UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GROUND-WATER RESOURCES OF WESTERN WHATCOM COUNTY, WASHINGTON

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and

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Prepared in cooperation with the Division of Hydraulics, Department of Conservation and Development of the State of Washington

December 1949

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ABSTRACT

Whatcom County is on the international border in the extreme northwestern part of the State of Washington. The western part of the county is a lowland area of about 380 square miles that extends eastward from Puget Sound to the foothills of the Cascade Mountains. The area, known as the Whatcom Basin, consists of low, glacially smoothed till plains rising to an altitude of 200 to 600 feet above broad river valleys to which they are connected by gentle slopes and terrace lands. The major drainage system in the area is that of the Nooksack River; some smaller streams drain local depressions.

The area has an equable oceanic climate. The precipitation is about 34 inches, occurring mostly as rain in the winter months.

The lowland is underlain largely by unconsolidated deposits of Pleistocene and Recent age. The bedrock that composes the foothills of the Cascade Mountains protrudes through the unconsolidated material in a few places around the margins of the lowland. These consolidated rocks are indurated continental-type sedimentary rocks of lower Eocene age and consist of sandstones, shales, conglomerates, and coal having a total thickness of more than 10,000 feet. The Tertiary rocks are underlain by pre-Tertiary metamorphic rocks that are exposed at a few places in western Whatcom County.

Prior to the Vashon glaciation in late Pleistocene time the Puget Trough was filled to a point now above sea level with clays, sands, and gravels, whose source was probably the bordering mountain ranges. Subsequently these unconsolidated deposits were deeply entrenched by streams.

The Vashon ice advanced into and over these lowland plateaus and gorges, diverted the drainage, deposited advance outwash material, and ultimately covered the entire northern part of the Puget Trough. At the close of the Pleistocene epoch the w a s t i n g ice deposited a ground-moraine mantle of till. The meltwaters from the retreating ice reworked the till in the river valleys or covered it with sediments, and deposited large amounts of outwash sands, gravels, and clays elsewhere in the lowland. The till mantles the upland areas that were the pre-Vashon intergorge plateaus. Recent alluvium now covers much of the valley floors.

The water-bearing characteristics of the pre-Tertiary metamorphic rocks are unknown, but they probably are capable of yielding little or no water. The few permeable beds of the Tertiary sedimentary rocks carry small amounts of fresh water where recharge and drainage have been adequate to flush out the saline or other highly mineralized water commonly found in the formation. Fresh water is found in the coarse-grained strata of the pre-Vashon Pleistocene deposits. Advance outwash gravels of the Vashon glaciation are important aquifers in several parts of the area; they are the principal deep source of ground water in western Whatcom County. The till is impermeable and yields only small amounts of perched water. The coarse-grained strata in the recessional outwash deposits and Recent alluvium yield moderate to large amounts of water.

The ground waters are generally of good quality and low hardness. Iron is the most common objectionable constituent, though it is confined chiefly to the recessional outwash and Recent alluvial deposits. At some places in the Nooksack and Sumas River flood plains, saline water has been found at depths of 1[illegible]0 feet or more in the Pleistocene and Recent deposits.

Ground water furnishes the principal domestic, industrial, and public water supply for western Whatcom County outside the City of Bellingham. An estimated 1,000 acres of farm land are irrigated with ground water. Approximately 3,000 dug wells, 475 drilled wells, 300 driven wells, and 100 springs yield about 6½ million gallons of water per day.

Water-short areas are found chiefly in parts of the upland areas where permeable strata are lacking or where the till capping prevents adequate recharge, and in areas where the Tertiary rocks lie at shallow depth beneath other materials of low permeability.

Ground-water resources of western Whatcom County, Washington

INTRODUCTION

Purpose and scope of study

This study was made as part of the continuing program for the collection and interpretation of the facts bearing on the ground-water supply of the State of Washington. It was made in cooperation with the Supervisor of Hydraulics of the Department of Conservation and Development, for the purpose of providing an inventory of the ground-water resources of western Whatcom County in order to aid in their development and administration.

The surface geology of a part of the area was mapped geologically in 1934 by a party under the Washington State Supervisor of Geology, who made their maps and notes available for this investigation. The mapping was completed by R. C. Newcomb and J. E. Sceva in the winter and spring of 1949.

The collection of hydrologic data was undertaken by W. N. Schlax, Jr., and Olaf Stromme in the summer of 1947 and was completed by Mr. Stromme in the summer of 1948. The report was completed by Mr. Sceva in the spring of 1949.

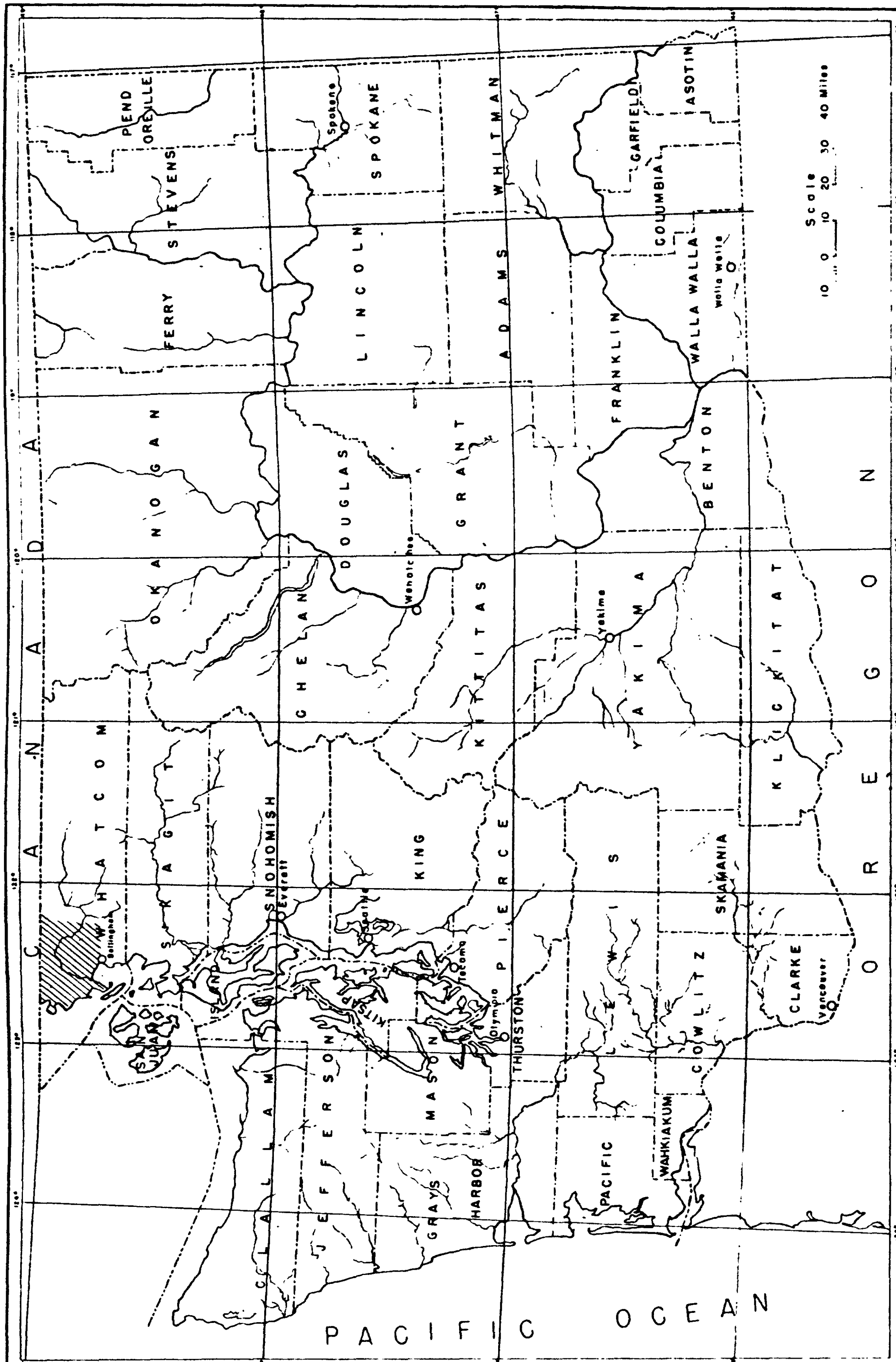
Location and extent of the area

Whatcom County is on the international border in the extreme northwestern part of the State of Washington. The portion of the county covered by this investigation embraces an area of approximately 380 square miles comprising townships 38 to 40 North and the area west of, and including most of, Range 4 East. It is a lowland area that extends from Puget Sound on the west to the foothills of the Cascade Mountains on the east. The location of the area is shown on plate 3. The principal city is Bellingham, population approximately 30,000 (1940 census), located at the southwestern edge of the basin.

The lowland area of western Whatcom County is variously known locally as the Bellingham Basin, the Nooksack lowland, and the Whatcom Basin. The lowland is continuous with the Fraser River lowland just to the north in British Columbia, and the whole is sometimes broadly termed the Fraser River lowland or "delta."

Acknowledgments

The well owners and operators were all considerate and helpful. Special acknowledgment for generous help is given to the well drillers who have operated in the area; they all contributed freely from their stock of accumulated information. These include C. F. Livermore and Son, W. Radke and Son, G. A. Bezona and Son, G. Cowden, A. Hillard, and W. J. Tilley.



Map of the state of Washington showing area covered by this investigation.

Well-numbering system

In this report, wells and springs are designated by symbols that indicate their respective locations according to the official rectangular public-land survey. For example, in the symbol 40/3-27J1, the part preceding the hyphen indicates successively the township and range; because the greater part of the area lies within the northeast quadrant of the Willamette base line and meridian, the directions (north and east) are omitted. Where the well or spring is located within the northwest quadrant, the letter "W" is added; for example, 39/1W-3E2. The first number that follows the hyphen indicates the section and the letter indicates a 40-acre subdivision of the section as shown in the following diagram:

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

The last number is the serial number of the well or spring in the particular 40-acre tract. Thus, well 40/3-27J1 is in the NE$\frac{1}{4}$SE$\frac{1}{4}$ sec. 27, T. 40 N., R. 3 E., and is the first well in the tract to be listed.

GEOGRAPHY

Physiography

General

The part of Whatcom County covered by this investigation, called the Whatcom Basin in this report, lies entirely within the Puget Trough section/ of the Pacific Border physiographic province. The Puget Trough section is a long north-south lowland lying just west of the Cascade Mountains of Oregon and Washington. On the west it is bordered by the Olympic Mountains and the Oregon Coast Range. The northern part of the trough in the United States is partially submerged below sea level in Puget Sound.

/ Fenneman, N. M., Physiographic division of the United States: Assoc. Am. Geographers Annals, vol. 6, p. 95, pl. I, 1917.

In general, the Whatcom Basin consists of low, glacially smoothed upland till plains rising to an altitude of 200 to 600 feet above broad river valleys to which they are connected by gentle slopes and terrace lands. The Cascade Mountain foothills rise rather abruptly in till-smeared slopes to a height of 3,000 feet or more overlooking the basin.

The Whatcom Basin is drained by one through stream, the Nooksack River, and by several creeks that drain local depressions.

Uplands

The highest areas of the Whatcom Basin, not counting the adjacent foothills, are the low plateaus or uplands. These areas have the smoothed surfaces commonly called till plains. The surface relief varies from hummocky, rolling moraine topography to nearly level land having gentle swales and swells. The upland surfaces are formed principally of till deposited from the Vashon glacier. In places outwash trains or lake-bed deposits are present on the till surface; in some other places ridges of the sandstone bedrock protrude.

There are four principal low plateau areas in the Whatcom Basin: the small peninsular area southwest of Blaine, herein called the Birch Point upland; the larger area extending 18 miles eastward from Blaine and across the boundary into Canada, herein called the Boundary upland; the large area just west of Ferndale, commonly called the Mountain View upland; and the broad area extending northward from Bellingham to the Nooksack River Valley, herein called the King Mountain upland. A fifth such area, the Lummi peninsula upland, between Lummi and Bellingham Bays, is treated only briefly herein.

The Birch Point upland comprises only about 4 square miles. It is bounded on three sides by steep sea cliffs a hundred feet or so in height, cut by the waters of Puget Sound. The upland rises in altitude to a maximum of about 265 feet. A thin layer of glacial till underlies the surface.

The Mountain View upland is a diamond-shaped plateau block that embraces an area of about 42 square miles. Its surface is formed by a number of low, rolling hills that rise to a maximum altitude of 385 feet. This upland is bordered on the west by Georgia Strait of the Puget Sound system. Along this margin steep sea cliffs drop from the upland surface to the beach. Along the northeastern and southeastern margins of the upland the surface descends to the low-level flood plains of the Custer Trough and the Nooksack River, respectively.

The surface of the Mountain View upland in most places consists of glacial till. This till is exposed along the sea cliff and in some of the road cuts in the area. A geologic section compiled from drillers' well logs (see pl. 6) shows the manner in which the till is draped over the upland. In places a thin cover of outwash gravels mantles this till surface (see pl. 8, A). Hummocky morainal topography (see pl. 7, A) is typical of a large part of this upland. Many large glacial erratic boulders lie on the surface and have been gathered along fence rows of the cultivated areas. The relatively impermeable till surface supports several swamps and a lake having an area of about 0.5 square mile. The Mountain View upland, like the other low plateaus, was forested in its native condition but is now mostly cultivated. It is dry during most summers and additional water is needed for irrigation.

The Boundary upland is about 10 miles long and 3 miles wide in Whatcom County but is part of a larger upland extending 10 miles into Canada to the Nicomekl River. Its surface rises to a maximum altitude of nearly 500 feet. It is a smoothly rolling, stony till surface, formerly covered by timber but now cut over and taken by thick brushy growth.

The King Mountain upland is a rolling till surface that rises from the 100-foot altitude of the Nooksack Valley outwash and alluvial plains to 500 feet or more where the till laps up on the slopes of the Cascade foothills. Knobs and ridges of the consolidated rocks of Tertiary age protrude through the unconsolidated deposits on this plateau slope. It consists about equally of cut-over brushland and cultivated farm land.

Lowlands

The lowlands or bottom lands of the Whatcom Basin consist largely of the Nooksack River flood plain and two branching lowlands — the Custer Trough leading northwest to Drayton Harbor and Birch Bay and the Sumas River Trough leading northward into Canada and the Fraser River drainage. Also included in the lowland area is that broad terrace known as the Lynden terrace, extending westward from the Sumas River Valley to the Boundary upland and southward to the Nooksack and Custer Trough bottom lands. These lowlands are mostly "flat" plains with the soft, dark alluvial soils characteristic of present or former flood plains. In general, the lowlands lie below 100 feet in altitude, but the Lynden terrace reaches as high as 150 feet or more.

The Sumas River Valley doubtless was used in late glacial time by the Fraser River, but more recently has been used as a northward distributary of the Nooksack River. The Lynden terrace is built of fine-grained glacial outwash deposits, which grade gently southwestward to the level of the outwash materials that in part floor the Custer Trough and follow as terraces alongside the lower plains of the Nooksack River. Extensive till plains in the lower part of the Custer Trough indicate that the glacial meltwaters did not use that outlet for long and probably had shifted to the Nooksack River Valley and cut below the Custer Trough level before glacial melting ceased.

Slopes

The connection between plateau surfaces and the bottom lands is characteristically a rolling till slope, though in places outwash or alluvial terrace deposits lie at the surface. Northwest of Ferndale a complex rough slope seems to indicate a recessional moraine. All slopes from plateaus to bottom lands are essentially constructional, but erosion has steepened them in a few places, such as near the spring outlets on the south side of the Boundary upland.

Drainage

The Nooksack River and its tributaries form the major surface drainage system in Whatcom County. This river rises in the snow fields and glaciers of the Cascade Mountains and flows across the lowland area in a broad arc that swings around the King Mountain upland. Gage records at Deming, just east of the Whatcom Basin in the Van Zandt quadrangle, show that the river flow ranged from 560 to 14,400 cubic feet per second in the more or less normal water year of 1936 (October 1935 through September 1936). The river leaves the mountain front at the east edge of the basin with a gradient of about 10 feet per mile, which increases to about 20 feet per mile near the small town of Lawrence and then decreases gradually to but 4 or 5 feet per mile from Lynden to the area where the river distributes over delta lands south of Ferndale.

The plateaus and upland slopes are drained by small creeks. Those creeks that are perennial are fed by springs or from lake storage; most of those not so favored are intermittent. The Sumas River drains the west slope of Sumas Mountain and flows northeastward from the Nooksack Valley to join the Fraser River in British Columbia. It has a low gradient generally in the order of 5 feet per mile in the part within Whatcom County. Johnson Creek, its main tributary, drains the east end of the Lynden terrace. California Creek and Dakota Creek drain respectively the south and north slopes of the Custer Trough. Much of their flow comes from springs emerging there. Tenmile, Anderson, and Squalicum Creeks drain the King Mountain upland, Tenmile Creek having especially strong spring sources. Fishtrap and Bertrand Creeks drain the runoff and ground-water discharge from the central and western parts of the Lynden terrace.

It is reported that several times within the past 60 years water from the Nooksack River, during times of flood, has left its channel between the towns of Lawrence and Everson and flowed northeastward into the Sumas River, which parallels the Nooksack River for several miles in this area. During one flood, waters from the Nooksack River were reported/ to have backed up west of the town of Everson and flowed northward into the drainage of Johnson Creek.

/ Helland, R. O., Water utilization in the Nooksack River, Washington: U. S. Geol. Survey interdepartmental rept. (mimeographed), 1941.

Climate

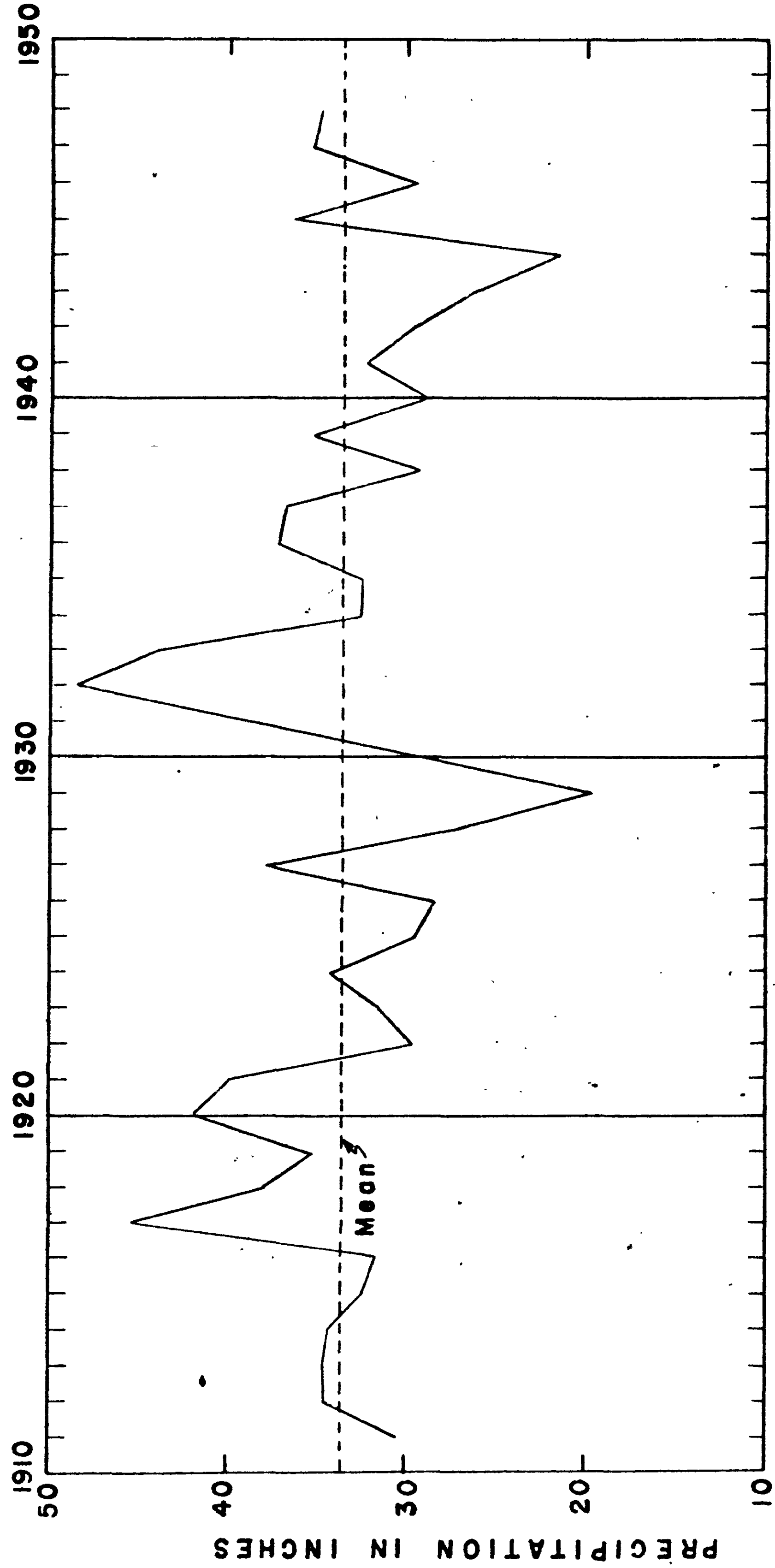
The western part of the Whatcom lowland, being situated on the floor of the Puget Trough and near the western margin of the rain belt produced by the Cascade Mountains, has an equable oceanic climate. Extreme temperatures are uncommon and precipitation is moderate. The winds are gentle and predominantly from the southwest.

The precipitation occurs largely as rain, predominantly in the late autumn and winter months. An average annual precipitation of 33.60 inches / was recorded at a weather station 2 miles north of the city of Bellingham for the period 1911-40. Plate 4 shows a graph of annual precipitation for that period. The driest month is July, for which the average precipitation has been 0.88 inches for the 38-year record at Bellingham (2 miles north). The wettest month is December, which has had an average of 13.32 inches of precipitation. Plate 5 shows the maximum and minimum limits of monthly precipitation and the over-all monthly average for the years 1911-48. These averages should be about representative for all of western Whatcom County. The amount of precipitation increases to the east where cooling air masses rising over the Cascade Mountains lose their moisture in the form of rain and snow.

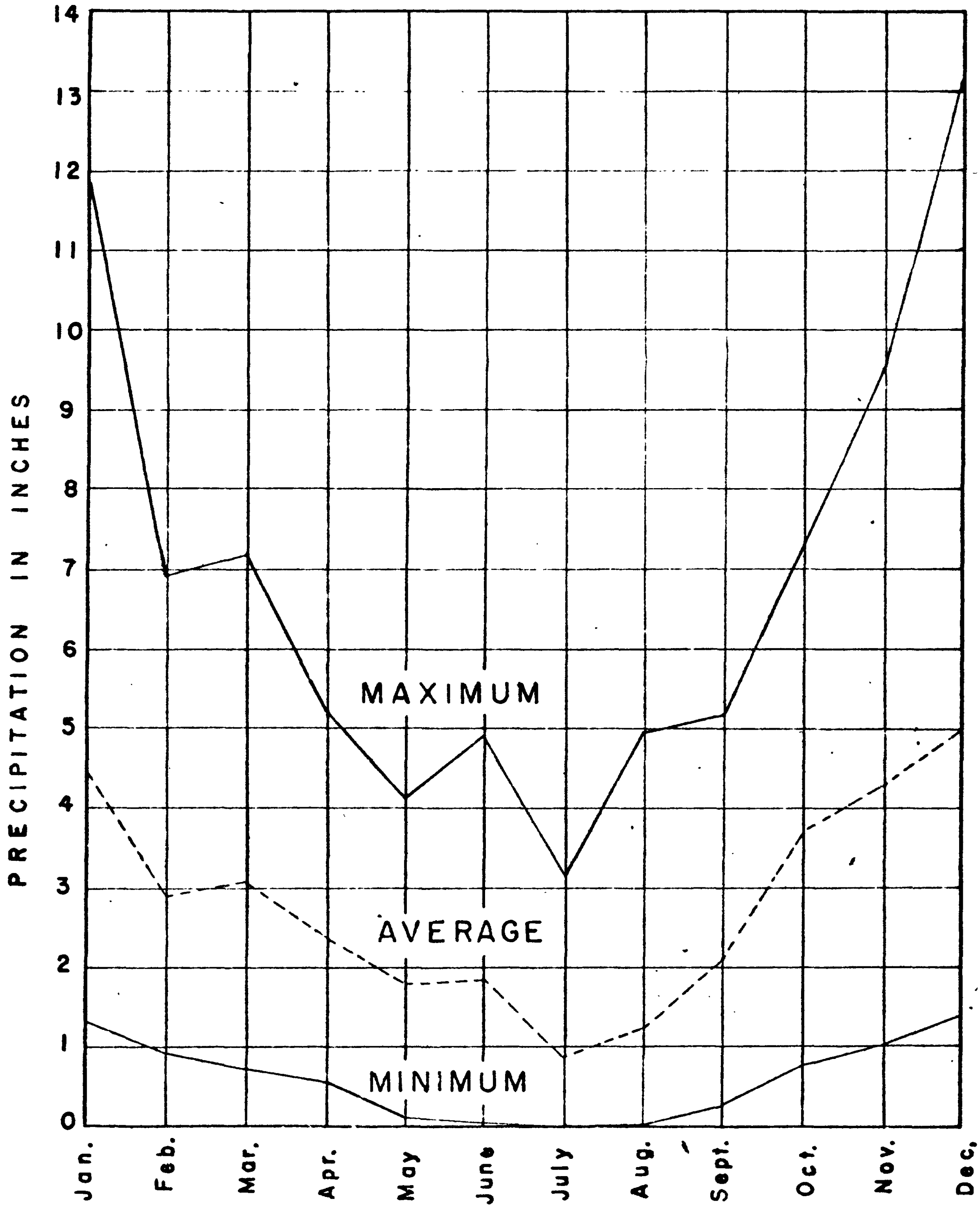
/ U. S. Weather Bureau records.

The mean annual temperature for western Whatcom County is about 49° F. Records from five weather stations compiled to 1930 show the following average temperatures: 50.1° F. at Bellingham, 48.7° F. 2 miles north of Bellingham, 49.8° F. at Marietta, 48.4° F. at Blaine, and 48.4° F. at Clearbrook. July usually has the highest average monthly temperature; the averages from the same five weather stations show it to be about 61.5° F. December has the lowest average monthly temperature, the average being about 36° F.

PLATE-4



Annual precipitation 2 miles north of Bellingham, 1911-48



Maximum, average, and minimum monthly precipitation 2 miles north of Bellingham, 1911-48

The growing season averaged about 145 days at Bellingham for a 21-year period to 1930. The average date of the last killing frost in the spring was May 13, and the average earliest killing frost in the autumn was October 15. The latest date recorded for a killing frost in the spring during the period was June 19, and the earliest date in the autumn was September 8.

The sky is generally clear in the growing season and cloudy or overcast during the winter months. Records show that for the 10-year period 1938-47, the station 2 miles north of Bellingham had an average of 148 clear days, 62 partly cloudy days, and 155 cloudy days. The weather station at Clearbrook recorded the following averages for the same period: 135 clear days, 64 partly cloudy days, and 166 cloudy days.

Culture and Industry

In its native condition Whatcom County supported a forest of fir, cedar, and hemlock. The forest of the lowlands was the best of native timber. It has been entirely cut over and has since largely given way to cultivation and waste brush land.

Agriculture furnishes the chief source of livelihood for a large portion of the rural population of western Whatcom County. Dairy farming is one of the most important activities, though the raising of various kinds of berries has nearly equal importance. Other important agricultural products of the county include beef cattle, seeds, bulbs, and vegetables. It is the consensus that proper application of about 1 foot of irrigation water will double the yield of most summer and fall crops and greatly exceed that benefit on some of the pasture lands.

Unpublished records
subject to revision

Lumbering is by far the most important nonagricultural industry in the county. Timber from the forests of the Cascade Mountains and other areas goes into the production of lumber, plywood, pulp for use in paper and rayon mills, and many other timber products.

Coal occurring in the Tertiary strata beneath Bellingham and the area to the north has, in the past, supported several active mines. Coal production from this area for use in home and industry has been carried on for the better part of a century.

The canning and processing of agricultural products, the fishing industry, and the tourist business furnish a means of livelihood for a large group of people within the county.

GEOLOGY

General

Unconsolidated deposits of Pleistocene and Recent age underlie most of the lowland area of western Whatcom County. These deposits consist of bedded sands, clays, and gravels as well as glacial till, and, so far as known, were laid down upon an erosion surface of considerable relief cut in the folded sandstones, shales, and conglomerates of the Tertiary sedimentary rocks. Eight miles or so southeast of Bellingham the pre-Tertiary metamorphic rocks, upon which the Tertiary rests unconformably, can be seen passing westward beneath the basal conglomerate of those sedimentary strata.

Description of the rock units

Pre-Tertiary metamorphic rocks

The older metamorphic rocks are exposed in only a few places in western Whatcom County. Several windows eroded through the Tertiary occur on the west slope of Sumas Mountain. These windows are not shown on plate 2 but are known to occur in sec. 2, T. 39 N., R. 4 E., and sec. 35, T. 40 N., R. 4 E. The Tertiary rocks in both places are underlain by dark-green peridotite, probably a metamorphosed basic lava.

Rocks underlying the Tertiary strata are also exposed several miles south of Bellingham along the Chuckanut Drive near the small community of Blanchard. There the rock is a graphitic schist believed to belong to the Leech River group, as used by McLellan /, of late Paleozoic and --

/ McLellan, R. D., The geology of the San Juan Islands: Univ. Washington Pubs. in Geology, vol. 2, p. 99, 1927.

according to Anderson / -- possibly early Mesozoic age.

/ Anderson, R. A., Washington State Coll. Research Studies, vol. 9, no. 3, pp. 189-202, September 1941

So far as known, the metamorphic complex does not include rocks that will yield substantial amounts of ground water. It exerts little influence upon the ground-water resources of western Whatcom County, except to furnish an impermeable basement for any water in the Tertiary strata, and was not studied in detail in this work.

Tertiary rocks

So far as known these Eocene sedimentary rocks form the base beneath the unconsolidated deposits throughout western Whatcom County. They are a thick sequence of sandstones, shales, and conglomerates of continental-type sedimentation. Interbedded in these sediments are abundant plant remains and some coal seams that have been mined for many years in the Bellingham district.

These sandstones, shales, and conglomerates were first described by White / as part of the Puget group. McLellan / called them the Chuckanut

/ White, C. A., On the Puget group of Washington: Am. Jour. Sci., vol. 136, 00. 443-450, 1888.
/ McLellan, R. D., op. cit., p. 136.

formation, as have later writers. /

/ Glover, S. L., Oil and gas possibilities of western Whatcom County: Washington Dept. Cons. and Devel. Rept. Inv. No. 2, p. 9, 1935.
Weaver, C. E., Tertiary stratigraphy of western Washington and northwestern Oregon: Univ. Washington Pubs. in Geology, vol. 4, p. 75, 1937.

The Tertiary sedimentary rocks are folded into broad, open folds that trend generally northwest-southeast. Prior to the burial beneath the Pleistocene deposits of the Whatcom Basin the folds of the Tertiary had been cut and beveled by erosion. The exposed knobs, and probably the buried surface, consist mostly of subdued strike ridges connected by intervening gentler slopes. Records of several drill holes in the Birch Bay district show a relief of as much as 200 feet per mile on the buried surface of the Tertiary bedrock. The buried surface descends generally northward from the southern and eastern margins of the basin, where it crops out, to the northwestern part of the Whatcom Basin (center of the "Fraser lowland"), where it was not encountered by the Blaine city well (40/1-4J1) which penetrated to 570 feet below sea level.

Quaternary rocks

__Pre-Vashon Pleistocene deposits.__- Pre-Vashon Pleistocene deposits can be seen in few places, if at all. Those visible deposits tentatively assigned pre-Vashon age in this report may actually be marginal deposits of early Vashon age. Definitely pre-Vashon Pleistocene deposits are not known to crop out in the Whatcom Basin. However, Pleistocene deposits definitely of pre-Vashon age are believed to form the cores of the principal low plateaus.

Sedimentary materials underlying till of the Vashon glaciation are exposed in the sea cliff along the west side of the Mountain View upland. In the SE¼SE¼ sec. 20, T. 39 N., R. 1 E., these deposits consist primarily of well-bedded clays having silt or fine sand partings. A section at this cliff shows the following stratigraphic succession:

Section downward from top of cliff, altitude about 170 feet:

Materials	Thickness (feet)
Gravel, clean, pebbly	3
Till (Vashon) carrying a few marine shell fossils . .	25
Sand with beds of gravel, irregularly bedded, and missing in some places	30
Clay, blue, well-bedded, with sand partings	100
Covered by beach strand	-

The logs of two nearby wells, 39/1-20M1 and -M2 (see table 2), show the material underlying the till to be chiefly fine sand and clay.

A similar section of Pleistocene deposits is exposed in the sea cliff 2½ miles southeast of Marietta where, in the SW¼NW¼ sec. 23, T. 38 N., R. 2 E., the following is found in an uneven and highly variable series of beds:

Section downward from top of cliff, altitude about 90 feet:

Materials	Thickness (feet)
Till, intimately mixed clay, sand, and gravel	3
Sand, variable, with interbedded clay	19
Clay, an unusual mixture of sand and gravel lenses with clay lenses and pods of rafted (?) cobbly till	3
Sand, medium-grained, well-bedded	6
Clay, blue, plastic, with sand partings	1
Sand, brown, medium-grained	5
Clay, blue, banded, plastic	1
Sand, brown, medium-grained, with clay partings and tortuously involuted clay interbeds	18
Clay, plastic, silty, with some pebbles, apparently a water-laid deposit with ice-rafted material included, abundant marine fossil shells	30
Covered by beach sand	-

Another section of pre-Vashon (?) beds is found in the river bluff 1½ miles above Cedarville where, in the SE¼NE¼ sec. 34, T. 39 N., R. 4 E., the following section is exposed:

Top of section is top of sand bed, at altitude of about 220 feet and near middle of cliff face

Materials	Thickness (feet)
Sand, brown, well-bedded, with numerous interbedded silt and clay layers; foreset sand layers dip as much as 45° northwest	7
Clay, blue, well-stratified, in places contains isolated rounded pebbles	40
Covered	-

These fine-grained deposits belong to the pre-Vashon or early Vashon filling of the Puget Sound Basin.

The correlation of the deposits below the Mountain View upland with the Admiralty clay, identified farther to the south/ and possibly to

/ Newcomb, R. C., Ground-water resources of Snohomish County, Washington, duplicated report on file in the Geological Survey office, Portland, Oreg.; to be published as a water-supply paper.

the north/ of this area, or with other pre-Vashon deposits is not certain

/ Johnston, W. A., Geology of Frazer River delta map area, British Columbia, Canada: Canada Geol. Survey Mem. 135, 1923.

at this time. It is believed that the clays and sands that underlie the till of the Vashon glaciation in the Nooksack Valley east of Cedarville are stream and lake deposits laid down in water impounded by the advance of the Vashon ice, and consequently belong to the Vashon rather than to the earlier Admiralty age. It is possible that the exposed sections northwest of Bellingham (described above) also belong to the marginal deposition of the Vashon glacier and are not representative of the older, truly pre-Vashon sediments that must form the "core" of the Mountain View upland.

In the stratigraphic designations placed on the drillers' logs in table 2, the term "Older Pleistocene (?) deposits, undifferentiated" is used to distinguish these deposits from the younger Pleistocene deposits of the Vashon glaciation.

Aside from the few described exposures, which may be of Vashon age, pre-Vashon deposits are known only from subsurface exploration, mostly by drilling for ground water and by records from test wells for oil and gas. Well 39/2-6N1, known as the Enterprise oil test, was drilled to a depth of 3,615 feet and reported penetrating about 615 feet of unconsolidated material above Tertiary rocks. The unconsolidated material in this case is presumed to be all of Pleistocene age, except for some Recent material at the top. The complete log of this well was published Glover. / The

/ Glover, S. L., op. cit., pp. 49-50.

unconsolidated materials penetrated below the Recent deposits were as follows:

Materials	Thickness (feet)	Depth (feet)
Quicksand	30	30
Sand, blue	70	100
Quicksand and gravel	95	195
Clay, blue	390	585
Sand	30	615
Tertiary sedimentary rocks	to bottom of well	

The lower 420 feet of these unconsolidated deposits is considered to be part of the pre-Vashon Pleistocene lacustrine or marine deposits of the Puget Sound Basin. Farthur north these earlier Pleistocene materials may have a somewhat different character. Well 40/1-4J1, located a few miles east of Blaine at an altitude of about 177 feet, was drilled 746 feet in depth, all the way in unconsolidated material. The log of this well (see table 2) shows the material to be somewhat coarser than that reported elsewhere, but the rotary methods employed in drilling the Blaine well may have resulted in the drillers' log showing materials coarser than they actually are.

The Whatcom Basin is roughly the southern half of the large delta-shaped lowland whose apex is to the northeast in the mountain canyon of the Fraser River. Considering this international lowland as a great structural basin whose floor is known to extend, at least in the Blaine area, to more than 560 feet below sea level, it is logical to surmise that a considerable thickness of clastic sediments, in large part laid down by the Fraser River in pre-Vashon time, underlies the few hundred feet of deposits of Vashon or earliest Vashon (?) age which are known in the Boundary and Mountain View uplands. Consequently, at depth in the northwestern part of the Whatcom County lowland, there is probably a thick series of pre-Vashon Pleistocene beds that might correspond to the pre-Vashon Pleistocene fill identified farther south in the Stanwood, Seattle, and Tacoma districts.

The occurrence of saline ground water in the upper one or two hundred feet of Pleistocene and Recent sediments in the Whatcom Basin is confined, so far as known, to a position relatively high up on the slope of this bedrock basin, and the presence of marine Pleistocene deposits above and near present sea level does not, from present information, preclude the possibility that fresh-water deposits and fresh ground water occur at depth in the deeper, earlier deposits of the "Fraser lowland".

Deposits of the Vashon glaciation.- In the section exposed on the sea cliff of the Mountain View upland there is an irregular thickness of cross-bedded sands and gravels close beneath the till of the Vashon glaciation. Beneath the till capping along the east slope of the Mountain View upland, well logs indicate a thick and persistent sand and gravel stratum. Also, exposed beneath the till capping at the Blaine city springs (40/1-4D1) and in quarries east of there along the Boundary upland escarpment, is a prominent zone of crossbedded gravelly outwash. In wells on the north slope of the King Mountain upland a rather thick section of coarse sand and gravel is shown to underlie the whole district beneath the till of the Vashon glaciation. These gravelly deposits are believed to belong to the advance outwash of the Vashon glacier. Elsewhere in the basin the outwash layer seems to consist more of material deposited in pounded water than of definitely currentlaid materials.

The till of the Vashon glaciation is a massively compact, durable, intimate mixture of clay, silt, sand, and pebble gravel, with occasional cobbles and boulders. It occurs largely as a ground-moraine deposit. It is bluish in color except near the surface or along joints, where it is stained a yellow-red color. The till ranges from a few feet up to 50 feet or more in thickness. It rises from the edge of the recessional outwash and alluvial deposits of the river valleys up over the uplands and ascends the mountain slopes that bound the Whatcom Basin. It is a hard distinctive stratum commonly known locally as "The Hardpan". The till averages about 20 feet in thickness, which is not so great as in Snohomish County some 75 miles to the south, where a thickness of 50 feet is about average.

The recessional outwash deposits of the Vashon glacier consist of sand and gravels and some finer material. They were laid down primarily as fluvatile deposits by streams flowing out from the retreating ice front. Some of the finer deposits were laid down in ponds, probably close to the ice front.

Above the till in places on the Boundary and Mountain View uplands (see pl. 8, A) there is exposed a thin cover of cross-bedded sands and gravels containing numerous large boulders. These deposits form a discontinuous cover over the uplands and were probably deposited by outwash streams when the ice front was nearby.

A few shallow channels were cut through the till and into earlier deposits by Vashon meltwater around the King Mountain upland. The floors of these channels are mantled by sand and gravel. The present Squalicum Creek follows one of these old channels. The delta deposits of Squalicum Creek were laid down by recessional meltwater at a time when sea level throughout this area stood some 50 to 60 feet higher than at present -- the same level to which the principal outwash deposits of the Nooksack Valley were graded. Squalicum Creek subsequently has cut a ravine into these meltwater deposits, down to the present sea level.

The Lynden terrace, the Custer Trough, and the broad area that extends northward from the King Mountain upland to the flood plain of the Nooksack River are underlain by the most extensive deposits of recessional outwash found in the Whatcom Basin. These deposits are primarily sand, though they contain beds of gravel and clay. They were laid down by large outwash streams flowing southward toward the outlets down the Custer Trough and the Nooksack River at a time when sea level stood 50 to 60 feet higher than at present. These streams may have removed the till from large areas along the floors of the broad channels that are now covered by the outwash deposits, but on the sides they deposited outwash upon the till slopes without removing the till.

The extensive terrace lands formed by these recessional outwash deposits now form some of the finest agricultural land in the county.

Recent alluvium

After the Fraser River had returned to its course along the northern side of its now-glaciated lowland "delta," the lower Nooksack River excavated its floor to the newer and lower sea level of today. The Nooksack River reworked much of the recessional outwash material, mixing it with silt and forming a flood-plain deposit that mantles the lower level cut in the recessional outwash deposits.

In some places the Recent alluvium can be divided into two units, younger and older alluvium, and this distinction is shown in some of the well logs in table 2. In general, the alluvial deposits now within reach of flood waters are considered young or practically contemporary in age. That alluvium above the reach of present streams, or other depositional agents, is considered older. There is some difficulty in places, distinguishing between the latest of the glacial outwash and the older alluvium and these materials are shown as of questionable designation on many of the logs in table 2.

Geologic history

The reconstruction of the course of geologic history, as it is recorded in the earth materials, helps to protray the conditions that exist in the strata and the circumstances that govern the reservoirs of ground water from which water supplies are obtained.

Tertiary

During the early part of the Eocene epoch of the Tertiary period, sands, silts, gravels, and organic material were laid down upon an erosion surface cut upon the older metamorphic and igneous rocks of the area. These deposits, after long-time compaction and consolidation, now constitute the Tertiary sedimentary rocks of the area. They were continental, fresh-water sediments; they were laid down on a broad valley floor, probably in the form of wide alluvial fans. / Local ponding of waters in the valley

/ Weaver, C. E., op. cit., p. 89.

permitted the accumulation of stratified sands and clays and the development of large swamps whose vegetal matter now constitutes the coal seams found in the Tertiary strata. Subsidence during that time of deposition permitted accumulation of more than 10,000 feet / of sedimentary materials.

/ Weaver, C. E., op. cit., pp. 78-89.

From the occurrence of large numbers of fossil palm fronds, the climate during this epoch is thought to have been much milder than the present temperate climate.

The ancestral Cascade Mountains were developed in a succeeding late Miocene or early Pliocene deformation; this deformation resulted in the development of large, northwest-southeast-trending folds. The main folding of the Tertiary strata probably occurred during this period of deformation. Continued erosion in Ploicene time reduced the ancestral Cascade Mountains to a broad westward-sloping plain of low or moderate relief, a condition in which the western Whatcom County region must have shared. Deformation occurred again near the close of the Pliocene epoch. It resulted in the uplift of the present Cascade Mountain area into a large upwarp having a north-south trend. The Olympic Mountain uplift and the Puget Trough downwarp were also formed at that time.

Quaternary

Pleistocene ("Ice Age").- During the Pleistocene eopch (sometimes called the "Ice Age") erosion reduced the newly formed Cascade Mountains to a stage of mature dissection. The deposition of the rock waste from that erosive period resulted in the partial filling of the northern, basinlike part of the Puget Trough. The upper part of these earlier Pleistocene sediments in the Puget Sound basin has been called the Admiralty clay. It is believed to have been deposited in a large, shallow, possibly fresh-water lake. Bretz / believed the Admiralty to have been marine, on

/ Bretz, J. H., op. cit., pp. 180-181.

the basis of several shell finds believed to come from the Admiralty. The senior writer has not found fossils in extensive searches of beds of known Admiralty age elsewhere in the Puget Sound region and calls attention to the possibility of fresh-water origin on the basis of their fresh (connate?) ground water and their lack of established marine fossils. The deposition of the Admiralty clay continued until the Puget Sound basin was filled to a level 200 or 300 feet above the present sea level.

The deposition of the Admiralty clay ended rather abruptly. The lake in which it was being deposited was drained, and a stream system developed across the top of the Admiralty. Deep canyons were quickly eroded along these stream courses. Some of these canyons were more than 800 feet in depth and reached back headward to the hard rocks of the mountain slopes. Whether an uplift of the entire area, a general lowering of sea level, or a decrease of 1,000 feet in the base-level control of the "Admiralty Lake" drainage accounted for the onset of such gorge cutting is not now definitely known.

As shown by the drainage levels that prevailed during the outwash phases of the Vashon glaciation, there was subsequent to the carving of these gorges, and possibly not until the onset of the succeeding Vashon glaciation, a regional lowering of the Puget Sound lowland by at least 600 feet and possibly more.

The advance of the Vashon ice is believed, from lack of erosion of the gorge slopes in Snohomish County to the south, to have begun soon after the deep gorges were cut. The ice moved southward from the piedmont ice fields between Vancouver Island and the Canadian Coast Range and pushed up the newly cut gorges of the Puget Sound section, blocking the drainage and forming many temporary lakes. Advance outwash materials from the ice were mixed and interfingered with the sediments brought down by the streams from the Cascade Mountains and deposited upon the floor of these impounded lakes. As the ice pushed up the canyons, the lake levels rose and the waters spilled over the intergorge divides and cut temporary diversion channels. The Fraser River in British Columbia was probably diverted southward across the area that is now western Whatcom County. In turn, the Nooksack and other rivers were diverted southward along the ice margin. As the ice moved southward in the Puget Trough it thickened over this area and pushed southeastward, finally reaching a height near the present 2,500- or 3,000-foot altitude mark.

Apparently, as the ice moved up the Nooksack gorge -- at first the one located in the swale just south of Blaine -- it forced the impounded waters to find a new outlet. That first outlet may have been cut on the south side of the present Birch Point upland. In turn, that channel would have been blocked as the ice advanced inland. The impounded water, then swollen by the added Fraser River drainage, apparently developed or greatly enlarged the channel that now is followed by the present Nooksack River east of the Mountain View upland. The ice tongues continued to move up the Nooksack gorge, blocking the diversion channels and forcing the water to spill southward across the King Mountain upland, there producing several smaller channels. The ice tongue moving up the Nooksack canyon may have merged with another ice tongue moving across the Fraser River lowland. That enlarged ice sheet then must have moved up the Nooksack Valley and impounded waters in the canyons of the mountain front, causing the development of new diversion channels southward through the mountains.

At one time the ice rose above the rims of the intergorge areas of the Puget lowland and spread out over the palteaulike areas formed of the Admiralty clay and advance deposits of the Vashon glaciation. The ice sheet at its maximum extent covered the whole Puget Sound basin southward as far as the towns of Tenino and Centralia, 130 miles south of Bellingham. Its upper surface reached as high as the present 2,500- or 3,000-foot mark in Whatcom County. The ice-front advance was not one continuous forward movement. The rate of melting at times exceeded the rate of thrust, causing the ice front to oscillate. Such oscillation apparently accounts for the presence of several separate layers of till in some places along cliffs at the edge of the intergorge uplands.

The Vashon ice finally melted back from the Puget Sound basin near the close of the Pleistocene epoch. It left behind a mantle of ground moraine over much of the area. In the drainageways the till was largely reworked or completely removed by the outwash streams flowing from the receding ice front. In places, the ice-borne debris was dropped in ponds or lakes. In other places, it built long trains of water-laid materials that now floor and partially fill some sections of the interplateau "gorges" both above and below present sea level.

Meltwater carried a thin deposit of sands and gravels over much of the till surface. The former diversion channels were partly filled by outwash deposits. The Nooksack River was diverted back into its former drainage route and again flowed across the lowland area, joining the Fraser River near the present site of Everson. A lowering of sea level from the 50- to 60-foot altitude of the late recessional-outwash terraces to its present position has since caused, or accompanied, the return of the Fraser to a channel along the north side of the "Fraser lowland."

Recent.- Since the recession of the Vashon ice the Nooksack River has reworked much of the outwash material in its valley and has produced a broad flood plain mantled with Recent alluvium. The lower portion of the present Nooksack Valley was probably a small estuary, and the Lummi Peninsula was then an island. Alluvial deposits have since filled this embayment, producing a near-sea-level flood plain that transformed ("tied") the island into a peninsula.

The recession of the Vashon glacier and the subsequent adjustment of the drainage to its new environment were succeeded by a short period of adjustment of topography and climate before man entered to find the earth materials, topography, soils, vegetation, and drainage that exert a primary control over his life today.

GROUND WATER

Occurrance of Ground water

Place and manner of occurrence

In this report the manner in which ground water occurs in the pore space of rock materials is described in two ways: first, by its mode of existence within stratigraphic units, and, later, by the hydrostatic condition (perched, unconfined, or confined) of its occurrence within given zones.

Pre-Tertiary metamorphic rocks

The metamorphic rocks (mainly schist and greenstone) that crop out within the area do not contain pores or openings other than the small joint cracks and shear zones common to hard rocks and consequently would be expected to carry ground water irregularly and only in small amounts, though it is possible that certain types of these rocks might afford small supplies of water when tested in otherwise water-lacking areas. No wells are known to obtain water from these materials in western Whatcom County, and the dense, tight character of these rocks makes them unlikely sources of substantial quantities of water.

Tertiary rocks

The Tertiary sedimentary strata carry small amounts of fresh water in the few places where pore space permits and where adequate recharge and drainage have flushed out the saline or other highly mineralized water commonly found in these strata. The yields are low — a 6-inch well penetrating a water-bearing stratum in the Tertiary generally yields only a few gallons a minute. The sandstone and conglomerate materials are rather poorly sorted, quite well cemented, and irregularly and discontinuously stratified, all of which characteristics help to account for their evident lack of permeability. In fact, the drilling records show that in many cases the meager supplies of water obtained from the Tertiary rocks have come from the "broken shale" members of the formation. During the well canvass, only a few wells were fould to obtain water from the Tertiary; these are at fairly high altitudes -- where downward flushing of the strata by fresh water would be expected to be most vigorous. Of those wells on lower ground essentially all give saline or other mineral-charged water. Investigation of reports of large flows or large potential yield from the Tertiary rocks -- such as rumors originating in oil-test drilling -- all proved to be unfounded.

The information gathered during this investigation indicates that the Tertiary sedimentary rocks are unlikely to provide ground water for any but the smallest needs and that well tests located relatively high on the hill slopes are more likely to find fresh water than are those on the lower lands.

Quaternary deposits

Pre-Vashon Pleistocene deposits.- Beneath the Mountain View upland fresh ground water has been developed from sand and gravel layers in stratified deposits. These deposits probably do not crop out. The same type of material is shown by the well logs to form the core of the Mountain View upland downward from near the base of the till of the Vashon glacier to the underlying consolidated rocks of Tertiary age. The water is largely unconfined and occurs in a body whose upper surface has the shape of a broad dome [illegible] higher "mounds" (see contours on pl. 1, A). The water-bearing [illegible] are thin and of low average yield.

The deeper Quaternary materials beneath the Boundary upland are known only from the log of one well (40/1-4E1) east of Blaine. The large amount of gravel reported for the deeper part of this well may be deceptive. That well was drilled by rotary methods, which elsewhere in the Puget Sound area have given well logs showing much more gravel than indicated by carefully measured cliff exposures and records of nearby percussion-drilled wells.

The water encountered in these Pleistocene strata is mostly fresh except along the west side of the Mountain View upland, where considerable saline water has been found. There, however, the strata may represent marginal advance deposits of the Vashon glaciation rather than the deposits that comprise the bulk of the upland. Little water can recharge these aquifers beneath the Mountain View upland by downward percolation from the surface. [illegible] groundwater recharge that does reach these aquifers [illegible] character of the till capping, and the low permeability [illegible] clay [illegible] the core of the Mountain View, Boundary, and Birch Point uplands, [illegible] of pre-Vashon [illegible] of the [illegible] upland.

gorges — quite possibly they belong to Admiralty time as represented by sediments farther south in the Puget Sound area. It is significant that the water so far developed in these strata is largely fresh. The strata beneath the Mountain View upland have been thoroughly tested and yields found to be low, but those beneath the Boundary and Birch Point uplands remain largely untested to date.

Advance outwash of the Vashon glacier.- Beneath the till capping on the Boundary upland is a thick zone of clean, water-washed, irregularly bedded gravels and coarse sand that crops out around the steep slopes southeast of Elaine. Likewise, similar gravel zones are encountered in well drilling just beneath the till in the area around the northeast side of Mountain View upland, in the area northward from King Mountain to Laurel, and in the small hilly area just west of Sumas. These deposits are advance outwash of the Vashon glacier. In some places (such as the river-bluff section east of Cedarville) the ice may have advanced into ponded water that allowed clay and "dirt" to accumulate, but in most places currents laid down the clean gravels and sands as the water escaped outward around and away from the advancing and thickening Vashon ice. The materials are generally porous and permeable, and below the local water table they carry large volumes of ground water. Yields of 200 to 400 gallons per minute from 10- or 12-inch cased wells are common in these areas. The evident sources of recharge water for these aquifers is precipitation on the upland above, the water entering the sand and gravel where the till capping is thin or absent. The ground water in these aquifers has established natural gradients toward points of exit. The Larabee Spring (39/2-36D1) and Crystal Springs (39/3-19L1) are natural discharge points for the advance-outwash aquifer north of King Mountain. The Sumas city springs (41/4-33H1) probably are supplied in part from the gravel beneath the till. The Elaine city springs (40/1-3M1) and numerous creek sources drain the advance outwash beneath the Boundary upland, and several small seepage springs probably drain the equivalent zone on the northeast end of the Mountain View upland. The gradient of the water table westward toward Larabee Spring is but 5 feet or so per mile. In view of the substantial discharge of the spring, the low gradient indicates that the sand and gravel are, in this instance, highly permeable.

Elsewhere, beneath the till there are "pockets" and "trains" of outwash gravel less extensive than those described above. In some places (such as at well 39/1-26E1) this advance outwash gravel lies above the water table; in some others it is penetrated far below the local water table, in such a position that the overlying till cap serves as a confining layer and flowing water wells (such as 41/1-31G1 and 39/2-20C2) are obtained. These advance outwash gravels and sands, both in the larger areas described above and in the other smaller isolated areas, are widely used sources of ground-water supply for people living on the lower parts of the upland areas. They are among the most satisfactory sources so far developed in the Whatcom Basin.

Till of the Vashon glaciation.- The till deposited by the Vashon glaciation is largely impermeable and causes much of the precipitation to run off, to remain within the upper (soil-zone) horizon, or to perch upon the till surface where permeable sediments overlie the till and water accumulates in them. However, some sand and gravel streaks do occur and afford irregular channels into and even through the till. Shallow wells dug into the till afford small supplies of water for domestic or stock purposes. These wells are in many areas the most common source of rural domestic supply. In places where one of the gravel or sand streaks is encountered a better than average well results and may supply a household throughout the year, but the great majority of the wells in the till are prone to go dry in the summer. Sometimes deepening an inadequate well affords more storage space and in rare instances deepening opens up gravel or sand streaks that let in more water to strengthen the well, but in some cases deepening results in perforating the till cap and in the loss of water into "dry" pervious materials below.

Recessional outwash of the Vashon glaciation.- A great train of water-laid sand, silt, clay, and gravel outwash descends southward from the boundary area west of Sumas forms the Lynden terrace and lines the Nooksack River lowland up to an altitude of about 60 feet near the present Sound shore. The outwash carries unconfined ground water at rather shallow depth. Much of the area underlain by outwash has as insufficient slope for good drainage and the ground water stands at drainage-ditch level. The outwash in the area near the upper, northern end is coarser-grained in general; there it is composed largely of sand and gravel, as compared to clay, silt, and sand along the Nooksack Valley below Ferndale and to similar materials in the Custer Trough below Custer Station. Much of the ground water of the outwash terraces flows out from springs along the river escarpments or is now ledoff by drainage works. In some places water levels in wells show a harmonious rise and fall with the rainfall cycle and with the level in the marginal drainage creeks (see pl. 11).

Wells obtain large yields when properly constructed in these outwash materials, but most of the present developments are merely small driven, drilled, or dug wells.

Many of the wells yield water so high in iron that it must be treated to make it satisfactory for domestic use. Beneath much of the lower part of the outwash-terrace area deeply drilled wells have encountered saline ground water. It is quite probable that this material was deposited into sea water, which then stood about 50 to 60 feet above present sea level, so that the salty water remaining at depth may well be connate water not yet flushed out.

Recent alluvium

Along the present flood plain of the Nooksack River and the broad trough occupied by the Sumas River, the recessional outwash materials have been cut out to a newer, lower level, over which the present rivers spread in flood time and have laid down thin deposits of Recent alluvium. The clays, silts, and sands are full of water up to about river level. The ground-water level generally shows variation with the level of the river and with the amount of rainfall. The ground water is developed for domestic and industrial supplies by small driven and drilled wells and by shallow dug wells. Much of the water contains an excessive amount of iron. Gaseous odors are present in some well water, which is considered to be of only fair quality.

Hydrostatic condition

The shallow soil-zone wells on the till-covered uplands tap water that is held up, perched, above the regional water table. Clay layers at the surfaces of some terraces, such as the low outwash terrace just east of the Nooksack River opposite the town of Ferndale, may cause a similar perching effect. Beneath the uplands, clay layers in the strata may also perch thin layers of ground water within the overlying pervious materials at a position above the general level of the water table.

Most ground water lies in the pores of the rock materials within a saturated zone whose upper surface grades toward an outlet, the steepness of the slope depending on the thickness and permeability of the materials and the amount of water moving through them. Such a ground-water surface is known as a water table and such ground-water occurrence is called unconfined. The regional water table in western Whatcom County is shown in part by the contours on plate 1. Beneath the uplands the water table is higher and culminates in low domes or "mounds" beneath points where recharge occurs from the surface. In the terrace lands, such as those north of Lynden, the water table lies near the surface and slopes toward the streams and drainage ditches or toward springs along the terminal or lateral escarpments. The lowest level of the regional water table is commonly along the major streams. The water table beneath the Nooksack River flood plain is in general balance with the river, into which the ground water escapes. The water table slopes toward the stream and downstream in conformity with the gradient of the stream. In the large trough followed northward by the Sumas River the regional water table slopes northward toward the Fraser River in Canada (see pl. 1).

Confined, or artesian, ground water occurs under pressure due to passage of the water beneath an inclined impermeable stratum in its path from a recharge area to a lower point of discharge./ In western Whatcom County the principal known areas of artesian ground water are the Anderson Creek area north of Squalicum Mountain, the Ferndale area, and the eastern part of the Blaine area.

/ The reader may note that hydrologists in general, including those of the Geological Survey, use the word artesian to mean any confined ground water. Most dictionaries still use the old designation meaning ground water that flows to the surface. In addition there is some popular misuse of the term to mean a well of large yield, or any relatively deep drilled well.

In the Anderson Creek area the confining "layer" is a complex overlapping arrangement of clay strata and the till of the Vashon glacier. Clay beds are present both above and below the till. The compound impervious zone inclines northward with the topographic slope of the district. Beneath that zone the water-bearing sands and gravels contain ground water under pressure. The recharge must take place through holes or thin places in the till along the mountain slopes above the Anderson Creek artesian area.

In the Ferndale district the ground-water zone beneath the till along the east side of the Mountain View upland apparently comes under confinement beneath the till in the lower slopes of the upland. Only a few wells (such as 39/2-19P1 and -20C2) have developed that artesian zone. The eastward extent of the till capping layer is not known; it may taper out, it may have been cut off by the ancestral Nooksack River, or it may even extend all the way across beneath the Nooksack River flood plain.

The eastern part of the Blaine area is likewise one in which the till capping confines water in the underlying gravel aquifer. The westward extent of the till is here also unknown, but, judging from its persistence beneath the Dakota and California Creek areas, it must extend westward beneath Blaine and for some distance to the west.

The presence of these three known areas of flowing artesian ground water confined beneath the till capping along the lower slopes from the uplands indicates that other such areas probably exist but have not yet been discovered.

Chemical character of the ground water

The ground waters of western Whatcom County are relatively low in dissolved mineral matter. They are in general of good quality; however, ground water of poor quality does occur. The quality in most cases depends mainly upon the geologic mode of occurrence.

In studying the mineral content of the ground water, four relatively complete chemical analyses were made on representative ground-water samples; in addition, one analysis of the Everson City water supply was furnished by water-department officials (see table 4). Geological Survey personnel tested 246 additional samples for hardness and 226 samples for chloride. Both types of test were made by field methods (see table 1, columns 16 and 17, and table 2, columns 11 and 12).

Hardness

The common classification of water hardness in use by the U. S. Bureau of Public Health is stated in parts per million by weight of the calcium and magnesium content expressed as calcium carbonate. The following table gives the commonly-used adjectives and their limits:

Hardness as $CaCO_3$, parts per million	Degree of hardness
0 - 55	Soft
56 - 100	Slightly hard
101 - 200	Moderately hard
201 - 500	Very hard

Of the field hardness determinations the greatest found in western Whatcom County was 295 and the least 10 parts per million. The greatest hardness was found in a saline water (well 38/2-1R1) from, or close to, the Tertiary sedimentary rocks just west of King Mountain. The softest water (well 39/4-33D1) came from the Tertiary bedrock and the outwash gravels above bedrock on the steep slope just south of Cedarville. Of 246 wells and springs whose water was tested for hardness, 76 were found to have soft water, 97 had slightly hard water, 67 had moderately hard, and only 6 had very hard water. Wells in the till of the Vashon glacier yielded water ranging in hardness from 85 to 150 and averaging above 100 parts per million, or moderately hard. The wells in the recessional glacial outwash yielded water ranging from 40 to 80 and averaging about 60 parts per million, or slightly hard. The water from the shallow wells in the Recent alluvium of the Nooksack and Sumas Rivers differs somewhat in hardness from place to place and at various depths. In many wells it is but 60 to 80 parts, whereas in others it runs as high as 175 parts per million or more.

Salinity

The small amount of ground water in the Tertiary rocks is saline or brackish, except on mountain slopes or other places where good circulation has apparently flushed out that type of water. Not only is the water from the Tertiary generally saline, but tests of water from wells in the overlying glacial or alluvial materials indicate that the Tertiary rocks may feed small amounts of saline water to nearby permeable beds in the unconsolidated materials.

The unconsolidated pre-Vashon Pleistocene deposits beneath the Mountain View and Boundary uplands appear to contain fresh water of low chloride content even when lying as much as several hundred feet below present sea level. Two field tests for chloride concentration, one showing 6 and the other 57 parts per million, were made on water from deep wells on the Boundary upland, and five such tests of water from wells on the Mountain View upland all showed less than 20 parts per million of chloride. This condition did not hold for all the wells on the western end of the Mountain View upland. The chloride is high in water from deep wells that may penetrate or approach the Tertiary bedrock, wells that may enter a series of marine beds of early Vashon age, or wells that may tap aquifers cut off from fresh-water recharge and into which sea water has found its way.

The principalzone of saline water lies at a depth of 100 feet or more beneath the lowlands of the Nooksack and Sumas River flood plains and the Custer Trough. There chloride as high as 1,000 parts per million, or even more, is to be expected. Possibly the advance and recessional outwash deposits of the Vashon glaciation were laid down in these lowlands under marine or brackish-water conditions and the connate saline water has not been flushed out since.

The recommended limit for chloride in drinking water given in the 1946 Public Health Service Drinking Water Standards is 250 parts per million. Water containing 500 to 1,000 parts per million or more, is widely used where better water is not available, but prolonged use of water having the higher concentrations is commonly enjoyable.

Gaseous impurities

Numerous wells drilled in the area where glacial materials cap the beveled coal-bearing Tertiary rocks have struck pockets of natural gas. In some cases water is confined under high pressure along with this gas accumulation. Well 39/2-28H1 was reported to have tapped confined water that shot 100 to 150 feet into the air by gas pressure. The well is about $1\frac{1}{2}$ miles east of Ferndale in an area where many wells produce methane gas, as described by Glover. / Well 39/4-33C1, three-quarters of a mile south of Cedarville, was reported to have had a gas explosion in the pump house when the pump was turned on. The chief constituent of the gas is methane which was probably generated in the organic matter of the underlying Tertiary rocks. Where strata of the Tertiary are beveled, the gas may be free to move up into the overlying Pleistocene deposits, where it becomes trapped by confining clay members until encountered by wells.

/ Glover, S. L., op. cit., pp. 48-60.

A few of the wells were reported to obtain water having the odor of hydrogen sulfide ("rotten-egg" gas). Such occurrence may be due to peat or swamp deposits in close proximity to the aquifer.

Simple aeration generally will remove dissolved gases from water for household or stock use, and their presence is rarely detrimental.

Iron

Iron in the ground water is by far the most common objectionable constituent of the water in western Whatcom County. Its occurrence is confined almost entirely to the areas of recessional outwash and Recent alluvium, the greatest concentrations being in the Recent alluvial deposits of the Sumas River flat.

Inasmuch as 75 to 90 percent of the total iron present is oxidized and precipitated on contact with the air (see table 4), the iron in the ground water probably is largely in the form of ferrous bicarbonate, $Fe(HCO_3)_2$. It is probably derived from action of carbon dioxide and vegetal acids on ferric oxide and other iron compounds in the rocks. The vegetal matter possibly consists largely of peat beds. The ferrous bocarbonate stays in solution and the water remains clear until exposed to the oxygen of the air, when the iron is oxidized and precipitated as yellow-brown ferric hydroxide, $Fe(OH)_3$. This precipitate causes the stains that often occur on laundry or porcelain fixtures. The concentration of iron (Fe) preferably should be kept under 0.3 part per million for domestic purposes. Raw iron-bearing water is suitable for irrigation, as the small amount of iron added to the soil has no deleterious effect. The acidity of some soils shows increase when iron-bearing water is used for irrigation, as these waters commonly are acid. This condition may necessitate the treatment of the soil or water by the addition of alkaline materials such as lime.

Iron-bearing waters, where allowed to stand as in wells, cisterns, reservoirs, or ditches, often support large colonies of hairlike iron-depositing bacteria. The decay of these bacteria sometimes gives a foul odor to the water. Wells yielding potable iron-bearing water when first put into operation may show an increase in "iron" taste and may, at times, become unsuitable for domestic purposes owing to the accumulation of these bacteria.

The chemical analysis of the iron-bearing water from well 40/4-10D1 (see table 4) shows the presence of manganese in a concentration great enough to cause staining of white fabrics even if the iron were not present. Manganese is often associated with iron-bearing water and may be present throughout the iron-bearing waters of the area.

Treatment of iron-bearing waters.- Most of the iron-bearing waters have to be treated to be entirely satisfactory for domestic use. This can be accomplished usually by aeration and filtration. Commercial devices utilizing zeolitic base-exchange methods are also used. The precipitation of ferric hydroxide is more efficient if the normally acid water is made slightly alkaline by adding lime solution or by passing the water over or through some alkaline material such as crushed limestone. After aeration the precipitate is easily removed by letting the water spray upon and pass through a sand filter in the presence of air. Often an easily changed removable tray that catches most of the iron precipitate is used at the top of the filter.

A second aeration, which will improve the taste, can be achieved by arranging the filtration process so that the water drips from the filter to the storage space.

Use of ground water

Ground water furnishes the principal domestic, industrial, and public water supply for western Whatcom County outside the city limits of Bellingham. An estimated total of 3,000 dug wells, 500 drilled wells, 300 driven wells, and 100 developed springs are in use to furnish that supply. As public knowledge concerning the presence and development of this important resource increases, greater and more effective use will be made of ground water.

Domestic supply for rural farmsteads makes up most of the present use. An estimated 3,000 dug wells, 475 drilled wells, 300 driven wells, and 90 springs yield about 3½ million gallons of water per day for domestic and farmstead purposes.

Public supply for all the incorporated settlements in the western part of the county, except the cities of Bellingham and Lynden, is furnished by ground water. At present 6 wells and 5 springs are so utilized. Bellingham conducts surface water from Lake Whatcom and Lynden now pumps treated water from a plant on the Nooksack River. The incorporated communities using ground water use about 1 million gallons per day. The following table shows the source and average consumption for these larger communities.

Water consumption of principal communities using ground water

Municipality	Source	Average consumption (gallons per day) / Maximum	Minimum	Number of customer connections	Present adequacy
Blaine	Well, springs (4)	365,000	186,000	648	Adequate
Everson	Wells (2)	250,000	240,000	210	Do.
Ferndale	Wells (3)	330,000	110,000	400	Do.
Nooksack					(Included with (Everson
Sumas	Springs (2) (1 in use)	80,000	60,000	220	Adequate

/ As reported (for 1949) by officials of the water departments concerned.

Unpublished records subject to revision

Industrial use of ground water is limited to a few food-processing plants and dairy-goods processors. Their use does not make up an important withdrawal — probably less than a million gallons per day.

Irrigation with ground water is increasing. So far, it has been mostly confined to the river flood plains and low terrace lands where pumping lifts are low and yields from shallow, inexpensive wells are high. At present an estimated 1,000 acres are irrigated with ground water. These lands receive almost a thousand acre feet of water per year — most of it distributed by sprinkler irrigation.

Other uses to which ground water is commonly put — such as cooling; commercial food-fish propagation, for which spring discharge is especially sought; and heat-pump systems of space heating — are not extensive in western Whatcom County. In all, probably not more than 6½ million gallons of ground water is used per day at present in the Whatcom Basin.

Areas of deficient ground-water supply

Here and there in western Whatcom County area are spots where the succession of underlying strata is such that suitable ground water is difficult to locate even in the amount necessary for simple household use. Some of these occur as exceptions within districts otherwise moderately well supplied with water-bearing strata, but most are areas of generally deficient supply. Among the districts lacking an adequate ground-water supply are (1) parts of the Mountain View upland, especially toward the western side, (2) parts of the Boundary upland, notably the higher portion, (3) isolated bedrock hills in the Squalicum Mountain district, and (4) some places in the alluvial bottom lands of the Everson district, where the quality of the raw ground water is commonly poor.

On the Mountain View upland the shallow wells in till are the chief source of farmstead supply. These wells go dry in the summer or fall of most years. Some deeper test wells (such as 39/1-29B2) have encountered largely non-water-bearing clayey sections beneath the till before entering "dry" bedrock. The tabulation of wells drilled in the western Mountain View upland shows that the ground-water yields are small and water-bearing zones generally weak in that area. The rumor that large water-bearing zones were encountered at depth in the Standard-Ferndale No. 1 oil-test well (39/1-5B1) has been found to have grown from talk about a fair water-bearing stratum that was struck at 175 feet, but its yield and quality are problematical. The available ground water will sustain the farmstead suppy of the upland, though in many cases in an inadequate or costly manner, but the conclusion must be drawn that ground water for sustained irrigation or similar uses is not available on the western two-thirds or more of the Mountain View upland. Possibly water for irrigation and other uses could be developed from surface sources by making local lakes and swamps into reservoirs where the natural surface water could be stored for diversion to irrigation -- possibly supplemented by pumping from the Nooksack River at Ferndale.

The Boundary upland in its highest part 3 miles east of Blaine is an area where ground water may be difficult to obtain. However, the situation may be largely due to lack of exploratory drilling. Most of the known drilled wells have obtained enough water for farmstead use.

In the knobby hill area about King Mountain, at the northern toe of the King Mountain upland slope east of Laurel, and in some places on the slopes of Squalicum Mountain, the Tertiary bedrock underlies the till of the Vashon glacier; both yield only meager water supplies. Where such circumstances prevail, as they do in many places within those districts, the lack of ground water amounts to a hardship which more subsurface exploration can alleviate but little. Household supplies can sometimes be supplemented by storage of water in cisterns during the rainy season, and farm supplies by development of surface-water sources.

The flood plain of the Nooksack is underlain mainly by rather fine-grained deposits in which the water is commonly iron-bearing in the upper 100 feet or so, and, in some places, saline below 100 feet. Below 150 to 200 feet the water is generally too saline for use and the alluvial or bedrock formations are unproductive. The iron-bearing water of the upper zone is perfectly satisfactory in most cases if the iron is removed and the acidity counteracted. Both these operations can be performed properly by simple home-constructed equipment (see section on Quality of Water). In some districts, such as near Wiser Lake, the fine-grained alluvial materials contain few water-bearing strata. In such instances some residents have solved their problem by repeatedly jetting down test wells until a satisfactory water-bearing sand stratum was located.

Development of additional ground water

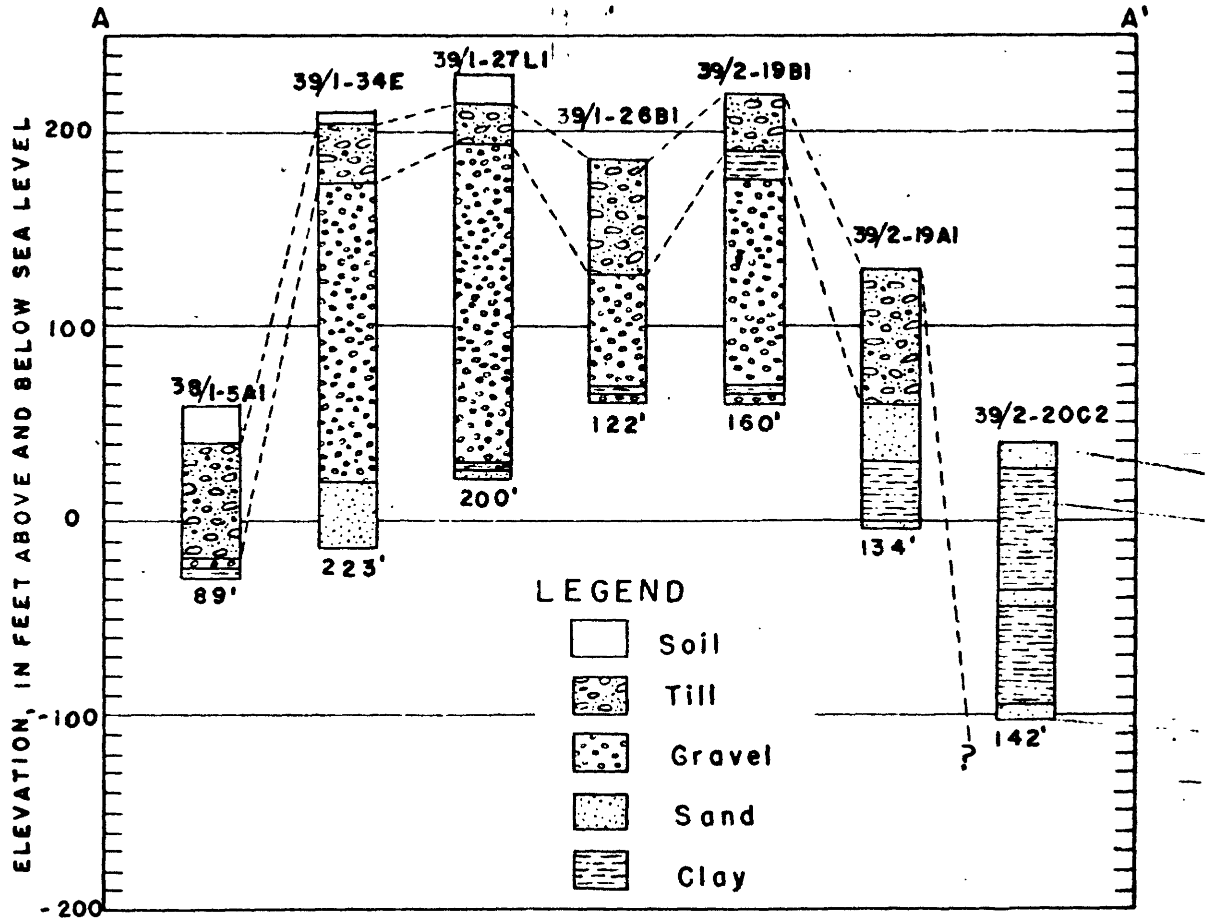
So far as could be learned during this investigation there is at present no ground-water overdraft (withdrawal in excess of recharge) in western Whatcom County. Recharge to nearly all aquifers is primarily by direct precipitation, and, inasmuch as the precipitation is moderately heavy (see pl. 4), the recharge of most aquifers, especially those with permeable zones extending to the surface, is in excess of the present rate of use. However, in case of increased pumpage there are some ground-water zones that might suffer overdrafts. Aquifers most likely to show this effect are those having a till capping that sheds off or perches much of the precipitation and from which the pumping withdrawal is continuous and concentrated. The gravel aquifer beneath the fill at Ferndale may begin to show overdraft if much greater withdrawals are made from it. In the lower part of the slope that aquifer has water under confinement and overdraft may first be noticed by decline in water level in wells in this aquifer along the upper slopes west of Ferndale.

Where the streams flowing from the outlets of an aquifer, such as represented by the flow of Larabee and Crystal Springs from the aquifer beneath the till north of King Mountain, is in use by game fish or appropriated under surface-water rights downstream, the ground-water body requires supervision in order to protect prior rights and still to obtain the benefit of the water storage facilities of the aquifer.

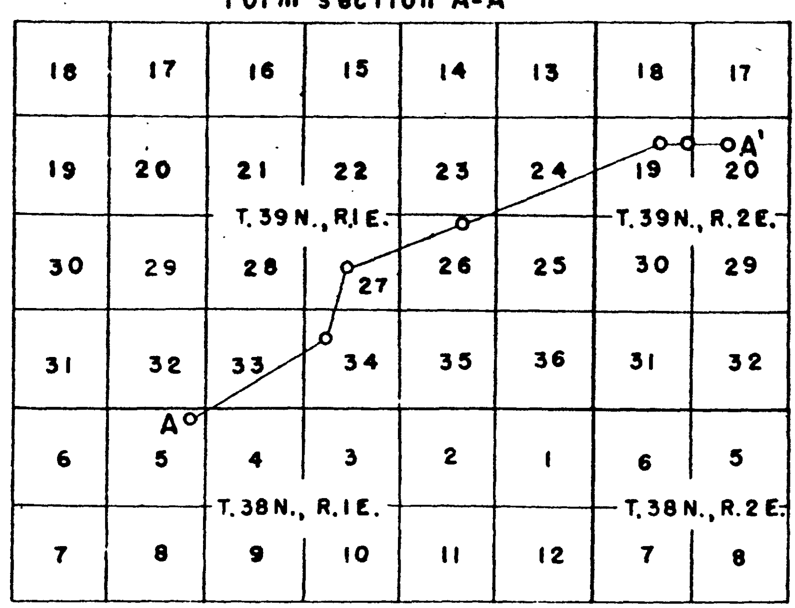
Most aquifers of the basin are now annually supplied in excess of their capacity to absorb and store recharge. More ground water is available for development. In an economic sense the development of this important resource is entirely desirable.

Wells dug or drilled to develop this additional water should be properly constructed. When properly made and finished, a well may have a useful life of at least 50 or 100 years, a period of beneficial use so great that slipshod methods and incomplete work that may cause the loss of the well are entirely unnecessary. Wells tapping confined water should have a casing set at least down to the aquifer, with a tight seal to the surrounding walls of the confining bed. A well that taps two water-bearing strata having substantially different static heads will permit water to drain from one stratum into the other, which may lower the yield of nearby wells drawing water from the drained stratum, and this point should be kept in mind in constructing new wells. Manuals and books on proper well construction are available in most public libraries and offices of county agricultural agents.

PLATE- 6



Index map showing locations of wells that form section A-A'

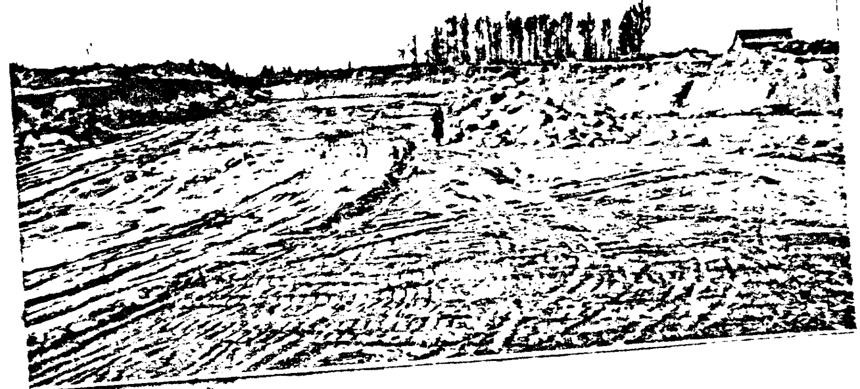


Well section (based on drillers logs) across the Mountain View upland

A. View northwest from the southeast corner of sec. 14, T. 39 N., R. 1 E., showing hummocky topography of the till-mantled Mountain View upland.

B. View southeast from the northwest corner of sec. 10, T. 39 N., R. 3 E., showing hummocky topography of the till-mantled King Mountain upland.

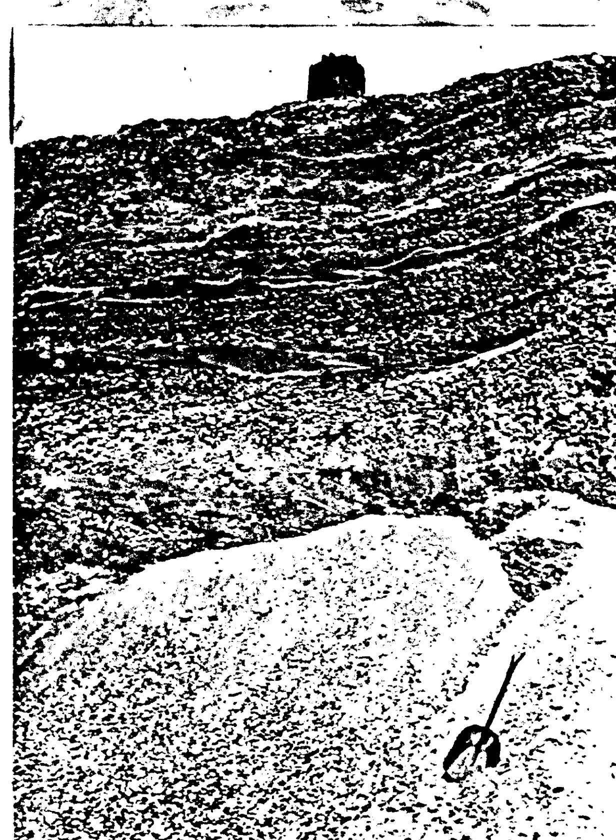
Plate 8



A. View east from the center of north line of sec. 16, T. 39 N., R. 1 E., showing thin mantle of recessional outwash gravels overlying the till of the Vashon glacier which forms the floor of the borrow pit.

B. Face of gravel pit in the SE$\frac{1}{4}$NW$\frac{1}{4}$ sec. 34, T. 41 N., R. 4 E., showing advance outwash gravels mantled by till.

A. Exposure of glacial till along the northeast shore of Lake Whatcom in sec. 32, T. 38 N., R. 4 E.



B. Face of gravel pit in the NW$\frac{1}{4}$ sec. 21, T. 40 N., R. 4 E., showing character of recessional outwash deposits.

Plate 7

A. View northwest from the southeast corner of sec. 14, T. 39 N., R. 1 E., showing hummocky topography of the till-mantled Mountain View upland.

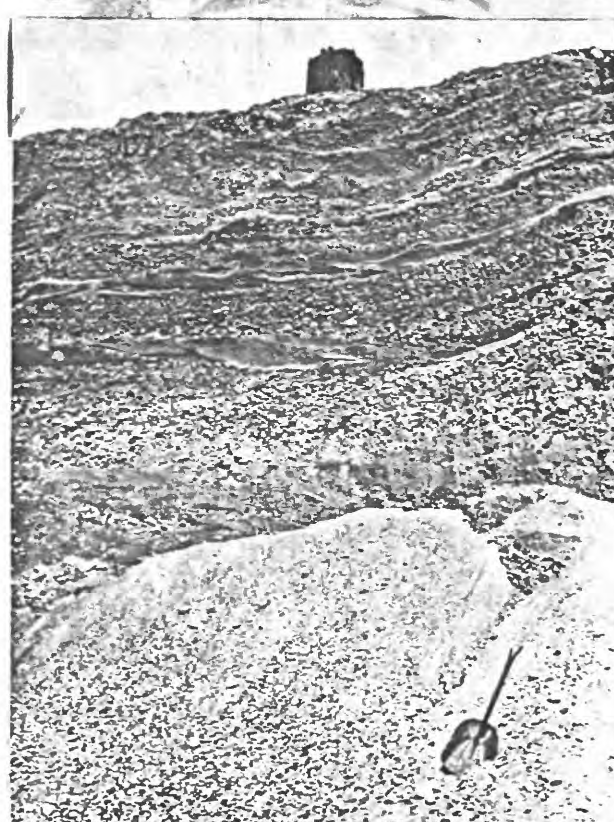
B. View southeast from the northwest corner of sec. 10, T. 39 N., R. 3 E., showing hummocky topography of the till-mantled King Mountain upland.

Plate 8

A. View east from the center of north line of sec. 16, T. 39 N., R. 1 E., showing thin mantle of recessional outwash gravels overlying the till of the Vashon glacier which forms the floor of the borrow pit.

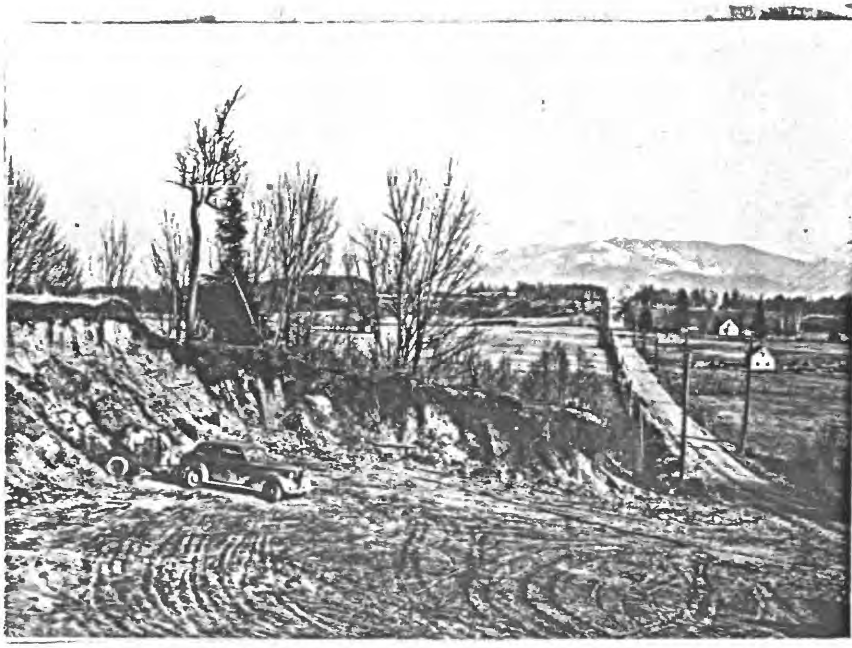
B. Face of gravel pit in the SE$\frac{1}{4}$NW$\frac{1}{4}$ sec. 34, T. 41 N., R. 4 E., showing advance outwash gravels mantled by till.

A. Exposure of glacial till along the northeast shore of Lake Whatcom in sec. 32, T. 38 N., R. 4 E.

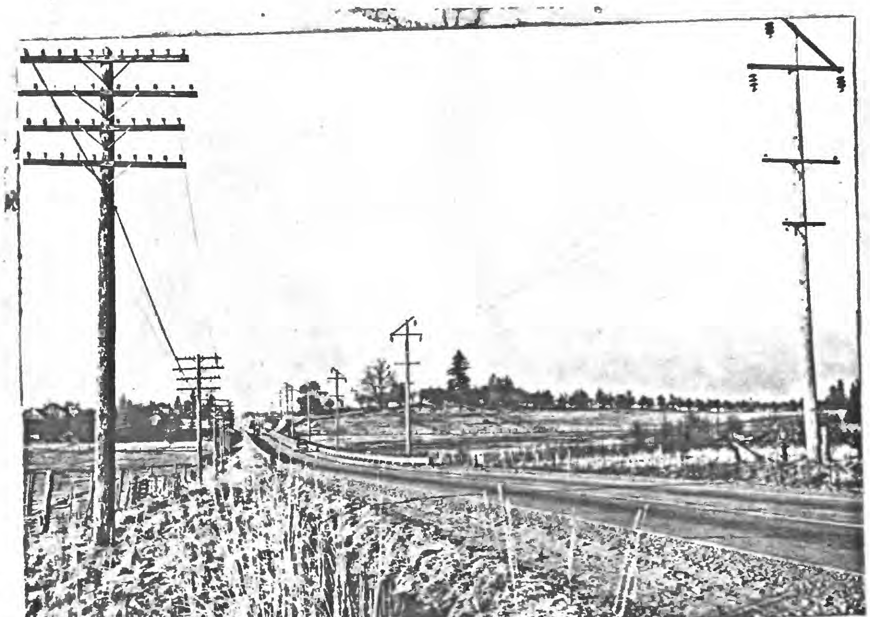


B. Face of gravel pit in the NW¼ sec. 21, T. 40 N., R. 4 E., showing character of recessional outwash deposits.

Plate 10



A. View east from the southwest corner of sec. 32, T. 41 N., R. 4 E., showing late outwash channel. Gravel pit in foreground is in earlier outwash materials. Vedder and Black Mountains in the background.



B. View north along the Guide Meridian Highway from the southeast corner of sec. 24, T. 39 N., R. 2 E., showing ridge composed of fossil-bearing till and clay with marginal outwash channel along south side.

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 30 N., R. 3 E.- Continued.																
11H1	R. E. Quinn	St 112	Dg	31	48	30	. .	. .	Sand	Unconfined	25±	. . .	P, 3	D	. .	. .	Water reported to contain trace of iron.
11Q1	W. F. Eak	St 105	Dg	26	10 30	20 6	. .	. .	Gravel	do.	23½	. . .	J, 20	D, S	35	. .	Do.
11L1	A. G. MacMillan	U 140	Dr	[illegible]	6	. .	. .	. .	. . .	Confined	9.6	July 24, 1947	P	S	115	174	Intended for irrigation but inadequate; temperature of water 50° F.
11Q2	J. J. Porter	U 140	Dr	57	6	. .	. .	. .	. . .	do.	7.6	do.	J, 5	D	. .	. .	
12H1	W. C. Hensel	St 112	Dr	39.9	6	39	1	38	Gravel	Unconfined	27.9	July 29, 1947	N	N	. .	. .	Reported to have penetrated gravel for entire depth.
12R1	R. A. Harriman	St 120	Dr	45	4	45	. .	. .	Gravel (?)	do.	30	When drilled	J, 10	D, S	. .	. .	
12L1	[illegible]	U 160	Dr	53	. .	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	. .	. .	
12Q1	Art Bruhl	St 130	Dg	18	24	. .	. .	. .	. . .	Unconfined	15.4	July 24, 1947	P, 3	D	50	5	
13E1	K. E. Falkins	St 130	Dg	13	40	. .	. .	. .	. . .	do.	8.9	do.	P, 3	D	. .	. .	Water reported to contain some iron.
13G1	West Coast Oil and Gas Co.	S 140	Dr	2175	. .	. .	. .	. .	. . .	Confined	Flow	July 1947	N	N	45	2300+	Salt water flow plugged off in 1948; flow was from about [illegible] feet; see table 2 for upper portion of log.
13R1	J. Unrich	U 160	Dg	6	30	6	4+	2+	Sand	do.	+.5	July 24, 1947	N	S	. .	. .	Water reported to contain small amount of iron.
14D1	K. Tjoelker	U 160	Dr	75	6	32	72	4	do.	do.	14	1945	N	N	. .	. .	See table 2 for log.
14E1	Emil Lind	U 155	Dr	212	6	16	172 207	1 5+	Sandstone do.	do.	3	do.	P, 4	D, S	. .	. .	Do.
14J1	C. Thonsow	U 150	Dg	12	60	. .	10	2+	Sandstone (?)	Unconfined	. .	. . .	P, 3	D	50	214	Reported 3 feet of soil and 7 feet of clay above aquifer.
14P1	E. Janoli	U 165	Dg	9.7	36	. .	. .	. .	. . .	do.	4.1	July 24, 1948	N	D, S	. .	. .	
14Q1	M. Lawrence	U 175	Dg	5.7	30	. .	. .	. .	. . .	do.	3.3	do.	P, 3	D	. .	. .	Water reported to contain trace of iron.
15C1	W. M. Franklin	St 200	Dr	40	6	17.5	26	14	Shale, creviced	Confined	2	Dec. 1946	P, 5	D, S	15	52	See table 2 for log.
15D1	Mike Lunde	St 95	Dr	63	6	30	63±	1	Sandstone	do.	20	1945	P, 3	D, S	60	5	Water said to have high iron content; penetrated sand and gravel to 25 feet, clay for 25 feet above aquifer.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 3 E.- Continued.																
24J1	D. A. McDonald	U 120	Dg	16.7	36	16	. .	. .	Sand	Unconfined	13.2	July 21, 1947	F, 3	D	65	5	Said to have penetrated hard compacted gravel above the aquifer.
24Q1	Ed Clans	St 75	Dg	17.4	36	16	. .	. .	do.	do.	9.3	Aug. 2, 1947	F, 3	D	. .	. .	Water said to contain iron.
24R1	Bert Sorenson	U 140	Dr	40	6	. .	46	6	Gravel	do.	40±	When drilled	. .	Irr.	. .	. .	See table 2 for log.
25H1	Mrs. F. Prato	U 150	Dr	60	. .	60	. .	. .	. . .	. . .		. . .	F, 7	D, S	. .	. .	
25R1	A. Thompson	U 125	Dg	28	48	2	25±	3±	Gravel	Confined	22.1	Aug. 2, 1947	F, 3	D, S	65	8	Reported to have penetrated 25 feet of "hardpan" above [illegible].
25Q1	Clyde Jones	U 150	Dr	57	4-6	. .	50	7	Gravel and sand	Unconfined	30	1946	F, 4	D, S	145	6	
25Q2	[illegible] Thomason	U 155	Dr	59.5	4	. .	52	7.5	Gravel	do.	52	do.	F, 3	[illegible]			See table 2 for log.
25R1	J. W. Elshree	U 165	Dg	57.0	24	57½	55½	2±	do.	do.	56.6	Aug. 9, 1946	F, 3	D, S	140	8	Water level reported to vary but 2 to 3 feet during year.
26L1	Clarence Erdman	U 105	Dg	29.0	24	29	7	22	Gravel, sandy	do.	23.7	Aug. 4, 1947	C	D, S	55	9	
26P1	H. B. Frohn	St 90	Dg	9.3	24	9	3	6	Sand and gravel	do.	6.9	Aug. 2, 1947	F, 3	D, S	60	10	[illegible] above and [illegible] below aquifer.
26Q1	W. E. Naseth	St 97	Dg	27.2	24	27	. .	. .	. . .	. . .	17.6	do.	F, 3	D, S	. .		[illegible]
27A1	Ray O'Neil	St 68	Dg	22	24	22	. .	. .	Sand	Unconfined	13±	. . .	F, 6	Ind, D	100	15	Said to furnish adequate supply.
27C1	J. R. Roth	St 60	Dg	16.9	24	16.9	. .	. .	do.	do.	13.7	Aug. 5, 1947	F	D	. .	. .	Do.
27D1	Mrs. L. A. [illegible]	St 65	Dg	15	14	15	. .	. .	do.	do.	10±	. . .	F, 3	D, S	. .	. .	Do.
27F1	A. Escher	U 95	Dg	23	24	23	. .	. .	Gravel	do.	20	. . .	F, 3	D, S	. .	. .	Water level said to be higher in summer than in winter.
27L1	W. O. VanCleave	St 93	Dg	18.5	24	15	. .	. .	Sand	do.	14.4	Aug. 5, 1947	F, 4	D	60	9	Water said to contain iron; gas well reported across road to south.
27Q1	F. F. Gerard	St 94	Dg	24	36	22	. .	. .	Sand and gravel	do.	6.5	Aug. 2, 1947	C, 50 F, 3	D, Irr	90	11	

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 2 E.- Continued.																
3Q1	Spencer Johnson	St 50	Dg	. .	. .	. .	. .	. .	Sand (?)	Unconfined	. .	. . .	J	D, S	. .	. .	Water said to be free of iron.
4P1	Harry Pfluger	Ap 50	Dg	. .	36	. .	. .	. .	Sand	do.	9	. . .	. .	D	. .	. .	Water reported to have slight iron content.
5A1	C. C. Reynolds	Ap 37	Dg	11.9	12	. .	. .	. .	do.	do.	6.2	Aug. 14, 1947	P, 4	D, S			Water said to have no iron [illegible]
5B1	W. C. Krieske	Ap 60	Dg, J	21	12	21	. .	. .	do.	do.	10	1947	P, 4	D	. .	. .	Water reported to have moderate iron content.
6Q1	John M. Stevens	Ap 70	Dn	12	12	12	. .	. .	do.	do.	. .	. . .	P, 3	D	. .	. .	Do.
7A1	G. B. Brown	Ap 70	Dg	. .	24	. .	. .	. .	do.	do.	. .	. . .	P, 3	D	. .	. .	Water reported to have slight iron content.
7N1	Orchard Water Association	S 220	Dr	190	6	190	170	20	Sand and gravel	Confined	160	May 1946	. .	D	70	10	Supplies [illegible]; see table 2 for log.
8B1	H. W. Fryer	St 73	Dg, J	35.3	30	35	. .	. .	Sand	Unconfined	10.0	Aug. 14, 1946	C, 300	Irr	45	. .	
8E1	Peter Koehn	S 95	Dr	63	6	63	55	5	do.	Confined	22	Oct. 1946	J	D	. .	. .	See table 2 for log.
8H1	C. L. Kemp	St 70	Dg J	14.9	24	15	. .	. .	do.	Unconfined	7.1	Aug. 14, 1947	P, 4	D, S	. .	. .	Supplies 2 homes.
8P1	Carl Gullickson	St 70	J	18.0	18	18	. .	. .	do.	do.	10.4	do.	. .	D	. .	. .	
9Q1	Ralph Bailey	St 70	J	29.0	36	29	. .	. .	do.	do.	11.6	do.	. .	Irr	. .	. .	
9R1	W. Vandergracht	St 40	Dg	7.0	30	7	. .	. .	do.	do.	5.5	Aug. 16, 1947	P, 3	D, S	. .	. .	Water reported to have slight iron content.
10L1	Stanley Graham	St 55	Dg, J	29.6	30	30	. .	. .	do.	do.	19.4	Aug. 2, 1947	J, 3	D, S	40	9	Do.
11A1	John Kooy	St 60	Dn	8	2	8	. .	. .	do.	do.	6	. . .	4	D, S	. .	. .	Do.
11D1	Henry Otterlei	St 60	Dg	20	18	20	. .	. .	do.	do.	8	. . .	P, 3	D, S	. .	. .	Do.
11G1	D. R. Quamby	St 60	Dg	13	. .	13	. .	. .	. . .	do.	. .	. . .	P, 3	D	. .	. .	Water said to be free of iron
12A1	H. A. Witte	Ap 85	Dg	18.3	36	16	. .	. .	Sand, fine	do.	10.3	July 29, 1947	C, 9	D, S	70	10	Do.
12H1	Unknown	Ap 75	Dg	22.5	30	23	. .	. .	Sand	do.	5.8	do.	J, 4	D	. .	. .	
12R1	H. Weatherby	Ap 75	Dn	18	. .	18	. .	. .	. . .	do.	11	. . .	J	D	. .	. .	Water reported to have high iron content.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 38 N., R. 3 E.- Continued.																
20L1	Unknown	St 135	Dr	916	8	358 215	186	27 21	Sand do.	. .	. .	. . .	. .	. .	. .	. .	Test for gas; see table 2 for log.
22E1	Cox & Kelley	U 480	Dr	220	. .	. .	191 208	5 12	Shale Sandstone, coarse	Confined	35±	1947	. .	N	. .	. .	See table 2 for log.
	T. 38 N., R. 4 E.																
5D1	C. E. Roberts	S 375	Dr	130	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	50	14	
6C1	Pete Strutz	U 275	Dr	150	2	. .	. .	. .	. . .	Confined	+4	. . .	P, 3	D, S	. .	. .	
6K1	C. S. Constant	S 360	Dr	195	4	192	154 194	2 1	Sand, fine Gravel, coarse	do.	+7	July 19, 1947	P, 5	D, S	. .	. .	See table 2 for log.
7D1	Carl Fisher	U 515	Dr	140	6	80	. .	. .	Gravel	do.	50	. . .	P, 3	D, S	. .	. .	
	T. 39 N., R. 1 W.																
1R1	P. J. Unruh	St 25	Dr	146	3	146	144	2	Sand, fine	Confined	Surface	Aug. 11, 1947	P, 5	D, S	20	105	See table 2 for log.
11F1	W. J. Reimer	U 90	Dg	24	30	None	. .	. .	Sand streaks in till	Unconfined	. .	. . .	P	D, S	. .	. .	Said to be inadequate in summer; penetrated soil to 1 foot, clay with stones (till) for 21 feet and clay for 2 feet.
11J1	Egil Melseth	U 100	Dr	147	4	147	141	6	Sand	Confined	110	Spring 1942	P, 4	D, S	. .	. .	See table 2 for log.
12D1	Ervin Koehn	S 95	Dg	18	48	None	. .	. .	. . .	Unconfined	4	1943	P	D, S	. .	. .	
12G1	N. Siemens	S 110	Dg	6	108	6	. .	. .	Sand	do.	. .	. . .	. .	D, S	80	8	
13C1	Helmar Melseth	U 100	Dr	135	. .	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	. .	. .	
13R1	John Arntzen	U 100	Dr	134	3	134	129	5	Sand	Confined	99	1941	P, 4	D, S	134	10	See table 2 for log.
	T. 39 N., R. 1 E.																
1J1	Emil Cernich	St 75	Dg	15.0	18	. .	. .	. .	. . .	Unconfined	13	Aug. 1947	P, 3	D, S	. .	. .	
1L1	Mrs. Ruby Ellis	St 70	Dr	73	6	72	62	10	Sand, black	Confined	2	June 1946	J, 6	D	40	12	See table 2 for log.
1N1	Lewis Thorp	U 190	Dr	111.5	6	111	73	38.5	Sand and gravel	Unconfined	101	1947	P, 4	D, S	80	13	Do.

Unpublished records
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Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R 1 E.- Continued.																
24C1	John Terhening	U 290	Dg	18.5	60	2	. .	. .	Soil zone on till	Perched	13.3	Aug. 11, 1947	P, 5	D	. .	. .	Said to be inadequate in dry season.
24D1	O. A. Hamestad	U 290	Dg	25	. .	None	. .	. .	Sand streaks in till	do.	. .	. . .	J, 4	D	. .	. .	Do.
24F1	I. W. Johnson	U 190	Dg	26.5	72	5	. .	. .	do.	do.	23.2	Aug. 6, 1947	. .	D, S	. .	. .	Do.
24H1	A. Mostrom	U 240	Dg, Dn	31	48	24	22	9	Gravel	Unconfined	16	. . .	P, 4	D, S	. .	. .	Penetrated soil and clay above aquifer.
25F1	Henry Derr	S 170	Dg	23.5	60	None	17	7	Sand streaks in till	Perched	17.5	Aug. 7, 1947	P, 3	D, S	. .	. .	
25K1	O. M. Sheppard	S 150	Dr	150	5	. .	. .	. .	Sand	. .	130	. . .	P, 3	D	. .	. .	
26C1	George Morelander	U 185	Dr	122	6	122	118	4	Gravel, coarse	Confined	110	Aug. 1946	P, 3	D, S	. .	. .	See table 2 for log.
26G1	Sam Amundson	U 210	Dg	14.0	24	12	. .	. .	Soil zone on till	Perched	11	Aug. 6, 1947	P, 3	D	. .	. .	Said to be inadequate in summer.
26H1	John MacGuire	U 180	Dr	143	3	143	140	3	Sand, fine	Confined	78	1940	. .	D	. .	. .	Penetrated topsoil to 4 feet and clay for 136 feet above aquifer.
26H1	Gottfred Kelin	U 180	Dr	100	4	. .	. .	. .	Sand (?)	. .	. .	. . .	P, 3	D, S	. .	. .	
27B1	A. Anderson	U 200	Dg	12	36	12	0	6	. . .	Unconfined	6.8	Aug. 7, 1947	P, 5	D, S	. .	. .	Supplies water for 3 farm homes and store.
27E1	Dean Benson	U 180	Dg	20	. .	. .	. .	. .	Soil zone on till	Perched	. .	. . .	. .	D, S	. .	. .	One of five similar wells; all are said to be inadequate.
27H1	J. Van Schindel	U 230	Dr	200	6	200	196	4	Sand, coarse	Confined	179	July 1945	P, 3	D, S	65	7	See table 2 for log.
27P1	J. C. Night	U 225	Dr	199	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	. .	. .	
28C1	J. Bailey	U 240	Dg	22	. .	. .	. .	. .	Sand streaks in till	Perched	Dry	Aug. 7, 1947	P, 3	D	. .	. .	Said to be inadequate in summer.
28D1	C. W. Anderson	U 240	Dr	233	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	. .	. .	
28F1	Louis Unick	U 230	Dr	205	6	205	195	10	Gravel	Unconfined	193	Feb. 1947	P, 3	S	. .	. .	See table 2 for log.
29C1	Fred Nyhell	U 165	Dr	210	6	210	180 191	1 19	Sand, fine Clay with sand layer	Confined	175	Mar. 1947	P, 3	D, S	90	12	Do.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 1 E.,- Continued.																
2P1	H. B. Schroeder	S 290	Dr	220	4	220	217	3	Sand	Confined	198	1946	P, 3	D, S	. .	. .	See table 2 for log.
3A1	Dan Arko	U 100	Dg	22.0	60	3	. .	. .	Sand streaks in till	Perched	21.0	Aug. 12, 1947	. .	D	. .	. .	Said to be inadequate.
3Q1	Mrs. F. Lewis	U 95	Dg	11.4	48	None	. .	. .	Soil zone on till	do.	6.8	do.	B	D	. .	. .	Do.
3R1	Hervis Arestad	U 270	Dr	200	. .	. .	. .	. .	. . .	. .	. .	. . .	P, 4	D, S	. .	. .	
5R1	Standard Oil Co. of Calif.	U 135	Dr				175	. .	Gravel in sub-till beds	Confined ?	. .	. . .	. .	. .	. .	. .	Oil test well; unconsolidated Pleistocene (?) deposits to Tertiary rocks at 350 feet.
5C1	J. O. Calhoun	St 110	Dg	28	. .	. .	. .	. .	Sand streaks in till	Perched	. .	. . .	P, 4	D	. .	. .	Said to be inadequate in summer.
5P2	L. S. Holmes	S 140	Dr	156	3	156	153	5	Sand	Confined	76	1943	P, 4	D, S	. .	. .	See table 2 for log.
5Q1	A. Linde	U 130	Dr	165	4	165	157	8	Sand, fine	do.	75	do.	J, 2	D, S	. .	. .	Clay 153 feet thick and top soil overlie aquifer.
6C1	Harry Ross	St 40	Dg	14.8	84	None	8	7	Soil zone on till	Perched	8.3	Aug. 11, 1947	P, 3	D	. .	. .	
6E1	Unknown	St 20	Dr	146	4	146	144	2	Sand, fine	Confined	Flow	. . .	. .	D	. .	. .	See table 2 for log.
6J1	Victor Linde	St 85	Dr	165	4	165	162	3	Sand	do.	44.1	Aug. 11, 1947	J, 5	D, S	. .	. .	Do.
7H1	Emil Haskinson	U 100	Dr	168	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	30	800	Water reported to contain iron.
7J1	Fred Ogmundsen	U 95	Dr	165	4	165	162	3	Sand	Confined	50.2	Aug. 11, 1947	J, 6	D	35	. .	Penetrated topsoil to 5 feet and clay for 157 feet above aquifer.
7Q1	L. Benson	U 100	Dg	18	96	None	. .	. .	Soil zone on till	Perched	. .	. . .	P, 3	D, S	. .	. .	Said to be inadequate in dry years.
7Q2	Do.	U 100	Dr	245	6	246	243	1	Sand and gravel	Confined	35½	March 1946	P, 3	D, S	50	140	See table 2 for log.
8P1	F. W. Larson	U 140	Dr										P, 3	D, S	95	224	
9E1	Ernest Bailey	U 205	Dg	27	84	None	. .	. .	Sand streaks in till	Perched	. .	. . .	P, 2	D, S	. .	. .	Said to go dry in summer.
9R1	Ole J. Brudwick	U 210	Dr	162	3	120	155	7	Sand	Confined	117	1943	P, 3	D, S	. .	. .	See table 2 for log.
10C1	Alfred Berg	U 300	Dr	212	4	212	208	4	do.	do.	180	1946	P, 2	D, S	90	7	Do.

Unpublished records
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Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 1 E.- Continued.																
1041	Gunnar Johnson	U 260	Dg	8.5	30	8.5	3	5.5	Sand	Unconfined	3	1947	. .	. .	. .	. .	
1101	Howard Willet	S 280	Dr	183	6	183	53	130	Gravel	do.	170	1946	P, 3	D, S	. .	. .	See table 2 for log.
1151	Herbert Larson	U 320	Dr	253	6 4	163 253	241	12	do.	do.	241	do.	P, 3	D, S	45	8	Do.
1241	Lowell Jackson	S 110	Dr	72	4	72	68	4	Sand	Confined	38	1944	J, S	D, S	125	. .	Do.
1212	H. E. Schroeder	St 90	Dr	42	4	. .	. .	. .	do.	. .	12	Aug. 1947	C	D, S	. .	. .	
1401	Fred Ruff	U 280	Dr	204	4	. .	. .	. .	. . .	. .	195	. . .	P, 2	D, S	. .	. .	
1441	O. J. Kobderstad	U 290	Dg	19.7	. .	. .	. .	. .	Soil zones on till	Perched	. .	. . .	P, 4	D	. .	. .	Said to go dry in summer.
1471	Joe Waddel	U 300	Dg	25.3	24	None	. .	. .	do.	do.	. .	. . .	J	D	. .	. .	Do.
1511	E. Pearson	U 230	Dr	214	4	218	212	2	Sand and gravel	. .	184	1939	P, 2	D, S	. .	. .	Penetrated till and gravelly clay above aquifer.
1661	G. E. Withers	U 215	Dg	20.5	60	None	. .		Soil zone on till	Perched	. .	. . .	P	D, S	. .	. .	Said to go dry in summer.
1741	W. G. Hunt	U 160	Dg	20	72	19	. .	. .	Sand streak in till	do.	. .	. . .	P, 3	D, S	. .	. .	Said to furnish small supply in summer.
1781	Orville Dougan	U 190	Dg	23	24	None	. .	. .	do.	do.	. .	. . .	J	D, S	. .	.	Do.
1881	George Rowland	U 100	Dr	219	4	219	114 214	3 5	Sand, fine Sand, coarse	Confined	160	1944	P, 3	D, S	. .	. .	See table 2 for log.
1811	T. J. Mauler	U 65	Dr	105	6	108	. .	. .	Gravel	. .	70	1947	J	D, S	. .	. .	
2041	Norman Bliss	U 245	Dr	223	4	220	. .	. .	do.	. .	. .	. . .	P, 3	D, S	105	15	
2101	Jess Haylett	U 240	Dr	217	. .	. .	. .	. .	. .	. .	. .	. . .	P, 3	D, S	. .	. .	
2181	Harvey Hanson	U 235	Dr	187	4-2	. .	. .	. .	Gravel	. .	169	1945	P, 3	D, S	90	8	
2201	S. E. Roberson	U 215	Dr	196	4	196	. .	. .	do.	. .	125	1932?	P, 3	D, S	. .	. .	
2441	H. C. Jurett	U 320	Dr	250	. .	. .	. .	. .	Sand	. .	. .	. . .	P, 3	D	30	14	Water reported to contain traces of iron.
2461	A. E. Swenson	U 370	Dr	290	4	. .	273	17	do.	Unconfined	273	1935	P, 3	D, S	35	11	Do.

Table 1.-- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 38 N., R. 2 E.-- Continued.																
19G1	E. B. Riddle	Ot 30	Dg	17	24	17	5	12+	Sand	Unconfined	12.9	July 26, 1948	P	D	150	81	
19G2	K. P. Cruikshank	Ot 30	Dr	170	5	170	165	5+	Gravel, sandy	Confined	38	1946	J	D, S	80	1160	Water said to have slight saline taste.
	T. 38 N., R. 3 E.																
1G1	R. E. Rantz	S 260	Dr	99	6	98	98	1	Gravel	do.	40	1943	J	D, S Irr	. .	. .	Penetrated "hardpan" (till?) to 11 feet and clay for 87 feet above aquifer.
1H1	R. Morgenthaler	S 260	Dr	83	4	83	80	3	Gravel	do.	+1	July 21, 1947	P, 3	D, S	90	8	Penetrated "hardpan" (till) to 12 feet and clay for 68 feet above aquifer. (Temperature of water 50° F.)
1J1	George Nunn	S 320	Dr	88	4	. .	. .	. .	. . .	do.	22	. . .	J	D, S	. .	. .	
1P1	W. B. Carl	S 430	Dr	134	4	134	116	18	Sand and gravel	do.	8.8	July 19, 1947	P, 3	D, S	185	23	Penetrated soil and "hardpan" (till?) to 10 feet and clay for 106 feet above aquifer.
2D1	Henry Heidman	S 430	Dr	125	8	. .	. .	. .	. . .	do.	+0.6	do.	J	D, S	. .	. .	
2D2	W. B. Carl	S 430	Dr	109	6	109	100	8	Sand	do.	5	Aug. 1947	. .	D	. .	. .	See table 2 for log.
2J1	S. Bonkoski	S 260	Dg	31.3	36	. .			Gravel	do.	26.4	July 21, 1947	J	D	. .	. .	Penetrated soil and "hardpan" (till?) to 8 feet and clay for 23 feet above aquifer.
2N1	H. R. Lambert	Fp 200	Dr	88	4	. .	. .	. .	. . .	. .	80	. . .	J	D, S	. .	. .	
3A1	C. C. Harriman	S 280	Dr	147	4	. .	. .	. .	. .	. .	. .	. . .	P, 3	D, S	105	28	
3C1	Chester Crandall	U 320	Dr	45	. .	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	125	5	
3G1	C. E. Earney	St 210	Dg	34.2	30	. .	. .	. .	. . .	Unconfined	12.7	July 18, 1947	J	D	205	15	
3Q1	R. A. Burns	S 240	Dr	96	4	96	94	2	Gravel	Confined	61	April 1947	P, 3	D	80	6	Penetrated "hardpan" (till) to 11 feet and clay for 83 feet above aquifer.
4M1	C. McGinnis	U 210	Dr	105	. .	. .	. .	. .	. . .	. .	. .	. . .	P, 4	D	105	20	

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 38 N., R. 3 E.- Continued.																
5C1	G. J. Johnson, et al.	U 275	Dr	182	6	. .	130	52	Sand and gravel	Unconfined	157.50	July 1948	T, 20	PS	110	9	Serves three families; see table 2 for log.
5E1	C. A. Ricklund	U 280	Dr	76	4	. .	. .	. .	. . .	. .	52.2	July 16, 1947	P, 3	D	125	4	
5F1	Walter Quimby	U 275	Dg	24.5	66	None	20	25	Sand streaks in till	Unconfined	20.2	do.	P, 4	D	. .	. .	Water reported slightly hard.
5H1	Carl Johnson	U 260	Dr	194	6	. .	186	8	Gravel	. .	...	. . .	P, 3	D	. .	. .	See table 2 for log.
5H2	D. B. Hart	U 260	Dr	180	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	110	110	Temperature of water 52°F.; Water reported to contain iron.
[illegible]	R. L. Sorensen	U 310	Dr	240	6	35	. .	. .	Sand and gravel	. .	22.2	July 16, 1947	C	D, S	230	20	
6D1	L. A. Wilkie	U 195	Dg	20.7	30	. .	. .	. .	. . .	Unconfined	14.0	do.	. .	D	225	35	
6E1	H. C. Rowan	U 200	Dr	115	5	115	113	2	Sand	Confined	65	July 1947	J	D	. .	. .	See table 2 for log.
6G1	John Bartel	U 240	Dr	. .	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D	135	4	
6H1	Andrew Ericson	U 255	Dg, Dr	86	4	85	. .	. .	. . .	. .	78	May 1935	P, 2	D	115	4	
6L1	E. N. Schow	U 200	Dr	20.9	6	21	17	1	Sand and gravel streak in till	Confined	9.8	July 16, 1947	. .	D	. .	...	Reported to have small yield.
7B1	Victor Ericson	U 180	Dg	15.2	48	. .	. .	. .	Sand	Unconfined	6.7	do.	P, 2	D	125	5	
7D1	Charles Mantz	S 180	Dr	. .	4	. .	. .	. .	. . .	. .	. .	. . .	. .	. .	. .	. .	Reported to yield saline water.
7D2	Do.	S 180	Dg	22.6	60	None	. .	. .	. . .	Unconfined	12.0	July 17, 1947	P, 2	D, S	210	28	Said to be inadequate in summer.
7D3	L. F. Larson	S 180	Dr	70	4	. .	. .	. .	. . .	. .	47±	July 1947	P, 2	D	45	60	Do.
7H1	Francis Cammack	S 195	Dg	32.0	36	. .	. .	. .	Sand streaks in till	Perched	15.2	July 17, 1947	P, 3	D	150	26	
7H2	W. R. Ensign	S 170	Dg	16.2	36	. .	. .	. .	. . .	do.	10	1947	B	S	. .	. .	Said to be inadequate in late summer.
8A1	J. J. Zeren	U 215	Dr	41.4	4	. .	. .	. .	. . .	. .	30.7	July 16, 1947	J	D, S	125	8	
8E1	R. W. Elaid	U 205	Dg	11.1	48	3	. .	. .	Sand	Unconfined	8.2	July 17, 1947	J	D, S	100	6	

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 38 N., R. 3 E.- Continued.																
8J1	H. L. Hubbard	U 185	Dg	14	24	None	13	1	Sand streak in till	. .	. .	. . .	P, 3	D	95	18	
9B1	O. H. Olson	U 250	Dr	156	6	156	147	9	Pea gravel and sand	Confined	Flow	July 30, 1948	P, 5	D, S	90	14	Flows 4 gallons per minute; see table 2 for log.
9C1	H. B. Creel	U 240	Dr	186	6	166	184	2	Sand	do.	110	1946	J	D, S	20	57	See table 2 for log.
9C2	Clarence Dixon	U 240	Dr	250	6	139	. .	. .	. . .	. .	120	do.	. .	D	. .	. .	Do.
9H1	P. E. Rogers	Fp 160	Dr	54	6	54	53	1	Gravel, coarse	Confined	40	June 1947	J	D, S	105	[illegible]	Do.
9Q1	J. W. Tool	Fp 160	Dg, Dr	[illegible]	[illegible]	. .	. .	. .	. . .	Unconfined	22.6	Jul. 17, 1947	J	D, S	75	[illegible]	
9R1	E. Norman	U 280	Dr	96	6	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	. .	. .	Supplies 2 homes.
10E1	A. Cavalero	Ap 185	Dr	64	6	64	45	19	Gravel, coarse	Unconfined	52	Sept. 1946	J	D	. .	. .	Penetrated "hardpan" (till) to 20 feet and clay for 25 feet above aquifer.
10G1	A. Gordon	S 320	Dr	163	4	. .	160	3	Sand and gravel	. .	. .	. . .	P, 3	D, S	. .	. .	Penetrated "hardpan" (till) to 12 feet and clay for 148 feet above aquifer.
10G2	Leonard Ellis	S 305	Dr	134	6	134	131	3	Sand with gravel	. .	125	1947	. .	. .	. .	. .	See table 2 for log.
10G3	R. G. Smith	S 350	Dr	250	6	. .	. .	. .	. . .	. .	. .	. . .	. .	. .	. .	. .	Abandoned; see table 2 for log.
10L1	L. E. Evans	S 295	Dg	17	72	None	. .	. .	. . .	. .	. .	. . .	. .	D	. .	. .	Penetrated till to 16 feet and clay for 1 foot.
11D1	Lee Johnson	S 350	Dr	185	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	35	40	
16A1	Wm. Gevman	S 280	Dr	140	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	105	8	
16G1	A. T. Goodman	S 290	Dr	185	5	18	150 184	1 1	Shale do.	Confined do.	40	1947	P, 3	D	80	6	Reported to furnish small yield; penetrated "hardpan" (till) to 18 feet and shale for 157 feet.
17A1	John Townsend	St 170	Dr	40?	4	. .	. .	. .	. . . .	. . .	. .	. . .	P, 3	D	65	10	

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	<u>T. 41 N. R. 2 E.</u>- Continued																
36N1	Wm. Ooms	St 130	Dg	12	36	. .	. .	. .	. . .	. .	9	. . .	. .	D, S	60	. .	Said to be inadequate in dry season; water reported to contain iron.
	<u>T. 41 N., R. 3 E.</u>																
31F1	J. F. Schellenberg	St 145	Dg	14.3	36	14	. .	. .	Gravel	Unconfined	11.6	Aug. 26, 1947	P, 4	D, S	. .	. .	Water said to be free of iron.
32E1	Peter Mipges	St 142	Dg	9.3	48	9	. .	. .	Sand (?)	do.	6.7	do.	P	D, S	. .	. .	Water reported to contain iron.
	<u>T. 41 N., R. 4 E.</u>																
31J1	Karl F. Johnson	St 190	Dr	58	6	58	50	8	Gravel	do.	50.7	Aug. 1948	J, 10	D, S	45	12	See table 2 for log.
33N1	Alfred Siler	St 135	Dg-Dn -Dr	30+	6	30+	. .	. .	Gravel (?)	. .	. .	. . .	P, 3	D, S	. .	. .	
[illegible]	Lincoln Garrison	Fp 40	J	17	12	17	. .	. .	Sand and gravel	Unconfined	5.6	July 23, 1948	P, 3	D	98	10	
36M1	Margaret B. Anderson	Fp 30	Dn	80±	1	80	75±	5+	Sand and gravel	Confined	3±	. . .	P	D	. .	. .	Penetrated clay above aquifer; water said to contain iron.
36J1	C. O. Perry	Fp 30	Dn	28±	1½	28	. .	. .	Gravel	do.	3±	. . .	C, 4	D, S	. .	. .	Do.
36K1	Ernest Froberg	Fp 35	Dn	. .	1¼	. .	. .	. .	. . .	. .	4±	. . .	P, 4	D, S	. .	. .	Water reported to contain iron.
	<u>T. 41 N., R. 5 E.</u>																
31H1	N. Bol	Fp 25	Dg	13.3	18	13	. .	. .	Gravel	Unconfined	7.9	July 23, 1948	P, 5	D, S	95	12	Temperature of water 51° F.
32Q1	Verl Nims	Fp 25	Dn	18	1	18	. .	. .	Sand, coarse	do.	7±	. . .	P, 3	D, S	. .	. .	Water reported to contain iron.

1/ Ap, alluvial plain; Fp, flood plain; Ot, Ocean terrace; S, slope; St, stream terrace; U, upland; altitudes from barometric traverse or interpolated from topographic maps.

2/ Bd, bored; Dg, dug; Dn, driven; Dr, drilled; J, jetted.

3/ Depths and water levels expressed in feet and decimals of feet were measured by the Geological Survey; those in whole feet were reported by owner, tenant, or driller; those followed by "±" were estimated. "Flow" indicates flowing well, static level not known; "+" measurement indicates known static level above surface; "Surface" means well full but not flowing.

4/ A, airlift; B, bucket; C, centrifugal; J, jet; N, none; P, plunger; R, rotary; S, siphon; T, turbine.

5/ D, domestic; Ind, industrial; Irr, irrigation; N, not in use; O, observation; PS, public supply; S, stock.

5/ Given in parts per million by weight (field analysis). Hardness is expressed as $CaCO_3$.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 4 E.- Continued.																
33F1	Robert Gran	Fp 90	Dg	16	. .	16	. .	. .	Sand, fine	Unconfined	6±	. . .	P, 3	D, S	. .	. .	
34N1	H. A. Funk	St 125	Dn	52	1½	52	. .	. .	Sand and gravel	do.	16±	. . .	P, 3	D	110	14	Temperature of water 49° F.
	T. 40 N., R. 5 E.																
6B1	G. C. Digerness	Fp 30	Dn	40	1½	40	. .	. .	Sand	do.	10±	. . .	P, 12	D, S	. .	. .	Water reported to have high iron content; well supplies 2 homes.
6L1	John Peterson	Fp 25	Dn	75	1¼	75	72+	3	Gravel	Confined	5±	. . .	P	D	30	8	
	T. 41 N., R. 1 E.																
31Q1	City of Blaine	Ap 55	Dr	247	12	247	. .	. .	Gravel	Confined	+18.75	June 25, 1948	N	PS	50	. .	See table 2 for log.
32J1	F. E. Fair	U 340	Dr	202	4, 3,2	202	. .	. .	Sand, fine	. .	. .	. . .	P, 5	D, S	60	10	
32Q1	S. Bjornson	U 255	Dg	26	60	. .	. .	. .	Soil zone on till	Perched	. .	. . .	N	N	. .	. .	
	T. 41 N., R. 2 E.																
31P1	M. J. Eberly	S 200	Dr	234	3	234	231	3+	Sand, fine	Confined	60±	1939	P, 3	D, S	65	450	See table 2 for log.
32Q1	A. L. Kraus	S 235	Dg	19	72	. .	. .	. .	Soil zone on till	Perched	13±	. . .	P, 3	D	. .	. .	Said to be inadequate in summer.
33M1	Val Burk	U 240	Dr	302	4	302	254	4	Sand, fine	. .	. .	. . .	N	N	. .	. .	Reported to be essentially a dry hole; see table 2 for log.
34Q1	Oscar Liffengren	U 220	Dg	12	50	. .	10	2	do.	. .	. .	. . .	N	N	. .	. .	Penetrated soil, sand and gravel to 2 feet, and clay for 8 feet above aquifer.
35Q1	Harry DeVries	St 140	Dg-J	22	18	22	9	13	Gravel	Unconfined	11.8	Aug. 21, 1947	J, 8	D, S	. .	. .	Penetrated 3 feet of soil and 6 feet of clay and gravel (till?) above aquifer.
36H1	Geo. A. Stierlen	St 142	Dg	18	12	12	. .	. .	Soil zone on till (?)	. .	12.6	Aug. 26, 1947	P, 3	D, S	. .	. .	Water said to contain trace of iron.
36H2	G. Temperman	St 142	Dg	22	18	. .	. .	. .	Gravel	Unconfined	8	. . .	P, 3	D, PS	40	14	Water reported to have trace of iron in winter.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 4 E.- Continued.																
28F1	John Julan	St 120	Dr	36	6	36	19	17+	Gravel	Unconfined	23	1947	J, 8	D, S	80	11	Supplies water for 2 farms; see table 2 for log.
28N1	Lloyd Burker	St 90	Dg	10.3	. .	10	. .	. .	Sand and gravel	do.	8.3	July 7, 1948	J	D	. .	. .	
29B1	Gerrit Tenkley	Fp 70	Dn	25±	1½	25	. .	. .	Sand (?)	. .	. .	. . .	P	D	. .	. .	Water reported to contain iron.
29H1	John Ligocki	Fp 75	Dn	12	1½	12	. .	. .	Gravel	Unconfined	6±	. . .	P, 3	D, S	60	10	
29L1	Arthur Ginger	Fp 80	Dg	18	. .	18	. .	. .	Sand and gravel	do.	12±	. . .	P, 12	PS	165	11	Supplies water for 15 families water said to contain iron.
29P1	Ralph Visser	Fp 80	Dn	16	1½	16	. .	. .	do.	do.	14±	. . .	P, 4	D, S	. .	. .	
30F1	Gerrard Bruynooghe	Fp 80	Dn	. .	. .	. .	. .	. .	Gravel and sand (?)	do.	. .	. . .	P	. .	95	14	Water said to contain iron.
31C1	C. S. Kale Canning Company	Fp 85	Dr	130	16	50	13	37	Gravel	do.	11	When drilled	C, 450	Ind	. .	. .	Penetrated soil to 13 feet above aquifer and 80 feet of clay below aquifer.
31E1	Henry Zwiers	Fp 85	Dn	28	1¼	28	. .	. .	do.	do.	12±	. . .	C, 5	D, S	125	8	Water reported to contain iron.
32A1	Pike Bros.	Fp 80	Dn	15	1½	15	. .	. .	Sand and gravel	do	11±	. . .	P, 16	D	115	8	Do.
32B1	Henry Edwards	Fp 85	Dn	13	1½	13	. .	. .	Gravel	do.	10±	. . .	P, 3	D	. .	. .	Do.
32G1	L. G. Pike	Fp 85	Dg	13	36	13	. .	. .	do.	do.	4±	. . .	P, 4	D	. .	. .	Do.
32K1	Geo. Germain	Fp 85	Dn	14	1½	14	. .	. .	do.	do.	9±	. . .	J, 6	D, S	. .	. .	Do.
32R1	J. N. Berg	Fp 90	Dg	12.5	. .	. .	. .	. .	Sand	do.	8.4	June 30, 1948	P, 3	D	115	6	Water reported to contain trace of iron.
33A1	Sam Sorenson	St 120	Dg	12	. .	. .	. .	. .	Gravel, coarse	do.	. .	. . .	P, 5	D, Ind	220	10	Supplies 2 homes and small sawmill; temperature of water 52° F.
33A2	Everson Hardwood Lumber Co.	St 120	Dr	101	6	100	100	1	Gravel	Confined	3.0	July 1, 1948	J, 30	N	30	1134	Flowed when first drilled; penetrated "hardpan" to 12 feet and clay for 88 feet above aquifer; temperature of water 49° F.

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 1 E.- Continued																
17P1	Bernard Wiebe	Fp 15	Dr	365	3	. .	. .	. .	" . . .	Confined	Flow	Aug. 14, 1947	N	S	110	220	Flowing 3.75 gallons per minute; see table 2 for log.
17Q1	I. T. Snow	Fp 20	Dr	113	3	. .	41	71	Sand and gravel	. .	8.66	do.	N	N	. .	. .	Penetrated clay to 12 feet and sand for 29 feet above aquifer.
17R1	Leonard Durr	Fp 35	Dr	54	3	54	. .	. .	. . .	. .	22½	. . .	N	S	. .	. .	
20D1	H. S. Bowman	St 40	Dg	24½	. .	. .	. .	. .	Sand (?)	. .	. .	. . .	P	D, S	. .	. .	Penetrated "hardpan" (till) for 24 feet above aquifer.
20H1	Alvin Haskett	St 65	Dg	16	36	16	. .	. .	Sand and gravel (?)	Unconfined	7.6	Aug. 13, 1947	P	N	. .	. .	Said to furnish inadequate supply.
21N1	Paul Holtzheimer	St 40	Dg	17½	36	. .	. .	. .	Sand in clay	. .	. .	. . .	P, 3	D	. .	. .	
22D1	L. E. Brainford	St 50	Dg	7.5	36	. .	0	10	Sand	Unconfined	4.2	Aug. 20, 1947	P, 5	D, S	. .	. .	Water reported to contain trace of iron.
22F1	C. W. Brown	St 40	Dg	7.5	24	6	. .	. .	do.	do.	. .	. . .	P, 3	D, S	. .	. .	Water reported to be free of iron.
23?1	Clara Larson	St 60	Dn	18	1½	12	. .	. .	Sand (?)	do.	. .	. . .	P, 3	D, S	. .	. .	Water said to contain small amount of iron.
24D1	John A. Loland	St 45	Dg-Dn	18½	. .	. .	. .	. .	do.	do.	. .	. . .	P, 5	D, S	. .	. .	Water reported to be free of iron.
24E1	Olaf Sandvig	St 60	Dg-Dn	16	? .	. .	. .	. .	do.	do.	13½	. . .	P, 5	D	. .	. .	Do.
25?1	Allen DeLight	St 45	Dn	12	6	. .	. .	. .	Sand and gravel	do.	9	. . .	P, 5	D, S	. .	. .	Water reported to have high iron content.
26N1	J. W. Dyck	St 40	Dg	12.7	24	12	. .	. .	Sand (?)	do.	6.8	Aug. 19, 1947	P, 5	D, S	. .	. .	Water said to contain iron.
26Q1	B. H. Porter	St 40	Dg	11	36	. .	0	11	Sand	do.	. .	. . .	P, 3	D, S	55	. .	Do.
27H1	G. A. Martin	St 50	Dg	9.6	30	. .	. .	. .	Sand (?)	do.	5.9	Aug. 20, 1947	P, 3	D, S	. .	. .	Do.
27?1	Joe Jensen	Ap 35	Dg	19.5	72	. .	. .	. . .	Clay soil zone	do.	. .	. . .	P, 3	D, S	. .	. .	Said to be inadequate in summer.
28D1	Pat Sullivan	Ap 40	Dr	212	. .	. .	. .	. .	Silt	. .	. .	. . .	N	. .	. .	. .	Penetrated blue clay and silt for entire depth; water said to be saline.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 2 E.																
2L1	Edith Keller	S 160	Dg	6	30	. .	. .	. .	Soil zone on till	. .	. .	. . .	P, 3	D, S	. .	. .	Said to be barely adequate in summer.
2R1	Wm. Vander Mey	St 115	Dg	11.8	30	. .	. .	. . .	. . .	Unconfined	10.7	Aug. 21, 1947	J	S	. .	. .	Water reported to have high iron content.
3H1	Bud Anderson	S 220	Dg-Dr	120	6	120	115	5+	Sand	. . .	. .	. . .	N	N	. .	. .	Not yet completed; see table 2 for log.
3L1	J. E. Barnhart	S 240	Dg	20.3	60	14	18	2+	Sand, fine	Unconfined	14.8	Aug. 21, 1947	P, 3	D, S	. .	. .	Said to be inadequate in dry season; see table 2 for log.
4A1	Wm. Tjoelker	U 240	Dr	86	6	86	63	23+	Sand	Confined	46.7	Aug. 18. 1947	J, 8	D, S	. .	. .	See table 2 for log.
4Q1	J. T. McPhail	U 245	Dr	107	2-4	107	105	2+	Sand, fine	do.	77	1942	P, 4	D, S	. .	. .	Do.
5P1	Mary E. Burk	S 210	Dr	107	3	107	96	11+	do.	do.	47	do.	P, 4	D, S	15	. .	Penetrated soil to 4 feet and clay for 92 feet.
5Q1	F. D. Koehn	U 225	Dg	46.3	72	. .	34	9	. . .	. . .	. .	. . .	N	N	. .	. .	Not yet completed; see table 2 for log.
6E1	Mrs. VanKeulen	S 200	Dr	263	3	263	261	2+	Sand	Confined	203	1943	P, 5	D, S	50	85	See table 2 for log.
6H1	G. Johnke	S 160	Dg	13.5	72	. .	. .	. .	Soil zone on till	Perched	. .	. . .	P	. . .	. .	. .	Said to be inadequate in dry season.
6R1	Orlie Rogers	S 165	Dg	15.1	40	. .	12	3	Sand and gravel	Unconfined	11.6	Aug. 21, 1947	P, 3	D	. .	. .	Penetrated soil to 2 feet and "hardpan" (till) for 10 feet above aquifer; water said to contain trace of iron.
7Q1	Chris Larson	St 95	Dg	9.2	48	9	7	2+	Sand, fine	do.	6.7	Aug. 20, 1947	C, 6	D, S	. .	. .	Water said to contain iron.
8D1	Boyd R. MacPhail	S 175	Dr	140	4	. .	. .	. .	. . .	. .	. .	. . .	N	N	. .	. .	See table 2 for log.
8N1	Henry E. Dyck	St 120	Dg	12	36	12	2½	10½	Sand and gravel	Unconfined	8	Aug. 20, 1947	C, 10	D	70	. .	
10J1	Frank Hiekstra	St 110	Dn	9	1½	9	. .	. .	Sand (?)	do.	. .	. . .	P, 3	D, S	. .	. .	Water reported to contain some iron.
10L1	John Reimer	St 115	Dg	25	18	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D	. .	. .	Said to be barely adequate in summer.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 4 E.-- Continued																
[illegible]	F. C. Franklin	St 85	Dg	19.3	. .	. .	. .	. .	Sand, small seams in clay	Unconfined	5.4	July 2, 1948	P, 3	D, S	. .	. .	Said to be inadequate.
18M2	Jake Kulsheck	St 80	Dg	21	30	. .	. .	. .	Gravel (?)	. .	5.4	July 12, 1948	P	D	. .	. .	
19D1	Wight Bros.	Fp 70	Bd	57	4	. .	6 27 56	1 2 1	Sand Gravel do.	. .	. .	. . .	P, 5	D, S	. .	. .	Water reported to contain iron.
19D2	Do.	Fp 70	Dr	435	14	435	. .	. .	. . .	Confined,	27	. . .	N	N			Abandoned; water said to be saline; penetrated bedrock at 425 feet.
19K1	E. VanSoest	Fp 75	J	38	6	38	24	14	Sand and gravel	do.	17½	. . .	P, 5	D	. .	. .	Water reported to contain iron; see table 2 for log.
20B1	Arnold Olson	Fp 60	Dg	14	36	14	. .	. .	do.	Unconfined	8½	. . .	C, 6	D, S	65	7	
20C1	Toby Leanders	Fp 65	Dg	18.3	18	18	15	3+	Gravel	do.	10.1	July 6, 1948	P, 4	D, S	105	21	Supplies 4 homes.
20F1	Do.	Fp 65	Dn	18½	. .	. .	. .	. .	Sand	do.	10½	. . .	P, 4	S	. .	. .	Water reported to contain iron.
20H1	Chris O. Larson	St 70	Dn	16½	1¼	16	. .	. .	Sand and gravel	do.	12	. . .	P, 3	D	. .	. .	Reported to be barely adequate in dry season; water said to contain trace of iron.
20N1	Alton Banner	Fp 60	Dn	12	1½	12	. .	. .	do.	do.	10	. . .	P, 3	D, S	90	8	Water said to contain trace of iron.
20P1	Nate Murphy	Fp 75	Dn	18	1½	18	. .	. .	Sand	do.	16+	. . .	P, 5	D	. .	. .	Water said to have high iron content.
20Q1	Geo. Hess	Fp 70	Dn	22	1½	22	. .	. .	Gravel	do.	14±	. . .	J, 6	D, S	. .	. .	Water said to contain iron.
21F1	John Bennet	St 150	Dg	55	18	55	. .	. .	do.	do.	51.2	July 21, 1948	J, 7	D, S	. .	. .	
22D1	Soner Korver	Fp 60	Dg	6	36	6	. .	. .	. . .	do.	3.0	do.	J, 12	D, S	135	34	
22H1	Lester Marvetz	St 160	Dr	74	5	74	73	1	Gravel	Confined	55±	1947	P, 5	D, S	. .	. .	See table 2 for log.
22N1	Theodore Sorenson	St 110	Dg	15±	. .	15	. .	. .	do.	Unconfined	12±	Oct. 1946	P, 3	D	. .	. .	

Unpublished records subject to revision

Table 1.- Records of representative wells

Location	Owner or occupant	Topography 1/ and approximate altitude (feet above sea level)	Type 2/	Depth (feet)	Diameter (inches)	Depth of casing (feet)	Water-bearing zone or zones				Water level		Type of pump 4/ and yield (gallons per minute)	Use 5/	Hardness 6/ (parts per million)	Chloride 6/ (parts per million)	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Ground-water occurrence	Feet below land-surface datum 3/	Date					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 38 N., R. 1 E.																
1B1	Everett Mats	Fp 10	Dr	330	6	330	117	4	Sand	. . .	. .	. . .	N	N	. .	. .	Said to furnish an inadequate supply - to be drilled deeper; see table 2 for log.
5A1	W. S. Hibbard	S 60	Dr	89	5	76	78	4	Boulders	Confined	60	Mar. 1947	N	N	. .	. .	See table 2 for log.
	T. 38 N., R. 2 E.																
1R1	E. L. Strickler	U 200	Dr	110	6	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D	295	550	
2B1	T. Parker	St 60	Dg	18.0	72	18	. .	. .	. . .	. .	7.5	Aug. 6, 1947	P, 3	D	. .	. .	Said to furnish an inadequate supply.
2E1	John Schafer	St 80	Dg	16	. .	. .	. .	. .	Clay with sand	. .	. .	. . .	. .	D	. .	. .	Do.
2R1	John L. Hamilton	U 130	Dg	35	. .	. .	. .	. .	Sand and gravel	Unconfined (?)	. .	. . .	J	D	110	34	Said to furnish small supply.
3C1	D. W. Roberts	S 80	Dr	53	4	. .	. .	. .	Gravel	. .	. .	. . .	J, 5	D	. .	. .	
6B1	Frank Imhoff	Fp 10	Dr	535	. .	. .	515	20	Sand, fine	Confined	Flow	. . .	. .	S	. .	. .	Water reported to be saline.
7A1	Lummi Indian School	St 40	Dg	18	54	18	9	9+	Sand	Unconfined	9.2	July 26 1948	P, 3	PS	50	65	Supplies several families.
9B1	Louis Crump	S 105	Dg	21.4	48	. .	. .	. .	. . .	do.	7.6	Aug. 5, 1947	P, 3	D, S	. .	. .	
9J1	R. O. Scott	U 150	Dg	36.2	36	. .	. .	. .	. . .	do.	32.9	do.	J, 5	D	120	23	
12A1	D. S. Anderson	U 200	Dg	17.5	. .	. .	. .	. .	Sand streaks in till	do.	16.9	July 16, 1947	. .	D	85	7	
12E1	D. E. Kinman	U 180	Dr	90?	4	. .	. .	. .	. . .	. .	. .	. . .	P	D	180	125	Temperature of water 51° F.; water shows some iron oxide stain.
14H1	C. A. Harvey	S 90	Dg	26.0	40	. .	. .	. .	. . .	Unconfined	9.0	Aug. 5, 1947	. .	Irr	. .	. .	

1/ Footnote explanations at end of table.

Unpublished records subject to revision

Table 4.– Analyses of waters from western Whatcom County[a]

Number	Source and owner	Date of collection	Hydrogen-ion concentration (pH)	Dissolved solids at 180° C. b/	Silica (SiO_2)	Iron (Fe)[c]	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Hardness as $CaCO_3$	Specific conductance (K×10⁶ at 25° C.)
				Parts per million															
39/2-36D1	C. V. Wilder. Spring. Water-table discharge from sub-till gravels.	April 7. 1949	7.3	167	19	0.04 (.01)	0.0	23	10	18	3.0	124	8.6	22	0.2	2.0	0.0	98	296
40/1-22I1	City of Blaine. Spring. Discharge from sub-till gravels.	do.	7.3	99	24	.06 (.01)	.0	12	6.5	5.8	2.0	78	5.7	3.3	.2	.1	.0	57	133
40/3-36H1	City of Everson. Dug public-supply well 30 feet deep. Water from gravel strata in valley alluvium.	April 8, 1949	6.6	206	19	.07 (.01)	.0	28	12	21	2.2	44	12	24	.3	5.6	.0	119	388
Do.	do.[d]	November 1944	6.59	. .	19.4	. .	. .	25.4	10	. .	. .	. .	7	74.5	. .	1.7	. .	107.7	. .
40/4-10D1	John Brayard. Driven domestic well 84 feet deep. Water from gravel strata in older alluvium.	April 8, 1949	6.8	180	48	12 (.42)	.42	14	17	13	2.8	138	1.6	14	.2	.2	.0	105	245

a/ All analyses by Geological Survey unless otherwise shown

b/ Sum of determined constituents, with bicarbonate converted to carbonate for the summation.

c/ Given as total iron. Iron left in solution at time of analysis shown in parentheses.

d/ Analysis by Laucks Laboratories, Inc., Nov. 21, 1944, for Arden Farms Co. and furnished by Everson city officials.

Unpublished records
subject to revision

Table 3.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
39/4-4A1.	J. Dahlgren	. .	S, 105	Soil or outwash deposits over till (?)	Seepage from deposits mantling till (?)	1	June 30, 1948	S	50	120	32	
39/4-9B1	E. Mariotto	. .	Ap 105	do.	do.	4	June 29, 1948	D, S	40	90	8	
40/1-[illegible]	City of [illegible]	. .	S, 250	Gravel, [illegible] outwash below till	Drains gravels from below till through openings in till-mantled surface	. .	. .	PS	. .	. .	. .	See table 4 for chemical analysis of water.
40/1-11F1	J. Forsythe	. .	S, 120	Soil zone on till	Drains soil zone on till-mantled slope	3	Aug. 19, 1947	D, S	. .	. .	. .	
40/1-21D1		. .	S, 20	do.	Drains soil zone on till-mantled surface, or rises from sub-till zone (?)	. .	. .	D, S	. .	. .	. .	
40/2-8E2	H. D. Dyck	. .	S, 120	Gravel	Drains sub-till gravel (?)	15	Aug. 21, 1947	N	. .	. .	. .	
40/3-19D1		. .	S, 75	do.	Water-table discharge along terrace escarpment	200±	Feb. 13, 1947	N	. .	. .	. .	
40/3-[illegible]		. .	S, 75	Sand and gravel	do.	200±	do.	. .	. .	. .	. .	
40/3-[illegible]	E. [illegible]	. .	Ap, 90	. .	. .	. .	. .	D, S	[illegible]	90	45	
41/4-[illegible]	City of [illegible]	. .	Fp, 65	Gravel and sand	Drains gravel and sand strata in till to north	[illegible]	Aug. 21, 1948	PS	. .	60	3	
41/4-[illegible]	Do.	. .	S, 100	do.	. .	300±	do.	N	. .	[illegible]	[illegible]	

1/ Also shown on plate 1.

2/ Ap, alluvial plain; Fp, flood plain; S, slope.

3/ e, estimated.

4/ D, domestic; PS, public supply; S, stock; N, none.

5/ Given in parts per million by weight.

Unpublished records subject to revision

Table 3.- Records of some representative springs

Location 1/	Owner or occupant	Name	Topography and altitude 2/ (feet above sea level)	Water-bearing material	Occurrence	Yield: Gallons per minute 2/	Yield: Date	Use 3/	Temperature (°F.)	Chemical character in parts per million: Hardness as $CaCO_3$ (field analysis)	Chemical character in parts per million: Chloride (Cl) field analysis	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
38/[illegible]	Fred [illegible]	. .	S, 40	Advance outwash(?) below till	Flow from sub-till beds	. .	. .	D, S	. .	. .	. .	
38/2-4P1	Mrs. Nelson	. .	S, 50	do.	Do. (?)	. .	. .	D, Irr	. .	75	13	One of several springs along base of slope.
38/3-[illegible]	E. Carman	. .	S, 200	Soil zone on till	Seepage from till (?) soil zone over bedrock	1/10(?)	July 17, 194[illegible]	S	50	50	8	
39/1-[illegible]	C. D. Wilson	. .	S, 130	Gravelly till (?)	Seepage from hummocky till slope (?)	. .	. .	D, S	. .	. .	. .	Supplies 2 homes.
39/2-25[illegible]	L. King	. .	S, 40	Soil zone	Seepage from soil zone (?)	. .	. .	D, S	[illegible]	. .	. .	
39/1-2[illegible]	G. Barnard	. .	S, [illegible]	Soil zone on till	Seeps on till-mantled slope	. .	. .	D, S	. .	. .	. .	
39/2-24[illegible]	Laurel Water Co.	. .	S, 90	Gravel (?)	Water-table discharge from sub-till gravel	10	. .	[illegible]	. .	[illegible]	[illegible]	Supplies a town and several business establishments.
39/2-36[illegible]	C. V. [illegible]	Larabee Springs	S, 160	Gravel and sand	do.	[illegible]	Aug. 9, 1946	D, S, Irr	. .	50	14	See table [illegible] for chemical analysis of water.
39/3-16[illegible]	F. Carter	. .	S, 110	Advance outwash below till (?)	Water table discharge (?)	. .	. .	D, S	. .	120	6	
39/2-19[illegible]		Crystal Springs	S, 115	Gravel	Water table discharge from sub-till (?) zone	300±	Aug. 9, 1946	S, Irr	. .	65	7	
39/3-20A1	E. A. Kratzig	. .	S, 95	Gravel(?)	do. (?)	16	. .	D, S	53	70	24	
39/4-3P1	L. Lieperant	. .	S, 260	Gravel	. .	. .	. .	D, S	. .	35	7	

1/ Footnote explanations at end of table.

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 1 E.- Continued.																
28F1	D. C. Hayward	Ap 30	Dg	26.5	. .	. .	. .	. .	. . .	Unconfined	13.6	Aug. 14, 1947	P	S	. .	. .	
29E1	R. P. Brown	Ap 35	Dg	23.8	60	. .	. .	. .	. . .	do.	20.32	do.	P	D	. .	. .	
[illegible]	A. Swartos	St 45	Dr	239	6	. .	. .	. .	Sand, fine	Confined	17.4	Aug. 15, 1945	J	S	40	1914	
[illegible]	H. E. Clay	St 35	Dr	225	4	225	220	5+	do.	do.	2	1946	J, 10	D, S	160	355	See table 2 for log.
31Q1	E. S. Irwin	St 60	Dr	170±	3	. .	. . .	. .	. . .	do.	20	1940	B, 4	D, S	. .	127	
31R1	Mrs. Lily Ott	St 95	Dg	25±	. .	. .	. .	. .	. . .	. . .	. .	. . .	P, 3	D, S	. .	. .	Said to be inadequate.
32D1	Arvid Harkins	St 70	Dg	31	96	10	. .	. .	Thin seams of sand in clay	Unconfined	6.5	Aug. 13, 1947	N	N	. .	. .	
32F1	Birch Bay Investment Co.	St 75	Dr	250	9	. .	90±	140+	Sandstone	. .	. .	. . .	N	N	. .	. .	Penetrated sandstone (Tertiary ?) at 90 feet; water said to be saline.
32M1	James L. Platt	St 105	Dr	245±	3	. .	. .	. .	Sand, fine	. .	. .	. . .	P, 4	D, S	100	262	
33D1	Wm. Newberry	St 40	Dg	6	120	6	. .	. .	Sand	Unconfined	5	. . .	P, 3	D, S	. .	. .	Water said to contain trace of iron.
33M1	Mrs. Lena G. Ley	S 143	Dg	24.6	. .	. .	. .	. .	Soil zone on till	Perched	9.3	Aug. 12, 1947	P, 2	D	. .	. .	Reported to be barely adequate in summer
33P1	Julius Thompson	S 120	Dr	80	6	80	74	?	Sand, fine	. . .	. .	. . .	J, 8	D, S	15	. .	Filled to 60 feet; see table 2 for log.
34C1	Mrs. Alma Hanson	St 90	Dg	25±	. .	. .	. .	. .	Clay, gravelly	. . .	. .	. . .	P	D	. .	. .	Said to be inadequate; saline water reported in 200-foot well in yard.
34L1	Harold Sundean	St 38	Dg	14.5	30	. .	. .	. .	Sand	Unconfined	10.0	Aug. 19, 1947	C, 12	PS	55	. .	Water said to contain trace of iron.
35K1	Jared Davis	Ap 30	Dg	12+	30	. .	. .	. .	do.	do.	9	. . .	P, 3	D, S	. .	. .	Do.
35P1	Laura Beatty	St 110	Dg	19.6	36	19	10	10+	Silt, sandy	. . .	13.3	Aug. 12, 1947	C, 4	D	. .	. .	Said to be inadequate in dry season.
36B1	C. E. Parcher	St 35	Dg	13	30	. .	. .	. .	Sand	. . .	. .	. . .	P, 3	D, S	. .	. .	
36J1	Anna E. Gorr	St 60	Dg	14	. .	. .	. .	. .	do.	. . .	. .	. . .	P	D, S	. .	. .	Water reported to be free of iron.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 2 E.- Continued.																
13Q1	Geo. E. [illegible]	St 45	Du	15	1½	15	0	15	Sand	Unconfined	8	Aug. 6, 1947	P, 3	D, S	70	37	
14G1	L. G. Hardenbrook	St 94	Dg	16.8	24	15	. .	. .	Sand and gravel	do.	5.4	Aug. 2, 1947	P, 5	D, S	. .	. .	
[illegible]	Edward [illegible]	St 70	Dg	13.6	[illegible]	12	. .	. .	Sand, fine	do.	7.1	Aug. 5, 1947	P, 4	D, S	60	9	
14J1	County Hospital	St 94	Dr	225	. .	. .	. .	. .	. . .	Confined	. .	. . .	. .	. .	. .	. .	Water said to be saline, well owner reported to have penetrated 200 feet of unconsolidated material over Tertiary sandstone.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	. .	. .	. .	. . .	do.	7.0	Aug. 6, 1947	[illegible] 4	D, S	. .	. .	Temperature of water 49° F.
[illegible]	[illegible]	H 80	Dg	22.1	42	8	. .	. .	Soil zone on till	Perched	24.3	do.	P 2	D	. .	. .	
[illegible]	E. [illegible]	St 80	Dg	6.5	36	14	. .	. .	Sand	Unconfined	3.6	Aug. 5, 1947	P, 3	D	. .	. .	
15E1	E. L. Stenberg	St 65	Dg	24.0	40	. .	. .	. .	. . .	do.	14.5	do.	P, 3	D.	115	26	Water reported to contain iron.
[illegible]	G. E. Wilder	W 190	Dr	105	6	105	50 93	32 12	Gravel	do.	69.5	1947	N	PS	105	14	See table 2 for log.
[illegible]	M. Nelson	H 120	Dr	90	6	90	75	15	do.	do.	71	May 1947	J, 5	D, S	85	30	Do.
	T. 39 N., R. 3 E.																
[illegible]	Louis [illegible]	St 100	Dg	40	. .	. .	. .	. .	Gravel and sand	do.	25	. . .	P, 3	D, S	. .	. .	Reported to have penetrated sand and gravel for entire depth.
[illegible]	[illegible]	St 112	Dg, Dn	. .	. .	. .	. .	. .	. . .	. .	. .	. . .	. .	D, S	. .	132	Water reported to contain iron.
[illegible]	Earl Campbell	St 100	Dg	24.1	30	. .	. .	. .	Gravel (?)	Undefined	20.3	July 30, 1947	P, 3	D	105	47	Water reported to contain trace of iron.
[illegible]	F. C. Jones	St 105	Dd	38	12	30	. .	. .	Sand and gravel	do.	30±	. . .	P, 5	D	. .	. .	
[illegible]	W. F. Hubbard	St 105	Dg	27	36	. .	. .	. .	Gravel	do.	19.5	Aug. 1, 1947	C, 60	Irr	. .	. .	
[illegible]	R. Vandervean	St 80	Dr	33.5	4	. .	. .	. .	. . .	do.	22±	. . .	P, 3	D, S	. .	. .	Water reported to have high iron content.
[illegible]	Walt Holden	St 85	Dg, J	32	36	32	. .	. .	Sand	do.	16	Aug. 1, 1947	T	Irr	. .	. .	

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 1 E.- Continued.																
2932	Fred Hysell	U 180	Dr	775	6	640	210	3	Sand, fine	. .	. .	. . .	N	N	. .	. .	Reported to have yielded 3 gallons per minute; see see table 2 for log.
[illegible]	James Day	U 1?0	Dg	[illegible]	.	. . .	. .	. .	Sand streaks in till	Perched	. .	. . .	P, 2	D, S	. .	. .	Said to be inadequate in summer.
[illegible]	W. F. Goddard	U 150	Dr	147	4	. . .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	. .	. .	
[illegible]	[illegible] W. Johnson	U 245	Dr	281	4 3 2	100 240 281	275	6	Sand, fine	Confined	146	1941	N	N	. .	. .	See table 2 for log.
[illegible]	Ellsworth Uhlich	U 20?	Dr	185	. .	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	. .	. .	
[illegible]	B. E. Warner	U 150	Dg	33.1	96	None	. .	. .	Sand streaks in till	Perched(?)	11.2	Aug. 7, 1947	P, 2	D	. .	. .	
3441	T. Nordtvedt	U 185	Dr	193	6	193	140 185	35 8	Sand do.	. . Confined	. . 133	. . . Dec. 1946	P, 3	D, S	. .	. .	Reported to have yielded 17 gallons per minute with 8 feet of drawdown; see table 2 for log.
[illegible]	J. A. Nevins	U 200	Dr	223	4	223	190	35	Sand, fine	Unconfined	190	Nov. 1935	P, 3	D, S	. .	. .	See table 2 for log.
[illegible]	[illegible]	U 2?3	Dg	6	[illegible]	6	. . .	. .	Sand and gravel	do.	5	1947	P, 3	D, S	. .	. .	
[illegible]	[illegible]	U 1??	Dr	[illegible]	6	. . .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	. .	. .	
[illegible]	Jim Ferguson	S 90	Dr	110	. .	. .	. .	. .	Sand, fine	. .	40	1945	J	D, S	. .	. .	
	T. 39 N., R. 2 E.																
[illegible]	Peter Hocking	Ap 70	Dg, J	24.4	18	24	. .	. .	do.	Unconfined	15.9	Aug. 1, 1947	P, 3	D, S	. .	. .	Water reported to have slight iron content.
[illegible]	J. S. Tuttle	Ap 85	Dg	27.2	. .	27	. .	. .	Sand	do.	13.5	July 29, 1947	P, 3	D, S	. .	. .	Water reported to contain iron.
[illegible]	E. L. Lathe	St 60	Dg, J	19.7	30	20	. .	. .	Sand with pebbles	do.	12.9	Aug. 1, 1947	J	D	35	30	Water reported to have moderate iron content.
301	Iva Strickland	Fp 40	Dg	7.8	36	. .	. .	. .	. . .	do.	6.1	Aug. 2, 1947	P, 3	D, S	. .	. .	Do.
[illegible]	C.O. Williams	St 50	Dg	32	12	32	. .	. .	Sand	do.	29	. . .	J	D, S	. .	. .	Water said to be free of iron.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	[illegible] - Continued.																
1976?	Town of Ferndale	S 160½	Dr	106	12	104	30½	76	Gravel	Unconfined	62.3	Aug. 6, 1948	T	PS	140	18	No. 5
1981?	A. E. Benson	S 80	Dr	91±	4	91±	. .	. .	. . .	. . .	30±	1947	P	D, S	115	23	
1971?	R. E. Bohn	Sb 50	Dr	69	4	69	66	3	Sand, fine	Confined	+9	Aug. 6, 1947	N	D, S	90	24	Flowing 3 gallons per minute on Aug. 6, 1947; see table 2 for log.
[illegible]	[illegible]	[illegible]	[illegible]	. . .	. . .	. . .	. .	. .	Sand (?)	Unconfined	. .	. . .	P, 2	[illegible]	. .	. .	Water reported to have slight iron content.
2001?	H. Heppel?	Sb 35	Dr	106	4	105½	96	10	"Quicksand"	. . .	. .	. . .	J, 6	D, Ind	15	65	See table 2 for log.
2002?	[illegible] Dressing Room?	Sb 40	Dr	[illegible]	6	135	130?	7	Sand	Confined	+6?	Aug. 27, 1948	T, 120?	Ind	95	18	Do.
2011?	Toney Bros.?	Sb 30	Dg	6.8?	24?	6.8	. .	. .	do.	Unconfined	1.0?	Aug. 14, 1947	P, 16	Ind	60	. .	
2001?	Harold Ahlstedt?	Sb 30	Dg	12.4	72	12.4	. .	. .	do.	do.	6.7	do.	P, 4	PS	. .	. .	Well across road to west, 90 feet deep, reported to have saline water.
[illegible]	N. D. Lemmer?	Sb 30?	Dg	17.6	30?	17.6	. .	. .	Sand, fine	do.	7.5	Aug. 6, 1947	P, 3	D, S	110	33?	
[illegible]	E. P. [illegible]	Sb 90?	Dg	24.0	35?	24	. .	. .	Sand	do.	19.5	do.	P, 3	D, S	. .	. .	Water reported to have trace of iron.
[illegible]	[illegible]	[illegible]	Dg	27.3?	30?	26?	. .	. .	Sand, some clay?	do.	20.2	do.	P, 3	D, S	. .	. .	Water reported to be free of iron.
[illegible]	[illegible]	Sb 80?	Dg?	. . .	. . .	. . .	. . .	. .	Sand, fine?	do.	. .	. . .	P, 3	D	. .	. .	Do.
[illegible]	Greenacres Memorial Park Cemetery	Sb 65?	Dg	11.4	3	. . .	. . .	. .	Sand	do.	6.9	Aug. 5, 1947	P, 6	D	. .	. .	
[illegible]	A. W. Anderson	Sb 60	Dn	20±	1¼	. .	. .	. .	do.	do.	. .	. . .	P, 3	D	. .	. .	Water reported to be free of iron; water from well across creek to south said to contain iron.
[illegible]	J. D. McKenzie?	Sb 36?	Dn	15	1¼	15	. .	. .	do.	do.	7	. . .	P, 3	D	. .	. .	
2591?	E. O. [illegible]	Sb 50?	Dg	12	. .	. .	. .	. .	. . .	. . .	. .	. . .	P, 3	D	. .	. .	Water reported to be free of iron.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 2 E.- Continued																
13H1	J. Koplewitz	Ap 75	Dr	30	12	30	7	23	. . .	Unconfined	7	. . .	P, 25	D, S	. .	. .	Water reported to have high iron content; nearby test [illegible]
13J1	T. Hansen	Ap 55	Dg	14	24	14	. .	. .	Sand, fine	do.	5.5	July 29, 1947	P	D, S	. .	. .	Water reported to have high iron content.
13M1	Leonard [illegible]	Fn 50	Dg						Sand	do.				D			[illegible]
14K1	G. L. Murray	St 60	Dg	17.4	24	18	. .	. .	do.	do.	5.2	Aug. 2, 1947	P, 3	D, S	. .	. .	Do.
15G1	Wm. Bechold	St 60	Dn	22	. .	. .	. .	. .	. . .	do.	. . .	. . .	P, 3	D, S			Water said to be free of iron.
16H1	Geo. Neevel	St 40	Dn	15	1½	15	. .	. .	Sand	do.	11	Aug. 2, 1947	P, 3	D, S	. .	. .	Water reported to have slight iron content.
18F1	L. J. Grant, et al.	S 220	Dg	60	. .	. .	. .	. .	Sand (?)	Confined	14	Aug. 11, 1947	P, 4	D, S	. .	. .	Water reported to have "boiled" when tapped.
18K1	John Lunde	U 230	Dg	15.0	72	. .	14	1	Sand, silty	do.	4.7	do.	P, 5	D, S	. .	. .	Penetrated 14 feet of till above aquifer.
18M1	Swedish Baptist Church	U 300	Dg	20.0	120	. .	. .	. .	Sand streaks in till	Perched	12.7	do.	P, 5	D	. .	. .	Said to [illegible] in dry [illegible]
19A1	W. Fry	S 130	Dr	134	6	134	130	4	Sand	Confined	50	Oct. 1946	J, 6	D	. .	. .	See table 2 for log.
19B1	Ole Iverson	U 260	Dr	160	6	160	155	5	Gravel	do.	145	May 1947	P, 5	D, S	. .	. .	Do.
19C1	John Ness	U 250	Dg	20	. .	. .	. .	. .	Sand streaks in till	Perched	. . .	. . .	P, 3	D	. .	. .	Said to [illegible]
19E1	Town of Ferndale	S 160	Dr	76	6	76	28	48	Sand and gravel	Unconfined	59	1936±	N	N	. .	. .	No. 1, abandoned; aquifer overlain by 28 feet of till.
19E2	Do.	S 160	Dr	67	12	67	40±	47	Gravel	do.	35	do.	T	PS	150	15	No. 2, aquifer overlain by 40 feet of till.
19E3	Do.	S 160±	Dr	102	12	102	40±	62	do.	do.	50	do.	N	N	. .	. .	No. 3, abandoned.
19E4	Do.	S 160±	Dr	120	12	120	40±	80	do.	do.	60±	1944	T	PS	135	23	No. 4.
19E5	Do.	S 160±	Dr	300	12	300	40±	260	Sand, fine	do.	50-60	do.	N	N	. .	. .	No. 5, abandoned because of "quicksand".

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 30 N., R. 3 E.- Continued.																
[illegible]	Edward Carr	St 90	Dg	16.3	36	76	. .	. .	. . .	Unconfined	15.1	Aug. 1, 1947	P, 8	D, S	60	11	Said to be barely adequate in dry season.
401	J. W. Rockey	St 95	Dg	22.5	40	. .	44	19.5	Sand	do.	10.1	do.	G, 150	Irr	. .	. .	
402	A. P. Lindblin	St 90	Dg	23.?	14	28	. .	. .	Sand and gravel	do.	19.8	do.	F, 5	D, S	40	10	Water reported to contain no iron.
501	[illegible]	St 65	Du	20	1.5	. .	. .	. .	. . .	. . .	. .	. . .	F, 3	S	50	17	Water reported to have high iron content.
502	F. W. Kempyer	St 85	Dr	87	. .	. .	6	27	Sand	Unconfined	12	1922	P, 3	D, S	. .	. .	
[illegible]	[illegible]	St 85	[illegible]	[illegible]	. .	. .	. .	. .	Sand (?)	do.	[illegible]	. . .	[illegible]	D, S	. .	. .	
602	E. E. Minske	St 95	Dg	30	24	. .	. .	. .	Sand	do.	20?	1942	P, 9	D, Ind	60	9	Supplies service station, store, and homes.
603	S. A. Anderson	St 75	Dg	17.3	24	24	2	24	do.	do.	11.3	July 30, 1947	C, 80	D, Irr	. .	. .	
604	Chas. Hillbrecht	St 85	Dg	17.2	24	27	2	16	do.	do.	8.9	do.	P, 3	D, S	30	6	
701	[illegible]	St 65	Dg	[illegible]	36	50	. .	. .	do.	do.	7.3	do.	C, 1000	Irr	. .	. .	
[illegible]	[illegible]	St 75	Dg	[illegible]	36	[illegible]	. .	. .	Sand (?)	do.	5.5	July 29, 1947	P, 3	D, S	40	8	
801	Lars Johnson	St 80	Dg	[illegible]	24	[illegible]	. .	. .	Sand	do.	[illegible]	. . .	P, 5	D	30	[illegible]	
901	L. D. [illegible]	St 90	Dg	20	[illegible]	24	. .	. .	do.	do.	16	1947	[illegible]	D, S	75	15	
[illegible]	[illegible]	St 95	Dg	28.1	40	73	. .	. .	do.	do.	15.6	July 30, 1947	J, 6	D, S	. .	. .	
[illegible]	Henry [illegible]	St 95	Dg	17.5	40	21	. .	. .	Gravel	do.	17.3	Aug. 1, 1947	P, 5	S	. .	. .	Reported to be inadequate in summer; water said to have high iron content.
[illegible]	Leslie Anger	St 110	Dr	29	14	28	. .	. .	Sand and gravel(?)	do.	. .	. . .	. .	D, S	. .	. .	Water reported to contain iron.
[illegible]	Frank Johnson	S 125	Dr	110	6	15	108	2	Sandstone	Confined	9	1945	J, 5	D, S	. .	. .	See table 2 for log.
1062	[illegible] McMillan	S 115	Dr	92	6	48.5	68	2	do.	do.	20	Dec. 6, 1946	J, 5	D	90	390	Do.
[illegible]	do.	S 140	Dr	210	6	22	. .	. .	Shale (?)	. .	26	Nov. 1946	[illegible] 3	D	45	9	Water reported to contain some gas; see table 2 for log.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 29 N., R. 2 E.- Continued.																
27R1	J. T. Feldt	St 95	Dg	10.7	24	10	. .	. .	Sand	Unconfined	8.1	Aug. 2, 1947	F, 3	D, S	. .	. .	Reported to furnish more water in summer than in winter.
28K1	Tom Bratt	St 45	Dg	17	36	17	. .	. .	do.	do.	5	. . .	F, 4	D	55	11	
28Q1	H. C. Holcombe	T 40	Dg	18.2	60	. .	. .	. .	Soil zone on till	Perched	6	. . .	S, 2	D, S	. .	. .	[illegible]
28R1	Tom Bratt	S 70	Dr	300±	. .	. .	. .	. .	. . .	Confined	+100 to 150	1942±	N	N	. .	. .	Reported flow by gas lift; well capped.
29L1	E. J. Olson	Fp 20	Dg	9.2	36	. .	. .	. .	[illegible]	Unconfined	5.5	Aug. 2, 1947	F, 3	D, S			
29Q1	Frank McKinnin	Fp 25	Dr	217	6	. .	. .	. .	. . .	Confined	+2.5	Aug. 4, 1947	N	S	20	1256	Flowing 1/4 gallon per minute; reported too saline for domestic use.
30C1	Jacob Schmeusler	S 55	Dr	71	4	70	70	3+	Sand	do.	+14	1944	N	D, S	. .	. .	Supplies 9 homes, temperature of water 50° F.; reported to flow 25 gallons per minute.
30K1	C. H. Harland	Fp 15	Dr	237	10 6 3	70 110 200	236	1+	Gravel	do.	+21	April 1945	N	D, S	110	100	Reported to flow 25 gallons per minute; water temperature about 50° F.; see table 2 for log.
31C1	S. Hernandez	Fp 16	Dr	240	4	. .			do. (?)	do.	Flow	Aug. 7, 1949	F	D, S	23	86	
31C2	Alfred Ulrich	Fp 15	Dr	245	4	. .	. .	. .	do. (?)	do.	+22.5	do.	F	D, S	65	45	
31E1	P. M. Peterson	Fp 20	Dr	175	6	175	172	3	Sand, fine	do.	+6.5	do.	N	N	70	840	See table 2 for log.
32R1	Gretchen Kaufman	St 60	Dg	14	. .	14	0	6+	do.	Unconfined	9±	1937	P, 4	D	. .	. .	
33C1	Hans Olson	St 40	Dg	8.5	. .	. .	. .	. .	Soil zone on till	Perched	Dry	Aug. 4, 1947	N	N	. .	. .	Collects soil zone seepage during wet season.
33C2	Do.	St 40	Dr	90	4	. .	. .	. .	. . .	Confined	+2	do.	N, 2	S	45	1224	Temperature of water 50° F.
33E1	Oliver Pederson	St 50	Dg	20.5	36	20.5	0	11	Sand	Unconfined	7-8	Aug. 5, 1947	C	D	. .	. .	Said to go dry in late summer; auger penetrated clay for 42+ feet below aquifer.

Unpublished records subject to revision

Table 1.- Continued

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 5 E.- Continued.																
15R1	K. Robson	U 150	Dg	16	36	. .	. .	. .	Sand	Unconfined	7.8	July 28, 1947	F	D, S	. .	. .	Penetrated till above aquifer
15Q1	Myron Lundquist	U 185	Dr	250	4	. .	137	13	Sandstone	. .	. .	. . .	P, 5	D, S	. .	. .	Reported to have penetrated 100 feet of shale below aquifer.
16B1	J. W. Bockhave	St 90	Dg	30.9	36	12	0	21+	Sand	Unconfined	7.9	July 29, 1947	C, 250	Irr	. .	. .	Reported to have penetrated clay below aquifer.
16[illegible]1	Ray Georgeff	St 80	Dr	[illegible]	2	. .	. .	. .	. . .	. . .	. .	. . .	P, 3	D, S	30	6	Water reported to contain trace of iron.
17[illegible]1	Albert A. Lerwin	St 80	Dg	14	[illegible]	12	4	8	Sand	Unconfined	3	1937	P, 3	D, S	. .	. .	Water said to contain trace of iron; reported to have penetrated 4 feet of silt and peat above aquifer.
17L1	V. Rohwer	St 95	Dn	20	1½	20	. .	. .	do.	do.	19	July 28, 1947	P, 3	D, S	. .	. .	Water reported to contain trace of iron.
17J1	Ray Halderman	St 91	Dr	24	4	24	3	21	Sand and gravel	do.	10	1941	P, 3	D, S	50	6	
19[illegible]1	R. E. Lord	St 95	Dg	25	30	25	. .	. .	Sand, fine	do.	15.6	do.	P, 2	D, S	. .	. .	Reported to have penetrated sand for entire depth.
[illegible]	Geo. W. White	St 70	Dg	13	36	13	. .	. .	do.	do.	11.0	July 24, 1947	P, 3	D, S	60	13	Do.
[illegible]	Earl [illegible]	St 75	Dg, Dr	24	. .	14	5	12	Sand	do.	[illegible]	1937	[illegible]	[illegible]	[illegible]	[illegible]	Water reported to contain some iron.
[illegible]	Fred Olsen	St 95	Dg	18	. .	. .	3	15+	do.	do	12±	do.	P, 10	D, S	. .	. .	Do.
[illegible]	Herman Hols	St 80	Dg	14.1	24	14	. .	. .	Sand, fine	do.	6.1	July 29, 1947	P, 4	D, S	. .	. .	Do.
[illegible]	E. A. Hudson	St 99	Dg	17.2	33	. .	. .	. .	do.	do.	5.5	do.	P, 3	D	65	14	Do.
19Q1	C. Dunn, et al.	St 90	Dr	50	6	50	26	24	do.	Confined	+2	April 1946	J, 15	D, PS	130	17	Lower 30 feet now filled; see table 2 for log.
19[illegible]1	Herbert Dyck	St 120	Dn	29.5	6	29.5	25.5	4	do.	do.	14.65	July 24, 1947	N	D, S	. .	. .	Penetrated "hardpan" (till) above aquifer.
19R2	A. E. Lloyd	St 125	Dr	45	4	. .	. .	. .	. . .	. .	. .	. . .	J, 6	D, S	105	11	Water reported to contain some iron.
19[illegible]1	Ray McIlman	St 100	Dg	17.7	30	8	. .	. .	Silt, sandy	Unconfined	3.0	July 24, 1947	P, 3	P, S	. .	. .	Temperature of water 54° F.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 3 E.- Continued.																
13Q1	M. Starkenburg	St 90	Dr	225	4	225	180	45	Sand, fine	Confined	12.8	July 12, 1948	N	N	50	1230	Abandoned because of "quick-sand"; see table 2 for log.
14B1	Wm. Ripperda	St 100	Dr	265	. .	. .	. .	. .	do.	do.	70±	1947	N	N	. .	. .	Abandoned; water said to be saline.
14B2	Do.	St 100	Dg	10.6	36	. .	. .	. .	Thin sand layer in clay	Unconfined	4.5	July 12, 1948	P, 4	D	. .	. .	Said to be barely adequate in dry season.
15H1	Fred Erickson	St 125	Bd	28	6	. .	. .	. .	Sand and gravel	do.	21.0	do.	P, 4	D, S	. .	. .	
15G1	J. Husfloen	St 125	Dg	25.4	. .	. .	. .	. .	do.	do.	14.4	July 9, 1948	P, 8	D, PS	. .	. .	Supplies water for store, service station and 2 homes.
15D1	J. L. Van Rossum	St 115	Dg	30.7	18	. .	. .	. .	do.	do.	18.5	do.	J, 11	D	. .	. .	
15K1	City of Lynden	St 100	Dr	68	10	68	16	52	do.	do.	12.7	Feb. 12, 1947	C	S, O	. .	. .	See table 2 for log.
15K2	Do.	St 105	Dg	36	36	36	2	34	do.	do.	16	Jan. 1947	C	PS	. .	. .	
15N1	Jack Wagter	St 60	Dg	10.4	. .	. .	. .	. .	Gravel, small seam in clay	do.	4.0	July 13, 1948	P, 4	D, S	. .	. .	
16B1	Thomas	St 110	Dg	15	35	. .	. .	. .	Sand (?)	do.	6.1	Aug. 27, 1947	N	N	. .	. .	
17A1	Gus Frazier	St 110	Dg	12	36	. .	. .	. .	Sand	do.	7.0	do.	P	D	. .	. .	
20B1	City of Lynden	Ap 105	Dr	210	. .	. .	. .	. .	. . .	. . .	. .	. . .	N	N	. .	. .	Water said to be saline.
22D1	John Werda	Fp 55	Dg	14.8	24	. .	. .	. .	Sand, fine, and gravel	Unconfined	10.2	July 13, 1948	P, 8	D, S	. .	. .	Reported to be barely adequate in dry season.
22E1	Gerrit Lenhear	Fp 55	Dg	20.3	18	. .	...	. .	Sand and gravel	do.	3.5	do.	P, 4	S	. .	. .	Water said to have high iron content; aquifer reported to be overlain by blue clay.
22G2	Theodore Smith	Fp 55	Dg	6	. .	. .	1±	5±	do.	do.	1.8	do.	P, 8	D, S	. .	. .	Said to be barely adequate in dry season.
22Q1	Paul Van Dyken	Fp 60	Dn	15±	. .	. .	. .	. .	Sand, fine	do.	11±	. . .	P, 4	S	. .	. .	Water reported to have high iron content.
23E1	Henry Slotemaker	St 70	Dg	16	36	. .	3±	11	Gravel	do	12.2	July 20, 1948	J, 10	D, S	55	17	Said to be inadequate in dry season.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 3 E.- Continued																
20F1	Glen Whitney	St 120	Dr	44	5	43	. .	. .	Gravel	Unconfined	22	. . .	P, 3	D	. .	. .	Penetrated "hardpan" (till) above aquifer.
20H1	Hans Gerdes	St 110	Dg	30	36	30	. .	. .	do.	do.	12	. . .	P, 10	D, S	65	14	
20N1	Lawrence Pullar	S 190	Dr	67	5	67	. .	. .	Sand and gravel	. .	50	1937	P, 2	D, S	. .	. .	
20R1	E. J. Higman	S 200	Dr	237	6	. .	. .	. .	. . .	. .	. .	. . .	P, 5	D, S	15	260	Supplies 2 homes.
21A1	A. Elander	Fo 100	Dr	45	6	. .	. .	. .	. . .	. .	15.03	July 29, 1947	N	N	. .	. .	Said to be inadequate.
21C1	S. A. Tarr	St 100	Dg	19.1	30	. .	. .	. .	Gravel	Unconfined	13.5	do.	P, 3	D, S	. .	. .	
21F1	A. J. Olsen	U 200	Dr	140	4	. .	. .	. .	. . .	. .	. .	. . .	P, 5	D, S	. .	. .	
22A1	Herman Jowelli	U 180	Dr	156	5	. .	. .	. .	. . .	. .	. .	. . .	P, 5	D, S	. .	. .	
24Q1	E. J. Needham	U 140	Dr	173	4	. .	100	73+	Sandstone (?)	Confined	10	1946	N	N	25	. .	Water said to have been saline; penetrated 100 feet of blue clay above aquifer.
25N1	J. E. Swanson	U 235	Dg	30	30	. .	25	5+	Sand, fine and gravel	Unconfined	24	. . .	P, 4	D, S	. .	. .	
25P1	Emil Schultz	U 240	Dg	27.3	. .	. .	. .	. .	. . .	Confined(?)	3.4	July 21, 1947	P, 3	D	. .	. .	
25P2	L. W. Beidler	U 265	Bd	21	. .	. .	. .	. .	Sand	do.	9	1946	. .	D	. .	. .	Reported to have penetrated clay above aquifer.
26H1	E. Neff	U 300	Dr	105	6	. .	. .	. .	. . .	. .	83.3	July 22, 1948	N	D	. .	. .	
26P1	Jarvis Ryan	U 250	Dr	170	4	170	. .	. .	Gravel	Unconfined	140	1944	P, 3	D, S	55	35	
27D1	A. O. Johnson	U 205	Dr	190	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	60	364	Water said to contain some iron.
27F1	Elsie Clark	U 200	Dr	73.5	5	73.5	69.5	4+	Sand	Confined	24	July 1947	J, 6	D	40	225	See table 2 for log.
27H1	R. P. Hanke	S 190	Dr	63	. .	. .	62	1+	Gravel	do.	. .	. . .	P, 4	D, S	. .	. .	Said to have penetrated "hardpan" (till) to 10± feet and clay for 52 feet above aquifer.
27F1	Elmer Zanden	U 265	Dr	185	6	185	65	120	Sand and gravel	Unconfined	150.8	July 23, 1947	N	D	110	8	Said to have penetrated soil to 4 feet, and "hardpan" (till) for 6 feet above aquifer.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 3 E.- Continued.																
35R1	Art Brue	St 101	Dg	23.3	42	. .	. .	. .	Gravel	Unconfined	20.5	July 30, 1947	C, 4	D, S	. .	. .	Water said to contain iron.
36H1	Town of Everson	St 90	Dg	30	84	30	3±	27	do.	do.	11.6	Aug. 11, 1948	C, 350	PS	. .	...	[illegible] water.
36H2	Do.	St 90	J	35	36	16	3±	32	do.	do.	11	do.	C, 350	PS	80	45	Temperature of water 49° F.
36J1	Gus Norstrom	St 90	Dg	19±	36	. .	. .	. .	do.	do.	. .	. . .	J, 6	D	. .	. .	Water reported to contain trace of iron.
	T. 40 N., R. 4 E.																
1A1	W. H. Terpstra	St 30	Dn	15	1½	15	12	3+	Sand	do.	11±	. . .	P, 4	D, S	75	5	
1B1	R. V. DenAdel	St 30	Dn	19	1¼	19	. .	. .	do.	do.	. .	. . .	P, 5	D	. .	. .	Water reported to contain iron.
1K1	Mrs. A. VerBrugge	St 40	Dn	20±	1¼	20	15±	5+	Gravel	do.	8±	Aug. 2, 1948	P, 6	D, S	75	8	Penetrated clay above aquifer; water said to contain iron.
1M1	Claude Smith	St 40	Dn	60	1¼	60	. .	. .	Sand and gravel (?)	do.	. .	. . .	P, 3	D	. .	. .	Water said to contain iron.
1P1	W. E. Bishop	St 40	Dn	18+	1½	18	14±	4+	do.	do.	20±	. . .	P, 5	D, S	. .	. .	Penetrated clay above aquifer.
2H1	E. J. Horn	Fp 35	Dn	15	1½	15	10	15	Sand	do.	10	. . .	P, 5	D, S	. .	. .	Penetrated clay above aquifer; water said to have high iron content.
2M1	Geo. Hovel	Fp 40	Dn	65	1¼	65	60	5+	Gravel	Confined	8±	Aug. 4, 1948	P, 5	D, S	. .	. .	Penetrated clay above aquifer; water said to contain iron.
2N1	Elmer Hovel	Fp 40	Dr	93	5	93	87±	3+	do.	do.	8	1943	P, 10	D, S	70	6	Do.
2Q1	H. L. Hovel	Fp 40	Dn	35±	1½	35	. .	. .	Sand and gravel	Unconfined	8±	. . .	P, 5	D, S	. .	. .	Water reported to contain trace of iron.
2Q2	Jack Walbers	Fp 40	Dr	38	4	. .	. .	. .	Gravel (?)	. .	. .	. . .	P, 5	D, S	. .	. .	Water said to contain iron.
3G1	Harry Conser	Fp 40	Dn	28±	1½	28	25	3+	do.	Unconfined	15±	. . .	P, 5	D, S	. .	. .	Do.
3P1	Eleno Bros.	Fp 45	Dn	34	1¼	31	30	4+	do.	do.	7	. . .	P, 5	D	. .	. .	Do.
3R1	Mike Kaptain	Fp 45	Dg	18.5	24	. .	. .	. .	Gravel, fine	do.	8.4	Aug. 2, 1948	C, 80	Irr	. .	. .	
4A1	Mrs. B. Garrison	Fp 45	Dn	20+	. .	. .	. .	. .	do.	. .	. .	. . .	P, 12	D, S	. .	. .	

Unpublished records
subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 3 E.- Continued.																
26N1	Carl Nelson	U 274	Dr	160	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	135	6	Supplies two farms and community club house.
28Q1	N. F. Schafer	U 290	Dg	30	30	5	. .	. .	Soil zone on till	Perched	23.6	July 22, 1947	J, 8	D	100	8	Inadequate; said to pump dry; temperature of water 52° F.
29B1	A. N. Anderson	S 170	Dr	93	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	. .	. .	
30B1	V. S. Walston	S 160	Dr	54	6	54	. .	. .	. . .	. .	. .	. . .	J, 8	D, S.	. .	. .	
30D1	E. J. Balfour	S½ 145	Dg, Dr	57	4	57	22 57	46 1+	Gravel Sand and gravel	. .	. .	. . .	J, 5	D, S	115	25	See table 2 for log.
30M1	Mrs. [illegible]	S½ 150	Dr	[illegible]	4	. .	. .	. .	. . .	. .	. .	. . .	P, 4	D, S	[illegible]	14	
31B1	O. E. Pike	U 280	Dg, Dr	140	12-4	140	. .	. .	Sand	Unconfined	120	1922±	P, 4	D, S	. .	. .	
31D1	Fred Fuchs	U 190	Dr	65	. .	. .	. .	. .	. . .	. .	. .	. . .	P, 6	D, S	145	9	
31H1	R. S. Rawls	U 190	Dr	95	6	95	80	15+	Gravel and sand	Unconfined	78	May 1947	J, 15	D	. .	. .	See table 2 for log.
31Q1	Chester Wallace	U 270	Dg	23	72	. .	. .	. .	Soil zone on till	Perched	5.53	July 21, 1947	. .	D	. .	. .	
31R1	Lee Lawson	U 305	Dr	215	4	. .	. .	. .	. . .	. .	. .	. . .	P, 4	D	70	10	
32A1	C. Fleming	U 270	Dg	21.9	60	[illegible]	. .	. .	Soil zone on till	Perched	17.1	July 22, 1947	P, 3	D	. .	. .	Said to be barely adequate in dry season.
32B1	C. Way et al.	U 325	Dr	150	6	150	. .	. .	. . .	. .	. .	. . .	P, 6	D, S	110	6	Supplies 2 farm homes.
32C1	Smith Road Community Water Co.	U 325	Dr	255	6	250	240±	15+	Gravel and sand, fine	Unconfined	242	July 1947	P, 12	PS	. .	. .	Standby for community water system.
32D1	Do.	U 320	Dr	242	6	242	222	20	Sand and gravel	. .	222	1935±	P, 25	PS	135	8	Supplies water for 17 homes; penetrated "hardpan" (till) to 18 feet and clay for 20 feet above aquifer.
32P1	John Horgen	U 290	Dr	175	4	. .	. .	. .	do.	. .	. .	. . .	P, 4	D	185	4	See table 2 for log.
33D1	Unknown	U 275	Dr	217	6	. .	182	30	Sand, fine	Unconfined	182	. . .	. .	. .	. .	. .	Do.
34D1	Fred Rouch	U 270	Dg	12	30	12	. .	. .	. . .	do.	1.5	July 21, 1947	P, 3	D, S	. .	. .	
34P1	Fred Gottschalk	U 320	Dr	196	6	. .	. .	. .	. . .	. .	185	1931	P, 3	D, S	. .	. .	

Unpublished records
subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 2 E.- Continued																
32A1	O. E. Wilson	Ap 30	Dg	13	36	. .	. .	. .	Sand	Unconfined	7.9	Aug. 18, 1947	P, 4	D, S	55	. .	Water said to contain iron.
32J1	O. P. Swanson	St 60	J	14.9	12	15	. .	. .	Sand, fine	. . .	9.6	do.	P, 4	D, S	. .	. .	Water reported to contain trace of iron.
32R1	Carl Clark	St 57	Dn	18	. .	18	. .	. .	Sand	Unconfined	. .	. . .	P, 4	D, PS	40	. .	
33C1	Clyde Wilson	St 60	Dg	30	30	. .	. .	. .	do.	do.	20	. . .	C, 5	D, S	. .	. .	
34C1	Roy Allen	St 50	Dn	28	1½	28	. .	. .	Sand and gravel	do.	. .	. . .	P, 3	D, S	. .	. .	
34Q1	Victor Ritter	Fp 30	Dg	17	...	. .	5	12	do.	do.	. .	. . .	P, 3	D	. .	. .	Water reported to contain iron; well 0.2 mile north, 175 feet deep has saine water.
35R1	Peder Severson	St 60	Dg	25	30	. .	. .	. .	Sand	do.	19	. . .	J	D, S	. .	. .	
36R1	C. E. Maxwell	St 70	Dg	32	30	22	. .	. .	Sand with pebbles	do.	18.1	July 30, 1947	P, 35	D, S	40	6	
	T. 40 N., R. 3 E.																
1J1	Paul VanDyken	St 140	Dg	. .	12	. .	. .	. .	. . .	. . .	. .	. . .	P, 4	D, S	65	20	Water reported to have high iron content.
2E1	Frank Ondeck	St 150	J	. .	24	. .	. .	. .	Sand and gravel	Unconfined	15±	. . .	P, 4	D, S	. .	. .	Water said to contain trace of iron.
2J1	Peter Krugt	St 125	Dg	7	60	7	. .	. .	Gravel	do.	. .	. . .	J, 5	D, S	. .	. .	Do.
3A1	Hugo Pen	St 150	Dg	20	24	. .	. .	. .	Sand and gravel	do.	12±	. . .	C	D, Irr	. .	. .	Do.
3N1	Ben Hamstra	St 130	Dg	13.8	15	. .	6	8	do.	do.	4.8	July 9, 1948	P, 4	D, S	. .	. .	
3P1	Alfred Brant	St 135	Dg-J	28	24	. .	6	22	Gravel	do.	8±	. . .	J	D, S	. .	. .	
4E1	John VanderHaak	St 130	Dg	. .	12	. .	. .	. .	. . .	do.	4±	. . .	P, 3	D, S	. .	. .	Water reported to contain iron.
4L1	Floyd Assink	St 130	Dn	30	. .	. .	4±	26	Gravel	do.	5±	. . .	C, 8	D, S	. .	. .	
4R1	L. Strimler	St 125	Dg	10	. .	. .	2	8	Sand and gravel	do.	6	. . .	P, 8	D, S	. .	. .	
5E1	G. VanBeek	St 130	Dg-J	10.2	12	10	. .	. .	Sand	do.	9.0	Aug. 27, 1947	P, 4	D, S	70	18	Water reported to have high iron content.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 9 E.- Continued.																
5A1	Ralph Demutts	St 130	Dg	24±	48	. .	. .	. .	Sand	Unconfined	7	. . . .	P, 6	D, S	. .	. .	Water said to contain iron.
5Q1	H. Deason	St 120	Dg	14	6	. .	. .	. .	Sand and gravel	do.	10±	. . .	P, 4	D	50	14	.
6D1	Arnd Reitman	St 130	Dg	17.3	18	. .	. .	. .	Sand, fine	do.	5.0	Aug. 26, 1947	N	S	. .	. .	Water reported to contain iron.
6N1	Will Bruns	St 122	Dr	156	6	156	152	4	Sand	Confined	75	Mar. 1947	J, 12	D, S	55	250	See table 2 for log.
7A1	A. R. Benson	St 125	Dg	23.7	48	. .	. .	. .	do.	Unconfined	7.5	Aug. 27, 1947	C	Irr	. .	. .	Water said to contain iron.
7H1	A. DeBruin	St 115	Dg	9.5	12	. .	2	7	Gravel	do.	4.3	do.	J, 5	S	. .	. .	Do.
7N1	Ernest Vandergriend	St 110	Dg	19	18	19	. .	. .	Sand	do.	7.0	Aug. 26, 1947	C, 12	S	85	26	Do.
8H1	Mrs. Lena Otter	St 115	Dg-J	15.6	12	. .	. .	. .	do.	do.	7.0	Aug. 27, 1947	P, 3	D, S	. .	. .	Water reported to have high iron content.
8N1	D. H. Francisco	St 110	Dg	12	. .	. .	. .	. .	do.	do.	8±	. . .	C, 8	D, S	. .	. .	Water said to contain iron.
9A1	A. R. Kirk	St 125	Dg	20	18	. .	9±	11+	Sand and gravel	do.	10.3	July 9, 1948	C, 12	D, S	40	12	
9A2	Do.	St 125	Dg	22.9	30	. .	. .	. .	do.	do.	8	do.	C, 400	Irr	. .	. .	Water said to contain iron.
9N1	Peter Hoeringa	St 105	Dg	12	36	. .	. .	. .	Sand	do.	7.9	Aug. 27, 1947	P, 5	D	. .	. .	Do., supplies house water for 3 farms. Water said to contain iron.
9Q1	N. W. Schydrating Co.	St 115	Dg-J	20.6	18	. .	. .	. .	Sand and gravel	do.	13.7	do.	C, 100	D, Ind	60	14	Water reported to contain trace of iron.
10G1	Frank Rodenburg	St 132	Dg	11±	48	10.6	. .	. .	Gravel	do.	8.1	July 9, 1948	J, 5	D, S	. .	. .	Water said to be free of iron.
10G1	Lester Brann	St 125	Dg	30±	. .	. .	16	14+	Sand and gravel	do.	14.0	do.	P, 5	D, S	20	7	
10M1	Unknown	St 125	Dr	42	10	. .	. .	. .	do.	do.	. .	. . .	. .	D, S	. .	. .	Water said to be free of iron.
11N1	Joe Alexander	St 90	Dg	12	36	. .	. .	. .	. . .	do.	8.2	July 12, 1948	R, 4	D,S	. .	. .	Water said to contain trace of iron.
12A1	James Bajema	St 125	Dg	15.1	36	12	2±	13+	Gravel, coarse	do.	11.1	do.	P, 10	D, S	50	7	Temperature of water 50° F.
12R1	S. W. Cummins	St 80	Dg	12	. .	. .	. .	. .	Gravel	do.	9±	. . .	P, 5	D, S	. .	. .	Water reported to contain trace of iron.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 4 E.- Continued.																
4J1	Mrs. M. J. Lochbaum	Fp 40	Dn	15	. .	15	. .	. .	Sand, fine, and gravel	Unconfined	14±	. . .	P, 8	D, S	160	7	
4Q1	Mrs. Ethel Williamson	Fp 45	Dn	40	1¼	40	. .	. .	. . .	. .	. .	. . .	P	D	. .	. .	Water said to contain iron.
5D1	J. C. Loreen	St 170	Dg	61	25	61	5	56+	Gravel	Unconfined	51.8	Aug. 12, 1948	J, 5	D, S	. .	. .	Do.
6C1	Albert Roosendaal	St 170	Dn	. .	1¼	. .	. .	. .	Sand and gravel (?)	. .	27±	. . .	P, 3	D, S	. .	. .	Water said to contain trace of iron.
6N1	Dick Tankley	St 140	Dg	. .	60	. .	. .	. .	do.	. .	20±	. . .	P, 3	D	. .	. .	
7H1	Hinton Bros.	St 70	Dg	17	. .	. .	. .	. .	Sand and gravel	Unconfined	13.4	July 2, 1948	P, 4	D, S	. .	. .	
7Q1	O. A. Kirkman	St 75	Bd-Dn	25	. .	. .	22	25+	Gravel	Confined	4±	. . .	P, 16	D, S	90	8	Penetrated clay above aquifer; supplies water for 3 farms.
8A1	C. Radder	Fp 50	Dn	13	. .	. .	. .	. .	Sand	Unconfined	8±	. . .	P, 3	D, S	. .	. .	Water reported to have high iron content.
8N1	W. D. Craig, et al.	St 60	Dn	22	. .	. .	. .	. .	Sand and gravel	. .	. .	. . .	P, 10	D, S	45	11	Supplies water to 4 homes and service station.
8Q1	Art Swanson	Fp 60	Dn	18±	. .	18	. .	. .	Sand	Unconfined	12+	. . .	P, 3	D, S	130	7	Water reported to have high iron content.
8R1	John J. Stadt	Fp 60	J	18.4	18	18	6	12	Sand, fine	do.	8.3	July 20, 1948	P, 16	D, S	90	9	Water said to contain trace of iron.
9N1	Rosenberg Olson	Fp 50	Dg	14±	4	14±	. .	. .	Sand	do.	. .	. . .	O, 4	D, S	. .	. .	Water reported to have high iron content.
10A1	Nick Honcoop	Fp 45	Dn	15	1¼	15	. .	. .	Gravel	do.	12	. . .	P, 5	D, S	. .	. .	Do.
10D1	John Brayard	Fp 45	Dn	84	. .	84	84	. .	do.	Confined	2	July 1948	P, 5	D, S, PS	100	10	Water said to contain iron; see table 2 for log; [illegible]
10E1	E. I. McWilliams	Fp 50	Dn	32	1¼	32	. .	. .	do.	do.	3±	. . .	P, 5	D, S	. .	. .	Water said to contain iron.
10F1	J. B. VanDiest	Fp 45	Dn	12	1¼	12	6±	6	do.	Unconfined	9	. . .	P, 10	D, S	45	6	Said to furnish inadequate supply; water reported to be free of iron.
10J1	Ed Collenius	Fp 45	Dg	12.7	24	14	12	1+	Sand, fine, and gravel	do.	9.4	Aug. 2, 1948	N	N	. .	. .	Abandoned due to "quicksand"; water reported to contain iron.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 4 E.- Continued.																
10J2	Ed Collenius	Fp 45	Dn	30	1½	30	. .	. .	Gravel	Unconfined	12	. . .	P, 5	D, S	. .	. .	Water said to have high iron content.
10M1	John M. Stork	Fp 50	Dn	32+	1½	32+	. .	. .	do.	. .	. .	. . .	P, 5	D, S	. .	. .	Do.
10R1	Theo Bracken	Fp 45	Dn	30±	3/4	30	25	5+	Gravel, fine	Confined	12±	. . .	P, 5	D	. .	. .	Do.
11F1	R. N. Steel	Fp 45	Dn	26	1¼	26	24.5	1.5	Gravel	do.	10±	. . .	P, 5	D, S	145	6	Do.
12F1	G. A. Brown	Fp 40	Dg	18.2	18	20	. .	. .	do.	. .	3.7	Aug. 4, 1948	P, 5	S	. .	. .	Water reported to contain iron.
14C1	Louis Thom	St 125	Dg	50	. .	. .	. .	. .	Sand	Unconfined	44	. . .	J, 5	D, S	. .	. .	
15D1	Ida Schuett	Fp 55	Dn	40	. .	. .	. .	. .	Gravel	. . .	22	. . .	P, 4	D, S	. .	. .	Water said to have high iron content.
15E1	John Willemsen	Fp 55	Bd-Dn	20	1¼	16	12	4+	do.	Unconfined	8±	. . .	C, 6	D	80	10	
15G1	B. W. Allingham	Fp 50	Dg-Bd	22.3	18	. .	. .	. .	do.	do.	12.3	July 21, 1948	P, 8	D, S	. .	. .	
15P1	C. R. Monnet	St 55	Dn	28±	. .	. .	. .	. .	do.	. .	. .	. . .	P, 3	D, S	. .	. .	
15R1	Geo. Dester	St 100	Dn	22	1¼	22	. .	. .	do.	. .	10±	. . .	P, 7	D, S	. .	. .	
15R2	W. H. McRea	St 80	Dr	132	6	130	. .	. .	Sand, fine	Confined	8	. . .	J, 10	D	45	7	Supplies 2 homes.
16A1	Wm. Bierlink	Fp 55	Dr	262±	5	. .	. .	. . .	. . .	do.	4±	1930-35	P, 5	D, S	95	139	
16E1	Harold Huisman	Fp 60	Dn	14±	1¼	14±	. .	. .	Gravel, fine	Unconfined	10±	. . .	P, 8	D, S	. .	. .	
16E2	T. B. Carmen	Fp 60	Dn	19±	1¼	19±	. .	. .	Sand	do.	12±	. . .	C, 12	D, S	. .	. .	Water reported to have high iron content.
16N1	H. E. Scheib	St 65	Dn	16	1¼	16	. .	. .	Gravel	do.	10±	. . .	C, 13	D, S	. .	. .	
17E1	W. B. Frost	Fp 60	Dg	14	. .	14	2	2	Sand and gravel	do.	12±	. . .	P, 4	D	95	12	
17N1	Bert Backstrom	Fp 60	Dn	56.1	1½	56	. .	. .	Sand	Confined	7.2	July 6, 1948	P, 4	D	165	28	Water reported to have high iron content.
18B1	R. Jones	St 80	Dn	165	. .	. .	. .	. .	. . .	. .	. .	. . .	N	N	. .	. .	Penetrated clay from 20 to 165 feet; said to be a dry well.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 1 E.- Continued.																
10L1	J. P. Match	St 60	Dg	23	30	23	. .	. .	Sand, fine	Unconfined	. .	. . .	P, 3	D, S	. .	. .	Water said to contain some iron.
10Q1	P. S. Moon	St 85	Dg	12	24	. .	. .	. .	Sand	. .	4.71	Aug. 19, 1947	P, 3	D, S	. .	. .	Do.
10R1	Gordon Pendleton	St 65	Dn	12	1¼	12	. .	. .	Sand (?)	Unconfined	. .	. . .	P, 3	D	. .	. .	
11H1	O. E. Thompson	S 100	Dg	12.5	30	. .	10.5	2	Sand, fine	do.	. .	. . .	C, 4	D, S	. .	. .	Said to be inadequate in summer; penetrated 1½ feet of soil and 9 feet of sand and gravel above aquifer.
12J1	A. L. Moritz	St 85	Dg	10	48	10	. .	. .	Sand	do.	6.6	Aug. 19, 1947	P, 4	D	. .	. .	Furnishes barely adequate supply.
12R1	Geo. E. Blackburn	St 85	Dg	21	24	. .	. .	. .	"Quicksand"	do.	12.0	do.	P, 5	D, PS	35	. .	Water reported to contain trace of iron.
13F1	W. H. Martens	St 80	J	10.4	12	12	4½	5½	Sand	do.	7.2	do.	P	D	. .	. .	Said to furnish inadequate supply.
13R1	Ivar Hanson	St 65	Dg	13	30	13	. .	. .	do.	do.	10	. . .	P, 6	D, S	. .	. .	Said to furnish inadequate supply; water reported to contain trace of iron.
14A1	Alvin Van Dyk	Ap 50	Dg	7.2	36	. .	. .	. .	Sand (?)	do.	2.8	Aug. 20, 1947	P, 4	D, S	. .	. .	Water reported to contain iron.
14N1	Mrs. G. E. Olson	St 60	Dg. Dn	32	12	. .	. .	.	do.	do.	. .	. . .	P, 3	D	. .	. .	Water reported to be free of iron.
15E1	Mike Lindal	St 95	Dn	12	1¼	12	. .	. .	do.	do.	. .	. . .	. .	D, S	. .	. .	Water reported to contain trace of iron.
16D1	W. S. Loop	Ap 30	Dr	126	3	. .	125	1+	"Hardpan" (sand or gravel?)	Confined	Surface	Aug. 20, 1947	N	N	. .	. .	See table 2 for log.
17E1	E. D. Partlow	Ap 30	Dn	10	1¼	10	. .	. .	Sand (?)	Unconfined	. .	. . .	P, 3	D, S	. .	. .	Water reported to contain trace of iron.
17E1	W. S. Loop	Ap 30	Dr	71	2	. .	70	1	"Hardpan" (Sand or gravel)	Confined	+16	. . .	N	D, S	60	12	Penetrated peat to 12 feet and sand for 58 feet above aquifer.

Unpublished records
subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 1 W.																
13H1	B. Johnson	Ap 60	Dg	8.6	24	9	0	9	Sand	Unconfined	6.1	Aug. 13, 1947	B	D	. .	. .	
22G1	W. C. Morris	S 110	Dr	115	6	115	110	5	Thin seams of sand in clay	Confined	73	1947	P, 6	D, S	7	11	See table 2 for log.
22K1	August Kinetat	S 80	Dg	20.5	72	. .	. .	. .	Soil zone on till	Perched	9.0	Aug. 13, 1947	P	D, S	. .	. .	Said to be inadequate in dry season.
22M1	R. Hower	S 100	Dg	29	96	. .	. .	. .	do.	do.	19	do.	P	D, S	. .	. .	
23G1	C. L. Kline	S 95	Dr	65	4	. .	. .	. .	. . .	Confined	10	1928±	P, 3	D, S	105	6	Water level reported to be intermittently at surface.
24G1	[illegible]	Ap 55	Dg	11	30	. .	5	6+	Sand, fine	Unconfined	5	. . .	P, 3	D, S	. .	. .	
	T. 40 N., R. 1 E.																
1A1	Joe Radonski	S 235	Dg	18.5	72	. .	. .	. .	Soil zone on till	Perched	. .	. . .	P, 3	D	. .	. .	Said to be inadequate in dry season.
1B1	R. S. Pendleton	S 220	Dr	117	3	117	100	17	Sand, fine	Confined	+3	Aug. 19, 1947	P, 3	D, S	75	6	See table 2 for log.
1C1	E. W. Johnson	S 160	Dr	276	6	276	270	6+	do.	do.	116	1947	P, 3	S	125	57	Penetrated soil to 3 feet and blue clay for 267 feet over aquifer.
2A1	Lyman Foy	S 360	Dg	14.5	40	. .	13	5.5	Sand	Unconfined	. .	. . .	P, 5	D, S	. .	. .	
3A1	Chas. Nelson	S 490	Dg	28	72	. .	. .	. .	Soil zone on till	Perched	26	. . .	D	D	. .	. .	Said to be inadequate in dry season.
3B1	Geo. Anderson	S 280	Dg	21	. .	. .	. .	. .	do.	do.	. .	. . .	P, 3	D, S	. .	. .	Water said to contain trace of iron; inadequate in summer.
4A1	City of Elaine	S 177	Dr	746	12	690	. .	. .	. . .	Confined	67.27	May 7, 1948	T	PS	60	6	See table 2 for log.
4C1	W. L. Robinson	St 80	Dr	106	3	106	104	2	Sand, fine	Confined	6	1943	N	N	. .	. .	Water reported to be saline; see table 2 for log.
4D2	Albert Neubauer	St 85	Dr	63	4	63	59	4+	do.	do.	Surface	1944	P, 3	D, S	25	148	See table 2 for log.
5B1	Harry Nielsen	St 65	Dg	13	36	. .	. .	. .	. . .	. .	. .	. . .	P, 2	D	. .	. .	Said to furnish inadequate supply.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 2 E.- Continued.																
11E1	H. H. Vanderyacht	St 110	Dg	14.9	36	12	3	12+	Sand and gravel	Unconfined	9.4	Aug. 21, 1947	J	D, S	. .	. .	Water reported to contain trace of iron.
12M1	Harry Stork	St 105	Dg	15	36	15	1	14	do.	do.	9.9	Aug. 18, 1947	P, 3	D, S	. .	. .	Water reported to have high iron content.
12R1	Pete Schuyleman	St 107	Dg	8.2	24	9	. .	. .	Sand	do.	5.6	Aug. 26, 1947	P, 3	N	. .	. .	Do.
13A1	H. O. Vandergriend	St 105	Dg	9	48	9	3	6	do.	do.	5.5	do.	P, 4	D, S	. .	. .	Water reported to contain trace of iron.
13D1	Mrs. Will Jackman	St 100	Dg	17.1	18	. .	. .	. .	do.	. .	11.8	Aug. 18, 1947	. .	D	. .	. .	Water reported to contain iron.
13R1	H. B. Crabtree	St 95	J-Dn	9	. .	9	. .	. .	do.	Unconfined	6±	. . .	P, 4	D, S	. .	. .	Water reported to have high iron content.
14E1	H. Headrick	St 90	Dg	20	24	. .	. .	. .	Sand (?)	do.	5.6	Aug. 21, 1947	J, 5	D, S	. .	. .	Water reported to contain trace of iron.
14F1	O. L. Sheets	St 85	Dg	25	36	24	. .	. .	Sand, fine	do.	22.5	do.	C, 12	D, S	. .	. .	Do.
15N1	G. C. Crabtree	St 88	Dg	26	36	24	20	6+	Sand	do.	6.0	Aug. 20, 1947	C, 100	Irr	75	. .	Do.
15Q1	Delton Cowan	St 85	Dg	18	12	. .	. .	. .	Sand, fine	do.	9.9	Aug. 21, 1947	P, 6	D, S	. .	. .	Water said to be free of iron.
15R1	T. J. McClelland	St 85	Dg	20.7	30	. .	. .	. .	Sand	do.	15.5	do.	P, 8	D, PS	. .	. .	
16D1	J. H. Henderson	S 125	Dg	9	30	. .	. .	. .	. . .	do.	. .	. . .	P, 2	D	. .	. .	Said to furnish small supply.
16H1	Howard Remington	St 85	Dg	8.4	30	. .	2±	7+	Sand (?)	do.	5.8	Aug. 20, 1947	P, 3	D, S	. .	. .	
17C1	John Tolsma	St 95	Dg	. .	. .	. .	. .	. .	. . .	do.	. .	. . .	P, 3	D, S	50	22	
18A1	H. T. Schringstead	St 96	Dg-Dn	9	36	7	7	2+	Sand, fine	do.	. .	. . .	P, 7	D, PS	100	. .	Water reported to have high iron content.
18D1	Joe Voorthuysen	St 85	Dg	11	30	. .	. .	. .	Sand	do.	7.3	Aug. 19, 1947	P, 4	D, S	. .	. .	Water reported to have slight iron content.
18H1	Jelt Zylstra	St 90	Dg	9	18	9	4	6	Sand, fine	do.	4.9	Aug. 20, 1947	P, 8	D, S	. .	. .	
18R1	G. Holtrop	St 85	Dg	8.4	48	8	. .	. .	Sand	do.	4.9	do.	P, 6	D, S	. .	. .	Said to furnish barely adequate supply in summer.

Unpublished records
subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 4 E.- Continued.																
29D1	Irene McPhail	St 200	Dr	125	. .	. .	. .	. .	. . .	. .	. .	. . .	P, 3	. .	. .	. .	
30E1	V. Tisland	St 230	Dr	60	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	70	100	
30M1	C. F. Smith	S 260	Dr	160	4	. .	. .	. .	. . .	Confined(?)	30	. . .	P, 3	D, S	130	195	
30R1	S. B. Burpee	U 210	Dr	208	4	208	. .	. .	. . .	Confined	Surface	. . .	. .	. .	. .	. .	
31C1	W. C. Porter	U 230	Dg	41.9	40	. .	. .	. .	. . .	. .	17.6	July 22, 1947	P	D, S	. .	. .	
31M1	Ed Johnson	U 270	Dr	80	4	. .	. .	. .	. . .	Confined	+12.5	July 21, 1947	N	D, S	. .	. .	Temperature of water 50° F.
31Q1	J. R. Montgomery	U 260	Dr	100	4	99	99	1	Sand and gravel	do.	+27.5	July 22, 1947	N	D, S	15	43	Water reported to contain iron; temperature of water was 49° F.; see table 2 for log.
32E1	C. Velum	S 275	Dr	53	4	53	51	2	Gravel	do.	42	July 19, 1947	F	D, S	. .	. .	Water reported to contain trace of iron; see table 2 for log.
32H1	Earl Rumsey	S 260	Dr	89	4	88	88	1	do.	do.	+23.1 Flow	Sept. 1934 July 22, 1947	N	D, S	25	95	Penetrated "hardpan" to 12 feet and blue clay for 76 feet above aquifer.
32R1	Oakes	U 560	Dr	253	6	250	250	3	Shale (?)	. .	. .	. . .	F, 3	D, S	. .	. .	See table 2 for log.
33C1	[illegible] Green	S 290	Dr	12[illegible]	[illegible]	60	60	6[illegible]	Shale	Confined	37	Aug. 1946	J, S	D	20	20	See table 2 for log.
33M1	Pete Shandney	S 330	Dr	168	6	78	78	90	do.	do.	40	June 1946	P, 3	S	10	57	Water needs aeration to remove hydrogen sulfide gas; well penetrated "hardpan" (till) to 12 feet and clay for 66 feet above aquifer.
33R1	A. Tyler	S 330	Dr	123	6	123	120	3	Gravel	do.	40	Sept. 1939	J, 3	D, S	15	29	Penetrated "hardpan" (till) to 11 feet and clay for 100 feet above aquifer.
34D1	Art Hillard	S 280	Dr	146	6	138	131	15	Sand, fine	Unconfined	122	Aug. 23, 1946	P, 3	D	. .	. .	See table 2 for log.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 2 E.- Continued.																
19A1	Hubert Sheets	St 75	Dg	25.7	36	20	. .	. .	Sand, fine	Unconfined	7.5	Aug. 18, 1947	C, 500	Irr	. .	. .	
19J1	John Erickson	Ap 65	Dg	13.6	30	14	. .	. .	do.	do.	11.0	do.	P, 4	D, S	. .	. .	
20C1	Pete Loewen	St 75	J	18.3	12	18	. .	. .	Sand	do.	6.9	Aug. 20, 1947	P, 8	D, S	. .	. .	
20N1	Oscar Ebe	St 70	Dg	14.5	36	14.5	. .	. .	do.	do.	9.0	Aug. 18, 1947	J, 12	D, S	50	. .	Water reported to contain trace of iron.
21B1	Unknown	St 85	J	10	6	10	. .	. .	Sand (?)	do.	4.7	Aug. 20, 1947	C, 5	S	. .	. .	
21N1	W. M. Bender	St 68	Dg	19	36	. .	. .	. .	Sand, fine	do.	5.0	Aug. 18, 1947	G, 120	Irr	. .	. .	
22R1	J. H. Swope	St 65	Dn	26	1¼	. .	. .	. .	Sand	do.	24±	. . .	P, 3	D, S	. .	. .	
23A1	Wm. Bitterman	St 91	Dn	20±	1¼	20	. .	. .	do.	do.	10±	. . .	J, 5	D	. .	. .	Water said to contain trace of iron.
24F1	G. Vermeulen	St 85	Dn	16	1¼	16	. .	. .	do.	do.	9±	. . .	P, 5	D, S	40	. .	Do.
24H1	VanTanten Bros.	St 93	Dg	41.8	36	. .	. .	. .	do.	do.	14.2	Aug. 21, 1947	C	Irr	50	. .	Water reported to contain iron.
24J1	Herman Huisingh	St 85	Dg	29.4	36	. .	. .	. .	Sand, fine	do.	20.7	do.	C, 12	D, PS	. .	. .	
25A1	Jule Crabtree	St 60	Dg	20	12	20	. .	. .	do.	do.	17±	. . .	P, 8	D, S	. .	. .	Said to furnish inadequate supply.
25C1	P. E. Preston	St 60	Dg	28.3	24	. .	. .	. .	Sand (?)	do.	18.0	Aug. 21, 1947	C, 5	D, S	. .	. .	Water reported to contain trace of iron.
26A1	John H. Terpsma	St 75	J	22.6	12	. .	. .	. .	Sand	do.	12.7	do.	P, 4	D, S	. .	. .	Do.
28E1	F. E. Bernard	St 60	Dn	26	. .	26	. .	. .	do.	do.	18	. . .	P, 10	D, S	. .	. .	Do.
29C1	Gilbert Iverson	St 70	J	20.8	18	20	. .	. .	Sand, fine	do.	7.0	Aug. 18, 1947	P, 9	D	. .	. .	
29Q1	N. E. Kramer	Fp 35	Dg-J	11.4	24	. .	. .	. .	. . .	do.	5.5	Aug. 25, 1947	P, 3	D, S	175	390	Water reported to have high iron content.
30C1	O. Iverson & Son	St 65	Dg	10	48	. .	. .	. .	Sand, fine	do.	8.0	Aug. 18, 1947	P, 16	Ind.	85	. .	Water reported to contain trace of iron.
31J1	G. M. Cowgan	St 55	Dn	11	1¼	11	. .	. .	Sand	do.	9±	. . .	P, 3	D, S	. .	. .	Water said to contain iron.

Unpublished records
subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 40 N., R. 3 E.- Continued.																
23L1	Lula Alex	St 70	Dg	16.3	8	16	. .	. .	Sand and gravel	Unconfined	10.8	July 13, 1948	P, 4	D	35	22	
23M1	Evert Scholten	Fp 60	Dg	11.4	18	. .	. .	. .	Gravel (?)	do.	6.3	do.	R, 8	D, S	. .	. .	Water reported to contain trace of iron.
24Q1	M. Starkenburg	St 90	Dg	12±	40	12±	1	9	Gravel	do.	1.5	July 12, 1948	P, 8	D, S	. .	. .	Said to be inadequate, in late summer.
27J1	Ray Shumway	Fp 65	Dg	. .	36	. .	. .	. .	. . .	do.	. .	. . .	P, 3	D, S	60	21	Water reported to have high iron content.
28L1	B. A. Velcke	Fp 50	Dg	10	30	. .	. .	. .	Gravel	do.	7±	. . .	N	D, S	. .	. .	Water said to contain iron.
29F1	Garret Polinder	Fp 45	Dg	24	12	24	16	8+	Sand and gravel	do.	16	. . .	C	D, S	. .	. .	Water reported to have high iron content; penetrated soil and clay for 16 feet above aquifer.
29H1	Abbott	St 50	Dr	240	. .	. .	. .	. .	. . .	. .	. .	. . .	N	N	. .	. .	Water said to be saline.
31H1	John Dykman	St 50	Dn	. .	2	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D. S	95	77	
31N1	N. W. Concrete Co.	St 70	Dg	50	36	40	. .	. .	Sand	Unconfined	40.5	July 30, 1947	J, 5	D, Ind	. .	. .	
32J1	Ray VanEdgom	St 80	Dg	31	6	. .	.	. .	. . .	do.	17	. . .	P (?)	D	. .	. .	Water reported to contain trace of iron.
32R1	John Hollander	St 80	Dg-J	19.7	42	. .	. .	. .	Sand	do.	12.9	Aug. 1, 1947	J, C	D, Irr	. .	. .	
34H1	Ralph VanDyk	Fp 65	Dg	12.5	. .	. .	. .	.	. . .	do.	10.6	July 30, 1947	P, 3	N	. .	. .	Said to be inadequate; nearby well, 72 feet deep, was reported to have produced saline water from sand below 60 feet of clay.
34J1	A. J. Chilton	St 85	Dr	23	12	24	. .	. .	Sand and gravel	do.	14±	1947	P, 3	D	. .	. .	Water said to contain trace of iron; nearby well, 120 feet deep, was reported to have produced saline water from sand below clay.
35L1	Dick Bouwman	St 85	Dg	14	36	. .	. .	. .	do.	do.	. .	. . .	P, 3	D, S	105	40	Water said to contain iron.

Unpublished records subject to revision

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 4 E.- Continued.																
9C1	Albert Theel	St 130	Dr	50±	4	..	..	..	Gravel	Unconfined	37	...	P, 3	D, S	..	..	
9C2	Frank Theel	St 130	Dr	50	6	50	..	..	Sand, gravel, and boulders	do.	35±	1947	J, 15	D	85	9	
9E1	O. Helgesen	St 135	Dr	50	4	50	..	..	Sand	do.	29±	1942	J	D	..	..	
14E1	Will Richards	St 135	Dr	50	6	50	8	42	Sand, gravel, and boulders	do.	23±	Dec. 1945	J	D, S	..	..	
16E1	Dave Wiedersoch	Fp 120	Dg	22.7	20	20	..	..	Sand	do.	20.7	June 30, 1948	P, 3	D, S	35	5	
18E1	H. S. Mitchell	U 200	Dr	110	6	10	..	..	Sandstone	Confined	20	...	P, 3	D, S	..	..	Reported to have penetrated bedrock at 10 feet.
19D1	Ross Young	U 200	Dr	50	6	7	7	43	do.	do.	20±	1940	J	D, S	..	..	Said to have penetrated 7 feet of till above aquifer.
19I1	Fred Quimby	St 155	Dg	24.4	12	..	..	..	...	Unconfined	23.2	July 28, 1947	P, 3	D, S	75	7	
20J1	Floyd Sherry	St 140	Dg	26	12	..	..	..	Gravel (?)	do.	22.1	do.	P, 3	D, S	..	..	
21G1	C. H. Hoff	St 140	Dg	13	36	12	..	..	Sand, fine	do.	10.0	...	P, 3	D, S	135	11	Water reported to contain trace of iron.
21J1	H. S. Glickenstaff	St 150	Dg	19.8	24	8	5	9	Gravel	do.	9.6	June 28, 1948	[illegible]	[illegible]	..		
26L1	John Bloes	Fp 170	Dn	37	6	37	2	35	Sand and gravel	do.	..	...	J, 5	D	110	16	Water reported to have a pH of 7..
27M1	C. Dunnell	Fp 156	Dg	56	..	..	..	..	do.	do.	20±	...	[illegible]	D, PS	[illegible]	[illegible]	Water reported to have high iron content.
28N1	D. Bell	St 160	Dr	43	..	..	..	..	Gravel	do.	28±	...	P	D	..	..	Water said to contain a trace of iron.
28Q1	Virgil Griffin	St 160	Dr	25	6	25	..	..	Sand and gravel	do.	6	April 1947	J	H	..	..	Reported to have penetrated sand and gravel for entire depth.
28R1	Harold Wickwirey	Fp 150	Dg	13	36	12	..	..	Sand, fine	do.	10.0	June 26, 1948	P, 3	D	..	..	
28R2	Cedarville Service Station	St 165	Dr	42	4	..	..	..	...	..	..	...	P, 3	D, PS	25	5	
28R3	H. Hanson	St 220	Dg	12.1	30	..	..	..	Sand streaks in clay (?)	Unconfined	5.9	July 19 1947	P, 3	D, S	..	..	

Table 1.- Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	T. 39 N., R. 3 E.- Continued.																
35A1	Raymond Bailey	U 260	Dr	193	6	. .	. .	. .	. . .	. .	120	1944	P, 3	D, S	50	205	
35J1	M. E. Jensen	U 220	Dr	. .	4	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D	. .	. .	
36M1	O. K. Podds	U 245	Dg	16.3	36	. .	. .	. .	. . .	Unconfined	11.5	July 21, 1947	P, 3	D, S.	. .	. .	
36Q1	W. L. Gallman	U 260	Dr	98	6	.98	97	1	Gravel	Confined	Surface	do.	P, 4	N	95	11	Penetrated till to 11 feet and clay for 85 feet above aquifer.
	T. 39 N., R. 4 E.																
4C1	Mrs. Ethel Urfer	Fp 90	Dr	64	4	. .	. .	. .	. . .	. .	3.6	June 30, 1948	N	N	. .	. .	Abandoned.
4E1	Mike Klein	Fp 90	Dr	. .	1½	. .	. .	. .	. . .	. .	. .	. . .	P, 3	D, S	. .	. .	Water reported to have high iron content.
4R1	George Todd	S 180	Dn	18.6	1	. .	. .	. .	Gravel	Unconfined	16.9	June 30, 1948	P, 3	D	. .	. .	Said to be inadequate in dry season.
5B1	Ed Terpsma	Fp 85	Dn	. .	1½	. .	. .	. .	do.	do.	8	do.	P, 3	D, S	. .	. .	
9K1	F. A. Heonski	Fp 90	Dn	. .	1½	. .	. .	. .	Sand and gravel	do.	. .	. . .	O	D, S	. .	. .	Water reported to contain some iron.
7M1	Chas. Anderson	St 140	Dg, Dr	47	6	42	36	11	Gravel	do.	41	1946	. .	. .	. .	. .	Penetrated 4½ feet of sand above aquifer.
8C1	Lawrence Osgooby	Fp 105	Dn	35±	. .	. .	. .	. .	. . .	. .	. .	. . .	O	D, S	95	8	Water reported to contain trace of iron.
8J1	Orville Thompson	Fp 115	Dg	12	36	. .	10	2	Gravel	Unconfined	10.0	June 29, 1948	C, 32	Irr	. .	. .	
9D1	Conrad Geleynse	Fp 110	Dg	37	. .	. .	. .	. .	Sand	do.	7.0	do.	P, 3	D, S	. .	. .	
9E1	Geo. Cogelow	Fp 110	Dn	20±	. .	. .	. .	. .	. . .	do.	. .	. . .	P, 3	D. S.	. .	. .	
9E1	J. Braithwaite	St 150	Dg	6.8	36	. .	. .	. .	Thin seams of sand in clay (till?)	Perched	5.0	June 29, 1948	J, 4	D	. .	. .	Said to be inadequate in dry season.
9E2	Isabel Braithwaite	St 135	Dr	55	4	55	. .	. .	Gravel	Unconfined	42	. . .	P, 3	D	. .	. .	Reported to have penetrated gravel for entire depth.
9L1	Halvor Helgesen	St 135	Dg, Dr	49.8	4	50	2	48	do.	do.	32.7	June 29, 1948	J, 5	D. S.	70	9	

Unpublished records subject to revision

DEPARTMENT OF THE INTERIOR

U. S. GEOLOGICAL SURVEY

MAP SHOWING LOCATION OF REPRESENTATIVE WELLS AND SPRINGS

50-7

PLATE 1A
WASHINGTON
(WHATCOM COUNTY)
BLAINE QUADRANGLE

UNPUBLISHED RECORDS
SUBJECT TO REVISION

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MAP SHOWING LOCATION OF REPRESENTATIVE WELLS AND SPRINGS

PLATE 1B
WASHINGTON
(WHATCOM COUNTY)
SUMAS QUADRANGLE

50-7

E. M. Douglas, Geographer in charge.
Topography by Pearson Chapman.
Triangulation by R. B. Robertson.
Surveyed in 1906

Scale 1/62500

Contour interval 20 feet.
Datum is mean sea level.

APPROXIMATE MEAN DECLINATION 1908

Edition of Aug. 1908 reprinted 1943
Polyconic projection. To place on North American datum move projection lines 100 feet south and 200 feet east

See plate 1A for explanation.

WASH.
SUMAS

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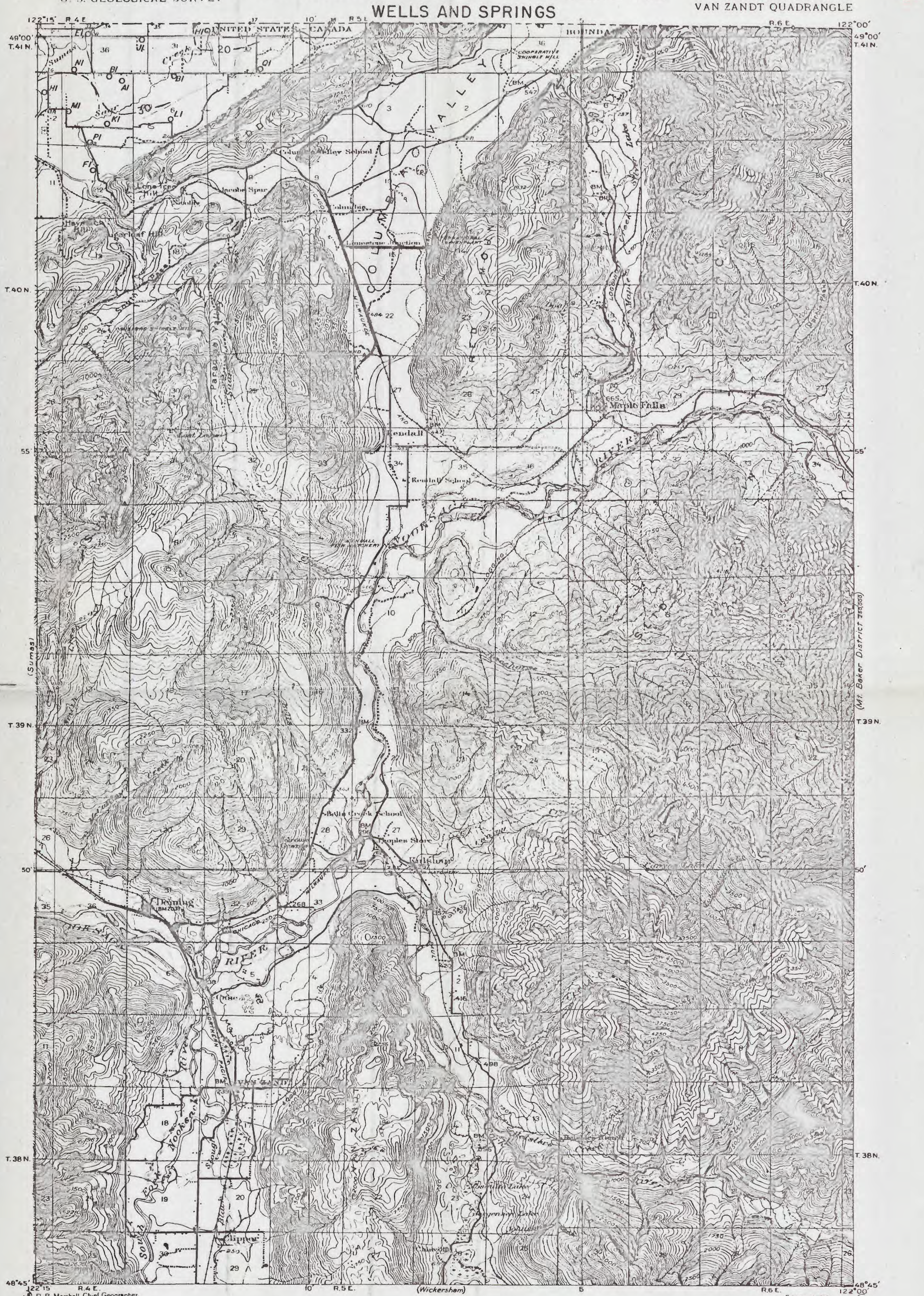
N4845—W12215/15

DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, SECRETARY
U. S. GEOLOGICAL SURVEY

TOPOGRAPHY
MAP SHOWING LOCATION OF REPRESENTATIVE WELLS AND SPRINGS

PLATE 1 C
WASHINGTON
(WHATCOM COUNTY)
VAN ZANDT QUADRANGLE



Edition of 1919.

R. B. Marshall, Chief Geographer.
Geo. R. Davis, Geographer in charge.
Topography by J. L. Lewis, S. G. Lunde, R. H. Sargent, and R. M. Wilson.
Control by U. S. and Canada Boundary Commission, L. F. Biggs, G. C. Jacobs, and F. J. McMaugh.
Surveyed in 1917-1918

SURVEYED IN COOPERATION WITH THE WAR DEPARTMENT AND THE STATE OF WASHINGTON

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Scale 1/62500

Miles · Yards · Kilometers

Contour interval 50 feet.
Datum is mean sea level.

See plate 1A for explanation.

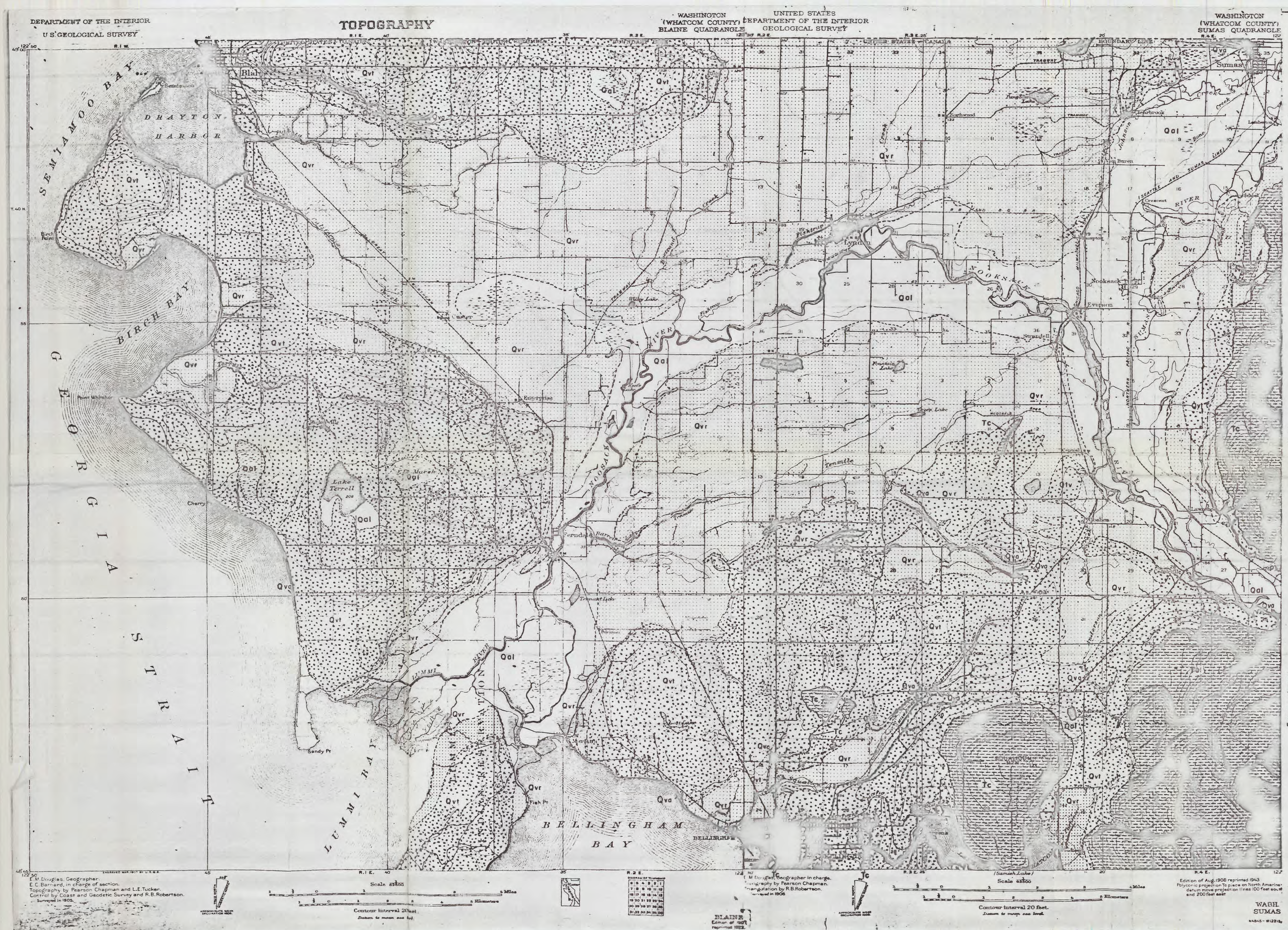
TRUE NORTH · MAGNETIC NORTH · 24½°
APPROXIMATE MEAN DECLINATION, 1917

VAN ZANDT

Note.—In joining with Sumas, use dotted projection corners

PLATE 2

50-7



EXPLANATION

QUATERNARY

Recent

Qal

Alluvium
(Clay, silt, peat, sand and gravel; coarse-grained members yield moderately large quantities of ground water. Water generally contains iron.)

Pleistocene

Qvr

Recessional outwash of the Vashon glaciation
(Sand, clay, silt, and gravel; deposited by outwash streams from the retreating ice of the latest glaciation. In places mantled by Recent alluvium. Coarse-grained members yield moderately large quantities of ground water. Water in many places contains iron.

Qvt

Till of the Vashon glaciation
(Gray, blue, hard, intimate mixture of clay, silt, sand, and gravel that is principally a ground-moraine deposit from 1 to 50 feet in thickness. Essentially impervious, but in most places the soil zone at surface yields small quantities of perched ground water.)

Qva

Advance outwash of the Vashon glaciation and pre-Vashon (?) Pleistocene deposits, undifferentiated
(Silt, sand, and gravel deposits laid down in front of the advancing Vashon ice. Includes older (?) fossil-bearing clay. Coarse-grained members yield moderately large quantities of ground water where below level of the regional water table.)

TERTIARY

Eocene (lower)

Tc

Tertiary sedimentary rocks
(Series of sandstones, shales, conglomerates, and coal, up to 10,000+ feet in thickness. Deposited as continental sediments. In most places is mantled with a cover of glacial material. Yields saline or mineralized ground water, small yields of potable water are obtained where salinity has been flushed out by ground water circulation.)

PRE-TERTIARY

pTu

Pre-Tertiary rocks, undifferentiated
(Metamorphosed sedimentary and igneous rocks. Yield little or no ground water.)

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