dr	450	16	25	----	----	do	C	20	1951	T, 375	P,S	----	----	City well 4.
3L1	do	S,250	Dr	980	10-6	762	957	23	do	C	----	4-39	T, 100	P,S	----	----	L; city well 1.
4L1	A. S. Platou	S,350	Dr	175	6	94	142	1	do	C	130	1946	----	D	----	----	
5K1	H. E. Davis	S,400	Dr	218	6	21	140	78	do	C	----	----	----	----	----	----	
5M1	V. R. Casebeer	S,400	Dg	39	36	39	16	23	do	U	15.0	11-1-51	J,8	D	----	----	Inadequate.
6A1	C. E. Yongue	S,485	Dr	210	6	58	170	40	do	C	73	1948	J,10	D	106	3	Materials, clay and sand to 55 ft; rock to 210 ft.
6D1	Ketell Construction Co.	S,350	Dr	839	16-12	535	535	304	do	C	200	1954	T	P,S	----	----	Penetrated Boring lava to 162 ft, clay 162 to 535, and basalt to bottom.
6H1	W. Bode	U,425	Dr	235	6	155	155	80	do	C	60	----	J,8	D	----	----	Readily pumped dry.
6J1	A. L. Fields	S,340	Dr	535	8	443	576	60	do	C	210	8-53	----	D	----	----	Materials reported, clay 0–6 ft, rock (Boring lava) 6–143 ft, clay (Troutdale formation) 143–433 ft, rock (basalt) 433–535 ft.
6R1	do	S,315	Dr	90	8-6	----	----	----	Boring lava.	----	----	----	J,15	D,S	122	3	
8C1	George H. Carl	S,230	Dg	30	36	30	20	10	Sand	U	15	1951	J,5	D	----	----	
8H1	Lake Oswego Water Co.	S,150	Dr	188	10	40	178	22	Basalt	C	5	----	T, 135	P,S	----	----	Ca; materials were peat 0–20 ft, basalt 20–178 ft; water company well 1.
8N1	do	S,115	Dr	258	10-8	51	99	159	do	C	1	1945	N	----	----	----	L.
8R1	do	S,225	Dr	607	12	58	----	----	do	C	----	----	----	----	354	285	Ca; reported not used because of hardness of water; water company well 3.
9D1	do	S,225	Dr	405	10	20	190	215	do	C	75	1946	T, 275	P,S	85	4	Ca, L; water company well 4.
9J1	do	S,240	Dr	502	10-8	165, 267-347	140-280	20-60	do	C	129	5-48	T, 200	P,S	63	3	Ca; water company well 5; 10-inch casing perforated 130–140 ft and 150–160 ft; 8-inch casing perforated 280–290 ft and 330–340 ft.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones			Ground-water occurrence	Water level		Type of pump and yield (gpm)	Use	Chemical character (ppm)		Remarks
							Depth to top (feet)	Thickness (feet)	Character of material		Feet below or above (+) land surface	Date			Hardness as $CaCO_3$	Chloride	
T. 2 S., R. 1 E.—Continued																	
14C1	Marylhurst College.	S,210	Dr	500	12	38	305	195	Basalt	C	125	1929	T, 350	D, Irr	----	----	
14F1	----do	S,200	Dr	519	12	81	301	218	--do	C	120	6- -47	T, 200	D, Irr	----	----	L; reported dd 80 ft pumping 300 gpm.
15C1	City of Oswego	S,560	Dr	640	10	----	260	340	--do	U	----	----	T	P,S	----	----	L; city well 2.
15G1	Ferry Smith	S,685	Dr	470	12	64	450	20	--do	U	364	12-24-48	T,60	D	98	3	Planned as water supply for 12–15 families.
16F1	Emily B. Jonston	S,485	Dr	407	----	----	----	----	--do	U	387	7- -51	P,10	S	68	3	Well originally drilled to 237 ft; deepened to obtain adequate water supply.
16K1	R. Luscher	S,450	Dr	138	6	130	----	----	--do	P	26	1951	J,10	D,S	68	4	
16M1	Emily B. Jonston	S,550	Dr	539	6	120	----	----	--do	U	434	1947	P,12	D,S	110	3	Water will iron-stain porcelain; inadequate supply of water.
16Q1	Carl Anderson	S,430	Dr	90	6	----	----	----	----	P	----	----	J,8	D,S	86	5	Inadequate supply of water.
17Q1	H. B. Morse	S,380	Dr	462	6	----	----	----	Basalt	U	400	1949	P,10	D	120	10	
18H1	I. L. Hefford	P,145	Dr	89	6	----	50	39	--do	---	----	----	J,5	D	60	3	
18M1	Frank Herbst	P,170	Dr	105	6	102	104	1	Sand	U	42	1951	J,8	D	98	6	
19C1	R. W. Walter	P,130	Dr	27	6	27	----	----	Gravel	U	----	----	P,5	D,S	74	5	

19G1	E. A. Gates	P,130	Dr	150	6	---	---	---	---	---	---	---	J,8	D,S	700	316	
19P1	Julius Skog	P,210	Dr	210	6	---	200	10	Gravel	C	70	1951	J,5	D	98	7	
19Q1	J. T. Miller	P,210	Dr	440	6	422	423	17	Basalt	C	95	8- -51	P,8	D	74	27	Deepened, 261–440 ft to obtain more water.
20A1	R. L. Hoffman	S,475	Dr	208	6	---	---	---	do	U	---	---	P,8	D,S	86	4	Used by two families.
20D1	C. J. Mason	S,150	Dr	108	6	---	---	---	do	C	37	1951	J,15	D	46	5	Basalt 4–108 ft.
20E1	M. E. Stonebrink	P,130	Dr	300	6	---	---	---	---	---	15	1951	J,15	D,S	140	3	
20N1	A. W. Borland, Sr.	S,190	Dr	240(?)	6	---	---	---	Gravel	C	---	---	P,8	D,S	60	4	
21Q1	R. A. Holmes	S,230	Dr	128	6	---	119	9	Basalt	C	---	---	---	D	---	---	Materials reported as clay 0–37 ft and basalt 37–228 ft.
22C1	K. B. Hall	S,450	Dr	527	6	35	123	280	do	C	---	---	T,35	D,S	96	5	L.
22C2	do	S,400	Dr	825	10-8	---	300	525	do	C	100	1950	---	---	---	---	Reportedly drilled for irrigation but found inadequate.
22G1	S. A. Swanson	S,525	Dr	98	6	60	83	15	do	P	83	1937	P,5	D,S	122	4	Basalt entered at 60 ft.
22G2	Mrs. Roe Cloud	S,575	Dr	173	6	80	153	20	do	P	108	1928	P,8	D	---	---	Basalt 80–173 ft.
22P1	Joe Hartman	S,525	Dr	410	6	13	235	5	do	U	320	1945	P,8	D,S	102	4	Basalt from 8 ft down.
23F1	K. Cummings	S,650	Dr	720	8	---	400	320	do	U	400	7- -54	---	---	---	---	Test pumped 20 gpm with 200 ft dd.
23M1	W. F. Carrington	U,730	Dr	150	---	---	---	---	do	P	52.38	10-16-51	P,8	D,S	72	7	Inadequate supply of water.
23N1	H. H. Gewecke	U,675	Dr	270	6	---	---	---	---	---	---	---	P,10	D	90	3	
24D1	Robinwood Water District.	P,135	Dr	275	---	---	20	255	Basalt	C	123	6- -47	T, 250	P,S	---	---	Reported to have produced 250 gpm with a drawdown of 9 ft after 2 hours of pumping; temp 60°.
25E1	H. E. Iback	S,620	Dr	455	6	50	440	15	do	U	335	1949	P,12	D,S	54	3	L.
26B1	Brownsville Timber Co.	U,700	Dr	100	6	---	---	---	do	P	52.38	10-15-51	J,15	D	74	3	Water reported cloudy after rain.
26J1	G. M. Shearer	U,630	Dr	90	6	35	35	55	do	P	35	1951	J,10	D,S	56	3	
26N1	Rolloy	S,600	Dr	320	6	---	---	---	do	P	---	---	P,8	D	98	4	Rock 12–320 ft.
27G1	Community well	S,425	Dr	226	6	43	197	29	do	P	---	---	P,10	D,S	82	6	Used by seven families.
27Q1	H. N. Bower	S,165	Dr	93	6	---	36	57	do	U	---	---	P,10	D	124	4	Inadequate.
28B1	Jerry Fiala	S,140	Dr	186	6	---	---	---	---	C	50	1944	P,10	D	134	3	
28M1	E. K. Ewald	S,160	Dr	104	6	90	90	14	Basalt(?)	C	---	---	J,8	D	92	5	Adequate for domestic use only.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones			Ground-water occurrence	Water level		Type of pump and yield (gpm)	Use	Chemical character (ppm)		Remarks
							Depth to top (feet)	Thickness (feet)	Character of material		Feet below or above (+) land surface	Date			Hardness as $CaCO_3$	Chloride	
									T. 2 S., R. 1 E.—Continued								
28P1	E. K. Ewald	S,160	Dr	80	6	80	-----	-----	Gravel	U	75	-----	J,10	D,S	56	5	Used by two families.
29J1	Earl H. Bywer	S,265	Dr	185	6	167	172	13	Basalt	C	35	1944	P,10	D	78	3	Do.
30J1	G. Keller	S,400	Dr	317	6	20	300	17	--do--	C	30	1916	P,15	D,S	78	3	
31D1	Gene Wilhelm	S,330	Dr	82	6	39	40	42	--do--	U	40	10- -49	J,10	D	66	4	Bailed 10 gpm for 1 hour.
31J1	Lloyd C. Tiedeman	S,415	Dr	290	6	60	60	230	--do--	C	60	1- -51	T,20	D,S	40	4	
31P1	J. E. Youmans	S,475	Dr	146	6	23	120	26	--do--	P	90	1948	P,5	D	50	4	Materials reported, 24 ft of clay and boulders, 122 ft of basalt.
32A1	S. C. Hill	S,510	Dr	435	6	80	400	35	--do--	U	400	7- -51	N	-----	-----	-----	
32E1	Susan Eisele	S,410	Dr	400	6	40	395	5	--do--	U	-----	-----	P,8	D,S	64	7	Inadequate; can be pumped dry in half an hour.
33B1	D. R. Diebold	S,175	Dr	24	8	-----	-----	-----	-----	U	15.10	10-17-51	J,5	D	40	4	
33C1	Karl Koch	S,310	Dr	202	6	34	195	7	Basalt	U	180	1950	J,20	D	62	4	Rock 34–202 ft.
34G1	H. Rohe	S,185	Dr	350	6	-----	345	5	--do--	C	10	1946	J,8	D	88	142	
34H1	N. O. Wright	S,160	Dr	428	6	-----	426	2	-----	C	70	1943	P,10	D,S	252	250	
34J1	Ward Wills	S,170	Dr	204	6	180	-----	-----	-----	-----	-----	-----	P,8	D,S	90	6	
35F1	Lloyd Hinkle	S,500	Dr	433	6	20	413	20	Basalt	U	400	1943	P,8	D,S	98	3	
35G1	F. W. Cairy	S,500	Dr	107	6	29	105	2	--do--	P	40	8- -48	J,10	D	88	3	

T. 3 S., R. 1 W.

1K1	William Elligsen	S,310	Dr	165	8	22	-----	----	Basalt	U	85	1950	P,20	D,S	88	4	Basalt 22–165 ft.
1P1	Sarah Ohling	S,350	Dr	132	6	15	-----	----	--do--	U	101	--------	P,8	D	108	5	Basalt 15–117 ft.
2C1	M. Redding	S,305	Dg	38	48	----	-----	----	--do--	P	34	6- -51	J,8	D	36	8	Aquifer is soft rock.
2N1	Christopoulos Estate.	P,215	Dr	94	6-4	94	85	9	--do--	C	F	7- 6-51	-----	D	66	4	Reported 21 ft of clay, 2 ft of gravel and 52 ft of clay overlying aquifer.
2N2	Bonneville Power Administration.	P,239	Dr	300	12	214	200	100	--do--	C	19.5	10- -41	P,20	Ind	82	3	L; at Oregon City substation.
2Q1	Doty and Doerner Nursery.	P,255	Dr	100	6	----	-----	----	---------	C	36.06	7-11-51	J,20	D, Irr	38	6	Used for irrigating 20 acres.
3A1	L. Garfield	S,255	Dr	80	6	47	50	30	Basalt	U	51	6- -51	J,8	D,S	36	6	
3J2	Mrs. Terry	P,225	Dr	92	6	60	60	32	--do--	C	40	1946	J,5	D	104	5	Basalt 47–92 ft.
3Q1	Mrs. Davies	P,155	Dg	21	-----	----	-----	----	Alluvium	U	18.14	7- 2-51	J,5	D	56	7	Water reportedly corrodes pipes.
4G1	C. W. Kemp	S,250	Dr	114	6	50	112	2	Basalt	C	------	--------	J,10	D,S	90	6	Penetrated 50 ft of decomposed rock and 64 ft of hard rock.
4J1	Floyd Rains	S,155	Dg	12	36	----	-----	----	Alluvium	U	5.97	7-23-51	J,5	D	82	8	Inadequate.
4N1	F. G. Chapman	S,290	Dr	95	6	60	60	35	Basalt	C	35	--------	J,8	D,S	52	5	
4Q1	Joe Taylor	S,325	Dg	43	48	----	36	7	Basalt, weathered.	P	34.75	7-23-51	P,5	D,S	16	5	
5A1	Mrs. Hunter	S,335	Dr	125	-----	----	-----	----	Basalt	C	------	--------	J,10	D,S	84	4	
5D1	W.C. Speaks	S,275	Dr	133	6	20	40	93	--do--	C	22.43	1943	J,10	D	68	4	L.
5L1	Al Oberst	S,410	Dr	100	6	67	65	35	--do--	C	72	10- -46	J,10	D,S	20	5	Reported 65 ft of clay above aquifer.
6D1	W. L. Dobson	S,215	Dr	50	6	40	35	15	--do--	C	F	8-13-51	J,8	D	60	6	Reported 35 ft of clay and 15 ft of rock.
7B1	Neal Dickenson	U,750	Dg	84	36	84	0	84	Clay	P	56.81	7-25-51	J,10	D	46	4	
8B1	John K. Smeed	S,540	Dr	210	6	----	70	140	Basalt	P	------	--------	P,8	D	32	5	Adequate only for domestic use.
9E1	Oliver Todd	S,480	Dg	50	24	25	25	25	--do--	P	45	1951	J,3	----	20	8	
9H1	W. Edwards	S,380	Dr	225	6	27	210	15	--do--	U	206	1944	P,5	D,S	58	4	Used by three families.
10K1	G. Selander	P,155	Dg	21	36	21	16	5	--do--	U	19.36	7-11-51	C,90	D, Irr	30	6	Pumps dry but has quick rate of recovery; supplies 16 sprinklers until early July.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones			Ground-water occurrence	Water level		Type of pump and yield (gpm)	Use	Chemical character (ppm)		Remarks
							Depth to top (feet)	Thickness (feet)	Character of material		Feet below or above (+) land surface	Date			Hardness as $CaCO_3$	Chloride	
									T. 3 S., R. 1 W.—Continued								
10N1	H. C. Conklin	S,235	Dr	115	6				Basalt	C	70.02	7-11-51	J,10	D	28	5	H figure 10.
10N2	H. H. Bryant	P,265	Dg	60	4		59	1	Sand and gravel.	U	38.76	7-24-51	P,8	D,S	26	5	
10R1	R. W. Clark	S,165	Dr	45	6				do	U	35.82	8-20-51	P,5	D,S	50	6	W.
11A1	Elmer Beckman	P,250	Dg	44	36	44	30	14	Basalt	U	24	7- -51	J,8	D,S	80	6	
11G1	E. Ritter	P,225	Dr	145	6		120	25	do	C			P,8	D,S	54	6	
11L2	Don Boeckman	S,200	Dr	150	6	130	130	20	do	C	100	8- -49	J,8	D,S	40	5	Water has a reddish color; penetrated 78 ft of clay and 72 ft of rock.
12N1	Henry Lzicar	P,215	Dr	180	6	162	166	14	Basalt(?)	C	30	1944	P,8	D	84	4	Reported 166 ft of clay and sand above aquifer.
13E1	Walter Schlickeiser	S,210	Dr	106	6				Sand(?)	C			P,5	D,S	98	5	
13P1	F. H. Stangel	S,175	Dr	90	6	90	85	5	Gravel(?)	C	27		J,10	D,S	62	6	
14G1	C. F. Berning	P,180	Dg	43	36				Gravel	C	25.41	7- 9-51	J,8	D	40	4	Reportedly water sometimes has reddish color.
14K1	Susan Seely	P,155	Dr	38	14	38	29	36	Gravel, bouldery.	U	17.92	7- 8-51	C, 200	Irr	60	5	H figure 13; used for irrigating 10 acres; casing perforated 29–36 ft.
15D1	Luther Brown	S,235	Dr	100	6	70	90	10	Basalt	C			J,5	D,S	54	5	
15J1	Otto Jaeger	S,210	Dg	22	72				Basalt, weathered.	U			P,5	D,S	52	7	

15L1	Oregon State Hospital.	S,215	Dr	920	14	252	250	670	Basalt	U	70	7- 2-58	T	P,S	-----	-----	Clay, 240 ft thick, drilled above bedrock; temp., of water $62\frac{1}{2}$°F. A second, similar well, 1,000 ft deep, was pumped at 2,000 gpm.
23A1	Falco Hollies	S,180	Dr	640	8	-----	-----	-----	do	C	26	1940	P,30	Irr	-----	-----	
23F1	Wilsonville Lumber Products.	P,150	Dr	346	12-8	347	314	33	do	C	F	7-10-51	T,40	Ind	162	26	Reportedly 314 ft of clay and decomposed rock above aquifer.
23F2	Flynn	P,140	Dr	71	6	-----	-----	-----	Boulders	U	54	-----	J,10	D	36	6	Has supplied about 20 families.
23M1	Mary F. Jobse	P,110	Dr	237	6	-----	-----	-----	-----	C	F	-----	-----	D,S	128	26	
									T. 3 S., R. 2 W.								
1A1	Jack Grover	S,225	Dr	105	6	68	90	15	Basalt	C	20	9- -50	J,5	D	120	3	Reported 90 ft of soil and decomposed rock above aquifer.
1E1	U. A. Brugger	S,450	Dr	155	6	41	129	26	do	P	110	1945	J,10	D,S	72	3	Reported rock entire depth.
1G1	Mrs. Agnes Dewey	S,320	Dg	50	60	-----	-----	-----	Basalt, weathered.	U	39.13	7-31-51	J,5	D,S	20	4	
1P1	Ludwig Gimm	S,200	Dr	82	6	36	80	2	Basalt	C	53.79	8-13-51	J,5	D	94	5	Reported 20 ft of clay and 52 ft of rock above aquifer.
2N1	J. R. Blake	U,730	Dr	176	6	82	82	23	do	P	75	-----	J,8	D,S	24	6	Water sometimes has reddish color; rock 82–176 ft.
3P1	Jones	U,850	Dr	99	6	99	83	16	do	P	-----	-----	J,5	D	32	3	Inadequate water supply.
4R1	N. F. Biesang	U,850	Dr	210	6	200	-----	-----	do	P	-----	-----	J,15	D,S	40	3	Do.
10C1	E. Sidel	U,830	Dr	188	6	59	59	129	do	P	-----	-----	P,5	D	-----	-----	Adequate only for domestic use.
11Q1	P. B. Wilkins	S,330	Dr	93	6	-----	-----	-----	-----	P	-----	-----	J,5	D	98	4	Readily pumped dry during summer.
12Q1	T. G. Landwarhr	U,1,080	Dg	80	48	-----	4	76	Basalt	P	-----	-----	-----	N	-----	-----	Inadequate; abandoned.

Table 1.—*Records of wells*—Continued

Well	Owner or occupant of property	Topography and approximate altitude (ft above sea level)	Type of well	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones: Depth to top (feet)	Water-bearing zone or zones: Thickness (feet)	Water-bearing zone or zones: Character of material	Ground-water occurrence	Water level: Feet below or above (+) land surface	Water level: Date	Type of pump and yield (gpm)	Use	Chemical character (ppm): Hardness as $CaCO_3$	Chemical character (ppm): Chloride	Remarks
							T. 3 S., R. 1 E.										
3N1	Emil Nodurft	U,710	Dr	290	6	23	----	----	Basalt	P	270	1930	P,8	D,S	50	3	Can easily be pumped dry.
4C1	R. P. Corderman	U,810	Dr	643	6	33	520	123	do	U	550	1945	P,5	D	64	8	L; water level was 68 ft when well was 110 ft deep.
4N1	L. A. Read	S,470	Dr	230	6	50	220	10	do	U	203	7- -51	P,8	D,S	60	4	Reported 50 ft of clay and 180 ft of basalt.
5A1	F. F. Fellows	S,525	Dr	365	6	----	----	----	do	U	325	1947	P,10	D	96	3	Used by two families.
5B1	H. R. Nelson	S,525	Dr	145	6	20	----	----	do	P	105.38	10- 8-51	P,8	D	84	4	Has been pumped dry occasionally.
5Q1	Walter Moser	S,350	Dr	190	6	----	----	----	do	C	----	----	P,10	D,S	----	----	Used by two families.
6C1	Gould	S,485	Dr	340	6	58	----	----	do	U	235	1927	P,12	D,S	88	3	Used by 11 families.
6H1	H. Nutting	S,560	Dr	413	6	30	----	----	do	U	----	----	P,15	D	86	5	Used by three families; rock 30–413 ft.
6P1	C. I. Sharp	S,285	Dr	135	6	----	----	----	do	C	----	----	J,10	D,S	62	2	
6R1	George Oldstead	S,190	Dr	85	6	----	----	----	do	C	----	----	P,8	D,S	----	----	
7A1	C. L. Chapman	S,180	Dr	85	6	12	9	74	do	C	F	10- 8-51	J,20	D, Irr	100	4	Used for irrigating 3 acres; dd is 20 ft with continuous pumping.
7E1	Harry F. Lane	P,250	Dr	235	6	118	118	117	do	C	62	8- -49	T,100	D, Irr	80	4	Used for irrigating 25 acres; yields 230 gpm with dd 120 ft after 10 days pumping.

7H1	Ed Mosier	S,205	Dr	280	--	--	--	--	do	C	--	--	T,100	D, Irr	84	9	Used for irrigating 10–15 acres.
7N1	Stanley Kruse	P,220	Dr	203	5	190	--	--	Silt	C	--	--	P,8	D,S	92	4	Inadequate supply of water.
8C1	John P. Wilkins	S,340	Dr	189	6	20	20	169	Basalt	U	150	1910	P,10	D,S	94	3	
8L1	George Horning	S,280	Dr	187	8	20	185	2	do	U	120	1911	P,12	D,S	96	5	
9D1	E. F. Breckman	S,290	Dr	140	6	100	100	40	do	U	128	1920	P,8	D,S	88	4	
10E1	John Hellberg	S,640	Dr	311	6	22	--	--	do	P	271	1951	T,12	D	66	3	Drilled through alternating layers of hard and soft rock.
15D1	H. H. Hering	S,600	Dr	180	--	--	--	--	do	--	--	--	P,8	D	108	2	
16C1	Fred Baker	S,250	Dr	375	6	--	--	--	do	C	100	1930	P,10	D	130	5	
17A1	William Loellermier.	S,225	Dr	135	6	100	75	60	Gravel	U	70	1925	P,10	D,S	116	3	
17F1	George Moser	P,200	Dg	20	48	20	14	6	Sand	U	16	1925	J,5	D	54	3	
18C1	W. Bruck	P,220	Dr	250	6	230	230	20	Basalt	C	60	1950	T,100	D, Irr	110	3	Used for irrigating 15 acres; has yielded 160 gpm with 60 ft dd after 24 hours pumping.
18C2	L. Wolf	P,210	Dr	60	6	--	--	--	do	--	--	--	P,5	D,S	62	4	Well reportedly entered local high in basalt bedrock.
18Q1	Kruse and Sons	P,195	Dg	30	60	30	--	--	Sand	U	3.67	10- 2-51	P,5	D	54	3	Used by three families; can be pumped dry.
21A1	F. E. Buckner	P,175	Dr	360	6	326	355	5	Gravel	U	59	5-30-60	P,2	D	--	--	Only clay above aquifer.
22G1	C. P. Pynn	S,95	Dr	100	--	--	--	--	Basalt	--	--	--	J,5	S	--	--	Reportedly entered rock at 10 ft.
22J2	do	S,90	Dr	68	6	12	8	60	do	C	20	1945	J,10	D,S	168	66	
22M2	Paul Hebb	S,165	Dr	442	10	--	419	5	Gravel	C	50	1958	--	P,S	--	--	Penetrated about 50 ft of boulder and cobble gravel and then clay all way to aquifer. Test pumped 105 gpm with 250 ft dd.

Table 2.—*Drillers' logs of representative wells*

[Stratigraphic designations by F. J. Frank]

Materials	Thickness (feet)	Depth (feet)
1N/1W-5D1		
[Multnomah County. Altitude about 750 ft. Drilled by R. J. Strasser Drilling Co., 1947]		
Soil and mantle (undifferentiated):		
Clay	38	38
Columbia River basalt:		
Rock, decomposed, brown	114	152
Rock, hard and soft, brown	46	198
Rock, hard, bray, black and brown	106	304
Rock, medium-hard, brown	19	323
Rock, hard, gray, black and brown	156	479
Rock, brown, creviced	6	485
Rock, soft, brown and black	14	499
Rock, hard, black, water-bearing	24	523
Rock, hard, black	27	550
1N/1W-20H1		
[C. E. Wismer. Altitude about 350 ft.]		
Soil and mantle (undifferentiated):		
Clay	43	43
Boring lava (basalt):		
Rock	147	190
Troutdale formation:		
Clay	206	396
Columbia River basalt:		
Rock	84	480
1N/1W-23K1		
[Richfield Oil Co. Altitude about 1,030 ft. Drilled by Fowler Drilling Co., 1946]		
Soil and mantle (undifferentiated):		
Soil and weathered basalt	97	97
Columbia River basalt:		
Boulders, and basalt	84	181
Basalt	500	681
Basalt and shale	25	706
Basalt	97	803
Sedimentary and volcanic rocks of Tertiary age:		
Sand and shale, fossiliferous	1,242	2,045
Volcanic sand, agglomerate, shale, clay, and lava flows	2,882	4,927
Basalt	349	5,276
Volcanic agglomerate and lava flows	2,609	7,885
1N/1W-23R1		
[Alfred H. Corbett. Altitude about 1,100 ft. Drilled by A. M. Jannsen Drilling Co., 1948]		
Soil and mantle (undifferentiated):		
Clay	50	50
Quicksand	10	60
Clay	18	78
Columbia River basalt:		
Rock, black	397	475

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
1N/1W-23R1—*Continued*		
Columbia River basalt—Continued:		
Rock, red and brown	85	560
Shale, sandy (basalt?)	290	850
Sedimentary strata of Tertiary age:		
Clay, sandy and sandstone	110	960
1N/1W-35H1		
[W. M. Perrault. Altitude about 650 ft. Drilled by A. M. Jannsen Drilling Co., 1948]		
Soil and mantle (undifferentiated):		
Clay	82	82
Boring lava:		
Rock, hard, crevice at 115 ft	33	115
Rock, soft	23	138
Rock, hard	101	239
Rock, soft, red, water-bearing	12	251
Rock, broken, red and gray	29	280
Rock, hard, gray	93	373
Troutdale formation:		
Clay, blue	137	510
Clay, yellow	17	527
Clay, red	53	580
Clay, brown	17	597
Conglomerate, water-bearing	15	612
Sand, coarse	3	615
Conglomerate, water-bearing	18	633
1N/1W-35M1		
[West Hills Nursery. Altitude about 455 ft. Drilled by A. Gaunt, 1948]		
Boring lava (basalt) and interfingered beds:		
Clay	70	70
Rock, hard, water-bearing at 80–100 ft	72	142
Clay	20	162
Rock, hard	43	205
Clay and rock	10	215
Rock	19	234
Troutdale formation:		
Clay, red	216	450
Clay, black and gray	77	527
1N/1W-36E1		
[Portland Gas and Coke Co. Altitude about 720 ft. Drilled by Harty Bros.]		
Soil and mantle (undifferentiated):		
Clay, sandy, yellow	63	63
Boring lava:		
Rock, gray	211	274
Rock, soft, red, water-bearing	36	310
Rock, hard, gray	96	406
Rock, soft, red, water-bearing	6	412

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
1N/1W-36E1—Continued		
Troutdale formation:		
Shale, blue	9	421
1N/2W-15C1		
[West Union School. Altitude about 210 ft. Drilled by A. Gaunt, 1948]		
Valley fill:		
Clay and sand, varicolored	190	190
Clay	140	330
Columbia River basalt:		
Rock, fairly hard, creviced toward bottom	230	560
1N/3W-1K2.		
[North Plains Water District. Altitude about 190 ft. Drilled by A. Gaunt, 1945]		
Valley fill:		
Clay	314	314
Clay, sandy	21	335
Sand, blue, and some gravel, water-bearing	5	340
Clay	46	386
Columbia River basalt:		
Rock, soft	200	586
Rock, hard	28	614
Rock, soft	96	710
1N/3W-5R1		
[Roy Catholic School. Altitude about 175 ft. Drilled by Blair Drilling Co., 1950]		
Valley fill:		
Clay, blue and gray	343	343
Wood and vegetation	1	344
Clay, blue	43	387
Sand, black	2	389
Clay, gray	9	398
Sand, black	8	406
1N/3W-7A2		
[L. J. Spiering. Altitude about 175 ft. Drilled by A. M. Jannsen Drilling Co., 1951]		
Valley fill (and decomposed rock?):		
Sand and clay	368	368
Sand, clay and gravel	63	431
Clay and sand	129	560
Clay	70	630
Rock, weathered	248	878
Columbia River basalt:		
Rock, rotten	22	900
Rock, soft lava	30	930
Rock, hard	16	946

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
1N/3W-36R3		
[Birdseye Cannery. Altitude about 185 ft. Drilled by A. M. Jannsen Drilling Co., 1929]		
Valley fill:		
Clay and soil	150	150
Shale, sandy (clay?)	20	170
Sand and gravel, water-bearing	2	172
Shale and hard clay	1,208	1,380
Wood and vegetation	100	1,480
Columbia River basalt:		
Rock, igneous	20	1,500
Basalt and clay, gray	119	1,619
1N/4W-14B1		
[L. J. Heesacker. Altitude about 165 ft. Drilled by Blair Drilling Co., 1950]		
Valley fill:		
Clay, blue and gray	483	483
Columbia River basalt:		
Basalt, red, burnt	14	497
Basalt, hard	14	511
Basalt, red	42	553
Basalt, hard	32	585
1N/4W-23R1		
[Arnold Goff. Altitude about 245 ft. Drilled by Blair Drilling Co., 1950]		
Valley fill:		
Clay, red, yellow	141	141
Columbia River basalt:		
Basalt, weathered, gray	42	183
Basalt, hard, blue	3	186
Basalt, brown, soft	54	240
Basalt, brown	21	261
Basalt, soft, water-bearing	1	262
Basalt, hard, blue to black	39	301
2N/1W-31Q1		
[Plainview School. Altitude about 710 ft. Drilled by Steinman Bros. Drilling Co., 1938]		
Soil and mantle (undifferentiated):		
Clay	34	34
Columbia River basalt:		
Rock, soft	34	68
Rock, hard, black, water-bearing	123	191
Rock, soft	20	211
Rock, hard, black	28	239
Rock, soft, black	17	256
Rock, hard, black, water-bearing	125	381
Rock, hard, gray and black	34	415
Rock, whitish, talcose	2	417

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
2N/2W-20A1		
[Otto Solberger. Altitude about 910 ft. Drilled by Hardy Bros., 1949]		
Soil and mantle (undifferentiated):		
Soil	5	5
Clay, red	20	25
Clay, brown and yellow, water-bearing at 70 ft.	120	145
Columbia River basalt:		
Rock and clay, soft	30	175
Rock	110	285
Sedimentary strata of Tertiary age:		
Clay, shale	60	345
Silt and sand, fine, black, containing sea shells	180	525
Sand, coarse, black and gray, contains sea shells	20	545
2N/3W-24P1		
[A. M. Anderson. Altitude about 640 ft. Drilled by A. Gaunt, 1946]		
Soil and mantle (undifferentiated):		
Clay	201	201
Columbia River basalt:		
Rock, soft, water-bearing at top	112	313
Sedimentary strata of Tertiary age:		
Clay and sandstone	144	457
1/1W-2P1		
[Commonwealth, Inc. Altitude about 420 ft. Drilled by R. J. Strasser Drilling Co., 1953]		
Soil and mantle (undifferentiated):		
Clay and soil	9	9
Boring lava (basalt):		
Rock, broken	18	27
Rock, gray, medium-hard	9	36
Rock, gray, hard	73	109
Rock, gray, hard (some broken crevices with brown seams)	42	151
Rock, gray, crevices	7	158
Rock, gray, hard	56	214
Rock, gray, very hard	17	231
Rock, brown	8	239
Troutdale formation:		
Conglomerate	14	253
Clay, yellow	44	297
Clay, blue	7	304
Clay, yellow	12	316
Clay, blue	13	329
Clay, yellow	35	364
Clay, blue	129	493
Clay, red	34	527
Clay, blue	66	593
Clay, red and yellow	34	627
Conglomerate	46	673

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
1/1W-2P1—Continued		
Columbia River basalt:		
Rock, decomposed	44	717
Rock, brown and gray, hard	53	770
Rock, brown, hard, broken	7	777
Rock, gray and black	77	854
Rock, black, water-bearing	18	872
Rock, gray, hard	3	875
1/1W-11L1		
[City of Beaverton. Altitude about 350 ft. Drilled by A. M. Jannsen Drilling Co., 1932]		
Boring lava (basalt):		
Rock, red and gray (crevice at 59 ft)	59	59
Rock, red (crevice at 88 ft)	52	111
Troutdale formation:		
Clay, yellow, blue, red	442	553
Sandstone, yellow	10	563
Clay, yellow	52	615
Columbia River basalt:		
Rock, with clay	35	650
Rock, black, hard	58	708
Rock, black, very hard	27	735
1/1W-17A2		
[St. Mary's of the Valley Academy. Altitude about 205 ft. Drilled by A. M. Jannsen Drilling Co., 1953]		
Valley fill:		
Clay, yellow, and soil	25	25
Clay, brown	13	38
Clay, blue	7	45
Clay, yellow	42	87
Clay, blue, gray and green	769	856
Sand, gray	19	875
Clay, gray	71	946
Clay, sandy, gray	13	959
Clay, sticky gray	16	975
Clay, sandy, brown and gray	43	1,018
Clay, gray, blue	104	1,122
Clay, brown	48	1,170
Columbia River basalt:		
Rock, hard, broken lower 28 feet	69	1,239
Rock, hard (cavity at 1,249 ft)	14	1,253
Rock, hard, broken (some water)	15	1,268
Rock, hard (cavity at 1,269 ft)	6	1,274
Rock, broken (water-bearing from 1,274 to 1,279 ft)	16	1,290
Rock, hard	14	1,304
Rock, broken (cavity at 1,359 ft; increase in water)	56	1,360
Rock, hard (cavity at 1,369 ft); test pumped 80 gpm with 230 ft of drawdown	14	1,374
Rock, hard, broken lower 31 ft	113	1,487
Rock, hard (crevice at 1,488 ft)	6	1,493
Rock, broken	1	1,494

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
1/1W-17A2—Continued		
Columbia River basalt—Continued:		
Rock, hard (crevice from 1,494 to 1,495 ft)	3	1,497
Rock, medium-hard	5	1,502
Rock, broken	5	1,507
1/1W-21P1		
[City of Beaverton. Altitude about 330 ft. Drilled by R. J. Strasser Drilling Co., 1945]		
Soil and mantle (undifferentiated):		
Clay	34	34
Rock, soft, gray (clay?)	4	38
Clay, yellow	16	54
Columbia River basalt:		
Rock, soft, gray, water-bearing from 90 to 96 ft	142	196
Rock, hard, gray to blue	524	720
Rock, hard, blue, with seams	15	735
Rock, soft, water-bearing	1	736
Rock, hard, blue	64	800
1/1W-24D3		
[Portland Golf Club. Altitude about 220 ft. Drilled by A. M. Jannsen Drilling Co., 1951]		
Valley fill:		
Clay and soil	20	20
Quicksand	22	42
Clay, blue	123	165
Clay, brown	20	185
Clay, red	119	304
Clay, hard, sandy	44	348
Columbia River basalt:		
Rock	20	368
Clay	10	378
Rock	52	430
Clay	8	438
Rock, hard	53	491
Rock, soft, porous	3	494
Rock, hard	6	500
1/1W-25M1		
[Warren Forsythe. Altitude about 200 ft. Drilled by John Beck, 1949, deepened in 1960]		
Soil and mantle (undifferentiated):		
Clay, blue	88	88
Columbia River basalt:		
Basalt, hard	5	93
Shale, soft near top (basalt?)	41	134
Basalt, hard	102	236
Basalt, interflow zone, water-bearing	2	238
Basalt, hard	4	242
Basalt, broken, water-bearing	11	253

Table 2.—Drillers' logs of representative wells—Continued

Materials	Thickness (feet)	Depth (feet)
1/1W-27C1		
[Robert Murphy. Altitude about 170 ft. Drilled by A. M. Jannsen Drilling Co., 1952]		
Soil and mantle (undifferentiated):		
Soil, clay, and silt	31	31
Columbia River basalt:		
Rock, soft and rotten	10	41
Rock, soft, caving, water-bearing lower 3 ft	31	72
Rock, soft	3	75
Rock, harder, honeycombed	22	97
Rock, hard with soft layers, water-bearing, with static level 3 ft below surface	30	127
Rock, hard, brown	15	142
Rock, soft, honeycombed	12	154
Basalt, harder, gray, water flowing at 184 ft	34	188
Basalt, hard, but broken, loose	22	210
Rock, shale(?), green, soft, mucky	13	223
Rock, gray, crisp, like shale(?)	25	248
Basalt, gray, water-bearing from 250 to 260 ft	13	261
Basalt, broken, rubbly with muck	19	280
Rock, more solid, black	8	288
Rock, soft, black, water-bearing, flowing 10 gpm	15	303
Basalt, rubble, loose, running, in cubical blocks	11	314
1/1W-33N1		
[George N. Clark. Altitude about 210 ft. Drilled by Steinman Bros. Drilling Co., 1951]		
Valley fill:		
Clay, yellow, sandy	15	15
Muck, blue (almost quicksand)	20	35
Clay, red, brown, and yellow	215	250
Clay, brick-colored	55	305
Clay, yellow	45	350
Columbia River basalt:		
Rock, soft, brown	33	383
Rock, gray	7	390
1/2W-19A1		
[Louis Hilleke. Altitude about 185 ft. Drilled by A. M. Jannsen Drilling Co., 1950]		
Valley fill:		
Clay, brown	15	15
Clay, sandy	10	25
Quicksand	35	60
Mud, blue	30	90
Clay and sand, blue	48	138
Clay and boulders, blue	5	143
Clay, with gravel, blue and yellow	117	260
Gravel and sand	7	267
Clay, varicolored	426	693
Clay, red	68	761
Clay, yellow	31	792
Clay, varicolored	26	818
Columbia River basalt:		
Rock, decomposed	14	832

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
1/2W-19A1—Continued		
Columbia River basalt—Continued:		
Sand and clay, gray	9	841
Rock decomposed, red and brown	23	864
Rock, gray	9	873
Rock, brown	30	903
1/2W-24J3		
[Aloha-Huber Water District. Altitude about 320 ft. Drilled by A. M. Jannsen Drilling Co., 1958]		
Soil and weathered rock (undifferentiated):		
Clay, brown, yellow, red	45	45
Columbia River basalt:		
Basalt, green and black	40	85
Basalt, decomposed	3	88
Basalt, red, hard	6	94
Basalt, red, soft	4	98
Basalt, black, brown, gray	172	270
Basalt, red and brown, water-bearing	23	293
Basalt, black, broken, water-bearing 300 to 312 ft	19	312
Basalt, gray and black	66	378
Basalt, brown, water-bearing	26	404
Basalt, gray and black	71	475
Basalt, black, soft, water-bearing	6	481
Basalt, black and gray	69	550
Basalt, brown, soft, water-bearing	3	553
Basalt, gray and black	100	653
Basalt, black, soft, water-bearing	4	657
Basalt, black	37	694
Sedimentary rocks of Tertiary(?) age:		
Shale, gray	26	720
1/2W-25J1		
[Jane S. Hackman. Altitude about 765 ft. Drilled by The Texas Co., 1947]		
Soil and mantle (undifferentiated):		
Clay and weathered basalt	100	100
Columbia River basalt:		
Basalt	939	1,039
Sedimentary and volcanic rocks of Tertiary age:		
Sand and shale, fossiliferous	1,801	2,840
Volcanic sand, agglomerate, shale	1,430	4,270
Shale, sandstone and agglomerate	4,936	9,206
Volcanic agglomerates and flows	57	9,263
1/2W-29Q1		
[W. T. Putnam. Altitude about 155 ft. Drilled by A. Gaunt, 1945]		
Valley fill:		
Soil	10	10
Quicksand	70	80
Clay, blue	80	160

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
1/2W-29Q1—Continued		
Valley fill—Continued:		
Sand, brown, contains wood	50	210
Clay, blue	10	220
Sand, brown, contains wood	50	270
Clay, blue	80	350
Sand, dark-brown, contains a log	50	400
Columbia River basalt:		
Rock, broken	45	445
Rock, solid	50	495
Rock, soft, water-bearing	10	505
1/2W-31C1		
[C. E. Asbahr. Altitude about 175 ft. Drilled by A. M. Jannsen Drilling Co., 1949]		
Valley fill:		
Clay, brown	20	20
Creek sand	2	22
Mud, blue	15	37
Sand, fine, blue	6	43
Mud, blue	34	77
Clay, brown and gray	91	168
Clay, sticky, blue	26	194
Clay and gravel	6	200
Gravel	4	204
Clay, red	21	225
Clay, brown	36	261
Columbia River basalt:		
Rock, decomposed	9	270
Gravel, cemented(?)	15	285
Rock	143	428
Rock, sand	35	463
Rock, decomposed	6	469
Rock	246	715
1/4W-2N2		
[R. C. Ritchey. Altitude about 190 ft. Drilled by Blair Drilling Co., 1950]		
Valley fill:		
Clay and topsoil	30	30
Clay, blue, containing wood and decomposed vegetation	28	58
Sedimentary beds of Tertiary age:		
Shale, blue, with thin sandstone strata	34	92
1/1-19P1		
[R. C. Coffell. Altitude about 435 ft. Drilled by Steinman Bros. Drilling Co., 1946]		
Soil and mantle (undifferentiated):		
Clay	30	30
Boring lava (basalt):		
Rock, red	9	39
Rock, hard, black	38	77
Rock, gray	23	100
Rock, brown	10	110

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
1/1-19P1—Continued		
Troutdale formation:		
Clay, red, yellow, blue	75	185
Clay, red	170	355
Clay, yellow (streaks of sand and gravel)	80	435
Clay, dark	50	485
Columbia River basalt:		
Rock, green	15	500
Rock, black, water-bearing	57	557

1/1-31C1

[Mrs. Francis Connolly. Altitude about 425 ft. Drilled by Steinman Bros. Drilling Co., 1951]

Materials	Thickness (feet)	Depth (feet)
Soil and mantle (undifferentiated):		
Clay, yellow	36	36
Boring lava (basalt):		
Rock, hard	15	51
Rock, soft, red	19	70
Rock, hard	66	136
Rock, soft, yellow, water-bearing	5	141
Rock, hard	5	146
Rock, brown, honeycombed	9	155
Troutdale formation:		
Clay, yellow	20	175

1/1-31D1

[Cathryns Charcoal Broiler Restaurant. Altitude about 400 ft. Drilled by A. M. Jannsen Drilling Co., 1953]

Materials	Thickness (feet)	Depth (feet)
Soil and mantle (undifferentiated):		
Clay	12	12
Boring lava:		
Rock, broken, black	14	26
Rock, gray	69	95
Troutdale formation:		
Clay, red	85	180
Clay, brown	4	184
Clay, red and brown	206	390
Sand, fine	2	392
Columbia River basalt:		
Rock, broken	18	410
Rock	200	610

2/1W-4G1

[City of Tigard. Altitude about 350 ft. Drilled by Strasser Bros., 1958]

Materials	Thickness (feet)	Depth (feet)
Soil and weathered rock (undifferentiated):		
Soil and clay	9	9
Shale, red	17	26
Conglomerate, gray and green	28	54
Weathered basalt, soft, gray	32	86
Columbia River basalt:		
Basalt, red, gray and brown with clay in seams	64	150

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
2/1W-4G1—Continued		
Columbia River basalt—Continued:		
Basalt, red	18	168
Basalt, gray with porous (water) zone 218–263 ft	95	263
Basalt, brown and gray	49	312
Basalt, gray and brown, porous	29	341
Basalt, gray, hard	16	357
Basalt, gray and brown, porous	19	376
Basalt, gray, hard	28	404
Basalt, gray, porous	18	422
Basalt, black	12	434
Basalt, gray, porous	16	450
Basalt, gray, hard	6	456
Basalt, black, porous	27	483
Basalt, gray	11	494
2/1W-8G1		
[John J. Bushnell. Altitude about 600 ft. Drilled by Steinman Bros. Drilling Co., 1946]		
Soil and mantle (undifferentiated):		
Clay	10	10
Columbia River basalt:		
Rock, brown and red	20	30
Rock, gray, containing crevices	55	85
Rock, brown and gray	185	270
Rock, greenish-gray	66	336
Rock, red, black and gray	59	395
Rock, brown, water-bearing	12	407
Rock, hard, black	20	427
Rock, soft, brown, with seams	9	436
Rock, black and green, crevice at 440 ft	11	447
Rock, soft, red	3	450
Rock, hard, black	38	488
Rock, soft, brown	8	496
Rock, hard, black	4	500
2/1W-11E1		
[City of Tigard. Altitude about 375 ft. Drilled by R. J. Strasser Drilling Co., 1947]		
Soil and mantle (undifferentiated):		
Top soil	2	2
Clay, yellow	9	11
Hardpan, with some sand	11	22
Silt and clay, yellow	25	47
Columbia River basalt:		
Rock, lava, soft	17	64
Rock, lava, gray and green	20	84
Rock, lava, black, gray, and red, medium hard	84	168
Rock, black and red, medium hard	24	192
Rock, black, hard	10	202
Rock, red and black, soft, porous, water-bearing	10	212
Rock, black, gray, medium hard	48	260
Rock, gray, porous, water-bearing	12	272
Rock, black and red, containing crevices	37	309
Rock, yellow and gray, water-bearing	16	325

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Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
2/1W-11E1—Continued		
Columbia River basalt—Continued:		
Rock, gray, hard	20	345
Rock, gray, medium hard	25	370
Rock, gray, hard	11	381
2/1W-13D1		
[Durham School. Altitude about 170 ft. Drilled by Frank Zell, 1951]		
Valley fill:		
Sand	45	45
Clay	20	65
Sand	70	135
Gravel	13	148
Clay	2	150
2/1W-13L2		
[M. Eastham. Altitude about 185 ft. Drilled by Steinman Bros. Drilling Co., 1941]		
Valley fill:		
Topsoil and boulders	15	15
Gravel and sand, packed	21	36
Gravel and boulders	44	80
Gravel, loose, water-bearing	25	105
Clay and gravel	15	120
2/1W-14A1		
[Tigard Senior High School. Altitude about 190 ft. Drilled by Steinman Bros. Drilling Co., 1953]		
Valley fill:		
Clay and sand	18	18
Clay, yellow and blue	48	66
Clay and sand, yellow and blue	50	116
Clay, blue and gray	34	150
Clay and quicksand	40	190
Clay, blue	52	242
Sand and gravel	2	244
Clay, blue-gray	16	260
Sand, water-bearing	1	261
Clay, blue-gray	63	324
Clay, yellow	17	341
Clay, blue	9	350
Clay, brown	10	360
Clay, blue	18	378
Shale, blue-gray	6	384
Clay, blue	46	430
Clay, brown,(1 gpm with woody material in water)	7	437
Clay and weathered gravel	8	445
Clay, blue-gray	32	477
Clay, brown, gritty	2	479
Clay, gray	33	512
Clay, chocolate-brown	16	528
Clay, blue, sandy	5	533

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
2/1W-14A1—Continued		
Valley fill—Continued:		
Shale, hard, brown	5	538
Clay, red	21	559
Columbia River basalt:		
Rock, soft, and clay, red	31	590
Rock, soft, and clay, yellow	37	627
Rock, soft, brown, yellow (5 gpm at 615 ft)	23	650
Shale, blue	7	657
Rock, brown	8	665
Shale, hard, blue	2	667
Rock, black	13	680
2/1W-24M2		
[City of Tualatin. Altitude about 120 ft. Drilled by Steinman Bros. Drilling Co., 1951]		
Valley fill:		
Top soil	8	8
Gravel, cemented, and boulders	12	20
Clay, blue, sandy	45	65
Clay, yellow	20	85
Clay, red	15	100
Clay, yellow, with a little fine gravel	50	150
Columbia River basalt:		
Rock, soft	22	172
Rock, with a hardpan	10	182
Rock, red and brown	17	199
Rock, soft, brown	37	236
Rock, hard	3	239
Rock, brown, containing crevices	35	274
Rock, red	4	278
Rock, brown, honeycombed	40	318
Rock, hard, containing crevices	7	325
2/1W-26B2		
[Portland Gas and Coke Co. Altitude about 225 ft. Drilled by Steinman Bros. Drilling Co., 1947		
Valley fill:		
Clay, yellow, sandy	18	18
Quicksand, yellow and blue	42	60
Clay, yellow and blue, sandy	115	175
Clay, red, brown and blue	50	225
Clay or shale(?), gray, soft	145	370
Clay or shale(?), brown, containing wood	40	410
Clay, red, soft	23	433
Columbia River basalt:		
Rock, honeycombed, water-bearing	17	450
2/1W-27H1		
[Bryan Tykeson. Altitude about 205 ft. Drilled by Steinman Bros. Drilling Co., 1948]		
Valley fill:		
Sand, silty, red and yellow	63	63
Sand, silty, blue, with some clay	12	75

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
2/1W-27H1—Continued		
Valley fill—Continued:		
Clay, sandy, blue	10	85
Clay, red, yellow and blue	87	172
Sand and gravel	5	177
Clay, yellow	33	210
Columbia River basalt:		
Shale(?), blue and yellow	10	220
Shale(?), red and yellow, hard	22	242
Rock, brown	65	307
Rock, dark-brown, hard	16	323
2/1W-32D1		
[City of Sherwood. Altitude about 190 ft. Drilled by A. M. Jannsen Drilling Co., 1946]		
Soil and mantle (undifferentiated):		
Clay	20	20
Quicksand and clay, blue	18	38
Columbia River basalt:		
Rock, sand	99	137
Rock, lava	38	175
Rock	7	182
Gravel, cemented(?)	24	206
Rock, lava	48	254
Gravel, cemented(?)	15	269
Rock, lava	4	273
Gravel, cemented(?)	23	296
Rock, broken	43	339
2/1W-35K1		
[Ben Andrews. Altitude about 340 ft. Drilled by Steinman Bros. Drilling Co., 1947]		
Soil and mantle (undifferentiated):		
Soil and clay, sandy	46	46
Columbia River basalt:		
Rock, soft	64	110
Rock, hard, gray, water-bearing	40	150
Rock, brown and gray	30	180
Rock, hard, gray	10	190
Rock, soft, brown	8	198
Rock, very hard	2	200
2/2W-1J1		
[Bierly Bros. Altitude about 285 ft. Drilled by A. M. Jannsen Drilling Co., 1950]		
Soil and mantle (undifferentiated):		
Clay	30	30
Columbia River basalt:		
Rock	150	180
Rock, gray	37	217
Rock, brown and black	73	290
Rock, hard, gray	78	368
Rock, soft, black, lava	20	388
Rock, brown	32	420

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
2/2W-1J1—Continued		
Columbia River basalt—Continued:		
Rock, hard, black	80	500
Rock, brown, lava	15	515
Rock, gray	10	525
Rock, brown, lava	8	533
Rock, gray	37	570
Rock, black, lava	18	588
2/2W-6D1		
[S. R. Rotchstrom. Altitude about 180 ft. Drilled by A. M. Jannsen Drilling Co., 1947]		
Valley fill:		
Clay	281	281
Columbia River basalt:		
Rock	177	458
Clay(?)	1	459
Rock, water-bearing	23	482
Sand(?)	4	486
2/3W-1A1		
[Harold Haase. Altitude about 180 ft. Drilled by A. M. Jannsen Drilling Co., 1948]		
Valley fill:		
Clay	15	15
Sand	5	20
Quicksand	15	35
Clay	251	286
Columbia River basalt:		
Rock	119	405
2/3W-1C1		
[Richard Kiefer. Altitude about 230 ft. Drilled by A. M. Jannsen Drilling Co., 1950]		
Valley fill (and decomposed rock?):		
Clay, red and boulders	155	155
Columbia River basalt:		
Rock, broken	3	158
Rock, brown and blue	22	180
Rock, soft, porous	35	215
Rock, hard, blue	27	242
Rock, soft	6	248
Rock, hard	1	249
Rock, broken	4	253
Rock, soft	9	262
Rock, broken	40	302
Rock, hard	11	313
Rock, broken	12	325
Rock, hard	10	335
Rock, hard, gray	28	363
Volcanic ash, fine, loose	3	366
Rock, loose	3	369

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
2/1-3L1		
[City of Oswego. Altitude about 250 ft. Drilled by A. M. Jannsen Drilling Co., 1939]		
Valley fill:		
Clay	50	50
Gravel and clay	10	60
Clay	20	80
Clay, red	35	115
Clay, brown	27	142
Clay, dark-brown	53	195
Clay, black	33	228
Columbia River basalt:		
Rock shale(?), hard, brown	14	242
Rock	32	274
Rock, hard	6	280
Rock	40	320
Basalt, gray	26	346
Rock	13	359
Rock lava, black	3	362
Rock, porous	20	382
Lava, black and red	36	418
Basalt, gray	6	424
Shale(?)	11	435
Clay(?), yellow and red	10	445
Shale(?), gray	45	490
Rock	24	514
Rock, sand, gray	9	523
Rock	83	606
Sand(?)	5	611
Rock, cavey	19	630
Rock, red	25	655
Shale(?), blue	14	669
Rock	56	725
Shale(?), blue	10	735
Rock, hard	5	740
Clay and rock	81	821
Rock, red	16	837
Rock and clay	95	932
Rock, blue, gray	25	957
Rock, red, water-bearing	15	972
Rock, blue, gray	8	980
2/1-8N1		
[Lake Oswego Water Co. Altitude about 115 ft. Drilled by R. J. Strasser Drilling Co., 1945]		
Soil and mantle (undifferentiated):		
Clay	10	10
Columbia River basalt:		
Rock, soft, brown	27	37
Rock, hard, blue	5	42
Rock, soft, brown	6	48
Rock, hard, gray	4	52
Rock, soft, brown	21	73
Rock, hard, green	5	78

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
2/1-8N1—Continued		
Columbia River basalt—Continued:		
Rock, hard, gray and black	21	99
Rock, soft, brown, water-bearing	23	122
Rock, hard, black	18	140
Rock, hard, green	19	159
Rock, soft, brown	13	172
Rock, hard, gray	7	179
Rock, soft, brown	12	191
Rock, hard, gray	6	197
Rock, hard, black, water-bearing crevice from 231–234 ft	46	243
Rock	15	258

2/1-9D1

[Lake Oswego Water Co. Altitude about 225 ft. Drilled by R. J. Strasser Drilling Co., 1946]

Materials	Thickness (feet)	Depth (feet)
Columbia River basalt:		
Rock, broken, red	6	6
Rock, solid, red	10	16
Rock, hard, gray	87	103
Rock, black	25	128
Rock, hard, gray	37	165
Rock, black	25	190
Rock, soft, honeycombed, water-bearing	7	197
Rock, hard, black	3	200
Rock, soft, black, carries some water	4	204
Rock, black	15	219
Rock, hard, black	68	287
Rock, soft, black, water-bearing	15	302
Rock, gray	7	309
Rock	96	405

2/1-14F1

[Marylhurst College. Altitude about 200 ft. Drilled by R. J. Strasser Drilling Co., 1947]

Materials	Thickness (feet)	Depth (feet)
Soil and mantle (undifferentiated):		
Clay	5	5
Sand, brown	13	18
Sand and gravel	17	35
Columbia River basalt:		
Rock, soft	14	49
Gravel, cemented(?)	15	64
Rock, medium hard, brown	17	81
Rock, hard, gray, seams 161–163 ft	82	163
Rock, hard, gray	11	174
Rock, brown	7	181
Rock, hard, gray	12	193
Rock, medium hard, black	16	209
Rock, gray	45	254
Rock, porous, red and gray, water-bearing	12	266
Rock, brown, green and black	35	301
Rock, hard,gray	50	351
Rock, hard,brown	18	369
Rock, hard, gray and black	78	447

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
2/1-14F1—Continued		
Columbia River basalt—Continued:		
Rock, porous, black, water-bearing	9	456
Rock, hard, gray	20	476
Rock, hard, black	25	501
Rock, broken, water-bearing	11	512
Rock, hard, gray	7	519
2/1-15C1		
[City of Oswego. Altitude about 560 ft. Drilled by A. M. Jannsen Dr'lling Co., 1935]		
Soil and mantle (undifferentiated):		
Clay	10	10
Columbia River basalt:		
Rock, red and gray	149	159
Rock, brown	24	183
Rock, decomposed, brown	12	195
Rock, gray	20	215
Rock, broken, brown and clay	26	241
Rock, gray, water-bearing 260–265 ft	89	330
Rock, porous	15	345
Rock, black	73	418
Rock, brown, creviced	54	472
Rock, with streaks of shale	27	499
Rock, black, some broken	19	518
Rock, black, with streaks of shale	23	541
Rock, gray	99	640
2/1-22C1		
[K. B. Hall. Altitude about 450 ft. Drilled by A. M. Jannsen Drilling Co., 1945]		
Soil and mantle (undifferentiated):		
Clay, sandy, red	35	35
Columbia River basalt:		
Rock, water-bearing at 123 ft	257	292
Rock, black	93	385
Rock, water-bearing	18	403
Rock, black	73	476
Rock, gray	51	527
2/1-25E1		
[H. E. Ibach. Altitude about 620 ft. Drilled by Steinman Bros. Drilling Co., 1949]		
Soil and mantle (undifferentiated):		
Clay and boulders	30	30
Columbia River basalt:		
Rock, soft	20	50
Rock, solid, gray	82	132
Rock, soft, black	10	142
Rock, hard, gray	10	152
Rock, soft, black and gray	72	224
Rock, hard, gray	46	270
Rock, soft, black, with crevices	2	272
Rock, gray and black	75	347

Table 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
2/1-25E1—Continued		
Columbia River basalt—Continued:		
Rock, soft, black and red	8	355
Rock, hard, gray and black	24	379
Rock, soft, red	8	387
Rock, hard, gray, with seams toward bottom	68	455
3/1W-2N2		
[Bonneville Power Administration. Altitude 238.6 ft. Drilled by R. J. Strasser Drilling Co., 1941]		
Valley fill (and decomposed rock?):		
Clay with boulders	51	51
Clay, blue, red, and yellow	142	193
Clay, sand, gray	8	201
Columbia River basalt:		
Basalt, water-bearing	99	300
3/1W-5D1		
[W. C. Speaks. Altitude about 275 ft. Drilled by Steinman Bros. Drilling Co., 1943]		
Soil and mantle (undifferentiated):		
Clay, yellow	14	14
Columbia River basalt:		
Rock, soft	43	57
Rock, fairly hard, water-bearing	47	104
Rock, soft	29	133
3/1-4C1		
[R. P. Corderman. Altitude about 810 ft. Drilled by Steinman Bros. Drilling Co., 1944]		
Soil and mantle (undifferentiated):		
Clay	29	29
Columbia River basalt:		
Rock, some water at 70 ft	81	110
Rock, soft, yellow	45	155
Rock, brown, hard and soft	305	460
Rock, black, hard and soft	60	520
Rock, brown, water-bearing	123	643

Table 3.—*Descriptions of representative springs*

Topography: P, plain; S, slope.
Yield: (e) estimated; (m) measured with 90° v-notch weir; (r) reported.

Use of water: D, domestic; Irr, irrigation; PS, public supply; S, Stock.

Number	Owner or occupant of property	Name of spring	Topography and approximate altitude (ft above sea level)	Water-bearing material	Occurrence	Yield: Gallons per minute	Yield: Date	Use	Hardness as $CaCO_3$ (ppm)	Cloride (Cl ppm)	Remarks
1N/4W-6D1	Melvin Green		P 340	Gravels along Gales Creek.	Intersection of water table.	15 (r)	7- 7-50	D	50	4	Reportedly larger flow in winter.
9Q1	L. E. Bamford		S 230	Columbia River basalt	Fissures in rock	30 (r)	12- 4-50	D,S, Irr	38	4	Supplies six families; irrigates garden and lawn.
14N1	Beverly Davis		P 220	do	Hillwash material	60 (e)	12- 4-50	D,S	14	3	Flow reportedly drops to 10 or 15 gpm in summer.
26J1	Frank Russel		S 220	do	Near contact with underlying marine shale(?).	30 (r)	11-27-50	Irr	--	--	Irrigates about 5 acres.
2N/2W-10F1	A. A. Albright		S 1,280	Residual soil on Columbia River basalt.	Seep from clay bank.	1 (r)	8-28-51	D,S	44	3	Reportedly has some flow the entire year.
19R1	A. J. Logan		S 300	do	do	3 (r)	8-24-51	D,S	38	3	Reportedly has very little fluctuation.
23R1	Oscar Emery		S 900	do	do	5 (r)	9- 4-51	D,S	40	4	Fluctuates with season.
2N/3W-10H1	Carl Raddatz		S 700	do	do	5 (r)	1- 9-51	D	12	4	

20Q1	Jacob Bass		S	250	Columbia River basalt	Near contact with marine shale(?).	5 (e)	1- 3-51	D,S	44	4	Very little fluctuation reported.
28E1	M. L. Smith		S	220	do	do	50 (m)	1- 3-51	D,S, Irr	14	3	Flow reportedly about 20 gpm in summer; used for irrigating garden.
31A1	H. J. Vandehey		S	225	Alluvium		5 (e)	1- 3-51	S	32	5	Used for Grade A dairy; reportedly very little fluctuation.
1/1W-4H1	Wolf Creek Highway Water Dist.	Johnson Spring.	P	200	Boring lava	Valley fill; contact with Boring lava.	340 (m)	7- -50 3-22-51 12- 4-52	PS	40	8	See table 4 for chemical analysis.
10H1	Polsky	Wessinger Spring.	P	190	do	Fissures at base of cliff in Boring lava.	625 (m)	3-23-51	D	35	7	Most of flow wastes to Beaverton Creek; see table 4 for chemical analysis.
1/3W-19J1	Lena Hinkle		S	440	Columbia River basalt	Contact with marine shale.			D,S	56	3	Supplies two houses and one dairy; reportedly very little fluctuation.
19R1	J. T. VanDyke		S	300	do	do	40 (r)	1-25-51	D	40	6	Supplies nine houses.
34K1	K. Tupper		S	700	Residual soil on Columbia River basalt.	Seep in soil zone	5 (r)	2-14-51	D,S	14	3	
35F1	John Haase		S	320	do	do	1 (e)	2- 4-51	D	44	3	Reportedly flowing about the same for 70 years.
2/1W-17L1	Lester Bennett		P	160	Alluvium	do			D	54	3	Very little fluctuation reported.
2/2W-17N1	R. Neugebauer		S	325	Residual soil on Columbia River basalt.	do	2 (r)	8- 6-51	D,S	10	4	Typical of small springs in Chehalem Hills.

Table 3.—*Descriptions of representative springs*—Continued

Number	Owner or occupant of property	Name of spring	Topography and approximate altitude (ft above sea level)	Water-bearing material	Occurrence	Yield: Gallons per minute	Yield: Date	Use	Hardness as $CaCO_3$ (ppm)	Cloride (Cl ppm)	Remarks
2/2W 35G1	Howell	----------	S 650	Residual soil on Columbia River basalt.	Seep in soil zone	15 (r)	7-30-51	D, Irr	40	5	Typical of small springs in Chehalem Hills.
2/3W-1L1	Lee Brown	----------	S 250	do	do	5 (r)	2-21-51	D,S	58	6	
4K1	Laurelwood Academy	----------	S 620	Columbia River basalt	Near contact with marine shale.	25 (r)	2- 5-50	D	--	--	Used as a standby supply; spring 2/3W-16C1 main source of water for school.
10N2	Earl Baker	----------	S 1,100	Residual soil on Columbia River basalt.	Seep in soil zone	3 (e)	3- 2-51	D	12	7	Reportedly very little fluctuation; supplies three houses.
16C1	Laurelwood Academy	----------	S 900	Columbia River basalt	Near contact with marine shale.	340 (m)	3-23-51	D	--	--	Measured ¼ mile below source; diversion for school supply.
23N1	Kenneth Whitmore	----------	S 1,100	Residual soil on Columbia River basalt.	Seep in soil zone	5 (e)	3- 2-51	D,S Irr	26	7	Used for irrigating garden; reportedly has very small fluctuation.

2/4W-8H1	J. H. Hoodenply	----	S 450	Colluvium	do	----	----	D,S	22	4	Reported to have large annual fluctuation.
2/1-5M2	W. B. Milmont	----	S 400	Boring lava	Contact of alluvium with Boring lava.	10 (r)	11- 1-51	D	82	4	Supplies five families.
33Q1	----	Community Spring.	S 300	Columbia River basalt	Many small seeps in soil zone.	----	----	D	20	3	Supplies about 30 families.
3/1W-3D2	H. Okagakie	----	P 150	Residual soil on Columbia River basalt.	do	100 (r) ?	----	Irr	38	5	Large annual fluctuation.
3/1-2F1	City of Willamette	----	S 125	Columbia River basalt	Interflow zone	----	----	---	72	5	Used for supplying pond in city park; at one time sole supply for city.
5L1	Ben Mosier	----	S 275	Residual soil on Columbia River basalt.	Seep in soil zone	4 (r)	10- 4-51	D,S	--	--	Smaller flow during dry season.
21C1	Clackamus Co.	----	S 125	Gravel layer in older alluvium.	Outflow in river bank.	30 (e)	10- 4-51	D	--	--	Called "Ferry Spring."

Table 4.—*Chemical analyses of water from representative wells and springs*

[Analyses by U.S. Geol. Survey except as noted. Values are given in parts per million except as indicated. Data are arranged under indicated well number and date of collection]

	1N/1W-20H1	1N/2W-21P1	1N/3W-1K2	1N/3W-6E1[1]	1N/3W-32P2[2]	1N/4W-23R1	1/1W-4H1[2]	1/1W-10H1[2]	1/1W-15K1[2]
	5-17-51	5-15-51	4-3-51	5-20-46	10-17-40	6-19-51	4-23-45	9-20-41	11-18-41
Temperature (°F)	57	54	59	----	----	----	----	----	----
Silica (SiO_2)	52	46	49	----	30	42	55	47	25
Iron (Fe):									
Total	.13	[3]2.32	.03	1.8	[4]3.5	.12	[4]1.3	.04	.16
In solution	.03	.01	.00	----	----	.06	----	----	----
Calcium (Ca)	37	44	15	----	20	8.4	11	14	13
Magnesium (Mg)	2.7	15	7.9	----	8.2	4.1	5.4	7	6.6
Sodium (Na)	68	8.9	31	38	[5]82	7.7	[5]8.5	11	98
Potassium (K)	11	9.5	9.0	----	----	1.8	----	----	.9
Bicarbonate (HCO_3)	174	241	136	136	277	62	59	77	285
Sulfate (SO_4)	6.6	.6	2.1	----	.8	1.4	2.6	3.4	.6
Chloride (Cl)	83	2.9	23	7	2.1	2.3	12	4.8	29
Fluoride (F)	.2	.14	.2	----	----	.1	----	.2	.1
Nitrate (NO_3)	.1	.3	.1	----	----	.1	----	----	----
Boron (B)	.26	.26	.3	----	----	----	----	----	----
Dissolved solids (total)	346	247	204	----	303	99	134	162	348
Hardness as $CaCO_3$:									
Calcium, magnesium	104	172	70	67	85	38	47	64	60
Noncarbonate	0	0	0	----	0	----	1	13	0
Percent sodium	56	10	45	----	70	29	26	28	78
Sodium-adsorption ratio (SAR)	2.9	.3	1.6	----	3.9	.55	.5	.63	----
Specific conductance (micromhos at 25°C)	541	383	283	----	----	99	----	----	----
pH (hydrogen-ion concentration)	7.6	7.2	7.6	6.9	----	7.4	6.7	----	----

	1/1W-17A2	1/1W-26E1[2]	1/1W-26E1[2]	1/1W-26E1[2]	1/1W-27C1[2]	1/2W-10B1[1]	1/2W-13M1[1]	1/2W-19A1[6]	1/2W-21H2[2]
	11-19-53	6- -50	12-21-51	9-22-52	3-17-52		4-2-51		2-16-38
Temperature (°F)	73	-----	-----	-----	55	-----	-----	-----	-----
Silica (SiO_2)	45	30	51	47.3	-----	-----	-----	-----	-----
Iron (Fe):									
Total	.33	[4]1.2	[4].78	[4]1.1	-----	0.1	0.8	0.1	6.0
In solution	-----	-----	-----	-----	-----	-----	-----	-----	-----
Calcium (Ca)	222	30	34	41	587	-----	-----	-----	-----
Magnesium (Mg)	45	30	15	16	-----	-----	-----	-----	-----
Sodium (Na)	290	[5]9.3	[5]9.3	[5]15.9	[5]510	-----	-----	-----	-----
Potassium (K)	40	-----	-----	-----	-----	-----	-----	-----	-----
Bicarbonate (HCO_3)	63	171	167	192	-----	344	184	71	54
Sulfate (SO_4)	2.7	3.7	2.3	2.5	-----	-----	-----	-----	0
Chloride (Cl)	960	22	22	38	1,840	-----	22	14	2,000
Fluoride (F)	.1	-----	-----	-----	-----	-----	-----	-----	-----
Nitrate (NO_3)	.3	-----	-----	-----	-----	-----	-----	-----	-----
Boron (B)	-----	-----	-----	-----	-----	-----	-----	-----	-----
Dissolved solids (total)	1,640	224	293	295	3,640	-----	100	-----	3,940
Hardness as $CaCO_3$:									
Calcium, magnesium	739	198	146	170	1,480	136	-----	72	540
Noncarbonate	687	58	10	-----	-----	-----	-----	-----	-----
Percent sodium	44	9	12	21	-----	-----	-----	-----	-----
Sodium-adsorption ratio (SAR)	4.6	.29	.33	.68	-----	-----	-----	-----	-----
Specific conductance (micromhos at 25°C)	3,140	-----	-----	-----	-----	-----	-----	-----	-----
pH (hydrogen-ion concentration)	8.2	-----	6.8	7.4	-----	7.5	7.6	6.5	6.9

See footnotes at end of table.

Table 4.—*Chemical analyses of water from representative wells and springs*—**Continued**

	1/2W-21H3[2]	1/2W-25J1[2,8]	1/2W-25J1[2,9]	1/2W-25J1[1,10]	1/2W-31C1	1/3W-5F1	2/1W-10C1[2]	2/1W-13B1[6]	2/1W-13B2[6]
	1-11-38	5-9-46	5-9-46	2-7-46	5-15-51	9-15-51	4-30-49		
Temperature (°F)	----	----	----	----	----	----	----	----	----
Silica (SiO_2)	----	----	----	----	50	44	----	13	23
Iron (Fe):									
Total	0.1	----	----	----	.43	[11]2.16	0.1	----	----
In solution	----	----	----	----	.25	.04	----	----	----
Calcium (Ca)	----	15,400	17,900	15,900	24	68	----	----	----
Magnesium (Mg)	----	31	24	10	15	30	----	----	----
Sodium (Na)	----	8,980	10,000	4,180	12	30	----	----	----
Potassium (K)	----	608	412	75	5.3	1.9	----	----	----
Bicarbonate (HCO_3)	104	196	99	34	156	428	162	120	171
Sulfate (SO_4)	0	16	21	25	1.6	.1	----	----	----
Chloride (Cl)	7.8	43,700	49,700	35,500	15	2.4	3.6	350	8.7
Fluoride (F)	----	----	----	----	.2	.3	----	----	----
Nitrate (NO_3)	----	----	----	----	.1	.1	----	----	----
Boron (B)	----	----	----	----	.15	----	----	----	----
Dissolved solids (total)	215	68,800	78,300	62,300	200	389	206	780	253
Hardness as $CaCO_3$:									
Calcium, magnesium	36	38,500	44,700	39,700	122	293	50	240	82
Noncarbonate	----	38,300	44,600	39,700	0	0	----	----	----
Percent sodium	----	33	32	18	17	18	----	----	----
Sodium-adsorption ratio (SAR)	----	20	20.6	9.3	.47	.76	----	----	----
Specific conductance (micromhos at 25°C)	----	----	----	----	427	595	----	----	----
pH (hydrogen-ion concentration)	6.6	----	----	6.9	7.7	7.4	6.8	----	----

	2/2W-8L1[12]	2/4W-23N1	2/1-8H1[13]	2/1-8R1[2]	2/1-9D1[2]	2/1-9J1[13]
	1-5-51	4-19-51	11-4-53	11-6-45	5-14-46	11-4-53
Temperature (°F)	----	----	----	----	----	----
Silica (SiO_2)	34	19	30	55	49	----
Iron (Fe):						
Total	5.1	[7]1.75	.1	[3].52	.5	0.1
In solution	----	.07	----	----	----	----
Calcium (Ca)	----	1,980	21	92	21	17
Magnesium (Mg)	----	113	14	30	7.8	6
Sodium (Na)	38	824	[5]8.2	[5]76	[5]17	[5]6.1
Potassium (K)	----	12	----	----	----	----
Bicarbonate (HCO_3)	122	51	120	168	132	85
Sulfate (SO_4)	8	30	15	.6	.7	10
Chloride (Cl)	10	5,010	16	285	4.3	12
Fluoride (F)	----	.2	----	.9	0	.02
Nitrate (NO_3)	----	----	----	----	.2	----
Boron (B)	----	2.1	----	----	----	----
Dissolved solids (total)	----	8,010	163	807	175	158
Hardness as $CaCO_3$:						
Calcium, magnesium	84	5,400	110	353	84	67
Noncarbonate	----	5,360	12	216	0	0
Percent sodium	----	25	----	32	31	----
Sodium-adsorption ratio (SAR)	----	.49	.34	1.75	.81	.33
Specific conductance (Micromhos at 25°C)	----	13,300	----	----	----	----
pH (hydrogen-ion concentration)	7	7	----	7.4	7.5	6.8

[1]Analysis by Permutit Co., Los Angeles, Calif.
[2]Analysis by Charlton Laboratories, Inc., Portland, Oreg.
[3]Includes 0.12 ppm manganese.
[4]Includes aluminum.
[5]Sodium and potassium as sodium.
[6]Analyst unknown.
[7]Includes 1.5 ppm manganese
[8]Water sample taken from bottom at depth of 9,203 ft.
[9]Water sample taken from interval 7,862–9,263 ft.
[10]Water sample taken from interval 3,505–3,534 ft.
[11]Includes 0.96 ppm manganese.
[12]Analysis by F. E. Myers Laboratory, Ashland, Ohio.
[13]Data from Oregon State Board of Health.

Table 5.—*Ground-water levels in observation wells*

[All measurements are below land-surface datum. p, pumping at time of measurement]

1N/1W-18J2

[Sam Joss. Dug well 70.7 ft deep tapping unconfined water in quicksand 65 to 71 ft below land surface]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1952*		*1952—Cont.*		*1953*	
May 17	43.90	Jan. 15	38.99	Aug. 21	40.37	Feb. 2	34.92
June 18	45.82	Feb. 18	p57.60	Sept. 25	39.25	Mar. 3	40.20
July 16	45.98	Mar. 17	38.40	Oct. 28	39.77	Apr. 6	41.53
Aug. 15	46.62	Apr. 21	38.04	Nov. 20	41.20	May 4	44.07
Sept. 22	51.92	June 25	42.60	Dec. 22	39.43	June 1	45.57
Oct. 22	52.52	July 28	38.78				
Nov. 24	47.62						
Dec. 17	39.49						

1N/1W-20J2

[Bethany Baptist Church. Dug well 40 ft deep tapping unconfined water in Boring lava]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951—Cont.*		*1952—Cont.*		*1952—Cont.*	
Apr. 10	19.00	Nov. 24	25.22	Apr. 21	18.55	Dec. 21	29.01
May 17	23.98	Dec. 17	18.07	June 25	27.26		
June 18	36.55			July 28	25.20	*1953*	
July 16	32.15	*1952*		Aug. 21	27.50	Feb. 2	5.35
Aug. 15	26.41	Jan. 15	7.19	Sept. 25	26.96	Mar. 3	10.25
Sept. 22	26.59	Feb. 18	6.95	Oct. 28	29.54	Apr. 6	14.13
Oct. 23	26.34	Mar. 17	10.55	Nov. 20	28.51		

1N/1W-31R1

[E. L. Pritchett. Dug well 25.8 ft deep tapping unconfined water in sand]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951—Cont.*		*1951—Cont.*		*1952—Cont.*	
Apr. 20	10.52	Aug. 15	17.65	Dec. 18	6.06	Feb. 19	6.75
May 17	9.51	Sept. 22	20.55			Mar. 17	7.71
June 18	p20.56	Oct. 22	13.27	*1952*		Apr. 22	12.25
July 16	23.57	Nov. 24	6.39	Jan. 15	7.04		

1N/1W-34D1

[S. H. Bloedon. Dug well 33 ft deep tapping unconfined water in alluvium]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951—Cont.*		*1952—Cont.*		*1953*	
Apr. 20	6.78	Dec. 17	3.23	July 30	9.99	Feb. 2	0.55
May 17	7.60			Aug. 21	10.24	Mar. 3	2.69
June 18	8.13	*1952*		Sept. 25	12.34	Apr. 4	1.18
July 16	8.71	Jan. 15	1.08	Oct. 28	14.33	May 4	6.85
Aug. 15	10.09	Feb. 18	1.53	Nov. 20	14.77	June 1	7.05
Sept. 22	12.29	Mar. 17	1.99	Dec. 22	15.10		
Oct. 22	13.05	Apr. 21	7.02				
Nov. 24	7.68	June 25	8.15				

Table 5.—*Ground-water levels in observation wells*—Continued

1N/2W-17F1

[Ernest Zurker. Dug well 53 ft deep tapping unconfined water in the valley fill]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Apr. 2	7.2	Dec. 17	5.73	July 30	16.00	Feb. 2	3.90
May 16	11.46			Aug. 21	23.01	Mar. 3	6.71
June 19	16.45	*1952*		Sept. 25	27.50	Apr. 6	6.44
July 16	20.85	Jan. 15	4.78	Oct. 28	28.05	May 4	9.13
Aug. 15	26.45	Feb. 18	4.50	Nov. 20	27.23	June 1	14.47
Sept. 22	27.80	Mar. 17	5.67	Dec. 22	26.00		
Oct. 22	24.38	Apr. 21	9.82				
Nov. 24	22.41	June 25	17.27				

1N/2W-21D1

[G. P. Frost. Bored well 35 ft deep tapping unconfined water in sand]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Mar. 28	5.77	Dec. 17	4.75	July 28	9.56	Feb. 2	4.39
May 16	5.93			Aug. 21	11.58	Mar. 3	5.13
June 19	6.89	*1952*		Sept. 25	12.09	Apr. 6	5.07
July 16	9.55	Jan. 15	4.39	Oct. 28	12.69	May 4	P9.28
Aug. 15	11.14	Feb. 18	5.71	Nov. 20	11.38	June 1	5.52
Sept. 22	12.43	Mar. 17	4.35	Dec. 22	8.91		
Oct. 22	4.93	Apr. 21	5.66				
Nov. 24	4.30	June 25	8.47				

1N/2W-32C1

[C. J. Wojahn. Bored well 23 ft deep tapping unconfined water in sand]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Mar. 27	1.96	Dec. 17	1.75	June 30	7.68	Feb. 3	1.39
May 17	4.14			July 30	16.86	Mar. 3	2.24
June 19	7.03	*1952*		Aug. 21	12.19	Apr. 7	2.20
Aug. 15	P15.21	Jan. 15	1.54	Sept. 25	12.96	June 1	2.96
Sept. 22	12.94	Feb. 18	1.60	Oct. 30	13.47		
Oct. 22	9.71	Mar. 17	1.63	Nov. 20	13.35		
Nov. 22	2.63	Apr. 22	2.81	Dec. 22	11.46		

1N/2W-33R1

[Robert Rice. Drilled well 42 ft deep tapping unconfined water in sand]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Mar. 30	24.00	Dec. 18	27.85	July 31	27.21	Feb. 3	27.28
May 17	24.58			Aug. 21	27.49	Mar. 3	27.21
June 19	25.82	*1952*		Sept. 25	27.67	June 6	26.34
July 16	P37.58	Jan. 16	26.34	Oct. 30	26.05		
Aug. 15	26.51	Feb. 19	25.53	Nov. 20	27.82		
Sept. 22	27.84	Mar. 17	27.30	Dec. 22	27.85		
Oct. 22	27.63	Apr. 22	25.55				
Nov. 24	27.33	June 30	26.66				

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Table 5.—*Ground-water levels in observation wells*—Continued

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)

1N/3W-8P1

[G. H. VanderZanden. Dug well 33 ft deep tapping unconfined water in alluvium]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1950		*1951*—Cont.		*1952*—Cont.		*1953*	
Nov. 21	3.85	Oct. 23	25.70	Apr. 22	9.29	Feb. 2	4.08
		Nov. 24	12.66	June 30	19.89	Mar. 3	5.77
1951		Dec. 24	4.97	July 28	27.99	Apr. 6	5.88
Apr. 19	9.34			Aug. 21	29.61	May 4	7.87
May 16	11.67	*1952*		Sept. 25	30.17	June 1	11.53
June 18	17.37	Jan. 15	8.05	Oct. 28	31.16		
July 17	30.39	Feb. 18	4.75	Nov. 20	29.79		
Sept. 25	30.79	Mar. 17	4.87	Dec. 22	28.40		

1N/3W-13F3

[Edwin Simantel. Drilled well 340 ft deep tapping confined water in sand strata of the valley fill]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1950		*1951*—Cont.		*1952*—Cont.		*1953*—Cont.	
Nov. 24	19.83	Dec. 18	21.26	Sept. 25	23.20	June 1	22.29
				Oct. 30	23.06	July 1	22.45
1951		*1952*		Nov. 20	23.21	Aug. 10	22.83
Mar. 16	21.29	Jan. 16	21.21	Dec. 22	21.70	Aug. 31	22.93
Apr. 19	21.62	Feb. 19	21.33			Oct. 5	23.08
May 16	21.77	Mar. 18	21.48	*1953*		Dec. 3	22.45
June 18	21.14	Apr. 21	21.99	Feb. 2	23.55		
Aug. 16	22.14	June 30	22.73	Mar. 3	22.47	*1954*	
Sept. 25	22.56	July 30	23.09	Apr. 6	22.55	Feb. 4	22.26
Oct. 22	21.77	Aug. 21	23.18	May 4	22.19	Apr. 20	22.07
Nov. 24	21.32						

1N/3W-28K2

[J. N. Jepson. Bored well 54 ft deep tapping unconfined water in "silt" of the valley fill]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1950		*1951*—Cont.		*1952*—Cont.		*1952*—Cont.	
Nov. 29	4.87	Oct. 23	15.70	Mar. 18	5.35	Dec. 22	13.74
		Nov. 24	8.02	Apr. 22	8.60		
1951		Dec. 18	3.92	June 30	12.56	*1953*	
Apr. 19	8.50			July 30	15.24	Feb. 2	3.39
May 17	9.60	*1952*		Sept. 25	16.93	Mar. 3	6.05
Aug. 16	16.52	Jan. 16	4.14	Oct. 28	17.95	Apr. 14	7.00
Sept. 25	17.53	Feb. 19	4.96	Nov. 22	17.44	June 1	11.44

1N/3W-30L1

[Rod VanderZanden. Drilled well 195 ft deep tapping confined water in sand]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Apr. 19	9.64	Dec. 17	12.50	July 28	P102.8	Feb. 2	13.80
May 16	13.75			Aug. 21	P128.86	Mar. 3	12.99
June 18	P109.22	*1952*		Sept. 25	48.80	Apr. 6	14.11
July 17	P108.09	Jan. 15	11.65	Oct. 28	26.51	May 4	13.58
Aug. 16	P102.25	Feb. 18	10.98	Nov. 20	18.10	June 1	13.30
Sept. 25	43.82	Mar. 17	11.14	Dec. 22	17.29		
Oct. 23	18.00	Apr. 22	11.02				
Nov. 24	13.63	June 30	21.31				

Table 5.—*Ground-water levels in observation wells*—Continued

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)

1N/3W-30L2

[Rod VanderZanden. Bored well 32 ft deep tapping unconfined water in silt]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1952*		*1952*—Cont.		*1953*	
Apr. 19	14.30	Jan. 15	4.51	Aug. 21	18.56	Feb. 2	4.40
May 16	10.74	Feb. 18	5.00	Sept. 25	20.79	Mar. 3	7.60
June 18	12.60	Mar. 17	5.95	Oct. 28	20.90	Apr. 6	7.10
Aug. 16	16.38	Apr. 22	8.99	Nov. 20	20.24	May 4	8.73
Sept. 25	19.10	June 30	13.81	Dec. 22	14.85	June 1	11.44
Oct. 22	14.95	July 28	18.55				
Nov. 24	6.63						
Dec. 17	6.60						

2N/3W-11G1

[Chas. Adams. Dug well 82 ft deep tapping perched water in Columbia River basalt]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1951*—Cont.		*1952*—Cont.	
Mar. 16	40.99	Aug. 16	73.79	Dec. 17	66.94	Feb. 18	62.10
Apr. 19	65.90	Sept. 22	72.36			Mar. 17	61.40
May 16	68.28	Oct. 22	74.83	*1952*		Apr. 22	77.00
June 18	70.25	Nov. 24	75.05	Jan. 15	55.04		
July 16	72.75						

2N/3W-14J1

[O'Connor and Corriery. Drilled well 165 ft deep tapping confined water in the Columbia River basalt]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1951*—Cont.		*1952*	
Jan. 6	88.84	June 18	89.97	Oct. 23	99.43	Jan. 15	89.49
Mar. 16	90.55	July 16	P121.27	Nov. 24	87.13	Feb. 18	90.70
Apr. 19	89.05	Aug. 16	93.47	Dec. 17	86.68	Mar. 17	90.90
May 16	87.79	Sept. 22	89.17				

2N/3W-16A1

[Dennis Hall. Drilled well 150 ft deep tapping unconfined water in gravel and boulders of the alluvium at a depth of 34 to 55 ft]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1951*—Cont.		*1952*—Cont.	
Jan. 3	6.30	July 16	P53.70	Dec. 17	6.46	Mar. 17	4.53
Mar. 16	4.88	Aug. 16	P51.49			Apr. 22	5.10
Apr. 19	5.77	Sept. 22	14.49	*1952*			
May 16	6.32	Oct. 22	10.59	Jan. 15	5.24		
June 18	7.10	Nov. 24	7.88	Feb. 18	4.60		

Table 5.—*Ground-water levels in observation wells*—Continued

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet	Date	Water level (feet)

1/1W-24F1

[Aaron Frank. Drilled well 520 ft deep tapping confined water in the Columbia River basalt. Airline measurements reported by owner]

1939		*1940*—Cont.		*1941*—Cont.		*1943*	
Apr. 15	52.0	Aug. 15	53.75	Nov. 15	47.0	Jan. 15	45.0
May 15	51.25	Sept. 15	50.0	Dec. 15	46.0	Feb. 15	45.0
June 15	45.5	Oct. 15	47.0			Mar. 15	44.0
July 15	51.25	Nov. 15	47.0	*1942*		June 15	44.0
Aug. 15	53.5	Dec. 15	46.0	Jan. 15	46.0	July 15	50
Sept. 15	47.75			Feb. 15	44.0	Aug. 15	50.5
Oct. 15	46.5	*1941*		Mar. 15	43.5	Sept. 15	47.0
Nov. 15	46.0	Jan. 15	46.0	Apr. 15	43.0	Dec. 15	47.0
Dec. 15	46.0	Feb. 15	45.0	May 15	43.5		
		Mar. 15	44.0	June 15	45.0	*1944*	
1940		Apr. 15	44.5	July 15	48.0	Jan. 15	47.0
Jan. 15	45.0	May 15	46.3	Aug. 15	49.0	Apr. 15	47.0
Mar. 15	43.25	June 15	53.25	Sept. 15	47.0	May 15	46.5
Apr. 1	43.0	July 15	53.0	Oct. 15	47.0	June 15	51.0
May 15	44.75	Aug. 15	47.65	Nov. 15	46.5	July 15	54.25
June 15	51.0	Oct. 15	47.0	Dec. 15	45.0	Aug. 15	55.0
July 15	53.0						

1/2W-8K1

[A. Hornecker. Drilled well 32 ft deep tapping unconfined water in sand]

1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Feb. 23	2.82	Dec. 18	2.11	July 31	P19.78	Feb. 3	1.75
May 18	P18.96			Aug. 22	P18.19	Mar. 3	3.34
June 19	P20.98	*1952*		Sept. 27	17.29	May 5	4.30
July 17	P23.29	Jan. 16	3.86	Oct. 30	22.97	June 2	6.16
Aug. 16	P23.57	Feb. 19	2.26	Nov. 28	12.1		
Sept. 22	19.74	Mar. 18	1.95	Dec. 23	9.55		
Oct. 24	8.66	Apr. 28	P14.43				
Nov. 25	4.81	July 1	P17.10				

1/2W-18P1

[Louis Malensky. Drilled well 70 ft deep tapping unconfined water in sand]

1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Jan. 30	3.60	Nov. 25	15.12	July 1	15.24	Feb. 3	3.29
Mar. 16	2.83	Dec. 18	3.74	July 30	14.95	Mar. 3	4.52
May 16	10.80			Aug. 22	P36.97	May 5	7.23
June 19	13.78	*1952*		Sept. 27	22.08	June 2	9.90
July 17	14.70	Jan. 16	3.51	Oct. 28	19.60		
Aug. 20	P36.27	Feb. 19	3.76	Nov. 28	18.40		
Sept. 26	17.85	Mar. 18	3.55	Dec. 23	18.15		
Oct. 24	17.27	Apr. 22	7.27				

Table 5.—*Ground-water levels in observation wells*—Continued

1/2W-28H1

[G. E. Garrison. Dug well 24 ft deep tapping unconfined water in sand]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Apr. 24	7.55	Dec. 9	1.72	July 1	11.00	Feb. 3	1.59
June 20	10.00			Aug. 1	8.73	Mar. 3	2.55
July 20	12.55	*1952*		Aug. 22	13.66	May 5	2.98
Aug. 20	13.70	Jan. 17	2.02	Sept. 27	14.94	June 1	5.61
Sept. 27	14.33	Feb. 20	1.77	Oct. 30	15.02		
Oct. 24	14.15	Mar. 18	1.75	Nov. 28	15.50		
Nov. 25	10.13	Apr. 28	5.68	Dec. 23	15.67		

1/2W-31H1

[J. C. Jones. Dug well 27 ft deep tapping unconfined water in sand]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1952*—Cont.	
Feb. 9	10.06	Oct. 24	24.47	Feb. 19	17.90	Oct. 30	24.15
Mar. 16	12.30	Nov. 25	23.98	Mar. 18	17.85		
May 18	18.68	Dec. 18	23.40	Apr. 28	19.00	*1953*	
June 19	19.90			July 1	21.05	Feb. 3	24.26
July 17	21.17	*1952*		Aug. 1	21.08	May 5	19.77
Aug. 20	22.38	Jan. 16	21.40	Aug. 22	23.91		
Sept. 26	22.65						

1/3W-8L1

[J. W. Nelson. Dug well 24 ft deep tapping unconfined water in alluvium]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Jan. 25	0.55	Dec. 18	4.64	June 30	15.63	Feb. 3	1.54
May 18	13.85			July 30	17.17	Mar. 3	5.57
June 20	15.89	*1952*		Aug. 22	17.95	June 1	12.57
July 17	16.53	Jan. 16	1.37	Sept. 27	19.33		
Aug. 16	17.93	Feb. 19	2.91	Oct. 30	21.35		
Sept. 26	20.07	Mar. 18	2.02	Nov. 28	21.56		
Oct. 23	20.72	Apr. 28	12.95	Dec. 22	22.06		
Nov. 23	17.12						

1/3W-10A1

[E. F. McCormacke. Bored well 47 ft deep tapping unconfined water in sand]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Mar. 14	6.25	Nov. 24	15.50	Apr. 22	13.54	Feb. 3	7.12
Apr. 17	13.54	Dec. 18	8.26	June 30	16.65	Mar. 3	12.34
May 17	15.23			July 30	P28.35	Apr. 14	12.40
June 18	15.67	*1952*		Aug. 21	P26.25	May 4	13.20
July 17	16.80	Jan. 15	8.57	Sept. 25	20.64	June 2	15.20
Aug. 16	17.58	Feb. 18	9.60	Oct. 28	19.73		
Sept. 25	18.57	Mar. 17	9.30	Nov. 20	P20.49		
Oct. 23	18.15						

Table 5.—*Ground-water levels in observation wells*—Continued

1/3W-14G1

[W. Demmin. Dug well 20 ft deep tapping unconfined water in sand]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Jan. 30	3.30	Dec. 18	2.10	July 1	11.57	Feb. 3	2.60
May 18	7.91			July 31	13.59	Mar. 3	5.33
June 30	10.85	*1952*		Aug. 22	14.30	Apr. 14	4.93
July 17	12.90	Jan. 16	4.30	Sept. 27	16.32	June 1	7.32
Aug. 20	14.61	Feb. 19	3.19	Oct. 30	16.47		
Sept. 26	15.50	Mar. 18	3.20	Nov. 28	15.84		
Oct. 23	13.56	Apr. 22	6.19	Dec. 23	13.20		
Nov. 25	4.20						

1/3W-17B2

[L. Newburg. Dug well 65 ft deep tapping unconfined water in alluvium]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1952*—Cont.	
Jan. 29	46.68	Nov. 25	60.95	Apr. 28	57.05	Dec. 23	60.78
May 18	61.78	Dec. 18	56.27	June 30	59.28		
June 20	60.39			July 31	60.49	*1953*	
July 17	59.71	*1952*		Aug. 22	58.96	Feb. 3	52.60
Aug. 16	58.92	Jan. 16	52.54	Sept. 27	60.28	Mar. 3	59.44
Sept. 26	60.97	Feb. 19	55.65	Oct. 30	62.98	June 1	60.66
Oct. 23	61.13	Mar. 18	55.00	Nov. 28	62.76		

1/3W-25P1

[E. Simantel. Drilled well 565 ft deep tapping confined water in the Columbia River basalt]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Feb. 14	45.33	Dec. 18	45.15	July 31	49.97	Feb. 3	44.69
May 18	41.55			Aug. 22	51.13	Mar. 3	44.35
June 19	51.58	*1952*		Sept. 27	P61.70	May 5	42.28
July 17	53.89	Jan. 16	43.16	Oct. 30	50.78	June 1	42.65
Aug. 20	54.69	Feb. 19	45.70	Nov. 28	50.11		
Sept. 26	48.72	Mar. 18	41.75	Dec. 23	48.80		
Oct. 24	49.32	Apr. 28	41.24				
Nov. 25	46.00	July 1	48.0				

1/4W-2N2

[R. C. Ritchey. Drilled well 92 ft deep tapping confined water in shale and sandstone strata of Tertiary age]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951*—Cont.		*1952*—Cont.		*1953*	
Jan. 12	8.02	Oct. 23	10.39	Apr. 28	10.58	Feb. 3	8.71
Mar. 19	8.26	Nov. 24	9.22	June 30	12.23	Mar. 2	10.31
Apr. 17	9.14	Dec. 18	7.09	July 31	12.99	Apr. 9	10.63
May 18	9.62			Aug. 21	13.36	May 4	10.45
June 19	10.69	*1952*		Sept. 27	13.72	June 1	11.67
July 17	11.84	Jan. 16	8.98	Oct. 30	13.97		
Aug. 16	12.62	Feb. 19	9.40	Nov. 20	13.73		
Sept. 25	12.82	Mar. 18	9.42	Dec. 22	11.23		

Table 5.—*Ground-water levels in observation wells*—Continued

2/1W-23N1

[G. Kogiso. Drilled well 125 ft deep tapping confined water in the Columbia River basalt]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1952—Cont.*		*1952—Cont.*		*1953—Cont.*	
Aug. 21	p70.15	Feb. 20	4.76	Dec. 23	7.28	Oct. 5	8.80
Sept. 27	11.24	Mar. 19	4.73			Dec. 7	1.59
Oct. 24	6.85	Apr. 28	4.40	*1953*			
Nov. 26	5.06	July 1	5.30	Feb. 4	4.43	*1954*	
Dec. 19	4.84	Aug. 22	15.61	May 5	5.46	Feb. 4	(1)
		Sept. 27	17.05	June 2	5.92	Apr. 20	(1)
1952		Oct. 30	9.34	July 1	5.16		
Jan. 17	4.85	Nov. 28	7.72	Sept. 1	9.73		

[1]Flowing.

2/2W-24M1

[Wm. Stenek. Drilled well 88 ft deep tapping perched water in the Columbia River basalt]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1952*		*1952—Cont.*		*1953*	
June 27	51.00	Jan. 17	42.54	Aug. 21	56.90	Feb. 4	34.00
July 17	60.20	Feb. 20	39.56	Sept. 27	54.69	May 5	46.73
Aug. 20	55.90	Mar. 19	40.33	Oct. 30	55.62	June 2	47.81
Sept. 27	55.14	Apr. 26	45.57	Nov. 28	56.38		
Oct. 24	54.80	July 1	50.69	Dec. 23	55.86		
Nov. 26	50.38	Aug. 1	53.40				
Dec. 19	40.08						

2/3W-2Q1

[John Will. Dug well 52 ft deep tapping perched water that apparently occurs in alluvium]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951—Cont.*		*1952—Cont.*		*1952—Cont.*	
Mar. 2	23.97	Nov. 26	12.23	Apr. 28	31.29	Dec. 23	26.20
May 18	44.00	Dec. 18	13.40	July 1	32.67		
June 19	32.88			Aug. 1	33.47	*1953*	
July 17	34.40	*1952*		Aug. 22	37.89	Feb. 3	12.89
Aug. 20	38.53	Jan. 16	15.58	Sept. 27	37.23	Mar. 2	25.37
Sept. 26	41.16	Feb. 19	17.09	Oct. 30	44.15		
Oct. 24	23.24	Mar. 18	14.57	Nov. 28	40.70		

2/4W-1B1

[R. B. McBurney. Bored well 30 ft deep tapping unconfined water in sand]

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
1951		*1951—Cont.*		*1952—Cont.*		*1953*	
Jan. 26	1.53	Oct. 23	14.28	Apr. 28	3.30	Feb. 3	0.76
Mar. 19	1.45	Nov. 25	.87	June 30	9.30	Mar. 2	2.53
Apr. 17	3.03	Dec. 18	.50	July 31	10.24	June 1	5.08
May 18	5.58			Aug. 22	9.99		
June 19	6.50	*1952*		Sept. 27	11.84		
July 17	9.91	Jan. 16	.95	Oct. 28	12.58		
Aug. 20	15.07	Feb. 19	1.04	Nov. 20	13.02		
Sept. 25	13.30	Mar. 18	.75	Dec. 22	11.97		

Table 5.—*Ground-water levels in observation wells*—**Continued**

Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)	Date	Water level (feet)
			3/1W-10R1				
		[R. W. Clark. Drilled well 45 ft deep tapping unconfined water in sand and gravel]					
1951		*1951*—**Cont.**		*1952*—**Cont.**		*1952*—**Cont.**	
Aug. 20	35.82	Dec. 19	26.82	Feb. 20	28.05	Aug. 1	34.29
Sept. 27	36.18			Mar. 19	27.57	Aug. 22	33.00
Oct. 27	29.76	*1952*		Apr. 28	30.32		
Nov. 26	27.29	Jan. 17	27.49	July 1	31.89		

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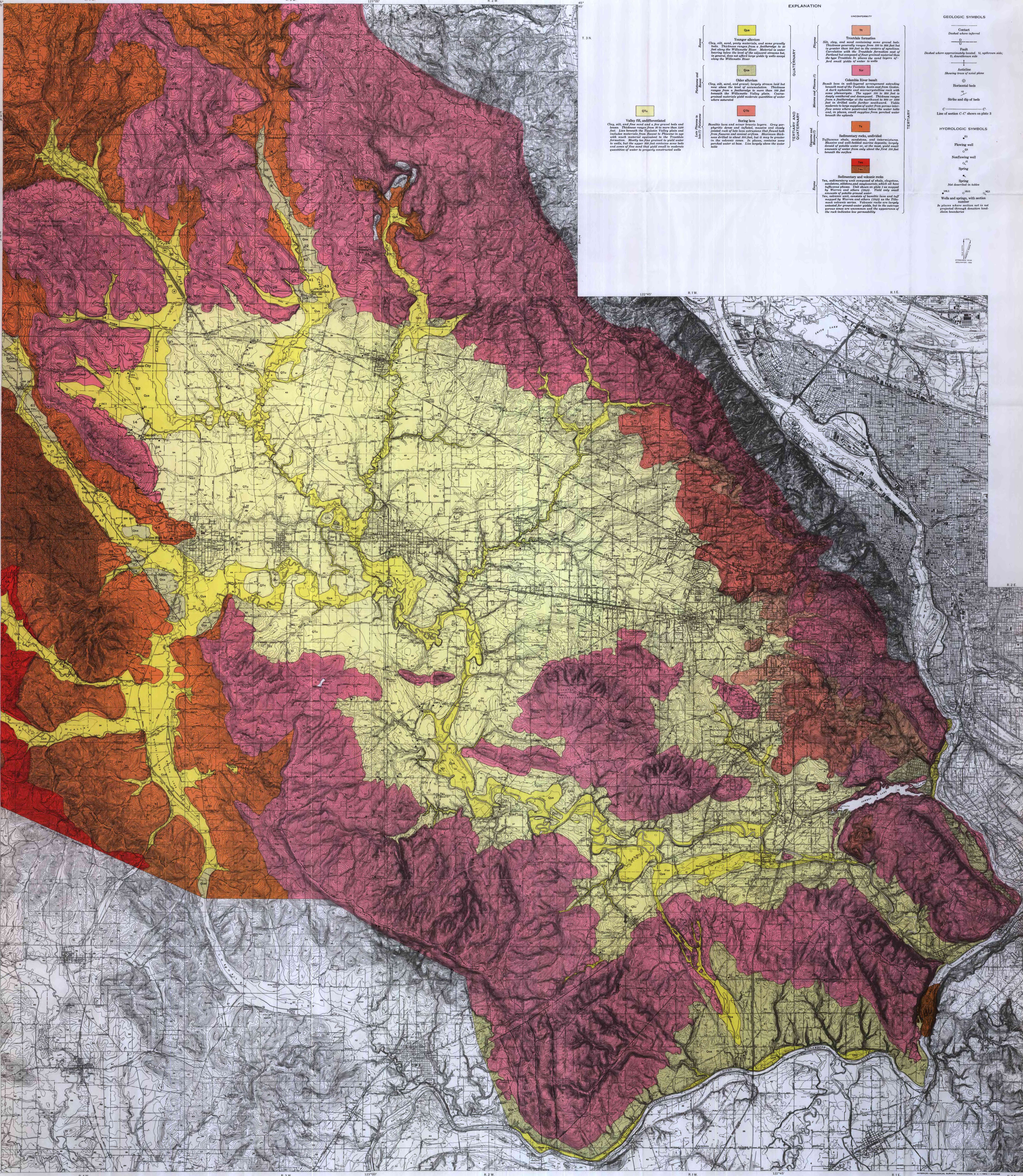

Base map by U.S. Geological Survey in cooperation with State of Oregon

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1964—W62349

Geology in part taken from Treasher (1942), Trimble (1957), Warren and others (1945), and Piper (1942). Fill-in mapping of large parts was done by R. C. Newcomb

MAP OF THE TUALATIN VALLEY, OREGON, SHOWING THE GEOLOGY AND THE LOCATION OF THE REPRESENTATIVE WELLS AND SPRINGS

SCALE 1:48 000

1 ½ 0 1 2 3 MILES

1 .5 0 1 2 3 KILOMETERS

CONTOUR INTERVAL 10 AND 40 FEET
DATUM IS MEAN SEA LEVEL

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER-SUPPLY PAPER 1697
PLATE 2

EXPLANATION

19A1
○ −630
Well entering Columbia River basalt at altitude shown, in feet above or below sea level

—— −200 ——— – – –?
Contour on top of Columbia River basalt
Dashed where approximately located; queried where doubtful

– – – – – – – – – – – –
Border showing limit beyond which basalt is at the surface, with overburden

Base map by U.S. Geological Survey in cooperation with State of Oregon

MAP SHOWING ALTITUDE OF THE TOP OF THE COLUMBIA RIVER BASALT BENEATH THE TUALATIN VALLEY, OREGON

SCALE 1:48 000
1 ½ 0 1 2 3 MILES
1 .5 0 1 2 3 KILOMETERS
CONTOUR INTERVAL 10 AND 40 FEET
DATUM IS MEAN SEA LEVEL

GEOLOGIC SECTIONS OF THE TUALATIN VALLEY, OREGON