34

STATE OF WASHINGTON

Albert D. Rosellini, Governor

DEPARTMENT OF CONSERVATION

Earl Coe, Director

DIVISION OF WATER RESOURCES

Murray G. Walker, Supervisor

Water Supply Bulletin No. 17

GEOLOGY and GROUND-WATER RESOURCES of WEST-CENTRAL LEWIS COUNTY, WASHINGTON

By

J. M. Weigle and B. L. Foxworthy

Prepared in cooperation with

UNITED STATES GEOLOGICAL SURVEY

GROUND WATER BRANCH

1962

STATE OF WASHINGTON

Albert D. Rosellini, Governor

DEPARTMENT OF CONSERVATION

Earl Coe, Director

DIVISION OF WATER RESOURCES

Murray G. Walker, Supervisor

Water Supply Bulletin No. 17

GEOLOGY and GROUND-WATER RESOURCES of WEST-CENTRAL LEWIS COUNTY, WASHINGTON

By
J. M. Weigle and B. L. Foxworthy

Prepared in cooperation with
UNITED STATES GEOLOGICAL SURVEY
GROUND WATER BRANCH
1962

Price $2.00, Division of Water Resources, Olympia, Wn.

3

FOREWORD

Water Supply Bulletin No. 17, "Geology and Ground Water Resources of West-Central Lewis County, Washington" was prepared under the Washington State Division of Water Resources - U.S. Geological Survey cooperative program and is a part of an overall inventory of water resources of the State of Washington being conducted by the Division of Water Resources.

The report was designed primarily as a discussion of the geology and an evaluation of the water-bearing characteristics of each important aquifer within the study area; however, geologists and engineers working in fields other than geohydrology will find Bulletin No. 17 a valuable reference. The highway engineer will find well logs and cross sections helpful in evaluating road bed conditions and locating borrow sites. The geologic map and geologic cross sections will assist the geologic engineer in evaluating foundation conditions for dams, bridges, buildings and other major structures. Industry seeking large deposits of sand, gravel, and clay materials within the study area will find the Lewis County report an important source of information. The geologist working in academic fields will enjoy the author's treatment of the Tertiary and Quaternary systems of the Lewis County area.

It will be the policy of the Division of Water Resources to continue to refine and improve our method of presenting geo-hydrologic data in order that it will be of value to the greatest number of people.

Everything possible has been done to insure the completeness and accuracy of the material presented herein.

-Robert H. Russell
Asstistant Supervisor
Division of Water Resources

CONTENTS

CONTENTS

CONTENTS

ILLUSTRATIONS

(Plates 1-5 in pocket)

CONTENTS

TABLES

GEOLOGY AND GROUND-WATER RESOURCES

OF

WEST-CENTRAL LEWIS COUNTY, WASHINGTON

By

J. M. Weigle and B. L. Foxworthy

ABSTRACT

Lewis County lies within the Puget Trough section of the Pacific Border physiographic province. The west-central part of the county, an irregularly shaped area of about 830 square miles, contains the bulk of the county's population and virtually all of its ground-water development. It occupies the central part of a structural and topographic basin surrounded by well-dissected hills, which rise as much as 2,000 feet above the flood plains of the major streams. The area is drained by two major river systems, the Chehalis-Newaukum and the Cowlitz.

The oldest rocks known in west-central Lewis County are a sequence of lava flows and pyroclastic and marine sedimentary rocks that are exposed in the foothills in the western and southwestern parts of the area. These and other volcanic and sedimentary rocks of Tertiary age constitute the bedrocks in the area. Overlying these bedrocks in the stream valleys are heterogeneous masses of alluvium and of drift from alpine glaciers that occupied the valleys of eastern Lewis County during Pleistocene time. Outwash from the continental Vashon glacier also occurs locally in the northern part of Lewis County, as far south as the city of Centralia.

For the area as a whole, the alluvial deposits of Quaternary age are of major importance from the standpoint of ground-water supply. The most extensive deposits used as an effective source of ground water are the glaciofluvial deposits that underlie upland plains and terraces to depths of about 50 to 200 feet. Of these, the unit most extensively exposed in the area of study is the Logan Hill formation of Pleistocene age. The most permeable is the sheet of outwash sand and gravel of the Vashon glaciation. Except in the Newaukum artesian basin, Tertiary materials are of secondary importance, as generally these materials yield only small amounts of water to wells and, locally, the water from them is too saline for normal use.

Development of the ground-water resources of Lewis County is at an early stage. The estimated total pumpage for all purposes in 1959 was about 3,000 acre-feet. The yield from most of the aquifers, particularly those of Quaternary age, can be increased substantially without danger of overdraft. Because the materials making up many of the aquifers are poorly sorted, these aquifers are of rather low permeability. For that reason, the yields of wells tapping them will depend largely on careful well construction.

Periodic measurement of water levels in a network of observation wells should be continued to provide information on long-term trends in level. Such information will be needed to guide the management of the water resources when pumping from ground-water bodies in west-central Lewis County is increased substantially. A measuring program will be of particular importance for the Newaukum artesian basin, where substantial development ultimately will cause some wells to stop flowing, but which may not cause a serious overdraft in the foreseeable future.

INTRODUCTION

West-central Lewis County is an important agricultural and commercial region in southwestern Washington in the development of which the ground-water resources are becoming increasingly important. In some upland parts of the area the density of settlement is controlled by the availability of ground water. At present, the potential supplies of ground water exceed the use; however, an increasing use of ground water for irrigation and the exploitation in recent years of artesian aquifers whose supply probably is limited make it apparent that orderly control of the development of the ground-water resources will be necessary if the maximum benefits are to accrue to the residents of the region.

Purpose and Scope of the Investigation

The present investigation was undertaken by the Geological Survey in 1952 in cooperation with the State of Washington Department of Conservation, Division of Water Resources. The objectives of the study are to collect and interpret basic geologic and hydrologic data pertaining to ground water in west-central Lewis County as an aid in the utilization and orderly development of this valuable resource.

Field work for the investigation included canvassing wells and visiting well drillers to obtain data on wells, measuring water levels in wells, collecting water samples for chemical analysis, measuring or estimating discharge of springs, and mapping the geology. Most of the field work was done by the senior author during the period 1952-57. In collecting the hydrologic data he was assisted by R. L. Washburn in 1952-53, by G. L. Buley in 1954, and by P. W. Hildebrand in 1954-55. Additional field work, consisting of geologic mapping in the eastern part of the area and field checking, was done by the junior author during 1958-59.

In general, the geologic mapping consisted of detailed reconnaissance in areas underlain by rocks of Tertiary age, and more detailed study in areas of younger rock materials, which are more important, as sources of ground water. The mapping was facilitated by the use of aerial photographs.

The field data, together with climatological and streamflow records, were analyzed and interpreted in terms of ground-water occurrence, availability, and suitability for use.

In 1956, after the bulk of the hydrologic data had been completed, a preliminary report, presenting records of wells and springs, water levels, and chemical quality of ground water in the area, was released for public dissemination (Weigle and Washburn, 1956). Most of those data are presented in this report.

In any area, the occurrence, availability, and movement of ground water are closely controlled by the geology, and are influenced by climate, landforms, and drainage. Therefore, in this report, geologic and geographic factors are discussed to provide a backgraound of information necessary for the best understanding of the hydrology of the area.

The investigation was made under the general direction of A. N. Sayre, former Chief, and P. E. LaMoreaux, present Chief, Ground Water Branch, U.S. Geological Survey, and Murray G. Walker, Supervisor, State Division of Water Resources, and under the direct supervision of M. J. Mundorff, former District Geologist, and A. A. Garrett, District Engineer of the Ground Water Branch in the State of Washington, and Robert H. Russell, Assistant Supervisor, State Division of Water Resources.

Location and Extent of the Area

Lewis County is within the Puget Trough in southwestern Washington (see p. 5). The county extends from the crest of the Cascade Mountains westward for some 90 miles to the Coast Range, and is about 25 miles wide in a north-south direction. The center of the county is about 33 miles south of the southern end of Puget Sound.

This investigation covers an irregularly shaped area of about 830 square miles in the western and central parts of Lewis County, which include most of the population and ground-water development. The area spans the county from north to south within the west-central lowland and extends eastward and westward up the valleys of the major streams (fig. 1).

Previous Investigations

One previous ground-water investigation was made on part of the area covered by this report; W. N. Schlax, Jr. (1947) made a preliminary study of southwestern Thurston County (fig. 1) that extended about 10 miles southward up the floor of the Chehalis River valley in Lewis County (fig. 3). His report describes geologic features that control the occurrence and availability of the ground water, and includes records of wells and springs.

Several geologic studies, differing greatly in intensiveness and emphasis, have been made in and adjacent to the area of this investigation. Reports of most of those studies are cited in the section of this report dealing with geology and are listed at the end of this report. However, most of the previous geologic stud-

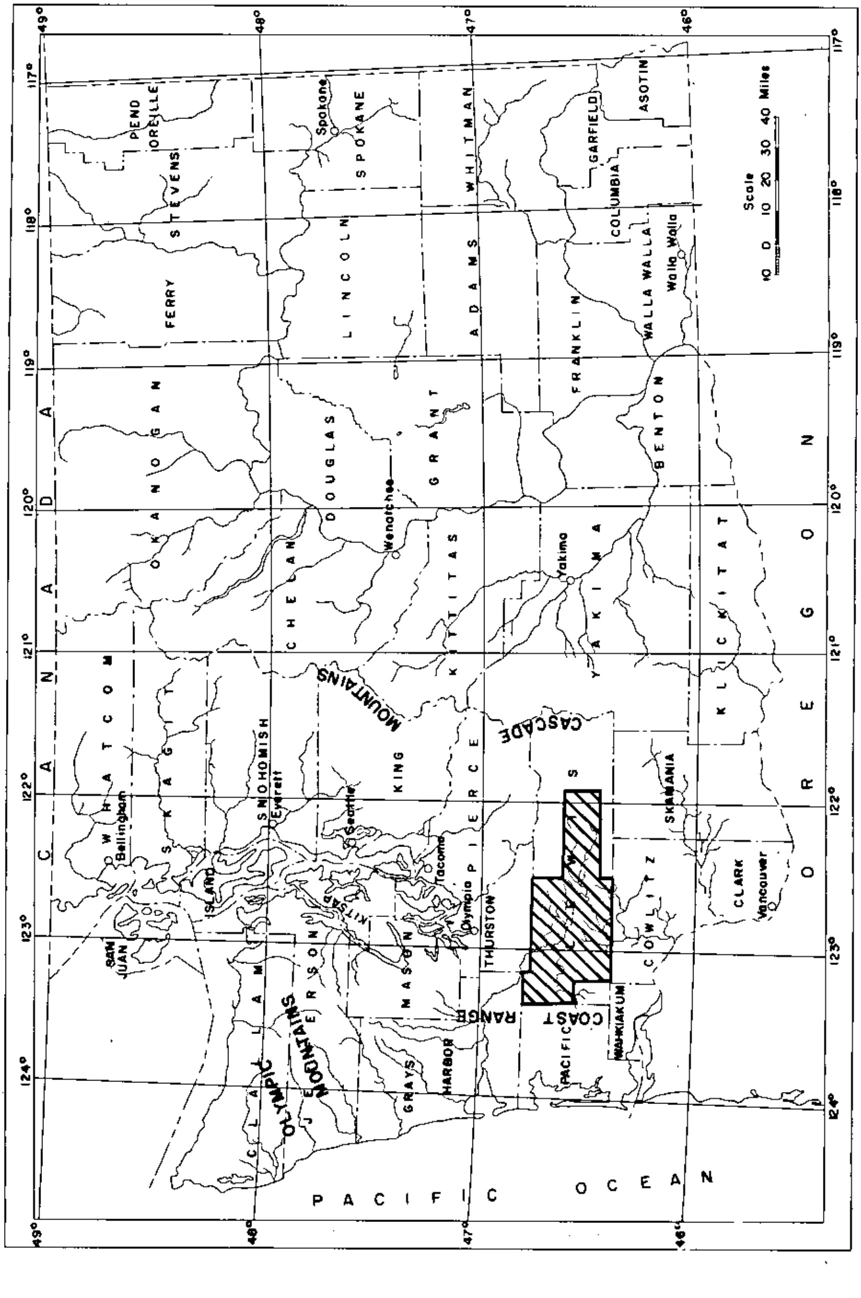


Figure 1.--Map of the State Washington showing area covered by this investigation.

ies were not concerned primarily with the water-bearing materials of Quarternary age and, therefore, did not treat them in detail sufficient for this study. Hence, additional geologic mapping has been necessary for this investigation, even in areas for which geologic maps already were in existence.

Well-Numbering System

In this report wells are designated by symbols that indicate their location according to the rectangular public-land survey. For example, in the symbol 12/2-17C2, the part preceding the hyphen indicates successively the township and range (T. 12 N., R. 2 E.) north and east of the Willamette base line and meridian. All townships in Washington are north of the Willamette base line. The letter "W" indicates ranges west of the meridian, but the letter "E" is omitted because most of the State is east of the meridian. The first number after the hyphen indicates the section (sec. 17), and the letter (C) gives the 40-acre subdivision of the section, as shown in figure 2. The last number is the serial number of the well in the particular 40-acre tract. Thus, well 12/2-17C2 is the second well canvassed in the NE¼ NW¼ sec. 17, T. 12 N., R. 2 E.

Springs are numbered in the same manner except that the letter "s" is added after the serial number. Thus, the first spring listed for the NE¼ NW¼ sec. 17 would have the number 12/2-17C1s.

Acknowledgments

This investigation was facilitated by the assistance of many individuals. Well data were provided by well owners and users, by well drillers, and by pump companies. Additional valuable assistance and information were given by R. E. Roffler, Lewis County Extension Agent, U.S. Department of Agriculture; personnel of the U.S. Soil Conservation Service; City of Tacoma, Light Division; and the Northern Pacific Railway Co. The friendly cooperation of all is gratefully acknowledged.

Landforms

The populous central part of Lewis County lies within the Puget Trough section of the Pacific Border physiographic province (Fenneman, 1931, p. 443-454). It extends east into the northern Cascade section of the Sierra-Cascade province and west into the Olympic Mountains section of the Pacific Border province. The Puget Trough is a huge valley that extends from Oregon due north across Washington and into British Columbia. Within the State of Washington the northern half of the Puget Trough is occupied by Puget Sound and the various straits surrounding the San Juan Islands; the southern half comprises the valley of the Cowlitz River and the upper basin of the Chehalis River.

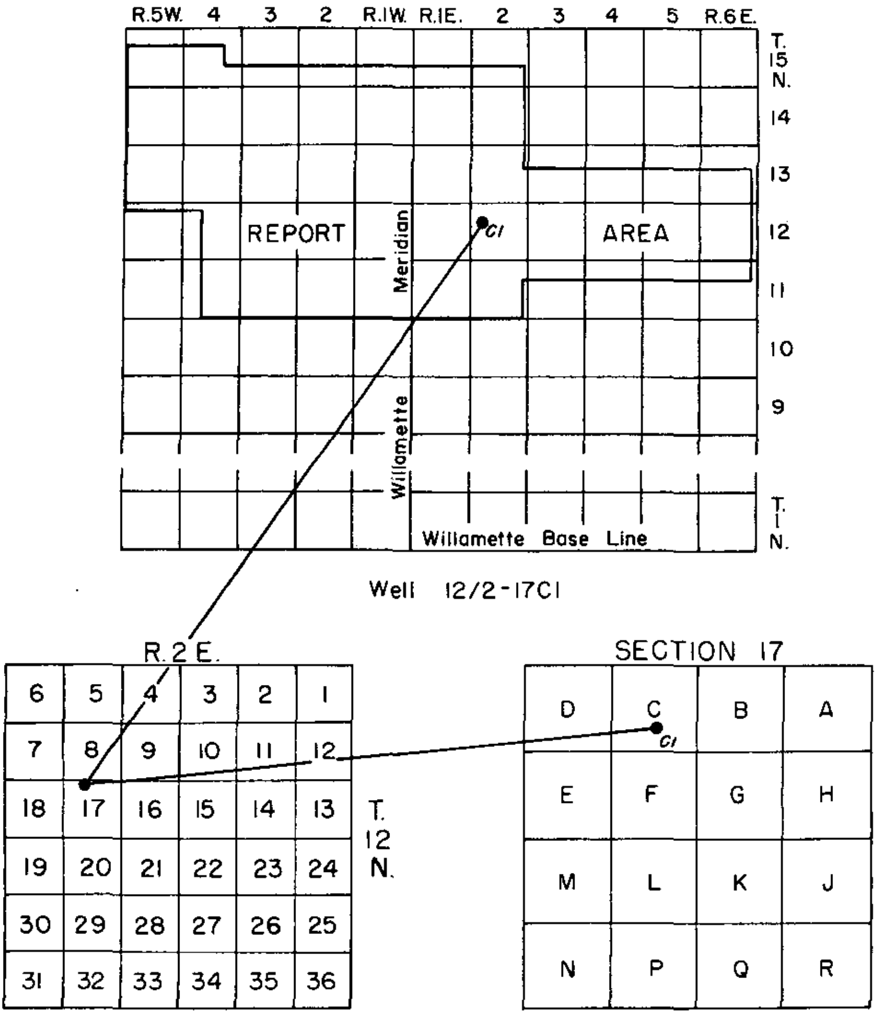


Figure 2.-- Sketch showing well-numbering system.

West-Central Lowland

The area of greatest ground-water development in Lewis County, and therefore of greatest importance in this investigation, is the area herein referred to as the "west-central lowland." This lowland is a roughly triangular area whose corners lie approximately at Centralia, Mayfield, and Vader (fig. 3). It is the central part of a structural and topographic basin which is surrounded by well-dissected hills rising as much as 2,000 feet above the flood plains of the major streams. Altitudes within the west-central lowland range from about 1,100 feet in the eastern part to less than 100 feet on the flood plain of the Cowlitz River at the southern boundary of the county. The overall slope of the lowland in general follows the major drainage pattern. In the eastern and southern parts the general slope is to the west and southwest, respectively; in the northern part, from the vicinity of Napavine northward, the general slope is to the northwest and north. The topography of the lowland is mainly one of broad upland plains, terraces that narrow at successively lower levels, and flood plains associated with the present drainage.

The benches and terraces were formed by a sequence of events that began in the early part of the Pleistocene epoch. During that time, the basin was partly filled with deposits of silt, sand and gravel. Streams, at times fed by glaciers, subsequently discharged across that fill, eroding broad valleys and formed terraces of alluvium and glacial-outwash materials (fig. 3). The oldest and most extensive terraces, which are here termed upland plains, lie at the highest levels, while progressively younger terraces lie steplike at successively lower levels.

The younger and lower terraces are relatively flat. The older, upland plains have undergone extensive erosion by stream action and present a more or less rolling surface, marked in many places by deep gullies extending back from the scarps. Landslides have occurred at many places along terrace scarps throughout the west-central lowland. Many of these landslides individually involve one-tenth of a square mile or more of land surface, and at some places landslides of different ages abut or overlap to form belts a quarter of a mile, or more, wide and several miles long.

In order to facilitate further discussion of the west-central lowland, its major physiographic features are delineated as follows: (1) Upland plains, comprising the upper and oldest benches and tablelands within the lowland area; (2) Intermediate terraces and benches; (3) Flood plains and adjacent low-lying terraces. The areas that constitute these physiographic divisions are shown in figure 3.

Upland plains

The upland plains are remnants of a formerly continuous surface on the basin fill. The ancient surface is represented by Jackson Prairie (T. 12 N., R. 1 W.), Alpha Prairie (T. 13 N., R. 1 E.), Logan Hill (Tps. 13 and 14 N., R. 1 W.), and smaller unnamed remnants west of Olequa Creek (Tps. 11 and 12 N., R. 2 W.), south of Mayfield, and along the Chehalis River at the west and northwest margins of the lowland (see pl. 1 and fig. 3). The surface of the upland plains is gently to moderately rolling. The highest knolls show a marked concordance, and

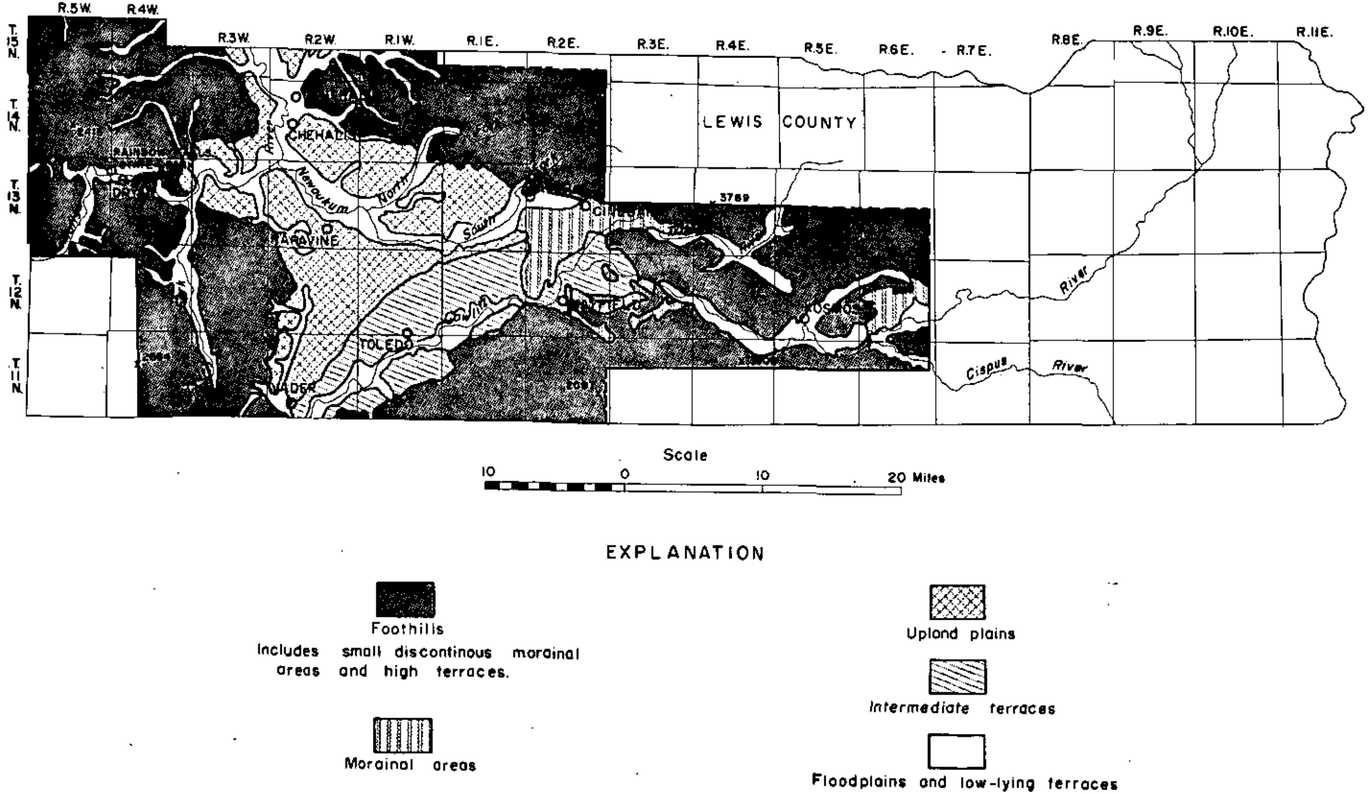


Figure 3.-- Map showing detailed physiographic divisions and ground-water provinces in area studied in Lewis County.

if connected would form a surface sloping generally to the west and southwest at about 20 to 30 feet per mile, from altitudes of about 900 feet near the eastern limit to about 400 feet in the western part of the lowland. Along the east, north, and west margins of the lowland, the upper surfaces on the fill slope upward more steeply against the surrounding hills.

Intermediate terraces

Some of the terraces intermediate (in age and altitude) between the upland plains and the flood plains are extensive enough, and of sufficient geologic and hydrologic importance, to warrant separate discussion. These, in order of decreasing age, are referred to herein as the Lacamas Creek terrace, the Newaukum terrace and equivalents, and the Layton Prairie terrace.

Lacamas Creek terrace.--The Lacamas Creek terrace is the most extensive of the intermediate terraces. It abuts the southeast side of the Jackson Prairie upland plain, parallel to, and north of, the Cowlitz River. It is about 150 feet lower than Jackson Prairie and 200 to 450 feet higher than the flood plain of the Cowlitz. It extends from the confluence of the Cowlitz River and Lacamas Creek northeastward for about 17 miles, to the valley of Mill Creek, and is 3 miles wide at its widest point. The surface slopes southwestward at a decreasing rate, from an altitude of about 740 feet near Salkum to about 240 feet where it terminates about a mile northeast of Vader. The total area is about 43 square miles.

Newaukum terrace and equivalents.--The city of Chehalis is built largely on remnants of a terrace that rises about 20 feet above the flood plain of the Newaukum River. Other remnants ranging up to 2 miles in width extend discontinuously in an easterly direction up the valleys of the Newaukum and its South Fork and into the valley of Kearney Creek to the vicinity of Cinebar, where the terrace surface is no longer clearly defined. As far as the remnants can be traced they maintain a constant relative elevation of 20 to 30 feet above the flood plains of adjacent streams. These terrace remnants are referred to collectively as the Newaukum terrace.

Similar terrace remnants are found along the valley of the Cowlitz River in the reach between Toledo and the mouth of Mill Creek. These segments range from about one-half to 1 mile in width and up to 7 miles in length. Terrace remnants of this group abut against the Lacamas Creek bench on its southeast side, at levels ranging from about 120 feet (near Salkum) to about 40 feet (near Toledo) below the surface of that bench.

On the basis of comparative altitudes, similarity of underlying material, and areal relationships, the terrace remnants in the Cowlitz River valley probably are contemporaneous with the Newaukum terrace, and probably were joined formerly with the Newaukum terrace in the area between the communities of Cinebar and Silver Creek (pl. 1, Tps. 12 and 13 N., R. 2 E.). This possibility will be discussed further in the section on geology.

Layton Prairie terrace.--The Layton Prairie terrace lies parallel to, and mostly south of, the Cowlitz River, and extends discontinuously from the Mossyrock-Ajlune area (pl. 5, T. 12 N., R. 3 E.) southwest past the southern boundary of Lewis County. The largest remnant of this surface is Layton Prairie, which overlooks the flood plain of the Cowlitz River east of Toledo and abuts the hills to the south (pl. 1). Layton Prairie averages about 2 miles in width and more than 5 miles in length.

From an altitude of about 650 feet at Mossyrock the remnants constituting the Layton Prairie terrace descend to about 200 feet near Toledo, an average slope to the southwest of 24 feet per mile. The terrace remnants, which are relatively flat, range from about 300 feet above the Cowlitz River at Mossyrock to 120 feet above that river near Toledo.

Flood plains and low-lying terraces

Within the west-central lowland the floor of the Chehalis River valley is relatively broad and flat. A plain as wide as 2 miles occupies the Chehalis River valley from the border of Thurston County to the vicinity of Claquato, about 9 miles south (pl. 2). In the next 6 miles upstream (west) from Claquato, the flood plain narrows only slightly, and is about 1½ miles wide near the communities of Littell and Millburn. Farther west, the flood plain narrows considerably, and upstream from Millburn it seldom is as wide as 1 mile.

Several minor terraces rise steplike from the flood plain of the Cowlitz River up to the Layton Prairie terrace. These terraces cannot be related to the more extensive benches, and they apparently represent rather transitory former levels of the Cowlitz River, probably during late Pleistocene and Recent time.

Foothills Area

In general, the higher land surrounding the west-central lowland is well dissected and rugged. The topographic features consist mainly of crags, knobs, and sharp ridges, sloping steeply to deep canyons and valleys. Numerous small, swift streams that drain the upland areas are actively eroding their channels, thus maintaining the rugged topography.

Although the hills west and east of the lowland rise as much as 2,000 and 4,000 feet, respectively, above the upland plains, they are small in comparison to peaks of the adjacent Cascade and Olympic Mountains. For this reason the hilly areas that lie outside the west-central lowland are referred to collectively in this report as the foothills area. Altitudes in the foothills area rarely exceed 4,000 feet; Mount Rainier, 6 miles north of the northern boundary of Lewis County is 14,410 feet high and Mount St. Helens, 14 miles south of the southern boundary, has a peak elevation of 9,671 feet.

Although most of the surface of the foothills area is well dissected, obvious remnants of ancient plains exist in places, notably in the east and south. Easily distinguishable in the hills south and east of Toledo are segments of an old plain, at present about 650 feet above sea level. Remnants of another old surface lie at 1,050 to 1,100 feet above sea level between Alpha and Mayfield, and vestiges of still other ancient surfaces are found at higher altitudes.

Upper Cowlitz River Valley

About $1\frac{1}{2}$ miles upstream from the mouth of Mill Creek (NE$\frac{1}{4}$ NE$\frac{1}{4}$ sec. 23, T. 12 N., R. 1 E.), the floor of the Cowlitz River valley is sharply constricted by a body of consolidated rocks that forms a steep-walled canyon, as deep as 450 feet near Mayfield. In the next 15-mile reach upstream the Cowlitz passes through a series of steep, and sometimes spectacular, gorges eroded in the consolidated rocks. Upstream from the vicinity of Riffe (sec. 24, T. 12 N., R. 3 E.) the valley floor gradually widens. Near the eastern edge of the area it is a relatively flat surface, as much as 3 miles wide, which rises sharply to the mountains on the north and south.

Glaciated Areas in Eastern Lewis County

The area immediately east of the west-central lowland includes a variety of landforms, many of which are related to glaciation. The topographic features include outwash plains and benches, shallow valleys and kettles, knolls, low hills, and drumlins. This area, which lies between and adjacent to Mill Creek and the Tilton River, north of the Cowlitz River and generally south of State Highway 5K, is referred to in this report as the Cinebar morainal area.

Topographic effects of glaciation, such as U-shaped valleys, hanging valleys, cirques, roches moutonées, and rock drumlins, also can be seen in the foothills and major valleys east of Mossyrock. Only the larger areas exhibiting morainal characteristics are outlined on figure 3.

Drainage

Two river systems--the Chehalis-Newaukum and the Cowlitz--drain most of Lewis County. The major drainage areas in the county are shown on figure 4.

Present drainage is from the eastern and western foothills areas, into the west-central basin, and out of Lewis County by way of the Chehalis and Cowlitz Rivers. The Chehalis River flows northward into Thurston County at a point 5 miles northwest of Centralia, and the Cowlitz River flows southward into Cowlitz County about 5 miles southwest of Toledo. The drainage divide between the Chehalis-Newaukum and the Cowlitz drainage systems trends generally west-southwest across the west-central lowland, and from there southward. Within the lowland the divide is formed by undulations on the Jackson Prairie upland plain, and is low and relatively inconspicuous.

An area of about 745 square miles in Lewis County is drained by the Chehalis-Newaukum River system; of that area, approximately 600 square miles is within the area studied. The Cowlitz River drains about 1,280 square miles of Lewis County, of which about one half is within the area of this study. About 265 square miles of the county is drained by other streams not important to this investigation (fig. 4).

The present drainage pattern was determined in part by the geologic structure of the area, as is explained in the following discussion of the major rivers and their principal tributaries.

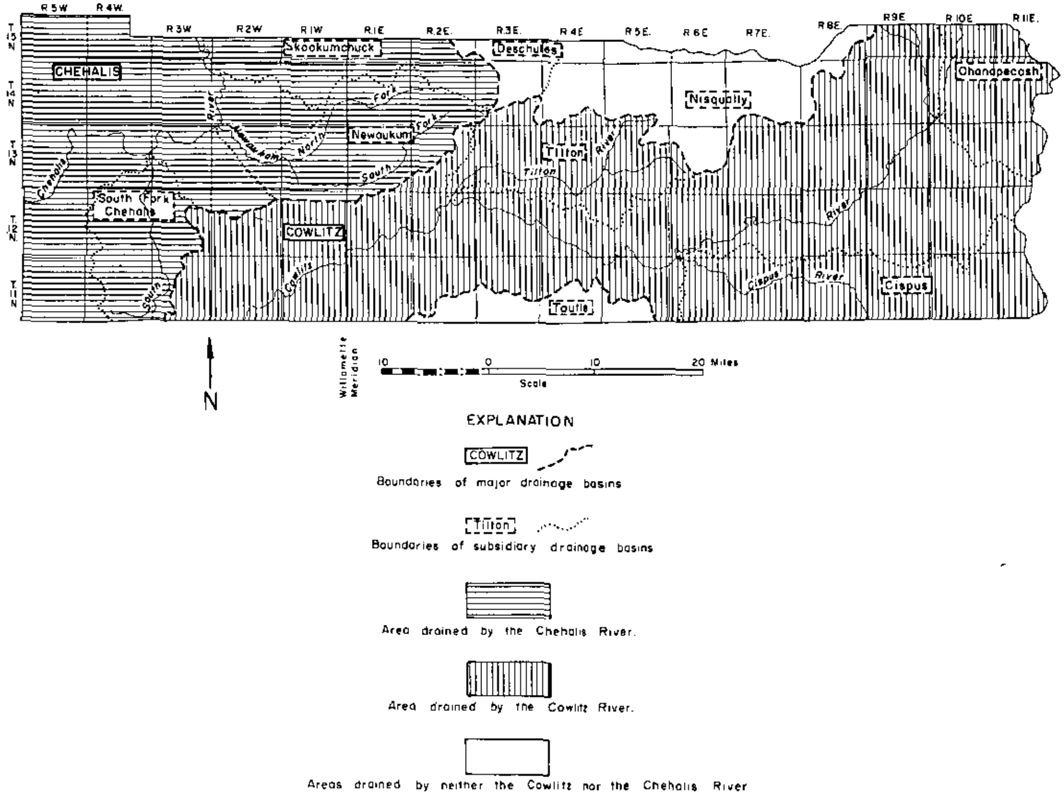


Figure 4.--Map showing major drainage areas in Lewis County.

The Cowlitz River

From its origin in glaciers on Mount Rainier and in lakes and springs on the upper slopes of the Cascade Range, the Cowlitz River flows west and southwest to its junction with Lacamas Creek near Vader (pl. 1), and thence south to the Columbia River 25 miles south of Lewis County. Upstream from the west-central lowland the Cispus and Tilton Rivers are the main tributaries of the Cowlitz River, and within the lowland the Salmon, Lacamas and Olequa Creeks (pl. 1) are the principal tributaries. Across the west-central basin--that is, from Mayfield southwest to the Lewis-Cowlitz County line--the Cowlitz River loses about 210 feet of altitude, or an average of 7.5 feet per mile. East of Mayfield the gradient of the Cowlitz steepens considerably; it is doubled in the first 10 miles upstream from Mayfield and becomes even steeper to the east.

The Chehalis River

From its headwaters in the highlands of western Lewis County, largely beyond the area mapped, the Chehalis River flows generally east and northeast to its confluence with the Newaukum River near Chehalis. From Chehalis the river flows north to Centralia, northwest into Thurston County, and ultimately empties into the Pacific Ocean near Aberdeen, about 45 miles west-northwest of Centralia. Of its many tributary streams, the Newaukum River, the South Fork of the Chehalis River, Lincoln Creek and Hanaford Creek (pl. 1) are the most important.

In the northwest part of Lewis County and especially in Tps. 13 and 14 N., Rs. 4 and 5 W., the drainage pattern is controlled to a considerable degree by the geologic structure. Two sets of faults and folds, trending generally east-west and north-south, have caused a rectangular drainage pattern (pls. 2 and 3). This pattern is most evident in the trends of the small streams in the foothills areas but it is apparent also from the course of the Chehalis River upstream from Adna (sec. 9, T. 13 N., R. 3 W.). The geologic structure of this part of the area is described briefly by Pease and Hoover (1957).

In its course from Adna to the Thurston County line the Chehalis River has an average gradient of only 1.8 feet per mile--the gentlest stream gradient within the county. Also, in this reach the river is associated with the widest flood plain and has a well-developed meandering channel pattern within the area. Elsewhere, upstream from the west-central lowland, the gradient of the Chehalis River ranges from about 5 to 10 feet per mile.

The Newaukum River

The Newaukum River rises in the foothills that bound the west-central lowland on the northeast and flows generally westward across the northern part of the lowland to join the Chehalis River at Chehalis.

The drainage pattern of the Newaukum and its tributaries hints strongly at control by a right-angle structural pattern oriented generally northwest and northeast, similar to the fault pattern in the area east of Centralia and Chehalis demonstrated by Snavely and others (1958, p. 86, pl. 1). A rude rectangular pattern is formed by the lower course of the Newaukum and, at places, by its tributaries. However, at other places, notably in areas of deep valley fill, the drainage pattern is dendritic.

The gradient of the Newaukum River averages 9.5 feet per mile. The gradients of its North and South Forks are considerably greater, even within the west-central lowland. The gradient of the South Fork, for example, is as great as 30 feet per mile near Onalaska.

Climate

The climate of Lewis County is typical of that of the Pacific Northwest region between the Cascade Mountains and the Pacific Ocean. Winters are wet and mild and summers are relatively warm and dry.

Lewis County lies in the path of the prevailing westerly winds and because it is not far east of the Pacific Ocean its climate is generally influenced by air which has traveled far over the Pacific Ocean and which has picked up considerable moisture in its lower two or three thousand feet. Besides providing moderate to large amounts of precipitation, this maritime air exerts a modifying influence on the temperature, especially in the western and central parts of the county. In eastern Lewis County the air is drier and, consequently, the range of both daily and seasonal temperatures is greater. The generally equable weather conditions are altered only occasionally by masses of drier air from the east.

Precipitation

Although it is relatively dry in the summer, Lewis County has considerable winter precipitation. The precipitation attains a maximum during December and a minimum during July or August. Centralia, for example, during the period of record, 1890-1955, has received a mean monthly precipitation of 7.56 inches in December and 0.61 inch in July (fig. 5). Three-fourths--75.4 percent--of the 44.77 inches annual precipitation at Centralia during that period fell between October 1 and March 31.

Figure 6 shows seasonal and areal variation of precipitation in Lewis County. The bar graphs show that the pattern of seasonal distribution is similar throughout the county, whereas the map shows that the total annual precipitation varies significantly from place to place. In general, within the area of this study, the mean annual precipitation is lowest, 45 inches per year, at Centralia, 52 inches at Rainbow Falls State Park, and 77 inches at Cinebar.

Figure 6 also indicates a precipitation trough that includes Centralia, Rainbow Falls State Park and Toledo and whose axis trends generally southeast. This trough coincides with a topographic low through which the moisture-bearing winds commonly are channeled.

A precipitation high extends from Paradise, on the southwest slope of Mount Rainier, to the southwest through Longmire, Mineral and Cinebar. The precipitation is concentrated in this part of the area as moisture-laden air, moving

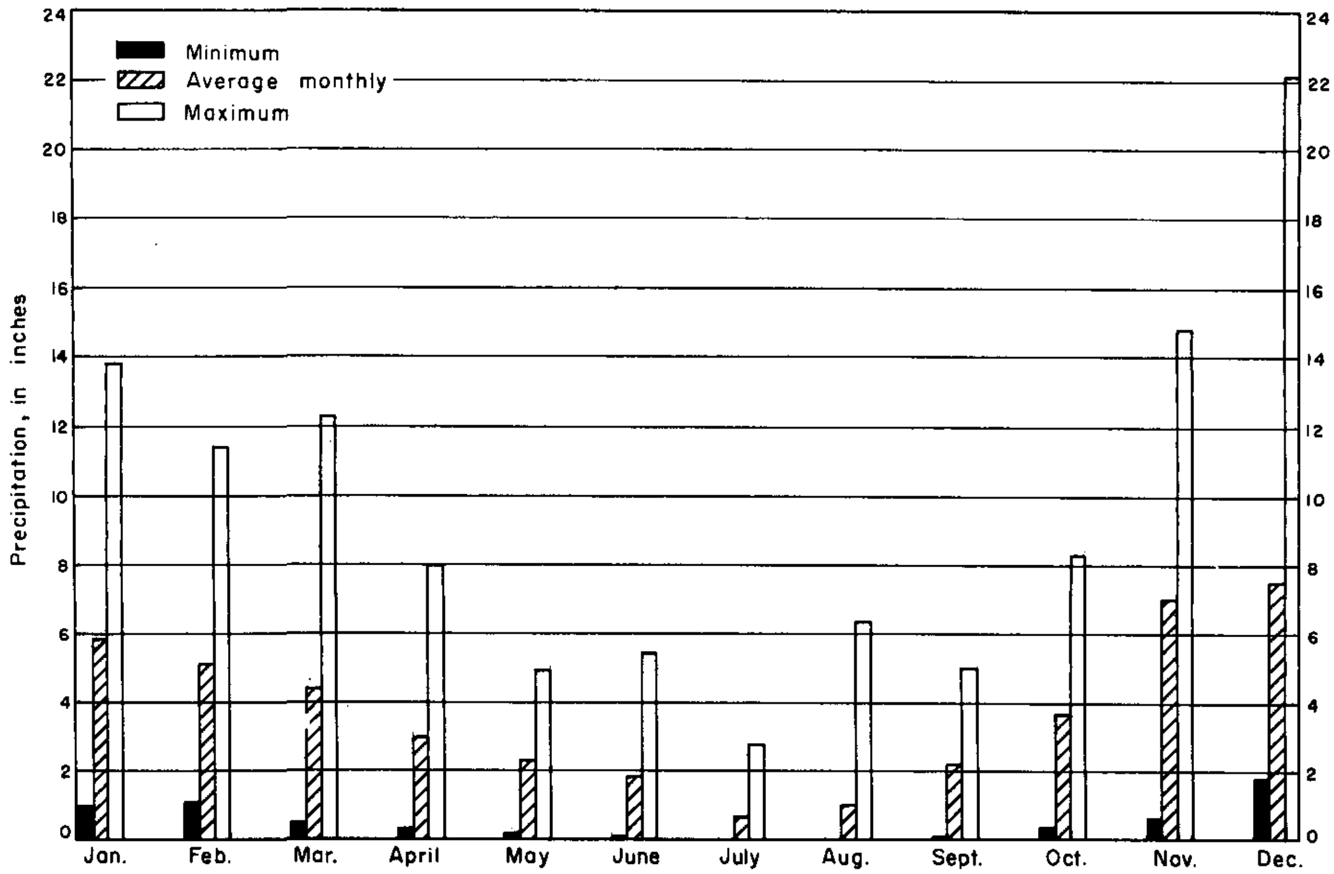


Figure 5.-- Range in precipitation at Centralia for the period 1890-1955.

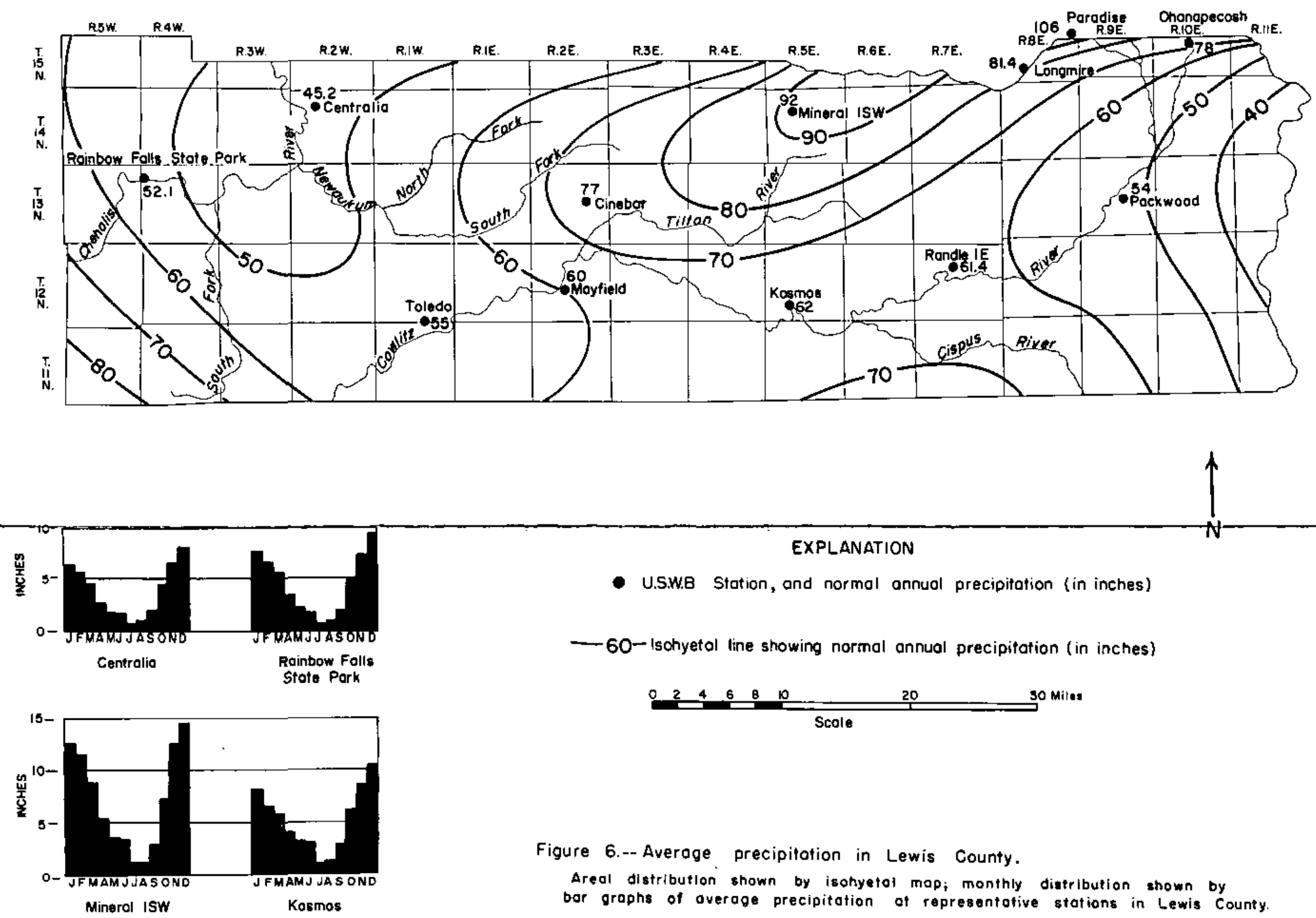


Figure 6.-- Average precipitation in Lewis County.
Areal distribution shown by isohyetal map; monthly distribution shown by bar graphs of average precipitation at representative stations in Lewis County.
(Based on U. S. Weather Bureau records.)

from the southwest during the wettest months (November, December, and January), begins to rise over a series of hills and mountains, including Mount Rainier (altitude 14,410 feet).

In Lewis County some correlation exists between altitude and mean annual precipitation. A definite increase in precipitation as associated with increase in altitude but other factors, such as adjacent topographic features and proximity to the ocean, also affect precipitation to such an extent that an accurate correlation cannot be made on the basis of altitude alone.

An appreciable part of the precipitation in Lewis County is snow. Both the amount of snowfall and the persistence of the snow cover are related to altitude. At altitudes below about 1,200 feet the annual snowfall is 1 to 25 inches and the snow cover does not normally persist more than a few days or a week. At higher levels, however, not only does a greater amount and higher percentage of precipitation fall as snow but also the snow melts more slowly because of generally lower temperatures. Longmire, at 2,761 feet above sea level, receives a mean annual snowfall of about 100 inches per year, and Paradise, at 5,550 feet above sea level, receives nearly 500 inches per year (fig. 6).

Precipitation that falls as rain begins its contribution to surface runoff and ground-water recharge relatively soon after it reaches the ground. Water that falls as snow, however, is "locked up" temporarily and does not add to ground-water recharge or to surface runoff until it melts.

Most inhabited areas in Lewis County are below 1,200 feet in altitude and snowfall in those areas is not of prime importance to ground-water problems. However, in the highlands (above 2,000 feet) snow from successive storms may accumulate for several weeks or months, absorbing some rainfall, until hugh volumes of water are stored in the snow pack. If this water is released rather abruptly, as with the advent of warm weather or heavy rain, only a small part of the water has time to infiltrate into the earth as ground-water recharge, and the greater part is carried off in streams. Conversely, if melting is relatively slow, there is more opportunity for recharge, more loss from the area as evaporation and as transpiration by vegetation, and less of the water flows off as direct surface runoff.

Temperature

Lewis County normally is dominated by air moving in from the Pacific Ocean; hence, generally mild temperatures prevail over the area through most of the year, although exceptions occur during the rather infrequent invasions of drier air from the north and east. The mean annual temperature at Centralia, at an altitude of 185 feet, is 51.4°F; the monthly mean temperatures for July and January are 64.4°F and 38.6°F. Kosmos, at an altitude of 755 feet, and Longmire, at 2,762 feet, have mean annual temperatures of 50.4°F and 44.6°F.

Seasonal and diurnal temperature ranges in Lewis County do not appear to vary appreciably with altitude. The difference between mean monthly temperatures for July--the warmest month--and January--the coldest month--is only 25° to 30°F. In most of the area, the mean daily temperature range amounts to 20° or 25°F. In winter the daily range is only 11° or 12°F, primarily because of the generally overcast conditions and increased humidity; in summer the daily range increases to about 30°F, because of the clearer skies and lower humidity.

The length of the growing season, between the last killing frost in spring and the first killing frost in autumn, is dependent on many factors, including latitude, altitude, slope, direction of exposure, proximity to the ocean and other bodies of water, and position with regard to large valleys. Hence, as would be expected, the growing season ranges considerably within Lewis County; it averages 169 days at Centralia, 146 days at Kosmos, and 134 days at Longmire.

Humidity

No humidity data are available for the area of this study, but relative humidity is measured at stations at Olympia, Kelso, and Tacoma, respectively, 22 miles north-northeast, 40 miles south, and 43 miles northeast of Centralia. Humidity figures obtained from those stations are the best obtainable, but they may be several percent higher than exist in Lewis County, particularly in the eastern part, owing to differences in distance from the Pacific Ocean and from Puget Sound.

In winter the relative humidity of air moving into the Pacific Northwest from the ocean is high and it remains so until after considerable moisture has been lost to precipitation as the air is forced up the western slope of the Cascade Range. During the winter months relative humidities of 80 to 90 percent are recorded at the stations cited above. The general winter overcast and the high moisture content of the air diminish the heating effect of the sun and subdue the ability of the air to evaporate water from the ground cover during that season of the year.

In summer, radiation from the warm land surface raises the temperature of the air and consequently lowers the daily average relative humidity to 65 or 75 percent at the above stations. Although the actual amount of moisture in the air may remain fairly constant throughout the day, afternoon heating of the air in the summer lowers the relative humidity considerably. Thus, in July the relative humidity at the above stations often drops from about 90 percent at 4:30 a.m. to 45 or 55 percent by 4:30 p.m. Occasional invasions of drier air from the east lower the relative humidity still more.

Economic Development

The population of Lewis County is predominantly rural and is concentrated in the Centralia-Chehalis area, which serves the commercial interests of surrounding lumbering and agricultural activities. In 1960 the combined population of Centralia and Chehalis was 13,785 as compared with 41,858 for the county as a whole. Population in the foothills area is sparse.

Lumbering, animal husbandry, farming, and, to a lesser extent, metal mining constitute the major industries in the area. Of these, lumbering has been and still is important in the economy of the county, although most of the remaining timber is on the mountains and the high foothills.

Much of the land, especially at low and intermediate levels, has been logged off and is used for woodlot and agricultural purposes. The chief agricultural products include poultry and poultry products, dairy products, livestock, hay and grain, nuts, fruits, and berries.

Coal mining has been an important enterprise in the past, but is not a major industry at present. Past production has been recorded (Culver, 1919, app. B) of at least 23 coal mines within the county, but only four were operating in 1952 (Snavely and others, 1958, p. 105). The Centralia-Chehalis district has accounted for most of the production, although thin beds of lignite and bituminous coal occur widely throughout the central part of the county.

Metalliferous ores, principally those of arsenic and mercury, also have been mined in small amounts in Lewis County.

GEOLOGY

Ground-water occurrence in a specific area can best be understood only if consideration is given to the geologic conditions in that area. The rock types, their thickness and extent, and the degree to which they have been altered, indurated, or deformed, all are important factors controlling the occurrence, movement and availability of ground water. Geologic conditions differ from place to place within an area, and even vary within the same rock unit, depending upon the environment at the time of deposition, and upon subsequent changes in conditions.

The rock materials exposed in Lewis County, so far as is known, are of Tertiary and Quaternary ages. Those of Tertiary age are predominantly volcanic rocks and fine-grained sedimentary rocks, such as shale, siltstone, and sandstone, but include also, in lesser amounts, pyroclastic rocks and conglomerate. They have undergone warping, folding, and faulting. The deposits of Quaternary age are predominantly coarser grained materials, such as gravel, sand,and conglomerate, but they include occasional strata of glacial till, loess,and volcanic ash and pumice. In general, the foothills and mountains in Lewis County are made up of rocks of Tertiary age and the lowlands are occupied by deposits of Quaternary age.

Rock Units and Their Water-Bearing Characteristics

Tertiary System

With few exceptions, the materials of Tertiary age yield only small amounts of ground water to wells and some of the water is so highly mineralized as to be unsuitable for most uses. Hence, detailed study of these materials is not important to the objectives of this investigation. For this reason and because they have been adequately mapped and described throughout much of the area by other workers, most of the Tertiary rock units were not delineated during the mapping for this investigation and are shown on the geologic maps as Tertiary rocks, undifferentiated. However, the individual rock units of Tertiary age, their stratigraphic relationships and their water-bearing character are discussed briefly in the following pages.

Rocks of Eocene and Oligocene age

The rocks that were deposited in the area during the Eocene and Oligocene epochs of the Tertiary period consist chiefly of fine-grained marine or brackish-water sedimentary rocks, interbedded with volcanic and pyroclastic rocks, and agglomerate. They include, from oldest to youngest, the Crescent(?) formation of Pease and Hoover (1957), the McIntosh, Northcraft, and Skookumchuck formations of Snavely and others (1951), and most of the Lincoln formation of Weaver (1912, p. 16). Rocks of Eocene or Oligocene age underlie most of the foothills surrounding the west-central lowland and extend beyond the area of this study.

Crescent(?) formation.--The oldest known rocks in the area are a sequence of lava flows and pyroclastic and marine sedimentary rocks that are exposed in the foothills in the western and southwestern parts of the area. Pease and Hoover (1957) tentatively correlated this series with the Crescent formation of Clallam County on the basis of lithology and stratigraphic position, and assigned an age of middle to early-late Eocene on the basis of contained microfossils. Those authors considered the Crescent(?) formation in western Lewis County to be equivalent in age to the lower part of the McIntosh formation farther east.

McIntosh formation.--Marine tuffaceous siltstone and claystone, and interbedded massive basaltic and arkosic sandstone, were mapped in Thurston County northeast of Centralia and Chehalis, assigned a middle Eocene age, and named the McIntosh formation by Snavely and others (1951). The age was later changed to middle and late Eocene (Snavely and others, 1958). Geologic sections prepared by them show that this formation, whose thickness probably exceeds 4,000 feet, extends southward beneath the west-central lowland at depths of 800 feet or more. They correlated the McIntosh formation with dark-gray siltstone, shale, and interbedded massive arkosic sandstone and coal beds that crop out in the Morton area in eastern Lewis County (pl. 5). The McIntosh formation also extends into western Lewis County (Pease and Hoover, 1957), where it underlies much of the foothills area.

The McIntosh formation generally yields only small amounts of water to wells, and much of the water is of such poor quality as to make it unsuitable for most uses. At least five wells in western Lewis County have produced salt water, water containing natural gas, or water of otherwise undesirable quality from rocks of the McIntosh. A few springs and shallow wells that tap weathered materials derived from the McIntosh formation yield water of qualities and in quantities adequate for domestic uses.

Northcraft formation.--The Northcraft formation, of late Eocene age (Snavely and others, 1958, p. 22-26), overlies the McIntosh formation throughout much of the area. The Northcraft formation consists chiefly of lavas, flow breccia, pyroclastic rocks, basaltic conglomerates and sandstone, whose total thickness may exceed 1,200 feet at places. The Northcraft crops out only in the northeastern and eastern parts of the area, from the vicinity of Mendota (sec. 3, T. 14 N., R. 1 W.) eastward beyond Morton (Snavely and others, 1958, p. 23, pl. 1), and southeastward beyond Mayfield (Roberts, 1958, p. 13). The Northcraft probably extends to a considerable depth beneath the eastern and northern parts of the west-central lowland, but it is not known to be present west of the Chehalis River.

Lavas of the Northcraft formation constitute the bedrock of the Mossyrock area and the foundation rock at the sites of the proposed Mayfield and Mossyrock Dams. At least 10 wells and numerous test holes penetrate the Northcraft in the Mossyrock-Mayfield area. The few records available from those wells indicate that some water is obtainable from sandy interbedded materials where they are present, but only meager amounts can be expected from the volcanic rocks. Of those 10 wells, yields from 5 were reported to be inadequate and that from 1 barely adequate for domestic use, even though all but 1 penetrated at least 150 feet into the Northcraft rocks. Yields from 2 other wells are considered adequate, but the quality of the water is objectionable. The most productive well tapping the Northcraft formation is well 12/2-11A1 (pl 1). It was drilled through about 300 feet of Northcraft rocks, and reportedly was bailed at a rate of 42 gpm (gallons per minute), with a resulting waterlevel drawdown of about 60 feet.

Some wells that did not produce sufficient water from the Northcraft formation later yielded supplies adequate for domestic use from shallow materials overlying that formation.

Skookumchuck formation and equivalents.--Marine fossiliferous sandstone and shale exposed along the bed of Olequa Creek from sec. 5, T. 11 N., R. 2 W., south beyond the border of Lewis County were described by Weaver (1937, p. 90) as the Cowlitz formation of late Eocene age. Weaver also described (1937, p. 53-74) the Puget group, a thick alternating sequence of continental sandstone and shale, with interbedded coal and associated gas, in the western foothills of the Cascade Mountains in parts of Washington. According to Weaver, these continental deposits interfinger to the west with the marine sediments of the Cowlitz formation. Erdmann and Bateman (1951, p. 39-40) mentioned that exposures of the Puget group occur in the neighborhood of Morton, and there consist mainly of sandstone, siltstone, carbonaceous shale, and coal. Roberts (1958, pl. 1) mapped beds of the Cowlitz formation southeast of the Cowlitz River near the southern boundary of Lewis County.

Snavely and others (1951) described a sequence of marine, nonmarine, and brackish-water sedimentary rocks (predominantly massive, cross-bedded sandstone and thin-bedded siltstone) with intercalated coal beds in the foothills east and northeast of Centralia, named them the Skookumchuck formation, and assigned them an age of late Eocene. They correlated these sedimentary rocks, which overlie the Northcraft formation, with the Cowlitz formation of Weaver. Pease and Hoover (1957) also described the Skookumchuck in the foothills of western and northwestern Lewis County, where the Skookumchuck is in gradational contact with the underlying McIntosh formation.

The Skookumchuck formation and its southern equivalent, the Cowlitz formation, apparently underlie the entire west-central lowland, although at places the upper surface may be 2,000 feet or more below sea level (Snavely and others, 1958, pl. 2). Rocks of the Skookumchuck formation are exposed most extensively in areas in the foothills northeast and west of the Centralia-Chehalis district, but probably are best known in secs. 29, 30, 33, 34, and 35, T. 15 N., R. 2 W., and in secs. 2, 3, 20, 22, 23, 28, and 29, T. 14 N., R. 2 W. In those areas, which are immediately north and east of the Centralia-Chehalis district, the Skookumchuck formation underlies the upland benches, and has been extensively explored and mined for coal.

More than 60 wells and test holes have been drilled into the Skookumchuck formation and its equivalent rock units within the area studied. Nearly half the wells either did not yield adequate supplies of water or produced water of unsuitable quality, or both. Several other presently used wells tapping the Skookumchuck reportedly yield amounts barely adequate for domestic use, or yield water with undesirable properties. The poor quality apparently results from the presence in the formation of highly saline connate water, and of coal and associated natural gas, which impart an offensive taste, odor, and color to some of the ground water.

At places, the connate water apparently has been flushed from the shallow parts of the Skookumchuck formation, for nearly half the wells tapping that formation reportedly yield water of acceptable quality and in quantities adequate for domestic use. Although yields of 10 gpm (gallons per minute) or more of water of good quality are rarely obtained from the Skookumchuck and Cowlitz formations, a few wells have produced several times that amount. Well 11/2W-34R2, about a mile southeast of the Cowlitz River, near the Cowlitz County boundary, is one of the most productive. It is 60 feet deep and is believed to penetrate rocks of the Cowlitz formation for about 20 feet. It reportedly has a pumping yield of 40 gpm, and a resulting drawdown of 20 feet. A partial field analysis (see table 5) indicates that its water is of unusually good chemical quality for water from the rocks of Eocene age.

A few of the wells tapping the Skookumchuck and Cowlitz formations flow, but those usually tap the deeper zones of the formation, where connate water and natural gas are encountered.

Hatchet Mountain formation.--Roberts (1958, p. 19-24, pl. 1) described a sequence of lava flows, flow breccia, and pyroclastic rocks that overlies the Cowlitz formation in the foothills southeast of the Cowlitz River, in the area covered by the Castle Rock and Toutle quadrangles. Roberts named this sequence the Hatchet Mountain formation, and assigned it to the late Eocene. In the type vicinity of the Hatchet Mountain (largely unmapped in this investigation) the total thickness of these rocks reportedly is more than 1,100 feet. The sequence apparently thins rapidly to the north and west, however, and materials of the Hatchet Mountain formation are not known to be present beneath the west-central lowland.

The water-bearing character of rocks of the Hatchet Mountain formation is unknown, because no wells in Lewis County are known to derive water from it.

Lincoln formation.--The Skookumchuck formation is overlain by the Lincoln formation by Weaver (1912, p. 10-22), a sequence of massive, well-indurated, fine-grained, basaltic tuffaceous sandstone and siltstone, with scattered lenses of conglomerate. Materials of the Lincoln formation are exposed extensively in the foothills east and west of the west-central lowland (Pease and Hoover, 1957; Snavely and others, 1958, p. 35, pl. 1), and they underlie younger deposits that form the upland plain east of the Centralia-Chehalis district and the benches immediately northwest and south of Galvin. They also crop out along both sides of Olequa Creek for a distance of several miles south from Winlock, and probably at other places in the lowland. It appears likely that these sedimentary materials, whose maximum thickness may be as great as 3,500 feet in the western part of the area (Pease and Hoover, 1957), become thin and coarsen toward the east. To the east of Alpha, the formation apparently contains a higher proportion of conglomerate than it does farther west. In the Centralia-Chehalis area, the formation reportedly includes beds that range in age from late Eocene to late Oligocene (Snavely and others, 1958, p. 43), but in western Lewis County, paleontologic evidence indicates that the Lincoln formation also includes beds of early Miocene age (Pease and Hoover, 1957).

In southern Lewis County, southeast of the Cowlitz River, about 570 feet of basaltic conglomerate, sandstone, siltstone, and clay--associated locally with beds of lignite and interbedded basalt flows--rests unconformably on the Hatchet Mountain and Cowlitz formations, of late Eocene age. Roberts (1958, p. 24-31, pl. 1) named these marine and continental rocks the Toutle formation, and considered them equivalent to the lower "basaltic sandstone" member of the Lincoln formation, as that designation is used by Snavely and others (1958, p. 35). Roberts' map indicates that in Lewis County the Toutle formation is exposed mainly in the foothills, but is found also northwest of the Cowlitz River, in secs. 24 and 26, T. 11 N., R. 2 E. Therefore, rocks of this formation probably under lie the central part of the terrace known as Smokey Valley at relatively shallow depths.

Of about 60 wells that are believed to have penetrated rocks of the Lincoln formation, about 20 reportedly are unsuitable for domestic supply by reason of poor quality of the water, insufficient yield, or both. Also, a considerable number of the wells yield water in quantities barely adequate, and of quality barely acceptable, for household use. In general, however, the wells tapping the Lincoln formation yield somewhat larger quantities, and water of better quality, than do wells tapping only the rocks of Eocene age. The most productive well that is believed to derive its water entirely from the Lincoln formation is well 12/2W-8Q1, owned by Norman Fries and located about 3 miles north-northwest of Winlock. It is 140 feet deep, and penetrates rocks of the Lincoln formation for a distance of 12 feet. It reportedly has a pumping yield of 75 gpm, and a resulting drawdown of 58 feet, and supplies water for irrigation.

Rocks of Miocene and Pliocene (?) age

Rocks of Miocene and Pliocene(?) age underlie the west-central lowland and cover extensive areas to the south and west of the lowland. These materials are predominantly clay, silt, and gravel, generally semiconsolidated but sometimes indurated to shale, siltstone, sandstone, or conglomerate. A layer of basalt, of middle(?) Miocene age, is interbedded in the sequence of these sedimentary materials in the foothills area west of the lowland, and extends eastward beneath Newaukum Hill, Napavine Prairie, and part of the Newaukum River valley. East of the lowland, other and probably older, volcanic materials, interbedded with fine-grained sediments, dominate the late Tertiary sequence.

Astoria(?) formation.--In western Lewis County the sedimentary materials of Miocene and Pliocene(?) age are predominantly marine sandstone. In that part of the area Pease and Hoover (1957) mapped and described a sequence of friable fine to coarse feldspathic, basaltic, slightly micaceous marine sandstone, containing occasional beds of conglomerate and siltstone, and including (in the area of the present study) a single layer of basalt.

The entire sequence, whose maximum thickness apparently exceeds 3,000 feet, was referred to as the Astoria formation of Etherington (1931, p. 40), and was assigned an age range of middle Miocene to early Pliocene(?).

The basalt interbed, whose position reportedly ranges from less than 100 to as much as 680 feet above the base of the Astoria(?) formation, was included by Pease and Hoover as a member of that formation, although it is continuous with a flow layer encountered farther east, where it is referred to by Snavely and others (1958, p. 58-61) as the Columbia River(?) basalt (see p. 24).

Along the north side of the Chehalis River valley, from the vicinity of Dryad eastward for several miles, the massive marine sandstone constituting the upper part of Pease and Hoover's Astoria(?) formation interfingers with a sequence of brackish-water deposits of bedded sandstone and siltstone, which contain fossil wood and leaves. Farther east, the upper part of the Astoria(?) formation pinches out, and a sequence of fluvial, lacustrine, and brackish-water deposits is the only unit that overlies the basalt.

Eastward from the western edge of the lowland there is a progressive decrease in lithological difference between the sedimentary materials deposited before and those deposited after the extrusion of the basalt. In the eastern part of the lowland, and farther east, the basalt is not present. Where the basalt is missing, the Miocene and Pliocene(?) sequence consists predominantly of fresh-water fluvial and lacustrine deposits, in which any beds equivalent to the lower part of the Astoria(?) formation are not identifiable.

In this report, the name Astoria(?) formation is applied only to the sedimentary materials of Miocene age, predominantly marine, that underlie the basalt in the western part of the west-central lowland and in the foothills area farther west. This usage of the name is in accord with the usage of Snavely and others (1958, p. 54) in the Centralia-Chehalis district. Where the basalt is missing, a distinction between the upper and lower parts of the Miocene and Pliocene(?) sequence based on surface exposures and well-log data, is neither practical nor essential to this study, and such distinction is not attempted in this report. In those areas where the Columbia River(?) basalt has not been encountered, the materials of Miocene and Pliocene(?) age are referred to informally as the nonmarine sedimentary rocks or the nonmarine unit.

Where it was encountered during the mapping for this investigation the Astoria(?) formation generally consists of fairly compact, massive, crossbedded fine- to medium-grained sandstone and some beds of siltstone and conglomerate. Beds containing marine fossils are common. At exposures in the foothills west of the west-central lowland the sand is yellow or yellow brown, although it has baked to a black or gray color immediately below its contact with the overlying basalt.

The Astoria(?) formation is not a highly productive source of ground water in Lewis County, but often yields water in amounts adequate for domestic purposes, and of a quality suitable for most uses. About 40 wells, most of which are in the Adna-Littell-Claquato district, have been drilled through the basalt and obtain water from sedimentary materials of the underlying Astoria(?) formation. On the basis of data from those wells, the average yield of water from the Astoria(?) formation is about 10 to 15 gpm, and about 30 of the 40 wells yield less than 35 gpm. Most of the wells that produce water from the Astoria(?) formation encountered their principal water-bearing zones within an interval of 50 feet below the basalt; the yields of very few wells have been improved by deeper penetration of the Astoria(?) materials. Several wells, most of which are in the district known as the Newaukum Prairie (pl. 1) have been drilled considerably deeper into the Astoria(?) formation or have penetrated it completely, without encountering appreciable amounts of water.

The only data available on the chemical quality of water from the Astoria(?) formation are from wells in the Adna-Littell-Claquato district. In that area, at least, water from that formation is satisfactory for most uses, except locally where ground water of a less desirable quality apparently has migrated into the Astoria(?) formation from adjacent older rocks.

Columbia River(?) basalt.--In the western part of the west-central lowland, and in the adjacent foothills areas, a layer of dark-gray or black fine-grained or finely porphyritic, sometimes vesicular basalt rests unconformably upon rocks of the Astoria(?) and Lincoln formations. Snavely and others (1958, p. 58) termed this flow the Columbia River(?) basalt, having correlated it with flows mapped as Columbia River basalt along the lower gorge of the Columbia River. As previously stated, the Columbia River(?) basalt extends west of the west-central lowland and is continuous with the "lower basalt member of the Astoria formation" of Pease and Hoover (1957). The Columbia River(?) basalt also is considered to be equivalent to, and probably continuous with, the basalt flow in a volcanic sequence described by Roberts (1958, p. 32, pl. 1) in north-central Cowlitz County and adjacent parts of Lewis County. Roberts considered that volcanic sequence to be middle(?) Miocene in age, and that age assignment also is used in this report for the Columbia River(?) basalt.

The basalt is a resistant, cliff-forming rock, and it caps a number of hills west of the lowland. In the field, it can be traced with comparative ease, and it is an excellent key horizon for correlation of well-log data. Furthermore, it is interbedded between the only rock units of Tertiary age that are important sources of ground water in Lewis County--namely, the Astoria(?) formation and the nonmarine unit--and at places it constitutes the only apparent break in the Miocene and Pliocene(?) sequence. For these reasons, the Columbia River(?) basalt is delineated on the geologic maps and in the cross sections that accompany this report, and is the only rock of Tertiary age so delineated. Its surficial extent is shown on plates 2 and 3.

In Lewis County the Columbia River(?) basalt is exposed in an arcuate belt of irregular width, which extends northward in the foothills just west of the west-central lowland, from the vicinity of Vader, to Sam Henry Mountain about 4 miles northwest of Winlock. North from Winlock it widens and curves northwestward to Meskill, and thence narrows and continues westward beyond the western border of Lewis County. The maximum width of exposure is about 4 miles, in the area between Crego Hill and Stearns Creek (pl. 2).

So far as is known, the remnants of the Columbia River(?) basalt indicated on the geologic map represent a single flow layer. Records of wells drilled through the basalt show that it is usually 40 to 90 feet thick, although locally it may be 125 feet thick or more. At Crego Hill the basalt layer appears to be as thick as 600 feet, but this apparent thickness may be due to a partial or complete duplication of the section by structural displacement. The upper part of the flow weathers to a reddish-brown clayey soil. At places the basalt is badly weathered to depths as great as 20 or 30 feet.

From Crego Hill, at a height of about 800 feet above the west-central lowland, the basalt dips northeastward beneath the west-central basin, and northward beneath the Chehalis River valley. In the vicinity of Adna it reverses its direction, dipping gently upward toward its exposures near Claquato (see pl. 4, sec. B-B'). No Columbia River(?) basalt was found north of sec. 28, T. 14 N., R. 3 W. Farther north, the basalt layer apparently either pinches out or has been removed by erosion.

To the east, the Columbia River(?) basalt extends beneath the plains known as Napavine Prairie and Newaukum River valley. It apparently pinches out abruptly near the confluence of the North and South Forks of the Newaukum River (pl. 4, sec. C-C'). Its easternmost known occurrence is at well 13/1W-29Q1, where it was encountered at a depth of 538 feet.

Two intrusive bodies of basalt, basalt porphyry, and gabbro have been reported in the area. One, a sill, reportedly intrudes the Skookumchuck formation and basaltic sandstone of the Lincoln formation in the area between the North Fork of the Newaukum River and Lucas Creek (Snavely and others, 1951, map and text). The other, a dike, crops out in two road cuts on the north side of Doty Hill, in the NE¼ sec. 19, T. 15 N., R. 5 W. (Pease and Hoover, 1957). The dike reportedly cuts through beds of the McIntosh formation and is about 30 feet thick. Both the sill and the dike probably were intruded during the outpouring of the basalt of middle(?) Miocene age, and the dike may have been a feeder for that basalt.

In some areas in Washington and Oregon the Columbia River basalt yields large amounts of water to wells, but in Lewis County it is not a productive source of water. Although the basalt usually is jointed to some extent, in either columnar or "brick-bat" structure, the joints apparently are not sufficiently open or interconnected to permit ready percolation of ground water. At places the basalt has been broken into loose brick-bats or somewhat larger fragments, as on Sam Henry Mountain (pl. 2), but at such places the basalt layer usually is thin and is above the main water table.

Of the wells in Lewis County which penetrate the basalt, the majority exploit the limited amounts of water in the mantle of weathered basalt above the hard rock, or are drilled entirely through the basalt layer and obtain water from the underlying materials. Relatively few wells obtain water from the basalt layer itself, and the water thus derived usually is sufficient only for limited domestic use.

Nonmarine sedimentary rocks.--A sequence of nonmarine sedimentary rocks of Miocene and Pliocene(?) age underlies the deposits of Quaternary age throughout most of the west-central lowland, and extends south and west of the lowland. This nonmarine unit is at the surface in much of the foothills area south of the lowland, and also along the north side of the Chehalis River valley west of Meskill. Elsewhere, its exposure is limited to discontinuous outcroppings along valley walls, and it is otherwise covered by younger materials. In the west-central lowland, this sequence consists of as much as 1,000 feet of semiconsolidated siltstone, sandstone, conglomerate, and tuff, which overlies the Columbia River(?) basalt, and which Snavely and others (1958, p. 61) refer to as the nonmarine sedimentary rocks, of Miocene and Pliocene(?) age.

Roberts (1958, p. 34) described a sequence of nonmarine semiconsolidated claystone, siltstone, sandstone, and conglomerate in southern Lewis County from exposures along both sides of the Cowlitz River and in the foothills extending southward into Cowlitz County. This nonmarine sequence, which overlies Roberts' middle(?) Miocene volcanic sequence and which he named the Wilkes formation, is of late Miocene age and is equivalent, at least in part, to the nonmarine sedimentary rocks of Snavely and others.

In this report the informal designation of Snavely and others for the nonmarine rocks is retained, but it is extended to include any nonmarine equivalent of the Astoria(?) formation that may be present in those areas where the Columbia River(?) basalt is missing.

The nonmarine unit consists chiefly of thin-bedded clay, silt, and sand of lacustrine or fluvial origin, with occasional beds of conglomerate, diatomite, tuff, and fine-grained volcanic ash. Many of the beds, especially in the lower part of the unit, have been indurated to shale, siltstone, or sandstone.

The predominant colors of the beds in this unit are blue, blue-green, and blue-gray; however, tan, brown, purple, and white strata also were observed. At outcrops of the rocks, an exterior tan or yellow-brown color often yields to a striking and characteristic blue or green when the surface is penetrated as little as a fraction of an inch. This color loses its intensity upon exposure to light for a few hours, and eventually takes on brownish shades.

Beds of soft sand and friable sandstone constitute only about 10 percent of the upper part of the nonmarine unit, but these sand strata yield most of the water to wells that tap the nonmarine unit. The sand is feldspathic, fairly well sorted, and has a clay matrix. The individual sand layers, which usually are distinctly bedded, range in thickness from a fraction of an inch to more than 20 feet, but thicknesses of 2 to 10 feet are more common. Well drillers usually refer to these beds as sand, quicksand, or sandy clay, and only occasionally as hard sand.

Much of the sand and soft sandstone contains fragile or soft rounded pebbles of gray pumice, which range in length from less than a quarter of an inch to more than 3 inches. These pebbles are decomposed to the extent that they can be crushed or smeared out easily between the fingers. Fragments of pumice occasionally are found in the drill cuttings from wells penetrating the nonmarine unit, and it is likely that they would be observed more frequently were they not crushed in the drilling process.

Compaction and induration of the nonmarine unit apparently are more pronounced in the older, usually deeper part of the unit. Also, the lower part of the unit appears to contain more sandy beds than does the upper part. Most of the wells in Lewis County that enter this unit, however, penetrate only its upper part.

Beds of conglomerate are found occasionally within the nonmarine unit, especially near the base. The conglomerate usually occurs in irregular or lenticular, poorly sorted beds. The pebbles and cobbles consist principally of porphyritic volcanic materials, and in lesser amounts of pyroclastic rocks, fragments of shale and siltstone, and siliceous particles. The materials composing the conglomeratic beds, their varied coloring, and their degree of decomposition are quite similar to those of the Logan Hill formation.

Locally, the nonmarine sedimentary rocks contain abundant plant remains. Relatively resistant layers of brownish-black, decayed and compressed twigs, branches, and bark sometimes protrude several inches from exposures of the nonmarine unit. Decayed wood also is encountered frequently at various levels during drilling of wells in the nonmarine unit, and the water from many of the wells carries fragments of wood, bark, and lignite.

Through most of its extent, the nonmarine unit has yielded only small amounts of water to wells. Most of the wells that penetrate this unit end in its upper part, which consists largely of relatively impermeable clay and silty clay. Water-bearing sand beds constitute only about 10 percent of the penetrated thickness. At places more than 100 feet of the impermeable materials must be drilled through before a water-bearing sand bed is encountered and at most places the sand strata themselves are only moderately permeable. Except in one district, which is described below, the yields of wells tapping the nonmarine unit usually are less than 10 gpm, and several wells reportedly obtain no water from the sedimentary rocks.

The nonmarine unit is considered to be a productive source of water in only one district--along the valleys of the Newaukum River and its North and South Forks. That district lies within a structural basin formed by a downwarping of the Tertiary rocks, and is referred to in this report as the Newaukum artesian basin (see pl. 1). Beneath this basin, water in the nonmarine unit is confined under artesian pressure, and more than 30 of the wells tapping this unit flow.

The materials of the nonmarine unit in this basin apparently are coarser and more permeable at some places than at others; drillers' logs mention coarse sand frequently and fine gravel occasionally. Yields of wells tapping these materials differ considerably from place to place. Some wells yield several hundred gallons per minute when pumped, and initial flows as great as 600 gpm have been reported from a few of these wells in the artesian basin.

Water from the nonmarine unit normally is of a chemical quality satisfactory for most uses, but at some places its quality apparently has deteriorated as a result of mixing with connate water from the older materials. A salt taste can be detected in water from a few wells.

Quaternary System

Deposits of Quaternary age mantle most of the west-central lowland and underlie terraces, valley floors, and some foothill areas elsewhere in Lewis County. They are by far the most important source of ground water in Lewis County. With the exception of glacial till and glaciolacustrine deposits found east of the lowland basin, they are generally coarser grained, less consolidated, and more permeable than the rocks of Tertiary age. In addition, the Quaternary materials often are so situated topographically that they receive recharge not only from direct precipitation, but also from streams.

Materials of Pleistocene age in Lewis County are predominantly glaciofluvial deposits of gravel and sand that underlie terraces and benches throughout the west-central basin and along some of the main valleys outside the basin. East of the basin, glacial till and morainal deposits are found in the foothill areas and are interbedded with outwash materials that underlie terraces in the valleys. Pumice and wind-deposited silt of late Pleistocene age mantle the foothills and benches indiscriminately in the eastern part of the area. In general, the thickest and most extensive deposits of Pleistocene age are the oldest; younger deposits are successively more limited in extent.

The materials of Recent age are predominantly alluvial deposits of clay, sand, and silt, and in minor amounts, of gravel. In general, these deposits are confined to valley bottoms and flank the present stream courses.

Logan Hill formation

The Logan Hill formation, of early Pleistocene age, is the unit most extensively exposed in the west-central lowland, and is the most important hydrologically. It underlies extensive plains in the center of the lowland, and overlaps the Tertiary rocks at the base of the surrounding foothills.

The Logan Hill formation, where relatively unweathered, generally occurs as a yellow-gray to yellow-brown heterogeneous mixture of gravel and sand and minor amounts of silt and clay. Lenses of sand or clay are common. In some places these lenses may be large enough to compose entire outcrops, and may resemble closely materials of the underlying rocks of Tertiary age. Lenses of till also occur in the Logan Hill formation, primarily in the central and eastern parts of the west-central lowland.

The coarser particles in the formation are of rock types found in the adjacent foothills, particularly hills east and northeast of the lowland. Most pebbles and cobbles are of porphyritic volcanic rocks. Fragments of dark basalt, ranging from dense to grossly porphyritic, are abundant. Andesite and diorite fragments also are common, although not so abundant as basalt. A distinctive hornblende andesite, blue, pink, or gray, constitutes as much as 10 percent of the gravel in many places, although it is less common or is absent in others. Other common fragments are siltstone, claystone, and shale derived from the adjacent and underlying rocks of Tertiary age. Materials reworked from the Tertiary sedimentary rocks doubtless also make up part of the matrix of the gravel. Agate, chalcedony, and petrified wood are present locally, particularly in the northwestern part of the basin.

At most places, the upper 20 to 50 feet of the Logan Hill formation has been badly weathered, and usually is described by well drillers as yellow or red clay and soft gravel. Exposures of the upper 20 or 30 feet of the Logan Hill formation are common in highway and railroad cuts in Lewis County, and almost invariably the material exposed is highly weathered. As seen in these exposures, the formation has been weathered to a reddish soil in the upper few feet and to a progressively lesser degree at greater depths. At depths of 10 to 20 feet the outlines of the pebbles and cobbles in the altered material are retained although these gravel-sized particles are so soft that a finger can be thrust through them, or through the interstitial clay with equal ease. A few feet farther below the surface, pebble and cobble outlines are more distinct and some grit, sand, and a few relatively sound pebbles and cobbles occur. The vertical progression of changes caused by weathering is gradual rather than abrupt.

When wet and freshly scraped, highway cuts that expose the weathered gravels of the Logan Hill are variegated, the yellow, red, brown, black, green, and blue pebbles and cobbles sheared cleanly or smeared out like paints on a palette. When the material is relatively dry, the colors of the exposed surfaces are much subdued. Blocks of the weathered material break indiscriminantly across pebbles and interstitial material. Often the individual pebbles are light in weight, and are less resistant than the matrix. In highway cuts that have stood unscraped for some time, the soft pebbles are washed out of the matrix, leaving well-defined sockets that give a characteristic pitted appearance.

Well logs indicate that below the weathered zone the Logan Hill formation consists mainly of beds of gravel, sand, and clay mixed in various proportions, the gravel and sand predominating. Many of these beds are described as cemented, and more than half the total thickness of the Logan Hill formation below its weathered zone is described in well logs as cemented gravel, cemented gravel and sand, gravel and clay, or gravel, sand, and clay.

Unweathered exposures of the Logan Hill formation are rare in Lewis County. In virtually all exposures, the weathered zone extends through the total exposed thickness, even where the basal part can be seen. Unfortunately, many potentially excellent exposures have been obscured by landslides, as along the valley wall of the Newaukum River.

Relatively unweathered Logan Hill materials were found along the southeastern side of an old railroad cut about $1\frac{1}{2}$ miles northeast of Onalaska, in sec. 20, T. 13 N., R. 1 E.; and in a highway cut about 2 miles south of Chehalis, in sec. 8, T. 13 N., R. 2 W., where gravel of the Logan Hill formation is in contact with the underlying nonmarine unit. A study of these exposures and of numerous well logs indicates that the Logan Hill formation was laid down as a heterogeneous mixture of gravel and sand, with minor amounts of silt and clay that often serve to bind the coarser materials into a type of cemented gravel. Sand and fine gravel commonly are segregated in crossbedded lenses, and large and small lenses of gray clay occur, but in general the overall appearance is that of mixed sand and gravel and minor amounts of clay. The considerable amounts of clay in the upper 20 to 50 feet of the formation are believed to be mainly products of alteration, by the weathering of clastic fragments in place.

In unweathered parts of the formation, the gravel particles are commonly subangular, and often faceted. In the weathered zone, the particles are so decomposed that their original size and shape cannot be determined.

The thickest part of the Logan Hill formation exceeds 150 feet near the middle of the west-central lowland, as indicated by the logs of several wells. The formation generally thins toward the foothills and along the margins of the upland benches. Where it is thickest, the Logan Hill generally has the greatest thickness of unweathered gravel in its lowest part from which it is capable of producing its largest yields of ground water.

The Logan Hill materials shown in plate 2 apparently are remnants of a sheet of gravel that originally extended throughout the basin of deposition. The Logan Hill formation probably was deposited chiefly as outwash from alpine glaciers located east of the lowland, but the outwash doubtless was augmented by alluvial deposits carried into the basin by streams draining the surrounding foothills. A glacial and glaciofluvial origin is indicated by the general lack of sorting, especially in the upper part of the formation, by the subangular and faceted fragments, and by the interbedded lenses of till. The mapped limits of the Logan Hill formation probably represent quite closely the original extent of the gravel sheet.

The contact between the Logan Hill formation and the underlying nonmarine sedimentary rocks is unconformable and moderately irregular. During the initial stages of deposition of the gravels, the soft materials of the nonmarine unit apparently were eroded at places and incorporated in the gravel deposits, for the basal 10 to 20 feet of the Logan Hill formation at many places contains abundant blue-gray silt and clay, and superficially resembles pebbly phases of the nonmarine unit. The erosion by the streams that deposited the Logan Hill formation doubtless partly accounts for the relief on the underlying nonmarine unit. However, erosion of these late Tertiary rocks may have occurred also during a period of nondeposition before the gravels were laid down. Such a hiatus is suggested by a 5- or 10-foot thickness of yellow clay, apparently discontinuous, that has been penetrated at the top of the nonmarine unit by a few of the wells. The yellow color is unique for clays of the nonmarine unit, and may represent a considerable period of weathering.

Generally, the upper surface of the Logan Hill formation has received no subsequent deposits, except for minor amounts of wind-deposited silt. At the eastern end of the west-central lowland, however, glacial drift of middle and late Pleistocene age overlies the formation. Locally, the Logan Hill formation has been exposed to weathering and the original gravel sheet has been dissected by streams. Jackson Prairie, Logan Hill, and Alpha Prairie are underlain by the most extensive remnants of the formation, although sizable remnants also cap the benches west of Centralia and Chehalis.

Erdmann and Bateman (1951, p. 48-52) described exposures of stained and excessively weathered gravel in the area between Mary's Corner, in sec. 9, T. 12 N., R. 1 W., and the community of Silver Creek, in sec. 17, T. 12 N., R. 2 E. They termed these deposits Ancient Drift(?), and tentatively considered them to be outwash gravels and tills related to an early Pleistocene ice advance, possibly Nebraskan or Kansan. Snavely and others (1951, map and text) applied the name Logan Hill formation to similar exposures of decomposed gravel and sand on Logan Hill, an upland bench east of Chehalis. They considered the formation to be of early Pleistocene age on the basis of stratigraphic and physiographic position and degree of weathering. Rocks of the Logan Hill formation in other parts of the west-central lowland, and in southern Thurston County to the north, were described subsequently by Snavely and others (1958, p. 67-72). Roberts (1958, p. 37-38, pl. 1) described materials of the Logan Hill formation that cap upland benches on the south side of the west-central lowland and extend southward into Cowlitz County.

The ancient drift of Erdmann and Bateman, and the Logan Hill formation of Roberts and of Snavely and others, are included in the Logan Hill formation as mapped during this investigation.

Deposits of materials that tentatively are considered equivalent to the Logan Hill formation occur to the north, south, and west of the area mapped. North of the area, Mundorff and others (1955, p. 6) mapped gravel of the Logan Hill formation in southern Thurston County as far east as the vicinity of Alder (about 17 miles north of Morton), where the gravel apparently is interbedded with glacial till. To the west, a weathered, reddish, somewhat finer gravel is exposed discontinuously along the valley of the Chehalis River, and extends westward into Grays Harbor County, where it was described and named the Satsop formation by Bretz (1913, p. 39-43).

Deposits similar to the Logan Hill formation occur to the south, in Clark County, Washington, and adjacent parts of Oregon. In those areas the deposits constitute the weathered upper gravelly part of the Troutdale formation, the occurrence of which in Oregon was described by Treasher (1942) and in Clark County, Wash., by Mundorff (1959, p. 58-61). The Troutdale formation also includes in its lower part a sequence of sand, silt, and clay, generally unconsolidated, that may correspond to the nonmarine sedimentary unit of Lewis County. On the basis of fossil plants in its lower part, the Troutdale formation has been assigned a Pliocene age (Chaney, 1944, p. 339; Wilkinson and others, 1946, p. 28; Trimble, 1957).

Correlation of the weathered gravels described above with the Logan Hill formation in Lewis County is suggested by overall similarities in lithology, physiographic expression, position, and degree of weathering. However, such correlation must be considered only tentative in the absence of additional evidence.

In general, the Logan Hill formation yields only small amounts of water from its upper, weathered zone, but is capable of producing moderately large yields from its lower, unweathered part. Where the formation is relatively thin, as it is along the flanks of the foothills and near the edges of some of the upland benches, the weathered zone extends nearly or completely through its entire thickness, and little water usually can be obtained, even from wells that completely penetrate the Logan Hill materials. Where the formation is thicker, as it is beneath Grand, Jackson, and Napavine Prairies, the unweathered sand and gravel in its lower part also are thicker, and those unweathered materials constitute a moderately productive source of ground water.

Some water reportedly is obtained from the cemented or clayey beds, or possibly from thin strata of gravel and sand not differentiated in the well logs. In general the more productive wells obtain most of their water from well-defined layers of gravel or gravel and sand that are not cemented. In most of the lowland, wells that penetrate the entire thickness of the Logan Hill formation usually encounter water-bearing gravel and sand at several depths, and a few of these wells have pumping yields of 200 gpm or more. The water-yielding capabilities of the Logan Hill materials are discussed further in the section of this report that deals with ground water in the upland benches.

Water from the Logan Hill formation generally is of better chemical quality than water from the underlying rocks of Tertiary age. Numerous field analyses (table 5) and three complete analyses of water from the Logan Hill formation (table 4, wells 12/2W-10N1, 13/2W-34A3, and 13/1E-19K2) indicate that it would be suitable for most uses. However, reports from many of the residents of the area indicate that the water from that formation locally contains excessive amounts of iron. This fact is substantiated by the analysis of water from well 12/2W-10N1.

Lacamas Creek unit

The Lacamas Creek unit is the oldest and most extensive of the intermediate terrace deposits of post-Logan Hill age (p. 8, fig. 3). The Lacamas Creek unit forms a broad terrace north of the Cowlitz River and south of Jackson Prairie, and extends northeastward from the vicinity of Vader to Mill Creek (pl. 2). This terrace includes the districts known locally as Drews Prairie and Lacamas Prairie, and also includes the higher part of the Cowlitz Prairie. The Lacamas Creek unit also underlies a terrace remnant that extends along the southeast side of the South Fork of the Newaukum River for a distance of about a mile downstream from the mouth of Kearney Creek. East of Mill Creek, the Lacamas Creek unit loses its identity, and apparently interfingers with morainal deposits in that part of the area.

Superficially, the materials of the Lacamas Creek unit resemble those of the Logan Hill formation. Both units are composed principally of glaciofluvial gravel and sand, the rock types are similar, and the sorting is similarly poor. Weathering of the upper part of the Lacamas Creek unit has, at places, produced the variegated appearance and pebble softness so common in the weathered part of the Logan Hill formation. Normally, however, the materials of the Lacamas Creek unit have been weathered to less than half the depths to which the Logan Hill formation has been weathered. A greater degree of rounding is evident in the unweathered gravels of the Lacamas Creek unit, and pebbles and cobbles are more frequently discoid.

In the unweathered part of the Lacamas Creek unit, beds of cemented gravel constitute a large proportion of the total thickness. In these cemented beds, the gravel and sand particles are tightly bound by a matrix of clay, which probably was part of the initial deposition, although some of the clay may be a product of alteration of the coarser particles. Locally, the cemented gravels contain abundant oxides of iron and manganese, which impart reddish brown or black colors to various lenses of the gravel, and which coat individual pebbles and cobbles. Toward the northeast the beds of cemented gravel thicken, and at some places coalesce, thereby constituting a greater proportion of the total thickness of the Lacamas Creek unit than they do to the southwest.

The materials composing the Lacamas Creek unit coarsen progressively to the northeast from Drews Prairie. Cobble and boulder horizons are encountered in wells near Ethel (sec. 7, T. 12 N., R. 1 E.), and eastward toward Mill Creek larger and more numerous boulders are encountered in wells in this unit.

The total thickness of the Lacamas Creek unit also increases toward the northeast. Under Drews Prairie the unit is 40 to 60 feet deep, and it thickens more or less progressively to the vicinity of Ethel. From Ethel northeastward to Mill Creek it apparently thickens rapidly because well 12/1-2E1, about a mile west of Mill Creek, penetrated 248 feet of predominantly gravel without encountering the underlying rocks of Tertiary age (see log in table 3). However, it is possible that the Lacamas Creek unit in that part of the area may be underlain by similar but older outwash gravels, perhaps related to the deposition of the Logan Hill formation, and that this well and similar nearby wells may penetrate those older gravels.

The Lacamas Creek unit was deposited as outwash from alpine glaciation during post-Logan Hill time. The source of the materials composing this unit may have been the glacier whose morainal deposits lie roughly east of Mill Creek and south of Kearney Creek (pl. 2), or another glacier whose terminus was farther east. It is probable that the basal part of the Lacamas Creek unit underlies later Pleistocene deposits in that morainal area, but the upper part of the unit there has been removed by erosion, or at least has been dissected to such an extent that the remnants, if any, could not be identified positively. Materials similar to those of the Lacamas Creek unit, but containing lenses of till, underlie the surface near the community of Silver Creek, in sec. 17 and 18, T. 12 N., R. 2 E., in an area of morainal topography. This questionable occurrence of the Lacamas Creek materials, together with the coarsening of the gravel and the increasingly rapid rise of the land surface to the northeast along the Lacamas Creek bench, suggest that at least part of the ice from whose meltwater the Lacamas Creek unit was deposited extended as far west as the morainal area east of Mill Creek.

In most places, the Lacamas Creek unit rests unconformably upon the nonmarine sedimentary rocks of Miocene and Pliocene(?) age. Beneath the eastern part of the Lacamas Creek bench, the nonmarine unit is believed also to underlie the thicker sequence of gravel, of which the Lacamas Creek unit may be only a part. Along the northwestern margin of the bench, the Lacamas Creek unit may overlap materials of the lower part of the Logan Hill formation.

Yields of water from the Lacamas Creek unit are generally comparable with yields from equal, saturated thicknesses of the Logan Hill formation. Supplies adequate for domestic use usually can be obtained, and several of the wells tapping this unit yield enough water for irrigation. However, where the Lacamas Creek unit is thin and consists mostly or entirely of cemented gravel, it yields little water to a well, except where it contains lenses of sand or gravel relatively free of clay. The more productive wells tapping the Lacamas Creek unit are those penetrating at least several feet of saturated unconsolidated gravel or sand. The beds of cemented gravel usually retard the downward percolation of ground water; where they occur near the land surface they may underlie small bodies of perched ground water in the overlying weathered materials.

Although one comprehensive analysis (table 4, well 12/1-9Q1) and numerous field analyses (table 5) indicate that water from the Lacamas Creek unit generally is of a chemical quality suitable for most uses, about one-fifth of the owners of wells tapping this unit report excessive amounts of iron in their water, and a few report that the water rapidly corrodes the water pipes.

Newaukum terrace unit

Sometime during late-middle or late Pleistocene time, a valley glacier east of the west-central lowland released gravel-laden meltwater that flowed generally down the present valley of the Cowlitz River and into the lowland. The meltwater stream divided at the east end of Burnt Ridge and flowed west and northwest along the Kearney Creek-Newaukum River valley, and southwest along the Mill Creek-Cowlitz River valley. Well-defined terraces formed of gravel and sand deposited by the meltwater can be seen along both routes, but are not definable in the morainal, loess-mantled areas east of Alpha and Salkum. The gravel and sand underlying these terraces constitute the Newaukum terrace unit.

In the Newaukum River valley between Alpha and Chehalis (pl. 2) the Newaukum terrace unit forms the terraces that flank the present flood plain of the Newaukum River and that lie about 20 feet above the level of the present flood plain. The basal part of the unit also underlies the alluvial deposits in some parts of the valley. In the Cowlitz River valley, the Newaukum terrace unit underlies a discontinuous band of terrace remnants lying mostly north of the Cowlitz River. Small bodies of Newaukum terrace materials also are found along the valley of Mill Creek, south of Burnt Ridge.

The materials of the Newaukum terrace unit, in general, are a poorly sorted mixture of sand and subrounded pebbles and cobbles, bound in a matrix of yellow or yellow-gray clay and silt. Silt or clay lenses also are present, but are not of sufficient size or number to be noted in the records kept by well drillers. This unit usually is referred to by drillers as "yellow clay and gravel (or cobbles), mixed," and in some places "cemented." Toward the east edge of the lowland, up the Newaukum River-Kearney Creek valley, and northeastward along the Cowlitz River valley, the gravel in this unit coarsens and includes greater amounts of cobbles and boulders.

Most of the gravel-sized particles in the Newaukum terrace unit are of volcanic rocks, predominantly basaltic or andesitic. Doubtless most of the materials were derived from Tertiary rocks east and northeast of the basin, but much apparently represents material reworked from the Logan Hill formation or the Lacamas Creek unit. In general, the pebbles are not weathered to a degree comparable with that observed in the Logan Hill formation, but scattered throughout are deeply weathered or even rotten pebbles of volcanic rock that probably were derived from those units.

The Newaukum terrace unit ranges in thickness from less than 20 to perhaps more than 100 feet, as indicated by exposures and well logs. Usually, however, it is less than 60 feet thick. It is underlain by fine-grained sedimentary rocks of the nonmarine unit of Miocene and Pliocene(?) age throughout much of its extent, and locally it may be underlain by unweathered gravels of the Logan Hill formation and the Lacamas Creek unit. In general, the Newaukum terrace unit appears thicker along the Cowlitz River valley than in the Newaukum River valley.

Yields of ground water from the Newaukum terrace unit usually are small, principally because most of the materials are tightly cemented, but also, at places, because only a relatively small proportion of the materials are saturated. Nevertheless, the unit is developed to a considerable extent as a source of water for domestic and stock uses, and yields sufficient for these purposes usually can be obtained from wells that penetrate nearly or completely through the Newaukum terrace unit. A few wells obtain somewhat larger yields from unconsolidated sand and gravel near the base of the unit.

Water from the Newaukum terrace unit often contains objectionable amounts of iron, and occasionally is reported to be corrosive to plumbing.

Layton Prairie unit

The Layton Prairie unit underlies a discontinuous terrace that extends along the Cowlitz River from the southern border of Lewis County upstream to the vicinity of Mossyrock (pls. 2 and 5). Along the lower Cowlitz River valley the terrace remnants abut the scarps of older terraces and the slopes of foothills underlain by Tertiary rocks. In the vicinity of Mossyrock the terrace terminates in areas of drumlin and moraine topography. The largest remnant of the terrace is Layton Prairie, which is 1½ to2 miles wide and about 5 miles long.

The Layton Prairie unit is composed chiefly of gravel and sand of glaciofluvial origin, and subordinately of clay and rock flour. The particles are chiefly of volcanic rocks--predominantly basaltic, and subordinately andesitic and rhyolitic(?). Fragments of siltstone, sandstone, and agglomerate also are present.

In the lower valley of the Cowlitz River, downstream from the mouth of Mill Creek, the materials of the Layton Prairie unit generally are poorly sorted, particles ranging in diameter from ½ to 3 inches predominating; however, there are many lenses of sand, marble-size pebbles, and mixed sand and fine gravel. In the Mossyrock area the Layton Prairie unit contains more well-defined beds and lenses of clay, sand, and gravel, at places; locally these are partly indurated. The rock types are essentially the same as those of the Layton Prairie materials farther downstream, but the grain sizes generally are coarser, and lenses of clean gravel or sand are more common in the materials beneath the Mossyrock bench.

Gray or white clay, frequently mixed with silt and fine sand, commonly coats and lightly binds the coarser particles in the Layton Prairie unit. Many of the lenses of well-sorted gravel have virtually no interstitial filling except for a thin coating of this clayey material, and these gravels are weakly cemented and very porous; some of these "openwork" gravels, however, are coated instead with black oxides of iron and manganese. The clayey material, which occurs also as an interstitial filling and binding agent in the more poorly sorted beds of the unit, probably contains material reworked from the fine-grained sedimentary rocks of Tertiary age, products of weathering of the Layton Prairie gravels, and glacial rock flour.

At most places, weathering of the Layton Prairie unit has produced only a thin rind of discoloration on the gravel particles. Perhaps 5 to 10 percent of the pebbles are thoroughly decayed, but these pebbles probably were derived from older terrace deposits, and had already undergone some weathering before being incorporated into the Layton Prairie unit. In some areas, however, the upper few feet of the unit has been considerably weathered, and the gravel-size particles are tightly cemented by clayey products of alteration.

Although the Layton Prairie unit is not indurated to the degree common in the terrace deposits of earlier Pleistocene age, well drillers often describe this unit also as cemented gravel, sometimes noting scattered sand pockets.

Drillers' logs indicate that the thickness of the Layton Prairie unit ranges from less than 20 feet, along the flanks of the foothills south of the Cowlitz River and in the western part of Smokey Valley, to at least 117 feet or more in the vicinity of Mossyrock (see table 1, well 12/3-18P1). A foundation test hole (12/3-8C1) located on the terrace north of Dunn Canyon penetrated 557 feet of gravel, sand, and clay, largely unconsolidated, before encountering rocks of the underlying Northcraft formation (log in table 3). This thick sequence, which apparently fills an ancient channel occupied during glacial times by the ancestral Cowlitz River, probably includes material older than the Layton Prairie unit in its lower part.

The materials of the Layton Prairie unit were deposited chiefly as glacial outwash, and the source for most of the material was the valley glacier whose terminus is marked by the morainal and ice-contact deposits that lie to the east, north, and south of Mossyrock. The glaciofluvial origin of the unit is proven by the existence of lenses of glacial till interbedded in the Layton Prairie unit near its eastern extent. Downstream from the Mossyrock area there apparently was a progressive increase in the amount of gravel contributed by nonglacial tributary streams.

Deposits of outwash gravel and sand interbedded with till, similar in position and lithology to parts of the Layton Prairie unit, underlie the triangular area between Cinnabar Creek, the Tilton River, and Highway 5K (pls. 2 and 5), and merge with the morainal deposits farther west. However, the gravels of these outwash deposits, which are exposed along the valleys of Cinnabar Creek and the Tilton River, contain horizons of boulders and cobbles, and are coarser in general than typical gravels of the Layton Prairie unit. Also, the upper weathered part of these outwash deposits resembles not only some Layton Prairie materials, but materials of the older terrace deposits as well. Because of the uncertainty of correlation with the Layton Prairie unit, the outwash materials in the triangular area described above are shown on the geologic map as terrace deposits undifferentiated.

From the vicinity of Mill Creek, down the valley of the Cowlitz River to about the middle of Smokey Valley, the Layton Prairie unit unconformably overlies the nonmarine sedimentary rocks of Miocene and Pliocene(?) age (Wilkes formation of Roberts). Beneath the western part of Smokey Valley, southward beyond the border of Lewis County, and upstream from Mill Creek, the Layton Prairie unit is underlain by rocks of earlier Tertiary age. From the vicinity of Mayfield upstream beyond Mossyrock, the Layton Prairie unit was deposited on the very irregular upper surface of the Northcraft formation. Hills and ridges of lavas of the Northcraft flank the terrace in that part of the area and knolls of the same material are buried to different depths by the Layton Prairie unit, or extend as rock-core drumlins above the general level of the terrace.

The Layton Prairie unit doubtless represents outwash from one of the latest of several advances of valley glaciers in eastern Lewis County, but its age cannot be assigned more closely than to the late-middle or late Pleistocene. The Layton Prairie unit is believed to be somewhat younger than the Newaukum terrace unit, but where these two terrace-forming units occur side by side, some of the materials mapped as Layton Prairie rocks may actually belong to the lower part of the Newaukum unit.

Glacial drift, the outwash phase of which includes the Layton Prairie unit, was described and termed younger drift by Erdmann and Bateman, (1951, p. 63), who considered it of Iowan or earliest Wisconsin age. The outwash of the younger drift was mapped in the Cowlitz River valley from about 1½ miles south of Salkum, up the valley to Riffe, at altitudes up to 850 feet; and up the Tilton River valley to Bear Canyon, at altitudes up to 1,300 feet. The area they mapped as outwash of the younger drift also includes the bench upon which Salkum is situated, and the terraces southward to the alluvial plain of the Cowlitz River. Similar gravel was described as underlying the broad plain to the south and southwest of Cinebar, between Mill Creek and the Tilton River, and high benches up to 1,300 feet in altitude between the Tilton and Cowlitz Rivers. Thus, the outwash phase of the younger drift mapped by Erdmann and Bateman includes not only the Layton Prairie unit, but also the materials described herein as terrace deposits, undifferentiated, and perhaps some materials of the Newaukum terrace unit. The lower part of the glaciofluvial sequence beneath the Mossyrock bench and the corresponding bench north of Dunn Canyon was mapped by Erdmann and Bateman (1951, p. 52-62) as part of their Shut-in glacial deposits.

Yields from wells tapping the Layton Prairie unit range from less than 1 to more than 200 gpm, that from a particular well depending largely on the local saturated thickness of the unit and the extent to which it is penetrated by the well. Records of more than 50 wells indicate that water in amounts adequate for the household and stock-watering needs of the average rural home usually can be obtained from wells that penetrate 40 feet or less of the unit, and from all the deeper wells. The greatest yields are from beds of unconsolidated gravel, or sand and gravel, that are near the base or are concentrated in the lower part of the unit. Well 12/2-13B1 probably is the most productive of the wells tapping the Layton Prairie unit. It is a drilled well 117 feet deep, and it obtains its principal supply from gravel and sand below the 90-foot depth. It reportedly was pumped for 4½ hours at a rate of 220 gpm, with a resulting drawdown of 2 feet. That well and at least four others that tap the Layton Prairie unit--wells 11/2W-34R2, -36A2, -36A4, and 12/2-14B1--are used to supply irrigation water.

The reports of well owners indicate that water from the Layton Prairie unit is of generally good chemical quality, although at places it reportedly contains troublesome amounts of iron or other undesirable chemical constituents. The results of field analyses of water from several of the wells and a comprehensive chemical analysis of a sample from well 11/1W-14L2 also indicate that the water from the Layton Prairie unit is of a quality suitable for most uses.

Morainal deposits

The materials referred to in this report as morainal deposits consist of irregular, generally heterogeneous bodies of glacial till and unconsolidated or semiconsolidated gravel, sand, silt, and clay, which were deposited directly from, or in close association with, alpine glaciers that formerly occupied much of eastern Lewis County. The morainal deposits extend discontinuously from the vicinities of Alpha, Lacamas, and Salkum (pl. 2) up the valleys of the Cowlitz and Tilton Rivers, to and beyond the eastern boundary of the area mapped (pl. 5).

Because the morainal deposits are heterogeneous, little of a general nature can be said of them. The lenses and tongues of gravel and sand resemble similar materials in the terrace deposits previously described--that is, they consist of subrounded or subangular particles derived predominantly from mafic volcanic rocks. The bodies of till usually are blue gray or light brown in color, and are dense but not well indurated and tough.

The morainal deposits comprise the materials of terminal, lateral, and ground moraines, and associated ice-contact features, of two or more alpine glaciers that occupied the valleys of eastern Lewis County during Pleistocene time. The areas of morainal deposits shown on plates 2 and 5 constitute only the larger occurrences of these deposits. The valleys of the Tilton and Cispus Rivers were glaciated throughout their extent, and glacial ice occupied the valley of the Cowlitz River at least as far west as the vicinity of Mill Creek (pl. 2). As a result, throughout eastern Lewis County many small bodies of glacial drift are found plastered or perched on the rocks of Tertiary age that form the valley walls. Small patches of glacial drift are found at altitudes as high as 2,300 feet along the Cowlitz River valley, in the NE¼ sec. 30, T. 12 N., R. 6 E.; these are not shown on plate 5 because of their small size.

The morainal deposits are thickest and most widespread in the Cinebar morainal area, a roughly triangular area between Mill Creek on the west, the Cowlitz and Tilton Rivers on the south and southeast, and State Highway 5K on the north (pl. 2). The morainal deposits in that area apparently represent the western termination of ice tongues of two or more glacial stages, and possibly of two ice tongues during one of these stages. The glaciers represented by these morainal deposits doubtless were the source of the materials underlying the intermediate terraces. However, no attempt was made during this investigation to relate the various bodies of till and outwash in the morainal deposits to corresponding terrace deposits farther west. Erdmann and Bateman (1951, p. 52-62) described the occurrence of glacial drift in the valleys of the Tilton and Cowlitz Rivers, and named this drift the Shut-in glacial deposits. The drift was described as occurring in the Cowlitz River valley from at least 3 miles downstream from the Mayfield damsite (near Mayfield) to 1½ miles upstream from the village of Riffe, and in the Tilton River valley at least as far upstream as Bear Canyon (see pls. 2 and 5). The morainal deposits of this report include part of the Shut-in glacial deposits of Erdmann and Bateman.

The water-yielding capability of the morainal deposits is highly variable from place to place, owing to the diverse composition of the unit. Gravel and sand, where they occur below the water table, normally yield moderately large supplies to wells, but clay, silt, and glacial till, even where saturated, do not yield appreciable amounts of water. At least one well (12/2-4B1) believed to tap the morainal deposits is used for irrigation, but none of the wells that obtain water from this unit is reported to yield as much as 100 gpm.

Water from the morainal deposits reportedly is of good chemical quality for most purposes.

Undifferentiated terrace deposits

The materials underlying some terraces in the area studied, principally in the valleys of the Cowlitz, Tilton, and Cispus Rivers, and in the Cinebar morainal area, cannot be related dependably to the more extensive terrace deposits previously described, and are referred to herein as undifferentiated terrace deposits of late Pleistocene age. The materials, in general, are younger than the Layton Prairie unit, but in some places probably include parts of that unit, the Newaukum terrace unit, and perhaps parts of the Shut-in glacial deposits of Erdmann and Bateman (1951, p. 52-62).

Except in the Cinebar morainal area, individual terraces included in this group usually are less than half a mile wide, and the accumulative width of these terraces at any one position along the valley is usually less than 1 mile. Along the Cowlitz Valley, southwest from Salkum to near the southern border of Lewis County, the thickness of these materials ranges from about 40 feet under the higher terraces to 10 to 20 feet under the lower terraces. The thickness and extent of these deposits is considerably greater in the Cinebar morainal area.

The undifferentiated terrace deposits of late Pleistocene age are almost entirely sand and gravel of fluvial and glaciofluvial origin. The materials are relatively well sorted and the pebbles generally are subrounded, well rounded, or discoid. Lenses of well-sorted sand are not uncommon. In general, the constituents are fine-grained or porphyritic volcanic rocks, predominantly basaltic but with a substantial proportion of andesitic and more silicic volcanic rocks. Smaller percentages of siltstone, shale, sandstone, and volcanic agglomerate are encountered also.

Weathering has produced little effect on these materials, other than to discolor the components to a reddish yellow, yellow brown, or black. Under the older terraces the materials in some lenses are completely coated with an irridescent black film of manganese oxide, and are bound together lightly by this substance or by iron oxides, clay, or silt, or various mixtures of these. In a few places, however, even under the older terraces, the materials are indurated sufficiently to warrant their being termed "cemented" by well drillers. The material underlying most of the terraces is described simply as sand and gravel.

An excellent exposure of the undifferentiated terrace deposits may be seen from a point on the bluff 1.2 miles south-southwest of Salkum, at the intersection of two county roads in the NE$\frac{1}{4}$ NE$\frac{1}{4}$ sec. 23, T. 12 N., R. 1 E. Good exposures may be seen also in a road cut on the Singleton-Spencer Road (pl. 2) in the E$\frac{1}{2}$ sec. 21, T. 12 N., R. 1 E., 0.2 mile east-northeast of the point where the road crosses Jones Creek.

In most of the areas of occurrence, the undifferentiated terrace deposits have been developed only slightly as a source of ground water, largely because of the sparse population of those areas. Water can be withdrawn relatively freely from these materials, but the saturated thickness of the deposits usually is so slight that water supplies sufficient even for domestic and stock purposes are not always obtainable during the later summer or early fall, when the water table declines to its seasonal low.

Drift of the Vashon Glacier and Deposits of equivalent age

In late Pleistocene time a continental glacier extended at least as far south in Washington as the southern part of Thurston County, just north of Lewis County (Mundorff and others, 1955, p. 10 and fig. 5). The bulk of the ice that made up this glacier accumulated in ice fields in Canada and northern Washington. The sand, gravel, and till deposited by the glacier and the outwash from the glacier were named the Vashon drift by Willis (1898, p. 141) and are shown on the geologic map of the Tacoma quadrangle prepared by Willis and Smith (1899). Materials deposited as outwash from the Vashon glacier (Bretz, 1913, p. 61-80, pl. 22) occur as far south as Centralia. They entered Lewis County from the north by way of the Chehalis and Skookumchuck River valleys. In Lewis County this outwash covers about 9 square miles and attains a maximum thickness of at least 90 feet. It underlies Fords and Waunch Prairies as far south as the city of Centralia. It is exposed along stream banks and in various gravel pits in the neighborhood of Centralia, in SE¼SE¼ sec. 6 and SE¼NE¼ sec. 7, T. 14 N., R. 2 W., and in sec. 31, T. 15 N., R. 2 W. At these exposures, sorting in the upper 20 to 30 feet is poor to moderately good, and stratification is rude to fair. Beds are lenticular, and there is great lateral variation in thickness of individual beds. Foreset bedding is common.

The outwash material in general is sand and gravel, the pebbles of which are well rounded and fresh appearing. Most of the material is volcanic rock of various types, probably derived from the Cascade Mountains or foothills at no great distance, but some granitic and metamorphic rock types apparently were carried in from the northern part of Washington or even from Canada.

Although no till of the Vashon glacier was found exposed at the surface in Lewis County, well drillers frequently report encountering a layer of consolidated material variously referred to as hardpan, cemented gravel and sand, or gravel and clay when drilling in the Vashon drift under Fords and Waunch Prairies. The layer averages about 10 feet in thickness, and ranges from about 20 feet under the northern parts of Fords and Waunch Prairies to 8 and 7 feet, respectively, in wells 14/2W-5G1 and 14/3W-1J2, which are the southernmost wells in which the material reportedly was encountered. The layer is somewhat undulatory in thickness and altitude; its top has been encountered at 6 to 39 feet below land surface and the bottom at 18 to 56 feet below the surface.

Well logs indicate that this till-like material is underlain by sand and gravel deposits similar to those above it, though perhaps somewhat finer grained and better sorted and stratified. Apparently that lower sand and gravel is at least as unweathered and loose as the upper outwash material.

About 2 cubic feet of the till-like material was brought up as a lump from a depth of about 35 feet from the Pioneer Sand & Gravel Co. pit in the SE¼ sec. 31,

T. 15 N., R. 2 W., about 2 miles northwest of Centralia. On the basis of physical appearance and sieve analyses, the material was considered to be till. The material was a mottled yellow-brown and gray mass of compact clay and scattered unsorted pebbles, tough and sticky when wet and hard when dried. Some of the pebbles were rounded or subrounded but most were angular, subangular, or faceted; nearly all were sound and fresh appearing. A sample taken from this mass was partially broken up and was air dried for a week. A sieve analysis of the sample showed the component grains whose diameters were between 1.25 and 0.0049 inches to be relatively unsorted. About 54 percent of the sample material was composed of grains whose diameters were less than 0.0049 inch. No pebbles in the test sample were larger than $1\frac{1}{4}$ inches in diameter, but cobbles several inches across were scattered through the larger mass from which the test sample was taken. It is likely that a test made on the entire 2-cubic-foot mass would show essentially the same size distribution, despite the incidence of scattered cobbles.

It might be concluded that the till-like material actually is a buried part of the Newaukum terrace unit, for the altitudes of the two are fairly concordant, and remnants of the Newaukum terrace unit might be expected on or beneath Fords Prairie, and possibly also Waunch Prairie. Furthermore, although material of the Newaukum terrace unit generally is more weathered and contains much admixed yellow clay, the freshness of the till-like material and lower sand and gravel could be due in part to protection from weathering by the overlying outwash.

It is possible, also, that this layer of hardpan represents mud that flowed south from the terminus of the Vashon glacier at the time of the southernmost advance of the ice, or that it is till resulting from a pre-Vashon glaciation. In this report, however, it is regarded tentatively as till of Vashon age, the lower sand and gravel as advance outwash and the upper outwash as recessional outwash. The reasons for considering the hardpan as till of the Vashon glacier are that the material thins to the south and is closely associated with materials that contain granite and quartzitic pebbles such as are common in drift of the Vashon glacier but rare in the Newaukum terrace unit. Also, the advance outwash (?) below the till (?) is considerably thicker than the relatively clean gravel and sand at the base of the Newaukum terrace unit.

The till (?) and outwash in Lewis County rests upon fine-grained, somewhat compact sedimentary materials of Tertiary age. In much of its extent it is 50 to 90 feet thick, but it may be several tens of feet thicker under parts of Fords Prairie northwest of Mountain View Cemetery and Fords Prairie School.

Despite its generally poor sorting the outwash is permeable, and good yields of water are obtainable from it in most of the area it underlies. As a rule, higher yields are obtainable from this material than from equal-saturated thicknesses of any other significant unit in Lewis County. The basal part of the recessional outwash (?) underlying some of the area is saturated, but because of the danger of water pollution in such shallow and permeable material it is utilized very little. The till (?) is relatively impermeable, and hence it also is used little as a source of water. Practically all the ground water obtained from the Vashon drift in Lewis County is withdrawn from the advance outwash (?).

Some gravel and sand deposits underlying the Recent alluvium in the valleys of the upper Chehalis and Newaukum Rivers and smaller streams probably are of an age equivalent to that of Vashon glaciation; in many places, however, deposition of sand and gravel has been continuous from the time of the Vashon glacier into

Recent time, and no distinction between sand and gravel of the two ages has been attempted. Undoubtedly too, some of the fluvial and fluvioglacial sand and gravel deposits described herein as undifferentiated terrace deposits, of late Pleistocene age, are contemporary with the Vashon glacier, as probably are some of the morainal deposits of the west-central lowland.

Drift of the Vashon glacier apparently dammed the flow of the Chehalis River near Centralia and backed water up the valleys of the Chehalis and Newaukum Rivers for distances of several miles above the confluence of those streams. In the resulting lake, which Bretz (1913, pp. 120-121) named glacial Lake Chehalis, there accumulated a body of generally fine grained lacustrine materials. They abut the Vashon drift in the vicinity of Centralia, underlie the Chehalis River valley upstream at least as far as Adna, and extend beneath the Newaukum River valley perhaps beyond Newaukum. They also underlie Salzer Valley and the valleys of Stearns and Coal Creeks. These lacustrine deposits are not exposed at the surface, and are not delineated on the geologic map.

The glacial Lake Chehalis deposits, according to well drillers' records, are primarily sand, silt, and clay. Organic matter, ranging in size from colloidal particles to logs, is contained in them in parts of the Chehalis River valley between Chehalis and Centralia. "Quicksand" reportedly has been found in several wells and is troublesome in shallow-earth operations, such as in emplacement and maintenance of water and sewer lines at places in the southern and southwestern parts of Centralia.

The glacial Lake Chehalis sediments generally lie directly upon predominantly fine-grained, compact sedimentary rocks of Tertiary age, but under parts of the valley of the Chehalis River above its junction with the Newaukum River the bedrock is Columbia River (?) basalt. As much as 70 feet of glacial Lake Chehalis sediments underlies the Chehalis River valley between Centralia and Chehalis, but these materials average only 30 to 50 feet in thickness in the Chehalis and Newaukum River valléys above the Chehalis-Newaukum River junction. In most drillers' logs the lacustrine materials are difficult to differentiate from the underlying sedimentary rocks of Tertiary age. In compiling the geologic sections (pl. 4) the glacial Lake Chehalis deposits are included with those older sedimentary rocks.

Fine-grained materials similar to the sediments of glacial Lake Chehalis were deposited in the valleys of Lincoln and Hanaford Creeks by long, serpentine bodies of water ponded when drift of the Vashon glacier blocked the lower ends of the valleys. The thickness of these deposits is not known, but probably does not exceed 20 to 30 feet in the Lincoln Creek valley and 40 to 50 feet in the Hanaford Creek valley.

At places in the Chehalis River valley, the glacial Lake Chehalis deposits are separated from the underlying rocks of Tertiary age by a layer of sand and gravel about 10 feet thick. In the vicinity of Centralia this layer of sand and gravel appears to grade into outwash of the Vashon glacier of contemporary age. Between Centralia and Chehalis it is at depths of 50 to 70 feet, but thickens and is found at progressively shallower depths up the valley of the Newaukum River to about sec, 14, T. 13 N., R. 1 W. From there it thins upstream, and no attempt has been made to distinguish it from overlying sand and gravel of Recent age. At places, between Claquato and Millburn and presumably under the wider part of Stearns Creek valley, it is found at depths ranging from about 20 to 40 feet below the surface.

The glacial Lake Chehalis materials are not very permeable and do not yield large amounts of water, but some wells obtain water sufficient for domestic supplies from sand and silt layers in these materials. Greater yields are obtainable from the layer of permeable sand and gravel where it occurs beneath the Lake Chehalis sediments. Most wells that penetrate a well-defined sand and gravel layer beneath the lacustrine deposits yield 20 to 100 gpm.

Undifferentiated valley fill

The floors of several valleys in eastern Lewis County, including those of Rainy Valley and Lake Creek valley, are underlain by irregular, heterogeneous, and mixed deposits of gravel, sand, silt, and clay and, at places, pumice and peat. Those materials were deposited variously as alluvium, alluvial fans, drift from alpine glaciers, and glaciolacustrine deposits, and at places they doubtless have been reworked since their original deposition. They are herein referred to as undifferentiated valley fill. The bulk of these materials probably was deposited during Pleistocene time, but at places the deposition has continued until the present time. The valley-fill deposits are mostly unconsolidated or semiconsolidated.

Small to moderate supplies of ground water usually can be obtained from layers of unconsolidated gravel and sand, although the combined thickness of these layers apparently constitutes a minor part of the total thickness of the valley fill, at least to the depths reached by wells. The total thickness of the valley fill is not known throughout most of its extent.

Partial field analyses (table 5) of water from three of the wells tapping this unit (wells 12/5-14H1, -14N1, and -28G1) indicate that the water is of generally good chemical quality.

Landslides

Landslides have occurred in parts of Lewis County since early in the Pleistocene epoch, and probably prior to that time. They are particularly common along the valleys, large and small, of the Chehalis-Newaukum drainage system. Many of these landslides individually involve one-tenth of a square mile or more of land surface, and in some valleys landslides of different ages abut or overlap laterally to form belts of landslide material a quarter of a mile or more wide and several miles long.

Many of the more recent landslides can be identified with relative ease by the arcuate shape of the wall scar, the shape and position of the slipped segment, and the hummocky surface of the landslide material. With increasing age these features are modified or obliterated by erosion and by the growth of vegetation. Many of the older landslides can be identified only by a churned-up appearance of the material in the slipped segment, by the projection of the segment as a spur onto the valley floor at the base of the scarp, or by the discordant presence of older material at a level below that which would be anticipated on the basis of the regional stratigraphy. In some places large masses apparently have slid down with little internal disturbance of the material.

Landslide activity has been so extensive along the valley of the Newaukum-Chehalis River system that in most of the outcrops the contact between the Logan Hill formation and the underlying material has been obliterated or the apparent contact has been displcaed downward. The landslides shown on plate 2 are based on field work, topographic maps, and interpretation of aerial photographs. Outside of that part of the area, landslides are much less common and only the more obvious examples are shown on plates 3 and 5.

At pointed out by Snavely (written communication, 1954), the slight gradient of the contact between the Logan Hill formation and the underlying nonmarine sedimentary rock unit, and the plasticity of the nonmarine unit, are favorable for the slumping of large masses of the Logan Hill formation where the nonmarine unit is saturated. Even where the Logan Hill formation is not underlain by the nonmarine unit, the underlying material (of Oligocene or Eocene age) frequently has the same degree of plasticity as that unit.

The earthquakes of 1949 and 1950 were accompanied by landslides of fair magnitude in Lewis County. As faulting in the Pacific Northwest was probably at least as active in Pleistocene as in Recent time, it appears reasonable to assume that earthquakes in the past often have triggered landslides in Lewis County, under the proper conditions of saturation, slope, and material. One is also led to suspect the presence of a very large number of landslides of various sizes that have been obscured by erosion or buried by Pleistocene deposits.

Little of a general nature can be said about the water-bearing properties of landslide material in Lewis County. Although a slipped mass still contains the material that composed it before the landslide, the material may have been churned up and the water-bearing characteristics altered to an unpredictable extent. Also, even though the mass of slipped material may be undisturbed internally, its hydraulic continuity with the parent formation is disturbed and may be broken completely.

Geologic Structure

The major deformations of the rock units in Lewis County occurred before the beginning of the Quaternary period, and therefore did not involve the principal water-bearing units, which are of Pleistocene age. However, where important supplies of fresh water are obtained from rocks of Tertiary age, the deformation of the Tertiary rocks closely controls the occurrence and availability of that water. Minor deformations, consisting principally of small-scale slippage along preexisting fault planes, may have caused offset in, and discontinuity of, some aquifers in the Pleistocene rock materials.

The geologic structure of most of the area is adequately described by Pease and Hoover (1957), Snavely and others (1958, p. 84-93, pls. 1, 2, 5), and Roberts (1958, p. 42 and 43, pl. 1). The general structural conditions that are pertinent to the occurrence of ground water in the area are discussed briefly below.

The part of the structural history with which this study is primarily concerned began with a mild local downwarping during middle Miocene time. Most of the major structural features had been formed previously, largely during early Miocene time, which, according to Snavely and others (1958, p. 84), was a period of marked deformation and erosion.

The slight downwarping during middle Miocene time produced local basins in which the Astoria (?) materials and the Columbia River (?) basalt accumulated. The local downfolding continued during late Miocene and Pliocene (?) time, when it was accompanied by deposition of the nonmarine sedimentary materials. Late Pliocene time was another period of deformation, when the rocks deposited during Miocene and Pliocene (?) time were folded and locally faulted. Minor folding and faulting may have continued into the Pleistocene epoch, but no definite evidence of such deformation was found during this study. On the contrary, the slight angular unconformity seen at a few exposures of the contact between the Logan Hill formation and the underlying nonmarine sedimentary rocks suggests that most of the deformation, at least, had occurred before the deposition of the Logan Hill formation.

The folding during Pliocene time produced two northwest-trending synclines in which appreciable amounts of fresh ground water are now obtained from the Tertiary rocks. One of those synclines--the southern part of the Chehalis River syncline of Snavely and others (1958, p. 90, pl. 1)--is in the Adna-Littell-Claquato district of the upper Chehalis River valley (sec. B-B', pl. 4), where supplies of fresh ground water are obtained from the Astoria(?) formation directly beneath the Columbia River (?) basalt.

A larger synclinal structure, in which large supplies of fresh water are obtained from artesian aquifers in the nonmarine sedimentary rocks, is occupied by the Newaukum River and the lower reaches of its north and south forks. That syncline (pl. 4, sec. B-B') is called the Napavine syncline by Snavely and others (1958, p. 90, pl. 1). In their report the axis of the syncline is shown as trending southeast from about the E¼ cor. sec. 6, T. 13 N., R. 2 W., to about the center of sec. 32, T. 13 N., R. 1 W. From there the axis apparently swings farther to the south; Roberts (1958, pl. 1) shows it crossing the Cowlitz River in sec. 9, T. 11 N., R. 1 W., south of the Toledo-Winlock airport, and passing beyond the Lewis County boundary in sec. 36, T. 11 N., R. 1 W. The approximate area in which the nonmarine sedimentary rocks are believed to be capable of yielding moderate to large supplies of water under artesian pressure is shown on plate 1. As previously stated, that area is herein referred to as the Newaukum artesian basin.

The occurrence of fresh water in the Tertiary materials of the synclinal areas mentioned above, and the occasional discoveries of unusually fresh water during the drilling of wells into the Tertiary rocks in other parts of the area, indicate a relationship between folding of the Tertiary sedimentary rock and the occurrence of fresh, rather than saline, water in them. Apparently, where these sedimentary rocks have been deformed into open folds, so that the tilted beds occur at or near the surface of the uplands, rainfall can infiltrate into any permeable zones and thus flush out the saline water that normally is found in them.

Faulting, involving rocks of Tertiary age, has been extensive in the area, and intermittent movement along some of the fault planes may have occurred during Quaternary time. Earthquakes have been fairly common in the area during Recent time, and local inhabitants relate that the flows of some springs and the water levels of various wells were altered materially by the earthquakes of April 21, 1949, and April 19, 1950. Also, inhabitants of the vicinity of Centralia and the lower Hanaford Creek report that large quantities of water squirted upward from the alluvial or outwash materials in that area during the earthquake of 1949. Any substantial movement along fault planes in Recent time would have disturbed material of Pleistocene or Recent age, but no field evidence of such deformation in Lewis County has been seen by the writers. However, this lack of evidence does not disprove the possibility of Recent movement along older fault planes, inasmuch as displacement of the Pleistocene or Recent beds probably would not be apparent in the unconsolidated material forming most of these deposits.

AREAL OCCURRENCE OF GROUND WATER

In general, the most permeable water-bearing materials in Lewis County are sand and gravel of Quaternary age. These are widespread in the west-central lowland but elsewhere are restricted to the valleys of the major streams. These materials include the Logan Hill formation, Lacamas Creek unit, Newaukum terrace unit, Layton Prairie unit, part of the glacial drift, and deposits that underlie the flood plains and low-lying terraces. The less permeable Tertiary materials in the foothills surrounding the basin cannot be relied upon to yield water in large amounts.

The most permeable unit of significance in Lewis County is the sheet of outwash sand and gravel of Vashon age extending into the county from the north and underlying the plains of the Chehalis and Skookumchuck Rivers as far as Centralia (see plate 2). Well 14/2W-5G2, of the city of Centralia, drilled entirely in these deposits, has been pumped continuously for as long as 12 hours at a rate of 880 gpm, with a drawdown of 18 feet. The specific capacity of this well is about 49 gpm per foot of drawdown.

The most extensive deposits used as an effective source of ground water are the gravel and sand that underlie the upland plains and the terraces in the west-central lowland to depths of about 50 to 200 feet. The permeability of much of this material is reduced by interstitial clay and silt. At most places, however, materials of relatively good permeability occur at one or more horizons in the deposits; yields of 50 to 150 gpm usually can be obtained.

Underlying the gravel and sand in most of the west-central lowland is the extensive nonmarine unit of Miocene and Pliocene (?) age, which consists chiefly of silt and clay and contains sand and gravel members that yield moderate supplies of water. In the valleys of the Newaukum River and its north and south forks, in T. 13 N., Rs. 2 W., 1 W., and 1 E., wells drilled into this formation yield artesian water in quantities which differ considerably from place to place, but which locally amount to several hundred gallons per minute. This part of the area is referred to as the Newaukum artesian basin (see p. 27). Moderate amounts of water are obtained from sand of the Astoria (?) formation of Miocene age underlying the basalt in and immediately north of the Chehalis River valley between Littell and Claquato.

With some notable exceptions mentioned earlier in the section dealing with the individual rock units, the permeability of most of the older Tertiary materials is so low that wells drilled into them usually yield, at most, only enough water for domestic use.

Foothills

The foothills area shown in figure 3 is sparsely inhabited and is primarily an area of forest use and stock grazing. The few inhabitants of most of the foothills area generally obtain water from the springs or creeks, or occasionally from shallow wells dug into the weathered upper zone of the underlying Tertiary rock units.

A considerable number of wells in the area have been drilled into the older Tertiary rocks to depths below the zone of weathering. However, most of those wells have yielded little water or water that is so highly mineralized as to be unsuitable for most uses.

South of Smokey Valley and Layton Prairie (plate 2) the foothills are capped by thin patches of the Logan Hill formation that are badly weathered and are capable of yielding little water. Underlying the Logan Hill formation in most of that area are beds of the nonmarine unit of Miocene and Pliocene (?) age apparently several hundred feet thick. As in other parts of the county, yields of 10 to 15 gpm can be expected from properly constructed wells tapping the nonmarine unit in this district. However, the abundance of friable sand in exposures of the unit in this area suggests that vigorous pumping of wells tapping it might bring up troublesome amounts of fine sand with the water.

In the foothills west of the west-central lowland, and north and south of the Millburn-Littell district, much of the upland surface also is underlain by the nonmarine unit of Miocene and Pliocene (?) age, or by the Astoria (?) formation, which contains an even greater proportion of fine- and medium-grained sand than does the nonmarine unit. In general, small yields might be obtained in these upland areas also, although the pumping of fine sand might be a problem of considerable importance.

Upland Plains

The upland plains, which occupy most of the land surface in the west-central lowland, are relatively flat and gently sloping, and are directly underlain by glaciofluvial gravel and sand of Pleistocene age, from which the vast majority of dug and drilled wells obtain their water. Ground-water recharge to the gravel and sand that underlie the upland plains occurs mostly by percolation downward from the land surface to the water table. The source of the water that recharges these aquifers is precipitation directly upon the upland plains and, to a minor extent, the flow of streams in adjoining foothill areas.

The major upland plains are underlain by material of the Logan Hill formation, which in turn overlies rocks of Tertiary age--generally clay, silt, and sand of the nonmarine unit of Miocene and Pliocene (?) age. At least 90 percent of the drilled wells and virtually all the dug wells in the upland plains obtain their water from the Logan Hill formation. Locally, moderate to large amounts of water can be obtained from sand members in the underlying Tertiary sedimentary rocks (see p. 54); however, throughout most of the upland-plains area, the Tertiary materials yield less water than can be obtained from the basal part of the Logan Hill formation. Although a high percentage of wells drilled in the upland plains extend to or almost to the base of the Logan Hill formation, few are drilled more than several feet into the underlying blue clay or shale.

Movement of ground water in shallow aquifers from the upland plains is generally toward stream valleys on the plains or toward the scarps. Discharge of water takes place through wells, by evapotranspiration, and through springs and seeps along the scarps. Of these springs, the largest observed is that which serves as water supply for the city of Onalaska. This spring, 13/1-20R1s, is reported to yield 50 to 75 gpm, which is far greater than the yield of any other spring known to discharge from Logan Hill materials.

Jackson Prairie

Jackson Prairie is about 70 square miles in extent and is roughly triangular in outline. From a constriction less than half a mile wide in sec. 35, T. 13 N., R. 1 E., near its eastern limit the plain widens and slopes gently westward. At its western limit, approximately at Stearns and Olequa Creeks, it is about 17 miles wide north to south. Its southern extension, east of Olequa Creek, is known as Finn Hill and Grand Prairie, and its northwest extension, east of Stearns Creek, is known as Newaukum Hill. An additional 4-square-mile area that was originally part of the same area lies west of Olequa Creek. The plain is limited on both the north and south by scarps that separate it from benches and terraces of lower level.

Jackson Prairie is underlain by the Logan Hill formation to depths ranging from 90 to more than 180 feet. The average thickness of the Logan Hill formation probably is about 140 feet. West of Stearns Creek, and southward to a point about a mile south of Evaline, the Logan Hill formation is underlain by the Columbia River (?) basalt. Below much of the Jackson Prairie, however, the Logan Hill formation is underlain by the nonmarine unit of Miocene and Pliocene(?) age. Locally, where the nonmarine unit is absent, the Logan Hill formation may rest directly on rocks of Oligocene age.

The main water table under Jackson Prairie slopes generally west; under Grand Prairie and Finn Hill it slopes southwest and under Napavine Prairie and Newaukum Hill it slopes northwest.

Under the main part of the prairie the gradient of the water table averages 35 feet per mile; in the vicinity of Napavine it steepens to 80 feet per mile. The steepening of the gradient probably is caused by a local decrease in permeability of the lower part of the Logan Hill formation.

The main water table, in general, is 10 to 40 feet below land surface. Under Grand Prairie and Finn Hill,it is somewhat lower--locally 50 to 60 feet below land surface. Southwest of Napavine Prairie it is about 70 feet, and northwest of the town of Napavine it is 110 to 140 feet below land surface.

Various small, shallow bodies of water are perched or semiperched in the material of the Logan Hill formation under the plain, but most of these are relatively unimportant. However, underlying the surface between the western part of Jackson Prairie and the northern part of Napavine Prairie and extending northwest under Newaukum Hill, the body of perched water is utilized more extensively than is the underlying, main ground-water body. The perched water table slopes northwest at about 20 feet per mile; the slope becomes somewhat steeper near the northwestern limit of the plain, where water is discharged through springs and into streams.

Although a detailed analysis was not made during the course of this investigation to determine groung-water pumpage, it is believed that the annual draft for all purposes probably is not greater than about 1,000 acre-feet per year.

The nonmarine unit of Miocene and Pliocene (?) age abuts or laps over the older materials under the western part of the plain, and probably some recharge is supplied to this unit from ground water that percolates down through the overlying Logan Hill formation and enters sandy or gravelly beds of the nonmarine unit along its contact with the older materials. As would be anticipated, near the region of abutment or overlap at least part of the younger unit is sandy or conglomeratic. Some ground water from the Oligocene rocks, where aquifers are truncated or where water can move along joints or fault planes, may enter the nonmarine unit at its contact with the older materials.

Although many of the irrigation wells on the plain are drilled entirely through the Logan Hill formation, few penetrate more than 5 to 20 feet of the underlying Tertiary materials. Only five are known to have penetrated 40 feet or more of Tertiary materials, and these are listed below:

Well No.	Thickness of Tertiary material penetrated (feet)	Tertiary material penetrated, water-bearing (percent)	Yield from all zones tapped (gpm)
11/2W-9P1	154	0	40
12/2W-9R2	67	22	75-80
13/1W-31P1	40	?	350
13/2W-21E1	446	4	73
13/2W-35B1	49	18	15

The Tertiary material penetrated by well 11/2W-9P1 probably is of the Cowlitz formation. The other four wells penetrated the nonmarine unit; the materials encountered in well 13/2W-21E1 also included 54 feet of Columbia River (?) basalt and 36 feet of clay beneath the basalt (Astoria ? formation). The proportion of water-bearing material in these Tertiary rocks is small and the yields doubtless are small in comparison with those obtained from the overlying sand and gravel of the Logan Hill formation.

The significance of the nonmarine unit of Miocene and Pliocene (?) age underlying Jackson Prairie is that, at least under the northwestern part of the plain, it receives recharge that helps to maintain the hydrostatic head in that part of the Newaukum artesian basin southwest of the old U.S. Highway 99, between Chehalis and Forest.

Alpha Prairie

Alpha Prairie, more sparsely populated than Jackson Prairie, occupies an area of about 20 square miles that slopes westward at about 40 feet per mile. It lies north of Onalaska, roughly between the North and South Forks of the Newaukum River. The middle fork of the Newaukum River is a through-flowing stream that heads in the foothills immediately northeast of the plain. Several tributaries of the North Fork, predominantly intermittent, originate on the plain. For a distance of about 6 miles the plain is bordered on the northeast by foothills composed of pre-Miocene sedimentary and volcanic rocks. On all other sides the plain is bounded by scarps that are as much as 200 feet high.

According to information contained in drillers' logs of wells, the Logan Hill formation underlying Alpha Prairie ranges in thickness from 15 to more than 100 feet. It is thickest in the eastern part of the prairie and is thinnest in the western part. Under most of the western part of Alpha Prairie, the Logan Hill formation, in turn, is underlain by the nonmarine unit of Miocene and Pliocene (?) age. Along the northeast edge of the prairie, the Logan Hill formation is underlain by older Tertiary materials that make up the foothills.

On the basis of water-level information obtained from wells ranging in depth from 34 to more than 400 feet, there is considerable variation in depth to water throughout the Alpha Prairie. In wells less than 50 feet deep, the water level ranges in depth from about 6 feet below land surface at well 13/1W-25D1 to 37 feet at well 13/1W-28A1. Some local variation is to be expected, because of the undulating surface of the prairie and because of the existence of fairly steep water-level gradients near the periphery of the prairie. These shallow wells are used chiefly for domestic purposes, and most appear to have yields adequate for such needs. Well 13/1-17C1, however, is 45 feet deep and yields about 50 gpm, a quantity in excess of that for normal domestic requirements. In deeper wells, water levels are at a considerably greater distance below land surface. In wells 13/1-14E1, -19K2, and -20F2, ranging in depth from 182 to 405 feet, the water level is more than 125 feet below the land surface.

The yields of these deeper wells, some of which undoubtedly tap the nonmarine unit (see log of well 13/1-20F2, table 3), are somewhat greater than those from the shallow ones discussed above.

The western part of the prairie probably lies within the area known as the Newaukum artesian basin. Therefore, wells in that part of the prairie that penetrate a considerable distance into the underlying nonmarine unit may be expected to yield water under artesian pressure.

Water-level gradients slope southwestward under the northeastern part of the plain, and thence generally westward. Although there is some movement of ground water toward the streams on the plain, the chief mode of discharge from the Logan Hill formation underlying the plain is through springs and seeps along the scarps. Some water probably percolates down into the nonmarine unit of Miocene and Pliocene (?) age from the Logan Hill formation. This percolation probably takes place primarily in the northeast where the material of the nonmarine unit apparently is somewhat coarser. Here, again, as under the Jackson Prairie, the presence of the nonmarine unit is hydrologically significant in that the recharge received under Alpha Prairie helps to maintain the hydrostatic head utilized by the flowing wells in that part of the Newaukum artesian basin east of the old U.S. Highway 99.

Logan Hill

The upland plain known as Logan Hill is about 16 square miles in extent and lies north and south of the valley of the Newaukum River and northwest of the North Fork of the Newaukum River. It lies east of the Chehalis River valley, and south of Salzer Valley. Less than half a mile of the extreme northeastern part of the plain abuts foothills of pre-Miocene rocks; apart from this short reach the plain is surrounded by steep slopes in general about 250 feet high, descending to the adjacent valley areas.

The Logan Hill formation, which directly underlies the plain, is in turn underlain by the nonmarine unit under most of the plain and by materials of Eocene and Oligocene age under the northern and western parts of the plain. About 2½ miles south-southeast of Chehalis, the Logan Hill formation is about 155 feet thick (see logs of wells 13/2W-3A1, -3G2), and thins to the north, east, and west. Under the east-central part of the plain it is 100 to 110 feet thick (see log of well 13/1W-5H2); under the westernmost part of the plain, where it rests directly upon materials of Eocene and Oligocene age, it is probably 50 to 100 feet thick.

Of the wells canvassed on Logan Hill, all the active ones are domestic or stock wells; none are used for irrigation. In general, the water levels in shallow wells--those less than 50 feet deep--range in depth from a few to about 40 feet below the land surface. The levels in deeper wells are a correspondingly greater distance below land surface. For example, in well 14/2W-26M1, 104 feet deep, the level is about 84 feet below land surface. In three wells in sec. 3, T. 13 N., R. 2 W., all about 150 feet deep, the levels range in depth from 75 to 120 feet below land surface. As stated earlier, deeper levels are to be expected near the edges of the prairie where natural loss of water by seepage along the base of the scarps has steepened regional hydraulic gradients. To a certain extent, however, the difference in levels results from the existence of semiperched zones in the upper part of the Logan Hill formation. The yields of all wells canvassed are small; on the average, yields not greater than 10 to 15 gpm can be expected, regardless of the depth of the well. Only one well 13/1W-5H2, about 1½ miles south of the Logan Hill church, is reported to have a greater yield, 35 gpm, with a drawdown of nearly 90 feet. The well is 110 feet deep and taps water-bearing zones in the Logan Hill formation.

Ground water in the Logan Hill formation moves generally south westward under the central part of Logan Hill and toward the adjacent river valleys.

Besides the ground-water discharge from Logan Hill through springs and seeps and by evaporation, as previously described, ground water also percolates downward from the Logan Hill formation into the nonmarine unit, particularly where that unit pinches out against the older Tertiary rocks in the area north and south of the eastern part of Coal Creek.

Minor Areas

Minor segments of the upland plains occur as benches that border parts of the Chehalis River valley between Ceres Hill and the northern boundary of Lewis County, and also occur in the vicinity of Alpha, Cinebar, Salkum, and Lacamas, and on the uplands south of the Cowlitz River.

Material of the Logan Hill formation underlies all these benches and commonly is less than 100 feet thick; it in turn is underlain by a variety of Tertiary materials that range from Eocene to Miocene and Pliocene (?) in age.

The wells on these benches supply only enough water for domestic and stock needs. Many of those tapping the Logan Hill formation are reported to be inadequate during at least part of the year. Well 14/3W-11F3, on Cook Hill, reportedly yields about 40 gpm, but most of the dug wells probably yield only 5 to 10 gpm. On Seminary Hill, immediatedly east of Centralia, where the Logan Hill formation is only 20 to 65 feet thick, that formation yields little water. Most of the wells here are dug or bored and, as in the other minor upland plains, few obtain more than enough water for domestic use.

Of the few wells known to have been drilled into the Tertiary materials below the Logan Hill formation, none yield more than 10 to 15 gpm; many yield less. For example, well 14/3W-26P1, about 3 miles west of Chehalis, was drilled 775 feet deep, into Tertiary materials; it yielded only 1½ gpm. The water level in this well is reported to be about 250 feet below land surface. Of the wells on Seminary Hill that penetrate the Tertiary materials none yields more than 15 gpm. The foregoing data suggest strongly that there is little hope of developing large quantities of water in most of these minor upland areas.

Intermediate Terraces

The intermediate terraces are those that lie along the major valleys of the west-central lowland, at altitudes below the general level of the upland plains and above the flood plains of the major streams. They include, in descending order, the Lacamas Creek bench (terrace), comprising the areas known as Drews Prairie, Lacamas Prairie, and part of Cowlitz Prairie; the Newaukum terrace, comprising the Newaukum Prairie and smaller remnants of the same surface along the valleys of the Newaukum and Cowlitz Rivers (pl. 2); the Layton Prairie, including its adjacent counterpart known as Smokey Valley and smaller segments of the same general surface in the Cowlitz River valley.

Recharge to the aquifers in the intermediate terrace deposits is by infiltration from precipitation falling directly on the terraces and from springs discharging along the scarps of the adjoining upland plains, and by lateral migration of ground water from truncated aquifers in the Logan Hill formation beneath those upland plains. The ground water moves generally toward the outer margins of the terraces and discharges principally through springs and seeps, and as evapotranspiration, along the scarps that descend to lower levels.

Lacamas Creek Bench

The Lacamas Creek bench is directly underlain by the Lacamas Creek unit which in general is composed of glaciofluvial sand and gravel. It is underlain, in turn, by the nonmarine unit of Miocene and Pliocene (?) age. From a thickness of more than 200 feet north of Salkum, the Lacamas Creek unit thins to about 60 feet under Drews Prairie. Toward the southwest, the glaciofluvial sand and gravel of the Lacamas Creek unit is increasingly well sorted; toward the northeast increasingly large amounts of clay are mixed with the sand and gravel at some depths, and boulders increase in size and frequency; lenses of till are encountered in this unit near the eastern end of the bench.

The Lacamas Creek unit contains locally extensive lenses of cemented gravel. Under the eastern third of the bench there is a more or less continuous layer of cemented gravel whose upper limit is usually between 60 and 100 feet below the land surface and whose lower limit is usually from 10 to 50 feet above the base of the Lacamas Creek unit.

Apparently, material of the Logan Hill formation is sandwiched between the Lacamas Creek unit and the nonmarine unit in some places under the northeastern part of the bench, but the materials in the Lacamas Creek unit and the Logan Hill formation are so much alike that they have not been distinguished in well logs.

The main aquifer in the Lacamas Creek unit under the Lacamas Creek bench is a completely saturated bed of sand and gravel, which is relatively free of clay and silt, at the base of the unit. The aquifer ranges in thickness from less than 10 feet to 50 feet or more; in general, it ranges from 20 to 40 feet and averages about 25 feet. Little is known of the lateral extent of this aquifer, but it probably is not as great as the area of the Lacamas Creek bench.

Some ground water also is perched or semiperched locally by the cemented gravel in the Lacamas Creek unit. Under the eastern part of the bench the base of this perched aquifer generally is 60 to 100 feet below land surface. Although at some places near the extreme southeast end of the bench the perched ground water is of only seasonal existence, elsewhere it is used extensively as a source of water for wells that serve perennial domestic and stock needs.

Fragmentary evidence showing the existence of the perched water body under the eastern part of the bench is available from the records of wells 12/1-9Q1 and 10P1. Well 9Q1, about 3 miles west of Salkum, originally was dug to 73 feet. For several years it supplied domestic (and stock?) needs. However, because the water supply was not dependable in late summer and early fall, the well was deepened to 143 feet; the water level in the deepened well was about 130 feet below land surface. Well 10P1, about three-quarters of a mile east of well 9Q1, was dug to a depth of 158 feet, and although water was first encountered at 63 feet, the water level in the completed well was about 153 feet below the land surface. These data show that a shallow water-yielding zone is present, at least during part of the year, above the regional water table.

Southwest of the Willamette meridian, the main water table under the bench usually is less than 50 feet, and in many places less than 30 feet, below the land surface. East of about the Willamette meridian, the altitude of the land surface increases more rapidly than does that of the main water table; hence, the depth to the water table is greater--between 100 and 200 feet below the land surface under most of the bench east of the road south from Onalaska, and more than 200 feet under the northeast corner of the bench.

Eastward from near the Willamette meridian, the perched water table usually is less than 50 feet but at some places is as much as 70 feet below the land surface.

The water in the main ground-water body moves generally southwestward under the bench at a gradient of 15 to 20 feet per mile, although locally, near the southeast edge of the bench, ground water moves toward the scarp and discharges through springs and seeps. Hydrographs (fig. 9) of three wells tapping the main ground-water body in the Lacamas Creek unit beneath the southwestern part of the Lacamas Creek bench show that the annual fluctuation of water level ranges from about 3 to about 12 feet in these wells tapping the main ground-water body. Other water-level data, not herein presented, suggest that the seasonal fluctuation of levels in the shallow, perched zone may be somewhat less. The seasonal rise in level in saturated zones in the Lacamas Creek unit probably occurs rather rapidly with the advent of the rainy season.

Most of the water withdrawn from wells on the Lacamas Creek bench is extracted from the Lacamas Creek unit. The yields of these wells are less than 100 gpm.

Well 11/1W-6D1, about 2½ miles north-northwest of Toledo, the only one on the Lacamas Creek bench known to obtain water from the nonmarine unit, was drilled through material of that unit from 51 to 201 feet below land surface. At 201 feet artesian water was encountered in sand. On the basis of the geology of the nonmarine unit in adjacent or nearby areas, aquifers in this unit may be rather extensive. The aquifers are believed to be chiefly sand; under the eastern part of the bench the sand may coarsen somewhat.

Potential yields from aquifers in the nonmarine unit under the bench probably are smaller than yields from the overlying Lacamas Creek unit.

Newaukum Terrace

As previously stated, the Newaukum terrace extends discontinuously from Chehalis upstream along the Newaukum River and its south fork about to Cinebar, and similar terraces occur along the north side of the Cowlitz River about from Toledo to the mouth of Mill Creek, near Salkum. All these terraces are included in this discussion, largely for convenience, inasmuch as both terrace systems are related, topographically as well as lithologically.

On the Newaukum terrace along the Newaukum River and its south fork, most of the wells are used for domestic supply. Those that are less than 50 feet deep tap the Newaukum terrace unit. Because of the cemented nature of the materials making up this unit, the yields of wells are small and a few well owners have reported them inadequate even for domestic use, although they may be as great as 10 to 15 gpm during at least a part of the year. In such wells, water levels vary considerably from well to well, but are generally less than 30 feet below the land surface. Of about 30 wells canvassed on the Newaukum terrace, all 50 feet deep or less, the water levels ranged from 3 to 38 feet below the land surface when the wells were canvassed, chiefly in 1953-54.

On many parts of the terrace, the Newaukum terrace unit, which yields water in small quantity to most domestic wells, is underlain by the nonmarine unit of Miocene and Pliocene (?) age. Locally, this nonmarine unit is a productive aquifer, and about half the wells tapping it in this part of the area flow. However, the amount of water from most of these flowing wells is small, and they must be pumped to produce economic yields. For example, well 13/2W-5H1, a city of Chehalis well, flows at the rate of about 10 gpm. When pumped, however, it yields about 150 gpm. Similarly, well 13/1W-29R1 flows at the rate of about 60 gpm, but when test pumped its reported yield was about 300 gpm. The wells whose piezometric heads are above the land surface are not restricted to any one part of the Newaukum terrace. The easternmost is well 13/1-22R1 and the westernmost is 13/2W-16F1. The distance between them is about three-fourths of the total reach of the Newaukum terrace.

Not everywhere does the nonmarine unit of Miocene and Pliocene (?) age directly underlie the Newaukum terrace unit. For example, well 13/1-28C1, about 1½ miles northeast of Onalaska, may tap the Logan Hill formation which here separates the terrace materials from the nonmarine unit. The extent to which the Logan Hill formation underlies the terrace unit is not known, however. Also, in the vicinity of Chehalis, the Newaukum terrace unit probably is directly underlain by materials of the Lincoln formation.

As mentioned earlier, a series of terraces along the north side of the Cowlitz River valley is equivalent to those whose water-bearing characteristics have been discussed in the foregoing paragraphs. This terrace system, ranging in width from ½ to 1 mile, extends discontinuously from Salkum southwestward to the vicinity of Toledo. At Salkum its altitude is about 560 feet; in the vicinity of Toledo its altitude is about 270 feet. Its southeastern side is limited by scarps that separate it from lower benches and from the Cowlitz River flood plain. The Newaukum terrace unit underlying these terraces ranges in thickness about from 30 to 150 feet, and is thickest in the vicinity of Salkum. The main aquifer apparently occupies the basal few feet of the unit and is continuous under at least the two northeasternmost segments of the bench system.

Yields of wells tapping the Newaukum terrace unit in the Cowlitz River valley are everywhere small, but seem to be adequate for domestic use or for watering stock. Several wells on these segments of the terrace obtain water from sand or fine gravel in the nonmarine unit of Miocene and Pliocene (?) age that underlies the Newaukum terrace unit. Well 12/1-15J1, about 1½ miles southwest of Salkum, obtains all its water from the nonmarine unit and yields 30 gpm with 19 feet of drawdown, from a reported static level of 124 feet. Well 11/1W-8E2, about 1 mile north of Toledo, taps the same unit and yields about 125 gpm with a 26-foot drawdown. That the nonpumping water level in this well was only 2 feet below land surface in 1953 indicates that the aquifer tapped is confined. However, no wells on the terrace along the Cowlitz River are known to flow. Here, yields from the nonmarine unit are somewhat greater than those from the overlying cemented sand and gravel of Pleistocene age.

Layton Prairie

The Layton Prairie is only a part of the ancestral terrace underlain by materials of the Layton Prairie unit. For this discussion, therefore, not only will the water-bearing characteristics of the materials underlying that terrace be discussed, but also those of the materials underlying Smokey Valley, as well as those of corresponding *terrace remnants along the whole course of the Cowlitz River within the mapped area* (plate 2). The thickness of the Layton Prairie unit appears almost everywhere to be less than 80 to 100 feet, on the basis of fragmentary information contained in a few drillers' logs. Locally, however, a considerably greater thickness is penetrated by wells. For example, at well 12/2-14B1 about 140 feet of the Layton Prairie unit was penetrated.

Nearly all the wells canvassed in Layton Prairie, in Smokey Valley, and in other places where the Layton Prairie unit occurs are either stock or domestic wells. In Layton Prairie most of these wells are less than 50 feet deep, and their water levels range from less than 10 to about 30 feet below the land surface. Little is known of the yield of any of these, except that the owners of most report them adequate. Yields of about 15 to 20 gpm are probably common. Locally where permeable zones occur in the nonmarine unit, they may contribute substantially to the yield of deeper wells (see log of 11/1W-21D1).

A similar range in well depth and in depth to water occurs in Smokey Valley. Many of the domestic and stock wells are less than 50 feet deep; the water level in these generally is less than 35 feet below the land surface. In the southwestern part of sec. 20, T. 11 N., R. 1 W., water levels are deeper, presumably because the water-bearing materials are largely drained through springs discharging at the nearby scarp, which makes it necessary to drill somewhat deeper to assure a perennial supply. Two wells here, 20M1 and N1, are 70 and 55 feet deep, and the water levels in both are below 50 feet.

A few wells in Smokey Valley are reported to yield water at a substantial rate. For example, well 11/2W-36A4, 65 feet deep and tapping the Layton Prairie unit has been pumped at a rate of 100 gpm.

On other remnants of the Layton Prairie terrace the hydraulic characteristics of wells tapping the Layton Prairie unit are virtually the same as those on Layton Prairie and in Smokey Valley. Wells on these other remnants locally yield as much as 40 gpm.

Chehalis River Valley

To simplify description of the areal occurrence of ground water in the Chehalis River valley, the several segments of the valley are considered separately. These segments are, in order downstream, the upper Chehalis Valley, including the valley areas above Millburn; the Millburn-Claquato district; the Centralia-Chehalis lowland; and the Fords Prairie-Waunch Prairie district.

Upper Chehalis River Valley

The areas included in the upper Chehalis River valley are the Pe Ell Prairie, the Doty-Meskill area, and the valley of the South Fork of the Chehalis River, including the Boistfort Prairie. Of these, the valley of the South Fork, about 12 miles long, is by far the largest.

Pe Ell Prairie

The Pe Ell Prairie is a small valley district adjacent to the Chehalis River. It is about 4½ miles long from Pe Ell to a point in sec. 11, T. 13 N., R. 5 W., where the river valley is constricted by outcrops of the Columbia River (?) basalt. In this district, Tertiary sedimentary rocks are overlain by only a few feet of alluvium. Of 6 wells canvassed on the prairie, 5 tap the alluvium. The yields of all are very small, and some, according to well owners, can be pumped only intermittently.

Only one well on the Pe Ell Prairie has been drilled into the underlying Tertiary rocks. This well, 13/5W-33J2, at Pe Ell, is 270 feet deep and yields water of inferior quality and unknown quantity.

Doty-Meskill area

In the lowland area near Doty, where the Elk Creek joins the Chehalis River, and east to Meskill, a small amount of ground water is being used for domestic and stock supplies. In this district, the thin mantle of alluvium that forms the valley floor apparently does not yield appreciable amounts of water to wells. Here only four wells, 13/4W-8C1, 13/5W-2P1, 13/5W-9F1, and 13/5W-12B1, are presumed to yield water from the alluvium. Although the water from these wells is soft and of good quality, the yields apparently are small.

Of 10 wells visited in this area, all except the 4 cited above tap water-bearing zones in sedimentary rocks of Tertiary age. These wells range in depth from 56 to 460 feet below the land surface, and the water levels in those for which records are available are within 15 feet of the land surface. Although the water may be of somewhat better quality, in general, than that from the Tertiary rocks underlying Pe Ell Prairie, it is poor, nevertheless. The most common complaint of the owners of these deeper wells is that the water contains enough iron to give it an objectionable taste. The yields of these wells are small. The greatest reported yield is 60 gpm, from well 13/5W-11D1; the yields of the other wells are 25 gpm or less.

Valley of the South Fork of the Chehalis River

In the valley of the South Fork of the Chehalis River about 25 wells were canvassed. All active wells for which data were collected are used for domestic and limited public supply, and for watering of stock. As far as could be determined during the investigation, none of the wells supply water for irrigation. Most of the domestic and stock wells tap permeable zones in the valley alluvium, which throughout this valley reach is only a few feet thick. Of 16 wells canvassed, all tap or are presumed to tap the valley alluvium. The depths range from 12 to 26 feet; the average depth is 19 feet. Virtually all these wells yield enough water for domestic use. The chief complaint offered was that many of the wells go dry late in the summer.

At many places, possibly through the whole valley reach from Wildwood to the confluence of the South Fork with the Chehalis River, the thin mantle of valley alluvium rests on Tertiary sedimentary rocks. In this reach, at least 10 wells are known to penetrate these older rocks. The yields of most of the wells are not markedly greater than of those tapping only the surficial materials. For example, of three wells ranging in depth from 100 to 212 feet, the yields of all are less than 10 gpm. The levels in two, 13/4W-36P1 and 13/3W-30P1, are about 10 feet below the land surface; the level in the other, 13/3W-30C1, reportedly is deeper.

All wells tapping Tertiary sedimentary rocks in this area yield water of inferior quality. Owners of these wells variously report the water to have a sulfur odor, to be salty or alkaline, or to produce objectionable brown stains.

Millburn-Claquato District

In the Millburn-Claquato district the valley floor is underlain by alluvium and glacial Lake Chehalis deposits. These materials are separated from the underlying Tertiary sedimentary rocks by a layer of the Columbia River (?) basalt. Southwest and west of Adna, the basalt beneath the valley floor is very thin or absent. To the southeast, extending across the valley and into the adjacent hill area, the basalt is 80 feet thick or more. Above the basalt, the alluvium and lacustrine sediments are 40 to 50 feet thick at most places. Although many wells were canvassed in this portion of the Chehalis River valley, as well as in the adjacent hill area to the north, very few drillers' logs were obtained. Therefore, the thickness of the various materials underlying the valley floor are known only approximately. Of about 35 wells canvassed in this district, all of which are presumed to derive water mainly from the alluvium, nearly all are stock or domestic wells. These range in depth from 15 to 58 feet; the average depth is about 40 feet. Although the yields of only a few of these wells were determined, the well owners reported that, in general, they were adequate. Doubtless, most of these wells will yield at least 15 gpm. In most of these wells, the range in depth to water from well to well is from about 8 to about 30 feet below land surface.

In the Millburn-Claquato area, no wells are known to yield water from the Columbia River (?) basalt. A few penetrate the basalt completely and tap permeable materials in the underlying Astoria (?) formation. These wells are 13/3W-1N1, 104 feet deep; 13/3W-3R5, 75 feet deep; 13/3W-5G1, 168 feet deep; and 13/3W-8G2, 150 feet deep. The drillers' logs of these indicate that the Columbia River (?) basalt was encountered in all except 13/3W-5G1, about 1½ miles northwest of Adna. As far as can be determined, the yields of these are not appreciably greater than those of the shallow wells that tap the overlying alluvium. There is some advantage, however, in drilling wells through the basalt because the water in aquifers immediately underneath the basalt--where it is present--occurs under pressure. The water levels in such wells are closer to the land surface, in general, than those in wells tapping only the alluvium. However, the yields are small, and, if an adequate yield is not obtained from materials just underneath the basalt, little will be gained by drilling deeper.

Centralia-Chehalis Lowland

In this report, the flood plain of the Chehalis River from Claquato to about the southern end of Fords Prairie is called the Centralia-Chehalis lowland. The area is very flat, ranging in altitude from about 185 feet near Claquato to about 175 feet northwest of Centralia.

The Tertiary materials that underlie this lowland at depth are overlain by unconsolidated deposits less than 50 feet thick. These unconsolidated materials consist of silt, sand, and clay in the upper part and sand and gravel in the lower part. The basal sand and gravel commonly makes up only a quarter of the total thickness. Some of this coarser material probably was deposited as advance (?) outwash from the Vashon glacier.

The yields of the wells tapping the alluvial and the advance (?) outwash deposits generally are less than 60 gpm. One well, 13/3W-1M1, is reported to yield 90 gpm. That well, and the other wells that produce moderate amounts of water from the materials beneath the lowland, tap gravel that directly overlies the rocks of Tertiary age. The older rocks beneath the gravel stratum are not known to yield appreciable amounts of ground water.

The levels in wells in this district range from about 10 to 40 feet below the land surface, but generally are less than 15 feet.

Fords Prairie-Waunch Prairie District

The Fords Prairie-Waunch Prairie district lies mostly between the Chehalis and Skookumchuck Rivers, just north of their confluence, and extends a short distance north of the project area. The district also includes the low bench south of the Skookumchuck River, upon which the city of Centralia is established.

The moderately to highly permeable sand and gravel deposited as outwash from the Vashon glacier underlies the Fords Prairie-Waunch Prairie district from the land surface to depths as great as 91 feet (in well 14/2W-5F1). In general, however, the outwash is less than 60 feet thick.

The outwash materials constitute the most productive aquifer in Lewis County. The greatest yield recorded, 880 gpm, is that from well 14/2W-5G2. Of several wells the range in reported yield is from 500 to 800 gpm. Of 45 wells tapping outwash of the Vashon glaciation, 33, or about 75 percent, yield 15 to 125 gpm.

In the area as a whole, water levels are relatively near the land surface. In virtually all the wells for which information is available, the water levels range from 10 to about 25 feet below land surface.

Recharge to the outwash materials probably occurs chiefly as direct infiltration from rainfall. Considering the shallow position of the water table through most of the district, it does not seem possible that the Skookumchuck and Chehalis Rivers or any of the smaller streams there are contributing appreciable quantities of water to the outwash materials.

Newaukum River Valley

The Newaukum River valley as discussed in this report includes the flood plain of the main stem from its confluence with the Chehalis River to the vicinity of Forest and the elongate valley areas through which flow the north, middle, and south forks. During the well inventory for this project, about 25 wells were canvassed in the Newaukum River valley. Of these, about 18 tap alluvial materials and the rest probably produce water from the nonmarine unit of Miocene and Pliocene (?) age. Locally, in the Newaukum River valley the nonmarine unit contains water under pressure, which at some places is great enough to cause wells to flow.

Alluvium of the Newaukum River Valley

The alluvium of the Newaukum River valley consists predominantly of fine materials. Locally, however, logs of wells report the existence of gravel or boulders. In this section of the report, alluvium has not been distinguished from the glacial Lake Chehalis sediments which are known to be present in much of the Newaukum

River valley. Together the lake sediments and alluvium range in thickness from a few feet to a few tens of feet. Of the shallow wells in Newaukum River valley known to tap alluvium, few are more than 30 to 40 feet deep.

Water levels in shallow wells in the Newaukum River valley range in depth from 2 to about 20 feet below land surface. As might be expected, the yields of all are small--30 gpm or less. Although most are adequate for domestic use, owners of a few report that the supply is inadequate, at least during a part of the summer, and that many wells yield water in which the iron content is objectionably high. In this area, a possible source of the iron is the Logan Hill formation, which underlies the upland areas flanking the Newaukum River valley on both its north and its south sides. The Logan Hill formation discharges substantial quantities of ground water to the valley areas.

Newaukum Artesian Basin

As discussed earlier, the nonmarine unit is a productive source of ground water only in the valleys of the Newaukum River and its north and south forks, and to a limited extent laterally on the upland plain and intermediate terraces. The basin in which the nonmarine unit was deposited was formed as a result of structural activity during late Pliocene time (see p. 44). This is one of the few places in Lewis County where such activity has influenced the occurrence and movement of ground water.

The Newaukum artesian basin as shown on plate 1 covers an area of about 25 square miles. Within it are all the wells tapping the nonmarine unit that are known to flow.

Recharge to the nonmarine unit within the Newaukum artesian basin is derived chiefly from precipitation that falls on the adjacent upland plains, which are underlain in part by the nonmarine unit. Because here the nonmarine unit is in hydraulic contact with overlying materials of Pleistocene age, at altitudes above at least the central part of the artesian basin, the hydraulic gradient in the basin is great enough to produce artesian pressures. In parts of the basin the artesian pressure is great enough to cause wells tapping the nonmarine unit to flow.

At many places in the Newaukum artesian basin, yields of a few hundred gallons a minute are common. For example, wells 13/1W-18K1 and -18R1 were reported to have flowed 400 and 350 gpm, respectively. Both wells are assumed to tap only the nonmarine unit. Fairly substantial yields are obtained from wells that tap only the uppermost part of the nonmarine unit in the artesian basin. Yields of 100 to 200 gpm from wells as deep as 250 feet are common. Although some wells flowed several hundred gallons a minute when first drilled (see table 1, wells 13/2W-15K1, -15M1, and -16H1), most have required the installation of pumps to develop their full potential.

On the basis of the records in table 1, water levels in wells tapping the nonmarine unit range from about 66 feet above the land surface (well 13/1W-29R1, in 1953) to 25 feet or more below. For many of the flowing wells inventoried it was not possible to determine the static pressure. For those that could be measured, however, a range in pressure from a few feet to 15 feet above the land surface was common.

Cowlitz River Valley

The Cowlitz River valley extends from the southern boundary of the project area (pl. 2) to about the mouth of Mill Creek. That part of the valley floored by alluvium ranges in width from less than ¼ mile to about 2 miles.

The alluvium probably is nowhere more than a few tens of feet thick. At well 11/1W-17L2 it is about 49 feet thick; at well 11/1W-9L1 it is at least 40 feet thick. Locally, the alluvium rests on materials of Tertiary age. At well 11/1W-17L2, alluvium is underlain by the nonmarine unit, which here is at least 186 feet thick. In the SW¼SE¼ sec. 24, T. 11 N., R. 2 W., the alluvium probably is underlain by sandstone and conglomerate of the Lincoln formation.

Water levels in wells tapping the alluvium in the Cowlitz River valley range in depth from about 7 to 25 feet below land surface. Although the yield of one well tapping the alluvium is reported to be 100 gpm (well 11/1W-9L1), this appears to be an exception. Most of the wells yield 5 to 20 gpm--enough for domestic or garden use but insufficient for general irrigation.

The chemical quality of water from wells tapping the alluvium in the Cowlitz River valley is good in general. Only a few owners report that water from their wells contains enough iron to produce a taste or to cause stains on clothing and plumbing fixtures.

Glaciated Valleys of Eastern Lewis County

In the eastern part of the area studied, a few wells tap a heterogeneous mixture of gravel, silt, and clay that is referred to earlier in this report (p. 42) as undifferentiated valley fill. On plate 2 this material extends over nearly all the floor of Rainy Valley and the floor of the valley of Lake Creek, a tributary of the Tilton River. The thickness of the material in these areas is not known.

Records are available for only a few wells tapping the undifferentiated valley fill. Except for well 12/5-14H1, which is 222 feet deep, all range in depth from 26 to 67 feet. Well -14H1 doubtless penetrates the whole thickness of valley fill and extends into underlying materials. However, as no log is available for this well, the depth base of the valley fill is indeterminate here. Of the shallower wells, 67 feet or less in depth, logs are available for only wells 12/5-22A1, -28A1, and -28G1. The records indicate that water is obtained from fine gravel, or from sand and gravel, ranging in thickness from 1 to 5 feet near the bottom of the wells. In all these shallow wells, water levels range from 8 to 30 feet below the land surface.

According to reports by well owners, all the wells yield supplies adequate for domestic use. Well 12/5-28G1 is reported to yield 42 gpm, an amount adequate for small-scale irrigation. The water produced from the undifferentiated valley fill is soft, and probably everywhere the hardness is less than 75 ppm (parts per million). In only one of the wells inventoried (12/5-28A1) did the owner indicate that the water contained iron of objectionable quantity.

FLUCTUATION OF WATER LEVELS IN WELLS

In 1952, when the study of ground water in Lewis County began, periodic measurement of water levels was started in 25 wells. Such measurement was continued in most of the wells into October 1955. These water-level measurements, as well as measurements beginning in 1942 in one well of the statewide key-well network, are shown graphically in figures 7 through 12.

The hydrographs in figures 7 to 12 present data for 1 well in the foothills area, 7 wells on the upland plains, 8 wells on the intermediate terraces, 5 wells in the Chehalis River valley, 3 wells in the Newaukum River valley, and 2 wells in the Cowlitz River valley.

The water levels in most of these wells show a typical rise in September or October each year, coincident with or immediately after the beginning of the winter rainy season (fig. 5). In most wells the recovery period extends into February or March; in some, it extends into April or May (for example, wells 13/2W-21D2 and 12/2W-35B2, fig. 8; well 11/2W-15A1, fig. 9; well 13/2W-15M1, fig. 11).

The seasonal decline in water level in the water-bearing zone tapped is dependent on the extent to which discharge (either natural or artificial) is greater than residual recharge. Levels in some of the wells (see 14/2W-19N1 and 14/3W-1A1, fig 10) decline rapidly. In other wells, the decline takes place over a much longer time (wells 13/1W-9E1 and 13/2W-21D2, figure 8; well 12/2W-7J2, figure 7). The amount of seasonal fluctuation varies from well to well. In wells 12/2W-9L3 and 12/1W-9D1 (fig. 8), and in well 11/2W-15A1 (fig. 9) the fluctuation is less than 5 feet. In wells 12/2-14B1 (fig. 9) and 14/3W-1A1 (fig. 10) it is about 15 feet, and in wells 12/2W-7J2 (fig. 7) and 12/2W-14E2 (fig. 8) it was more than 15 feet during 1955.

The amount of seasonal fluctuation in wells in a given area should be given consideration in drilling new wells to avoid the possibility of the water level dropping below the bottom of the casing during periods of low water. For example, in December 1952, the water level in well 13/1W-9E1 (fig. 8) was only about 4 feet above the bottom of the well. During a particularly dry year, the level could drop still farther, possibly to the point where the well no longer would yield water.

The most significant feature shown by the hydrographs is that concerned with long-term fluctuations. Although the 3-year span of record is not long enough to depict long-term trends with confidence, the hydrographs show that, in general, the

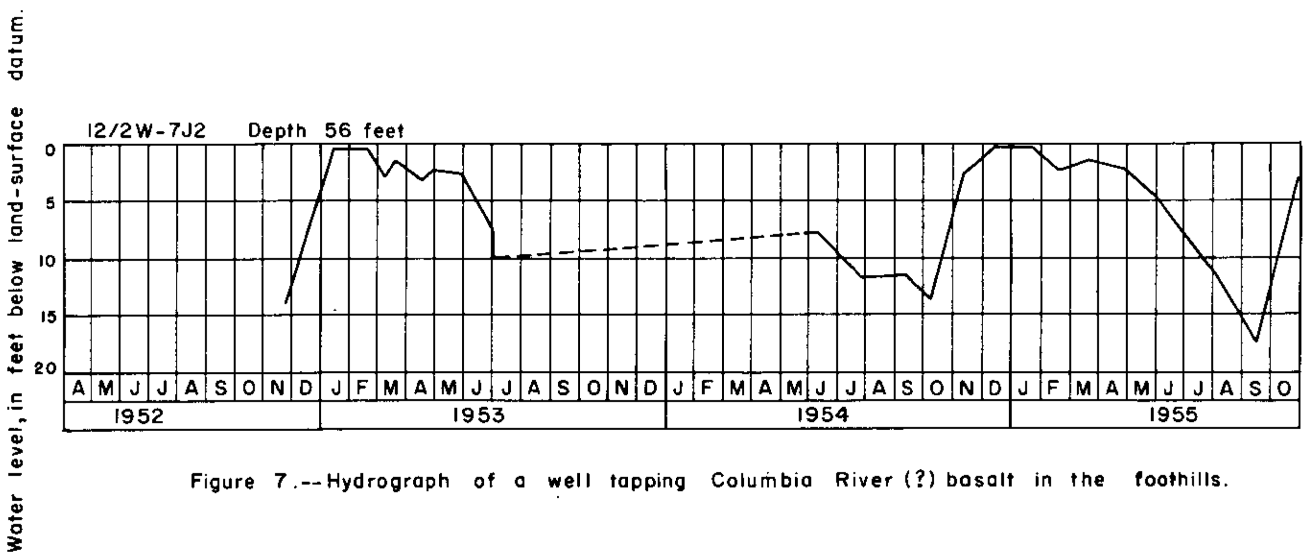


Figure 7.--Hydrograph of a well tapping Columbia River (?) basalt in the foothills.

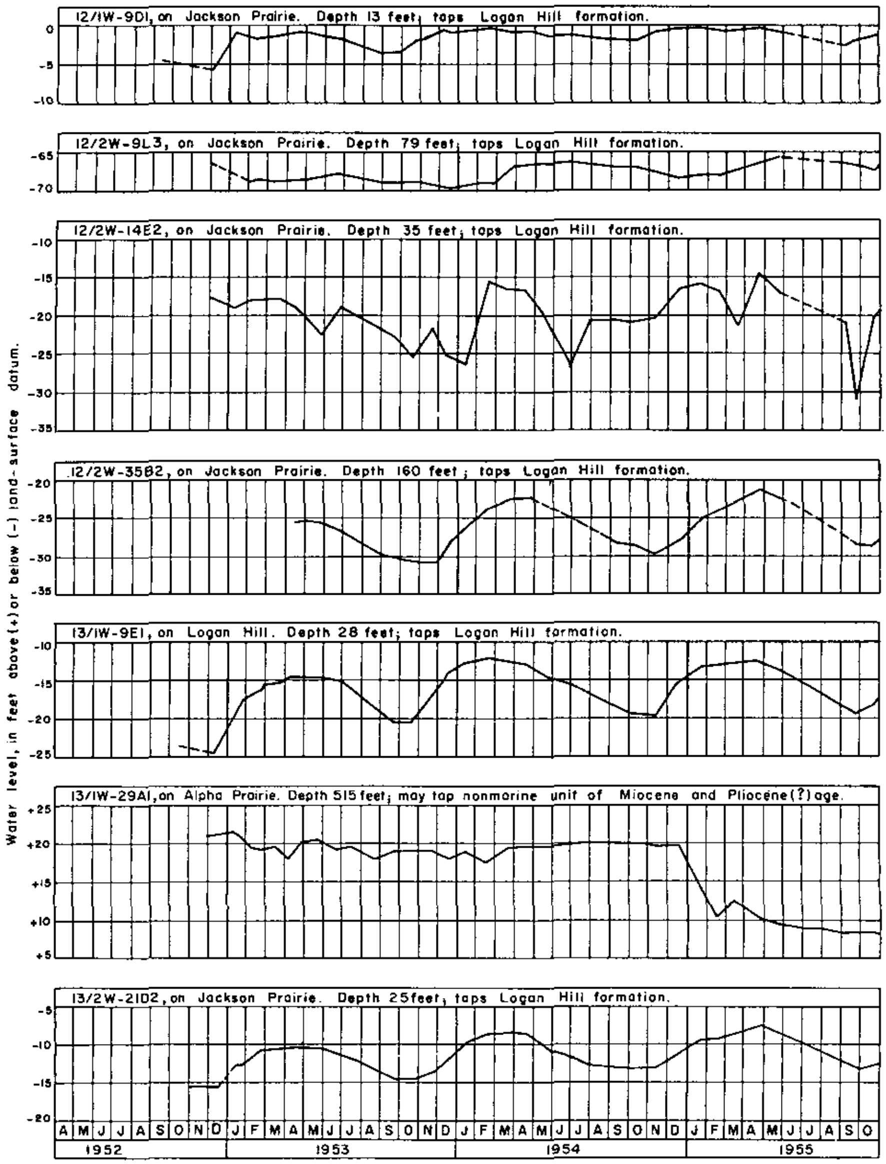


Figure 8.-- Hydrographs of selected wells on the upland plains.

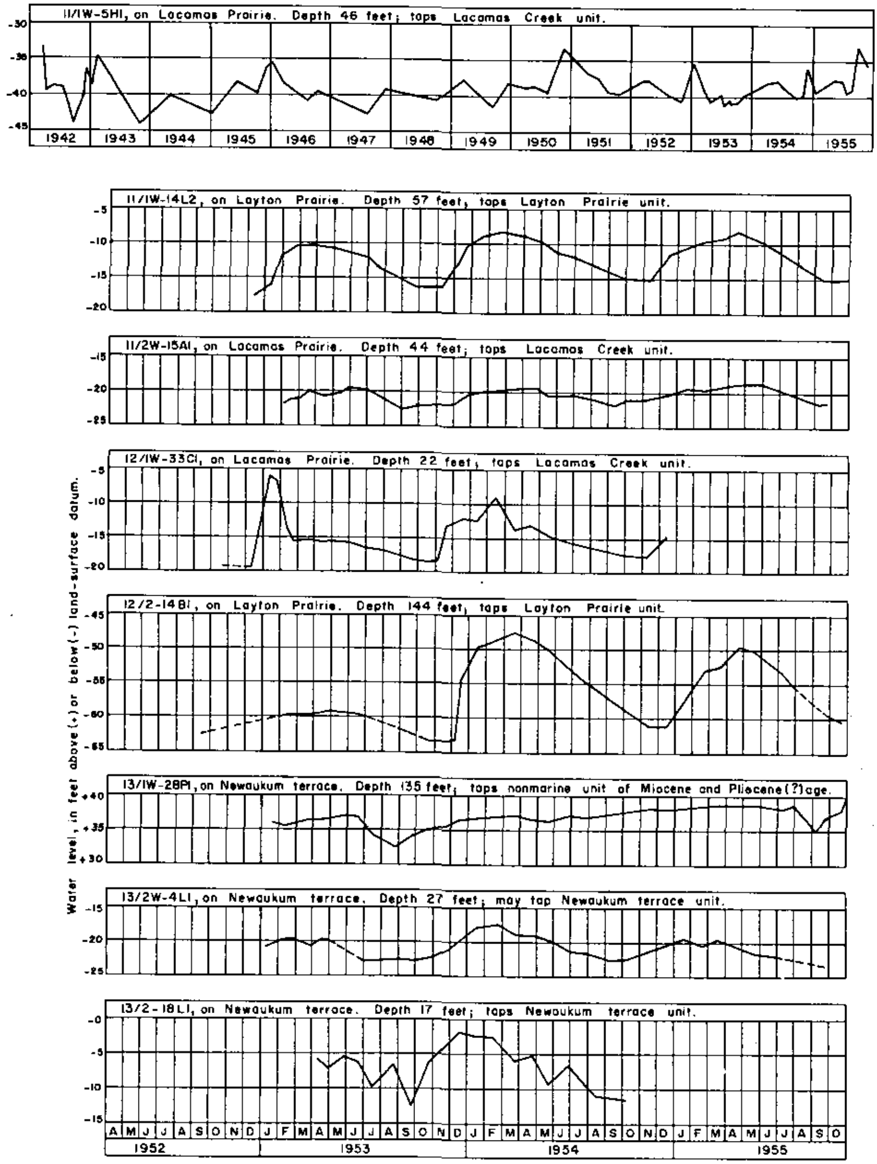


Figure 9.--Hydrographs of selected wells on the intermediate terraces.

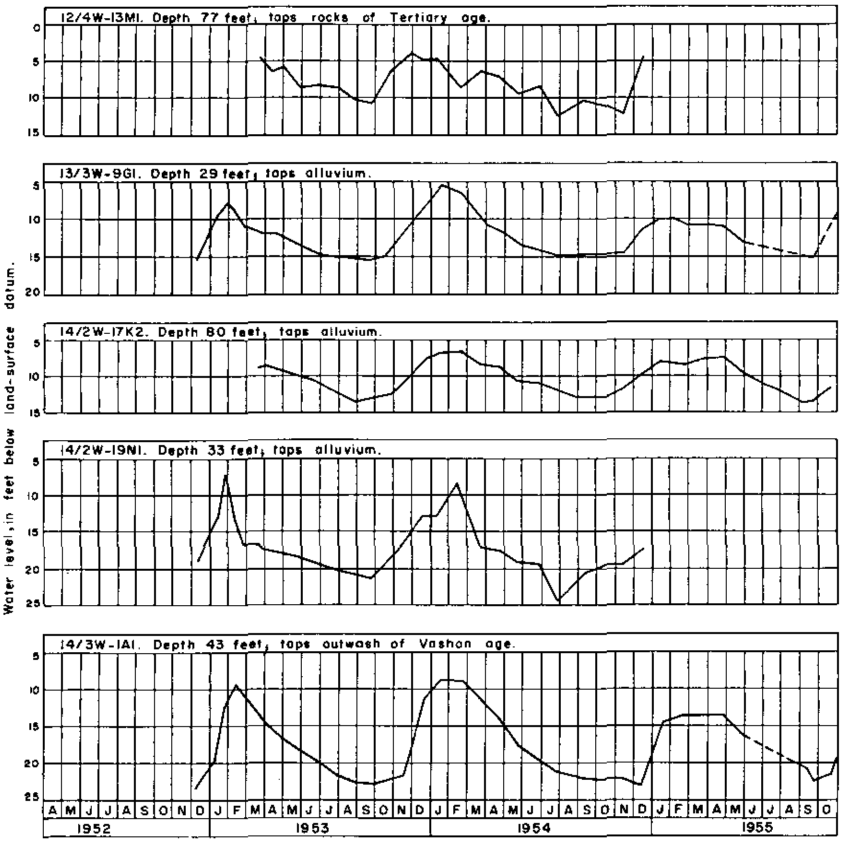


Figure 10.--Hydrographs of selected wells in the Chehalis River valley.

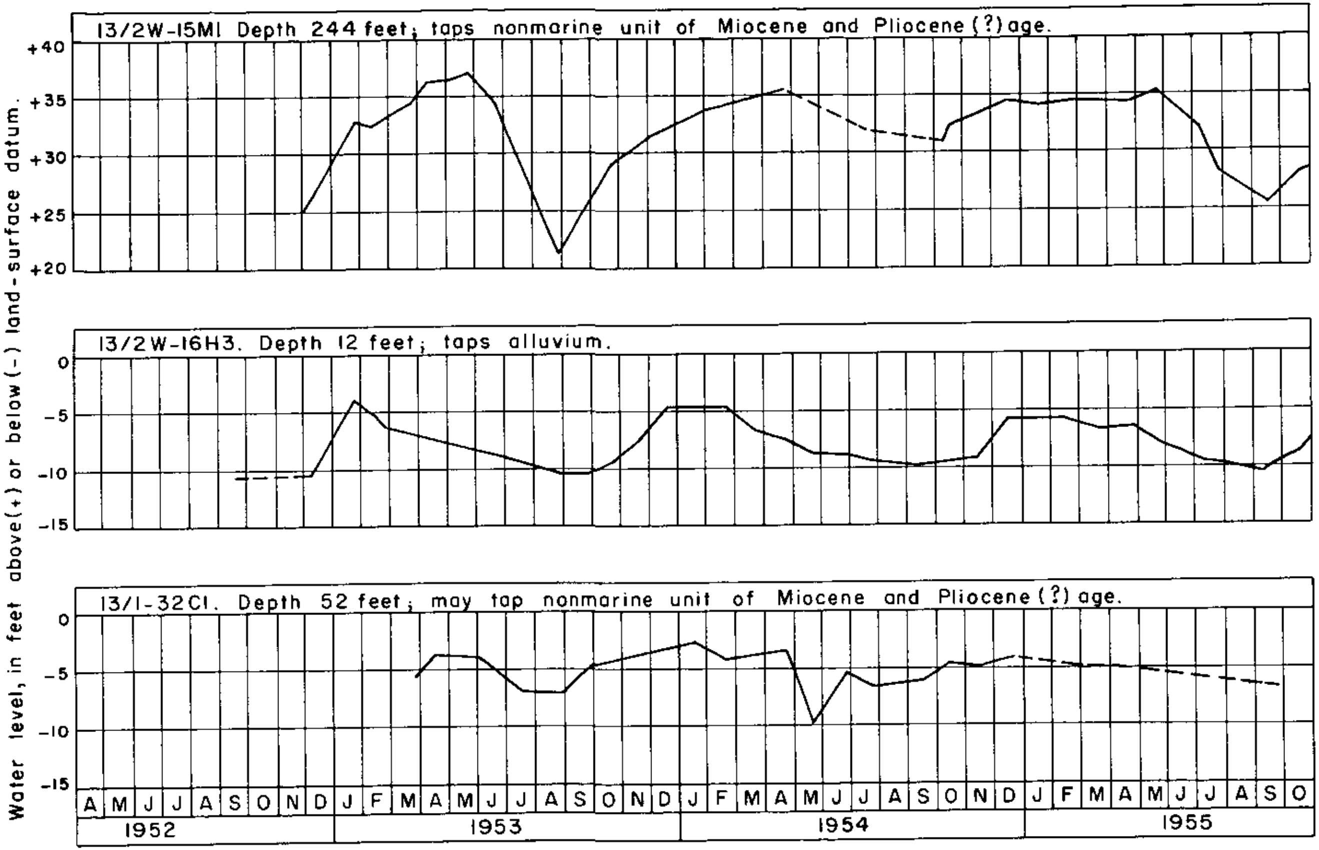


Figure 11.--Hydrographs of selected wells in the Newaukum River valley.

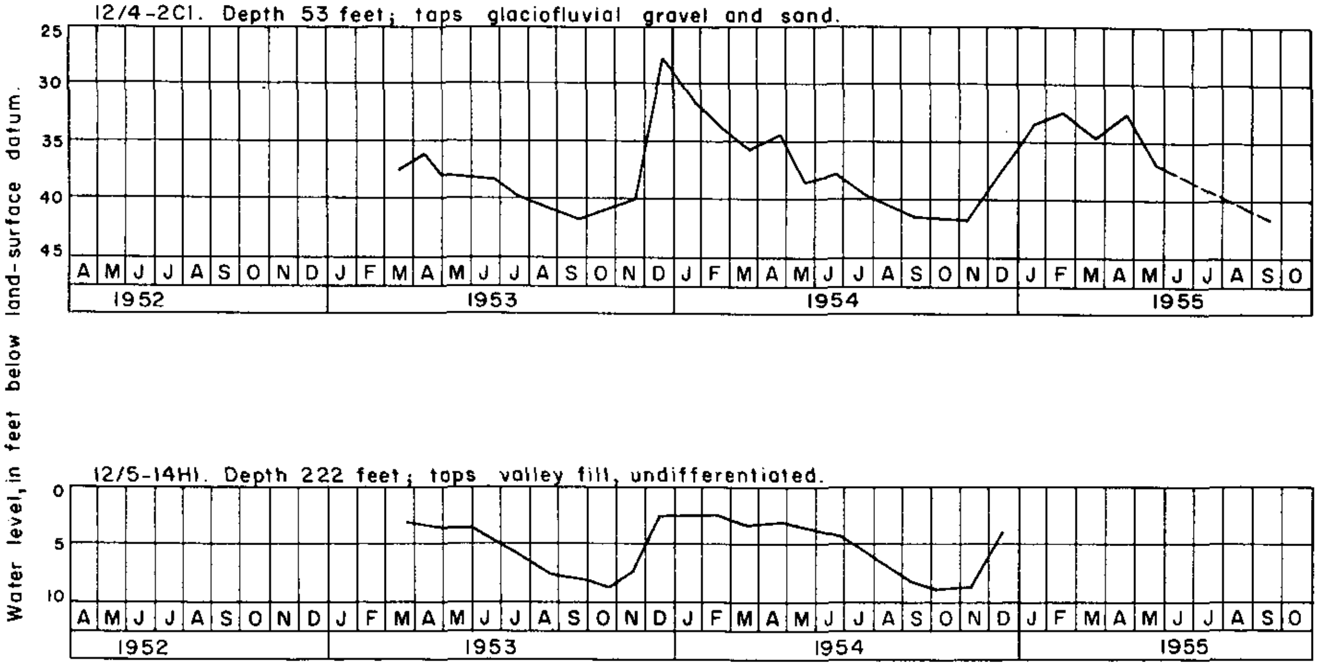


Figure 12.--Hydrographs of selected wells in the Cowlitz River valley.

spring recovery in level for each well is about the same for each of the three years, 1953 to 1955. It appears that, at least during that period, the amount of ground water pumped was less than the amount potentially available for use. To confirm the extent to which development since 1955 may have depleted the ground-water supply, measurements of levels were made in several of the observation wells in 1960. These measurements all fall within the fluctuation span shown on the hydrographs of each of the wells measured.

USE OF GROUND WATER

Present Development

The use of ground water for domestic, public-supply, and irrigation purposes is discussed below; the amount of ground water used solely for industrial needs was not determined during the study. Much of the industrial demand is concentrated in urban areas, and for that reason the quantities used would be a part of the overall public supply discussed below. The total amount of ground water withdrawn from wells for the aforementioned uses was about 3,000 acre-feet in 1959.

Domestic Supplies

By far the largest number of wells in Lewis County are used for domestic purposes. Most of these are small dug wells, adequate in capacity for only home or farm use. In table 1 are listed about 800 wells that are used solely or partially for domestic needs, and all the domestic wells in the project area were convassed. On the basis of rural population (about 30,000 in 1960), there may be as many as 5,000 domestic wells in the county. If the average use was 300 gpd (gallons per day) from each well, the estimated average withdrawal from the county for rural domestic use was $1\frac{1}{2}$ million gpd, or about 1,600 acre-feet per year.

Public Supplies

Of about 10 cities in Lewis County that have public water-supply systems, 8 obtain water from wells or springs. These cities are Centralia, Napavine, Winlock, Vader, Toledo, Onalaska, Salkum, and Mossyrock. Of these, Centralia and Vader depend chiefly on surface water to furnish the total public supply, and use wells only intermittently when supplementary water is needed. Of the eight cities listed, Centralia uses the largest amount of ground water, 31 million gallons a year from 3 wells. This amount is about 3 percent of that city's total demand. The estimated ground-water demand in 1959 of all the eight cities was about three-quarters of a million gallons a day, about 800 acre-feet per year.

Irrigation Supplies

To determine the amount of ground water used during 1959 for irrigation, electrical-energy data were obtained from the Lewis County Public Utility District. By computing the amount of energy required to pump given quantities of water, where well-pumping rates were known, a factor was developed that could be applied to the area as a whole. It was thus determined that the yield of ground water for irrigation was about 700 acre-feet in 1959.

That this figure is reasonable was confirmed by data furnished by R. E. Roffler, Lewis County Extension Agent of the U.S. Department of Agriculture. According to Mr. Roffler (oral communication, 1960), about 5,000 acres of land currently is under irrigation in Lewis County, of which about 15 percent is irrigated by ground water applied at the rate of about three-quarters of a foot per acre per year. On the basis of these data, the annual ground-water use for agriculture is estimated to be about 600 acre-feet. This pumpage is reasonably close to the independently determined estimate above.

Future Development

The economy of Lewis County in the foreseeable future doubtless will continue to be based on the lumbering industry and on the manufacture of forest products. However, some increase in other types of industry can be anticipated, together with a commensurate increase in population in urban areas and in rural and suburban homes in and around the west-central lowland. The extent to which irrigation requirements will increase in the immediate future is not known. However, because the stream water available for irrigation may now be almost completely appropriated, it can be said categorically that additional supplies for irrigation must come almost entirely from ground-water sources.

Thus it may be expected that more and more ground water will be needed for industrial use and public supply near the present population centers, for rural domestic (including stock watering) use in all but the highest, most rugged parts of the county, and for irrigation in the west-central lowland and adjacent valleys.

Data currently available, as discussed earlier in this report, indicate that development of ground water into 1960 has not resulted in any evident depletion of the ground water in storage. Except locally, development of ground water in the valley areas of Lewis County can be increased severalfold. Because the economic development of the county is not expected to increase materially in the foreseeable future, it appears that with careful water management the ground-water supply should be ample to meet the needs for many years.

There are two distinct approaches to the problem of obtaining additional supplies of ground water in Lewis County. The first involves the further development of known ground-water bodies, such as those in the Logan Hill formation and younger deposits, and those in Tertiary materials, for example, in the Newaukum River valley and in the Adna-Littell-Claquato district. The second involves prospecting for additional supplies in areas where, on the basis of inferred structural conditions, the hydrologic regimen is favorable to the occurrence of fresh water in aquifers of Tertiary age.

At many places, wells tapping aquifers of the Logan Hill formation and of other terrace deposits yield comparatively small amounts of water. This does not mean that these aquifers are nearing depletion. Rather, it suggests that the aquifers are of comparatively low permeability or, of equal likelihood, that well construction is inadequate and that the capabilities of the aquifers have not been developed fully.

The Vashon outwash is capable of sustaining much larger yields, suitable for industrial use and, after treatment, for municipal supplies. The nonmarine unit of Miocene and Pliocene (?) age in the Newaukum artesian basin also is capable of much additional development. Because the rate of recharge to the nonmarine unit may be comparatively small, additional development of this unit should be accompanied by the establishment of an extensive observation-well network, to determine the onset and magnitude of long-range storage depletion, if such should develop. Therefore, all new wells drilled in those same areas probably would have substantially greater yields if they were drilled sufficiently deep to insure penetration of all water-bearing zones present, and if the casing has an adequate number of perforations of a proper slot size to effectively screen out the aquifer materials.

In the event of future shortage of ground water it may become economically feasible to prospect for additional supplies of water from rocks of Tertiary age; for example, the Skookumchuck, Lincoln, and Astoria (?) formations and the nonmarine unit beyond the known extent of the Newaukum artesian basin. As previously discussed, the conditions are most favorable for the occurrence and development of fresh water in the Tertiary rocks where permeable beds have been tilted so as to occur at or near the surface in potential recharge areas of the uplands or foothills, and where these same beds continue beneath adjacent lowlands at depths shallow enough for economic drilling.

CHEMICAL QUALITY OF GROUND WATER

The chemical quality of water in the area of this investigation is indicated by 310 chemical analyses of water from wells and springs. Of these, 292 are determinations of chloride, hardness, and bicarbonate (table 5) and 20 are comprehensive analyses in which many of the chemical constituents and physical properties common to water analysis have been reported (table 4).

General Range in Chemical Character

The analyses listed in tables 4 and 5 show a wide range in concentrations of the various constituents. The range in chloride is from 1 to nearly 29,000 ppm which is considerably more than the normal concentration of chloride in sea water. However, water from most of the sources (249 of 310 waters analyzed for this constituent) contain less than 20 ppm of chloride. Of these 249, about 80 percent contain 10 ppm of chloride or less. The range in hardness of water is from less than 10 to about 16,000 ppm, although most analyses report less than 75 ppm. The range in bicarbonate is much less, from 0 to 805 ppm. Except locally, where the iron content of water is sufficiently high to render it unsuitable for use, ground water throughout much of the area is of good quality and can be used for all normal purposes.

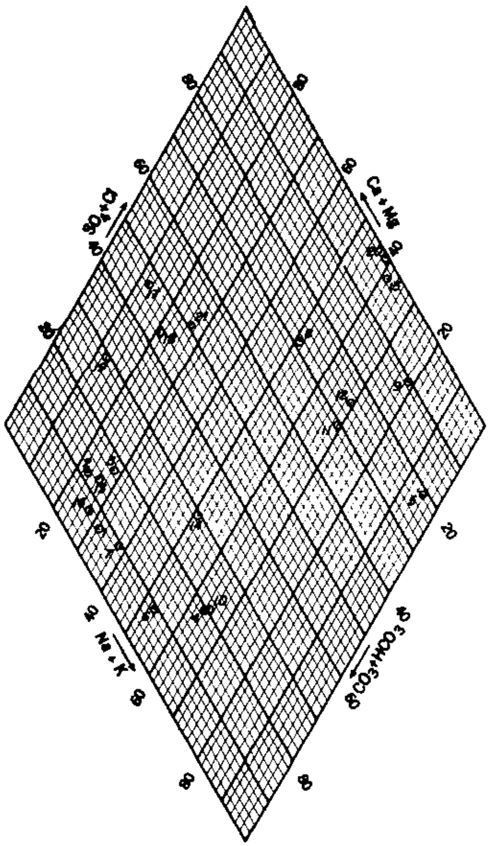
Figure 13 includes one-point plots of the 21 comprehensive analyses listed in table 4. The method of plotting has been described by Piper (1944, p. 914). Although, at first glance, the plots of the analyses seem dispersed randomly over nearly all the field of the figure, closer scrutiny reveals the existence of three rather generalized groups. The predominant cations in the analyses plotted in the lower left portion of the diamond-shaped grid are almost equally divided between the alkaline earth metals (calcium and magnesium) and the alkali metals (sodium and potassium). The predominant anion is bicarbonate. In all the samples plotted in the lower left portion the range in dissolved solids is from 85 ppm (well 12/2W-10N1) to 184 ppm (well 13/1W-28P1). The analyses plotted in the upper left portion of the grid represent a calcium bicarbonate type of water. For these, the range in dissolved solids is less than in the other analyses, from 67 to 141 ppm. Except for one analysis in which the predominant cations are potassium and magnesium and the predominant anions are nitrate and bicarbonate, the analyses plotted in the upper right portion of the grid represent a sodium chloride type of water. Within this group is the water that is the most saline of the area; in some respects it is similar in composition to ocean water.

Of the three types of water shown diagramatically on figure 13, only that represented by analyses plotted in the lower left portion of the grid is found throughout the project area. Virtually all the water considered fresh or potable in the western part of the state is of this type. The second type, which is represented by the four analyses plotted in the upper left portion of the field, is restricted to a specific area. All four analyses are of water from wells that are north of Centralia and that tap outwash sand and gravel of Vashon age. The third type, that represented by the six analyses plotted in the upper right part of the field, excluding that for well 12/1-9Q1, is restricted largely to the western part of the project area.

There is no doubt that at least one example of water of the third type, that from well 14/2W-22H1 (analysis 20, fig. 13) is connate. The others, represented by analyses 5, 9, 11, 12, and 15, may represent blends of connate and fresh water. Because the waters whose analyses plot in the upper right part of the field are not equally saline, it is reasonable to expect that blending of connate and fresh water has not proceeded at a uniform rate at all localities.

With regard to the possible source of the saline water, which is believed to be of connate origin, data from all the wells in Lewis County that are known or were reported to yield saline water were scanned to determine the depth or stratigraphic zone from which the water was obtained. Of 18 wells for which some data are available, all tap rocks of Tertiary age, and, of these, all except one probably tap materials of Eocene age.

None of these wells was drilled on the high foothills; all were drilled on valley bottoms, on the flanks of foothills, or on terraces or benches. The location data for these wells suggest that saline water is most likely to be found in aquifers of Eocene age at altitudes of less than 200 feet above sea level.



Point no.	Well	Dissolved solids (ppm)	Depth of well (feet)
1	11/1W-8E2	126	79
2	11/1W-14L2	114	57
3	11/2W-29P1	138	186
4	11/2W-32C1	133	220
5	11/2W-32C1	1,160	220
6	11/2W-32D1	139	75
7	12/2W-10N1	85	100
8	12/1-9Q1	109	140
9	13/1W-19Q1	806	751
10	13/1W-28P1	184	135
11	13/2W-5H1	483	322
12	13/2W-15M1	576	244
13	13/2W-34A3	146	101
14	13/3W-2F1	104	90
15	13/5W-33J2	1,546	270
16	13/1-19K2	111	182
17	14/2W-4E1	67	63
18	14/2W-5F1	141	93
19	14/2W-5H1	126	72
20	14/2W-22H1	45,500	1,200
21	15/3W-36K2	96	54

Figure 13.—Chemical character of water from wells in Lewis County

In the foothills above the valleys, the few wells drilled through appreciable thicknesses of Eocene materials at altitudes greater than 200 feet above sea level have not encountered saline water, although the presence of marine fossils at these elevations shows that the materials there are of marine origin. If more deep wells were to be drilled into Eocene materials at altitudes above 200 feet, saline water probably would be found to exist at the higher levels. It appears more likely, however, that the connate sea water in the Eocene beds above 200 feet, or in anticlinal folds, has been drained or flushed out by fresh water derived from precipitation.

In most parts of the area, the existence of saline water in rocks of Eocene age has not been critical because water in economic quantity has been and now is available at shallower depth from younger materials. However, the hydraulic head of water in the Eocene rocks in many places is great enough to make upward leakage extremely likely, provided that vertical transmissibility of both the Eocene rocks and those overlying them is sufficient to allow water to migrate upward to the producing zones. Wells tapping Eocene, and particularly Oligocene, rocks have poor yields, a factor suggesting that the likelihood of upward migration of saline water is comparatively slight. Nevertheless, some water in youger materials locally has been contaminated by saline water. For example, although the water from the nonmarine unit of Miocene and Pliocene (?) age is generally of good quality, in a few places, as in secs. 15 and 16, T. 13 N., R. 2 W., wells yield water that is at least incipiently contaminated (see analysis of water from well 13/2W-15M1).

The upward migration of saline water may explain the high chloride and bicarbonate content and the hardness of ground water in the basal gravel of the glacial Lake Chehalis deposits in the Chehalis River valley. For example, wells 14/2W-19A1 and -19H2, 55 and 65 feet deep, yield water that is fairly hard and contains 80 and 1,560 (?) ppm of chloride.

The upward migration of saline water may also be the cause of one instance of deterioration of water in a well tapping outwash of the Vashon glaciation. Well 14/2W-6M13, 40 feet deep tapping outwash gravel, yields water containing about 150 ppm of chloride, a concentration greater than the average of water from most of the wells in this area that tap outwash materials.

In most of the examples cited above, upward migration of saline water can only be suggested as a possible source of contamination noted at the wells. Confirmation of such a source would be dependent on the collection of more chemical and hydrologic data in these specific areas.

Water for Domestic Use

For the west-central part of Lewis County in general, ground water is of a quality suitable for domestic use. However, the analyses listed in tables 4 and 5 show that locally, the iron content and hardness of ground water are sufficiently high that some users may consider the water unsuitable. On the basis of standards of water quality established by the U.S. Public Health Service (1946) iron plus manganese should not exceed 0.3 ppm. It is at about this concentration that ferric hydroxide begins to form when the water is exposed to the air. The water acquires a reddish cast and a crust forms in pipes and tanks and causes a rust-colored stain on laundered clothing.

In a very few of the waters whose analyses are listed in table 4 are the common constituents present in such high concentrations as to be noticeable to the taste. For example, a chloride concentration of 200 to 300 ppm in water containing an equivalent amount of sodium will give the water a salty taste to most people. About 17 percent of the waters analyzed for chloride contain more than 20 ppm of that constituent and only about 9 percent contain more than 100 ppm.

All waters analyzed, with the exception of that from well 14/2W-22H1, which is not likely to be used for domestic purposes, contain much less than the tentative limit of nitrate, 44 ppm, beyond which, as reported by Hem (1959, p. 239), nitrate appears to be toxic.

Iron Content of Ground Water

Of the 20 samples of ground water whose analyses are listed in table 4, all except 1 were tested for iron. In 8 of these, the iron content is less than 0.3 ppm. The data are inadequate to show the geographic limits of iron-bearing and non-iron-bearing water. However, iron in troublesome concentration is found generally throughout the area in which wells were inventoried as a part of this project. Of all the well owners interviewed in Lewis County, perhaps one-fourth reported the occurrence of deposits of scale in pipes or tanks, or other effects attributable to the presence of excessive amounts of iron in the water. Many owners of shallow wells in the older Pleistocene gravel units report the occurrence of clear water that turns reddish brown after standing or being heated, or which produces the usual red or brown scale in pipes and tanks.

The presence of less iron in fresher material below the weathered portion of the same zone is pointed up by reports of well owners who have deepened shallow wells or who have drilled deeper wells adjacent to existing shallow ones.

Locally, in the Logan Hill formation the iron content of ground water is high, which might be expected in these weathered materials at most places.

In general, water from wells only 10 to 40 feet deep in the upper, weathered parts of formations of Quaternary age contains more iron than does the water from wells drilled into the deeper, and hence fresher, materials of the same age.

Hardness of Ground Water

To the user of water for domestic purposes, the property of water hardness is related to its action with soap. Water is considered to be hard if a large amount of soap is required to produce a lather and if an insoluble residue is formed as a result of the addition of soap. Conversely, a water is considered to be soft if it produces a lather following the addition of only a small amount of soap. The soap-consuming power of a water results from the presence of cations that form insoluble compounds with soap. Chief among these in most ground waters are calcium and magnesium.

The hardness of water to be used for ordinary domestic purposes does not become objectionable until it becomes greater than about 100 ppm (Hem, 1959, p. 147), although at this level it does not seriously interfere with the use of water for most purposes.

Of the 305 samples from wells and springs in Lewis County of which hardness was determined, 179 had a hardness of 50 ppm or less; only 11 had a hardness greater than 150 ppm. Most of the water whose hardness was reported to be noticeable by users is from the nonmarine unit except that from rocks of Eocene age, which is considered to be largely or entirely connate. Throughout nearly all the area where these rocks occur, water from the younger outwash and from the Logan Hill formation is softer.

Water for Irrigation

The usefulness of a water for irrigation is dependent largely on the chemical quality of the water. Some of the important factors that determine whether a water can be used for irrigation without causing plant or soil damage are the total dissolved solids content, the proportion of sodium to the other cations, and the concentration of individual constituents of the water.

According to the U.S. Salinity Laboratory Staff, (1954, p. 69-82) certain definite criteria have been established to determine, from a chemical analysis, whether a water can be used for irrigation without harm to cultivated plants. The total concentration of salts should be less than that equivalent to an electrical conductivity of 2,250 micromhos/cm (1,350 to 1,600 ppm); the sodium hazard is low if the sodium-adsorption ratio 1/ is less than 10 for waters whose electrical conductivity is less than 250 micromhos/cm; boron content should be less than 1 to 2 ppm, depending on the type of plant to be irrigated. The U.S. Salinity Laboratory Staff (1954, p. 81) also reports that waters with more than 2.5 equivalents per million of residual sodium carbonate 1/ are not suitable for irrigation.

1/ Sodium adsorption ratio and residual sodium carbonate are determined by the following relations where ion concentrations are expressed in equivalents per million.

$$\text{Sodium-adsorption ratio (SAR)} = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

$$\text{Residual sodium carbonate} = (CO^{--} + HCO_3^{-}) - (Ca^{++} + Mg^{++})$$

By applying the foregoing criteria to the analyses listed in table 4, all except the two most saline connate waters are suitable for irrigation. For most, the SAR is considerably less than 10; for some it is less than 1. For all except the two saline waters, the dissolved solids content is considerably less than the range in which concentration of salts in the soil will begin. Although boron was not determined in all the analyses, the available data show that at least locally the concentration of boron in ground water is very low and not likely to result in damage to the crops cultivated in Lewis County.

SUMMARY AND CONCLUSIONS

1. The gravel and sand deposits of Quaternary age that underlie the west-central lowland and valleys of the major streams yield most of the ground water in west-central Lewis County. Outwash from the Vashon glacier is the rock unit most productive of ground water; the Logan Hill formation is the unit tapped by the greatest number of wells.

2. Rock materials of Tertiary age, which make up the foothills areas and underlie the west-central lowland at depth, are generally less permeable than materials of Quaternary age. The Tertiary rocks commonly yield only small amounts of water to wells in the upland area, and are known to be capable of yielding moderate to large amounts only in the Newaukum artesian basin, the Adna-Littell-Claquato district, and a few other localities.

3. The total amount of ground water used in west-central Lewis County in 1959 was about 3,000 acre feet. The most important single use was for domestic purposes; the amount used for these purposes is more than twice the amount used for public supplies, the next largest use. Ground water supplied only about 15 percent of the water used for irrigation in 1960; however, additional water for irrigation must come almost entirely from ground-water sources, as the stream water available for irrigation is now almost completely appropriated.

4. Except locally, the available ground water is adequate to meet the expected needs in the foreseeable future. The perennial yield of most aquifers can be increased appreciably without danger of overdraft.

5. Recharge of the ground-water bodies is principally by infiltration of the abundant precipitation falling within the area. The infiltration doubtless is retarded at places by the relatively impermeable mantle of weathered materials. The movement of ground water in the area has the same general pattern as the surface streams--that is, the ground water moves from the slopes of the foothills and from the upland plains toward the stream valleys. Discharge of the ground water is mostly by seepage to streams, by evapotranspiration, and through wells and springs.

6. Ground water from the aquifers of Quaternary age is generally of a chemical quality suitable for most uses, although at places it contains troublesome amounts of iron, or is harder than desirable for household uses. Conversely, the rocks of Tertiary age commonly yield water that is so highly mineralized as to be unsuitable for most uses.

7. Additional, but currently unknown, supplies of fresh ground water might be found at places in the Tertiary rocks wherever permeable beds have been tilted so as to crop out in the upland plains or foothills and extend continuously beneath the lowlands. At such places the conditions are favorable for recharge of the permeable beds as well as for the flushing from them of any saline water that they formerly may have contained.

REFERENCES CITED

1. Bretz, J H., 1913, Glaciation of the Puget Sound region: Washington Geol. Survey Bull. 8, 244 p.

2. Chaney, R. W., 1944, The Troutdale flora (Oreg.), chap. 12 of Chaney, R. W., ed., Pliocene floras of California and Oregon: Carnegie Inst. Washington, Pub. 553, Contr. Paleontology, p. 323-351.

3. Culver, H. E., 1919, The coal fields of southwestern Washington: Washington Geol. Survey Bull. 19, 155 p.

4. Erdmann, C. E., and Bateman, A. F., Jr., 1951, Geology of dam sites in southwestern Washington, Part 2, Miscellaneous dam sites on the Cowlitz River above Castle Rock, and the Tilton River, Washington: U.S. Geol. Survey open-file report, 308 p.

5. Etherington, T. J., 1931, Stratigraphy and fauna of the Astoria Miocene of southwest Washington: California Univ. Dept. Geol. Sci. Bull., v. 20, no. 5, p. 32-56.

6. Fenneman, N. M., 1931, Physiography of western United States: McGraw-Hill Book Co., 534 p.

7. Hem, J. D., 1959, Study and interpretation of the chemical characteristics of natural water: U.S. Geol. Survev Water-Supply Paper 1473, 269 p.

8. Mundorff, M. J., 1959, Geology and ground-water resources of Clark County, Washington, with a description of a major alluvial aquifer along the Columbia River: U.S. Geol. Survey open-file report, 660 p.

9. Mundorff, M. J., Weigle, J. M., and Holmberg, G. D., 1955, Ground water in the Yelm area, Thurston and Pierce Counties, Washington: U.S. Geol. Survey Circ. 356, 58 p.

10. Pease, M. H., Jr., and Hoover, Linn, 1957, Geology of the Doty-Minot Peak area, Washington: U.S. Geol. Survey Oil and Gas Inv. Map OM 188.

11. Piper, A. M., 1944, A graphic procedure in the geochemical interpretation of water analyses: Am. Geophys. Union Trans., pt. 4, p. 914-923.

12. Roberts, A. E., 1958, Geology and coal resources of the Toledo-Castle Rock district, Cowlitz and Lewis Counties, Washington: U.S. Geol. Survey Bull. 1062, 71 p.

13. Schlax, W. N., Jr., 1947, Preliminary report on ground-water resources of the central Chehalis Valley, Washington: U.S. Geol. Survey open-file report, 43 p.

14. Snavely, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington, with a section on Microscopical character of the Centralia-Chehalis coal, by J. M. Schopf: U.S. Geol. Survey Bull. 1053, 159 p.

15. Snavely, P. D., Jr., Roberts, A. E., Hoover, Linn, Jr., and Pease, M. H., Jr., 1951, Geology of the eastern part of the Centralia-Chehalis coal district, Lewis and Thurston Counties, Washington: U.S. Geol. Survey Coal Inv. Map C 8, 2 sheets.

16. Treasher, R. C., 1942, Geologic map of the Portland area, Oregon: Oregon Dept. Geology and Mineral Industries.

17. Trimble, D. E., 1957, Geology of the Portland quadrangle (Oregon-Washington): U.S. Geol. Survey Geol. Quad. Map GQ 104.

18. U.S. Public Health Service, 1946, Public Health Service Drinking Water Standards: Public Health Reports, v. 61, no. 11, p. 371-384.

19. U.S. Salinity Laboratory Staff, 1954, Diagnosis and improvement of saline and alkali soils: U.S. Dept. Argiculture Handb. 60, 160 p.

20. Weaver, C. E., 1912, A preliminary report on the Tertiary paleontology of western Washington: Washington Geol. Survey Bull. 15, 80 p.

21. Weaver, C. E., 1937, Tertiary stratigraphy of western Washington and northwestern Oregon: Washington Univ. Pub. in Geology, v. 4, 266 p.

22. Weigle, J. M., and Washburn, R. L., 1956, Records of wells and springs, water levels, and quality of ground water in Lewis County, Washington: U.S. Geol. Survey open-file report, 352 p.

23. Wilkinson, W. D., Lowry, W. D., and Baldwin, E. M., 1946, Geology of the St. Helens quadrangle, Oregon: Oregon Dept. Geology and Mineral Industries.

24. Willis, Bailey, 1898, Drift phenomena of Puget Sound: Geol. Soc. America Bull., v. 9, p. 111-162.

25. Willis, Bailey, and Smith, G. O., 1899, Description of the Tacoma quadrangle [Washington] : U.S. Geol. Survey Geol. Atlas, Folio 54.

TABLE 1

Records of Representative Wells in Lewis County, Washington

Table 1. — Records of representative wells in Lewis County, Wash.
[See Plates 1, 3, and 5.]

Well number: See page 5 for description of well-numbering system.
Altitude: Land-surface datum at well; mostly interpolated from topographic maps.
Type of well: Bd, bored; Dg, dug; Dn, driven; Dr, drilled; J, jetted.
Depth of well: Reported depths below land surface are given in feet; measured depths are given in feet and tenths.
Water-bearing zone(s); depth and thickness: First figure is depth to top of zone below land surface; second is thickness of zone penetrated.
Water level: Levels given in feet and tenths were measured by USGS; those in feet only were reported by owner, tenant, or driller. A plus sign (+) indicates that the level is above land surface; "flow" indicates that the level is above land surface, but is not known.
Type of pump: B, bucket; C, centrifugal (large); J, jet (deep-well type); N, none; P, piston (deep-well type); S, suction (piston, gear or small centrifugal); Sb, submersible; T, turbine. Electrically operated unless specified as H, hand-operated; W, wind-operated.
Use of well: C, commercial; D, domestic; De, destroyed; Ind, industrial; Inst. institutional; Irr, irrigation; N, none; Obs, observation of water-level fluctuation; PS, public supply; RR, railroad; S, stock.
Remarks: Ca, chemical analysis in table 4; Cf, field analysis for bicarbonate, chloride, and hardness in table 5; dd, drawdown; gpd, gallons per day; gph, gallons per hour; gpm, gallons per minute; H, hydrograph included in report; hr, hour(s); L, log in table 3; min, minute(s); ppm, parts per million; Temp, temperature in degrees Fahrenheit. Remarks on the adequacy and dependability of the water supply, general quality of the water, and materials penetrated are reported by owner, tenant, or driller.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
									T. 11 N., R. 1 W.						
1D1	Frank Linwood	260	Dg	13	36	4	10	2	Gravel, fine	5.6	2-25-53	S	---	D	Cf, L.
2C1	O. J. Steele	247	Dg	17	36	----	---	--	------------	1.8	2-25-53	S	---	D,S	Pumped dry in summer.
2G1	John Hefley	218	Dg	15	24	15	15	--	Sandstone	7.4	2-25-53	S	½	D	Cf.
2H1	Joe Mathews	240	Dg	18	48	2	---	--	Cobbles and boulders, cemented	8.8	2-25-53	S	---	D,S	Cf.
4A1	Frank Chromey	360	Dg	2	72 x 48	4	---	--	Gravel, cobbles and boulders, cemented	51.2	2-25-53	J	1	----	Supply inadequate in late summer and fall.

4D1	Albert Kletsch	342	Dg, Dr	75	6	75	---	--	-------------	41.3	2-25-53	J	1	D	Drilled in 45-ft dug well. Water level same in both wells, 2-25-53.
5A1	Anton Brunner	338	Dg	37	42	4	---	--	-------------	32.3	2-13-53	J	1	D,S	
5H1	Mrs. Joseph Sommer	340	Dg	46	48	----	38	8+	Sand, semiconsolidated	33.1	2-6-42	P	½	D,S Obs	Deeply weathered material above sand. H.
5H4	A. W. Peterson	342	Dr	70	6	65	68	2+	Gravel	32	3- -50	J	3/4	D	Pumped steadily 15 hr. L, Cf.
5K2	S. H. Woody	325	Dg	43	48	12	---	--	Sand and gravel	37.2	10-22-54	J	½	D,S	Dug to fine gray sandstone (?).
5N1	A. M. Drown	325	Dg	44	48	6	---	--	Gravel and sand	39.7	8-14-53	J	½	D,S	Cf, temp 54.
5P1	Byron Ackley	320	Dg	39	48	10	37	3+	Sand and gravel	75	8-17-53	J	1½	D	Cemented gravel to 37 ft. Temp 55.
6D1	Church of Latter Day Saints	302	Dr	201	6	201	201	--	Sand	6	Spring 1955	J	3/4	D	Cf, L, temp 52.
6K1	Ed Fleischmann	318	Dg	30	48	6	---	--	Gravel	27	--------	J	3/4	D,S	Gravel to 25 ft, sand to 28 ft, gravel to 30 ft. Iron in water.
7E1	C. Sorenson	295	Dg	45	48	6	---	--	Gravel	41.2	8-14-53	J	½	D,S	
8D1	Floyd Henriot	325	Dg	55	84	7	---	--	Gravel, "riverbed"	48	--------	J	3/4	D	Pumped dry in 1 day at 4 gpm.
8E1	H. Collier	275	Dr	40	6(?)	40	20	20	Sand and gravel	20	--------	J	1½	----	Bailed 20-30 gpm; 5 to 10 ft of white clay above gravel and sand.
8E2	Town of Toledo	240	Dr	79	8	79	58 74	14 4	Sand, blue-gray Sand, gray	2	8-25-53	--	---	----	Originally 450 ft. deep. Pumped 6 hr at 125 gpm, dd 26 ft. Ca, L, temp 53.
8R1	E. G. Berlin	110	Dg, Dn	26	24 x 1¼	18-26	5	21+	Gravel	-------	--------	S	1/3	D	Sand to 5 ft.
9J1	E. F. Boone	118	Dr	45	6	45	4	38	Sand	12.8	8-5-53	J	1	D,S	Flowed 1 day when drilled. L, temp 53.
9L1	F. E. Forman	110	Dr	40	8	40	33	5	Gravel, "pea"	12.4	2-18-55	--	---	D, Irr	Pumped 100 gpm, dd 13 ft. L.
9M1	A. G. Westergard	110	Dr	22	6	25	7	18	Sand and gravel	7.0	2-18-55	--	---	----	Original depth, 25 ft; sand to 6 ft. Bailed 20 gpm. Casing perforated 20 to 25 ft.
10N1	Layton Prairie Schoolhouse	227	Dr	137	4	137?	---	--	-------------	37.5	11-10-54	P (H)	---	N	"Swamp water" at 30 ft; penetrated mostly blue clay.
10P1	James Taylor	227	Dg	21	56	5	---	--	Gravel	17.8	8-5-53	--	1/3	D,S	Went dry fall of 1952.
12E1	C. E. Hurst	308	Dg	41	45 x 54	0	---	--	----Do------	38.2	8-4-54	N	---	N	Cemented gravel entire depth.
12F1	E. J. Smith	318	Dr	86	8	76	75	11+	Gravel, "pea," and sand	40	--------	J	1/3	D,S	Adequate supply. L.
13B1	Henry Armstrong	303	Dg	33	48	2	---	--	Gravel, cemented	12	8-11-53	J	½	D,S	Water hard in fall when level begins to rise.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
								T. 11 N., R. 1 W. -- Continued							
13C1	E. P. Layton	304	Dg	33	36	----	---	--	Gravel	28.7	10-16-52	J	½	D,S	Penetrated all gravel except for 1½-ft layer of sand.
13M1	Mrs. George Olson	289	Dg, Dr	48	6	48	---	--	----Do------	8	Fall 1946	S	1/3	D,S	
14C1	J. L. Fickars	282	Dr	33	7	33	30	4+	Gravel, fine	25	8- -52	J	3/4	D	Reddish clay and "rocks" to 30 ft.
14E1	Clark Blair	280	Dr	55	6	55	---	--	Gravel and sand	11.6	8-6-53	J	½	D,S	Sand near bottom. Cf.
14L2	Harvey Daniels	280	Dr	57	6	58	---	--	Gravel	14.6	8-26-53	J	½	D, Irr Obs	Bailed 20 gpm. Ca, H.
15C1	E. E. Stone	240	Dr	113	6	62	---	--	------------	9	--------	Sb	½	D,S	Water enters well at 32 ft and 100 ft. Cf.
15G1	James Reese	270	Dr	56	6	56	---	--	------------	27	8- -51	J	½	D	Water red upon standing, has oil film.
16E1	B. Blair	215	Dr	53	6	52	40	--	Gravel	35	6- -53	J	2½	D	Red clay to 13 ft. Yield 17± gpm.
16E2	Guy Bowan	213	Dr	156	6	156	52	3	-----Do-----	39.0	8-10-53	J	1	D	Cf, L.
16H1	Ernest Cooper	240	Dr	36	7	36	36	--	Gravel, loose	14	2-11-52	J	---	D	L, temp 50½.
16P2	--- Stevenson	225	Dr	36	6	36	---	--	Gravel, fine	16	10- -52	S	½	----	Cf, temp 53.
17A1	H. M. Shepardson	110	Dr	41	6	40	---	--	Gravel	16	--------	J	½	D,S Irr	Yield 5± gpm. L.
17L2	Rudolf Klein	105	Dr	235	6	235	---	--	Shale	0	--------	N	---	De	Water meager, salty. Driller reported gas. Well buried. L.
18B1	B. J. Daring	200	Dg	21	22	21	---	--	Gravel	19.1	8-14-53	S	½	D	Easily pumped dry. Iron in water. Temp 53.
20M1	L. Cunningham	203	Dr	70	6	70	57	13	Gravel and sand	57	--------	J	¼	D,S	L, temp 52.
20N1	Iris Ballard	207	Dg	55	32	25	---	--	Gravel	54.2	8-12-53	P (H)	---	D	Water level ranges from about 53 to 54 ft. Cf, temp 54.

21D1	N. A. Kent	220	Dr	173	6	165	---	--	-------------	11	10- -53	N	---	N	L.
21G1	Otto Nielsen	245	Dg	25	72	6(?)	---	--	Gravel (?)	21.2	8-7-53	S	¼	D,S	Water occasionally blackens porcelain.
22K1	J. H. Washburn	260	Dg	20	30	4	14	6+	Gravel, cemented	14	8-11-53	S	½	D,S	Temp 55.
28A1	R. M. Martin	251	Dg	22	48	6	---	--	Gravel	6	---------	S	1/3	D,S	Water hard, contains iron.
29B1	Kenneth William	221	Dg	37	36 x 48	15	---	--	Gravel, cemented	32.8	8-12-53	P	½	D	Yellow clay, upper 10 to 12 ft.
29D1	James Allon	214	Dr	48	4	48	42	6+	Gravel and sand	41	---------	J	½	D,S	L.
29G1	Ellen Wolcott	220	Dg	30	30(?)	30	29	1+	Gravel, fine, and sand	27.5	8-11-53	J	3/4	D,S	Cemented gravel to 29 ft. Adequate supply reported.
29M1	J. T. Williams	219	Dg	39	26 x 51	10	---	--	Gravel	34.9	8-13-53	J	½	D,S	Dry in fall. Iron in water. Cf, temp 54.
29P1	L. J. Withrow	232	Dg	24	30	28	---	--	-----Do-----	18.5	8-13-53	S	1/3	D,S	Iron in water. Temp 53.
30D1	Daniel Rajala	183	Dg	30	-------	30	---	--	Gravel (?)	27	---------	S	¼	D,S	
30E1	F. S. Yankis	195	Dg	28	-------	28	25	--	Gravel	23	---------	J	1	D,S	Mostly clay to 25 ft.
30M1	John Young	200	Dg	26	10	26	---	--	-------------	20.9	8-14-54	S	¼	D,S	Cf, temp 54.
30R2	M. A. Turners	219	Dr	45	6	45	---	--	Gravel	-------	---------	J	½	D,S	Water at 27 and 40 ft. Iron in water.
32M1	E. E. Hanks	280	Dg	12	40	13	---	--	Sand and clay	10.4	8-12-53	S	1	D	Temp 53.
									T. 11 N., R. 2 W.						
1A2	H. B. Eddy	303	Dg	22	48	7	20	6	Gravel, partly cemented	18.6	2-13-53	J	---	D	Original depth 26 ft. Cf, temp 50.
2E2	Chris Christensen	465	Dr	146	6	146	---	--	Gravel	50.3	9-22-55	Sb	½	D, Irr	Cased off "red colored water" at 122 ft. Bailed 12 hr, dd 2 ft.
2J1	H. Clark	308	Dg	37	36	18	---	--	-----Do-----	34½	---------	J	½	D	Easily pumped dry. Iron in water.
3H1	J. F. Roth	408	Dg	36	46	15	---	--	-----Do-----	26.3	8-20-53	J	3/4	D,S	Brown precipitate in water. Temp 53.
3R1	W.D. Capps	405	Dg	59	-------	5	---	--	-------------	52.3	8-20-53	J	½	D	Iron in water. Cf, temp 54.
4A1	Ire Reinseth	450	Dg	98	48	6	86	12+	Gravel and sand	87.6	8-20-53	P	3/4	D,S	Iron in water. Cf, temp 52.
4R1	Joe Lewis	436	Dg	58	40	5+	---	--	-------------	56.2	8-20-53	P	½	D,S	Temp 53.
5A1	Curtiss Bowan	258	Dr	217	6	176	---	--	-------------	Flow	---------	S	1/3	C	Water produces iron stain.
5D1	Riste Hakala	250	Dr	50	8	50	---	--	Sand or siltstone	26	1947±	J	¼	D	Iron in water. Pumped 5 gpm, dd 24 ft.
6P1	Charles Beardsly	560	Dr	117	6	150	---	--	-------------	71.7	8-28-53	Sb	½	D	Originally 250 ft deep. Odd odor. Water produces iron stain. Temp 53.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
							T. 11 N., R. 2 W. -- Continued								
7H1	W. Marsyla	400	Dg	36.05	60	36	30	6	Sand, white	29.2	8-27-53	P	3/4	-----	Yellow rock and clay to 30 ft. Temp 54.
8P1	R. R. Longmore	205	Dg	18	36	16	14	4	------------	17½	--------	S	1/3	D	Occasionally dry. Blue shale at 18 ft.
9M1	Ralph Seely	390	Dg	61	65 x 50	5¼	---	--	Gravel	55.8	8-21-54	J	3/4	D,S	Temp 54.
9P1	Sam Leathers	420	Dr	287	8	147	117	16	Gravel and coarse sand	80	1-5-54	T	5	D, Irr	Pumped 4 hr at 40 gpm, dd 20 ft. Cf, L.
10F1	Hilma Leine	448	Dg	84	40	6	---	--	Gravel (?)	79.5	8-20-54	--	3/4	D	Much iron in water. Temp 54.
11N1	K. R. Breidenstein	295	Dr	64	6	64	37	22	Gravel and sand	37	--------	T	5	Irr	Bailed 60 gpm, dd 1 ft. Sulfur taste and smell. Cf, L, temp 54
12B1	O. R. Lampitt	292	Dg	35	48	10	---	--	Sand and gravel	27	--------	J	½	D,S	Clay and cemented gravel above aquifer.
12R1	--- Clark	290	Dg	53	30	10	---	--	Gravel	51.4	8-19-53	P	½	D,S	Cemented gravel entire depth. Cf, temp 54.
14B1	--- Blomgren	250	Dg	39	-------	0	---	--	Gravel (?)	36.5	8-19-53	J	½	D	Pumped dry easily. Temp 56.
15A1	Perry Zion	260	Dr	44	6	-----	---	--	Sand and gravel	22.4	8-26-53	P	1	D,S	Pumped 1 hr at 10 gpm, little dd. Casing perforated. Cf, H.
15A2	------Do------	265	Dr	46	12	45	28	12	Sand and gravel	25.0	1-21-53	T	5	Irr	Pumped 75 gpm, dd 20 ft on 5-17-50; less than 32 gpm in fall of 1952. L.
17E2	Russell Foreman	205	Dr	182	6	182	139	--	Sand, white	-------	--------	J	1	D,S	L.
17M1	Matt Uitto	200	Dr	90	6	110	100	--	-----Do-----	37.7	8-27-53	P	3/4	D	Gravel to 10 ft, overlying soapstone (?). Water produces an iron stain. Temp 54.
17N1	Oscar Anderson	180	Dr	145	6	-----	---	--	------------	10-12	--------	J	¼	D Inst	Pumped 8 hr, dd less than 1 ft. Water soft.

19D1	Fred Johnson	435	Dr	105	6	100	---	--	Sand, coarse	65	--------	J	½	D,S	Water at 60 ft and 100 ft, yield 8 gpm. Water produces an iron stain.
19M1	Mary Ann Raab	375	Dg, Dr	93	6	90	---	--	------------	-------	--------	J	1	D,S	Dug to 26 ft. Yield 16 gpm. Water produces an iron stain.
19Q1	R. A. Parish	365	Dg	47	42-36	2	---	--	------------	36.4	8-25-53	J	½	D	Supply adequate for normal use. Penetrated clay mostly. Temp 51.
20M1	Logan Ferrier	150	Dg	42	24	-----	---	--	------------	26.3	8-27-53	J	¼	D	Supply usually adequate. Temp 53.
20N1	William Schoch	180	Dr	75	6	-----	---	--	Basalt	12	1947	J	¼	D	L.
20R1	W. Erickson	410	Dg	58	30	59	---	--	------------	51.3	8-21-53	J	½	D,S	Temp 54.
21C1	Charles Perttula	420	Dg	63	42	6	55	9	Gravel	55.8	8-21-53	J	½	D	Soil and "hardpan" to 10 ft, gravel to bottom.
22H1	--- Davis	253	Dg	67	48	6	---	--	-----Do----	62.5	8-17-53	J	½	D	Pumped dry in 2 hr. Reportedly very little seasonal change in water level. Cf, temp 54.
23G1	Sulo Kolehmainen	185	Dr	110	12	34	20	10	Gravel	16	--------	--	---	Irr	Bailed 40 gpm; dd 9 ft. L.
24Q2	Ed Ritzman	110	Dr	568	------	-----	---	--	------------	+20	--------	N	---	N	Test hole, U.S.G.S. Fuels Branch. L.
25B1	Mrs. Ahonen	180	Dg	24	48	24	28	2	Gravel	19.7	8-18-53	S	½	D,S	Dug to 30 ft, penetrated 26 ft of blue clay above aquifer. Supply for 2,000 chickens.
26C1	Wayne Kattelus	100	Dg	24	48	4	---	--	-----------	11.8	8-19-53	S	¼	D	Well bottoms in blue clay. Iron in water. Temp 55.
28N2	Robert Wigley	240	Dg	21	------	0	---	--	-----------	15.8	8-25-53	S	1/3	S	Water produces orange stain; bad odor occasionally. Temp 53.
29E1	O. H. Schmidt	175	Dg	30	23	25	25	5	Sandstone, yellow	23	8-22-53	S	1/3	D,S	Water produces brown stain.
29P1	Northern Pacific Ry.	143	Dr	186	8	-----	124	62	Sandstone	22	5-3-51	T	5	RR	Pumped 18 hr at 70 gpm, dd 108 ft. Ca, L.
30D1	E. D. Allen	160	Dr	55	6½	54	35	20	Sandstone, blue	R 35 to R 45	--------	J	1	D,S	Water produces brown stain. L.
32C1	Town of Vader	140	Dr	220	6	60	80	140	Sandstone	20	--------	T	15	PS	Water tastes salty; used only when creek supply low. Pumped 86 gpm, dd 140 ft. Ca, L.
32D1	A. Bruner	134	Dr	75	6	-----	---	--	------------	------	---------	J	½	D, C, Irr	Supplies several families. Water produces brown stain. Ca.
34M1	J. T. Krusor	73	Dg	17	72-60	14	---	--	Silt, sandy	10.7	8-18-53	S	½	D	Occasionally dry. Penetrated silt entire depth.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 11 N., R. 2 W. -- Continued						
34R2	--- Beyers	160	Dr	60	8	56	48	1+	Clay, sandy	26.4	8-18-53	T	3	D,S Irr	Pumped 40 gpm, dd 20 ft. Pumped sand. Cf, L, temp 52.
35E1	George Leeder	165	Dg	36	36	36	---	--	------------	31.5	8-18-53	J	½	D,S	Pumped 3 hr when water level measured. Cf, temp 54.
36A2	C. R. Calvin	205	Dr	67	7	-----	55	12	Gravel, loose	26.4	8-17-53	Sb	3	D,Irr	Pumped 40 gpm, dd 40 ft. Little iron in water. Well formerly 42 ft deep in "hardpan", with much iron in water. Cf, temp 55.
36A4	------Do------	205	Dr	65	8	65	27	13	Sand and gravel	20.9	8-26-54	T	5	Irr	Pumped 100 gpm, dd 10 ft. Iron in water. L.
									T. 11 N., R. 3 W.						
8D1	Robert Cabe	350	Dg	22	36	22	---	--	Gravel	11.8	8-4-54	S	½	D,S	Water hard.
17G1	Fred Dowell	375	Dg	14	72	10	---	--	Gravel and clay	9.2	8-4-54	S	---	D,S	Pumped dry. Water soft.
25A1	E. D. Allen	155	Dr	350	2	-----	---	--	------------	-------	--------	N	---	N	Deep water salty. Plugged at 14.9 ft.
26P1	J. S. Peters	160	Dr	230	6	80	---	--	------------	75	---------	Sb	---	D	Pumped dry. Water soft.
34P1	Ben Helland	206	Dr	89	6	-----	---	--	Sand	12.6	8-4-54	J	½	D	Water hard, some iron.
35D1	H. E. Dobbins	180	Dg	13	60	0	9	--	Clay, blue	12.0	8-4-54	S			
									T. 11 N., R. 1 E.						
6Q1	Oren Leyton	180	Dg	95	-------	0	---	--	Gravel	7.5	9-25-53	S	¼	D	Water has greasy film, produces brown stain.

14D1	M. J. Kalich	580	Dg	23	36	0	---	--	Rock, volcanic (?), jointed	-------	---------	S	½	----	Dry late in summer. Cf.
15C1	H. L. Withrow	347	Dg	16	36	0	---	--	Clay, red	13	---------	B (H)	---	D	Dry late in summer. Water soft.
16J1	Harry Inman	318	Dg	19	30	24	---	--	Sand and gravel	67	8-13-54	S	---	N	Water hard, produces an iron stain.
16P1	---------------	316	Dr	540	------	-----	---	--	-------------	-------	---------	N	---	N	Test hole, U.S.G.S. Fuels Branch. L.
19K1	A. F. Schmit	300	Dr	112	6	112	100	12+	Sand, blue	30	---------	P	½	D	Water hard; iron in water. Yield 20 gpm. L.
20C1	---------------	330	Dr	223	------	-----	---	--	-------------	-------	---------	N	---	N	Test hole, U.S.G.S. Fuels Branch. L.
29Q1	Joe Eckels	285	Dr	200	6	-----	---	--	-------------	96.2	8-13-54	P	1	D	Well can be pumped dry. Cf.
33P1	C. F. Quinn	380	Dg	23	8	23	---	--	Gravel	19.8	8-17-54	S	½	D	Dry late in summer. Water hard.
									T. 12 N., R. 1 W.						
1N1	E. S. Payne	555	Dg	20	36	20	---	--	Sand and gravel, red	0	---------	N	---	D	Well flows in winter and spring. Water soft.
4K1	A. Dec	560	Dg	35	48	4	---	--	-------------	13.1	1-9-53	S	½	D,S	Cf, temp 47.
4M1	Weldon Pascoe	530	Dg	23	84	5	---	--	-------------	3.8	1-9-53	S	½	D	Temp 49.
4M3	Jackson Prairie School	537	Dr	86	6	86	---	--	Sand and gravel	32	1-31-47	J	1	PS	Red clay overlies aquifer. Supply for 45 students.
4N3	Paul G. Engen	540	Dr	92	6	92(?)	86	6	Gravel	21	9-27-53	J	3	D, Irr	Pumped 12 hr at 30 gpm, dd 10 ft. Rapid recovery. L.
5C2	O. W. Bliss	526	Dr	115	6	115	85	--	Gravel, yellow	28.2	1- -53	J	1	D,C	Supplies two homes and a cafe. Temp 49.
5E1	A. A. Singer	525	Dr	128	6	128	115	13	Gravel and sand, clean	32	4-21-52	T	7½	Irr	Pumped 4 hr at 120 gpm, dd 38 ft. Rapid recovery. Cf, L, temp 51.
5E2	A. A. Singer	525	Dg	39	36	5	35	3	Sand and gravel, clean	34.3	10-24-52	J	1	D	Supply adequate.
5G2	Rex Briem	528	Dr	77	6	68	72	5	Gravel	20 to 25	7- -50	J	½	D	Water soft. L.
5H1	Leslie Sample	530	Dg	33	60	4	---	--	-------------	2.6	1-9-53	S	---	D	Inadequate during summer. Cf.
5M1	L. B. Johnson	510	Dr	50	6	50	46	4	Gravel, fine	13	4- -52	P	½	D	"Hardpan" to 46 ft.
5P1	Alonzo Corp.	524	Dg	35	48	42	---	--	Clay, yellow, and weathered gravel	3.0	1-15-53	J	½	D,S	Rapid recovery.
6C1	D. C. Alexander	510	Dg	36	42	5	---	--	-------------	1.1	1-8-53	J	½	D,S	Pumped blue sand. Temp 48.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 12 N., R. 1 W. -- Continued						
6K1	--------------	500	Dg	24	48	3	---	--	Clay, yellow, and weathered gravel	1.6	1-8-53	S	1/3	D	Temp 46.
6L1	G. E. Chappell	505	Dr	106	6	106	90	16	Gravel and some sand	29	1- -52	J	½	D,S	Pumped ½ hr at 40 gpm, dd 43 ft. L.
7C1	Ray D. Surface	501	Dr	82	6	82	60	22	Gravel, fine, and sand	20	8- -52	J	1/3	D	Yield 15 gpm.
7D1	E. Billingsley	502	Dg	45	60-48	6	---	--	------------	32.7	11-12-52	J	½	D,S	Supply for 6,000 turkeys. Temp 53.
8A1	Levi Westgard	540	Dg	40	36	4	---	--	Clay (?)	17.8	1-15-53	J	---	D,S	Water level reported 33 ft during fall.
8D1	James Corp.	523	Dg	39	48	4	---	--	------------	17.5	1-15-53	J	1	D,S	Can be pumped dry. Temp 48.
8P1	J. P. Guenther	522	Dg	27	42	22	22	5	Gravel	10.8	1-16-53	S	½	D,S	Water entering well at 11 ft, 1-16-53.
8Q1	Jack Salsbury	515	Dg	22	30	7	---	--	Clay, brown	14	--------	S	1/3	D,S	Water level reported nearly constant. Iron in water. Cf.
9A1	Henry Lucas	561	Dg	33	42	4	---	--	------------	1.4	1-14-53	S (H)	---	N	Cf, temp 47.
9A2	------Do-------	561	Dr	92	6	92	85	5	Sand, fine, and gravel	13	1947	J	1	D	Yield 75-100 gpm. L.
9B2	R. R. Neer	560	Dg	35	42	4	---	--	------------	3.1	1-15-53	J	1	D,S	Supply for 4,000 chickens, Cf.
9D1	G. C. Gruel	521	Dg	13	33	-----	---	--	Gravel (?)	4.9	9-15-52	N	---	N	Standby use for fire protection.
9D3	Rae Mathis	521	Dg	28	180 by 144	28±	---	--	------------	Flow	--------	S	½	D	

9D4	Ralph Boe	533	Dr	68	6	68	---	--	------------	------	--------	J	1	C,D Irr	Supplies grocery store and service station, 100 gph for refrigeration unit. Water level near land surface.
9J2	K. R. Thomas	550	Dg	29	42	3	---	--	------------	13.0	1-16-53	S	---	D	Cf, temp 47.
9N2	F. J. Young	540	Dg	45	48	4	---	--	------------	3.5	1-28-53	J	---	D,S	Water hard, corrodes pipes and metal utensils badly.
10C1	C. K. Adams	568	Dg	38	60-36	5	---	--	Clay, yellow, and gravel	3.5	1-16-53	P	½	D,S	Can be pumped dry; rapid recovery. Cf.
10G1	Lena Blavelt	577	Dg	28	36	9	---	--	Gravel, weathered	24.8	1-23-53	S	---	D	
10G3	K. M. Walker	578	Dg	----	42	10	---	--	------------	28.6	1-23-53	P	½	D	Cf, temp 48.
10H1	Harry Matthiesen	524	Dg	14	72	14	10	2	Gravel	1.3	1-23-53	S	¼	D,S	Reportedly pumped dry in 12 hr with ½-hp pump.
11C1	Omer O. Rud	585	Dg	22	36	22	---	--	-----Do-----	14.0	1-16-53	S	¼	D	Cf.
11K1	Claude Lewis, Jr.	422	Dg	21	48	5	---	--	------------	5.8	1-23-53	S	¼	D	Pumped dry in fall. Water entering well at 4.5 ft, 1-23-53.
12D1	H. A. Ekiss	446	Dg	30	52	0-6 25-30	25	5	Gravel and sand, clean	25.1	1-20-53	S	½	D,S	
12N2	W. L. Anderson	448	Dg	35	54-42	8	32	3	Gravel and sand, cemented	21.7	1-21-53	J	½	D	Can be pumped dry in 6 hr with present pump; rapid recovery. Water rusts pipes.
12P2	Edward Moltz	458	Dg	40	30	6	---	--	Sand (?)	10.1	1-21-53	J	½	D,S	Water has mineral taste. Water entering well at 5½ ft, 1-21-53. Cf.
13D1	Duane Chapman	435	Dg	27	42	4	---	--	Gravel, weathered, and sandy clay	3.2	1-21-53	B (H)	---	D	Supply adequate.
13J2	Warren Smith	462	Dr	120	12	120	80	40	Gravel, cemented, sand and fine gravel	30.5	9-10-52	T	25	Irr	Pumped 7 days at 320 gpm, dd 81½ ft. Irrigates 60 acres. Cf, L, temp 50.
15E1	Dan Boone, Sr.	440	Dg	16	72	16	---	--	Gravel (?)	0.8	1-22-53	S	---	D,S	Encountered white clay and gravel. Water hard.
15N1	P. T. Hurd	373	Dg	18	24	13	---	--	Clay and gravel, cemented(?)	6.9	1-22-53	S	---	D	Can be pumped dry in fall; slow recovery.
16K1	Wash. State Parks and Recreation Commission	400	Dr	61	6	61(?)	20	41	Gravel	16	Spring, 1950	N	---	N	Pumped 30 gpm, dd 38 ft. Iron in water. Blue clay to 20 ft.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
							T. 12 N., R. 1 W. -- Continued								
16K2	Wash. State Parks and Recreation Commission	400	Dr	104	10	97	92	6	Sand, brown and black	40.5	9-10-52	Sb	3	D,PS	Pumped 7 hr at 55 gpm, dd 72 ft. Much iron in water. Cf, L, temp 52.
16L1	------Do-------	400	Dr	263	6	100	200	--	Sand	62.8	5- -53	N	---	N	Drilled to 350 ft, nearly all through blue clay and shale. Yield very low.
16Q1	E. S. Hofmann	368	Dg	36	17.9	36	21	1	Gravel, cemented, and clay	12.6	1-22-53	S	---	D	
16Q4	Wash. State Div. Forestry	378	Dr	58	6	58	45	13	Sand and gravel	-------	---------	--	---	D,Inst	L.
18D2	E. J. Updyke	479	Dr	21	6	21	19	2	Gravel	6.0	9-19-52	S	$\frac{1}{2}$	D,S	Bailed 17 gpm, dd 1-2 ft. Clay overlies gravel.
18E1	Roy Reinke	481	Dg	26	28	4	---	--	------Do-----	19.2	12-9-52	S (H)	---	D,S	Cf.
18M1	Ben Meier	480	Dr	87	6	84	55	32	Gravel and sand	17.7	3-12-53	--	---	D	Bailed 20 gpm, dd 42 ft. Cf, L.
19C1	John Sokolich	500	Dg	34	72-48	8	---	--	Gravel and clay	28.2	12-5-52	--	---	D,S	
19F1	W. F. Barber	485	Dg	23	48	6	---	--	"Rock" and clay	2.7	12-10-52	S	$\frac{1}{2}$	D	Temp 48.
19M1	Isidor Von Rotz	478	Dg	18	36	14	---	--	Sand and gravel	16.8	12-9-52	S	$\frac{1}{2}$	D	Supply inadequate; rapid recovery. Temp 51.
19N1	John Meier	490	Dg	44	54-42	4	---	--	------------	37.1	12-10-52	J	$\frac{1}{2}$	D,S	Cf, temp 50.
20L1	William Meister	362	Dg	22	48 x 54	22	20	2	Gravel and sand, clean	4.2	5-13-53	B (H)	---	D,S	Blue-gray muck to 20 ft.
21B1	Lacamas Schoolhouse (abandoned)	368	Dg	16	30	-----	---	--	------------	13.2 0.9	10-14-52 1-22-53	S (H)	---	N	Supply inadequate

21L1	Louis Elken	346	Dg	14	12	14	---	--	Clay (?)	2.8	2-12-53	S	---	D	Pumped 4½ hr with plunger pump; dd 10 ft.
21P1	John Grohs	341	Dg	12	4-48	12	10	2	Sand and gravel	1.6	2-12-53	S	½	D	Casing: 4-inch tile to 8 ft; 48-inch to 12 ft. Cemented sand and gravel to 10 ft. Iron in water.
21P2	E. J. Bayne	350	Dg	15	48	15	14	1	Sand, cemented	7	--------	S	¼	D,S	Iron in water. Cf.
22C1	J. J. McEwen	377	Dg	14	28	12	7	5	Gravel, cemented, and sand	3.7	1-22-53	S	½	D,S	
23N1	E. L. Fish	388	Dg	22	60-48	7	18	4	Sand and cobbles, clay binder	18.7 16.6	9-15-32 1-29-53	S	½	D,S Irr	Cf, L.
23R1	E. G. Harris	403	Dg	32	50-36	5	---	--	Gravel, cemented (?)	23.7	1-28-53	P (H)	---	N	Cf.
24A2	Russell Gibson	451	Dg	43	39-36	11	---	--	-----Do-----	37.7	1-23-53	J	½	S	Cf.
24N1	E. G. Harris	417	Dg	38	42	8	---	--	-----Do-----	32.0	1-28-53	J	½	D,S	Water entering well at 8 ft, 1-28-53. Cf.
25R1	Walter Harmanson	355	Dg	36	48	9	---	--	Gravel	29.0	1-30-53	J	½	D	Water level reported to vary 1-2 ft seasonally. Cf.
26E1	Leroy Davidson	386	Dg	21	40	0	16	5	-----Do-----	15.1	1-29-53	S	¼	D,S	
26J2	Carl W. Pitlick	405	Dr	68	6	68	---	--	Sand, coarse, and gravel	38	---------	J	½	D	Bailed 8 gpm.
27E1	Robert Williams	366	Dr	31	6	31	28	3	Gravel	12	Spring 1951	S	½	D,S	Water level reported nearly constant.
27H1	L. L. Francy	382	Dg	19	60	4	---	--	-------------	2.4	1-29-53	S	½	D,S	Iron in water. Cf, temp 47.
28F1	M. E. Sinclair	355	Dg	16	60-42	8	---	--	-------------	11.4	2-12-53	S	---	D	Cf.
28P1	Glenn Netteland	344	Dg	16	55-48	2	---	--	-------------	12.5	2-12-53	S	¼	D,S	Supply usually adequate. Cf.
29D1	M. E. Hart	345	Dr	32	6	32(?)	32	--	Sand, coarse, green-blue	10.1	5-13-53	S (H)	---	D	Pumped 40 gpm, dd 3 ft. L.
32G1	Milton Scott	328	Dg	20	45	4	---	--	-------------	2.8	2-13-53	S	½	D,S	Cf, temp 47.
32Q1	Earl Chandler	334	Dg	21	50	6	---	--	-------------	10.6	2-13-53	S	½	D	Cf, temp 47.
33C1	J. Pluard	342	Dg	22	48	0	---	--	Gravel	19.4	10-24-52	S	---	D	Penetrated weathered cemented gravel. H.
33G1	James R. Allison	353	Dg	30	54	8	---	--	-----Do------	2.4	2-11-53	S	¼	D,S	Gravel to bottom. Can be pumped dry.
33H1	C. A. Payton	355	Dg	27	48	4	---	--	-------------	20.3	1-29-53	S	3/4	D,S	Temp 47.
33L1	D. L. Mitchell	345	Dg	40	54	5	---	--	-------------	33.6	2-11-53	J	½	D	Water contains iron. Cf.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
	T. 12 N., R. 1 W. -- Continued														
34A1	Leroy McConnell	380	Dg	46	48	3	---	--	-------------	38.3	1-29-53	J	½	D,S	Occasionally pumped dry during summer. Temp 49.
34D2	Mrs. Theresa Borto	361	Dg	30	60	5	---	--	-------------	14.8	1-29-53	S (H)	---	N	Cf, temp 49.
34J1	John Dorn	340	Dg	32	60	2	---	--	-------------	29.6	2-11-53	J	½	D,S	Pumped dry in 20 min. Water level reportedly constant. Cf.
34R1	George Herren	332	Dg	51	72	4	---	--	-------------	34.6	2-11-53	J	¼	D,S	Can be pumped dry in summer. Cf.
35G1	Henry McQuigg	340	Dg	35	42	8	---	--	Gravel	24	--------	S	1/3	D,S	Has been pumped dry in 2 hr.
36D1	W. L. Dillon	330	Dg	60	48	25	---	--	Cobbles and boulders	30	--------	J	3/4	D	Cf.
36E1	Phillip Gisselberg	342	Dg	55	48	5	---	--	-------------	51.7	2-10-53	J	1	D,S	Supply usually adequate, temp 49.
36R1	John Hinkley	275	Dg	28	72-48	4	---	--	Gravel, cobbles, boulders, some sand	14.1	2-11-53	S	¼	D	Supplies two homes. Can be pumped dry.
	T. 12 N., R. 2 W.														
1N1	Wendell Hill	481	Dg	29	52-40	4	---	--	-------------	27.8	12-4-52	S	½	D,S	Supply inadequate. Cf.
1P1	Ben Richardson	484	Dr	129	6	129	116	13	Sand, coarse, and gravel	30	8-29-52	J	½	D,Irr	L.
2D1	Ivan Buckovic	460	Dg	42	60	-----	---	--	-------------	32.7	11-13-52	J	½	D	Temp 51.
2D2	------Do-------	460	Dg	16	30 x 30	-----	13	3	Gravel	0	7-24-53	T	5	Irr	"Hardpan" from 2 to 13 ft. Pumped 8 hr at 75 gpm. Supply barely adequate.

2E1	Charles D. Hoag-lund	466	Dg	43	48	0	---	--	Clay and gravel	37.9	11-13-52	J	½	D	Temp 50.
2H1	J. H. Nelson	482	Dg	50	48	20	35	15	Clay and weath-ered gravel	42.8	11-12-52	J	1	D,S	Supply usually adequate. Temp 53.
2J1	------Do-------	482	Dr	140	8	137	70	67	Gravel, sandy, clayey	70	6-4-53	T	10	D,S Irr	Pumped 4 hr at 135 gpm, dd 55 ft. L.
2N1	C. E. Goudie	460	Dg	48	54	5	20	28	Clay and weath-ered gravel	26.7	11-13-52	J	¼	D,S	Cemented gravel to 20 ft. Cf, temp 51.
2P1	H. McKee	485	Dg	53	42	6	50	2	Boulders, grav-el, tight sandy matrix	41.7	11-12-52	J	---	D	Temp 49.
2Q1	J. H. Constant	475	Dg	33	48	8	---	--	Gravel	30.4	11-12-52	J	½	D,S	Report much seasonal fluctuation of water level. Water soft. Temp 49.
3A2	R. A. Laney	464	Dr	200	6	194	180	20	Sand, fine	100	12-31-52	J	1½	D	L.
3F1	Gunnar Larson	450	Dr	84	6	83	---	--	Sand, black	30 23	9- -50 5- -51	J	1½	D,S	Bailed 16½ gpm; dd 35 ft. Water slightly blue. Cf.
3J1	E. G. DeHaven	468	Dg	42	36	42	---	--	Clay and weath-ered gravel	39	9- -52	J	½	D,S	Iron in water. Water hard for 2 weeks after heavy rains.
3N1	R. S. Randt	450	Dg	42	48	4	---	--	-------------	35.6	11-14-52	J	¼	D,S	Cf, temp 48.
3Q1	Harry Lipps	458	Dg	45	48	8	---	--	-------------	37	Fall 1947	J	¼	D	Yields 2 gpm. Iron in water.
3Q2	Tom Estep	460	Dg	29	30	10	---	--	Clay and weath-ered gravel and cobbles	26.5	11-13-52	S	---	D	Temp 50.
4H1	Wilbert Beal	418	Dg	20	48-42	4	---	--	Gravel, coarse	12.7	11-14-52	S	¼	D,S	Supply for 2,000 turkeys.
4J1	John Clark	438	Dg	44	--------	8	40	4	Gravel	34.1	11-14-52	J	½	D,S	Topsoil to 8 ft, clay to 40 ft.
4Q1	John Gaines	440	Dr	110	6	80	---	--	Sand	35.1	11-14-52	J	½	D,S	Temp 50.
4Q3	W. K. Wachter	446	Dr	184	8	184	115	7	Sand and gravel Gravel	94.0	5-14-53	P	½	D,S	Pumped 15 hr at 260 gpm, dd 18-20 ft. L.
5M1	Holger Nelson	410	Dg	54	36(?)	-----	---	--	-------------	48.2	11-19-52	J	---	D	Temp 50.
6C1	Henry Schombel	565	Dg	65	60-42	8	55	8	Clay, sandy, consolidated	63.0	11-5-52	J	½	D,S	Supply for 2,000 chickens. Cf.
6J1	---------------	513	Dg	38	66-42	0	---	--	-------------	33.5	11-19-52	P (H)	---	N	Temp 50.
7J1	Harold Breshon	715	Dr	233	8	-----	---	--	-------------	Dry	11- -51	N	---	N	Some water in jointed basalt. L.
7J2	------Do-------	700	Dr	75	8	35	35	40	Basalt, frac-tured	14.4	11-20-52	J	½	D,S	Originally 75 ft deep. Iron in water. Water turns black when soap added, yellow when bleach added. Cf, H, L, temp 50.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
T. 12 N., R. 2 W. -- Continued															
8A2	Archie Floch	404	Dr	69	6	69	68	1	Sand, black	44	7- -47	J	½	D,S	Water soft, L.
8H1	Paul Sobolesky	400	Dg	48	48	4	---	--	Cobbles	45.2	11-19-52	P	½	D	Report more water in summer than in winter. Cf, temp 51.
8J2	Fred Conradi	410	Dg, Dr	90	6	90	---	--	Gravel	74	10- -49	P	---	D,S	Well dug 71 ft. Bailed 10 gpm, dd 3 ft.
8P2	George Fries	550	Dr	155	4	140	---	--	------------	Dry	Summer 1952	T	5	N	L.
8Q1	Norman Fries	505	Dr	140	6	136	136	4	"Rock," jointed	30.4 30.0	3-10-53 11-20-52	T	5	Irr	Pumped 7 hr at 75 gpm, dd 58 ft. Water soft. Cf, L.
9A1	H. G. England	455	Dg	51	48	6	45	7	Sand and gravel, cemented	44.9	11-14-52	J	½	D,S	Soil and clay to 20 ft; sand and gravel to 52 ft. Water soft.
9A2	------Do-------	455	Dg	62	48	6	---	--	Gravel and sand	6	11-14-52	P	½	S	Well connected with 12/2W-9A1, L.
9B1	M.G. Egebert	450	Dr	150	6	150	140	10	Gravel and sand	99.3	1-27-53	Sb	---	D	Has been supply for 8,000 chickens. Water soft. L.
9D1	W. J. Wilson	410	Dg	70	42	5	30	14	Sand	67	11-18-52	P	½	Irr	Report less water in winter than in summer. L.
9E2	Clarence Sobolesky	415	Dg	59	42	18	---	--	Cobbles and gravel	53.0	11-19-52	P	3/4	D,S	Report 3-4 ft water in well before 1950 earthquake; 6-8 ft since. Temp 50
9G1	E. R. Gill	437	Dg, Dr	135	6	135	127	8	Sand and gravel	71	2- -47	P	3/4	D,S	Dug to 80 ft. Water level dropped 51 ft when drilled. Bailed 10-15 gpm. L.
9L3	J. M. Cooper	440	Dr	79	6	80	60	19+	Gravel, cemented, and clay	65.6	11-20-52	J	1	D	Iron in water. H.

9L4	G. R. Smith	435	Dr	143	8	143	92	51	Gravel, coarse to fine	69½	2- -53	--	---	Irr	Pumped 4 hr at 284 gpm, dd 11 ft. Cf, L, temp 50.
9Q1	Hope Grange Hall	437	Dr	110	6	-----	---	--	Gravel	77.3	11-14-52	N	---	D	To be used for Grange hall.
9R2	John Behymer	440	Dr	225	8-6	225	94	6	Gravel, some clay	74.5	2-17-53	T	7½	Irr	Pumped 4 hr at 75-80 gpm, dd 24 ft. L.
							195	15	Clay and cobbles						
10D1	C. W. Carlson	465	Dg	57	60	5	---	--	Clay (?)	49.5	11-14-52	J	3/4	D	Supply inadequate. Temp 49.
10D2	------Do-------	465	Dr	190	8	190	125	55	Gravel, coarse, and sand	50.4	9-23-53	T	7½	D,Irr	Pumped 4 hr at 100 gpm, dd 63 ft. L.
10N1	L.P. Schwarzkopf	440	Dr	100	6	100	64	4	Sand and gravel	28	Fall 1950	T	5	D,S	Pumped 1 hr at 120 gpm, dd 55 ft. Pumped fine sand, Ca, L.
							72	28	Gravel and sand						
11J1	Lew Cambridge	465	Dr	103	6	99	100	3	Sand and gravel (?)	21.58	12-3-52	J	1½	D,S	Water level reported nearly constant.
12A1	Dick Blanksma	473	Dg	15	42-36	8	---	--	Clay and gravel	12.4	11-12-52	S	---	D	Temp 52.
12N1	Ed Malarz	490	Dg	58	48-40	5	---	--	------------	44.0	12-3-52	J	1/3	D,S	Cf.
12Q1	Carl Thomeson	471	Dg	14	28	14	---	--	Sand, black	12.2	12-3-52	S	¼	D,S	Penetrated mostly clay. Water soft.
13C1	John Pierog	464	Dg	30	48-30	8	23	4	Clay, sandy, and gravel	24.8	12-3-52	S	¼	D	Supply inadequate in fall, 1952.
13E1	Albert Neuert	460	Dg	25	48-72	6	---	--	Gravel (?)	20.0	12-4-52	S	---	D	Supply adequate.
13P1	C. L. McCuen	468	Dg	29	60	7	---	--	Gravel and cobbles, weathered; sandy clay	21	--------	S	¼	D	Iron in water. Water is hard.
14A3	J. L. Hemenway	472	Dg	26	48	0	23	3	Gravel, weathered; clay, sandy	23.0	12-4-52	S	---	S	
14E2	August Sturza	450	Dg	35	30	6	---	--	------------	17.8	2-25-53	J	½	S	H.
14R2	St. Urbans Grange	460	Dg	21	50-36	5	---	--	------------	16.7	12-2-52	S	1/6	D	Temp 51.
										16.2	12-10-52				
16A1	Willis Porter	412	Dg	60	45	8	---	--	------------	50.2	11-26-52	J	½	D	Supply adequate.
16C1	R. Jensen	440	Dg	46	------	46	39	7	Gravel and clay	39	--------	J	---	D	Supply adequate. L.
16E1	James Maguire	475	Dg	22	30-36	8	---	--	------------	21.0	11-25-52	S (H)	---	S	Yields only 7-10 gpd. Temp 49.
16E2	------Do-------	460	Dg	22	36(?)	22	---	--	------------	18.4	11-25-52	S	½	D,S	Well dug to solid rock. Supply barely adequate; bailed 3 gpm.
16E3	------Do-------	475	Dr	185	4	------	90	1	Sand, fine	------	---------	--	---	----	L.
							165	20							

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
							T. 12 N., R. 2 W. -- Continued								
16F3	Mackey Bros.	440	Dr	154	6	114	---	--	Sand	50 46.0	7- -53 7-20-54	J	---	D,Ind	Supplies sawmill. Basalt from 42 to 117 ft. Cf, temp 51.
16J1	Willis Porter	445	Dg	108	42	5	105	3	Gravel, fine	102.7	11-26-52	J	1	D	Can be pumped dry in half an hour, rapid recovery. L.
16M1	H. Goodell	475	Dg	35	35	28(?)	---	--	------------	28.0	11-25-52	P	¼	D	Cf, temp 50.
16N1	Henry Mann	467	Dg	5	30	5	---	--	------------	1.4	11-26-52	S	3/4	D	Supplies two homes. Water tastes odd, stains sink green. Cf.
17A1	Axel Backman	490	Dg	11	36	7	---	--	Clay, red; "rocks" 4-12-in. diameter	9.8	11-20-52	P	1	D	Penetrated clay and "rocks" for entire depth.
17B1	------Do-------	520	Dr	161	6	150	152	9	Shale (?)	54	11- -51	J	1½	S	Basalt to 71 ft. Water tastes and smells of oil; oil film on surface. Formerly used successfully for irrigation. Cf.
17C1	Gus Milbredt	700	Dg	23	48	0	16	6	Clay	16.6	11-20-52	S	¼	D,S	Dug entirely in clay. Temp 50.
17M1	J. A. Smith	450	Dr	65	6	65	---	--	------------	50	10- -52	J	1	D	Yielded only 30 gpd in Oct. 1952.
17N1	Otto Ollie	430	Dg	16	42	-----	---	--	------------	10.1	11-21-52	S	---	D,S	Supply adequate since deepening 2 ft in Sept. 1952.
17R1	Clark Nicewanger	490	Dg	15	48(?)	-----	---	--	------------	10.5	11-25-52	S	1	D,S	Flows in winter months. Drilled 143-ft dry well in 1946. Cf, temp 52.
18G1	Jesse Gans	680	Dg	47	48	0	---	--	------------	44.0	11-21-52	J	½	D,S	Iron in water. Cf, temp 49.
18H1	Ed Henry	440	Dg	18	60	6	---	--	Clay, blue, and gravel	14.5	11-21-52	S	¼	D	Supply inadequate. Water tastes odd.
19A1	J. B. Skidmore	510	Dg	42	72	7	---	--	------------	35.6	11-25-52	P	¼	N	Hard clay 7-42 ft. Can be pumped dry. Cf.

19L1	Bill Hillard	430	Dg	30	36	4	---	--	Clay, hard	8	12-9-52	S	---	D	Dug in clay "hardpan."
19Q1	Victor Lilja	432	Dg	20	60-48	8	---	--	------------	17.1	1-7-53	B (H)	---	D	Clay "hardpan" 9-20 ft. Temp 50.
20C1	Charles Ollie	448	Dg	71	60(?)	70	---	--	------------	67.6	11-21-52	P	½	D	Hard formation from 60 to 70 ft.
20G1	William Blum	463	Dg	39	39	-----	---	--	------------	41.0	11-21-52	J	---	D,S	Cf, temp 50.
20H1	Stella Hunt	450	Dr	59	8	59	---	--	Sand	27	---------	J	1½	D,Irr	Adequate supply reported.
20L1	W. M. Foster	405	Dg	27	58-48	8	---	--	------------	21.5	11-21-52	S	½	D,S	Water has iron taste, stains clothes yellow. Cf, temp 49.
21D1	Mrs. C. A. Rice	440	Dg	4	66	0	---	--	Gravel and clay, hard	1.3	11-26-52	S	¼	D	Cf, temp 48.
21K1	L. S. Cass	400	Dg	53	36	6	---	--	Cobbles and gravel	47.5	11-26-52	J	3/4	D,S	
22L1	George Epley	440	Dg	93	44	0-5 83-93	---	--	------------	90.6	11-26-52	Sb	---	D,S	Temp 51.
22L2	Toivo Kaija	425	Dg	88	48	8	---	--	------------	86.4	12-12-52	P	½	D	Temp 50.
22R1	Joseph Lummer	420	Dg	22	50	3	---	--	Gravel, cemented	15.6	12-12-52	S	---	D	Entirely in clay and cemented gravel. Temp 50.
23C1	R. L. Hofmann	464	Dg	42	48	6	---	--	------------	36.1	12-10-52	J	½	D,S	Reportedly little water-level fluctuation; low yield. Iron in water. Temp 51.
23E1	William Schaefer	454	Dg	69	40	5	74	1	Sand	62.2	12-12-52	P	½	D,S	Originally dug to 75 ft. Water leaves yellow scum on drinking glass.
23H1	Joe Waller	493	Dr	134	6	134	---	--	------------	43	8- -51	T	2	D,S	Bailed 20 gpm, dd 22 ft. Water-bearing material at 3 levels.
23M1	Emil Hofmann	473	Dr	128	6	128	100	28	Sand and "pea" gravel	75.5	12-11-52	Sb	½	D,S	Yield 17 gpm. Casing perforated 110-120 ft.
23R1	Evelyn Driskell	444	Dg	11	48	-----	---	--	------------	1.2	12-10-52	S	---	D	Cf, temp 52.
24B2	C. P. Ruether	470	Dr	72	6	72	70	2	Sand, coarse	8.8	12-5-52	J	¼	D,S	Bailed half an hour at 30 gpm; dd 21 ft. Rapid recovery. Cf, L.
24C1	Ben Meier	475	Dg	31	72-42	6	---	--	Gravel and clay, sandy	22.5	12-5-52	S	½	D,S	Iron in water.
24H1	Carl D. Bailey	470	Dg	22	60	8	18	4	Sand and weathered gravel	------	--------	S	¼	D,S	Water is cloudy after heavy rain. Iron in water.
24Q1	William Sorensen	476	Dg	16	36	-----	---	--	Gravel	9.3	12-10-52	S	---	D,S	Water soft, temp 49.
25A1	O. L. Geer	480	Dg	42	38-44	30	30	12	Gravel and clay, cemented, red	29.4 30.6	9-18-52 12-10-52	J	1	D,S	Reportedly little seasonal change in water level.
25C1	Douglas Mickelson	471	Dr	52	6	53	---	--	Sand	21.4	12-10-52	J	½	D,S	Supply adequate.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
T. 12 N., R. 2 W. -- Continued															
25D1	William Franz	473	Dg	25	24	24	---	--	Clay, red	18.2	12-30-52	S	½	D,S	Use about 100 gpd; supply inadequate.
25G1	Carl Radant	483	Dg	47	36	47	---	--	Gravel and boulders, cemented	34	---------	J	1	D,S	Caving clay, 13 ft, overlies aquifer.
25H1	Charles Acord	478	Dg	32	72 x 60	6	24	8	Gravel	25.7	5-13-53	S	½	D	L.
26K1	L. R. McEwan	476	Dg	53	------	-----	---	--	------------	39.3	5-14-53	--	1	D	Pumped for 2 min before measurement. Slow recovery.
26M2	C. L. Cline	470	Dr	127	6	-----	---	--	Gravel	46.1	5-14-53	P	3/4	D,S	Penetrated clay and gravel.
26R1	Woodrow Sipp	500	Dr	122	6	123	---	--	------------	58.1 56.4	12-24-52 5-13-53	P	1½	D,S	Water soft.
27D1	W. P. McCarthy	460	Dr	137	6	135	125	10	Gravel and sand	99.3	12-11-52	P	---	D	Casing perforated.
27F1	Ole Reinseth	460	Dg	102	44-36	5	---	--	"Rock" and clay	96.4	12-11-52	P	1	D,S	
27R1	G. Frelich	465	Dg	67	48	10	51	16	Gravel and sand, packed	51.6	5-14-53	J	1	D,S	Water level reported constant, yield high. L.
28H1	M. R. Alexander	457	Dr	129	6	125	100 (?)	--	Sand	100.8	12-12-52	J	1	D	Water-bearing material at 3 levels.
28J1	City of Winlock, well 2	365	Dr	260	12	-----	---	--	Gravel and sand	13	--------	T	7½	PS	Pumped 18 gpm, dd 50 ft. L.
28M1	Bert Johnson	404	Dr	66	6	60	55	11	Gravel, fine	55	--------	J	1	D	Supply adequate. L.
28R1	City of Winlock, well 1	355	Dr	55	8	55	---	--	Gravel and coarse sand	16	--------	T	7½	PS	Pumped 125 gpm, dd 39 ft. Supplies city in winter. L.
29A1	John Hakola, Sr.	340	Dg	18	42-36	7	---	--	Gravel and clay	9.0	12-31-52	P	1/6	D	Water level reported 14-16 ft below land surface in summer. Water has mineral taste. Cf.
29H1	Hugo Blumstrom	410	Dg	53	48	4	40	13	Sand	50.6	12-30-52	P	3/4	D	

29L1	William Ojala	419	Dg	37	48-36	8	---	--	------------	33.7	12-31-52	P	½	D,S	Water level reported nearly constant, recovery rapid.
30G1	Oscar Wedam	460	Dr	328	8	29	23	122	Sandstone	22	6- -52	Sb	5	D,S	Water soft. L.
							178	9	Sandy clay						
							200	5	Sand						
							314	14	Sand						
31B1	M. G. Perkins	545	Dr	207	6	126	112	28	Shale, sandy	30	2-6-52	T	5	Irr	Bailed 40 gpm, dd 37 ft. Yield originally higher. L.
31C1	Felix Anderson	640	Dr	153	6	125	150	3	Gravel, blue-black	-----	---------	P	3/4	D,S PS	Supply adequate. Water black for 3 days after earthquake in 1949. L.
32D1	Carl Maki	495	Dg	43	48	-----	37	6	"Quicksand," white	26.0	5-15-53	J	½	D,S	L.
32Q1	Emil Jarvi	405	Dr	315	8-6	315	100+	--	Gravel, fine	60	1949	P	3	D	Casing perforated.
							300+	1							
33B1	City of Winlock, well 3	320	Dg-Dr	60	28	-----	---	--	Gravel and sand	12	--------	T	3	PS	Pumped 80 gpm, dd 48 ft. L.
34D2	John Zion	465	Dg	76	48	5	---	--	Sand and gravel	64.4	12-22-52	P	3/4	D,S	Can be pumped dry with present pump.
34F2	V. O. Harkins	470	Dr	176	8	171	86	84	-----Do-----	65	11-29-55	--	---	----	Pumped 230 gpm, dd 25 ft. L.
34G1	Andrew Hinen	475	Dr	185	8	185	120	65	Gravel and sand	70	5- -52	T	10	D,S Irr	Has pumped 120 gpm while irrigating. L.
							---	--	-----Do-----						
35B2	Clayton Mickelsen	460	Dr	160	8	160	90	29	Gravel, coarse, and sandy	25.7	4-10-53	T	---	Irr	Bailed 60 gpm, dd 8 ft. H, L.
							150	10	Gravel, coarse						
35F2	J. E. Huber	465	Dg	45	36	7	---	--	------------	39.9	12-23-52	J	½	D	Yellow clay and weathered gravel to 30 ft. Red-yellow sand to 35 ft.
35G2	Ralph Champ	470	Dg-Dr	129	8	129	110	19	Sand and gravel	42	4-13-53	--	---	----	Bailed 5 gpm, dd 22 ft. L.
35H1	Clayton Mickelsen	487	Dr	130	6	130	115	15	-----Do-----	57.9	9-18-52	J	1	D,S	Bailed 17 gpm, dd 45 ft. L.
35K1	C. A. Graham	460	Dg	48	48	4	45	3	Sand and gravel	40 41.5	11-1-52 12-24-52	P	½	D,S	L.
35R1	Gust Nyberg	485	Dg	58	48	4	---	--	Gravel and sand	53 54.4	1- -48 12-24-52	J	½	D,S	Encountered thick layer of clay.
36N1	Edward Lampitt	415	Dg	25	48	9	---	--	Sand and cobbles	18 12.8	Summer 1952 12-24-52	S	½	D,S	Report water level 17-18 ft below land surface in summer.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 12 N., R. 3 W.						
4B1	J. C. Stech	1,160	Dg	15	21	14	---	--	Gravel	8	Summer 1953	S (H)	---	D	Water produces brown stain. "Hard-pan" overlies gravel.
5D1	--- Unterwegner	260	Dg	20+	42	20+	---	--	Clay	6	6- -52	S	½	D	Dug entirely in clay. Yield low.
5F1	G. J. Valentine	320	Dg	47	42±	47	---	--	------------	17.3	12-29-53	J	1/3	D	Temp 49.
8C1	V. W. Shaklee	283	Dg	30	30	27	27	3	Gravel	0	--------	S	½	D	Supply adequate. L.
13F1	John King	518	Dr	220	6	55	58	--	------------	11.1	1-7-53	P	½	D	Supply for 4,000 chickens. L.
24G1	Irvin Thomas	455	Dr	55	8	55	---	--	Clay (?)	17.4	1-7-53	J	½	D	Well penetrates clay and shale. Water hard, has mineral taste. Iron in water.
24J1	Ludwig Heitzmann	442	Dg	30	54	10	10	20	------------	0	Winter	S	½	D	Well penetrates shale. Supply barely adequate in fall.
30Q1	Louis Hill	324	Dg	20	6	16	16	2	Gravel	18	--------	S	1/3	D	Pumps dry in 20 min. Water hard; contains iron. L.
					30	16-20									
31R1	J. A. Thompson	330	Dr	20	8	-----	---	--	Shale (?)	16½	--------	S	½	D,S	
									T. 12 N., R. 4 W.						
1B1	E. M. Roundtree	270	Dg	15	44	5	---	--	Gravel	5.2	12-31-53	S	1/3	D	Gravel overlies blue shale.
1N1	Boistfort School	259	Dg	23	36	23	---	--	------------	16.0	8-4-54	S	5	Inst	Water hard.
1N2	-------Do-------	258	Dr	465±	6	-----	---	--	------------	------	--------	N	---	N	Encountered salt water.
2G1	Elmer Ellingson	255	Dg	19	30	10	---	--	Silt	8.2	12-31-53	S	1/3	D	Soapstone at 11 ft. Cf.
2P1	Emil Berg	320	Dr	80	6	23	---	--	Sand	12	7- -50	S	¼	D,S	Water soft.
2Q1	E. A. Born	274	Dg	27	36	28	---	--	Sand and gravel	13.7	8-5-54	S	¼	D	Well pumps dry; water contains iron.
4A1	Emil Berg	370	Dg	10	48	0	---	--	------------	5.3	8-5-54	S	1/3	D,S	Well pumps dry; water soft.
8J1	Merle Henry	432	Dg	16	24	16	---	--	Sandstone, gray	15	--------	S	½	D	Well pumps dry; water hard, rust colored when boiled.

12D1	--- Banjuh	261	Dg	16	48	16	14	2	Gravel	2	--------	S	½	D,S	Sandy loam overlies gravel.
12D2	Boistfort Church	267	Dr	100	------	-----	10	8	------------	-------	--------	--	---	-----	L.
12M1	Frank Riedl	279	Dg	12	14	14	12	--	Gravel	4.4	12-31-53	S	½	D,S	Loam and 7 ft of sandy gravel overlies gravel. Cf.
13M1	George Alden	330	Dr	81	7	-----	79	2	Gravel, fine	3.4	3-20-54	J	---	D,S	Water reportedly tastes odd in dry weather. H, L.
14F1	H. C. Livingston	302	Dg	21	48	0	---	--	Shale, gray	17	8-4-54	S	¼	D	Well pumped dry. Supplies two houses.
24C1	Harold Parker	365	Dg	26	60	26	---	--	------------	8.4	--------	S	½	D,S	Water soft.
									T. 12 N., R. 5 W.						
2C1	Frank Rumbalski	475	Dr	200	6	50	---	--	Limestone (?)	7.7	8-10-54	N	---	N	Water hard.
									T. 12 N., R. 1 E.						
2C1	J. R. Clark	650	Dg	48	42	8	---	--	Gravel and clay	42.7	9-2-53	J	½	D	Water reported high in silica; leaves brown stain.
2E1	William Hansen	690	Dr	248	6	244	220	28	Sand and gravel	212.5	9-2-53	P	1½	D,S	Cf, L. temp 52.
2N1	E. H. Powell	670	Dr	241	12	241	226	9	Gravel and yellow clay	214 195	2- -51 5-3-52	T	25	Irr	Pumped 4 hr at 180 gpm, dd 40 ft. L.
2P1	E. A. Shore	675	Dg	55	36	7	52	6	Gravel, cemented	49.6	9-24-54	B (H)	---	D	Dry in fall. Well formerly 40 ft deep and adequate until area logged off, then dug to 58 ft.
2Q1	Lawrence Roe	708	Dg	42	42	8	---	--	Clay, yellow	------	--------	J	½	D,S	Well dry 6 weeks in fall 1952.
3A1	Oscar Dutcher	637	Dg	25	40±	4	---	--	Clay (?)	13.1	9-2-53	S	¼	D	Deepened to 25 ft in fall 1952.
3C1	Ed Zandecky	616	Dg	29	------	8	---	--	Gravel	18.0	9-2-53	S (H)	---	D	Dry, first time in fall 1952. Temp 52.
3F1	Ira Baker	636	Dg-Dr	75	8	75	---	--	Gravel and sand	72	--------	J	1	D,S	Supplies four houses.
3Q1	Jake Blair	637	Dg	52	42	9	49	2	Gravel	49	--------	P	½	D,S	Clay to 8½ ft. Water produces red stain. Cf.
4P1	A. C. Blankenship	580	Dr	150	6-5	150	134	--	Sand and gravel	125	1935	Sb	2	D,S	Encountered first gravel at 35 ft.
6H1	Frances Finney	640	Dg	27	-------	-----	---	--	Gravel and yellow clay	------	--------	S	---	D	Water contains iron.
8P2	Dr. J. A. Kehoe	519	Dg-Dr	112	8	112	85 103	12 13	Sand and gravel -----Do-----	85	--------	T	5	Irr	Dug to 89 ft. Cf, L, temp 51.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
							T. 12 N., R. 1 E. -- Continued								
8Q2	J. C. Nelson	526	Dr	141	8	141	94	47	Gravel and sand	93	6-21-25	T	20	Irr	Pumped 215 gpm, dd 14 ft. Pumped 240 gpm while irrigating. Cf, L.
9N1	Anna Judd	548	Dg	109	42	6	---	--	Sand (?)	105.8	8-29-53	P	---	D,S	Temp 53.
9Q1	C. E. Farr	572	Dg	143	------	14	131	9	Gravel, cemented	131.3	9-10-52	P	1½	D,S	Deepened from 3 ft in 1930. Ca, L, H, temp 51.
10A1	Arnold Hite	652	Dg	27	36	8	---	--	-----Do-----	23	8-27-53	S	¼	D,S	Supply inadequate. Water produces brown stain.
10P1	Earl Kerr	598	Dg	158	42	13	153	5	Gravel, tight	153.5	10-20-54	Sb	2	D	Highest water level reported 146 ft. L.
11E1	W. R. Wilson	656	Dg	28	60	10	---	--	Gravel, cemented	18.4	8-31-53	S	½	D	Water produces brown stain.
11H1	K. P. Lewis	710	Dg	47(?)	48	12	---	--	Gravel	31.3	8-31-53	J	1	D,S	Much iron in water.
11N1	F. L. Guyer	637	Dg	55	40	10	48	7	Gravel, cemented	48.8	8-29-53	J	1/3	D,S	Cemented gravel for entire depth. Water produces red stain; hot water turns blue when exposed to copper.
11N2	Walter Pries	644	Dg	27	48	4	---	--	-----Do-----	22.1	8-31-53	S	½	D,S	Well dry in fall 1952.
12P1	S. G. DeGross	565	Dr	357	4	357	343	14	Sand and gravel, fine	60	1952	T	---	D	Tested at 50 gpm. Supplies three homes. Cf, L, temp 52.
12Q1	Vera Talbott	562	Dr	354	90+	-----	---	--	Gravel, fine	194	1953	P	3	D,PS	Supplies 20 houses, 5 small businesses. Cf.
13B1	Owen Merry	558	Dr	170	6	170	150	20	-----Do-----	74.6	3-23-55	--	---	D,C	Supplies restaurant, trailer court. Bailed 2 hr at 10 gpm, dd 80 ft. Cf, L.
13C1	H. Hammill	561	Dr	165	5	118	---	--	Sand, gray	110	--------	P	2	D,S	Supplies 5 houses.
13D1	--- Kostick	553	Dr	70	6	70	---	--	Gravel	50	--------	P	5	Ind	Supplies sawmill.
13D2	W. P. Althauser	549	Dr	156	6	155	150	5	Gravel	142	7- -53	J	1	D	Bailed 7 gpm, little dd. L.

13E1	Leo Kaiser	530	Dg	47	43	3	---	--	Clay (?)	14.2	9-2-53	J	1	D	Cf.
13L1	J. M. Bullock	525	Dg	28	54	6	---	--	Gravel	20.3	9-3-53	S	½	D,S	Supplies two families
13N1	William Spath	433	Dg-Dr	284	6	115	---	--	------------	106.7	7-6-55	N	---	N	Tested at 4½ gpm. Water salty. Cf, L.
14H1	Leo Kaiser	535	Dr	162	6	162	160	2	Sand and gravel	146.0	9-2-53	--	---	----	Bailed 8 gpm. L.
15A1	Harold Keenan	613	Dg	37	33	8	---	--	Gravel	36.5	9-3-53	J	½	D,S	Pumped dry in ½ hour. Temp 52.
15J1	P. J. Harms	483	Dr	173	6	173	165	8	"Shale," sandy	124	3-30-47	T	3	D,S Irr	Pumped 4 hr at 30 gpm, dd 19 ft. Cf, L.
17B1	S. G. DeGross	534	Dr	137	6	137	120	17	"Quicksand" and gravel	100	9-1-53	T	7½	Irr	Pumped 4 hr at 65 gpm, 35 ft dd, rapid recovery.
17M1	Frank Coutts	498	Dg	78	39	8	---	--	Gravel and sand	73.3	9-3-53	P	½	D	Temp 52.
17N1	W. J. Coutts	500	Dr	120	12	120	80	40	Gravel, loose	70	8- -51	T	5	Irr	Pumped 4 hr at 100 gpm, 23 ft dd. L.
18A1	L. P. Lowe	510	Dg	77	38	12	---	--	Gravel (?)	73.8	8-29-53	P	3/4	D,C	Temp 52.
18B1	John Moltz	502	Dg	72	48 x 36	8	---	--	Gravel	67.9	8-29-53	J	½	D,S	---Do---
18E1	J. J. Logan	466	Dg	45	72	7	44	1	Gravel and sand	40	--------	J	½	D	Supplies two houses.
19D1	Cliff Oertli	454	Dr	60	6	60	---	--	------------	40	9- -48	J	3/4	D	Drilled through thick layer of white clay. Bailed 17 gpm, little dd.
30D1	Martha Ike	400	Dg	30	48	6	---	--	------------	28.8	1-30-53	B (H)	---	D	Supply usually adequate.
32L1	W. H. Byrd	185	Dg	16	24	16	13	3	Gravel and sand, gray	13	--------	S	½	D	Gravel and clay overlie aquifer. Dry in late summer. Water level varies with stage of Cowlitz River.
33J1	Einar Due	388	Dr	120	4	-----	---	--	Sand, black	35	---------	Sb	½	D,S	Additional 72-ft dug well goes dry in summer. Pumped 13 gpm, dd 11 ft. Cf.
									T. 12 N., R. 2 E.						
4B1	W. F. Lenz	720	Dg	45	48	6	---	--	Gravel and clay	29	9- -53	P	1/3	D,S	Pumped dry in fall of 1952.
4K1	W. H. Wilson	685	Dr	270	10	122	41	--	Clay, sand, and gravel	32	--------	J	3/4	D	Well originally 270 ft deep. Plugged at 127 ft. Pumped 15 gpm. Pumps sand. Cf, L.
4P2	Elmer Powell	680	Dr	240	6	240	180	40	Boulders and gravel, cemented	180	9-8-54	T	---	D,Irr	Tested 85 gpm. Cf, L.
6Q1	Earl Zenknor	930	Dg	40.8	------	-----	---	--	------------	37.4	9-24-53	P	½	D	Pumped dry in fall, 1952. Temp 52.
8M1	Rudolph Kaech	1,020	Dr	220	6	200	---	--	Gravel	120	--------	Sb	5	D,S Irr	"Rock" 200 to 220 ft. Yield 55 gpm. Water produces brown and green stain. Cf, temp 50.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
T. 12 N., R. 2 E. -- Continued															
8P1	Elmer Powell	830	Dg	20	-------	-----	18	2	Clay, gravelly	12	--------	S	½	D, Irr	Yield 5-10 gpm.
9A1	William Ludwig	450	Dr	110	8	-----	55	55	Gravel and sand, cemented	55.0	3-25-55	T	5	N	House vacant. Yield 50 gpm. L.
11A1	E. Sweet	605	Dr	370	12	-----	290 360	5 5	Rock and gravel Rock, red	235	3-1-55	--	---	Irr	Bailed 42 gpm, dd 60 ft. L.
13B1	N. A. Aldrich	621	Dr	117	8	122	90	32	Gravel and sand	75.2	7-17-53	--	---	Irr	Backfilled to 117 ft. Pumped 4½ hr at 220 gpm, dd 2 ft. Cf, L, temp 51.
14B1	E. W. Blaisdell	582	Dr	144	10	320	65	71	Numerous beds of sand and gravel	62.6	9-9-52	T	10	Irr	Pumped sand; plugged at 144 ft. Pumped 8 hr at 250 gpm, dd 63 ft. Cf, H, L, temp 51.
16A1	Rudy Pries	465	Dr	150	6	22	27	18	Rock and "shale"	3	--------	S	½	D	Bailed 7 gph. Supply inadequate. L.
17C2	Floyd Kinney	815	Dg	17	42	9	---	--	Gravel, cemented	9.8	9-23-53	S	½	D	Water produces brown stain.
17G1	Ray Huntting	665	Dr	150	6	140	80	60		70	--------	P	½	D	Supplies seven families. Drilled 180 ft; plugged at 150 ft. L.
17J1	R. W. Rigg	680	Dr	278	8-6	278	266	12	Gravel	266	1948	P	2	D,S	L.
17L1	Walter Sears	667	Dg-Dr	174	6	174	170	4	Gravel, loose	129	3-17-55	--	---	-----	Tested 20 gpm. L.
17P1	H. B. Ranson	645	Dg	54	36	6-8	---	--	Gravel	50.7	9-17-53	J	½	D,S	Well usually dry in late fall.
17Q1	P. E. Severns	605	Dr	193	6	187	---	--	Sand	168	Fall 1951	T	3	D	Bailed 10 gpm, little dd. Gravel and blue clay successively overlie aquifer. Cf.

18C1	W. B. Damron	643	Dg	83	36	6	---	--	Gravel	76.9	9-17-53	J	3/4	D,S	Cemented gravel and sandstone above aquifer. Water produces brown stain. Cf.
18G1	Harold Powell	660	Dr	144	6	144	---	--	Gravel	-------	--------	P	1	D,S	Penetrated mostly gravel. Yield 3-4 gpm.
18H1	Ray Cook	642	Dg	24	42	6	---	--	Clay and boulders	16.1	9-16-53	S	¼	D	Supply adequate.
20F1	F. C. Marsh	645	Dr	237	6	63	---	--		49	1955	J	1	D	Originally 126 ft deep. L.
24A1	K. Adams	840	Dr	197	6	18	17	1	Clay and gravel	10	10- -52	S	¼	D	Supply adequate, water soft. L.
35F1	N. F. Howard	600	Dr	97	6	95	95	2	Gravel	16	--------	S	3/4	D	Pumps fine blue silt. Bailed 33 gpm, dd 2-3 ft. L.
35G1	Marvin Howard	590	Dr	58	6	56	56	2	Gravel	15	--------	S	½	D	Supplies three houses. Bailed 33 gpm, dd 2-3 ft. Well deepened from 36 ft because of hard water. L.
35G2	-----Do-------	607	Dr	38	6	36	36	2	Gravel	18	--------	S	3/4	D	Supplies swimming pool. Bailed 33 gpm, dd 2-3 ft. L.
									T. 12 N., R. 3 E.						
8C1	--------------	737	Dr	585	------	-----	---	--	------------	-------	--------	N	---	De(?)	Test hole for damsite investigation. L.
16J1	W. H. Bowen	810	Dr	154	6	18	292 146	2 8	Sand, black	28	7- -54	J	1	D,S	Supplies two homes. Water hard, produces hard white residue. L.
17B1	R. L. Nelson	750	Dr	30	6	28	28	2	Sand (?)	14.8	8-25-54	S	½	D	Can be pumped dry. Cf.
18P1	J. E. Swigart	670	Dr	117	6	-----	97	20	Gravel, cemented	97	9- -46	J	1	D	Water hard. L.
21A1	W. H. Newton	828	Dr	100	6	50	36	14	Clay and gravel	35.7	8-24-54	J	1½	D	Supplies three houses. Water soft. Pumped 10 gpm, dd 52 ft. L.
21G2	C. Blankenship	775	Dr	250	6	22	---	--	------------	225	8- -54	N	---	N	Yield very small. L.
22D1	Harry Belcher	780	Dr	190	6	60	172	18	Sand, black	70	8- -51	Sb	1½	D,S	Water soft. Cf, L.
22R1	Lowell Davis	833	Dr	215	6	110	---	--	Rock, porous	22	9- -48	J	3/4	D,S	Supplies three houses. Water hard.
24C1	W. O. Jackson	530	Dr	73	7	73	73	--	Gravel	10	--------	J	1½	D,C	Supplies gas station and cabins. Cf, L.
25D1	L. F. Bartley	880	Dg	8	40	10	---	--	------Do----	5.0	8-20-54	S	---	D,S	Water soft.
25H1	W. Hadaller	1,400	Dg	16	42	15	---	--	Sandstone	11.3	8-20-54	S	---	D	Supply inadequate. Water soft.
25L1	C. W. Kaiser	1,450	Dg	14	48	10	10	4	Gravel, cemented, hard, gray	5.5	7-6-55	S	¼	D,S	

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 12 N., R. 3 E. -- Continued						
26D1	Wallace Osborne	800	Dr	246	6	37	---	--	Sand	Flow	8-20-54	S	1	D,S	Gray siltstone with interbeded fine sand from 46 ft to bottom. Gas in water. Cf, temp 50.
28L1	R. A. Perkins	1,200	Dr	52	6	52	---	--	Sand, gray	14.3	8-20-54	S	1/3	D	Cf, temp 48.
									T. 12 N., R.4 E.						
2C1	Ed Fissel	956	Dr	53	4	53+	---	--	------------	37.4	3-18-53	N	---	N	Yield 5 gpm. Cf, H, temp 52.
									T. 12 N., R.5 E.						
7D1	C. W. Lane	1,000	Dg	19	60	20	---	--	Clay	14.7	8-27-54	S	¼	D	Dry in August. Water soft.
7K1	O. D. Hall	1,000	Dr	100	6	100	---	--	Sand	10	9- -49	J	1	D	Cf.
14H1	W. W. Sylva	862	Dr	222	6	20	---	--	Gravel	1.0	3-18-53	S	1/3	S	Cf, H.
14K1	-----Do-------	843	Dg	19	------	-----	8	11	Gravel, cobbles	8.1	3-18-53	S	¼	D,S	Yield 7 gpm.
14N1	A. W. Hamilton	827	Dr	24	6	22	---	--	------------	6.0	4-8-53	S	1/3	D	Cf, temp 47.
17D1	Carl Schmuck	1,000	Dg	26	30	26	23	3	Gravel and clay	20	8-15-54	S	¼	D,S	Dry some years. Water soft. Aquifer overlain by 20 ft of shale and "rock."
22A1	John Hackney	827	Dr	52	6	-----	31	5	Gravel, fine	------	--------	J	2	D,Irr	L.
22K1	--------------	800	Dr	38	6	38	---	--	Sand and gravel	20	9- -46	S	3/4	D	Water soft.
28A1	Lawrence Goodwin	775	Dr	31	6	-----	30	1	-----Do-----	------	--------	S	½	-----	Pumped 8 gpm, dd 14 ft. Water soft, contains iron. L.
28G1	K. W. Barrett	767	Dr	39	8	39	35	4	-----Do-----	13	1943	J	1½	D,C	Supplies 17 houses, store, restaurant. Yield 42 gpm. Cf, L.

32K1	--- Hiett	677	Dr	47	6	-----	---	--	Sand and gravel	25.4	8-24-54	J	3/4	D	Pumped ½ hr at 25 gpm, dd ½ ft. Water soft.
									T. 12 N., R. 6 E.						
10E1	Frank Dunaway	1,125	Dr	68	6	45	---	--	Sand	30	8- -52	N	---	N	Well was destroyed.
11P1	George Justice	990	Dn	23	1½	23	---	--	Gravel	14	4- -49	S	¼	D,S	Water soft.
									T. 13 N., R. 1 W.						
1D1	Ed Pfirter	393	Dg-J	124	21-3	60	124	--	Cobbles	+15 6	1945 4-15-53	N	---	N	L.
2A1	L. F. Miller	388	Dr	85	6	44	87	1	Sand	5.6	4-15-53	J	½	D,S	Originally 88 ft deep. Slight flow until earthquake of 1949. Pumped 10 gpm, dd 40 ft. Cf, L, temp 49.
2B1	Leonard Deskins	382	Dg	18	36	10	16	2	Gravel	3.8	4-14-53	S	---	D,S	Supply inadequate.
2G1	Andrew Johnson	375	Dg-Bd	51	36 3	20 51	50	1	-----Do-----	5.2	4-14-53	P	¼	D	Dug 21 ft, bored 30 ft. Water occasionally produces rust stain. Cf, L.
2P1	G. F. Wixson	367	Dg	25	48	25	---	--	Gravel (?)	4.4	4-16-53	S	¼	D	Water produces rust stain.
4F1	Wesley Watt	574	Dg	22	48	4	---	--	------------	5.7	4-17-53	S	½	D	Report water level constant. Cf.
5G1	E. F. Bena	547	Dg	15	30	14.7	14	--	"Hardpan"	2.5	4-17-53	S	½	D	Supply adequate.
5H2	Carl Harmon	558	Dr	108	6	100	103	5	Gravel, fine, and sand	6.5	4-20-54	T	3	D,Irr	Pumped 35 gpm, dd 88 ft. Cf, L.
5N1	Paul Seines	560	Dg	28	36	28	20	8	Clay and gravel	9.9	4-17-53	S	---	D,S	Report always at least 6 ft of water in well.
6D1	Cecil Pattee	524	Dg	49	------	0	---	--	Gravel	38.8	4-22-53	J	½	D	Water turns red on standing. Cf.
6M1	Floyd Pattee	528	Dg	43	42	-----	40	3	-----Do-----	40	--------	S (H)	---	S	Hard white clay underlies gravel.
6R1	E. F. Boadway	525	Dg-Dr	53	78-6	-----	---	--	------------	6.8	4-21-53	N	---	N	Dug to 53 ft, drilled to 165 ft. Formerly yielded 3,000 gpd. Cf.
7B1	P. W. Cristler	530	Dg	40	30-48	40	---	--	------------	17.5	4-22-53	P	¼	D,S	
7E1	E. L. Rasmussen	533	Dg	40	36	-----	---	--	Gravel, fine	7	--------	S	---	D,S	Supply adequate.
8B1	Otto Koepke	560	Dg	34	48	5	---	--	Clay, red	32 27.3	Late summer 4-17-53	S (H) (W)	---	D,S	Well being pumped while measured. Pumped dry during late summer.
8H1	Hiram Hatcher	560	Dr	53	6	53	---	--	------------	23.9	4-17-53	S (H)	---	D	Report iron in water. Cf.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
							T. 13 N., R. 1 W. --- Continued								
9D1	Ed Wendell	545	Dg	21	60	0	---	--	------------	12.6	4-17-53	N	---	N	Well in yellow-brown clay and weathered gravel. Temp 46.
9E1	S. A. Connally	578	Dg	29	27 39	8 29	24	5	Gravel, sand, and clay	23.6	10-14-52	B (H)	---	D	Cf, H, L.
9N1	J. J. Hendershot	345	Dg	45	------	-----	37	8	Sand, fine	-------	--------	N	---	N	Cf, L.
11C1	Tom Hawes	398	Dg	26	30	12	12	--	Clay and gravel	1.2	4-16-53	S	½	D,S	Water rust colored. Cf, temp 48.
11F1	Ben Snyder	412	Dr	186	6	-----	---	--	------------	dry	4-16-53	N	---	N	L.
12R1	Ernest Peterson	690	Dg	32	36	8	---	--	Clay, red, gravel	6.9	3-14-55	S	1/3	D	Report water rusts pipes badly.
16F1	James Tauscher	313	Dr	500(?)	5½	200	---	--	------------	Flow	4-1-55	N	---	N	Oil test hole. Report well originally 1,500 ft deep, now plugged at about 500 ft. Report water-bearing at 124 ft, 500 or 600 ft, and a lower level. Estimated initial flow 200 gpm. Measured flow 4/7/55 35 gpm. Temp 57 before plugging, 56 after.
17H1	Frank Hamilton	301	Dg	15	72-48	-----	12	1½	Gravel, sand	11.9	9-19-52	S	5	Irr	Low yield; slow recovery. Gravel, sand, carbonized wood to 13½ ft, blue clay to 40 ft.
17H2	------Do-------	305	Dr	150	------	-----	140	10	Sand	Flow	4-7-55	N	---	N	Yield 19 gpm. Cf, L, temp 52.
17K1	Ted Teitzel	298	Dr	1,595	5	200	120 500-600	--	------------	143	3-14-55	N	---	Irr	Oil test well. Flow 400 gpm, 3-15-55. Fine sand and bits of wood in water. Irrigated with 140-170 gpm all summer 1955. Temp 58.

17N1	Ted Teitzel	288	Dr	70	4	70	---	--	Sand, white	Flow	7- -47	N	---	De	Oil test well. Flow not vigorous.
18D1	G. E. Burton	320	Dg	19	48	4	12	8	Gravel, cement	12.0	11-9-54	S (H)	---	D	Cemented gravel and clay to 20 ft. Aquifer underlain by blue clay.
18H1	Ted Teitzel	530	Dg	24	30	-----	---	--	------------	21.9 11.7	10-17-52 4-15-53	S (H)	---	N	Cf.
18K1	Inez Teitzel	310	Dr	565	5½	-----	440 550	-- --	Sand, fine Sand, coarse	Flow	2-10-55	N	---	De	Oil test well. Originally flowed 400 gpm. L, temp 57.
18R1	------Do------	280	Dr	541	5½	-----	350 385 400 541	5 15 35 --	------------ Shale, sandy Sandstone Sand	Flow	1-16-55	N	---	De	Oil test well. Originally flowed 350 gpm. Cf, L, temp 57.
19D1	Harold Quick	280	Dr	115	8	115	110	5	Sand, fine	30	11-12-52	J	½	D	Pumped sand. Cf, L.
19F2	---------------	298	Dr	1,000†	5½	86	480	7	Sandstone	-------	--------	N	---	De	Oil test well. L.
19G1	Dr. Weldon Pascoe	275	Dr	200	6	200	---	--	------------	-------	--------	J	---	D,S	Occasionally supplies two houses. L.
19L1	Tony Resch	293	Dg	31	48-36	4	---	--	------------	10.4	4-23-53	S	½	D,S	Gravel, cobbles, boulders 4-11 ft.
19Q1	Dr. L. G. Steck	307	Dr	751	12	751	738	13	Sand and gravel	34	9-18-51	T	50	Irr	Pumped 250 gpm, dd 206 ft. Ca, L.
20C1	Ted Teitzel	280	Dr	75	4	75	70	5	Sand, white	Flow	7- -47	N	---	De	Oil test well. Reported yield 400-500 gpm. L.
20D1	A. B. Isberg	310	Dg	30	54	28	19	10	Sand	22 17.6	Summer 1952 4-22-53	S	¼	D,S	Report mostly sand to 29 ft, solid rock beneath.
20E1	------Do------	320	Dr	2,000	6	200	500	50?	Gravel, fine(?)	94+	4-7-55	N	---	N	Oil test well. Flowing 450 gpm 4-7-55, temp 54.
20F1	L. J. Carty	325	Dg	35	-------	9	39	1	Gravel, cemented	32.2	4-23-53	J	½	D	Originally dug to 40 ft. Cf.
20P1	Keene Teitzel	354	Dg	40	48-24	40	38	2	------------	38.0	4-22-53	N	---	N	Lower 17 ft cased with 24-in tile. Upper 23 ft gravel, cobbles, boulders, uncased.
21H1	L. B. Allan	378	Dg	25	65-36	20	22	2	Sand	3.1	4-24-53	S	½	D	Yellow clay, fine gravel, and layers of blue muck to 22 ft. Cf.
21P1	Frank Hedgers	522	Dg	41	36	8	---	--	Clay and gravel	35.6	4-23-53	J	---	D,S	Water hard.
22P1	Corwin Sabin	562.	Dr	127	6	127	125	2	Gravel	65	Spring 1948	J	1	D,S	Report minor aquifer at 50 ft, cemented sand 50-125 ft. Cf.
23Q1	W. L. Rush	560	Dg	18	48	2	---	--	------------	14.2	4-24-53	B (H)	D	-----	Cobbles at 10 ft. Cf.
24Q1	George Keenan	613	Dr	84	6	84	83	1	------------	14	--------	J	½	D	Report hard formation above aquifer, very rapid recovery.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 13 N., R. 1 W. -- Continued						
25B1	I. E. Weiher	613	Dr	101	6	100	100	1	------------	29 51	1948 9- -52	J	½	D,S	Report mostly clay to 99 ft, hard formation to 100 ft.
25D1	E. S. Norman	584	Dg	25	12-36	25	---	--	Siltstone (?), gray	5.5	4-24-53	S	½	D	Iron in water.
26B1	J. L. Sabin	580	Dg	40	48	5	---	--	------------	26.7	4-24-53	J	---	D	Pumped dry in summer.
27P1	O. J. Ricker	373	Dg	24	30	24	---	--	Gravel, cemented	2.0	4-28-53	S	---	D	Iron in water. Water rusted out pipes in 2 years.
28A1	T. Nuernberger	542	Dg	47	42	8	---	--	Gravel and cobbles	36.8	4-24-53	J	½	D,S Irr	
28P1	R. L. Wade	360	Dr	135	6	135	132	3	Sand	+38.1	4-17-55	N	---	D,S Irr	Ca, H, L, temp 52.
29A1	Harry Wulz	438	Dr	515(?)	13	515+	501	86?	Sand and shale	+20	4-29-55	N	---	N	Oil test well. Drilled 6,500 ft. Plugged at 515 ft, water below is salty. Cf, H, L, temp 55.
29M1	Charles Russell	328	Dg	20	36	20	---	--	Gravel	14	7- -52	S	---	D	Yield limited. Water hard.
29Q1	Ed Wulz	325	Dr or J	538	------	90	533	5	Sand	20	1928	P	3/4	N	Slight flow initially. Pumped sand; well capped. L.
29R1	J. E. Deniston	347	Dr	250	------	233	215	30	"Sandrock", blue Sand and clay	+66.5	8-27-53	N	---	Irr	Reportedly flows 60 gpm. Pumped 4 hr at 300 gpm, dd 8 ft. Pumice in water. Cf, L, temp 51.
30A1	O. F. Schulz	320	Dg	28	60	8	---	--	Gravel	11.9	5-1-53	S	---	D	Supply adequate.
30A3	F. B. Smith	317	Dr	320	6	308	308	5	Sand, gray	100	6-25-54	Sb	2	D,Irr	Bailed 17 gpm, dd 75 ft. Cf, L.
30B1	G. H. French	317	Dg	30	42	7	---	--	Gravel (?)	24 18.6	Late summer 4-23-53	S	---	D,S	Iron in water. Gravel, cobbles, and boulders, 7 to 19+ ft.

30G1	Fred Tietzel	322	Dg	30	48	6	28	2	Gravel	15	--------	S	¼	D,S	"Hardpan" 2-28 ft. Water blackens steel pipe, corrodes copper and brass fittings.
31K1	E. C. Sommers	484	Dg	33	40	7	---	--	Clay and gravel	1.1	1-8-53	S	---	D	Cf, temp 46.
31N1	A. C. Smith	500	Dr	98	6	-----	98	--	Gravel, fine	29	--------	J	¼	D,S	Report mostly yellow clay with some gravel to 98 ft. Bailed 33 gpm.
31P1	Clyde Moore	507	Dr	185	6-4	185	---	--	------------	20	9- -43	J	1½	D,Irr	Sand, gravel, clay to 145 ft, blue mud to bottom. Casing, 6-inch to 165 ft, 4-inch liner, perforated, from 165 to 185 ft. Pumped 4 hr at 350 gpm, dd 24 ft.
31P3	------Do------	507	Dg	50	42-84	4	20	30	Gravel and clay	11.5	6-3-54	B (H)	---	S	Yield 5 gpm. Much iron in water, encrusts pipes. Cf, temp 52.
31P4	------Do------	502	Dr	146	8	146	70	65	Gravel and sand	27	5-30-53	T	10	Irr	Pumped 4 hr at 140 gpm, dd 80 ft. L.
31R1	G. A. Peters	508	Dg	31	72-48	6	---	--	Gravel, soft, and clay	0.7	1-9-53	S	½	D	Temp 48.
32A1	Lucian Hamilton	335	Dr	205	6	180(?)	180	10	Sand, fine	22.5	7-8-55	T	2	S	Pumped fine sand. Cf, L.
32F1	C. H. Wolfe	365	Dg	36	48	40	---	--	------------	20.2	1-14-53	S	½	D,S	Yield limited.
32N1	James Cottet	520	Dr	122	6	122	---	--	Gravel	30	Fall 1947	J	1	D	Bailed 20 gpm, dd 50 ft, rapid recovery. Supplies 3 homes. Report minor aquifer at 30 ft. Cf.
33B1	F. O. Nederlander	353	Dg	14	36	14	---	--	Gravel	5.5	4-28-53	J	---	D	Well dug in sand and gravel.
33C1	R. R. Acheson	350	Dg	14	36	-----	---	--	------------	7	Summer 1947	C	2	----	Pumped 4 hr at 50 gpm, dd 5 ft.
33D1	Jim Hamilton	345	Dr	70	6	-----	65	5	Gravel, fine	+25	4-8-53	C	2	D,S	Well supplies *swimming pool. Report* flow 50 gpm spring 1948, 25 gpm Apr. 1952. Cf, L, temp 51.
33M1	H. E. Urich	427	Dg	65	40	65	---	--	------------	15.6	4-30-53	P	3/4	D	Flowed 1-1-51. Report air in water. Cf.
34D2	John Stover	373	Dg	21	8	21	6	15	Gravel, cobbles	15	Summer 1952	--	---	D,S	"Hardpan" at 6 ft. Iron in water.
34N1	R. Sill	549	Dg	54	36	7	---	--	------------	21.3	1-27-53	J	1/3	D	Water level low in summer. Water entering well at 65 ft, 1-27-53. Cf.
35A1	L. S. Godsey	418	Dr	185	6	178	177	8	Sand and pumice pebbles	25	7-7-55	N	---	D	Iron in water. Cf, L, temp 51.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 13 N., R. 1 W. -- Continued						
35B1	Carden Qualls	406	Dr	183	6	183	180	3	Sand (?)	11½	1950	J	2	D	Bailed 30 gpm, dd 70 ft. Report flowed 2½ gpm. Cf, L.
35D1	C. E. Arnold	388	Dg	18	18	18	---	--	Gravel	6.7	4-28-53	S	---	D	Report depth to water 12-13 ft. Sept. 1952.
35M1	Paige Twiss	450	Dr	88	6	88	80	8	-----Do-----	5.0	4-30-53	S (H)	---	D	Iron and "lime" in water. L.
35M2	------Do-------	443	Dr	78	6	78	75	3	-----Do-----	3.0	4-30-53	S (H)	---	N	Iron and "lime" in water. Cf, L.
36C1	Ernest Hamilton	430	Dr	65	6	57	58±	2±	Sand, fine	5	--------	J	2	D,S	Bailed 30+ gpm, dd 25 ft. Report water has odd taste and produces iron stain in winter. Cf.
									T. 13 N., R. 2 W.						
2J2	J. P. Balsom	320	Dr	210	6	175	210	--	------------	5	---------	J	---	D,S Irr	Yield 10 gpm. L.
3A1	R. W. Kennicott	525	Dr	150	6	150	150	5	Sand, coarse, and fine gravel	75	1945	P	½	D	Well originally drilled 230 ft deep. L.
3G1	--- Childers	527	Dr	150	6	150	---	--	Sand and gravel	120	7- -52	J	---	D	Casing perforated. Pumped 15 gpm. Cf.
3G2	Northwest Lumber Co.	527	Dr	157	6	-----	120	32	-----Do-----	111.9	7-27-55	J	2	D	Tested 10 gpm, dd 26 ft. L.
3K1	Bruce Baxter	460	Dg	9	36	9	---	--	------------	3.2	11-7-52	S	1/3	D	Report well recovers 1 inch per hour after being pumped dry.

4L1	William A. Hanson	205	Dg	28	72	28	---	--	Gravel	23.0	10-14-52	S	½	D,S	Supply adequate. H.
4P1	City of Chehalis, test well 4	189	Dr	262	4	50(?)	115	34	Sand and gravel	-------	--------	N	---	N	L.
5B1	City of Chehalis, test well 2	175	Dr	396	4	50(?)	98	3	Silt	Flow	9-12-52	N	---	N	Well capped. L.
5H1	-----Do------	183	Dr	322	12	295	23	16	Gravel						Test well. Pumped 125-150 gpm.
					8	322	95	13	Sand and gravel	Flow	5-14-53	N	---	N	Estimated flow 8-10 gpm, 9/12/52, pumped 150 gpm. Well capped. L, Ca.
							290	24	-----Do-----						
5H2	City of Chehalis, test well 1	182	Dr	408	4	50(?)	100	16	Gravel and sand	------	--------	N	---	N	Test well. Pumped 45 gpm, dd 30 ft. Casing in place, capped. L.
							282	19	-----Do-----						
5J1	City of Chehalis, test well 3	185	Dr	409	4	50(?)	111	8	Sand, coarse	------	--------	N	---	N	Test well. L
							231	20	-----Do-----						
5M1	Antonio Vaserani	193	Dg	19	30	-----	17	2	Gravel and sand	12.0	10-28-52	S	¼	D	Supply adequate.
7H3	J. F. Thomas	380	Dg	38	48	6	32	6	Gravel	31.9	10-29-52	J	---	D,S	Sandy clay and weathered gravel 4-32 ft. L, temp 51.
7H4	------Do-------	365	Dg	19	48	-----	18	5	Gravel, fine, hard	13.1	10-29-52	N	---	N	Sandy clay and weathered gravel overlie aquifer.
7J3	J. H. Jones	393	Dg	53	42-75	17	37	16	------------	34.5	10-29-52	J	½	D,S	Pumped 4 hr at 25 gpm; dd 1 ft. L, temp 51.
8E1	Charles Rowett	310	Dg	25	30	26	16	2	Gravel, fine	16.1	10-28-52	S	---	D	Report 11-ft recovery overnight. Cf.
8E2	--- Bradshaw	355	Dr	97	8	97	87	10	Sand, coarse	80	1946	J	½	D	Supply adequate. L.
8L1	Art Dahl	260	Dr	145	4	88	100	50	Sand and gravel	67.2	9-12-52	J	½	D	Backfilled from 350 ft. Pumped 10 gpm, dd 28 ft. L.
8M1	Nels Hanson	380	Dg	32	48	6	30	2	Sand and gravel	26.9	10-28-52	J	½	D	Supply for 1,000 chickens.
8Q2	Rudy Graves	229	Dr	41	6	43	---	--	Sand, coarse	35.7	12-30-52	J	½	D,S	Blue clay at 43 ft. Report water level constant. Water hard, iron taste.
9E1	W. J. Schwartz	193	Dg	25	36	-----	12	13	Gravel	7.0	10-17-52	S	5	Irr	Pumped 125 gpm, dd 15 ft. L.
9P1	Harry Hail	200	Dr	37	6	35	35	2	Sand and gravel	20	7- -52	J	½	D,S	Supply adequate. L.
9Q1	R. Richmond	205	Dr	37	6	37	---	--	Gravel	8.3	10-14-52	J	½	S	Some water at 12 ft, in sand. Cf.
10L1	Ed Maurin	230	Dr	127	4	42	110	1	Sand	8.5	10-15-52	N	---	N	Well originally 355 ft, flowed; has since filled in. L.
10P1	A. W. Green	235	Dg	24	42	10	---	--	Gravel	19	--------	S	1/3	D,S	Supply inadequate. Requires 24 hr to recover 5 ft.
10P2	S. Parypa	238	Dg	17	36	17	---	--	-----Do-----	13.1	10-15-52	S	¼	D	Supply adequate.
10Q2	Robert Butts	242	Dr	165	6	165	160	5	------------	30	1946	N	---	N	L.
12F3	C. R. Emison	370	Dr	180	6	180	---	--	Sand	32	4-17-53	J	1½	D	Originally 219 ft deep. Cf, L.
12H1	Thorval Tunheim	480	Dg	31	30	-----	---	--	------------	25.3	11-6-52	J	½	D,S	Supply barely adequate.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 13 N., R. 2 W., -- Continued						
12R1	J. A. McReynolds	520	Dg	43	30	42	---	--	Gravel, fine, and clay	34.2	11-6-52	J	½	D,S	Supply adequate for domestic use.
14C1	J. L. Schindler	260	Dr	47	6	47	---	--	Clay, sandy	-------	--------	P	¼	D	Numerous boulders to 23 ft, sandy clay to 47 ft. Cf.
14D1	N. W. Swolgaard	252	Dg	23	30	22	---	--	------------	20.0	10-15-52	S	---	D,S	Report water occasionally has odd taste in summer.
14N1	Frank Hamilton	228	Dr	295	4	290	294	1	Sand	+14½	4-8-53	N	---	N	Report water has mineral taste. L.
15G1	Rudy Ahrens	243	Dg	25	36	-----	---	--	------------	21.8	9-11-52	S (H)	---	D,S	Supply has been adequate for 30 years.
15G2	Walton Hamilton	239	Dg	22	6-24	22	20	2	Gravel	20	--------	S	---	D,S	Supply inadequate.
15K1	S. C. Breen	222	Dr	306	6	33	239 268	12 38	Sand, fine Gravel, fine	+36½	4-18-53	T	15	Irr	Well pumped some fine sand. Report initial head and flow (2-1-52) 60 ft, 525 gpm. Cf, L, temp 53.
15M1	Dennis Hamilton	220	Dr	244	6	212	229	15	Sand, fine to coarse	+36¼	4-8-53	T	15	Irr	Report initial head and flow (11-30-51) 41½ ft and 233 gpm. Pumped 3 days at 85 gpm, dd 34 ft. Pumped 150-175 gpm when irrigating. Ca, H, L, temp 52.
15N1	Nathan Hamilton	218	Dg	24	48	20	20	2	Gravel	15.0	10-16-52	S	---	D,S	Supply inadequate.
15N2	------Do-------	213	Dg	18	48	16	5 17	2 1	-----Do----- -----Do-----	10	10-16-52	--	---	D,S	Supply inadequate. Blue clay 1-5 ft and 7-17 ft. L.

15R1	Frank Hamilton	248	Dr	435	4-3	260	95 270	-- 30	Sand	+12	4-8-53	S	3	D,S Irr	Basalt at 435 ft. Report well flowed 30 gpm; pumped 70 gpm. Pumped some sand. Cf,L.
15R2	------Do-------	225	Dr	400	6-4	290	95 280	-- --	Gravel, fine	+27½	4-8-53	N	---	N	Basalt at 400 ft. Report flow 50 gpm, pumped 120 gpm. Cf, L.
16D1	--- Larson	208	Dr	32	6	32	25	7	Sand	10.9	10-16-52	S	½	D	Supply adequate.
16F1	Marvin Hamilton	210	Dr	260	6	240	240	20	Sand	Flow	10-16-52	S	3/4	D	Water has flat mineral taste. Cf, L.
16G1	Mary J. Thode	208	Dg	12-15	10-18	12-15	---	--	Gravel, fine	-------	--------	S	¼	D	Report water level fluctuates with creek level, 300 ft from well.
16H1	Mollie M. Hamilton	211	Dr	208	6	196	208	--	Sand	+37½	5-21-54	S	3/4	D,Irr	Report initial head and flow (9/14/51) 53 ft and 600 gpm. Cf, L, temp 52.
16H3	Anna McLeod	208	Dg	12	38	-----	---	--	Gravel	10.4	9-18-52	S (H)	---	D	H, temp 53.
16J1	Ralph Hearn	214	Dr	105	6	105	95	10	Clay, sandy	+23	1946	S	---	D	Report flowed 15 gpm. Water has mineral taste. Cf, L.
17E1	G. K. Williams	365	Dg	44	60	6	43	4	Gravel, polished	39.4	10-29-52	N	---	D	Dug to 47 ft. Cf, temp 51.
17F2	J. A. Miller	353	Dg	28	42	6	---	--	Clay and gravel	22.0	10-24-52	S	---	D	Penetrated yellow clay and badly weathered gravel. Cf.
17M1	Oliver Weiher	380	Dg	25	54	0	---	--	-----Do-----	23.8	10-29-52	S	---	D	Penetrated yellow clay and weathered gravel. Supply inadequate. Water produces iron stain.
18R1	Carl Lamb	380	Dg	38	54	8	---	--	Sand (?)	35.0	10-30-52	J	¼	D	Iron in water. Temp 52.
19H1	R. S. Hartley	395	Dr	89	6	89	84	5	Gravel, fine, and brown sand	50	7- -52	J	½	D	Mostly yellowish clay to 84 ft. Cf.
19J1	J. D. Cowley	405	Dg	55	36	55	---	--	Clay and gravel	-------	--------	J	½	D,S	Well cased 0-4 ft and 45-55 ft. Penetrated mostly clay and weathered gravel. Iron in water.
19R1	Ed Milton	345	Dg	40	56	28	35	5	Sand	39½	--------	N	---	N	Supply inadequate. L.
20D1	E. W. Phillips	397	Dg	43	60-48	-----	---	--	Clay and gravel	35.3	10-30-52	J	½	D	Supply adequate.
21D2	A. M. Cook	425	Dg	25	40	5	---	--	-----Do-----	15.3	10-24-52	S	¼	D	Penetrated mostly yellow clay and weathered gravel. Iron in water, causing red-brown crust in pipes. Cf, H.
21D3	C. D. Roberts	420	Dr	140	6	140	115	10	Gravel, fine, yellow	115	1948	T	5	D,Irr	Well originally 200 ft deep. Report water level constant. Pumped 4 hr at 60 gpm. Cf, L.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
							T. 13 N., R. 2 W. -- Continued								
21E1	Bonneville Power Admin.	432	Dr	612	10 8	262 550	134	28	Sand and gravel	115	6-7-40	T	---	D,Ind	Pumped 6 hr at 73 gpm, dd 4 ft. Cf, L.
21K1	Alex Balestra	442	Dg	31	60	6	31	1+	Sand	25.7	10-24-52	J	---	D	Yellow clay and weathered gravel 6-31 ft.
21K2	T. M. Balestra	440	Dr	175	8	175	139	21	Gravel and sand	127	9-7-53	T	10	D,S Irr	Pumped 4 hr at 200 gpm, dd 14 ft. Cf, L.
21P1	Don Hamilton	420	Dr	165	6	145	125	11	Gravel	30	10-16-51	T	7½	S	Pumped 200 gpm, dd 55 ft. L.
21R1	J. C. Carlson	442	Dg	32	42-36	6	24	8	Gravel and clay	24.2	10-24-52	S	---	D,S	Penetrated mostly yellow clay and weathered gravel. Cf.
21R2	------Do-------	441	Dr	168	8	168	70 139	10 16	Gravel and sand -----Do-----	135	3-12-54	T	15	Irr	Pumped 12 hr at 120 gpm, dd 10 ft. Water enters perforations at 70-80 ft. L.
22E2	Grant Gleason	276	Dg	16	36	-----	13	5	Sand	15.2	10-16-52	S	---	D	Originally dug to 18 ft. Supply inadequate.
22G1	W. A. Wichert	240	Dr	130	6	130	28 100	12 10	Sand and gravel Sand, fine	8	--------	J	3	S,Irr	Pumped 4 hr at 40 gpm; dd 4 ft. Pumped some sand and mica flakes. Cf, L.
22P1	John Jensen	330	Dg	46	24	45	---	--	Sand	39.6	10-24-52	J	---	D	Supply inadequate.
22P2	G. V. Curtis	320	Dg	11	30	11	10	1	-----Do-----	1	--------	S	1	D	Blue clay to 7 ft, "rock" to 8 ft, reddish sand to 10 ft.
23N1	L. Ratkowski	258	Dg	15	48	6	7	1	Gravel and sand	6.8	12-22-52	S	---	D	Encountered 8- to 10-inch boulders. Temp 54.
24A1	I. I. Edwards	270	Dg	25	48	14	---	--	Gravel	10.6	1-14-53	S	¼	D,S	Well in gravel, fine sand.
24P1	E. C. Matson	282	Dg	22	42	7	---	--	Clay and gravel	17.8	11-7-52	S	½	D	Supply inadequate.
25G1	John Carnes	299	Dg	33	36	-----	---	--	"Rocks"	29.5	10-21-52	J	½	D,S	Cf, temp 56.
26A1	F. F. Stedham	282	Dg	17	40	18	15	3	Sand, black	15.2	10-22-52	S	---	D	Originally dug to 18 ft, blue sandy clay 3-15 ft, Cf, temp 51.

26G1	John Hodgson	289	Dr	50	4	45	---	--	------------	4	6- -50	S	8½	D,Irr	Pumped 4 hr at 100 gpm, dd 7 ft.
26G3	Charles Pederson	285	Dr	138	6	138	138	--	Sand, gray	19 8.9	8-2-53 8-25-54	S	1	D	Pumped 30 gpm, dd 10 ft. L.
26L1	G. L. Milton	315	Dr	145	6	145	140	20	Sand, fine	50	--------	J	1	D	Originally 160 ft deep. Pumped sand. Cf, L.
26M1	Harry Bowen	440	Dg	19	36	6	---	--	------------	17.4	10-22-52	S	½	D	Temp 51. Cf.
26M2	J. L. Clement	440	Dr	160	6	140	155	5	Sand, fine	80	1947	J	---	----	Water stains enamel fixtures yellow. Cf, L.
27F1	Alex Messal	441	Dg	19	84-72	6	---	--	------------	14.9	10-31-52	S	¼	D	Supply adequate.
27M1	H. Carlson	441	Dg	40	48	-----	---	--	Gravel, weathered	34	--------	P	3/4	D,S	Gravel badly weathered, mixed with yellow clay. Pebbles (½- to ¼-inch) are light in weight, friable.
27Q2	R. Q. Fudge	442	Dg	34	44-52	12	34	--	Gravel and clay	21	--------	S	1	D	Iron in water. Cf, L.
27Q4	F. L. Holmes	439	Dr	84	6	84	37 80	8 4	Sand and gravel	15	9- -52	S	½	D	Pumped 4 hr at 30 gpm, dd 7 ft. L.
28A1	J. C. Carlson	440	Dr	175	8	175	142	18	Gravel and sand	139 149.8	3-9-54 8-15-55	T	15	Irr	Well being pumped when measured; pumped 160 gpm, dd 10 ft. Cf, L, temp 51.
28C1	Don Hamilton	414	Dr	132	6	132	103	11	Sand	45	10- -51	N	---	N	Pumped 200 gpm, dd 75 ft. L.
28J1	F. A. Brooks	405	Dg	17	72	5	---	--	------------	14.1	10-31-52	S	½	D,S	Supply inadequate. Water causes scaly rust in pipes. Cf, temp 53.
31B1	Nathan Creemer	210	Dr	36	12	20	30	--	Shale	1.0	5-15-53	N	---	N	Pumped 20 gpm, dd 19 ft. L.
31B2	------Do-------	255	Dr	244	12	100	110	--	------------	28.5	11-5-52	J	1	D,S	Yield 10 gpm. Shaly, friable sandstone 110-235 ft.
31C1	Grover Mullins	225	Dr	50	6	50	42	8	Sand, coarse	1	1947	T	5	D,S Irr	Irrigates 22 acres. Cf, L.
31R1	Ed Haase	405	Dr	222	8 6	113 222	185	37	"Shale," sandy	152	8-7-52	T	5	S,D Irr	Pumped 4 hr at 50 gpm, dd 27 ft. Cf, L.
32M1	M. F. Ralph	240	Dg	33	32	33	32	1	Sand	27.1	11-5-52	J	½	D	Supply adequate. Cf.
32P1	Phyliss Carter	275	Dg	10	48	0	---	--	------------	3	--------	S	---	D	Well flows during winter.
33L2	L. H. Nelson	433	Dg	52	36	12	50	2	Gravel, sandy	42	--------	J	½	D,S	Clay 3-50 ft.
33R1	John Lemons	407	Dg	40	42	40	34	6	Clay and gravel	34.4	10-31-52	J	½	D,S	Supply inadequate. Sand layers in gravel and clay.
34A3	Napavine	444	Dr	101	8	101	60	41	Gravel	36	8- -54	--	---	PS	Pumped 120 gpm, dd 64 ft. Ca, L.
34G1	L. J. Buroker	431	Dg	24	36	24	---	--	------------	12.2	10-31-52	S	¼	D,S	Much iron in water.
35B1	D. A. Emerson	447	Dr	139	4	135	130	9	Sand, fine	60	6- -46	J	1	D,S	Occasionally pumped sand. Supply for 2,000 turkeys and 1,500 chickens, yields 15 gpm, L.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
							T. 13 N., R. 2 W. -- Continued								
35D2	Paul Miller	440	Dg	25	36(?)	-----	---	--	------------	19.0	10-23-52	S	3/4	D,C	Supply inadequate for service station. Cf.
35D3	------Do-------	440	Dg-Dr	85	6	85	70	15	Sand and gravel	15	4-21-53	--	---	D,Ind	Drilled inside 35D2. Bailed 20 gpm, dd 49 ft. L.
35M1	E. W. McCoy	440	Dg	26	36	26	19	7	Clay and gravel	17.3	1-6-53	S	½	D	Water red on standing. Temp 50.
35Q2	C. M. Gibson	444	Dg	18	12 x 21	-----	---	--	------------	6	8-15-52	S	3	Irr	Pumped 24 hr at 45 gpm, dd 6 ft.
35R1	S. Johnson	465	Dr	85	6	85	---	--	Gravel, polished	21	1947	J	---	D	Bailed 15 gpm, dd 33 ft.
36N1	Louis Holmes	460	Dr	80	6	80	---	--	Sand, fine	20	--------	J	1/3	D	Supply adequate. Cf.
36N3	J. D. Redwine	468	Dr	120	8	120	47	70	Sand and gravel	25.0	1-27-53	T	7½	Irr	Pumped 4 hr at 150 gpm, dd 24 ft. L.
36P1	J. A. Peterson	475	Dr	136	6	136	40 58 101	12 22 22	Gravel and sand -----Do----- -----Do-----	29.4	9-24-53	T	7½	Irr	Pumped 4 hr at 96 gpm, dd 30 ft. L.
36P2	------Do-------	480	Dr	101	6	101	70 100	-- 1	Sand Gravel	28.5	10-23-52	--	---	D	Supply adequate.
36Q1	William Eskeli	455	Dr	63	6	63	55	8	Gravel and sand	22	3-13-53	J	½	D	Yield 5 gpm. L.
							T. 13 N., R. 3 W.								
1M1	Frederick Young	185	Dr	43	6	43	---	--	Gravel	16	--------	T	5	Irr	Pumped 10 hr at 90 gpm, dd 14 ft.
1N1	------Do-------	190	Dr	104	6	50	100	4	Shale (?)	19.1	6-15-53	J	1	S	Yielded 5 gpm. Water hard, tastes odd. Also has dry well 170 ft deep. L.
2D1	Kenneth Walker	283	Dr	108	6	40	90	18	Sand, white	14	1945	J	½	D	Well flowed when drilled. Cf, L.

2D2	John Peters	284	Dg- Bd	25	36-8	6	---	--	Sand, white	6.8 6.5	5-28-47 6-16-53	S (H)	---	N	Bottom of well on solid rock.
2F1	H. D. Peters	260	Dg- Dr	90	6	-----	---	--	Basalt	-------	---------	J	½	D	Basalt from 55 to 90+ ft. Iron in water. Ca.
2G1	Lee Blackwell	267	Dg	22	54	5	---	--	------------	14.9 11.8	5-27-47 6-16-53	S	1/3	D	Iron in water.
2G2	I. A. Briske	222	Dr	78	6	40(?)	---	--	------------	16.7 13.5	5-28-47 6-16-53	J	½	D	Supply adequate. Cf.
2G3	F. T. Wilson	200	Dg	29	48	28	---	--	------------	24.6 18.5	5-28-47 6-16-53	S	¼	D	Bottom of well on solid rock.
2K1	Ted Spence	190	Dr	65	6	65	72	26	Sand and gravel	29.0	7-2-53	P	1	N	Originally 105 ft deep, was bailed at 12+ gpm; casing pulled back and well filled to present depth. Supply inadequate. Pumped sand. L.
2M1	R. T. Cole	254	Dg, Dr	122	6	60	103	19	Sand, white	40.3 36.3	5-27-47 6-19-53	J	1	D,S	Cf, L.
2M3	Jerry Peters	240	Dr	114	6	25	108	6	Sand, white	35	Summer 1952	J	1	D	Pumped 8 hr at 12 gpm; dd 20 ft. L.
2P1	C. E. Black	182	Dr	48	6	48	37	--	Gravel	15 26	1- -48 7- -48	J	---	D,S	Bottom of well in solid rock. Iron in water.
3A1	Lester Finley	240	Dg- Dr	130	6	-----	119	11	Rock, soft	29.2 31.6	5-28-47 6-16-53	J	3/4	D,S	Supplies 2 homes. Water hard, contains iron. L.
3B2	A. P. Erp	240	Dr	72	6	32	26 65	7 5	Sandstone Sand (?)	25.6	6-17-53	J	½	D,S	Report water level 20 ft below land surface in winter. Iron in water. L.
3D1	Walter Marth	250	Dg	38	40	7	20	--	Clay, red	24.0	6-17-53	J	---	D	Supplies two homes. Dry in summer. Mineral taste when water level is low.
3J1	A. C. Hoveland	200	Dg	26	48-36	-----	---	--	------------	15.8 19.9	5-28-47 6-19-53	S	¼	D	Cased 0-3 ft and 17-26 ft. Water hardest when level is low (Aug.-Sept.)
3Q1	Thomas Cole	200	Dr	72	16-8	8	---	--	------------	Flow	6-19-53	N	---	N	Well originally 1,492 ft deep, plugged at 72 ft. Basalt to 70 ft. Water-bearing at 100 ft, 350 ft, 750 ft. Water bubbles. Cf.
3R5	J. E. Schwarz	197	Dr	75	6	60	60	15	Sand, white	40	--------	J	3/4	D	Originally 88 ft deep. Supplies two homes. Cf. L.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
							T. 13 N., R. 3 W. -- Continued								
4J1	Pearl Massingham	235	Dg	30	48	3	---	--	Clay, white	13.3	6-18-53	S	$\frac{1}{4}$	D	Dry in August.
5G1	C. L. Black	205	Dr	168	8	125	---	--	Sandstone (?)	10	7- -52	J	2	D,S	Yield 30 gpm. Former 30-ft well had good yield but quality unsatisfactory. L.
5J1	Dewey Gowen	200	Dg	26	30	26	---	--	Gravel	19	Summer 1953	S	$\frac{1}{2}$	D,S	Silt, sand, "hardpan," overlie gravel. Report 12-ft range in water level. Supply adequate.
5P1	Ray Hagerman	202	Dr	70	6	70	---	--	Sand	------	--------	J	3/4	D	Drilled through rock, water-bearing material above and below rock. Water hard, iron in water.
6D1	Charles Brown	203	Dg	36	48	12	28	8	Gravel	26	Summer 1953	P	$\frac{1}{2}$	D,S	Supply adequate.
6R1	--- Raschke	214	Dr	230	6	230	130	100	Sandstone (?)	Flow	12-23-53	J	2	D,S	Yielded 15+ gpm. Cf.
7J2	Arthur Anderson	255	Dr	160	6	24	88	72	Sandstone (?)	68	8- -52	J	$\frac{1}{2}$	D	Pumped 12 gpm, dd 97 ft. Cf, L. Temp 48±.
8E1	E. Zandecki	254	Dr	83	6	-----	---	--	Gravel	Flow	1949	J	1	D,S	Pumped 3 hr at 4$\frac{1}{2}$ gpm, dd $\frac{1}{2}$ ft.
8G1	--- Haase	223	Dg	20	48	-----	14	6	Sandstone (?)	13	Summer 1953	S	$\frac{1}{2}$	D	Red clay overlies sandstone (?). Iron in water.
8G2	--- Tanksley	238	Dr	150	6	25	110	40	Gravel	8	1949	J	1	D,C	Supplies service station. L.
8G3	Earl Anderson	240	Dr	172	6	48	133	39	Gravel (?)	20	1946	J	1	D,S	L.
8K1	C. A. Lindstedt	240	Dr	175	6	36	112	63	Sand, dark green	33	1952	J	1$\frac{1}{2}$	D,S	Cf, L.
9A1	H. L. Starry	210	Dg	12	48-42	0	---	--	Clay and gravel	5	--------	S	---	D,S	Recovered 2$\frac{1}{2}$ ft in 5 hr after being pumped dry.
9G1	Adna Grange	185	Dg	29	48	4	---	--	------------	14.2	6-24-53	S	$\frac{1}{4}$	D	H.

9G4	Art Scherer	185	Bd	37	10	37	36	1	Gravel	18.3	6-18-53	S	½	D,C	Supplies three homes, gas station, grocery store. L.
9H1	Ed Nielsen	183	Dr	40	6	40	38	2	Gravel, fine	12	1945	J	---	D,S	Bailed 25 gpm.
10B1	W. L. Mezger	185	Dg	45	36	45	---	--	-----Do-----	11.0	6-18-53	J	½	D,S	Water level rises when adjacent land is irrigated.
10G1	W. D. Hofmann	180	Dg	25	10-36	25	18	7	Sand	13	9- -51	S	---	D	
10N1	Max Orloske	238	Dg	17	------	16	---	--	Gravel	11.9	7-2-53	S	¼	D	
11D3	G. H. Hall	185	Dr	57	10	57	---	--	------------	30	5- -53	T	3	D	Report no gravel encountered. Pumped 36 hr steadily.
11M2	William Payne	186	Dg	19	78	19	---	--	------------	12.8	7-2-53	S	---	D	Cf.
12D1	F. L. Young	240	Dr	95	6	90	80	10	Gravel, weathered	30	1944	J	3/4	D	Originally 150 ft deep. Yield 3-4 gpm, supplies two homes. L.
14D1	G. H. Whittaker	200	Dg	28	18	28	---	--	------------	19.3	7-3-53	S	½	D,S	Supplies two homes.
15B1	Ralph Young	230	Dr	185	6	185	"near bottom"	--	Sand and "muck"	10	--------	J	3/4	D,S	Drilled through "rock" from 30 to 50 ft. Well flowed several days initially. Supplies three families. Water yellowish, forms black scum when boiled. Cf.
15J1	Hubert Pillette	420	Dr	57	6	52	42	15	Gravel, fine	6	--------	J	½	D	
17L1	Lawrence Parypa	630	Dg	32	------	0	---	--	Clay, yellow	20	9- -53	S (H)	---	D	Dug in yellow clay.
18A1	G. A. Fleshman	565	Dg	25	------	25	---	--	Gravel	0	Winter	S	1/3	D	Yellow clay overlies gravel.
20D1	William Henrich	670	Dg	21	18	-----	---	--	"Soapstone," red	16	Summer	S	½	D	Well bottoms on "rock." Water produces brown stain.
21D1	J. A. Unterwegner	725	Dg	27	48	27	19	8	Sand, yellow	19	1951	J	½	D,S	Red clay to 19 ft.
21R1	P. B. John	680	Dg	21	72	0	---	--	Clay	10	12- -53	S	3/4	D,S	Water tastes clayey in fall.
22E1	Page Bennett	655	Dg	35	-------	-----	---	--	------------	17.5	12-21-53	J	1/3	D	Pumped dry with present pump. Temp 51.
24K1	Joe Ford	200	Dr	60	8	-----	25	35	Basalt	23.7	7-3-53	T	3	D,S	Basalt from near surface to bottom.
25B1	Clarence Olson	190	Dg	13	66	-----	---	--	Clay	4.7	12-29-53	S	¼	D	Dry in summer.
27J1	William Karvia	480	Dg	16	42	-----	---	--	Sandstone (?)	1.4	12-28-53	S	½	D	Supply adequate. Water leaves black stain, rusts pipes badly. Cf.
27K1	W. J. Schwarz	530	Dr	28	72	0	---	--	Sand	13.0	12-28-53	B (H)	---	D	Red clay overlies sand.
28H1	Russell Olsen	700	Dr	135	6	60	---	--	-----Do-----	50	1947	P	1½	D,S	Penetrated mostly blue clay. Bailed 7 gpm. Water produces yellow stain.
30C1	A. and B. Kostick	227	Dr	118	6	118	---	--	------------	100	--------	J	½	D,S	Bottom of well in reddish clay. Bailed 6 gpm. Water has odd taste, sulfur odor. Cf.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
									T. 13 N., R. 3 W. -- Continued						
30E2	--- Wilson	228	Dg	20	30	21	21	--	Gravel and sand	7.6	12-30-53	S	½	D	Penetrated clay, sandstone, gravel successively. Temp 53.
30P1	Harry Fenn	239	Dr	212	6	30	165	--	Sand	10	1946	J	½	D	Bailed 5 gpm. Water has sulfur odor and taste, blackens silverware. Cf, L.
31D1	R. E. Lawlainen	242	Dg	18	36	10	---	--	Shale, blue	14	Summer 1952	S	¼	D	Pumped dry in summer.
									T. 13 N., R. 4 W.						
3L1	C. Christin	260	Dr	81	8	-----	65	16	Sandstone (?)	10	4-16-54	J	1	D,S	Pumped 4½ hr at 11½ gpm, dd 36 ft. Cf, L.
4N1	E. Wooten	273	Dr	60	6	-----	---	--	Sandstone (?)	7	10- -51	S	½	S	Yield 25 gpm. Coal from 35 to 39 ft.
6P1	L. J. Dokter	285	Dr	56	6	56	---	--	------------	14	--------	J	3/4	D	Bailed 12½ gpm. Water hard, tastes of iron. L.
7B1	Rainbow Falls State Park	275	Dr	460	6	-----	---	--	------------	-------	--------	N	NU		Pumped 15 gpm. Quality of water is poor.
8C1	Mayne Perry	278	Dg	25	30	25	24	1	Gravel	13	8- -51	S	½	D	Water soft. L.
9D1	W. W. Kiser	270	Dg	9	36	-----	---	--	------------	2.4	8-11-54	S	---	D	Well pumped dry. Water soft.
11F1	William Tracy	560	Dg	26	48	6	23	3	Gravel	20	8- -54	N	---	N	Water soft.
23C1	F. Fitz	227	Dg	20	36	------	---	--	-----Do-----	10	8- -54	S	¼	D	Sandy loam (15-20) overlies gravel. Water soft.
23J1	L. B. Spinning	233	Dr	130	6	130	---	--	------------	Flow	8-11-54	S	---	D	Supplies two homes. Water soft.
24F1	C. A. Anderson	223	Dg	20	48	-----	---	--	Gravel	12.6	8-6-54	S	½	D,S	Water soft. Cf.

24G1	T. W. Long	225	Dg	25	38	11	18	4	Gravel, cemented	12.3	12-29-53	S	½	D	Yellow clay to 18 ft. Temp 52.
25H1	Frank Bamer	230	Dr	53	6	30	---	--	Sand, black	11.0	12-30-53	J	½	D,S	Penetrated "bluestone" above black sand. Water hard, tastes flat, turns brown when bleach added. Cf, temp 50.
26Q1	T. H. Matheny	640	Dg	24	36	24	---	--	Sandstone	Flow	Winter	N	---	D	Penetrated clay and sandstone (?). Dry in summer. Water produces brown stain.
31Q1	William Smith	720	Dg	19	36	15	---	--	Clay	11.1	8-5-54	S	2½	D	Water soft.
33N1	T. Thorson	360	Dg	16	48	-----	14	2	Shale, blue	14.7	8-5-54	S	3/4	D	Gray shale 2-9 ft, blue shale to 16 ft. Well pumps dry. Water soft.
36G1	Robert Battey	241	Dg	14	24	15	9	1/6	Gravel	7 4.8	Summer 12-30-53	S	---	D	Bottom 6 ft in soapstone (?). Yield 4 gpm. Water produces brown stain.
36G2	-------Do------	241	Dr	326	6	-----	---	--	------------	8	1938±	N	---	N	Salt water near bottom of well. Report large yield.
36P1	J. C. Ridenour	246	Dg-Dr	100	24-4	22	---	--	Gravel	11	Summer 1953	P	½	D,S	Penetrated soft sandstone, blue clay, gravel, 1½ ft of "lime," and soft sandstone successively. Yield 4½ gpm. Water produces brown stain.
									T. 13 N., R. 5 W.						
1A1	B. T. Carpenter	375	Dg	22	20	22	---	--	Gravel	15	8- -54	S	1/3	D	Water soft.
2P1	Joe Wilson	315	Dg	14	40	20	11	2	-----Do-----	11.1	8-10-54	S	1/3	D	Originally 20 ft deep; topsoil to 4 ft, gravel to bottom.
3H1	Lester Merrill	375	Dg	14	48	-----	---	--	Sandstone	8.6	8-10-54	S	¼	D	Dry in late summer. Water soft.
3N1	Dan Morton	390	Dr	136	6	86	---	--	------------	55.1	8-10-54	J	1	-----	Supply adequate. Cf.
9F1	A. Lusk	345	Dg	12	48	-----	---	--	------------	1.1	8-10-54	S	¼	D	Water soft.
10C1	Paul Ratkie	325	Dr	110	6	58	---	--	Sandstone, blue	15	9- -52	J	¼	D	Well almost entirely in blue sandstone. Bailed 3 gpm. Water soft, tastes of iron.
11D1	E. Lusk	322	Dr	97	6	-----	---	--	Sandstone	-------	--------	J	1	D	Well drilled 120 ft. Pumped 60 gpm. Water hard, has iron taste.
11M1	Jack Lusk	325	Dr	180	6	-----	---	--	Sand	19.7	8-11-54	P	1/3	D	Water soft, has soda taste.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
							T. 13 N., R. 5 W. -- Continued								
12B1	--- Karboski	290	Dg	12	24	-----	---	--	------------	3.6	8-11-54	S	1/4	D	Water soft.
15R1	W. F. Rhoades	337	Dg	12	36	12	---	--	Gravel	------	--------	S	1/4	D	Well pumped dry. Water hard.
23Q1	Leon Kowalski	370	Dg	23	60	12	---	--	Sandstone, blue	13.2	8-10-54	S	2 3/4	D	Water soft.
26E1	John Kowalski	378	Dg	19	48	-----	---	--	Gravel	14	10- -54	S	1/4	D,S	----Do----
27R1	C. E. Baxter	385	Dg	13	48	-----	---	--	Gravel, pebble, packed	3.4	4-9-53	S (H)	1/4	D	Pumped 2 hr at 18 gpm, dd 2.4 ft.
28R1	Jasper Packer	470	Dr	178	6	-----	---	--	Clay, blue	------	--------	N	---	N	Encountered salt water and gas.
33J1	Hugh Snelson	425	Dg	21	36	21	---	--	------------	15	--------	S	1/2	D	Well pumped dry. Water soft, contains iron.
33J2	John Kaszycki	425	Dr	270	6	250	---	--	------------	------	--------	Sb	1 1/4	D	Water salty; unfit for drinking and cooking. Ca.
36E1	Pete Fabris	425	Dg	29	30	-----	---	--	Shale	26	4- -52	S	1 1/2	D	Well pumped dry. Water hard, contains iron.
									T. 13 N., R. 1 E.						
9J1	---------------	930	Dg	34	48	5	---	--	Clay	23.4	9-16-53	J	1/3	D	Well in yellow, red clay. Supply adequate. Cf, temp 51.
14C1	C. D. Lester	875	Dg	38	-------	-----	---	--	------------	27.7	9-10-53	J	1/2	D	Well pumped dry. Cf, temp 52.
14E1	L. R. Temple	855	Dr	330	6	276	118	--	Gravel	125	10-8-53	Sb	1	D,Irr	Bailed 20 gpm, dd 10 ft. Cf, L.
							325	5							
								--	Gravel, fine						
14H1	Mary Cole	715	Dg	42	52	8	---	--	Gravel	28.4	9-9-53	J	---	D	Well dry in fall, 1952, temp 53.
14R1	Martin Jacobson	665	Dr	40	6	40	36	14	Sand, white	15+	1946	J	1/2	D,S	Originally drilled to 50 ft. L.

15H1	J. E. Uden	815	Dg	23	-----	-----	---	--	------------	14.5	9-10-53	S	¼	D	Well can be pumped dry. Temp 54.
16H1	Henry Miller	784	Dg	26	-----	4	---	--	Clay, gravelly	18	8- -53	S	1/3	D,S	Slow recovery. Water produces brown stain.
16L1	Jesse Hawkins	758	Dr	140	6	128	140	--	Sand, gray	41.1	9-10-53	--	---	D	Red clay and gravel to 140 ft; some water at 70 ft. Bailed 10 gpm, dd 30 ft. Cf.
17C1	W. D. Ginger	764	Dg	45	36	-----	32	13	Gravel, soft	20	--------	S	---	D, Irr	Pumped 4 hr at 50 gpm, dd 2 ft.
17R1	Gordon Lundeen	732	Dr	125	6	125	70	63	Sand and gravel	12 (?)	--------	J	1½	D,S	Originally drilled to 133 ft. Cf, L.
19K2	R. R. Szelap	690	Dr	182	10	158	102	18	"Sandrock," blue	128	5-2-52	T	7½	S,Irr	Pumped 4 hr at 80 gpm, dd 20 ft. Ca, L, temp 50.
					6	182	123	59	Gravel and sand						
19P1	Albert Duvalko	665	Dg	48	40	8	---	--	Gravel, weathered	30	Summer 1952	J	½	D	Well cased from 0 to 8 ft and 28 to 48 ft.
										3.7	4-28-53				
20F1	M. F. Clark	705	Dg	19	38	4	---	--	Clay	16.4	9-11-53	S	¼	D,S	Water has taste and odor, produces brown stain.
20F2	------Do-------	695	Dr	405	-----	234	---	--	Sand	148	8-15-55	--	---	Irr	Pumped 120 gpm, dd 27 ft. Yields fine sand. Cf, L.
21C1	W. C. Matkin	750	Dg	36	-----	4	---	--	Gravel	17.9	9-11-53	J	½	D	Well mostly in clay, some gravel; bottom in blue clay. Iron in water. Cf, temp 52.
22G1	C. A. Carson	840	Dg	33	-----	0	---	--	Clay	26.8	9-11-53	J	¼	D	Well dry July-Sept., 1952. Cf, temp 52.
22R1	C. E. Greene	600	Dr	150	8	150	150	--	Sand	Flow	6-22-53	--	---	D	Originally flowed 200-225 gpm. Pumped sand; yield dropped. L.
22R2	-------Do------	600	Dr	150	8	113	120	2	Sand, blue	+25½	1- -54	--	---	Irr	Pumped 130 gpm, dd 23 ft. Water occasionally smells and tastes of sulfur. Cf, L, temp 49.
							145	5	-----Do-----	+17	5-27-54				
22R3	George Hypes	602	Dg	11	-----	0	---	--	Gravel	5.2	9-15-53	S (H)	---	D	Iron in water.
23B1	H. L. Lindeman	652	Dg	6	24	7	---	--	-------Do-----	3.3	9-15-53	S	½	D	Water produces brown stain. Cf.
25K1	George Reimann	1,042	Dg	36	48	12	---	--	Clay, "rocky," yellow	30.8	9-11-53	J	½	D,S	Supply adequate. Water produces brown stain. Cf, temp 54.
26N1	A. Jorgenson	602	Dg	16	48	6-8	---	--	Gravel and clay	10.6	9-11-53	S	3/4	D	Well mostly in yellow clay, "rocks," some gravel.
26R1	Wiley Rhodes	960	Dg	38	-------	------	---	--	------------	Dry	7-27-55	N	---	N	L.
27J1	H. L. Thayer	602	Dg	21	60	5	---	--	Gravel	13.8	9-15-53	S	¼	D	Temp 52.
28C1	Chester Fickett	558	Dr	37	6	-----	---	--	Sand, black	20.5	9-15-53	S	¼	D,S	Water produces brown stain. Cf, temp 52.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
T. 13 N., R. 1 E.--Continued															
28N1	Delmar Woods	518	Dr	97	6	30	---	--	Gravel	Flow	9-15-53	J	½	D,S	Cf.
30C2	Palo Tade	710	Dr	208	8	200	90	110	Clay, sand, gravel	90	6- -54	T	7½	Irr	Pumped 110 gpm; dd 80 ft. L.
30D1	Charles Dorn	645	Dr	108	6	108	107	1	Gravel	21½	1943	J	1	D	Sand from 70 to 107 ft. Pumped 7½ gpm. Cf.
31P1	D. C. Jensen	470	Dr	128	6	90	123	5	Sand, blue-gray	Flow	8-27-54	J	1	Ind	Yield 3 gpm. Supplies poultry processing plant. Cf, L, temp 50.
31Q1	G. J. Orning	476	Dg	17	21	18	---	--	Gravel	11.5	9-16-53	S	¼	D	Water produces brown stain. Temp 51.
32B1	C. A. Jorgensen	505	Dr	130	6	122	122	8	Sand	Flow	7-8-55	N	---	D	Reported flow 3 gpm. Cf, L, temp 50.
32C1	Orville Day and Ralph Sawyer	500	Dr	52	6	52	52	--	Gravel, fine	5.6	3-18-53	J	½	D	Supplies two homes. Cf, H, L.
32M2	Ed Guiberson	485	Dr	210	6	108	125	1?	Sand (?)	Flow	8-17-55	S	¼	D	Bailed 20 gpm, dd 70 ft. Cf, L.
33A1	W. E. Woods	559	Dr	125	8(?)	65	---	--	Clay, blue	Flow	--------	J	---	D,S	Clay from 75 to 125 ft. Cf.
35F2	J. F. Simpson	807	Dr	120	6	114	---	--	Gravel, cemented (?)	101.6	8-9-55	J	½	D	L.
T. 13 N., R. 2 E.															
14Q1	Tom Harper	960	Dg	32	60	-----	---	--	Sand and gravel	17.0	8-19-54	S	½	D	Cf.
15P1	C. A. Linn	880	Dr	40	6	40	---	--	Sand	5.4	8-18-54	J	½	D	Reported yield 90 gpm.
16P1	Bill Core	805	Dg	12	48	4	---	--	Gravel	8.9	8-18-54	S	---	D	Well pumped dry. Water soft.
17J1	E. S. Katyryniuk	802	Dg	52	6	-----	---	--	Gravel, fine	12	9- -52	J	---	D	Supply adequate. Water soft.

17K1	Frank Kulas	790	Dg	27	36	8	16	10	Gravel, cemented	14.7	8-18-54	S	1/4	D,S	Clay from 6 to 16 ft. Pumped dry in fall.
18K1	John Courtney	725	Dg	14	50	10	---	--	------------	5.1	8-18-54	S	1/2	D	Supply adequate. Water soft.
18L1	---------------	728	Dg	17	36	-----	---	--	------------	11.0	9-10-54	--	De		H.
18M1	--- Arnold	711	Dg	27	36	30	---	--	------------	14.0	8-18-54	S	1/2	D	Supply adequate. Water soft.
20M1	--- Logan	1,090	Dg	28	48	3	---	--	------------	25.1	9-17-53	B (H)	---	D	Hard brown till (?) encountered. Cf, temp 49.
22A2	E. Girard	890	Dr	65	6	65	---	--	------------	-------	---------	J	1	D	Water hard.
22N1	Frank Townsend	790	Dg	13	8	-----	12	1	Gravel	12	---------	S	1/2	D	Supply adequate.
26E1	H. E. Justice	804	Dg	26	48	10	---	--	-----Do-----	19.4	8-18-54	B (H)	---	D	Dry in dry summers. Water soft.
30D1	Frank Foland	1,081	Dg	30	36	10	---	--	Clay	20	--------	S	1/2	D	Well pumped dry.
34N2	W. F. Faas	670	Dr	90	6	82	---	--	Gravel, cemented	25	4- -54	J	3/4	S	Supply adequate. Cf.

T. 13 N., R. 4 E.

25H1	H. G. Anderson	1,030	Dr	34	6	34(?)	---	--	Gravel	12	8- -46	J	1/3	D	Report high yield. Water smells of sulfur.
33R1	H. M. Justice	920	Dg	31	18	-----	27	3	Sand and gravel	13.5	3-18-53	B (H)	---	D	Supply adequate. L.
34P1	Janet Schoonover	935	Dr	77	6	-----	---	--	Sand, black	13.6	8-27-54	J	1	D	Water contains iron.

T. 13 N., R. 5 E.

19C1	Elmer Rouner	1,080	Dr	198	6	0	30	--	Sand	------	--------	N	---	N	Encountered coal and gas between 80 and 194 ft, "bedrock" from 194 to 198 ft. Water brown, brackish.

T. 14 N., R. 1 W.

7N1	Matt Beck	240	Dr	125	4	75	119	6	Sandstone, soft	15	9- -30	N	---	N	L.
36N1	Ed Pfirter	395	Dg	21	36	21	---	--	Gravel, fine	2.7	4-15-53	S	1/4	S	Well bottom is on hard blue clay. Iron in water. Water cloudy.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
T. 14 N., R. 2 W.															
2M1	L. R. Chapman	300	Dg	33	48	33	---	--	Clay, rust-red	29	1940	N	---	De	Entirely in red clay containing bits of "coal." Iron in water.
3K1	Wendell Schroeder	320	Dg	15	48	0	---	--	------------	1/3	4-10-53	N	---	N	Cf, temp 46.
3N1	F. H. Jones	410	Dg, Dr	70	2½-2	55	55	15	Shale, clayey	------	-------	P	½	D	Drilled in 12-ft dug well. Blue, clayey shale from 55 to 70 ft. Supply inadequate. Cf.
3N2	A. T. Allen	240	Dr	15	4	0	35	--	------------	0.3	4-10-53	N	---	N	Shot hole for seismic traverse, originally 70 ft deep. Penetrated blue clay and siltstone.
4E1	Northern Pacific Ry. Co.	190	Dr	63	26 16	38 57	---	--	Gravel and sand	------	--------	T	25	RR	Formerly city of Centralia well 1. Pumped 4 hrs at 400 gpm, dd 12 ft. Ca, L.
4N1	Centralia Lumber Mill	190	Dr	40	6	40	---	--	Gravel	12.6	4-9-53	S	1	Ind	Supplies mill pond May-Sept.
4P1	City of Centralia	200	Dr	1,003	------	-----	---	--	------------	-------	--------	N	---	De	Test well. L.
4R1	Charles Hadley	410	Dg, Dr	70+	4	70	---	--	------------	29.2	2-26-53	J	½	D	Drilled in 30-ft dug well. Blue clay and sand near bottom. Supply inadequate.
4R2	Walter Swearingen	415	Dg	20	50-40	3	---	--	------------	13.1	2-26-53	N	---	N	Well in hard yellow-brown material. Cf.
5A1	LeRoy Westgard	185	Dr	37	6	37	---	--	Gravel	15.7	4-9-53	S	3/4	D	Sand overlies gravel. Water hard.
5B2	Leo Schrader	185	Dr	39	6	39	---	--	------------	7.6	4-8-53	S	1/3	S	Supply adequate.
5C2	Bert Sumner	185	Dr	34	8	34	---	--	------------	6.0	4-9-53	S	½	D	Water at 13 and 30 ft. Temp 49.

5F1	City of Centralia, well 4	185	Dr	93	26 16	39 90	15	75	Gravel	15	6- -35	T	75	PS	Pumped 794 gpm, dd 28 ft. Standby only. Ca, L.
5G1	City of Centralia, well 3	185	Dr	95	26 16	38 84	47	33	Gravel and sand	13	4- -35	T	150	N	Pumped 565 gpm, dd 39 ft. Condemned for public supply. L.
5G2	City of Centralia, well 5	185	Dr	88	26 16	39 88	15	73	Gravel	15	7- -35	T	50	PS	Pumped 12 hr at 880 gpm, dd 18 ft. Standby only. L.
5H1	City of Centralia, well 2	185	Dr	72	26 16	39 68	11	54	Gravel and sand	11	2- -34	T	60	PS	Pumped 803 gpm, dd 34 ft. Standby only. Ca, L.
6C1	C. N. Smith	173	Dr	50	6	44	---	--	Gravel, fine	23	Summer 1952	J	1	Irr	Driller estimated yield at 60 gpm.
6D1	George Hense	173	Dr	43	6	43	---	--	Gravel, coarse	30	10- -52	J	3/4	D	Water soft. Yield 17 gpm.
6D2	Clifford Norris	174	Dr	47	6	47	---	--	Gravel	27 16.8	Summer 1952 4-3-53	T	5	D, Irr	Deepened from 27 ft in summer, 1952. Report large yield.
6E2	Mountain View Cemetery Assoc.	170	Dr	51	8	51	24	27	Sand and gravel	25	--------	T	10	Irr	Topsoil to 2 ft, sand and gravel to 27 ft. Pumped 4 hr at 90 gpm.
6F1	Dr. L. E. Johnston	169	Dr	60	8	60	48	12	Gravel	17	--------	T	5	Irr	"Hardpan" from 47 to 48 ft. Pumped 100 gpm for 24 hr.
6H3	Ed Ringel, Sr.	168	Dr	51	6	51	46	5	-----Do----	12.5	4-8-53	J	1	Irr	Cemented gravel from 30 to 46 ft. Pumped 4 hr at 20 gpm, dd 27 ft.
6L2	D. J. Deter	169	Dr	50	6	46	47	3	Gravel, fine to coarse	25	9- -52	J	½	D,S	Bailed 15 min, no dd noticeable. Water hard.
6L3	Keith Reichert	169	Dr	45	6	45	---	--	Gravel, fine to coarse	17.1	3-20-53	J	½	D	Cf.
6M2	Lawrence Weinke	169	Dr	33	6	33	---	--	------------	15.8	4-1-53	S	½	D	Well 90 ft deep. Black "clay" (no water) from 60 to 90 ft. Iron in water. Cf, temp 52.
6M3	E. E. Siemers	169	Dr	48	6	48	38	10	Gravel	22	12- -52	J	1½	D,S	Bailed 30 gpm, dd 2 ft. Casing perforated from 38 to 48 ft.
6M4	------Do------	169	Dr	49	6	49	---	--	Gravel, coarse	15.4	4-1-53	P	3/4	D	Bailed 20 gpm, dd less than 1 ft.
6M7	M. J. Loop	169	Dr	36	6	36	---	--	Gravel, some sand	18.5	4-2-53	J	½	D	Report pumping 15 min with present pump lowers water level 18 ft.
6M13	R. J. Reichert	169	Dr	40	6	40	---	--	Gravel	27 17.8	Fall 1952 4-7-53	P	1	D, Ind	Iron in water. Cf.
6M14	William Westley	169	Dr	47	6	47	---	--	Gravel	19.0	4-7-53	J	1/3	D	Temp 52.
6N1	R. V. Grainger	162	Dr	56	6	56	12	44	Gravel and sand	12	6-6-51	T	3	Irr	Pumped 4 hr at 45 gpm, dd 3 ft. L.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 14 N., R. 2 W.--Continued						
7C2	Bert Hartman	163	Dr	51	8	51	45	6	Gravel	30	7- -52	J	D	----	Bailed 20 gpm, little dd. Water soft.
7E2	E. Dodds	167	Dg	22	48	22	---	--	Gravel (?)	3.6	4-1-53	S	$\frac{1}{4}$	D	Clay overlies gravel. Report mineral taste in water.
7F2	R. A. Galbraith	180	Dr	52	6	52	27	25	Sand (?)	27.0	5-17-47	J	$\frac{1}{2}$	D	Iron in water. Cf.
7L1	K. H. Verd	167	Dr	87	6	67	45	42	-----Do-----	20	--------	J	1	D,S	Yield originally 10 gpm, now less. Water hard. L.
7M2	H. H. White	180	Dr	75	6	75	---	--	Gravel	24.3	3-20-53	J	1/3	D	Supply adequate. Cf.
7Q1	George Finni	180	Dr	67	6	67	60	7	-------Do----	26.9	3-19-53	J	$\frac{1}{2}$	D	Iron in water. Cf, L.
7R1	Marguerite Humphreys	180	Dr	64	6	64	---	--	Sand and gravel	10.3	3-17-53	--	---	Irr	
8N3	F. G. Fortier	180	Dg	20	30	20	---	--	Sand	9.9	3-18-53	S	$\frac{1}{2}$	D	Penetrated all sand, except cobbles from 18 to 19 ft.
8N5	W. E. Thompson	180	Dr	47	6	47	---	--	Sand, coarse	9.7	3-18-53	J	---	S	Water hard.
9H3	Mrs. S. Glasman	500	Dg	18	60-50	7	---	--	-----------	14.2	2-26-53	S	$\frac{1}{4}$	D	Supply adequate. Cf, temp 49.
9J2	A. S. Kresky	520	Dg	39	36	39	---	--	-----------	32.7	2-26-53	J	$\frac{1}{2}$	D	Well bottom is on hard rock. Supply inadequate. Water soft.
9Q1	Eugene Holit	530	Dg	18	48	4	15	1	Shale (?) soft	14.5	2-26-53	--	---	D	Well in clayey shale below 10 ft, becoming hard below 16 ft.
10L1	J. E. Smith	525	Dg	14	96-60	14	---	--	Clay	2.9	2-21-53	S	$\frac{1}{2}$	D,S	Temp 49.
10N1	Spencer Harmon	510	Dg	47	48	4	---	--	------------	$37\frac{1}{2}$ 28.5	8- -52 2-26-53	J	$\frac{1}{4}$	D,S	Yellow-brown clay and gravel to 25+ ft. Bottom of well in hard blue fossiliferous shale (?).
10R2	Floyd Watson	565	Dr	300	6	300	275	25	Gravel, coarse	265.2	6-17-53	--	---	D	Bailed 10 gpm. L.
11A1	Arne Fagerness	440	Dg	15	30	15	---	--	-----------	4.5	6-17-53	S	$\frac{1}{2}$	D	Water has iron taste. Cf.

11E1	Kenneth Carr	500	Dr	185	5	147	146	39	Gravel, fine	142	10- -49	Sb	1¼	D	Casing perforated from 134 to 144 ft. Yield 12 gpm, rapid recovery. Cf.
11F2	Martin Wright	520	Dg	16	30	16	---	--	------------	10.7	6-17-53	--	---	-----	Supply usually adequate, temp 47.
11M1	Sven Lange	560	Dg	47	30	47	---	--	------------	33.6	2-20-53	J	¼	D	Supply usually adequate.
11R1	William Wolter	230	Dg	27	24	20	---	--	------------	17.2	2-18-53	S	½	D	Supply usually adequate, recovery rapid. Temp 51.
12E1	Elsie Spencer	380	Dg-Bd	34	36-8	18	32	2	Sand	20.9	2-18-53	N	---	N	Well in clay 10-32 ft and at 34 ft. Cf.
13C1	Perry Ramsaur	260	Dg	16	30	16	15	1	Sand, fine (?)	0.6	2-18-53	S	¼	D	Well is located on marshy hillside and bottom is in blue clay. Upper 15 ft in shale. Temp 49.
14N1	Norman Wirta	230	Dr	119	6	111	60	59	Sand	45	Summer 1946	J	1	Ind	Iron in water. Yield 15 gpm. Supplies slaughterhouse. L.
14R1	G. Steffensen	215	Dg	25	60	25	23	2	"Soapstone"	15.9	2-27-53	S	¼	D	Well in soapstone (?) from 20-25 ft. Pieces of coal near bottom.
15A1	Frank Aggers	565	Dg	44	36	37	---	--	------------	2.2	2-21-53	J	1/3	D	Yellow clay to 20 ft, sandy clay to 43 ft, petrified wood at 35 ft. Supply usually adequate.
15A3	Bob Hunter	565	Dg	56	24-60	50	60?	--	Gravel and cobbles cemented	41.5	2-21-53	J	½	D	Temp 48.
15E3	Walter Petersen	195	Dg-Bd	24	6-30	22	22	2	Sand (?) fine, blue	0.6	3-4-53	S	---	D,Ind	Penetrated mostly blue-gray shale or clay. Supplies sawmill.
15N1	M. J. Brotherson	200	Dr	123	6	65(?)	65	58	Sand, fine	35	--------	J	---	D,S	Water has mineral taste, contains iron.
16E2	Francis Watterson	175	Dr	78	6	82	65	--	Shale (?) sandy	3.6	3-12-53	N	---	N	Originally drilled to 102 ft. Supply adequate for domestic use. L.
16J1	T. J. Thomsen	170	Bd, Dr	79	6	61	59	20	Sandstone	26.9	3-3-53	J	½	N	Augered 41 ft. Pumped 20 min at 7 gpm, dd 7.35 ft. Water contains iron, occasional odor. Cf,L.
16M1	Francis Watterson	175	Dg	11	30	11	---	--	------------	2.5	3-12-53	S	¼	D	Water produces brown stain.
17D2	Harry Ritter	175	Dr	62	4	62	55	7	Gravel	R-17	3-12-53	?	3/4	D,S	Reported pumped 12 hr at 16½ gpm, dd 4 inches. Supplies 2 homes. Iron in water.
17D3	J. J. Collins	175	Dr	63	6	63	---	--	Sand (?)	10.8	3-13-53	J	---	D	Pumped 30 gpm, dd 10 ft. Water has mineral taste, leaves rust stain on enamel. Cf, L.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
							T. 14 N., R. 2 W.--Continued								
17D4	L. E. Chalmers	175	Dr	63	6	63	61	2	Gravel	10.4	3-18-53	C	3	D,Irr	Sandy clay to 61 ft. Pumped 25 gpm, dd 15 ft. Supply inadequate for irrigating 5 acres. Water hard.
17E1	Leonard Santee	175	Dr	53	6	50	50	3	-----Do-----	8.8	3-18-53	P J	¼ 1/3	D	Pumped 4 hr at 35 gpm, dd 3 ft. Water hard. L.
17K2	Oscar Keto	175	Dr	80	6	80	75	5	Gravel, fine	8.8	3-17-53	N	---	N	Silt to 75 ft. H.
18C2	James McCash	180	Dr	222	6	10	150	72	Siltstone (?)	75	1932	P	2	D,S	Blue hard material (siltstone?) from 10 to 222 ft.
18D1	J. P. Newbury	185	Dg	24	30	-----	---	--	Siltstone	19.9	5-17-47	N	---	D	Dry every summer. Discharge by gravity siphon.
18R1	Alfred Hamilton	175	Dr	50	6	50(?)	---	--	Gravel	15.0	5-26-47	J	---	D,S	Mud, blue clay, quicksand overlie gravel. Water hard, has mineral taste, stains enamel.
19A1	------Do------	175	Dn or J	55	2	-----	---	--	------------	-------	--------	J	1	D	Iron in water. Cf.
19F1	Leopold Blaser	175	Dg	11	30	-----	---	--	"Quicksand"	4.4 1.8	5-26-47 3-31-53	N	---	N	Cf.
19F3	------Do------	175	Dr	51	6	60	50	10	Gravel	11.0	3-18-53	J	1	S	Originally 60 ft deep. Quicksand from 20 to 50 ft, gravel to 60 ft. Water hard, contains iron.
19H1	Bridgett Emrich	175	Dg	23	36	23	---	--	"Quicksand"	15.4 13.1	5-17-47 3-18-53	S (H)	---	D	Cf.
19H2	-----Do-------	175	Dn	65	2	65	65	3	Gravel	14	--------	S (H)	---	N	Well in "quicksand" nearly entire depth. Water has soda taste. Cf.

19H3	Bridgett Emrich	175	Dr	75	6	75(?)	65	10	Gravel	9.8	3-18-53	N	---	N	"Quicksand" to 65 ft. Water hard, has soda taste.
19H4	------Do------	175	Dn?	300	2(?)	150(?)	292	8	Sand(?)	15-25	1941	N	---	N	Capped and sealed. Water has salt or soda taste. L.
19N1	A. R. Hamilton	175	Dg	33	36	-----	---	--	------------	16.8	3-19-53	J	½	D	Cf, H.
20A1	Iver Floe	190	Dr	102	6	102	---	--	Sand, white	12.8	3-12-53	C	2	D	Dd 15 ft after 3 days pumping, water hard, has mineral taste.
20B1	John Marth	175	Dr	55	6	55	---	--	Gravel	7.1 6.2	5-22-47 3-13-53	P	1/3	D,S	Supplies two homes. Iron in water. Cf.
22A3	Louis Howell	205	Dg	12	36	12	12	--	Sandstone, blue	4	--------	S (H)	---	----	Yellow clay to 12 ft. Supply usually adequate.
22H1	Oscar Keto	240	Dr	1,200	4 2	800 1,200	---	--	Sand (?)	+0.2	2-27-53	N	---	N	Salt water at 275 ft, gas at 1,200 ft. Water effervesces. Ca, L.
22K1	------Do-------	560	Dr	1,800	12-10	450	418	42	Sand, gray	211.5	3-3-53	N	---	N	Cf, L.
23A1	Norman Svinth	195	Dg	29	18	29	---	--	Clay and gravel, weathered	2.4	2-27-53	S	¼	S	Iron in water. Cf, temp 49.
23M1	A. E. Edwards	230	Dr	301	3		120	--	Sandstone, silty	Flow	9- -51	N	---	N	Test hole U.S.G.S. Fuels Branch. Plugged and sealed. L.
23P1	Tom Moran	230	Dg	32	48	50	50	15	Sand and gravel	3.4	3-4-53	N	---	N	Originally 85 ft deep, has caved. Water stains clothes yellow, turns yellow when boiled. Cf, L.
24H1	Leo Noel	360	Dg	10	72±	4	4	5	Siltstone (?)	1.9	3-3-53	S	1/3	D	Gravel and cobbles to 4 ft, gray siltstone or sandstone to bottom. Supply usually adequate. Cf.
26L1	Ervin Henderson	600	Dg	32	36	32	12	6	Gravel	2.3	3-5-53	S	1	D,S	Fine yellow-brown and yellow-gray sand from 18 to 31 ft.
26M1	B. R. Anderson	560	Dr	104	6	100	100	4	Sand, fine	84	--------	P	3/4	D,S	Yield 5 gpm. Pumped sand occasionally. L.
28Q1	Tom Hampson	195	Dr	75	6	60	60	10	Sand, coarse	3.5	3-11-53	--	---	D	Yield 2 gpm. Cf, L.
28Q2	------Do------	195	Dr	50	6		---	--	------------	2.0	3-11-53	N	---	N	Originally 145 ft deep. Water is hard, contains iron and effervesces. L.
28Q3	------Do------	195	Dr	180	6	0	35 135	--	"Quicksand" Sand	30	4- -52	N	---	De	Quicksand at 35 ft. Salt water at 136 ft in sand. Gas encountered. Water salty.
28R1	Ralph Loy	205	Dr	1,000	4(?)	0	---	--	------------	------	--------	N	---	N	U.S.G.S. test hole. Flowing at 940-ft depth.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 14 N., R. 2 W.--Continued						
30R1	Forget-Me-Not Ice Cream Plant	180	Dg	30	36	30	---	--	Gravel	26½	1931	P	---	Ind	Used in refrigeration equipment. Supply inadequate. Report calcium content excessive.
31C1	City of Chehalis	170	Dr	127	8	65	35	1	Sand	11.9	5-1-53	N	---	N	Test well. Bailed 80 gpm, little dd. Cf, L, temp 53.
31P1	------Do------	170	Dr	1,031	8	40	25	14	Gravel, fine	14	5-1-53	N	---	N	Test well. Pumped 70 gpm, dd 20 ft. L.
31P2	------Do------	170	Dr	50	8	35	---	--	------------	21½	5- -53	N	---	De	Test well. L.
31P3	------Do------	170	Dr	34	8	30	---	--	------------	20.4	5-15-53	N	---	N	---Do---, L.
31Q1	------Do------	170	Dr	34	24	34	17	14	Gravel	12.4	10-20-53	--	---	----	L.
34E1	Lloyd Macomber	245	Dr	130	6	100	130	--	Sand, fine	47	8- -47	J	1	D	L.
35A1	Joe Wendling	550	Dg	33	24	33	30	2	Clay and sand	21.9	3-5-53	B (H)	---	D,S	Supply adequate.
35E2	Mrs. Fay McCorcle	430	Dg	14	54	2	14	1	Sand and gravel, yellow brown	4.9	3-6-53	S	¼	----	Originally dug to 15 ft. Yellow-brown clay to 14 ft. Supply adequate.
35G2	E. R. Fleming	520	Dg	31	36	31	---	--	Gravel and clay	13.6	3-6-53	--	---	----	Cf.
36A2	C. C. Gilman, Jr.	577	Bd	30	12-8	5	18	2	Clay, red	19.2	3-6-53	J	½	D	Supply adequate.
									T. 14 N., R. 3 W.						
1A1	E. L. Hendricks	170	Dr	43	6	43	---	--	------------	17.6	5-17-47	C	1	D	Pumped 8 hr at 15 gpm, dd 2½ ft. H.
1A2	L. B. Henderson	170	Dn	42	2	42	---	--	Gravel	14 15	4- -53 6-1-53	T	3	D, Irr	Pumped 4 hr at 30 gpm, dd 10 ft.

1B1	J. E. Miller	165	Dr	46	6	46	38	8	Gravel and sand	13 14	6-2-48 5- -54	C	5	D, Irr	Pumped 4+ hr at 60 gpm, dd 7 ft. L.
1B2	F. H. Steelhammer	166	Dr	47	6	47	28	19	-----Do-----	24 28.0	9-27-49 7-9-54	T	5	Irr	Sand and gravel to 47 ft. Casing perforated 36-45 ft. Bailed 4 hr at 48 gpm, dd 1 ft.
1F2	C. A. Sellards	163	Dr	44	6	44	---	--	-----Do-----	16	1-15-53	J	2	D, Irr	Sand and gravel to bottom. Pumped 4 hr at 30 gpm, dd 3 ft.
1G2	C. VanDerWel	168	Dg	27	48	-----	16	11	Gravel	18.8	7-15-54	S	½	D	Gravel to 27 ft.
1H1	A. Osborn	170	Dr	57	6	57	---	--	Gravel and sand	34	9- -52	T	5	D, Irr	Pumped 4 hr at 85 gpm, dd 4 in.
1J1	Washington State Dept. of Game	169	Dr	56	8	56	54	2	Gravel and sand	25 17.1	8-15-46 7-15-54	J	5	D, S	Clay, gravel, and sand to 54 ft. Pumped 4 hr at 42 gpm, dd 10 ft. Water soft.
1J2	John Meiers	169	Dr	55	6	55	35	20	-----Do-----	18 18.2	7-9-52 7-15-54	J	3	D, S Irr	Pumped 4 hr at 40 gpm, dd 5 ft. Water soft. L.
1K3	L. Strentz	165	Dg	26	48	26	20	6	Gravel, coarse	20.4	7-15-54	S	1¼	D, Irr	Sand and gravel to 26 ft.
1R1	Steve Drop	169	Dr	43	8	43	20	23	Sand and gravel	15 10.5	5-20-50 4-2-53	N	---	N	Clay to 20 ft, sand and gravel to 43 ft. Casing perforated 30-43 ft. Pumped 4 hr at 15 gpm, dd 6 ft.
1R3	T. E. Goodman	169	Dr	52	8	48	48	4?	Gravel	16.9	4- -50	C	3	D, Irr	Penetrated nearly all gravel. Some water at 25 and 35 ft. "Hardpan" overlies aquifer. Pumped 8-10 hr at 40 gpm, dd 3 ft.
2L1	Al Harting	350	Dg	27	36	27	---	--	"Rocks," soft	21.9	7-14-54	J	3/4	D, S	Supply inadequate. Water soft, blue-green. L.
2L2	------Do------	340	Dg	45	72	-----	22	23	Sand and gravel	23.4	7-14-54	J	1	D, S	L.
3R1	T. Fagerness	410	Dg	24	36	-----	---	--	Gravel	20.9	7-14-54	S	¼	D	Water level low in fall.
11F3	C. Sareault	390	Dg	35	36	35	10	25	-----Do-----	20½ 18.1	November 7-16-54	P	½	D	Pumped 2 hr at 40 gpm, dd 10 ft. Report water acid. Cf, L.
11G1	J. Gibbs	370	Dg	40	36	40	38	2	-----Do-----	7	7- -54	J	½	D, S	Clay to 38 ft. Pumped 3 hr at 5 gpm, dd 6 ft. Water soft. Temp 52.
11H1	A. Atwood	360	Dg	9	72x120	-----	---	--	Shale (?)	3.8	7-16-54	S	¼	D	Supply usually adequate.
12E2	D. E. Blanchard	320	Dg	31	36	5	---	--	Gravel and clay	25.7	7-20-54	S	¼	D	Supply limited in summer.
12H1	Joe Graf	173	Dg	22	48	20	20	2	Gravel	10.1	7-20-54	S	½	D	L.
12J3	Ted Neuert	173	Dr	72	6	55	40	20	Shale(?), blue	20	7- -53	J	1	D	Supply adequate. Water hard, contains iron.
13C2	P. H. Brooks	185	Dg, Dr	53	6	50	50	3	Gravel	11	1952	J	½	D	Water soft, contains iron, has soda taste. L.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
T. 14 N., R. 3 W.--Continued															
13D3	L. L. Butterfield	205	Dg	27	48	-----	23	1	Gravel	13.4	7-22-54	S (H)	---	D	Water soft.
13G2	Harold Barnes	----	Dr	84	6	-----	---	--	------------	Flow	7-21-54	J	1/3	D	Water soft, contains iron.
14Q1	C. C. Heath	480	Dg	40	48	-----	---	--	------------	12.7	2-21-54	N	---	D	Dry in late summer. Water hard, contains iron. Discharge by siphon.
18D1	Carl Mittge	290	Dg	20	36	21	---	--	Shale, blue	12.7	7-29-54	S	½	D	Cf.
22Q1	J. Anderson	700	Dg	37	48	40	---	--	Shale	21.8	7-22-54	J	¼	D	Water level low in spring. Water soft.
24Q1	Ted Goebel	215	Dg	16	60	16	---	--	Clay (?)	5	7- -54	S	3/4	D,S	Pumped dry occasionally.
25C1	Warren Aust	195	Dr	180	6	-----	---	--	------------	30±	5-17-47	P	3/4	D	Well almost entirely in shale; water-bearing at 36 ft, 58 ft, 78 ft. (Casing perforated at these levels.) Yield 3 gpm. Iron in water.
26P1	Stanley Tufts & Paul Yott	470	Dr	775	6	555	700	75	Sand, fine	250	1953	N	---	N	Bailed 1½ gpm. L.
26R1	H. J. Alexander	330	Dg	36	48	13	30	6	Shale	32.2	7-21-54	J	½	D,S	Clay to 30 ft. Cf.
27A1	F. P. Siegwarth	560	Dg	39	39	-----	29	10	Gravel and clay	29.1	7-22-54	J	3/4	D	"Shot" clay to 20 ft, yellow clay and gravel to 39 ft. Can be pumped dry with present pump. Water soft.
28A1	Ben Thomas	550	Dg	33	50	6	23	10	Shale	16.1	7-22-54	J	½	D	Dry in fall. Water hard, contains iron.
28J1	S. R. North	490	Dg	45	60	-----	---	--	Sand and gravel	38.3	7-23-54	J	---	D,S	Water "rusty" when level is low.

28J3	A. J. Givens	470	Dr	151	6	151	144	7	Sand and gravel	130	4- -54	N	---	N	Yield 12 gpm. L.
31L1	A. Peterson	230	Dr	62	8	62	---	--	Shale, blue	5	--------	J	1	D,S	Yield 20 gpm. Water hard, contains iron.
33H1	Howard Saxton	490	Dg	35	45	35	26	9	Clay and rock	26	7- -53	J	3/4	D	Red clay to 6 ft, blue-gray clay and soft rock to 35 ft.
34H1	Ben Pratt	340	Dg	20	48	-----	8	12	Sandstone, white	10	7- -54	S (H)	---	D	Soapstone (?) from 2 to 8 ft. Hard gray-white sand to 20 ft. Water soft.
34Q1	Kenneth Wilson	240	Dr	135	6	70	70	65	Basalt, jointed	32.3	6-16-53	J	3/4	D	Gray clay to 70 ft, jointed basalt to 135 ft. Yield 5 gpm. Cf.
34R1	Al Bieker	250	Dg, Dr	125	6		---	--	------------	23.5	6-17-53	J	½	D,S	Dug to 47 ft. L.
35A1	Seventh Day Adventist Church	240	Dr	258	6	240(?)	240	5	Sand, fine	150	--------	--	---	Inst	Blue clay to 240 ft. Bailed 8 gpm, dd 25 ft.
35K2	H. F. Hanke	320	Dg	50	40	50	---	--	Sandstone	30.4	7-21-54	J	½	D	Pumped dry in summer. Water hard, sometimes contains iron. Water level sometimes rises to land surface.
35P1	Clara McDonald	350	Dr	96	6	80	80	16	Basalt, jointed	88	9- -43	J	3/4	D	Supply limited. Greater supply at 72 ft cased off. Iron, yellow sediment in water. Cf, L.
35Q1	Carl Wenzelburger	320	Dr	73	6	14	70	3	Sand, white	20	Spring, 1953	J	½	D,S	Water forms brown crust in pipes, Cf, L.
36H1	Kelly Hamilton	180	Dr	138	6	64	---	--	------------	30	1- -55	T	2	D,S	Pumped 90 days at 20 gpm, dd 18 ft. Water leaves yellow-brown stain. Cf, L. Temp 50.
36K1	Art Hamilton	180	Dr	93	6	93	48	10	Sand and gravel	40	5- -49	T	3	D,S	Pumped 4 hr at 20 gpm, dd 10 ft. Supplies 6 homes. L.
36Q1	------Do------	180	Dr	220	8 6	80 (?)	80	140	Sandstone	40	9- -42	T	5	D	Yield 33 gpm. Inflammable gas in water. Cf, L.
									T. 14 N., R. 4 W.						
2D1	E. Mason	230	Dg	28	40	28	---	--	Shale, blue	12	7- -54	S	---	D	Dry in August. Water soft, contains iron.
3D1	Earl Ingalls	190	Dg	22	36	21	---	--	Sandstone, blue	14	8- -46	S	½	D,S	Supply limited in summer. Iron in water. Cf.
4C1	E. Manberg	200	Dr	100	6	80	---	--	"Rock," white	11.1	7-28-54	J	½	D,S	Water-bearing at 85 and 95 ft. Water soft.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 14 N., R. 4 W.--Continued						
6L1	F. Barton	265	Dg	65	6	65	---	--	------------	25.6	7-28-54	J (?)	½	D,S	Cf.
13R1	Milo Adams	260	Dg	18	48	18	---	--	"Rock," soft, blue and brown	12.4	7-29-54	S	¼	D	Pumped dry. Water hard.
15C1	C. T. Setzer	300	Dr	90	6	0	---	--	------------	16.1	7-30-54	J (?)	½	D	Originally drilled 176 ft deep; caved at 90 ft. Salt water at 176 ft. Cf.
15R1	Cliff Thayer	270	Dg	22	36	22	---	--	Shale, blue	4.6	7-30-54	S	½	D,S	Soil to 5 ft; fossiliferous hard blue shale to 22 ft. Water soft.
16A1	C. E. Waltar	305	Dr	20	6	20	---	--	------------	6	7- -54	P	½	S	Salt water at 165 ft, plugged well to 20 ft. Penetrated mostly blue clay. Well almost dry in summer. Water hard, contains iron.
23N1	Ben Geiszler	280	Dg	21	48	-----	---	--	Clay, blue	8.5	7-30-54	S	½	D,S	Pumped dry in summer. Water soft.
25H1	A. C. Anderson	220	Dg	28	48	27½	27	--	Sandstone, white, hard	17	8- -51	S	---	D	Water hard.
36B1	H. Reed	405	Dg	22	72	0	---	--	Clay, gray	14.8	7-29-54	S	1/3	D	Supply adequate. Water soft.
36F1	R. Packwood	225	Dr	24	6	22	---	--	Sand, black	6.5	7-29-54	S	1/3	D	Shale overlies aquifer. Supply inadequate. Water hard, iron in water.
									T. 14 N., R. 5 W.						
1C1	C. E. Glasgow	285	Dg	15	36	10	10	5	Shale, blue	10	7- -54	S (H)	---	D	Supply adequate. Water soft.

12C1	Melvin Stacy	400	Dg	26	36	26	---	--	Shale (?)	16.6	7-28-54	--	---	D	Pumped dry in summer. Water soft, iron in water.
									T. 14 N., R. 1 E.						
31J1	Lloyd Hildeshein	495	Dg, Bd	32	30-8	23	---	--	------------	9.7	4-15-53	S	½	D	Dug to 23 ft.
									T. 15 N., R. 1 W.						
26M1	Alton Colvin	250	Dr	111	4	108	---	--	Sand	10	--------	J	½	D,S	Penetrated clay and sandstone above aquifer. Water produces white residue. Occasionally pumped sand.
27F1	W. H. Butter- worth	250	Dr	107	6	101	---	--	------------	0	Winter 1953	J	3/4	D,S	Water at 45 ft. Pumped 1 hr at 10 gpm, dd 70 ft. Water soft. Cf.
27G1	Leon Rector	235	Dr	57	6	57	---	--	Sandstone	35	--------	J	1	D,S	Penetrated coal, "soapstone," "graystone," blue clay, coal, and sandstone successively. Water soft.
28B1	Joe Brotherson	245	Dr	85	6	85	---	--	------------	3	Winter 1953	P	---	D,S	Coal from 50 to 65 ft. Casing perforated. Water hard, sometimes brown.
									T. 15 N., R. 1 W.						
29M1	Nolan Peterson	250	Dg, Dr	313	4	-----	---	--	------------	16	--------	J	1/3	D,S	Water hard, has mineral taste. Cf,L.
30J1	R.W. Schoelkopf	240	Dr	90	6	70	---	--	------------	------	--------	J	3/4	D	Sandstone from 10 to 35 ft. "Quick-"sand at 60 ft. Yield 4 gpm. Water hard, contains iron.
30K1	M. Miller	235	Dr	100	6	90	---	--	Sand, white	4	--------	J	---	D,S	
									T. 15 N., R. 2 W.						
25E1	Ben Meyer	245	Dg	24	7	-----	---	--	Clay	10	--------	S	1/3	D	Pumped 20 min at 5 gpm, dd 14 ft. Always dry in Oct. Water hard.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s)			Water level		Pump		Use of water	Remarks
							Depth to top (feet)	Thickness (feet)	Character of material	Depth below land surface (feet)	Date	Type	Horsepower		
									T. 15 N., R. 2 W.--Continued						
26K1	*A. L. Sward*	240	*Dr*	119	4	-----	119	--	*(Sand, fine)?*	70	--------	J	---	D,S	Drilled in "rock" from 40 to 110 ft. Pumped fine sand. Cf.
26N1	H. F. Johnson	225	Dr	55	8	55	55	--	Sand	14	--------	J	¼	D	Water soft. L.
27M1	W. R. Gilkey	225	Dg	20	36	-----	---	--	Gravel (?)	10	--------	S	½	D,S	Supply adequate. Water soft.
27N2	L. Van Ronk	190	Dr	50	8	-----	---	--	Sand	13.1	6-23-54	N	---	N	"Quicksand"at 10 ft; silt at 50 ft. Pumped 60 gpm, dd 32 ft. Intended for irrigation use, but water silty.
28K1	L. Albough	205	Dr	27	6	27	---	--	Gravel	11	Winter 1953	S	½	D	Pumped 1 hr at 27 gpm, dd 4 inches. Water soft.
28M4	L. Stark	240	Dg	25	36	-----	---	--	-----Do-----	19	--------	S	¼	D	Brown clay to 10 ft, overlying blue clay and gravel. Pumped 4 hr at 6 gpm, dd 6 ft. Water soft.
28N4	D. O. Codey	210	Dr	36	5	-----	---	--	------------	9	1953	--	1	D,Irr	Pumped 25 gpm, dd 3 inches.
29J1	L. H. Proctor	215	Dr	40	6	40	33	--	Gravel	27	4- -49	J	3	D,S	Originally 100 ft deep, but more water at present depth. Pumped 32 gpm, dd 5 ft. Cf.
29L1	Stoker Mining Co.	305	Dr	401	4		---	--	------------	------	--------	N	---	N	U.S.G.S. test hole, plugged. L.
29Q4	T. E. Martin	205	Dg	13	48	-----	9	4	Gravel, fine	11.0	7-1-54	--	---	D	Soil and brown sand to 9 ft, fine gravel to 13 ft.
29R5	E. Ambeau	220	Dr	31	6	31	---	--	Gravel	19.1	6-30-54	S	¼	D	Water slightly hard.
30N1	E. Kuper	165	Dr	45	6	45	---	--	Gravel, fine	20	1952	T	5	D,Irr	Water soft, leaves iron stain.
30P1	U.S.G.S. Fuels Branch	200	Dr	600+	------	-----	---	--	------------	Flow	1- -50	N	---	De	Test well. Water salty, very hard, effervesced.
31B1	J. M. Holladay	190	Dr	53	6	53	---	--	------------	20	5- -45	J	2	D,Irr	Yield 40 gpm.

31C1	H. Watilo	167	Dr	55	8	-----	---	--	Sand	25.7	7-2-54	J	3/4	D	Water soft.
31D4	W. Bailey	165	Dr	50	6	50	---	--	Gravel	28	Spring 1954	T	5	Irr	----Do----
31E5	M. D. Almy	166	Dr	57	6	57	---	--	Sand and gravel	17	3-27-54	T	2	D, Irr	Sand and gravel to 57 ft.
31F3	E. Neuert	166	Dr	51	6	51	---	--	Gravel and sand	16	Winter 1953	J	1	D	Soil to 3 ft, gravel to 51 ft. Pumped 30 gpm. Water soft.
31F5	Pacific Sand & Gravel Co.	166	Dr	112	12	112	43	40	------Do-----	32	8-22-46	T	30	Ind	Pumped 4 hr at 250 gpm, dd 42 ft. Used in washing sand and gravel. Cf, L.
31L4	N. A. Bishop	169	Dr	57	6	57	33	24	Sand and gravel	33	12-16-52	T	3	D, Irr	Pumped 4 hr at 50 gpm, dd 7 ft. Water soft, brown. L.
31N1	F. M. Moses	170	Dr	53	6	53	25	28	-----Do-----	18	5-28-50	C	5	Irr	Pumped 4 hr at 100 gpm, dd 10 ft. Water soft. L.
31P2	--- Damme	172	Dr	42	6	42	---	--	-----Do-----	16.6	7-1-54	J	1	D	Water soft; rusty color.
31Q1	Southwest Washington Livestock Marketing Association	175	Dr	60	6	60	25	35	-----Do-----	25	9-10-46	--	---	Ind	Sand and gravel to 60 ft. Bailed 4 hr at 45 gpm, dd 6 ft. Supplies slaughterhouse.
32B2	A. Taylor	205	Dg	17	48	17	14	2	Gravel	12.2	6-30-54	S	3/4	D	Gravel to 16 ft; well bottoms on "hardpan." Supply usually adequate. Water soft, has rust color.
32G5	T. R. Parrish	193	Dr	59	10	59	50	9	Gravel and sand	3	1-31-51	C	5	Ind	Pumped 1 hr at 110 gpm, dd 9½ ft; at 150 gpm, dd 12½ ft. L.
32J3	F. Loy	196	Dn	27	1½	27	---	--	Sand and gravel	14	Summer 1953	C	1	D	Sand and gravel to 27 ft. Pumped 35 gpm.
32K2	W. P. Johnson	185	Dr	34	6	34	30	4	Gravel	9.1	6-30-54	S	3/4	Irr	Supply adequate. L.
32K3	Helmer Nyman	185	Dr	60	6	60	56	4	Sand and gravel	6 10	2-8-51 6-30-54	T	2	Irr	Pumped ½ hr at 75 gpm, dd 6 ft. Water hard. L.
32Q2	M. J. Martinell	185	Dg, Dr	41	6	41	33	8	Gravel	6.1	4-9-53	J	½	D	Well dug to 29 ft, later drilled to 41 ft. Yield 17 gpm. L.
32R1	W. F. Juneman	187	Dr	41	6	41	---	--	Gravel, fine	14.6	4-9-53	C	3	Irr	Dd 2 ft pumping 20 gpm.
33D1	C. R. Linderman	200	Dr	27	6	27	20	7	Sand and gravel	8	1948	C	3	Irr	Used also for fire protection. Pumped 4 hr at 60 gpm, dd 19 ft. Water soft. L.
33E1	Mrs. E. Wolff	195	Dr	33	6	33	28	5	Gravel	8.0	6-30-54	C	1½	D, S Irr	Pumped 4 hr at 30 gpm, dd 15 ft.
33E4	C. G. Blanchard	200	Dr	35	6	35(?)	12	23	-----Do-----	12	Summer 1953	J	½	D	L.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
									T. 15 N., R. 2 W.--Continued						
34J1	A. B. Dace	450	Dr	40	4		---	--	Sand (?)	0	10-26-50	N	---	N	U.S.G.S. test hole, plugged. L.
35A1	W. J. Allen	220	Dr	54	5	45	---	--	-----Do-----	10	--------	J	½	D	Well bottom is on hard "rock." Water hard. Yield 5 gpm.
									T. 15 N., R. 3 W.						
25E1	C. Wagner	150	Dr	43	6	-----	---	--	Gravel	15.0	7-7-54	P	¼	D	Supply adequate. Water soft.
25G1	A. Aho	162	Dr	56	6	56(?)	---	--	-----Do-----	26	10- -49	J	2	D, Irr	Pumped 4 hr at 33 gpm, dd 10 ft.
25K1	R. P. Damme	163	Dr	50	6	50	---	--	-----Do-----	21.0	7-8-54	C	3	Irr	Pumped 36 hr, little dd.
25L3	E. L. Ticknor	163	Dg, Dr	52	6	52	---	--	-----Do-----	21.6 24.7	4-30-47 7-7-54	J		D, Irr	Pumped 4 hr at 70 gpm, dd ½ ft. Water soft.
25L4	V. F. Cain	163	Dr	69	6	69	50	19	-----Do-----	17	3-7-50	--	---	D, Irr	Pumped 4 hr at 100 gpm, dd 2 ft. Water soft. L.
25L5	J. L. Clement	163	Dr	62	6	62	---	--	-----Do-----	29	5-3-54	J	3	D, Irr	Pumped 4 hr at 30 gpm, dd 10 ft.
25L6	E. Saunders	163	Dr	36	6	36	---	--	-----Do-----	15	1- -50	J	½	D	Pumped 1 hr at 20 gpm, dd 22 ft.
25R1	L. O. Shult	164	Dr	45	6	45	30	15	-----Do-----	30	5-15-50	T	5	D, Irr	"Hardpan" to 30 ft. Pumped 4 hr at 90 gpm, dd 2 ft. Water soft.
26A1	E. Sorenson	145	Dr	30	6	-----	---	--	Gravel, fine	11.7	7-7-54	S	1/3	D	Supply adequate. Water soft.
26A2	R. B. Ticknor	145	Dr	30	7	30	6	24	Gravel, coarse	6.6 7.9	4-30-47 7-8-54	--	---	Irr	Soil to 6 ft. Casing perforated from 20 to 30 ft.
26G1	------Do------	146	Dg, Dr, Dn	40	6	40	14	26	Gravel and sand	14	Winter 1953	C	3	Irr	Dug 20 ft, driven to 30 ft, drilled to 40 ft. Pumped 24 hr at 60 gpm, dd 12½ ft. Water soft.
26J2	F. H. Watson	150	Dr	35	8	35	30	5	Gravel and sand	15	1-5-52	S	½	D, Irr	Bailed 4 hr at 70 gpm, dd 4 ft. L.

26K3	I. Matheny	146	Dr	53	8	53	28	25	Gravel and sand	9 18.7	8-5-51 7-7-54	C	5	Irr	Pumped 4 hr at 120 gpm, dd 2 ft. Water soft. L.
27F1	L. D. Riley	370	Dg	50	48	8	---	--	Clay and gravel	35	9- -53	J	½	D	Gravel, weathered, varicolored. Pumped 3 hr at 12 gpm, dd 15 ft. Iron in water.
27R1	C. Smalley	340	Dg	30	48 x 72	-----	---	--	-----------	17.5	7-15-54	S	¼	D	Supply adequate. Water soft.
29D1	E. J. Faber	160	Dg	24	48	-----	---	--	-----------	18.7	7-27-54	S	½	D	Supply limited. Water hard, contains iron.
30B1	Russ Webster	180	Dg	45	48	1	---	--	Sand and shale	34.1	7-27-54	J	½	D,S	Well almost entirely in shale. Water hard, has "odd" taste.
31H1	Gene White	200	Dg	12	36	-----	---	--	Clay, "shot"	2.7	7-27-54	S	½	D	Supply limited. Water soft.
34C1	E. S. Andrews	160	Dr	103	2	103	---	--	Sand (?)	5	7- -54	S	1/3	D,S	Aquifer is 6-ft soft bed between 2 layers of hard shale at unknown depth. Pumped 17 gpm, little dd. Water has sulfur taste after much pumping.
34K1	J. Porn	150	Dg	12	36	12	---	--	-----Do-----	7.5	7-14-54	S	½	D	Water soft, contains iron.
34R1	Oscar Larson	170	Dr	140	6	140	---	--	Sandstone	20	Summer 1943	J	1½	D	Casing perforated. Cf.
35B1	E. Canzotti	155	Dr	33	6	33	---	--	Sand	13	Summer 1943	T	3	D,Irr	Supply adequate. Cf.
35C1	--- Hill	155	Dg	24	36	-----	---	--	Gravel	15.6	7-13-54	S	½	D	Supply usually adequate. Water soft.
35F1	F. Hewitt	155	Dr	100	8	100	60	7	Sand, black	17-20	Summer 1953	J	½	D	Supplies 3 homes. Water has rust color on standing. Cf.
35G1	W. Groome	155	Dr	50	6	40	---	--	Sand, blue	8.4	7-13-54	C	3	Irr	
35H1	L. Boggs	155	Dg	17	84	17	---	--	Gravel	10.4	7-13-54	C	3	Irr	Reported dd 5 ft. Water hard.
35L4	G. G. Ingalls	155	Dr	68	6(?)	64	64	4	Sand	17½	Summer 1940	J	1	D	Pumped 22 hr at 13 gpm, dd 10 ft. Cf, L.
35M1	G. Sturdevant	155	Dg	18	36	18	---	--	Gravel	14.5	7-13-54	C	3	Irr	Supply adequate. Water soft.
36A4	O. Gloyd	165	Dr	55	2	-----	---	--	Gravel	23.6	7-6-54	J	1½	Irr	----------Do--------------
36F2	Leo Seifert	165	Dr	54	7	54	37	17	Gravel, coarse	20 24.7	1-15-47 7-9-54	C	7½	D,S Irr	Pumped 4 hr at 125 gpm, dd 26½ ft. Report water level fluctuates from 15 to 29 ft below land surface. Water soft. L.
36G1	D. S. Ward	165	Dr	52	6	52	---	--	Sand and gravel	27 24.2	10-12-52 7-12-54	C	3	D,Irr	Sand and gravel to 52 ft. Pumped 70 gpm, dd 8 ft. Cf.

Table 1. -- Records of representative wells in Lewis County, Wash. -- Continued

Well No.	Owner or tenant	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Water level: Depth below land surface (feet)	Water level: Date	Pump: Type	Pump: Horsepower	Use of water	Remarks
	T. 15 N., R. 3 W.--Continued														
36H3	J. Gehrman	164	Dr	53	6	53(?)	47	6	Gravel	22	1945	J	3/4	D	Supply adequate. Water soft. L.
36K2	Clifford Reisinger	165	Dr	54	8	54	23	31	Gravel, coarse	20 18	7- -43 1-15-47	T	5	Irr	Pumped 4 hr at 125 gpm, dd 4 ft. Ca, L. Temp 52.
36L1	R. W. Sloan	164	Dr	44	6	44	---	--	Gravel	29.1	7-9-54	J	½	D,Irr	Clay and gravel to 40 ft, soapstone(?) to 44 ft. Water soft.
36L3	P. M. Steelhammer	165	Dr	43	6	43	18	25	----Do-----	18.1	7-9-54	C	5	Irr	Pumped 10 hr at 120 gpm, little dd. Water soft. L.
36N1	Pete Nix	163	Dr	65	8	65	---	--	-----Do-----	13	1947	T	5	Irr	Pumped 4 hr at 120 gpm, dd 1 ft.
36R1	H. Custer	167	Dr	46	-----	46	---	--	Gravel, fine	27.8	7-8-54	J	½	D	Supply adequate.
	T. 15 N., R. 4 W.														
16R1	Charles Echo	130	Dr	173	6	-----	---	--	------------	165	Summer 1950	N	---	N	Report natural gas in well.
20Q1	H. Glad	145	Dg	12	36	12	9	3	Clay, blue	9.3	8-3-54	S	½	D	Soil to 9 ft, blue clay and wood 9 to 12 ft. Supply limited in Sept. Water soft.
25A1	J. S. Fogelsong	180	Dg	34	36	34	---	--	Shale, gray, jointed	34	8- -52	P	¼	D	Supply adequate. Water hard, encrusts pipes rapidly.
26L1	G. W. Padham	180	Dr	43	2	-----	30	13	Clay and gravel	3	8- -54	S	½	D	Water soft, leaves "rusty" stain.
30R1	W. H. Scott	190	Dg	24	36	-----	---	--	Clay, blue	16½	7- -54	S	½	D	Water soft.
32Q1	M. L. Rahm	220	Dg	9	36	10	---	--	------------	4.9	7-28-54	P	---	D,S	Water soft, has rusty color.
33P1	Hubert Wirkkala	200	Dr	240	6	-----	---	--	------------	10	7- -54	N	---	N	
34H1	Watilo Bros.	200	Dg	23	36	20	---	--	Shale, blue	15.5	7-27-54	S	½	D,S	Dry in Sept. Water soft, contains iron.

									T. 15 N., R. 5 W.						
16J1	C. J. Grandorff	150	Dg	11	60	-----	---	--	------------	8.2	8-3-54	S	¼	D,S	Water hard, has rust color in summer.
21A1	J. Dix	190	Dg	9	------	9	---	--	------------	4	7- -54	S	½	D	Supply adequate. Water soft.
22M1	J. Danforth	220	Dg	12	36	12	---	--	Shale, gray		7- -54	S	¼	D	Well pumped dry. Water soft. Report level fluctuates from 0 to 10½ ft below land surface.
27C1	--------------	320	Dg	15	36	-----	---	--	"Rock," rust-red	10	7- -54	S		D,S	

Table 2.--Records of selected springs in Lewis County
See plates 1, 2, 3, and 5

Approximate altitude: Altitude of land surface at spring, interpolated from topographic maps.
Yield: Reported by owner or user unless otherwise noted in "Remarks" column.
Use: D, domestic; Irr, irrigation; PS, public supply; S, stock.
Temperature: Measured by U.S.G.S. personnel.
Remarks: Cf, field test for chemical quality (see table 5).

Spring	Owner or tenant	Approximate altitude (feet)	Water-bearing material	Yield (gpm)	Use	Temperature °F	Remarks
T. 11 N., R. 1 W.							
1R1s	---------------	185	Gravel, coarse	22½	---	51	Flow measured 10-16-52. Cf.
7R1s	--- Leonard	230	Gravel	------	D,S	53	Little seasonal fluctuation. Cf.
8E1s	Town of Toledo	240	------------	90	PS	---	
11G1s	--- Kerkendoll	200	Gravel	------	D,S	51	Little seasonal fluctuation. Cf.
19K1s	T. E. Smith	120	Gravel, underlain by blue-gray siltstone	5	D,S	53	Flow decreases in fall. Cf.
19M1s	Erland Aboen	120	Gravel	------	D,S	52	Flow dependable. Cf.
20L1s	A. Blake	130	------Do------	------	D,S	52	Little seasonal fluctuation. Cf.
21P1s	I. S. Coverdell	200	------Do------	7	D	---	Little seasonal fluctuation.
24C1s	Joe Rensing	340	Clay	------	D	51	Flow decreases in fall. Cf.
28M1s	Guy Brown	180	Gravel, underlain by blue clay	------	D,S	54	Little seasonal fluctuation. Cf.
T. 11 N., R. 2 W.							
4D1s	--- Egbert	380	Gravel, underlain by "hardpan"	300	D	---	Flow decreases in fall.
5J1s	C. Brown	380	Gravel	------	D,S	51	Flow dependable. Cf.

11N1s	K. R. Breidenstein	340	Gravel and clay	13	D,S	53	Little seasonal fluctuation.
11R1s	J. D. Farmer	240	Gravel	12	D,S	53	-----------Do----------- Cf.
23H1s	Archie Reed	140	------Do------	------	D,S	---	Flow decreases in fall. Cf.
T. 11 N., R. 3 W.							
18H1s	Howard Detering	530	------Do------	------	D,S	---	Little seasonal fluctuation.
T. 11 N., R. 2 E.							
9J1s	Jerry Belcher	940	Clay	1	D	---	Little seasonal fluctuation. Supplies 2 homes.
10J1s	Earl Clowe	1,030	------Do------	------	D,S	---	Little seasonal fluctuation. Cf.
16B1s	S. E. Weaver	1,170	------Do------	1	D,S	---	Little seasonal fluctuation.
T. 11 N., R. 4 E.							
10B1s	Alice Rea	1,300	------------	5	D,S	---	Little seasonal fluctuation. Supplies 3 homes.
T. 11 N., R. 6 E.							
6C1s	F. C. MacDonald	1,100	------------	3	D	---	Flow decreases in fall. Supplies 6 homes.
T. 12 N., R. 1 E.							
12D1s	Charles Montgomery	680	Gravel	------	D	---	Little seasonal fluctuation. Supplies 2 homes.
14C1s	John Christian	590	------Do------	3	D	52	Little seasonal fluctuation.
22M1s	W. E. Stepp	310	Gravel, underlain by blue sandy clay	6	D	50	-----------Do-----------
22Q1s	Taylor Bros.	295	Gravel	8	---	49	Flow measured 7-6-55. Cf.

Table 2.--Records of selected springs in Lewis County--Continued
See plates 1, 2, 3, and 5

Spring	Owner or tenant	Approximate altitude (feet)	Water-bearing material	Yield (gpm)	Use	Temperature °F	Remarks
T. 12 N., R. 2 E.							
1G1s	S. C. Carson	460	Gravel	------	D,S	49	Flow decreases in fall. Cf.
10L1s	Clarence Stiltner	460	------Do------	------	D	49	------------Do-----------
11F1s	Washington State Fish Hatchery	400	------Do------	2,400	D	51	Discharges from 3 openings. Little seasonal fluctuation. Cf.
17D1s	------------	880	------Do------	9	D,S	51	Little seasonal fluctuation. Supplies 8 homes.
21Q1s	M. Stacy	440	------Do------	33	D	49	Little seasonal fluctuation. Cf.
T. 12 N., R. 3 E.							
7D1s	P. H. Birley	600	------Do------	------	PS	49	Little seasonal fluctuation. Cf.
16P1s	W. N. Blankenship	950	Clay, gray	------	D,S	---	Supply low in summer.
19H1s	Ethyl Stehe	850	Rock, soft, red	3	D,S	---	Flow decreases in fall.
36N1s	Harry Bowen	1850	------------	5	D	---	Little seasonal fluctuation.
T. 12 N., R. 4 E.							
3M1s	Isaac Crumb	1000	Clay	3	D	---	Little seasonal fluctuation. Cf.
9M1s	Ellis Compton	1350	Basalt (?)	5	D	---	-----------Do--------------
19K1s	Mary Workman	550	------------	5	D	---	Little seasonal fluctuation.
T. 12 N., R. 5 E.							
29J1s	Harold Hill	850	Basalt (?)	5	D	---	Little seasonal fluctuation.
31P1s	Ed Stiltner	630	Sand and fine gravel	5	D	---	----------Do-----------

T. 12 N., R. 6 E.							
9E1s	Owen Huddleston	1350	Gravel	5	D,S	---	Flow decreases in fall. Cf.
T. 13 N., R. 2 W.							
12A1s	Richard Keckeis	490	------Do------	------	D,S	---	Little seasonal fluctuation. Supplies 2 homes.
22E1s	Harry Gleason	320	Sand, red	3	D,S	---	Little seasonal fluctuation. Cf.
30L1s	C. F. Norman	250	Sand	3	D,S	---	------------Do--------------
T. 13 N., R. 4 W.							
7F1s	Rainbow Falls State Park	440	------------	5	PS	---	Flow decreases in fall.
22G1s	William Tracy	250	Clay, yellow	1	D	---	Little seasonal fluctuation.
T. 13 N., R. 1 E.							
20R1s	Town of Onalaska	596	Gravel (loosely-cemented)	50-75	PS	50	Flow dependable. Cf.
T. 13 N., R. 4 E.							
25R1s	Josh Evans	1,225	Clay	5	D	---	Flow decreases in fall. Cf.
T. 14 N., R. 3 W.							
2D1s	--- Bates	240	------Do------	1	D	---	Little seasonal fluctuation.
24A1s	Carl Hanke	230	Clay, blue	½	D	---	Little seasonal fluctuation.
T. 14 N., R. 4 W.							
36K1s	Carl Johnson	300	Gravel	½	D	---	Little seasonal fluctuation.
T. 15 N., R. 2 W.							
29B1s	C. Lowery	200	------------	------	D	---	Little seasonal fluctuation. Cf.

Table 2.--Records of selected springs in Lewis County--Continued
See plates 1, 2, 3, and 5

Spring	Owner or tenant	Approximate altitude (feet)	Water-bearing material	Yield (gpm)	Use	Temperature °F	Remarks
T. 15 N., R. 3 W.							
34N1s	E. Steinbrenner	225	-----------	------	D,Irr	---	Little seasonal fluctuation.
T. 15 N., R. 4 W.							
15H1s	L. England	180	Gravel	------	D,S	---	Flow decreases in fall. Cf.
27R1s	--- Kosola	310	Clay	½	D	---	Little seasonal fluctuation.
T. 15 N., R. 5 W.							
25E1s	Troy Baker	275	Gravel	1	D	---	Little seasonal fluctuation.

Table 3.-- Logs of selected wells in Lewis County

Most of the data in this table were obtained from records made by well drillers during construction of the wells, although some data were supplied from memory by drillers and well owners. A few of the wells were examined by Geological Survey personnel. The original records have been edited for consistency of presentation, but were not changed otherwise. For the purpose of clarity, the authors' interpretations have been added in parentheses after some of the drillers' designations. All depths and depth intervals are given in feet below land surface at the well.

Material	Thickness (feet)	Depth (feet)
Well 11/1W-1D1		
Frank Linwood. Altitude 260 ft. Dug by owner, 1947.		
Gravel, cobbles, and boulders, cemented	10	10
Gravel, fine, water-bearing	2	12
"Soapstone" (blue-gray clayey shale)	---	13
Curbing: 36-inch to 4 ft.		
Well 11/1W-5H4		
A. W. Peterson. Altitude 342 ft. Drilled by F. Galivan, 1950.		
Topsoil	2	2
Clay	2	4
Gravel, cemented	2	6
Clay, some gravel	62	68
Gravel, clean	2	70
Casing: 6-inch to 65 feet.		
Well 11/1W-6D1		
Church of Latter Day Saints. Altitude 302 ft. Drilled by C. Rubey, 1955.		
Clay	12	12
Gravel and rocks, cemented. Water at 50 ft sufficient for domestic use	39	51
Clay, green and blue	89	140
Clay, blue	61	201
Sand, blue, and chunks of rotten wood; water-bearing	---	----
Casing: 6-inch to 201 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 11/1W-8E2		
Town of Toledo. Altitude 240 ft. Drilled by Price, 1953.		
Clay and gravel	30	30
Clay, blue	10	40
Silt, blue	18	58
Sand, blue-gray	14	72
Clay, blue	2	74
Sand, gray	4	78
Clay, blue, heavy	52	130
Clay, blue, with "soapstone" layers several ft thick	245	375
Shale (cuttings showed grains of quartz and gray claystone)	10	385
Siltstone (cuttings showed grains of quartz and dark volcanic materials)	65	450

Casing: 8-inch, originally set to 290 ft; yield 2 gpm, static water level 100 ft. Casing pulled back, finally set to 79 ft, and perforated from 60-78 ft.

Material	Thickness (feet)	Depth (feet)
Well 11/1W-9J1		
E. F. Boone. Altitude 118 ft. Drilled by F. Galivan, 1948.		
Silt	3½	3½
Sand; water at 42 ft	38½	42
Clay, blue	3	45

Casing: 6-inch to 45 ft.

Material	Thickness (feet)	Depth (feet)
Well 11/1W-9L1		
F. E. Formen. Altitude 110 ft. Drilled by W. Price, 1955.		
Topsoil	2	2
Sand and dirt, brown	12	14
Gravel, cemented, gray	19	33
Gravel, fine, water-bearing	5	38
Gravel, cemented, dark-brown	2	40

Casing: 8-inch to 40 ft; perforated from 30 to 40 ft.

Material	Thickness (feet)	Depth (feet)
Well 11/1W-12F1		
E. J. Smith. Altitude 318 ft. Drilled by W. Price, 1945.		
Loam	11	11
Gravel, cemented	19	30
Clay	6	36
Gravel, cemented	39	75
Gravel, fine, and sand; water-bearing	11	86

Casing: 8-inch to 76 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 11/1W-16E2		
Guy Bowan. Altitude 213 ft. Drilled by Dale Magee, 1949.		
Gravel, mostly cemented	52	52
Gravel, water-bearing	3	55
Clay, blue	101	156
Casing: 6-inch to 156 ft.		
Well 11/1W-16H1		
Ernest Cooper. Altitude 240 ft. Drilled by Frank Galivan, 1953.		
Topsoil, clay, some boulders	26	26
Gravel, cemented	10	36
Gravel, loose, water-bearing	---	36
Casing: 6-inch to 36 ft.		
Well 11/1W-17A1		
H. M. Shepardson. Altitude 110 ft. Drilled by Price, 1952.		
Soil	8	8
Gravel	32	40
Clay, blue	1	41
Casing: 6-inch to 40 ft.		
Well 11/1W-17L2		
Rudolf Klein. Altitude 105 ft. Drilled by O. E. Erdman, 1933.		
Clay, sandy	14	14
Sand and gravel	31	45
Clay	1	46
Clay and gravel	1	47
Boulders and "rocks"	1½	48½
Clay	129½	178
Clay with sand and gravel streaks	47	225
Shale	10	235
Casing: 6-inch to 235 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 11/1W-20M1		
L. Cunningham. Altitude 203 ft. Drilled by King Bros., 1929.		
Dirt	12	12
Gravel, cemented	20	32
Gravel, with scattered sand pockets; lower part water-bearing	38	70
Clay, blue	---	----
Casing: 6-inch to 70 ft.		
Well 11/1W-21D1		
N. A. Kent. Altitude 220 ft. Drilled by Frank Galivan, 1953.		
Soil and clay	8	8
Gravel, cemented. Water at 35 ft; static water level 10-12 ft; water at base	46	54
Clay, blue, sticky	34	88
Sandstone, water-bearing. Good yield at 110-120 ft; static water level 30-40 ft	22	110
Shale, greenish-gray, constantly squeezed into drill hole	58	168
Sand, dark greenish-gray. Inflammable gas at 170 ft	5	173
Casing: 6-inch to 165 ft.		
Well 11/1W-29D1		
James Allon. Altitude 214 ft. Drilled by Bell, 1928.		
Clay	22	22
"Hardpan"	20	42
Gravel and sand, water-bearing	6	48
Casing: 4-inch to 48 ft.		
Well 11/2W-9P1		
Sam Leathers. Altitude 420 ft. Drilled by C. D. Roberts, 1954.		
Topsoil	3	3
Clay, red	7	10
Clay, yellow	20	30
Clay, yellow, and gravel	40	70
Boulder and clay	5	75
Clay, white, soft, some sand	32	107
Gravel and sand, cemented	10	117
Gravel and coarse sand, water-bearing	16	133
Shale	45	178

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 11/2W-9P1--Continued		
Shale, sandy	2	180
Sandstone, hard	3	183
Clay, blue	7	190
Clay, dark gray	25	215
Shale, sandy	72	287

Casing: 8-inch to 147 ft; perforated from 112 to 133 ft.

Well 11/2W-11N1

K. R. Breidenstein. Altitude 295 ft. Drilled by C. D. Roberts, 1951.

Material	Thickness (feet)	Depth (feet)
Topsoil	2	2
Clay, white	18	20
Gravel, cemented	17	37
Gravel and sand, water-bearing	22	59
Shale	5	64

Casing: 6-inch to 64 ft; perforated from 45 to 58 ft.

Well 11/2W-15A2

Perry Zion. Altitude 265 ft. Drilled by C. D. Roberts.

Material	Thickness (feet)	Depth (feet)
Clay, sticky, brown	10	10
Clay and gravel	10	20
Gravel and sand, cemented	8	28
Sand and gravel, water-bearing	12	40
Clay, blue, and gravel	6	46

Casing: 12-inch to 45 ft; perforated from 28 to 42 ft.

Well 11/2W-17E2

Russell Foreman. Altitude 205 ft. Drilled by W. Price, 1947. Memory log.

Material	Thickness (feet)	Depth (feet)
Topsoil	12	12
Gravel, water-bearing	5	17
"Soapstone," yellow, and blue "hardpan" containing "clam" shells	122	139
Sand, white, water-bearing	4+	143+
No record	38-	181
"Mud bank"	1	182
No record, water-bearing	---	----

Casing: 6-inch to 182 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 11/2W-20N1		
William Schoch. Altitude 180 ft. Drilled by W. Price, 1947.		
Clay and gravel	20	20
Basalt, black	55	75
Casing: 6-inch.		
Well 11/2W-23G1		
Sulo Kolehmainen. Altitude 185 ft. Drilled by W. Price, 1951.		
Topsoil	3	3
Clay, brownish yellow	13	16
Gravel, rotten	4	20
Gravel, clean, water-bearing	10	30
Clay, blue, sticky	80	110
Casing: 12-inch to 34 ft; perforated from 22 to 34 ft.		
Well 11/2W-24Q2		
Ed Ritzman. Altitude 110 ft. Drilled by W. Price(?) 1951(?).		
Soil, clayey, bouldery	5	5
Sandstone, weathered	2	7
"Bedrock" (carbonaceous siltstone with coal streaks)	1	8
Sandstone, carbonaceous	5½	13½
Conglomerate	1	14½
Sandstone	½	15
Conglomerate	2½	17½
Sandstone, some pebbles	14	31½
Siltstone	3	34½
Sandstone, fossiliferous	28	62½
Conglomerate	2	64½
Sandstone	7½	72
Conglomerate, fossiliferous	3	75
Conglomerate	6	81
Sandstone	22	103
Conglomerate, fossiliferous	7	110
Sandstone, fossiliferous	57	167
Sandstone	46	213
Conglomerate	22	235
Sandstone	10	245
Conglomerate	12	257
Sandstone, fine-grained	86	343
Siltstone	1	344
Sandstone, fine-grained	33	377
Siltstone, carbonaceous, with sandstone	35	412
Siltstone, carbonaceous, with sandstone streaks	156	568

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 11/2W-29P1		
Northern Pacific R. Altitude 143 ft. Drilled by owner, 1949.		
Clay, yellow	5	5
Gravel and clay	9	14
Shale, sandy	6	20
Shale, sandy, water	4	24
Shale, dry	52	76
"Rock" (basalt)	12	88
Shale, dry	36	124
Sandstone, water	62	186
Casing: 8-inch.		
Well 11/2W-30D1		
E. D. Allen. Altitude 160 ft. Drilled by O. Keto, 1952.		
Clay, yellow	20	20
Sandstone, yellow	15	35
Sandstone, blue, water-bearing	20	55
Casing: 6-inch to 54 ft.		
Well 11/2W-32C1		
Town of Vader. Altitude 140 ft. Drilled by W. Price, 1948.		
Soil and clay	20	20
Sandstone	20	40
Basalt	40	80
Sandstone, water-bearing	140	220
Casing: 6-inch to 60 ft.		
Well 11/2W-34R2		
--- Beyers. Altitude 160 ft. Drilled by W. Price, 1953.		
Topsoil	5	5
Silt	23	28
Gravel	12	40
Clay, blue, sandy, water-bearing at base	8	48
"Rock"	12	60
Casing: 8-inch, set to 56 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 11/2W-36A4		
C. R. Calvin. Altitude 205 ft. Drilled by C. D. Roberts, 1954.		
Topsoil	2	2
Clay, yellow	8	10
Gravel and sand, cemented	15	25
Sand and fine gravel, water-bearing	2	27
Sand and coarse gravel, water-bearing	13	40
Shale (basalt?)	25	65
Casing: 8-inch to 65 ft; perforated from 27 to 40 ft.		
Well 11/1-16P1		
Test hole. Altitude 316 ft. Drilled by U.S. Geol. Survey.		
Soil, clayey	11	11
Sand and silt, clayey	7	18
Sand and gravel	1	19
"Bedrock" (carbonaceous siltstone)	1	20
Lignite	1	21
Conglomerate, pebble	5	26
Claystone, tuffaceous	8	34
Claystone, sandy	17	51
Siltstone, carbonaceous, with coaly fragments	9	60
Clay	2	62
Claystone with carbonaceous material	5	67
Lignite	1	68
Siltstone, carbonaceous	5	73
Lignite	1	74
Clay, gravel	14	88
Siltstone, carbonaceous	1	89
Lignite	4	93
Claystone	1	94
Siltstone, carbonaceous	2	96
Lignite	1	97
Siltstone, carbonaceous	1	98
Lignite	1	99
Siltstone, carbonaceous	6	105
Lignite	1	106
Siltstone, carbonaceous	1	107
Lignite	2	109
Siltstone, carbonaceous; lignite streaks	14	123
Lignite	1	124
Siltstone, clayey	20	144
Conglomerate, pebble	32	176
Sandstone, carbonaceous	17	193
Siltstone, carbonaceous	4	197

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 11/1-16P1--Continued		
Lignite	1	198
Siltstone, carbonaceous	10	208
Sandstone, pebbly	21	229
Conglomerate, pebble	3	232
Tuff, lapilli	31	263
Siltstone, clayey	65	328
Siltstone, carbonaceous	62	390
Tuff, lapilli	14	404
Siltstone, carbonaceous; sandy interbeds	126	530
Tuff, lapilli	4	534
Agglomerate	6	540
Well 11/1-19K1		
A. F. Schmit. Altitude 300 ft. Drilled by F. Galivan, 1952.		
Topsoil and clay	12	12
Clay, alternately blue and yellow	88	100
Sand, blue, water-bearing, and clayey gravel	12	112
Casing: 6-inch to 112 ft.		
Well 11/1-20C1		
Test hole. Altitude 330 ft. Drilled by U.S. Geol. Survey.		
Soil	14	14
Gravel	3	17
Sand and small gravel	6	23
"Bedrock" (blue clay)	16	39
Sandstone, with some clay	1	40
Siltstone, clayey	2	42
Sandstone, fine-grained	7	49
Siltstone, clayey	15	64
Carbonaceous material	1	65
Siltstone, clayey	14	79
Lignite	½	79½
Siltstone, carbonaceous	½	80
Sandstone, fine-grained	16	96
Siltstone, clayey	16	112
Siltstone, carbonaceous, with coal streaks	2	114
Lignite	½	114½
Bone	½	115
Lignite	½	115½
Sandstone, carbonaceous	2½	118
Lignite	2	120
Siltstone, carbonaceous	1½	121½
Clay	5½	127
Siltstone, carbonaceous	1	128
Lignite	1½	129½

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 11/1-20C1--Continued		
Siltstone, carbonaceous	2	131½
Bone	1½	133
Siltstone, carbonaceous, with coal streaks	3	136
Siltstone, clayey	1	137
Sandstone, fine-grained	23½	160½
Lignite with small siltstone partings	2½	163
Siltstone, carbonaceous, with coal streaks	½	163½
Sandstone, carbonaceous, with coal streaks	¼	163 3/4
Lignite	¼	164
Sandstone, carbonaceous, with coal streaks	3	167
Lignite	3½	170½
Siltstone, carbonaceous	1	171½
Sandstone, clayey	13½	185
Siltstone, carbonaceous	10	195
Sandstone, clayey	16½	211½
Siltstone, clayey	11½	223
Well 12/1W-4N3		
Paul G. Engen. Altitude 540 ft. Drilled by F. Galivan, 1953.		
Topsoil	6	6
Clay, yellow	35	41
"Hardpan"	25	66
Gravel, cemented	20	86
Gravel, clean, smooth, with organic material; water	6	92
Casing: 6-inch to 92(?) ft.		
Well 12/1W-5E1		
A. A. Singer. Altitude 525 ft. Drilled by F. Galivan, 1951.		
Soil and clay	10	10
Gravel and sand, cemented; no decrease in rottenness of gravel	70	80
Sandstone, coarse, friable, gray-green	20	100
Gravel, hard, clean, and black sand, water-bearing	28	128
Casing: 6-inch to 128 ft; perforated from 105 to 125 ft.		
Well 12/1W-5G2		
Rex Briem. Altitude 528 ft. Drilled by F. Galivan, 1950.		
Topsoil	2	2
Clay	23	25
Gravel, cemented	10	35
Sand, black	10	45
Gravel, cemented	27	72
Gravel, water-bearing	5	77
Casing: 6-inch to 68 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/1W-6L1		
G. E. Chappell. Altitude 505 ft. Drilled by C. D. Roberts, 1952.		
Topsoil	4	4
Clay	66	70
Gravel and clay, slightly cemented	20	90
Gravel, some sand; water-bearing	16	106
Casing: 6-inch to 106 ft.		
Well 12/1W-9A2		
Henry Lucas. Altitude 561 ft. Drilled by King Bros., 1947.		
Clay, yellow, some cemented gravel	80	80
"Hardpan," gray, very hard	8	88
Sand, fine, white	2	90
Gravel, water-bearing	2	92
Casing: 6-inch to 92 ft.		
Well 12/1W-13J2		
Warren Smith. Altitude 462 ft. Drilled by W. Price, 1951.		
Topsoil	5	5
Silt	15	20
Gravel, cemented, water at 80 ft	80	100
Sand, blue-gray, fine, water-bearing	15	115
Gravel, fine, and sand, water-bearing	5	120
Casing: 12-inch to 120 ft; perforated from 24 to 30 ft, 40 to 50 ft, 80 to 90 ft, and 100 to 120 ft.		
Well 12/1W-16K2		
Wash. State Parks and Recreation Comm. Altitude 400 ft. Drilled by King Bros., 1952.		
Topsoil	2	2
Clay, yellow	25	27
Clay, blue	9	36
Sand, yellow	3	39
Gravel, cemented, water-bearing	10	49
Gravel, "dirty"	9	58
Clay, blue	7	65
"Sandrock," soft, yellow; bailed 20-35 gpm	20	85
Clay, yellow	2	87
Clay, blue	5	92
Sand, clayey, black and brown; bailed 50-55 gpm	6	98
Clay blue	6	104
Casing: 10-inch to 97 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/1W-16Q4		
Wash. State Division of Forestry. Altitude 378 ft. Drilled by C. D. Roberts.		
Clay	6	6
Clay and boulders	18	24
Gravel, cemented	21	45
Sand and gravel, water-bearing	13	58
Casing: 6-inch.		
Well 12/1W-18M1		
Ben Meier. Altitude 480 ft. Drilled by C. D. Roberts, 1953.		
Topsoil	3	3
Clay, yellow	27	30
Clay, yellow, and gravel	10	40
Gravel, cemented	15	55
Gravel and sand, water bearing	30	85
Sand, coarse, some fine gravel; water-bearing	2	87
Casing: 6-inch, set to 84 ft.		
Well 12/1W-23N1		
E. L. Fish. Altitude 388 ft. Dug by Owner, 1941.		
Clay, gray-white, sticky	7½	7½
Gravel, cemented with clay	10½	18
Sand and cobbles, cemented with clay, water-bearing	4	22
Curbing: 48-inch to 7½ ft.		
Well 12/1W-29D1		
M. E. Hart. Altitude 345 ft. Drilled by F. Galivan, 1952.		
Topsoil	2	2
Clay, yellow	18	20
Gravel, cemented but rotten (weathered gravel bound by clay products of alteration)	3	23
Gravel, cemented, hard	9	32
Sand, coarse, greenish-blue; water rose from 32-ft depth to 14 ft	---	32+
Casing: 6-inch		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2W-1P1		
Ben Richardson. Altitude 484 ft. Drilled by C. D. Roberts, 1952.		
Clay, hard	4	4
Clay, yellow, and weathered gravel	50	54
Gravel and sand, cemented	20	74
Gravel and sand, cemented; water-bearing	16	90
Sand, "pure"	1	91
Gravel, cemented	6	97
Sand, coarse, some gravel; water-bearing	12	109
Sand, very fine	7	116
Sand, coarse, and gravel; water-bearing	13	129
Casing: 6-inch to 129 ft.		
Well 12/2W-2J1		
J. H. Nelson. Altitude 482 ft. Drilled by O. Keto, 1953.		
Clay, red	70	70
Sand and gravel, soft, mixed with clay	67	137
Gravel, water-bearing	3	140
Casing: 8-inch to 137 ft; perforated from 70 to 133 ft.		
Well 12/2W-3A2		
R. A. Laney. Altitude 464 ft. Drilled by C. D. Roberts, 1952.		
Gravel, cemented, and clay	124	124
Clay, blue	56	180
Sand, fine, water-bearing	20	200
Casing: 6-inch to 194 ft.		
Well 12/2W-4Q3		
W. K. Wachter. Altitude 446 ft. Drilled by C. D. Roberts, 1953.		
Dug well	64	64
Gravel and sand, cemented	51	115
Sand and gravel; water-bearing	7	122
Gravel, cemented	23	145
Gravel and sand; water-bearing	15	160
Sand, silty	7	167
Gravel, with a little sand; water-bearing	17	184
Casing: 8-inch to 184 ft; perforated from 115 to 122 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2W-7J1		
Harold Breshon. Altitude 715 ft. Drilled by V. W. Athey, 1951.		
Clay, yellow, some gravel	33½	33½
Rock, hard, black	112½	146
Sand and clay, yellow, with small "creek" gravel	54	200
Rock, shaly, yellow and black (jointed and weathered tuffaceous siltstone)	10	210
Sand and clay, yellow, and some small gravel	15	225
Sand, green	8	233
Casing: None. Well "dry."		
Well 12/2W-7J2		
Harold Breshon. Altitude 700 ft. Drilled by V. W. Athey, 1951.		
Clay, red	35	35
Basalt, fractured, water-bearing	40	75
Casing: 8-inch to 35 ft.		
Well 12/2W-8A2		
Archie Floch. Altitude 404 ft. Drilled by Fox Bros., 1947.		
Topsoil	2	2
Clay, yellowish, and weathered gravel	45	47
Sand	3	50
"Hardpan"	7	57
Sand	11	68
Sand, black	1	69
"Rocks," large	---	69+
Casing: 6-inch to 69 ft.		
Well 12/2W-8P2		
George Fries. Altitude 550 ft. Drilled by F. Galivan, 1952.		
Topsoil	10	10
Basalt	70	80
Shale(?)	10	90
Clay, blue	55	145
Sand and gravel	10	155
Casing: 4-inch to 140 ft. Well "dry."		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2W-8Q1		
Norman Fries. Altitude 505 ft. Drilled by V. W. Athey, 1952.		
Topsoil	5	5
Basalt	78	83
Wood, decomposed	16	99
Shale, blue	10	109
Sandstone	19	128
Rock, black, not as hard as basalt	8	136
Joint or cavity in above material, water-bearing	4	140
Casing: 6-inch to 136 ft.		
Well 12/2W-9A2		
H. G. England. Altitude 455 ft. Dug by owner, 1914.		
Topsoil	6	6
Clay	14	20
Gravel and some sand, consolidated, weathered	42	62
Curbing: 48-inch to 6 ft.		
Well 12/2W-9B1		
M. G. Egebert. Altitude 450 ft. Drilled by C. D. Roberts, 1947.		
Clay, red	20	20
Clay, yellow, and gravel	60	80
Gravel, cemented	45	125
Sand and gravel	15	140
Gravel and sand, soft but consolidated, water-bearing	10	150
Casing: 6-inch to 150 ft.		
Well 12/2W-9D1		
W. J. Wilson. Altitude 410 ft. Dug by owner.		
Topsoil	4	4
Clay and weathered gravel	26	30
Sand, water-bearing	14	44
Cobbles and sand, cemented	26	70
Casing: 42-inch to 5 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2W-9G1		
E. R. Gill. Altitude 437 ft. Drilled by Jannsen, 1947. Log from memory.		
Dug well; static water level 10 ft	80	80
Sand and gravel, cemented; lost water on entering this bed	40	120
Clay or sand, blue	7	127
Sand and gravel; water-bearing; static level at 71 ft	8	135
Casing: 6-inch to 135 ft.		
Well 12/2W-9L4		
G. R. Smith. Altitude 435 ft. Drilled by C. D. Roberts, 1953.		
Topsoil	3	3
Clay, red, sticky	7	10
Clay, white	3	13
Clay, yellow, gritty, some gravel	7	20
Gravel, cemented	54	74
Gravel, water-bearing	1	75
Gravel, cemented	5	80
Sand, fine, brown; water-bearing	7	87
Gravel, cemented	5	92
Gravel, coarse and fine; water-bearing	28	120
Gravel, fine, water-bearing	14	134
Gravel, fine, "washed"	9	143
Casing: 8-inch to 143 ft.		
Well 12/2W-9R2		
J. W. Behymer. Altitude 440 ft. Drilled by V. W. Athey and C. D. Roberts, 1953.		
Clay, yellow, soft gravel	50	50
Clay, yellow, and hard gravel	14	64
Gravel, cemented	19	83
Gravel, tight, and yellow clay; a little water; static water level 68 ft	11	94
Gravel, "large"	6	100
Gravel, some yellow clay; some water at base	18	118
Gravel, cemented (?), clean	40	158
Clay or shale	37	195
Clay and cobbles, small particles of wood; water-bearing, static water level 75 ft	15	210
Clay, sandy	10	220
Clay or shale, gray, sticky	5	225

Casing: 8-inch to 124 ft, 6-inch from 99 to 230 ft. Perforated from 86 to 121 ft, and 195 to 210 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2W-10D2		
C. W. Carlson. Altitude 465 ft. Drilled by C. D. Roberts, 1953.		
Topsoil	1	1
Clay, red	17	18
Clay, red, and soft gravel, mixed	22	40
Clay, yellow, and gravel	20	60
Gravel and sand, cemented; a little water	20	80
Clay and gravel, mixed	45	125
Gravel, coarse, water-bearing	3	128
Sand and gravel, cemented; a little water	52	180
Clay, yellow	5	185
Clay, blue	5	190
Casing: 8-inch to 190 ft; perforated from 127 to 180 ft.		
Well 12/2W-10N1		
L. P. Schwarzkopf. Altitude 440 ft. Drilled by C. D. Roberts, 1950.		
Topsoil	5	5
Clay, red	5	10
Clay, yellow, and cemented gravel	54	64
Sand and fine gravel, water-bearing	4	68
Gravel, cemented	4	72
Gravel, water-bearing	20	92
Gravel and fine sand, water-bearing	8	100
Clay, blue	---	100+
Casing: 6-inch to 100 ft; perforated from 70 to 100 ft.		
Well 12/2W-16C1		
R. Jensen. Altitude 440 ft. Dug by owner.		
Topsoil	2	2
Clay	18	20
Sand	2	22
Clay and gravel	24	46
Well 12/2W-16E3		
James Maguire. Altitude 475 ft. Drilled by C. D. Roberts, 1955.		
Clay, red	16	16
Basalt	41	57
Clay, silt, and sand; water at 90 ft in fine sand; green silty clay somewhere from 90 to 120 ft	108	165
Sand, fine, gray, water-bearing	20	185
Clay or siltstone, sticky, blue-gray and light gray; pebbles of soft rock	---	185+
Casing: 4-inch.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2W-16J1		
Willis Porter. Altitude 445 ft. Dug by owner, 1935.		
Topsoil	6	6
Clay, red, "consolidated"	41	47
Gravel and boulders, diameters 4-16 inches	38	85
Sand and gravel	19½	104½
Sand	½	105
Gravel, fine, water-bearing	3	108
Curbing: 42-inch to 5 ft.		
Well 12/2W-24B2		
C. P. Ruether. Altitude 470 ft. Drilled by C. D. Roberts, 1951.		
Clay	4	4
Clay and soft gravel	20	24
Gravel and sand, cemented	45	69
Clay, blue	1	70
Sand, coarse	2	72
Gravel, cemented, yellow	---	72+
Casing: 6-inch to 72 ft.		
Well 12/2W-25H1		
Charles Acord. Altitude 478 ft. Dug by owner.		
Topsoil	1	1
Clay, yellow	5	6
Clay, rusty, hard, and a few 1½-inch hard pebbles	18	24
Gravel	8	32
Cribbing: Brick, 72 by 60 inches, to 6 ft.		
Well 12/2W-27R1		
G. Frelich. Altitude 465 ft. Dug by owner, 1928.		
Clay	10	10
Gravel	5	15
Sand	12	27
Clay, blue	1	28
Sand and gravel, clean, packed, water-bearing	39	67
Curbing: 48-inch, concrete, to 10 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2W-28J1		
City of Winlock well 2. Altitude 365 ft. Drilled by C. King, 1932.		
Clay	25	25
Gravel, cemented; pebbles hard, cleaner toward bottom	---	---
Gravel and very coarse sand, clean, gray, water-bearing	---	60
Shale	200	260
Casing: 12-inch, perforated from 18 to 60 ft.		
Well 12/2W-28M1		
Bert Johnson. Altitude 404 ft. Drilled by C. D. Roberts, 1949.		
Topsoil	3	3
Clay, yellow-brown	52	55
Gravel, fine to medium, water-bearing	11	66
Casing: 6-inch to 60 ft; perforated.		
Well 12/2W-28R1		
City of Winlock well 1. Altitude 355 ft. Drilled by C. King, 1932.		
Clay	25	25
Gravel, cemented; pebbles hard, and cleaner toward bottom	---	----
Gravel and very coarse sand, clean, gray, water-bearing	---	55
Shale	---	55+
Casing: 8-inch to 55 ft; perforated.		
Well 12/2W-30G1		
Oscar Wedam. Altitude 460 ft. Drilled by Athey and Brewer, 1952.		
Clay, "shot"; "clam" shells	18	18
"Rock," soft, brown	2	20
"Sandrock" and silt, green	3	23
"Sandrock," green, water-bearing	122	145
"Sandrock," gray	5	150
"Sandrock," green, clay, and shells	25	175
"Sandrock," greenish-gray	3	178
Clay, sandy, green, and shells; water-bearing	9	187
"Rock," hard	2	189
Sand, gray	3	192
Sand, green, and shells	8	200
Sand, gray, water-bearing	5	205
Sand, green, clay and shells; static water level 35 ft	25	230
Sand and shells	17	247

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2W-30G1--Continued		
Clay	11	258
Sand	4	262
Clay	6	268
Sand	5	273
"Soapstone"	4	277
Sand	2	279
"Soapstone"	3	282
Sand, fine	15	297
Sandstone	2	299
Sand	11	310
Clay	4	314
Sand, green, water-bearing; static water level 22 ft	14	328

Casing: 8-inch to 29 ft. Pumping yield: 15 gpm when well was 230 ft deep, 30 gpm at final depth.

Well 12/2W-31B1

M. G. Perkins. Altitude 545 ft. Drilled by C. D. Roberts, 1952.

Material	Thickness (feet)	Depth (feet)
Clay, red, and gravel	100	100
Shale	12	112
Shale, sandy, water-bearing; static water level 30 ft	28	140
Clay, sticky, black and gray, with streaks of coal and petrified wood	50	190
Clay, sticky, gray; hard drilling	17	207

Casing: 6-inch to 126 ft.

Well 12/2W-31C1

Felix Anderson. Altitude 640 ft.

Material	Thickness (feet)	Depth (feet)
Soil and clay	10	10
Siltstone, tuffaceous, gray	48	58
Siltstone, blue-black, hard (not basalt, according to owner)	92	150
Gravel, of same blue-black material, rounded pea to marble size; can be crushed between fingers	3	153

Casing: 6-inch to 125 ft.

Well 12/2W-32D1

Carl Maki. Altitude 495 ft. Dug by owner.

Material	Thickness (feet)	Depth (feet)
Clay, red, and rotten gravel	36	36
"Hardpan"	1	37
"Quicksand," white	6	43

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)

Well 12/2W-33B1

City of Winlock well 3. Altitude 320 ft. Dug; drilled by Charles King, 1932.

Material	Thickness (feet)	Depth (feet)
Clay	25	25
Gravel, cemented; pebbles harder and cleaner toward bottom	---	----
Gravel and very coarse sand; clean, gray, water-bearing	---	60
Shale	2	62

Original diameter 48 inches.
Casing: 28-inch to 60(?) ft; perforated from 45 to 60 ft.
Bottom 10 to 15 ft back-filled with boulders.

Well 12/2W-34F2

V. O. Harkins. Altitude 470 ft. Drilled by C. King, 1955.

Material	Thickness (feet)	Depth (feet)
Clay, yellow	86	86
Sand, gravel, and boulders, water-bearing	84	170
Shale	6	176

Casing: 8-inch to 171 ft; perforated.

Well 12/2W-34G1

Andrew Hinen. Altitude 475 ft. Drilled by C. D. Roberts, 1952.

Material	Thickness (feet)	Depth (feet)
Clay, red	10	10
Clay, yellow	30	40
Clay, yellow, and broken rock	30	70
Clay, sandy, and gravel	30	100
Gravel, coarse, and sand	20	120
Gravel and sand, water-bearing	5	125
Gravel and fine sand	5	130
Gravel, coarse, and sand; water-bearing	20	150
Gravel and cemented sand	10	160
Gravel and sand, water-bearing	25	185

Casing: 8-inch to 185 ft; perforated from 120 to 125 ft, 130 to 150 ft, and 160 to 178 ft.

Well 12/2W-35B2

Clayton Mickelson. Altitude 460 ft. Drilled by C. D. Roberts, 1953.

Material	Thickness (feet)	Depth (feet)
Clay, yellow, and gravel	60	60
Gravel, coarse, water-bearing	30	90
Gravel, cemented, water-bearing	15	105
Gravel, coarse, and sand; water-bearing; static water level 35 ft; bailed 40 gpm, dd 20 ft	14	119

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2W-35B2--Continued		
Sand, brown	21	140
Sand, brown, some fine gravel	10	150
Gravel, coarse	10	160
Casing: 8-inch to 160 ft; perforated from 90 to 117 ft.		
Well 12/2W-35G2		
Ralph Champ. Altitude 470 ft. Drilled by C. D. Roberts, 1953.		
Dug well	60	60
Gravel, cemented	50	110
Gravel, fine; water-bearing	7	117
Sand, fine; water-bearing	3	120
Gravel, medium to coarse	9	129
Casing: 8-inch to 129 ft.		
Well 12/2W-35H1		
Clayton Mickelson. Altitude 487 ft. Drilled by C. D. Roberts.		
Dug well; mostly clay	60	60
"Rock," broken	10	70
Clay and "soapstone"	45	115
Sand and "rock" (gravel?), some clay; water-bearing	15	130
Casing: 6-inch to 130 ft.		
Well 12/2W-35K1		
C. A. Graham. Altitude 460 ft. Dug by owner, 1915.		
Topsoil	3½	3½
Clay, red	26½	30
Gravel, weathered, and clay	15	45
Sand and gravel, water-bearing	3	48
Curbing: 48-inch, concrete, to 4 ft.		
Well 12/3W-8C1		
V. W. Shaklee. Altitude 283 ft. Dug, 1953.		
Clay and sand, mixed	24	24
"Quicksand"	3	27
Gravel, water-bearing	3	30
Casing: Tile, 30-inch to 27 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/3W-13F1		
John King. Altitude 518 ft. Drilled by Fox Bros., 1947.		
No record	---	50
Shale, gray, with shells	8	58
No record; water-bearing	---	----
No record	---	200
Sand	20	220
Casing: 6-inch to 55 ft.		
Well 12/3W-30Q1		
Louis Hill. Altitude 324 ft. Dug.		
Topsoil	1	1
Clay, yellow	15	16
Gravel, water-bearing	2	18
Shale	2	20
Casing: Tile 6-inch to 16 ft; 30-inch to 20 ft.		
Well 12/4W-12D2		
Boistfort Church. Altitude 267 ft. Drilled by C. D. Roberts.		
Soil, sandy loam, and clay	10	10
Sand and gravel	8	18
Clay, blue and yellow	32-	50
Shale	50	100
Casing: none.		
Well 12/4W-13M1		
George Alden. Altitude 330 ft. Drilled by O. Keto, 1952.		
Boulders	12	12
"Soapstone" (blue clay)	67	79
Gravel, fine	2	81
"Soapstone," hard	---	81+
Casing: 7-inch.		
Well 12/1-2E1		
William Hansen. Altitude 690 ft. Drilled by C. King.		
Clay and gravel	50	50
Gravel and boulders, cemented; some boulders very large	170	220
Sand and gravel, loose, water-bearing	28	248
Casing: 6-inch to 224 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/1-2N1		
E. H. Powell. Altitude 670 ft. Drilled by Richardson Drilling Co., 1952.		
Clay, red	8	8
Gravel, yellow clay, and boulders	69	77
"Hardpan"	5	82
Gravel, clay, and boulders	117	199
Gravel and clay	27	226
Gravel and clay, with streaks of water-bearing sand; bailed 40 gpm, dd 2 ft	9	235
Gravel and clay, yellow	6	241
Casing: 12-inch to 241 ft; perforated from 215 to 235 ft.		
Well 12/1-8P2		
Dr. J. A. Kehoe. Altitude 519 ft. Drilled by A. P. Graf and O. Keto, 1951.		
Dug well; static level 85 ft	85	85
Sand and gravel, water-bearing	12	97
"Hardpan," and a little blue clay	6	103
Sand, gray, and fine gravel, coarser toward bottom; water-bearing	9	112
Casing: 8-inch to 112 ft; perforated from 85 to 112 ft.		
Well 12/1-8Q2		
J. C. Nelson. Altitude 526 ft. Drilled by C. D. Roberts, 1955.		
Topsoil	2	2
Clay, yellow	6	8
Gravel and boulders, cemented	26	34
Gravel and sand, cemented	60	94
Gravel and sand; water	13	107
Sand, fine, and big gravel; water	5	112
Gravel, coarse	13	125
Sand, "heaving," and big gravel	6	131
Sand	6	137
Gravel, "fist-size," reddish	4	141
Casing: 8-inch to 141 ft; perforated from 94 to 107 ft, and from 111 to 125 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued.

Material	Thickness (feet)	Depth (feet)
Well 12/1-9Q1		
C. E. Farr. Altitude 572 ft. Dug, 1935(?).		
Clay, red	12	12
Gravel, cemented, hard, but decomposed	58	70
Sand, water-bearing; does not keep water in summer. (Original bottom of well)	3±	73
Gravel, cemented	70	143
Curbing: Concrete to 14 ft.		
Well 12/1-10P1		
Earl Kerr. Altitude 598 ft. Dug by owner, 1930.		
Clay	8	8
Gravel	2	10
Gravel, hard, tightly cemented; a little water at 63 ft	130	140
Cobbles and boulders, stacked; no sand or clay boulders to 12 inches in diameter	5	145
Gravel, hard, tight; water rose slightly	13	158
Sand, gray(?)	---	158+
Curbing: Concrete, 42-inch, to 13 ft.		
Well 12/1-12P1		
S. G. DeGross. Altitude 565 ft. Drilled by C. King and W. Price, 1930 and 1952.		
Soil	6	6
Gravel and cobbles, fresh, cemented; boulders toward base; water at 40 and 78 ft	72	78
Shale, blue-gray, some small pebbles, fine sand, "bentonite;" and variegated clay in lower part of section	122	200
Same as above, with sand and carbonized wood; some water	143	343
Sand, white, gritty, and yellow-gray soft gravel	2	345
Gravel, fine and clean sand	12	357
Casing: 4-inch to 357 ft; perforated from 337 to 357 ft.		
Well 12/1-13B1		
Owen Merry. Altitude 558 ft. Drilled by W. Price, 1955.		
Topsoil	6	6
Clay, yellow, gravel, and boulders, slightly cemented; bailed 2 gpm at 48 ft; static water level 23½ ft	67	73
Boulders	27	100
Siltstone, blue; lenses of fine gravel less than ½ ft thick, 1-5 ft apart; water below 150 ft; at 150 ft static water level dropped to 80 ft	70	170
Casing: 6-inch to 170 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/1-13D2		
W. P. Althauser. Altitude 549 ft. Drilled by W. Price, 1953.		
Dirt	3	3
Dirt and gravel; water enough to drill with at 85 ft	119	122
Sand, brown	4	126
Gravel and dirt	24	150
Gravel, clean, water-bearing	6	156
Casing: 6-inch to 155 ft.		
Well 12/1-13N1		
William Spath. Altitude 433 ft. Drilled by W. Price.		
Gravel, mostly cemented, water-bearing	100	100
Sand, fine, loose, gray	15	115
Sand, fine, firm, or gray sandy clay; a little hard from 160-170 ft	60	175
Sand, "runny," blue, water-bearing	5	180
Sand, fine, firm, gray	20	200
Wood, "coaly," brown-black, soft	15	215
Clay or shale, gray	25	240
Clay, blue	40	280
Basalt	4	284
Clay, blue	---	----
Casing: 6-inch to 115 ft.		
Well 12/1-14H1		
Leo Kaiser. Altitude 535 ft. Drilled by W. Price, 1952.		
Topsoil	5	5
Rock and gravel, loose	5	10
Silt	25	35
Gravel	100	135
Sand	15	150
Shale, blue, muddy	10	160
Sand and gravel	2	162
Casing: 6-inch to 162 ft.		
Well 12/1-15J1		
P. J. Harms. Altitude 483 ft. Drilled by C. D. Roberts, 1947.		
Clay, yellow	30	30
Clay, yellow, and gravel, mixed	15	45
Gravel and small boulders, cemented	15	60

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/1-15J1--Continued		
Gravel and sand, cemented	85	145
Shale, blue	20	165
Shale, sandy, water-bearing	8	173

Casing: 6-inch to 173 ft.

Well 12/1-17N1

W. J. Coutts. Altitude 500 ft. Drilled by W. Price, 1951.

Material	Thickness (feet)	Depth (feet)
Clay	20	20
Gravel, cemented; seepage	60	80
Gravel, loose, water-bearing	40	120

Casing: 12-inch to 120 ft; perforated from 96 to 116 ft.

Well 12/2-4K1

W. H. Wilson. Altitude 685 ft. Drilled by Richardson Drilling Co., 1951-52.

Material	Thickness (feet)	Depth (feet)
Topsoil and clay	7	7
"Hardpan"	34	41
Clay, yellow, sand, and gravel	7	48
"Hardpan," boulders; water partly shut off at 87 ft, shut off completely at 96 ft	73	121
Clay, brown, and gravel	9	130
"Hardpan"; water at 182 and 207 ft; yield 5 gpm	94	224
Clay, brown	11	235
Clay, blue	7	242
Clay, blue, and gravel; yield 5 gpm	8	250
"Hardpan," blue, with yellow clay streaks	20	270

Casing:. 10-inch to 122 ft; perforated from 35 to 108 ft. Plugged at 127 ft.

Well 12/2-4P2

Elmer Powell. Altitude 680 ft. Drilled by W. Price, 1954.

Material	Thickness (feet)	Depth (feet)
Boulders and gravel, cemented	170	170
Sand and mud	50	220
Clay, blue	20	240
Shale	---	----

Casing: 6-inch to 240 ft; 20 ft of perforations.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2-9A1		
William Ludwig. Altitude 450 ft. Drilled by W. Price, 1955.		
Gravel and dirt, loose	35	35
Gravel, loose, water-bearing	5	40
Shale, blue	8	48
Gravel, cemented	15	63
Sand, cemented	11	74
Gravel, cemented	8	82
Sand, cemented	3	85
Gravel and sand, cemented	5	90
Gravel, cemented	10	100
Gravel and sand, cemented	10	110
Casing: 8-inch. Total yield 48-110-ft interval, 50 gpm.		
Well 12/2-11A1		
E. Sweet. Altitude 605 ft. Drilled by W. Price, 1953.		
Dirt	11	11
Gravel	17	28
Sand, brown	7	35
Shale, blue, and gravel	20	55
Shale, muddy	10	65
"Rock" (basalt)	20	85
Rock, red, and cinders	21	106
Rock, blue, hard	30	136
Rock, black	4	140
Rock, red	15	155
Rock, black	17	172
Rock, red	19	191
Rock, black	13	204
Rock, red, and shale	16	220
Rock, blue, hard	6	226
Rock, black	9	235
Rock, red	15	250
Rock, black	31	281
Rock, red	5	286
Rock and shale	4	290
Rock and gravel; water, 10 gpm	5	295
Rock, black	10	305
Rock, red	5	310
Rock, black, hard	8	318
Rock, gray	7	325
Rock, red	7	332
Rock, gray, hard	3	335
Rock, red, sandy, soft	7	342

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2-11A1--Continued		
Rock, red, coarse	11	353
Shale, blue	7	360
Rock, red, water-bearing; bailed 42 gpm	5	365
Rock, black	5	370

Casing: 12-inch.

Well 12/2-13B1

N. A. Aldrich. Altitude 621 ft. Drilled by W. Price, 1953.

Material	Thickness (feet)	Depth (feet)
Topsoil	5	5
Mud and gravel	75	80
Gravel, loose	5	85
Gravel, cemented	5	90
Gravel, water-bearing	30	120
Sand, water-bearing	2	122

Casing: 8-inch to 122 ft; perforated from 97 to 117 ft; backfilled with gravel to 117 ft.

Well 12/2-14B1

E. W. Blaisdell. Altitude 582 ft. Drilled by Richardson Drilling Co., 1951.

Material	Thickness (feet)	Depth (feet)
Topsoil	4	4
Clay, brown	3	7
Clay, yellow, and gravel	8	15
"Hardpan"	47	62
Clay, sand, and gravel	3	65
Sand and gravel; static water level 59 ft	2	67
"Hardpan"; water shut off	3	70
Clay, coarse sand, and gravel	3	73
Sand, coarse, and gravel, fairly loose. Yield 25 gpm at 76 ft	7	80
Clay, brown	6	86
"Hardpan"	18	104
Sand and fine gravel; water rose	1	105
"Hardpan"	7	112
Clay, yellow, and gravel	8	120
"Hardpan"	8	128
Gravel, sand, and clay	5	133
Sand, fine, and loose gravel	3	136
"Hardpan"	7	143
Clay, blue, with streaks of fine sand	77	220
Clay, gravel, and some shale	2	222
Clay, blue, with streaks of fine sand	13	235
Sand, fine, and clay	12	247
Clay, blue, with streaks of sand	68	315
Clay, blue	7	322

Casing: 10-inch to 320 ft; perforated from 65 to 132 ft, and from 139 to 143 ft. Pumping yield: 375 gpm at 322 feet, but pumped sand; 250 gpm after plugging well at 144 feet.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2-16A1		
Rudy Pries. Altitude 465 ft. Drilled by W. Price, 1953.		
Dirt and clay	12	12
"Rock" (basalt)	15	27
Rock, red, with a little water; 5 gph at 30 ft	9	36
Rock and shale, brown; 7 gph at 45 ft	9	45
Rock, dirt, and brown sand	23	68
Rock, red	4	72
Shale, brown	8	80
Rock, red	15	95
Shale, sandy, brown	10	105
Rock, black	5	110
Rock, blue	40	150
Casing: 6-inch to 22 ft.		
Well 12/2-17G1		
Ray Huntting. Altitude 665 ft. Drilled by C. D. Roberts, 1944.		
No record	---	----
Gravel, cemented	---	60
Gravel	20	80
No record; water-bearing	60	140
"Rock"	40	180
Sand, dry; lost water	---	180+
Casing: 6-inch to 140 ft; perforated from 80 to 130 ft. Plugged well at 150 ft.		
Well 12/2-17J1		
R. W. Rigg. Altitude 680 ft. Drilled by C. D. Roberts, 1948.		
Topsoil	2	2
Clay, yellow, and gravel	38	40
Gravel and boulders, cemented	220	260
Sand and gravel, water-bearing	18	278
Casing: 8- and 6-inch, set to 278 ft.		
Well 12/2-17L1		
Walter Sears. Altitude 667 ft. Drilled by W. Price, 1954.		
Dug well	63	63
Sand and gravel, cemented	107	170
Gravel, loose, water-bearing	4	174
Casing: 6-inch to 174 ft; perforated from 170 to 174 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/2-20F1		
F. C. Marsh. Altitude 645 ft. Drilled by C. D. Roberts, 1955.		
"Rock," loose, "piled up" (no matrix); ranged from pebble to cobble size	20	20
Clay or "muck," blue; fairly fresh maple log at 23 ft	43	63
"Rock"; hard black rock containing pockets of "powdery" black material at 6 levels, and some water just above(?) each level; first such layer was 3-4 ft thick, at about 100 ft	160	223
"Red formation": water-bearing	14	237
Casing: 6-inch to 63 ft.		
Well 12/2-24A1		
K. Adams. Altitude 840 ft. Drilled by C. D. Roberts.		
Topsoil	1	1
Clay and gravel; water at base	17	18
"Rock," red, soft, becoming hard and jointed at 180 ft; water at 197 ft, very hard and red	179	197
Casing: 6-inch to 18 ft.		
Well 12/2-35F1		
N. F. Howard. Altitude 600 ft. Drilled by F. Galivan, 1951.		
Topsoil	10	10
Boulders in sandy matrix (semiconsolidated)	10-15	20-25
Gravel, cemented	70-75	95
Gravel, "river," water-bearing	2	97
Casing: 6-inch to 95 ft.		
Well 12/2-35G1		
Marvin Howard. Altitude 590 ft. Drilled by F. Galivan, 1947.		
Topsoil	10	10
Boulders in sandy matrix (semiconsolidated)	10	20
Gravel, cemented	36	56
Gravel, "river," water-bearing	2	58
Casing: 6-inch to 56 ft.		
Well 12/2-35G2		
Marvin Howard. Altitude 607 ft. Drilled by F. Galivan, 1951.		
Topsoil	10	10
Boulders in sandy matrix (semiconsolidated)	7	17
Gravel, cemented	19	36
Gravel, "river," water-bearing	2	38
Casing: 6-inch to 36 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/3-8C1		
Altitude 737 ft. Drilled by A. & M. Co., 1927.		
Soil, boulders, and gravel	12	12
Gravel and boulders, mixed with clay	27½	39½
"Hardpan"	2½	42
Sand, gravel, and boulders, cemented; "water sand" at 107 ft	69	111
Gravel, loose	5	116
Gravel, cemented	4	120
Sand, loose, coarse	2	122
Gravel and sand, cemented	14	136
Sand	1	137
Boulders, gravel and sand; loose; lost water	79	216
Sand, hard	9	225
Gravel, loose	1	226
Clay, sandy	9	235
Clay and sand	35	270
Sand, gravel, and clay; loose	22	292
Sand, "running," water-bearing	2	294
Sand, blue, "heaving"	9	303
Sand, black	35	338
Sand, blue, mixed with clay	45	383
Sand and clay	22	405
Sand, gravel, and boulders; loose	5	410
Sand, black, running	5	415
Sand and gravel, blue, loose	6	421
Boulder and gravel, loose	3	424
Sand and gravel	1	425
Boulders	2	427
Sand and clay	26	453
Clay, blue, some shale	16	469
Sand, loose	2	471
Gravel, coarse	3½	474½
Gravel and sand	5½	480
Clay and sand	6	486
Gravel	3	489
Clay and "loose shale" (silt?)	1	490
Sand and "quicksand"	12½	502½
Gravel and sand, loose	29½	532
Boulders, fine gravel, and black sand; loose	25	557
Rock, black	9	566
Rock, black and gray	16	582
Rock, black, gray, and brown	3	585
Well 12/3-16J1		
W. H. Bowen. Altitude 810 ft. Drilled by F. Galivan, 1945.		
Clay and gravel	18	18
"Granite," blue	88	106
"Rock," gray	5	111

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/3-16J1--Continued		
"Rock," red	5	116
"Rock," white	5	121
"Granite," blue	25	146
Sand, black, water-bearing	8	154
Casing: 6-inch to 18 ft.		
Well 12/3-18P1		
J. E. Swigart. Altitude 670 ft. Drilled by F. Galivan.		
Topsoil	2	2
Clay, brown	10	12
Gravel, cemented	105	117
Casing: 6-inch.		
Well 12/3-21A1		
W. H. Newton. Altitude 828 ft. Drilled by C. D. Roberts, 1949.		
Clay	20	20
Clay and gravel; water-bearing	30	50
Shale, hard, gray	50	100
Casing: 6-inch to 50 ft.		
Well 12/3-21G2		
C. Blankenship. Altitude 775 ft. Drilled by W. Price.		
Clay and rocks	22	22
"Granite," blue	62	84
"Granite," red	2	86
"Granite," blue, with 2 layers of red "granite"	164	250
Casing: 6-inch to 22 ft.		
Well 12/3-22D1		
Harry Belcher. Altitude 780 ft. Drilled by W. Price, 1951.		
Clay	45	45
"Granite"	127	172
Sand, black, water-bearing	18	190
Casing: 6-inch to 60 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 12/3-24C1		
W. O. Jackson. Altitude 530 ft. Drilled by F. Galivan.		
Topsoil	6	6
Gravel	37	43
"Soapstone," white	30	73
Gravel, water-bearing	3	76
Casing: 7-inch to 73 ft.		
Well 12/5-22A1		
John Hackney. Altitude 827 ft. Drilled by R. B. DeRemer, 1951.		
Clay and cemented pebbles of volcanic ash; layered	25	25
"Hardpan" (hard clay with pebbles)	6	31
Gravel, fine	5	36
Clay	16	52
Casing: 6-inch.		
Well 12/5-28A1		
Lawrence Goodwin. Altitude 775 ft. Drilled.		
Topsoil and clay; water at 13 ft	13	13
Gravel, dry	5	18
"Hardpan"	12	30
Sand and gravel, water-bearing	1	31
Casing: 6-inch.		
Well 12/5-28G1		
K. W. Barrett. Altitude 767 ft. Drilled by C. D. Roberts, 1943.		
Topsoil	4	4
Gravel, "hardpan"	2	6
Sand and gravel	4	10
"Hardpan"	25	35
Sand and gravel, water-bearing	4	39
Casing: 8-inch to 39 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/1W-1D1		
Ed Pfirter. Altitude 393 ft. Dug and jetted by owner, 1945.		
Topsoil	2	2
Clay	18	20
Gravel	4	24
Clay, dry, hard, blue-gray	100	124
Boulders or cobbles; water flowed at surface initially; carried bits of "charcoal"	--	124+
Casing: 21-inch tile, and 3-inch steel, set to 60 ft.		
Well 13/1W-2A1		
L. F. Miller. Altitude 388 ft. Drilled by King Bros., 1938.		
Topsoil	2	2
Clay	10	12
Gravel	2	14
Clay, dry "soapy," blue	73	87
Sand, dark; water	1	88
Casing: 6-inch to 44 ft.		
Well 13/1W-2G1		
Andrew Johnson. Altitude 375 ft. Dug by owner.		
Gravel, mostly	15	15
"Gumbo"	35	50
Gravel	1	51
Casing: 36-inch to 20 feet, 3-inch from 20 to 51 feet.		
Well 13/1W-5H2		
Carl Harmon. Altitude 558 ft. Drilled by E. King, 1954.		
Clay, blue; water at 30 ft	103	103
Gravel, fine, soft, yellow, and sand; water-bearing	5	108
Clay, blue	2	110
Casing: 6-inch; screened from 103 to 108(?) ft.		
Well 13/1W-9E1		
S. A. Connally. Altitude 578 ft. Dug by owner.		
Clay, red, and soft "pinshot" gravel	20	20
Gravel, coarser, harder, but thoroughly weathered; sand and clay, mixed	9	29
Curbing: 27-inch, cement to 8 ft, bricks to 29 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/1W-9N1		
J. J. Hendershot. Altitude 345 ft. Dug by S. A. Connally.		
Clay, blue	37	37
Sand, black, fine, in thin layers dipping about 45°; water-bearing. Branches of carbonized wood up to 2-3 inches in diam, encountered at 39 or 40 ft	8	45
Well 13/1W-11F1		
Ben Snyder. Altitude 412 ft. Drilled by C. D. Roberts, 1949.		
Topsoil	2	2
Clay(?)	15	17
Clay, blue; log at 100 ft	169	186
Well 13/1W-17H2		
Frank Hamilton. Altitude 305 ft. Drilled by E. King, 1954.		
Gravel, clay at top	28	28
Clay, blue	47	75
Sand, blue-gray, and wood	5	80
Clay, blue	60	140
Sand, a little, layered, and wood, yield 1 gpm	10	150
Clay, blue	--	---
Well 13/1W-18K1		
Inez Teitzel. Altitude 310 ft. Drilled by Continental Oil Co., 1955.		
Clay, yellow	40	40
Gravel and boulders	25	65
Shale and sandy shale with some interbedded sandstone	360	425
Sandstone	70	495
Shale and sandy shale	70	565
Casing: 5½-inch. Well plugged.		
Well 13/1W-18R1		
Inez Teitzel. Altitude 280 ft. Drilled by Continental Oil Co., 1955.		
Soil	5	5
Sand and clay, yellow, sticky, some gravel	10	15
Gravel, fairly coarse	5	20
Shale	5	25
Shale, sandy	10	35
Shale, firm, sandy	5	40
Shale, sandy	20	60

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/1W-18R1--Continued		
Shale, sandy, loose	40	100
Sand, firm, with wood	25	125
Sand, firm	45	170
Shale	15	185
Shale, sandy	5	190
Shale, tough	15	205
Shale	15	220
Shale, sandy	5	225
Shale, firm	40	265
Shale, sandy, green	75	340
Sandstone, soft	5	345
Coal and wood	5	350
No record; fresh water	5	355
No record	20	375
Shale, green	10	385
Shale, sandy; water-bearing	15	400
Sandstone; well flowing from 430-435	35	435
Shale, sandy	106	541
Sand(?), water-bearing	--	---

Casing: 5½-inch.
Note: Water-bearing at several levels

Well 13/1W-19D1

Harold Quick. Altitude 280 ft. Drilled by C. D. Roberts, 1946.

Material	Thickness (feet)	Depth (feet)
Clay, yellow, and boulders	30	30
Clay, blue	80	110
Sand, fine, with much mica, water-bearing	5	115

Casing: 8-inch to 115 ft.

Well 13/1W-19F2

Altitude 298 ft. Drilled by Continental Oil Co., 1955.

Material	Thickness (feet)	Depth (feet)
Boulders and clay	27	27
Shale, blue, alternate sticky and sandy	453	480
Sandstone, soft; slight amount of flowing water	7	487
Basalt(?), hard, light blue-gray; sample fragment was volcanic (vesicular?)	83	570
"Hard layers," with some pebbles of various volcanic rocks	250	820
"Softer material"	180+	1000+

Casing: 5½-inch to 86 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/1W-19G1		
Dr. Weldon Pascoe. Altitude 275 ft. Drilled by C. D. Roberts.		
Clay, yellow, some boulders	30	30
Clay, blue	30	60
Sand, with logs, water-bearing	10	70
Clay, blue	35	105
Sand, with logs; slight water seepage	5	110
Clay, blue	70	180
Sand	3	183
Clay, blue	17	200
Casing: 6-inch to 200 ft.		
Well 13/1W-19Q1		
Dr. L. G. Steck. Altitude 307 ft. Drilled by Richardson Drilling Co., 1951.		
Topsoil	4	4
Clay, yellow, and gravel	8	12
"Hardpan"	31	43
Sand, coarse, and gravel; water, tested 8 gpm	7	50
Clay, multi-colored	3	53
Clay, blue	15	68
Clay, blue, sandy	5	73
Sand	18	91
Clay, blue	97	188
Clay, multi-colored	44	232
Sand and water; yield 25 gpm; sand "heaved" 30 ft	4	236
Clay, blue	64	300
Sand, "heaving"	8	308
Clay, blue, sandy	12	320
Clay, multi-colored	44	364
Sand, dry, streaks of clay	18	382
Clay, multi-colored	74	456
Clay, sandy	11	467
Clay, multi-colored	71	538
Sand, gravel, and wood; pumped 12 hr at 100 gpm	2	540
Gravel and clay	6	546
Clay, sandy	5	551
"Hardpan"	41	592
Clay and gravel	7	599
Clay, multi-colored	34	633
Clay, blue, sandy	5	638
Clay, sandy, and shale; water-bearing; bailed 55 gpm, dd 75+ ft	4	642
Clay, blue, sticky	94	736
Clay, blue and gravel	2	738
Sand and gravel, water-bearing; pumped 126 gpm	2	740
Clay with streaks of sand and gravel, water-bearing; pumped 430 gpm	11	751
Casing: 12-inch to 751 ft; perforated from 738 to 751 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/1W-20C1		
Ted Teitzel. Altitude 280 ft. Drilled by Texas Oil Co., 1947.		
Gravel	--	---
Clay, blue	--	70
Sand, white, with bark and wood; water, under pressure	5	75
Casing: 4-inch to 75 ft. Well filled.		
Well 13/1W-28P1		
R. L. Wade. Altitude 360 ft. Drilled by King Bros., 1941 .		
Clay, yellow	4	4
Boulders and clay; some water-bearing sand at 16 ft	12	16
Clay, blue, some shale	100	116
Silt and much "block" wood, water-logged	16	132
Sand, dark; water, under pressure	3	135
Casing: 6-inch to 135 ft.		
Well 13/1W-29A1		
Harry Wulz. Altitude 438 ft. Drilled by Selburn-Washington Oil Co., 1952.		
Shale and rocks	74	74
Shale, blue, and rocks	37	111
Shale and rocks	62	173
Shale and gravel	100	273
Clay, blue	80	353
Shale, blue	30	383
Shale	118	501
Sand and shale; water under pressure	86	587
Sand and blue shale	277	864
Sand and shale	364	1,228
Shale, streaky	323	1,551
Shale, hard, streaky, and sand	218	1,769
No record	----	6,500
Casing: 13-inch to 515 ft; plugged at 515(?) ft. (water below is salty).		
Well 13/1W-29Q1		
Ed Wulz. Altitude 325 ft. Drilled by Wulz Bros., about 1928.		
Sand, clay, and gravel	20	20
Gravel, clean; "hardpan" at 22 ft	2	22
Clay, blue with some leaves and wood; log at 500± ft	511	533
Sand, "beach," medium-grained	5	538
Basalt(?), gray, hard	----	----
Casing: set to 90 ft; capped.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/1W-29R1		
J. E. Deniston. Altitude 347 ft. Drilled by King Bros., 1953.		
Gravel and boulders; a little clay on top; a little water at base	35	35
Clay, dark blue; a little sand	2	37
Clay, light blue	48	85
Sand, blue, and wood, water-bearing; yield 20-25 gpm	3	88
No record	7	95
Clay, light blue	35	130
Sand and wood; 10 gpm of water, static water level 2½ ft	2	132
Clay, trace of sand, slick, blue-green-gray; a little water, near 195 ft	83	215
Clay and sand, mixed, harder, blue-green-gray, water-bearing	10	225
Same, but softer, and loose sand	15	240
Sand, reddish, "grains of volcanic material," pumice, and pebbles; water-bearing; strong odor first few days	5	245
Clay, blue	5	250

Water barely flowed originally; pressure and yield increased for several weeks. Casing to 233 ft.

Material	Thickness (feet)	Depth (feet)
Well 13/1W-30A3		
F. B. Smith. Altitude 317 ft. Drilled by O. Keto, 1954(?).		
Clay, blue	34	34
Sand and gravel, water-bearing	3	37
Clay, blue	72	109
Sand, fine, "mushy," water-bearing; yield 1½ gpm	2	111
Clay, blue	197	308
Sand, hard, gray, water-bearing	5	313
Clay, blue	7	320

Casing: 6-inch to 308 ft.

Material	Thickness (feet)	Depth (feet)
Well 13/1W-31P4		
Clyde Moore. Altitude 502 ft. Drilled by C. D. Roberts, 1953.		
Clay, yellow, sticky	20	20
Gravel, cemented	20	40
Boulders, small, and gravel	7	47
Gravel, cemented, and clay	23	70
Gravel and sand, water-bearing	25	95
Gravel and sand, water-bearing	18	113
Gravel and sand, very tight, water-bearing	22	135
Gravel and sand, with some clay	3	138
Gravel and yellow clay, mixed	5	143
Clay, blue	3	146

Casing: 8-inch to 146 ft; perforated.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/1W-32A1		
Lucian Hamilton. Altitude 335 ft. Drilled by C. D. Roberts.		
Boulders	20	20
Clay, blue	97	117
Sand, some water	8	125
Clay, blue	55	180
Sand, fine, blue-gray, water-bearing	10	190
Clay, blue	15	205
Casing: 6-inch to 180 (?) ft.		
Well 13/1W-33D1		
Jim Hamilton. Altitude 345 ft. Drilled by C. D. Roberts, 1944.		
Peat	3	3
Clay, sandy; several artesian water-bearing zones near 20 ft	62	65
Gravel, fine; water, under pressure	5	70
Casing: 6-inch.		
Well 13/1W-35A1		
L. S. Godsey. Altitude 418 ft. Drilled by E. King, 1955.		
Topsoil	2	2
Clay, yellow	4	6
Clay and boulders	34	40
Clay, blue	43	83
Sand; a little water	2	85
Clay, blue	74	159
Sand; a little water	2	161
Clay, blue	16	177
Sand, gray, and pumice pebbles; water, under pressure; odor initially	8	185
Casing: 6-inch to 178 ft.		
Well 13/1W-35B1		
Carden Qualls. Altitude 406 ft. Drilled by C. D. Roberts, 1950.		
No record	80	80
Sand; water rose to surface	2	82
Clay, blue	98	180
Sand(?), fern leaves, and bark; water-bearing, static water level about 12 ft above land surface	3	183
Casing: 6-inch to 183 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/1W-35M1		
Paige Twiss. Altitude 450 ft. Drilled by C. D. Roberts, 1949.		
Gravel	20	20
Clay, blue	60	80
Gravel, water-bearing	8	88
Casing: 6-inch to 88 ft.		
Well 13/1W-35M2		
Paige Twiss. Altitude 443 ft. Drilled by C. D. Roberts, 1950.		
Topsoil	2	2
Clay, blue	73	75
Gravel	3	78
Casing: 6-inch to 78 ft.		
Well 13/2W-2J2		
J. P. Balsom. Altitude 320 ft. Drilled by Roberts and King. (Owner's memory log.)		
No record	---	---
Clay, blue	---	105
"Quicksand"; water flowed at surface	35	140
No record	20	160
Clay, blue	50	210
Sand(?)	---	---
Casing: 6-inch to 175 ft.		
Well 13/2W-3A1		
R. W. Kennicott. Altitude 525 ft. Drilled by C. D. Roberts, 1945.		
Topsoil	4	4
Clay, yellow, with badly weathered gravel	146	150
Sand, coarse, and some fine gravel; water-bearing	5	155
Clay, blue, hard, sandy. Cedar log at 230 ft	75	230
Casing: 6-inch to 150 ft.		
Well 13/2W-3G2		
Northwest Lumber Co. Altitude 527 ft. Drilled by C. D. Roberts, 1954(?).		
Topsoil	1	1
Clay, yellow	49	50
Clay, yellow, and soft gravel	21	71
Clay, yellow, gravel, and some sand; a little water	49	120

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-3G2--Continued		
Sand, gray, and some gravel; water-bearing	20	140
Sand, white, and some gravel; water-bearing	4	144
Sand, coarse, and gravel; water-bearing	8	152
Sand, yellow	3	155
Clay, blue	2	157

Casing: 6-inch.

Well 13/2W-4P1

City of Chehalis, test well 4. Altitude 189 ft.

Material	Thickness (feet)	Depth (feet)
Clay and loam	5	5
Clay	3	8
Gravel, coarse	20	28
Gravel,fine, and sand	4	32
Boulders and gravel	10	42
Clay, silty	63	105
Silt, sandy, and wood	10	115
Sand, coarse, and fine gravel; water-bearing	34	149
Clay, plastic	27	176
Silt and wood	11	187
Clay, plastic	22	209
Clay and silt	11	220
Clay, plastic	42	262

Casing: 4-inch to 50(?) ft.

Well 13/2W-5B1

City of Chehalis, test well 2. Altitude 175 ft.

Material	Thickness (feet)	Depth (feet)
Clay and loam	8	8
Gravel, coarse and fine	31	39
Clay, silty	8	47
Sand and silt	4	51
Sand, clay and wood	10	61
Clay, silty and wood	11	72
Clay, silty, very plastic	26	98
Silt, water-bearing	3	101
Clay, plastic	29	130
Clay, friable	14	144
Clay, sandy	56	200
Clay and sand, abrasive	48	248
Sandstone, medium-hard	104	352
Clay and silt	44	396

Casing: 4-inch to 50(?) ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-5H1		
City of Chehalis, test well. Altitude 183 ft. Drilled by N. C. Jannsen, 1953.		
Clay and boulders	10	10
Sand and gravel	13	23
Gravel, loose, water-bearing	16	39
Clay	53	92
Clay, some gravel	3	95
Sand with gravel; water	13	108
Clay, wood	17	125
Clay	59	184
Clay, with wood, sand, gravel	71	255
Clay, some sand and gravel	35	290
Sand and gravel; water	24	314
Clay, sandy	8	322
Casing: 12-inch to 295 ft, 8-inch to 322 ft; perforated from 23 to 39 ft, 96 to 106 ft, and 295 to 315 ft.		
Well 13/2W-5H2		
City of Chehalis, test well 1. Altitude 182 ft.		
Fill material	3	3
Clay and loam	9	12
Gravel, fine	9	21
Gravel, coarse	23	44
Clay, silty, plastic	30	74
Wood	1	75
Clay, silty	17	92
Clay, sandy	8	100
Gravel and coarse sand, with wood; water-bearing	16	116
Silt, wood	4	120
Clay, medium plastic	17	137
Clay, silty, wood	51	188
Gravel and coarse sand	1	189
Clay, hard, plastic	93	282
Gravel and coarse sand, with wood; water-bearing	19	301
Clay and silt	44	345
Gravel, fine	21	366
Clay, hard and plastic, and silt	42	408
Casing: 4-inch to 50(?) ft.		

Table 3.--Logs of wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-5J1		
City of Chehalis, test well 3. Altitude 185 ft.		
Clay and loam	11	11
Gravel and sand	19	30
Clay, gravel, and wood	11	41
Clay, silty, friable	12	53
Clay, plastic	21	74
Clay, silty	31	105
Clay and sand	6	111
Sand, coarse, water-bearing	8	119
Clay, silty	22	141
Clay, sandy	28	169
Clay, plastic	20	189
Clay, silty, friable	42	231
Sand, coarse, water-bearing	20	251
Clay, silty	80	331
Silt	12	343
Clay, sandy	39	382
Sandstone, hard, abrasive	27	409
Casing: 4-inch to 40 or 50 ft.		
Well 13/2W-7H3		
J. F. Thomas. Altitude 380 ft. Dug by owner, 1940		
Topsoil	4	4
Clay, sand, and weathered gravel	28	32
Gravel, weathered, some sandy clay; smooth cobbles 2-6 inches in diameter dispersed throughout	6	38
Curbing: 48-inch, concrete, to 6 ft.		
Well 13/2W-7J3		
J. H. Jones. Altitude 393 ft. Dug by A. Jewell.		
Topsoil	3	3
Clay, blue	29	32
Clay, yellow, and weathered gravel	5	37
Consolidated material, fine, with a talc-like feel	16	53
Casing: 42-75 inch, concrete, to 17 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-8E2		
--- Bradshaw. Altitude 355 ft. Drilled by C. D. Roberts, 1946.		
Boulders and clay	11	11
Boulders	6	17
Sand	2	19
Clay, variegated	32	51
Clay, blue and brown	31	82
Clay, (blue?)	5	87
Sand, coarse, gray, water-bearing	10	97
Casing: 8-inch to 97 ft.		
Well 13/2W-8L1		
Art Dahl. Altitude 260 ft.		
Soil	3	3
Clay, yellow	12	15
Clay, blue	15	30
Sand and wood, fine gravel at base; water-bearing	7	37
Clay, sandy, blue	63	100
Sand, wood, and fine gravel; water at base	50	150
Clay, blue, and layered sand	200	350
Casing: 4-inch to 88 ft.		
Well 13/2W-9E1		
W. J. Schwartz. Altitude 193 ft. Dug by owner, 1946.		
Topsoil	1	1
Clay	9	10
Sand	2	12
Gravel, water-bearing	13	25
Curbing: 36-inch, concrete.		
Well 13/2W-9P1		
Harry Hail. Altitude 200 ft. Drilled by C. D. Roberts, 1952.		
Gravel	20	20
Clay	15	35
Sand and gravel, water-bearing	2	37
Casing: 6-inch to 35 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-10L1		
Ed Maurin. Altitude 230 ft. Drilled by J. L. McBride, 1952.		
"Rock" and gravel	42	42
Clay, blue	68	110
Sand, water-bearing	1	111
Clay, blue, sandy	24	135
Clay, blue	220	355
Boulder or hard formation, (basalt?)	---	----
Casing: 4-inch to 42 ft.		
Well 13/2W-10Q2		
Robert Butts. Altitude 242 ft. Drilled by King(?), 1946.		
Clay, gravelly, brown; water from 50 to 52 ft	52	52
Clay, blue, "roots" from 140 to 150 ft	108	160
Sand, some water	5	165
Clay, blue	---	----
Casing: 6-inch to 165 ft; perforated at about 150 ft.		
Well 13/2W-12F3		
C. R. Emison. Altitude 370 ft. Drilled by F. Galivan, 1951.		
Topsoil	2	2
Clay, yellow	38	40
Clay, blue, and some sand; wood at 100 ft and 150 ft	140	180
Casing: 6-inch to 180 ft.		
Well 13/2W-14N1		
Frank Hamilton. Altitude 228 ft. Drilled by J. L. McBride, 1952.		
Topsoil	6	6
Gravel	51	57
Clay; occasional layers of black sand (2 to 8 ft thick), gas, wood, and "coal" encountered at various levels; small artesian water-bearing zone at 95 ft	237	294
Sand; water, under pressure	1	295
Casing: 4-inch to 290 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-15K1		
S. C. Breen. Altitude 222 ft. Drilled by J. L. McBride, 1952.		
Topsoil	2	2
Clay, plastic, with iron-oxide stains	7	9
Gravel, medium to coarse (gray granite type)	14	23
Clay, friable, with traces of silt and dark wood; badly faulted from 180-195 ft	207	230
Silt, hard, with lenses of clay	9	239
Sand, fine, grayish, with some "heaving," water-bearing	12	251
Clay, plastic, grayish green	17	268
Sand, coarse, and fine gravel, with pieces of wood; water, under pressure	38	306
Casing: 6-inch to 33 ft.		
Well 13/2W-15M1		
Dennis Hamilton. Altitude 220 ft. Drilled by J. L. McBride, 1951.		
Topsoil, dark brown	3	3
Clay, silty, light brown	9	12
Gravel, fine to medium, water-bearing	26	38
Clay, plastic, gray-blue, with traces of wood	180	218
Clay, friable, with silty streaks	11	229
Sand, fine to coarse, dark gray, with wood "float"; water, under pressure	15	244
Casing: 6-inch to 212 ft. Well yielded sand and pieces of wood for first week.		
Well 13/2W-15N2		
Nathan Hamilton. Altitude 213 ft. Dug by owner.		
Topsoil	1	1
Clay, blue	4	5
Gravel, water-bearing	2	7
Clay, blue	10	17
Gravel, water-bearing	1	18
Casing: 48-inch to 16 ft.		
Well 13/2W-15R1		
Frank Hamilton. Altitude 248 ft. Drilled by McBride and King, 1951.		
Topsoil	6	6
Gravel	44	50
Clay, with layers of sand; water under pressure in sand at 95 ft	220	270
Sand; water, under pressure	30	300
Clay	135	435
Basalt	---	---
Casing: 4 and 3-inch, set to 260 ft. Wood particles and small amounts of gas encountered in clay 50-435 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-15R2		
Frank Hamilton. Altitude 225 ft. Drilled by McBride and King, 1952.		
Topsoil	5	5
Gravel	28	33
Clay; sand, with water under pressure, at 95 ft and 280 ft	367	400
Basalt	---	----
Casing: 6 and 4-inch, set to 290 ft.		
Well 13/2W-16F1		
Marvin Hamilton. Altitude 210 ft. Drilled by J. L. McBride, 1952.		
Topsoil	1	1
Clay, brown	3	4
Clay, brown, and weathered gravel	8	12
Clay, blue	130	142
Sand	3	145
Clay, blue	95	240
Sand; water, under pressure	20	260
Casing: 6-inch to 240 ft.		
Well 13/2W-16H1		
Mollie M. Hamilton. Altitude 211 ft. Drilled by C. F. King.		
Soil	5	5
Gravel	25	30
Clay, blue	178	208
Sand; water, under pressure	---	----
Casing: 6-inch to 196 ft.		
Well 13/2W-16J1		
Ralph Hearn. Altitude 214 ft. Drilled by C. D. Roberts, 1946.		
Gravel and boulders, cemented	28	28
Clay, blue	67	95
Clay, sandy, grading downward to "beach" sand; water, under pressure	10	105
Casing: 6-inch to 105 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-19R1		
Ed Milton. Altitude 345 ft. Dug by owner, 1951.		
Clay and gravel	10	10
Sand, "rock," and clay, alternating	23	33
"Rock" (boulders and cobbles), 1-5 inches in diam	2	35
Sand, yellow-brown; very little water	5	40
Curbing: 56 inches to 28 ft.		
Well 13/2W-21D3		
C. D. Roberts. Altitude 420 ft. Drilled by owner, 1948.		
Clay, red	3	3
Clay and weathered gravel	69	72
Sand and gravel, water-bearing	15	87
Gravel, cemented	28	115
Gravel, fine, yellow, water-bearing	10	125
Gravel and clay, cemented	15	140
Clay, blue	60	200
Casing: 6-inch to 140 ft.		
Well 13/2W-21E1		
Bonneville Power Admin. Altitude 432 ft. Drilled by O. B. Olson, 1940.		
Fill	4	4
Clay, yellow	60	64
Clay, sandy	16	80
Clay, blue	14	94
Clay, sandy	14	108
Clay, blue	19	127
Sand with clay	7	134
Sand with gravel, water-bearing	10	144
Sand, gravel, and clay, water-bearing	18	162
Sand and clay	4	166
Clay, blue	71	237
Clay, gray	17	254
Clay, blue	133	387
"Quicksand," water-bearing	5	392
Gravel, fine	13	405
"Quicksand," water-bearing	14	419
Clay, blue	69	488
Clay, black	10	498
Sand, black	24	522
Rock, hard, black	54	576
Clay	36	612
Casing: 10-inch to 262 ft, 8-inch to 550 ft; perforated from 144 to 154 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-21K2		
T. M. Balestra. Altitude 440 ft. Drilled by C. D. Roberts, 1953.		
Topsoil	2	2
Gravel, soft, and clay	53	55
Gravel and sand, water-bearing	25	80
Clay, yellow, with streaks of blue clay	54	134
Clay and gravel	5	139
Gravel and sand	21	160
Clay, yellow, sticky	15	175
Casing: 8-inch to 175 ft; perforated from 139 to 160 ft.		
Well 13/2W-21P1		
Don Hamilton. Altitude 420 ft. Drilled by J. L. McBride, 1951.		
Clay, silty	30	30
Gravel, medium to coarse (unconsolidated)	12	42
Gravel, coarse, sandy	16	58
Clay, gravelly, yellowish (till-like)	47	105
Clay, sandy	20	125
Gravel, medium; water under pressure	11	136
Basalt, broken, weathered	5	141
Basalt, unweathered	24	165
Casing: 6-inch to 145 ft; perforated from 123 to 143 ft.		
Well 13/2W-21R2		
J. C. Carlson. Altitude 441 ft. Drilled by C. D. Roberts, 1954.		
Topsoil	3	3
Clay, sticky, red	7	10
Clay, yellow	10	20
Gravel and clay, mixed, yellow	48	68
Gravel, cemented	2	70
Gravel and sand, water-bearing	10	80
Gravel and clay	7	87
Clay, yellow, with blue streaks	18	105
Sand; a little water	3	108
Clay and silt, mixed	31	139
Sand and gravel, "washed," water-bearing	16	155
Clay, yellow and blue	13	168
Casing: 8-inch to 168 ft; perforated from 70 to 80 ft and 140 to 155 ft.		

Table 3.-- Logs of selected wells in Lewis County.--Continued

Material	*Thickness (feet)*	*Depth (feet)*
Well 13/2W-22G1		
W. A. Wichert. Altitude 240 ft. Drilled by C. D. Roberts, 1949.		
Clay	6	6
Boulders and gravel	18	24
Gravel, cemented	4	28
Sand and some gravel, water-bearing	12	40
Clay, sandy, yellow	20	60
Clay, blue	40	100
Sand fine, gray, water-bearing	10	110
Clay, blue	20	130
Casing: 6-inch to 130 ft; perforated from 28 to 40 ft and 100 to 110 ft.		
Well 13/2W-26G3		
Charles Pederson. Altitude 285 ft. Drilled by O. Keto, 1953.		
Clay, red	30	30
Gravel, small; a little water	2	32
Clay, blue	106	138
Sand, gray, rather loose, water-bearing	---	---
Casing: 6-inch, set to 138 ft.		
Well 13/2W-26L1		
G. L. Milton. Altitude 315 ft. Drilled by C. D. Roberts, 1946.		
Clay, yellowish, with some "rock"; water-bearing gravel at 35 ft	35	35
Clay, blue	105	140
Sand, fine, water-bearing	20	160
Casing: 6-inch to 145 ft.		
Well 13/2W-26M2.		
J. L. Clement. Altitude 440 ft. Drilled by C. D. Roberts, 1947. (Owner's memory log.)		
Topsoil	2	2
Clay, red	43	45
Sandstone(?), blue	110	155
Sand, fine, water-bearing	5	160
Casing: 6-inch to 140 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-27Q2		
R. Q. Fudge. Altitude 442 ft. Dug by A. Jewell, 1950.		
Topsoil	2	2
Clay	5	7
Sandstone, gray, friable	6	13
Clay, yellowish, and "rocks," consolidated but friable; water at 24 ft and 34 ft	21	34
Casing: 44 and 52-inch, concrete, to 12 ft.		
Well 13/2W-27Q4		
F. L. Holmes. Altitude 439 ft. Drilled by C. D. Roberts, 1952.		
Clay, red	10	10
Clay, white, very sticky	10	20
Clay, yellow	2	22
Gravel and boulders	5	27
Gravel, cemented, with some sand	10	37
Gravel and some sand; water-bearing	8	45
Gravel, cemented	35	80
Sand and gravel, water-bearing	4	84
Casing: 6-inch to 84 ft.		
Well 13/2W-28A1		
J. C. Carlson. Altitude 440 ft. Drilled by C. D. Roberts, 1954.		
Topsoil	3	3
Clay, yellow	7	10
Clay, sticky, red	10	20
Clay, yellow, and gravel, mixed	53	73
Gravel, cemented	23	96
Clay, yellow	46	142
Gravel and sand, water-bearing	18	160
Clay, yellow	5	165
Clay, blue	10	175
Casing: 8-inch to 175 ft; perforated from 140 to 160 ft.		
Well 13/2W-28C1		
Don Hamilton. Altitude 414 ft. Drilled by J. L. McBride, 1951.		
Topsoil, reddish-brown	2	2
Clay, brown	10	12
Gravel, medium to coarse, contained soft, weathered "clay balls."	28	40
Clay, gravelly, yellowish, till-like	63	103
Sand, medium, sharp, water-bearing	11	114
Basalt, weathered	18	132
Casing: 6-inch to 132 ft; perforated from 100 to 116 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-31B1		
Nathan Creemer. Altitude 210 ft. Drilled by C. D. Roberts, 1948.		
Clay and gravel	5	5
Gravel and boulders	11	16
Clay, sandy	4	20
Clay, sandy, and shale	4	24
Shale; water at 30 ft	16	40
Casing: 12-inch to 20 ft.		
Well 13/2W-31C1		
Grover Mullins. Altitude 225 ft. Drilled by C. D. Roberts, 1947.		
Topsoil	6	6
Clay, yellow	14	20
Rock, broken	10	30
Shale	12	42
Sand, coarse, black, water-bearing	8	50
Casing: 6-inch to 50 ft.		
Well 13/2W-31R1		
Ed Haase. Altitude 405 ft. Drilled by C. D. Roberts, 1952.		
Clay, red	10	10
Clay, yellow, mixed with gravel	50	60
Gravel and sand, cemented	40	100
Gravel and clay, cemented	8	108
Boulders	2	110
"Rock," hard, gray, non-basaltic; upper 2 ft broken	4	114
Clay, blue	11	125
Shale, sandy, black	60	185
Shale, sandy, water-bearing	37	222
Casing: 8-inch to 113 ft, 6-inch to 222 ft; perforated from 186 to 222 ft.		
Well 13/2W-34A3		
Napavine. Altitude 444 ft. Drilled by C. D. Roberts, 1954.		
Clay, yellow	60	60
Gravel; water at several levels	41	101
Clay, blue	---	---
Casing: 8-inch to 101 ft, perforated.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-35B1		
D. A. Emerson. Altitude 447 ft. Drilled by C. D. Roberts, 1946.		
Topsoil	3	3
Clay, red, and gravel and sand, partly cemented; some water at 89 ft	87	90
Clay, blue	40	130
Sand, fine	9	139
Casing: 4-inch to 135 ft.		
Well 13/2W-35D3		
Paul Miller. Altitude 440 ft. Drilled by C. D. Roberts, 1953.		
Dug well	25	25
Clay, yellow, and soft gravel	15	40
Gravel, cemented	30	70
Sand and gravel, water-bearing	15	85
Casing: 6-inch to 85 ft.		
Well 13/2W-36N3		
J.D. Redwine. Altitude 468 ft. Drilled by C. D. Roberts, 1953.		
Topsoil, water-bearing	3	3
Clay, red, sticky	15	18
Clay, yellow, and decomposed gravel	10	28
Gravel and cobbles, cemented	4	32
Gravel and sand, cemented	15	47
Sand and gravel, water-bearing	16	63
Sand, fine, brown, water-bearing	5	68
Gravel, cemented, water-bearing	17	85
Sand, fine, brown, water-bearing	5	90
Gravel and sand, cemented	5	95
Gravel, coarse, and sand; water-bearing	2	97
Sand, fine, water-bearing	11	108
Gravel and some sand, water-bearing	9	117
Clay, yellow, and gravel	3	120
Casing: 8-inch to 120 ft; perforated from 50 to 60 ft, 70 to 81 ft, 93 to 95 ft, and 110 to 115 ft.		
Well 13/2W-36P1		
J. A. Peterson. Altitude 475 ft. Drilled by C. D. Roberts, 1950.		
Clay, red	20	20
Clay, yellow	13	33
Gravel, cemented	7	40
Gravel and sand, water-bearing	12	52

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/2W-36P1--Continued		
Gravel, cemented	6	58
Sand and gravel, water-bearing	22	80
Sand and gravel, cemented	21	101
Gravel and sand, water-bearing	22	123
Clay, blue	13	136

Casing: 6-inch to 136 ft; perforated from 60 to 80 ft, 95 to 107 ft, and 115 to 123 ft.

Well 13/2W-36Q1

William Eskeli. Altitude 455 ft. Drilled by O. Keto, 1953.

Material	Thickness (feet)	Depth (feet)
Clay	40	40
"Hardpan," gravel	15	55
Gravel and sand, loose, water-bearing	8	63

Casing: 6-inch to 63 ft.

Well 13/3W-1N1

Frederick Young. Altitude 190 ft. Drilled by C. D. Roberts, 1951.

Material	Thickness (feet)	Depth (feet)
"Loam"	39	39
Gravel	4	43
Shale (basalt?)	57	100
Shale, water-bearing	4	104

Casing: 6-inch to 50 ft.

Well 13/3W-2D1

Kenneth Walker. Altitude 283 ft. Drilled by C. King, 1945.

Material	Thickness (feet)	Depth (feet)
Soil	12	12
Basalt; joint from 42-45 ft	78	90
Sand, white, water-bearing	18	108

Casing: 6-inch to 40 ft.

Well 13/3W-2K1

Ted Spence. Altitude 190 ft. Drilled by F. Galivan.

Material	Thickness (feet)	Depth (feet)
Topsoil (and clay?)	---	---
Basalt	---	72
Sand and gravel, white, water-bearing	8	80
Sand, water-bearing	4	84
Gravel, water-bearing	14	98

Casing: 6-inch to 65 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/3W-2M1		
R. T. Coie. Altitude 254 ft. Drilled by C. King, 1946.		
No record	35	35
Basalt, dense, black	68	103
Sand, white, water-bearing	19	122
Casing: 6-inch to about 60 ft.		
Well 13/3W-2M3		
Jerry Peters. Altitude 240 ft. Drilled by F. Galivan, 1951.		
Topsoil	10	10
Basalt	80	90
Sandstone; charred log directly under basalt	18	108
Sand, white, water-bearing	6	114
Casing: 6-inch to 25 ft.		
Well 13/3W-3A1		
Lester Finley. Altitude 240 ft. Drilled by C. King, about 1941.		
No record	40	40
Basalt	79	119
Rock, soft, water-bearing	11	130
Casing: 6-inch.		
Well 13/3W-3B2		
A. P. Erp. Altitude 240 ft. Drilled by O. Erdman, 1942.		
Soil, clayey; water at 16 ft	16	16
Sandstone	17	33
Shale, dark blue	32	65
"Softer material"; water-bearing	5	70
Hard formation	2	72
Casing: 6-inch to 32 ft.		
Well 13/3W-3R5		
J. E. Schwarz. Altitude 197 ft. Drilled by F. Galivan, 1952.		
Soil	4	4
Rock, solid (basalt)	56	60
Sand, white; water-bearing	15	75
Casing: 6-inch to about 60 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/3W-5G1		
C. L. Black. Altitude 205 ft. Drilled by F. Galivan, 1952.		
Soil, clayey	26	26
Clay, blue	4	30
Gravel, "river"	4	34
Clay or silt	---	----
Sandstone, water-bearing	---	168
Casing: 8-inch to 125 ft.		
Well 13/3W-7J2		
Arthur Anderson. Altitude 255 ft. Drilled by V. W. Athey, 1952.		
Clay	18	18
Rock, hard (basalt)	70	88
"Sandrock," black	7	95
"Sandrock," green; yield 7 gpm at 135 ft	62	157
"Sandrock," gray; yield 12 gpm at 160 ft	3	160
Casing: 6-inch to 24 ft.		
Well 13/3W-8G2		
Tanksley. Altitude 238 ft. Drilled by F. Galivan, 1949.		
Clay, red	25	25
Rock (basalt)	85	110
Gravel, water-bearing	40	150
Casing: 6-inch to 25 ft.		
Well 13/3W-8G3		
Earl Anderson. Altitude 240 ft. Drilled by F. Galivan, 1946.		
"Dirt" and blue sandstone	48	48
Rock (basalt)	85	133
"Dirt," and sandstone or gravel, water-bearing	39	172
Casing: 6-inch to 48 ft.		
Well 13/3W-8K1		
C. A. Lindstedt. Altitude 240 ft. Drilled by V. W. Athey, 1952.		
Soil, clayey	18	18
Rock, black (basalt)	69	87
Sandstone, gray	25	112
Sand, dark green	63	175
Casing: 6-inch to 36 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/3W-9G4		
Art Scherer. Altitude 185 ft. Bored by owner, 1947.		
Topsoil	6	6
Sandy formation, water-bearing	28	34
"Hardpan"	2	36
Gravel, water-bearing	1	37
Casing: 10-inch tile to 37 ft.		
Well 13/3W-12D1		
F. L. Young. Altitude 240 ft. Drilled by C. D. Roberts, 1944.		
Gravel, weathered	80	80
Gravel, weathered, water-bearing	10	90
Rock, very hard (basalt)	20	110
Clay, blue	40	150
Casing: 6-inch to 90 ft.		
Well 13/3W-30P1		
Harry Fenn. Altitude 239 ft. Drilled by C. King, 1946.		
Soil, clayey	12	12
Shale, blue	88	100
Sandstone, soft, brown; water at about 165 ft	65	165
Sand, black; water-bearing(?)	47	212
Casing: 6-inch to 30 ft.		
Well 13/4W-3L1		
C. Christin. Altitude 260 ft. Drilled by C. Frye.		
Loam, sandy	12	12
"Hardpan," (gravel)	15	27
Clay, blue	38	65
Sandstone, water-bearing	16	81
Casing: 8-inch.		
Well 13/4W-6P1		
L. J. Dokter. Altitude 285 ft. Drilled by O. Keto, 1952.		
Topsoil	4	4
Gravel	10	14
Sandstone	35	49
Clay, black	7	56
Casing: 6-inch to 56 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/4W-8C1		
Mayne Perry. Altitude 278 ft. Dug by owner.		
Topsoil	4	4
Gravel, fine	4	8
Boulders	8	16
Sandstone	8	24
Gravel, water-bearing	1	25
Casing: 30-inch, concrete, to 25 ft.		
Well 13/1-14E1		
L. R. Temple. Altitude 855 ft. Drilled by O. Keto, 1953.		
Clay, red	30	30
Clay, red, with some soft gravel; 10 gpm at 118 ft	88	118
Clay, sandy, red, with some gravel	152	270
Sand, hard, gray	5	275
Clay, blue	50	325
Gravel, fine, water-bearing	5	330
Casing: 6-inch to 276 ft; perforated from 125 to 140 ft and at bottom.		
Well 13/1-14R1		
Martin Jacobson. Altitude 665 ft. Drilled by C. D. Roberts, 1945.		
Topsoil	6	6
Gravel, rock, clay; rusty water at 16 ft	20	26
No record	10	36
Sand, white, water-bearing	14	50
Clay, blue	---	---
Casing: 6-inch to 40 ft.		
Well 13/1-17R1		
Gordon Lundeen. Altitude 732 ft. Drilled by O. Keto, 1953.		
Clay(?)	70	70
Sand and gravel, water at 73 ft and below	63	133
Clay, blue	27	160
Casing: 6-inch to 125 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/1-19K2		
R. R. Szelap. Altitude 690 ft. Drilled by C. D. Roberts, 1952.		
Clay, yellow	25	25
Clay and small boulders	12	37
Gravel and broken rock, mixed	31	68
Gravel and sand, cemented	34	102
"Sandrock," blue, water-bearing	18	120
Gravel and sand, mixed with clay	3	123
Sand and gravel, packed	5	128
Sand and gravel, "washed," water-bearing	30	158
Gravel and coarse sand	4	162
"Open pocket" (sand?)	6	168
Sand	14	182
Clay, blue	2	184

Casing: 10-inch to 158 ft, perforated from 107 to 115 ft, and 128 to 155 ft; 6-inch from 0 t 182 ft, perforated from 142 to 182 ft.

Material	Thickness (feet)	Depth (feet)
Well 13/1-20F2		
M. F. Clark. Altitude 695 ft. Drilled by E. King, 1955.		
Clay, reddish-yellow, and some rocks; a little water at about 35 ft	35	35
Clay, gravel, and boulders; static water level 155 ft at 185-ft depth	150	185
Clay, blue; wood and pumice pebbles	40	225
Sand, fine, a little wood; pumped 30 gpm with a little sand	2	227
Clay, blue; wood and pumice pebbles	8	235
Clay with thin beds of sand and fragments of wood and pumice; yield 100 gpm	28	263
Clay, a little wood	32	295
Sand, very fine, reddish, with some wood	1½	296½
Clay	4	300½
Sand	3½	304
Clay, sandy, soft, blue	21	325
Same, but sandier	1	326
Clay, blue, with red-brown streaks; static water level 170 ft in zone from 330 to 405 ft	79	405

Casing: to 234 ft, open bottom.

Material	Thickness (feet)	Depth (feet)
Well 13/1-22R1		
C. E. Greene. Altitude 600 ft. Drilled by F. Galivan, 1952-53.		
Topsoil, dirt, gravel	12½	12½
Gravel, cemented, and sand; water at about 30 ft	47½	60
Sand, coarse, with some small gravel	4	64
Clay, blue, a little sticky, with wood	83	147

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/1-22R1--Continued		
Hard material	3	150
Sand, fine to medium "granite color" (black and white grains) water under pressure (originally flowed 300 gpm)	---	---

Casing: 8-inch, set to 67 ft, perforated from 50 to 60 ft, casing removed a week later as water leaked up around casing; 8-inch unperforated casing set to 150 ft.

Well 13/1-22R2

C. E. Greene. Altitude 600 ft. Drilled by C. King, 1953.

Material	Thickness (feet)	Depth (feet)
Surface dirt	2	2
Gravel and boulders, cemented	16	18
Sand and clay, muddy, blue, water-bearing	17	35
Clay, brown, and wood	55	90
Clay, blue, gray-white streaks (pumice?)	30	120
Sand, blue, and wood; water	2	122
Clay, blue	23	145
Sand, blue, and black wood, water-bearing	5	150

Casing: 8-inch to 113 ft.

Well 13/1-26R1

Wiley Rhodes. Altitude 960 ft. Dug by owner, 1940.

Material	Thickness (feet)	Depth (feet)
Dirt and rocks	20	20
Gravel, cemented	6	26
Gravel, blue, yellow, and red; dirt	12	38

No water

Well 13/1-30C2

Palo Tade. Altitude 710 ft. Drilled by E. King, 1954.

Material	Thickness (feet)	Depth (feet)
Clay, yellow	90	90
Clay, yellow, sand, gravel, and boulders; some cemented, some water-bearing	110	200
Clay, blue	8	208

Casing: 8-inch to 200 ft, perforated from 130 to 195 ft.

Well 13/1-31P1

D. C. Jensen. Altitude 470 ft. Drilled by F. Galivan, 1953.

Material	Thickness (feet)	Depth (feet)
Gravel and clay; saturated	35	35
Clay, blue	88	123
Sand, blue-gray; water under pressure	5	128

Casing: 6-inch to 90 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)

Well 13/1-32B1

C. A. Jorgensen. Altitude 505 ft. Drilled by E. King, 1955.

Material	Thickness (feet)	Depth (feet)
Mud, sandy, blue	13	13
Clay, blue	47	60
Wood	2	62
Clay, blue	60	122
Clay, blue; includes a water-bearing sand layer (water under pressure)	8	130
Clay, blue	---	---

Casing: 6-inch to 122 ft.

Well 13/1-32C1

Orville Day and Ralph Sawyer. Altitude 500 ft. Drilled by F. Galivan, 1952.

Material	Thickness (feet)	Depth (feet)
Gravel, boulders, and dirt	12	12
Clay, blue, sticky	40	52
Gravel, fine, and coarse sand. Weathered volcanic and granitic water-worn pebbles. Pumice pebbles. Water-bearing	---	---

Casing: 6-inch to about 52 ft.

Well 13/1-32M2

Ed Guiberson. Altitude 485 ft. Drilled by E. King, 1955.

Material	Thickness (feet)	Depth (feet)
Clay, gravel, and sand, reddish; yield 5 gpm	45	45
Clay, blue: water at 125 ft under pressure	80	125
Clay, blue-gray	85	210

Casing: 6-inch to 108 ft.

Well 13/1-35F2

J. F. Simpson. Altitude 807 ft. Drilled by C. Rubey, 1955.

Material	Thickness (feet)	Depth (feet)
Clay, "rusty"	48	48
Clay, sand, gravel, and boulders; loose	30	78
Gravel, cemented; cleaner at bottom. Sample from base showed dense and coarse varicolored volcanic small pebbles, generally subrounded to subangular, but polished	42	120

Casing: 6-inch to 114 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 13/4-33R1		
H. M. Justice. Altitude 920 ft. Dug by owner, 1953.		
Clay, gravel, and sand	8	8
Clay, blue	19	27
Sand and gravel, water-bearing	1	28
Gravel, clean, dark, water-bearing	2	30
Clay, blue, soft, sticky	1	31
Casing: 18-inch tile.		
Well 14/1W-7N1		
Matt Beck. Altitude 240 ft. Drilled by King Bros., 1930.		
No record	30	30
Coal	20	50
No record	25	75
"Bedrock"	44	119
Sandstone, calcareous, soft, water-bearing	6	125
Casing: 4-inch to 75 ft.		
Well 14/2W-4E1		
Northern Pacific Railway Co. Altitude 190 ft. Drilled by N. C. Jannsen, 1934.		
Gravel, coarse	20	20
Sand, coarse	1	21
Gravel, coarse	14	35
Gravel, coarse, with a little sand	3	38
Sand and gravel	1	39
Gravel, coarse	6	45
Gravel, loose	5	50
Gravel, loose, mixed with sand	6	56
Clay, blue	7	63
Casing: 26-inch to 38 ft, 16-inch to 57 ft; perforated from 38 to 53 ft.		
Well 14/2W-4P1		
City of Centralia, test hole. Altitude 200 ft. Drilled by N. C. Jannsen, 1934.		
Clay, yellow	20	20
Shale, blue	110	130
Shale, hard	2	132
Shale	32	164
Shale, hard	110	274
Shale, hard, dark	101	375
Shale, hard, layers of sandstone	51	426
Shale	34	460

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 14/2W-4P1--Continued		
Sandstone, blue, very hard, and layer of shale	23	483
Sandstone, gray, hard	1	484
Shale, gray	6	490
Sandstone, hard	3	493
Shale and hard sandstone layer	32	525
Shale, gray, soft	35	560
Sandstone	20	580
Shale, gray, sandy	28	608
Sandstone, hard	22	630
Shale, sandy	40	670
Sand, hard	10	680
Shale	40	720
Sand, some water; water flows 3 gpm, bailer test 20 gpm, drawdown 120 ft	3	723
Wood, rotten	14	737
Shale, carbonaceous, soft, and poor-grade coal	9	746
Sandstone, soft	9	755
Sandstone, white, soft	13	768
Sandstone, hard	8	776
Sandstone, white	12	788
Limestone, very hard	3	791
Limestone, hard	2	793
Sandstone	13	806
Shale, blue	10	816
Sandstone, white, soft	9	825
Sandstone	12	837
Coal	7	844
Shale	6	850
Sandstone; small amount of coal at 845 ft	12	862
Coal	5	867
Sand	5	872
Coal	5	877
Sandstone, very hard	4	881
Sandstone, cemented, very hard	4	885
Coal	4	889
Sandstone, hard	49	938
Sandstone	10	948
Coal	6	954
Shale, brown, hard	31	985
Shale, gray, sticky	18	1,003

No water encountered in upper 600 ft; small seepage below that depth.

Well 14/2W-5F1

City of Centralia, well 4. Altitude 185 ft. Drilled by N. C. Jannsen, 1935.

Material	Thickness (feet)	Depth (feet)
Clay and gravel	12	12
Gravel and boulders, loose	50	62
Gravel, finer	7	69
Gravel, mixed with some sand; signs of water	7	76

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 14/2W-5F1--Continued		
Gravel, water-bearing	8	84
No record	2	86
Gravel	4	90
Shale, (clay), hard	3	93
Casing: 26-inch to 39 ft, 16-inch from 0 to 90 ft; perforated from 40 to 87 ft.		
Well 14/2W-5G1		
City of Centralia, well 3. Altitude 185 ft. Drilled by N. C. Jannsen, 1935.		
Gravel, coarse	28	28
Gravel, fine, and sand	2	30
Gravel, coarse	9	39
Gravel, cemented	8	47
Stones, large, and coarse gravel	10	57
Gravel, fine, and some sand	6	63
Gravel, fine (largest about 2 inches in diam)	10	73
Gravel and sand	7	80
Gravel and clay	4	84
Clay	2	86
Sandstone	3	89
Sandstone, black	6	95
Casing: 26-inch to 38 ft, 16-inch from 0 to 84 ft; perforated from 42 to 82 ft.		
Well 14/2W-5G2		
City of Centralia, well 5. Altitude 185 ft. Drilled by N. C. Jannsen, 1935.		
Clay, yellow	10	10
Gravel, few large rocks	78	88
Clay	---	---
Casing: 26-inch to 39 ft, 16-inch from 0 to 88 ft; perforated from 41 to 85 ft.		
Well 14/2W-5H1		
City of Centralia, well 2. Altitude 185 ft. Drilled by N. C. Jannsen, 1935.		
Gravel, loose	15	15
Gravel, loose, and large boulders	2	17
Gravel, loose	5	22
Gravel, loose, mixed with some brown sand	4	26
Stones, large, and loose gravel	4	30
Gravel	1	31
Gravel, loose, and stones	8	39
Gravel, loose	6	45
Gravel, loose, and sand; packed sand at 46 ft	4	49

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 14/2W-5H1--Continued		
Sand and gravel, some large stones	4	53
Gravel and sand	2	55
Gravel, loose, and sand; some large stones	3	58
Gravel and stones	7	65
Gravel and stones; some clay	2	67
Clay	5	72

Casing: 26-inch to 39 ft, 16-inch from 0 to 68 ft; perforated from 43 to 66 ft.

Well 14/2W-6N1

R. V. Grainger. Altitude 162 ft. Drilled by C. D. Roberts, 1951.

Material	Thickness (feet)	Depth (feet)
Clay	7	7
Sand	3	10
Gravel and sand, water-bearing	26	36
Gravel and coarse sand, water-bearing	20	56

Casing: 6-inch to 56 ft; perforated.

Well 14/2W-7L1

K. H. Verd. Altitude 167 ft. Drilled by E. U. Posey, 1948±.

Material	Thickness (feet)	Depth (feet)
Soil, clayey	5	5
Shale, blue	40	45
Sand, yield 10 gpm	42	87

Casing: 6-inch to 67 ft.

Well 14/2W-7Q1

George Finni. Altitude 180 ft. Drilled by O. Keto, 1950.

Material	Thickness (feet)	Depth (feet)
Sand, fine, and clay, yellow	60	60
Gravel, small, and sand, water-bearing	7	67
Clay, blue	---	---

Casing: 6-inch to 67 ft.

Well 14/2W-10R2

Floyd Watson. Altitude 565 ft. Drilled by C. King, 1953.

Material	Thickness (feet)	Depth (feet)
Clay, blue	120	120
Clay and fine gravel	155	275
Gravel, coarse, cobbles, and some petrified wood	25	300

Casing: 6-inch to 300 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 14/2W-14N1		
Norman Wirta. Altitude 230 ft. Drilled by Fox Bros., 1946.		
Clay	45	45
No record	---	---
Coal	---	---
No record	---	60
Sand: water-bearing	59	119
Casing: 6-inch to 111 ft.		
Well 14/2W-16E2		
Francis Watterson. Altitude 175 ft. Drilled by O. Keto, 1951.		
Clay, blue	42	42
Sand, fine, water-bearing	2	44
Clay, blue: a little water in sandy shale at 65 ft	58	102
Casing: 6-inch to 82 ft.		
Well 14/2W-16J1		
T. J. Thomsen. Altitude 170 ft. Drilled by O. Keto.		
Loam, sandy clay	18	18
Peat and some "quicksand"	3	21
Clay or shale, blue-gray, sticky	20	41
Clay, blue, "heavy"	7	48
Sand and gravel, clean	11	59
Sandstone; water-bearing	20	79
"Coal roof"	---	---
Casing: 6-inch to 61 ft.		
Well 14/2W-17D3		
J. J. Collins. Altitude 175 ft. Drilled by C. D. Roberts, 1952.		
Sand	50	50
Gravel, fine, thin	---	---
Clay, blue, thin	---	---
Sand(?), water-bearing	---	63
Casing: 6-inch to 63 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 14/2W-17E1		
Leonard Santee. Altitude 175 ft. Drilled by C. D. Roberts, 1946.		
Loam, black	3	3
Clay, red	22	25
"Quicksand"	25	50
Gravel, water-bearing	3	53
Casing: 6-inch to 50 ft.		
Well 14/2W-19H4		
Bridgett Emrich. Altitude 175 ft. Drilled by C. White, 1940(?).		
"Quicksand," wood	65	65
Gravel	10	75
Clay(?)	215	290
Very hard layer (basalt ?)	2	292
Sand(?), water-bearing	8	300
Casing: 2(?)-inch to 150 or 175 ft.		
Well 14/2W-22H1		
Oscar Keto. Altitude 240 ft. Drilled by O. Keto, 1944.		
No record	---	---
No record, some water	---	30
No record	---	---
Sand, coarse, gray; good supply of water	---	60
Coal	8	68
Shale, brown, and sand, in alternate layers. Salt water at 275 ft. Gas and salt water under pressure at 1,200 ft	1,132	1,200
Casing: 4-inch to 800 ft; 2-inch from 800 to 1,200 ft.		
Well 14/2W-22K1		
Oscar Keto. Altitude 560 ft. Drilled by O. Keto, 1941.		
Clay(?)	---	---
Sand(?)	---	200
Gravel, yellow-brown, weathered	133	333
Shale, gray, sandy	25	358
Coal	2	360
Sand, gray: water from 418-460 ft, yield 10 gpm	100	460
Shale, light brown, sandy toward bottom	25	485
Clay(?), dark brown, sticky	15	500
Shale, light brown, sandy at top	95	595
Sand, gray, some shells	25	620
Clay, gray, sticky, shells at top	80	700

Table 3.--Logs of selected wells in Lewis County.--*Continued*

Material	Thickness (feet)	Depth (feet)
Well 14/2W-22K1--Continued		
Shale, gray and brown, showings of gas and oil	60	760
Shale, light green and gray	10	770
Shale, brown	35	805
Shale, green, sticky	7	812
Shale, brown, streaks of coal, gas and oil showings	8	820
Shale, brown and gray, mixed with fine sand, gas pressure increased with depth, gas and water boiled over bailer	70	890
Shale, green, shells and gas	110	1,000
Shale, brown, shells and coal streaks	90	1,090
Shale and clay, gray, and fine sand, oil colorings and gas	30	1,120
Sand, gray, and water	10	1,130
Sand, gray, salt water and gas	51	1,181
Sand, rock	4	1,185
Sand, fine, chalky	5	1,190
Sand, white, fine, salt water	25	1,215
Clay, dark gray	15	1,230
No record	395	1,625
Shale	10	1,635
Lime	15	1,650
No record	150	1,800

Encountered propane gas from 1,545 to 1,575 ft and paraffin oil from 1,615 to 1,625 ft.

Well 14/2W-23M1

A. E. Edwards. Altitude 230 ft. Drilled by J. L. McBride(?), 1951.

Material	Thickness (feet)	Depth (feet)
Overburden	15	15
Sandstone, friable	2	17
Siltstone, fossiliferous, greenish-gray, some carbonaceous beds and thin coal streaks	49	66
Sandstone, friable, greenish-gray, some siltstone interbeds	14	80
Siltstone, largely carbonaceous, rare sandy interbeds	18	98
Sandstone, silty, fossiliferous	96	194
Siltstone, with sandy beds, very thin-bedded and highly fossiliferous	107	301

Casing: none.

Well 14/2W-23P1

Tom Moran: Altitude 230 ft. Dug.

Material	Thickness (feet)	Depth (feet)
Sand, clay and fine gravel; 3½-ft coal seam between 35 and 45 ft	65	65
Clay, yellow, and angular cobbles	10	75
Shale, blue	10	85

Casing: 48 by 48-inch; wooden to 50 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 14/2W-26M1		
B. R. Anderson. Altitude 560 ft. Drilled by E. U. Posey, 1947.		
Topsoil, clay	4	4
Clay, hard, yellow	2	6
Gravel, red and brown, weathered	---	---
Clay, white	---	100
Sand, white, fine, water-bearing	4	104
Casing: 6-inch to 100 ft.		
Well 14/2W-28Q1		
Tom Hampson. Altitude 195 ft. Drilled by O. Keto, 1953.		
Clay, sandy	30	30
Clay, gray, hard	30	60
Sand, gray, coarse, water-bearing	10	70
Clay, light gray	5	75
Casing: 6-inch to 60 ft.		
Well 14/2W-28Q2		
Tom Hampson. Altitude 195 ft. Drilled by C. D. Roberts, 1952.		
Clay (?)	65	65
Shale	75	140
Coal	5	145
Casing: none.		
Well 14/2W-31C1		
City of Chehalis, test well. Altitude 170 ft. Drilled by N. C. Jannsen, 1953.		
Loam, sandy, and alluvium	35	35
Sand, fine, much fairly-fresh wood, water-bearing	1	36
Clay, brown, and gravel	29	65
Clay, blue, tough	62	127
Casing: 8-inch to 65 ft.		
Well 14/2W-31P1		
City of Chehalis, test well. Altitude 170 ft. Drilled by N. C. Jannsen, 1953.		
Silt, grading to sand	25	25
Sand and fine gravel, volcanic	14	39
Basalt(?)	11	50
Clay, silty, micaceous, blue green to gray	165	215
Clay, blue-gray, silty, alternating with blue-gray silty shale	20	235

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 14/2W-31P1--Continued		
Shale, silty, blue-gray, micaceous; ash-gray soft bentonite or limy layer from 325-327 ft	195	430
Clay, fine, sandy, blue-gray, micaceous	60	490
Same, with shells (scaphopods and pelecypods)	30	520
Sand, clayey, rusty-colored, medium to fine; shells	20	540
Sand, coarse, micaceous, rust-colored	5	545
Clay, sandy, blue-gray, shells	35	580
Clay, (siltstone?), shells; a few 12-inch boulders from 605 to 624 ft	44	624
Clay, sandy, blue-gray, shells	109	733
Clay, little sand, blue-gray, shells	77	810
Clay, blue-gray, about 25 percent sand, shells	9	819
Limestone, dense, dark blue-gray	1	820
Clay, sandy, blue-gray, shells	14	834
Clay, shells; limestone layer	22	856
Clay or siltstone, slick, finely micaceous, gray-brown blue-green blend, shells; limestone layer	18	874
Same, in limestone	48	922
Siltstone, finely micaceous, shells; limestone layer	23	945
Same, but no limestone	21	966
Claystone or siltstone, blue, shells	21	987
Claystone or siltstone, about 50 percent with coarse sand or fine gravel, shells	22	1,009
Same, shells more scattered	22	1,031

Casing: 8-inch to 40 ft. Gravel-packed to 40 ft.

Well 14/2W-31P2

City of Chehalis,test well. Altitude 170 ft. Drilled by N. C. Jannsen, 1953.

Material	Thickness (feet)	Depth (feet)
Sand, brown, fine	21	21
Silt	8½	29½
Clay, blue, fine, sandy	5½	35
Hard material (basalt?)	9	44
Clay, blue	6	50

Casing: 8-inch to 35 ft.

Well 14/2W-31P3

City of Chehalis, test well. Altitude 170 ft. Drilled by N. C. Jannsen, 1953.

Material	Thickness (feet)	Depth (feet)
Silt	21	21
Gravel, medium-sized	1	22
Clay, sandy, yellow-brown; some medium-sized gravel which may have come from above	12	34
Hard material (basalt?)	---	---

Casing: 8-inch to 30 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 14/2W-31Q1		
City of Chehalis. Altitude 170 ft. Drilled by N. C. Jannsen, 1953.		
Silt	14	14
Sand, fine	3	17
Gravel, $\frac{1}{2}$-inch to $1\frac{1}{2}$-inch; streak of blue clay from 21 to 22 ft	14	31
Clay, blue	3	34
Well 14/2W-34E1		
Lloyd Macomber. Altitude 245 ft. Drilled by C. D. Roberts, 1947. (owner's memory log)		
Clay	100	100
Sandstone	30	130
Sand, fine, black, water-bearing	---	---
Casing: 6-inch to 100 ft.		
Well 14/3W-1B1		
J. E. Miller. Altitude 165 ft. Drilled by C. D. Roberts, 1948.		
Gravel and black dirt	4	4
Boulders	6	10
Sand and gravel	4	14
Gravel and sand, cemented	6	20
Sand, brown	5	25
Sand and gravel, packed	13	38
Gravel and sand, water-bearing	8	46
Casing: 6-inch to 46 ft.		
Well 14/3W-1J2		
John Meiers. Altitude 169 ft. Drilled by T. J. Pollmor, 1948.		
Gravel	20	20
Sand	8	28
"Hardpan" (clay and gravel)	7	35
Gravel, yield 10 gpm	4	39
Sand	14	53
Gravel	2	55
Casing: 6-inch to 55 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)

Well 14/3W-2L1

Al Harting. Altitude 350 ft. Dug by owner.

Material	Thickness (feet)	Depth (feet)
Dirt	2	2
Clay	10	12
"Hardpan"	2	14
Sand	2	16
"Hardpan"	1	17
Clay	1	18
"Hardpan"	2	20
Sand	2	22
Rocks, yellow, soft	5	27
Lava rock(?), vesicular	---	---

Casing: 36 by 36-inch, brick, to 27 ft.

Well 14/3W-2L2

Al Harting. Altitude 340 ft. Dug by owner.

Material	Thickness (feet)	Depth (feet)
Dirt	2	2
Clay	20	22
Sand, coarse, gray, water-bearing	3	25
Gravel, water-bearing	20	45

Casing: 72-inch, brick.

Well 14/3W-11F3

C. Sareault. Altitude 390 ft. Dug.

Material	Thickness (feet)	Depth (feet)
Clay, sandy	10	10
Gravel, fine and coarse, water-bearing	25	35
"Shale rock"	---	---

Casing: 36-inch, brick, to 35 ft.

Well 14/3W-12H1

Joe Graf. Altitude 173 ft. Dug by owner.

Material	Thickness (feet)	Depth (feet)
Soil	3	3
Clay	5	8
Rock, blue	12	20
Gravel, water-bearing	2	22

Casing: 48-inch, brick, to 20 ft.

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 14/3W-13C2		
P. H. Brooks. Altitude 185 ft. Drilled by King, 1952.		
Loam, black	2	2
Clay, blue	48	50
Gravel, water-bearing	3	53
Casing: 6-inch to 50 ft.		
Well 14/3W-26P1		
Stanley Tufts and Paul Yott. Altitude 470 ft. Drilled by King, 1953.		
Clay, blue, apparently some coal	200	200
Clay, blue	345	545
Sandstone, medium to fine, micaceous, with clay and silt; scattered bits of shell, wood, small rounded pebbles of white quartz; water at some levels	105	650
Similar, with more shells	50	700
Sand, fine, gray, "woody," water-bearing	75	775
Casing: 6-inch to 555 ft.		
Well 14/3W-28J3		
A. J. Givens. Altitude 470 ft. Drilled.		
Clay	52	52
Clay and sand, blue	92	144
Sand and gravel, water-bearing	7	151
Casing: 6-inch to 151 ft, perforated from 145 to 151 ft.		
Well 14/3W-34R1		
Al Bieker. Altitude 250 ft. Drilled by C. D. Roberts, 1948. (Owner's memory log)		
No record	47	47
Hard formation (basalt?)	53	100
"Mud"	25	125
Casing: none.		
Well 14/3W-35P1		
Clara McDonald. Altitude 350 ft. Drilled by C. King, 1943.		
Soil	30	30
Clay, blue, "mucky"	25	55
Shale	4	59
Shale or clay	13	72

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 14/3W-35P1--Continued		
Sand(?); water rose to top of casing	8	80
Basalt, jointed, water-bearing; static water level 88 ft	16	96
Casing: 6-inch to 80 ft.		
Well 14/3W-35Q1		
Carl Wenzelberger. Altitude 320 ft. Drilled by C. King, 1935±.		
Soil and clay	14	14
Basalt	56	70
Sand, white, water-bearing; water rose to 30 ft	3	73
Casing: 6-inch to 14 ft.		
Well 14/3W-36H1		
Kelly Hamilton. Altitude 180 ft. Drilled by F. Galivan, 1955.		
Clay, yellow, brown, and blue	30	30
Sand, medium to fine, water-bearing	10	40
Clay, blue, water somewhere from 40 to 138 ft	98	138
Casing: 6-inch to 64 ft. Sand from 30-40 ft cased off, as well pumped sand.		
Well 14/3W-36K1		
Art Hamilton. Altitude 180 ft. Drilled by C. D. Roberts, 1949.		
Clay	48	48
Sand and gravel; water-bearing	10	58
Shale, blue	35	93
Casing: 6-inch to 93(?) ft; perforated from 48-58 ft.		
Well 14/3W-36Q1		
Art Hamilton. Altitude 180 ft. Drilled by C. D. Roberts, 1944.		
Clay, brown	80	80
Sandstone, water-bearing, also contains inflammable gas	140	220
Casing: 8-inch to 80 ft, and 6-inch below, to unknown depth.		
Well 15/1W-29M1		
Nolan Peterson. Altitude 250 ft. Drilled by A. Foote, 1946±.		
No record	56	56
Clay, blue	16	72
Coal	9	81
Coal, soft, and clay	18	99

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 15/1W-29M1--Continued		
Coal	20	119
Clay, "gumbo," black	28	147
Coal	2	149
Clay, sticky, black	26	175
Clay, light	11	186
Clay, light, sandy	9	195
Clay, dark	14	209
Clay, coal	5	214
Clay, dark, brown	5	219
Coal	12	231
Sandstone, light gray, and clay	21	252
Sandstone	6	258
Sandstone, softer	2	260
Sandstone, very fine, light gray	50	310
Coal	3	313

Casing: 4-inch.

Well 15/2W-26N1

H. F. Johnson. Altitude 225 ft. Drilled by Davis, 1951.

Material	Thickness (feet)	Depth (feet)
Clay	18	18
"Soapstone"	37	55
Sand, water-bearing	---	---

Casing: 8-inch to 55 ft.

Well 15/2W-29L1

Stoker Mining Co. Altitude 305 ft. Drilled by T. Prather, 1951.

Material	Thickness (feet)	Depth (feet)
Landslide material	21	21
Siltstone, carbonaceous, chocolate brown, with greenish-gray siltstone	10	31
Coal seam	7	38
Sandstone, greenish-gray, fine, feldspathic, slightly micaceous, silty in part	117	155
Siltstone, slightly sandy	54	209
Sandstone, fine, friable, faintly-bedded, slightly micaceous, slightly tuffaceous; thin calcareous zones	139	348
Siltstone, greenish-gray	3	351
Coal seam, thin interbeds of coal and "bone"	4	355
Sandstone, fine, slightly micaceous	30	385
Siltstone, increasingly clayey with depth	16	401

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 15/2W-31F5		
Pacific Sand & Gravel Co. Altitude 166 ft. Drilled by C. D. Roberts, 1946.		
Gravel and boulders	11	11
Boulders, gravel, and sand	12	23
Gravel and clay, mixed	20	43
Gravel and sand, water-bearing	12	55
Gravel, water-bearing	5	60
Sand, water-bearing	5	65
Gravel, water-bearing	18	83
Shale, blue, and gravel	29	112
Casing: 12-inch to 112 ft; perforated from 45 to 58 ft, from 68 to 76 ft, and from 78 to 88 ft.		
Well 15/2W-31L4		
N. A. Bishop. Altitude 169 ft. Drilled by C. D. Roberts, 1952.		
Gravel and coarse sand	10	10
Gravel and sand, cemented	23	33
Sand and gravel, water-bearing	24	57
Casing: 6-inch to 57 ft.		
Well 15/2W-31N1		
F. M. Moses. Altitude 170 ft. Drilled by C. D. Roberts, 1950.		
Pit (no log)	13	13
Sand	2	15
Gravel and sand, cemented	10	25
Gravel and sand; water-bearing	28	53
Casing: 6-inch to 53 ft; perforated from 35 to 48 ft.		
Well 15/2W-32G5		
T. R. Parrish. Altitude 193 ft. Drilled by Richardson Well Drilling Co., 1951.		
Clay, yellow, and topsoil	4	4
Sand, coarse, and gravel	2	6
"Hardpan" with streaks of clay	12	18
Sand, coarse gravel, and some clay	18	36
"Hardpan"	12	48
Clay and gravel	2	50
Gravel and some sand, fairly loose	6	56
Sand, coarse, and loose gravel	3	59
Casing: 10-inch to 59 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 15/2W-32K2		
W. P. Johnson. Altitude 185 ft. Drilled by C. King, 1952.		
Topsoil	6	6
Sand, gravel, and clay	24	30
Gravel, dirty	2	32
Gravel, water-bearing	2	34
Casing: 6-inch to 34 ft.		
Well 15/2W-32K3		
Helmer Nyman. Altitude 185 ft. Drilled by Richardson Well Drilling Co., 1951.		
Dirt, black, and gravel	5	5
Clay and gravel	6	11
Sand and gravel	20	31
Sand, coarse, and gravel	4	35
Sand, gravel, and clay	8	43
Sand, coarse, and gravel	3	46
"Hardpan"	10	56
Sand, black, fine to coarse	1	57
Gravel and coarse sand, loose	3	60
Casing: 6-inch to 60 ft.		
Well 15/2W-32Q2		
M. J. Martinell. Altitude 185 ft. Drilled by O. Keto, 1952.		
Sand, gravel, clay(?)	29	29
"Hardpan"	4	33
Gravel, water-bearing	8	41
Casing: 6-inch to 41 ft.		
Well 15/2W-33D1		
C. R. Linderman. Altitude 200 ft. Drilled by C. D. Roberts, 1948.		
Topsoil	4	4
Boulders and gravel	8	12
Sand and gravel, cemented	8	20
Sand, coarse, and gravel, water-bearing	7	27
Casing: 6-inch to 27 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 15/2W-33E4		
C. G. Blanchard. Altitude 200 ft. Drilled by Kroy, 1948.		
Clay	7	7
Gravel, "big"	23	30
Gravel, fine	5	35
Casing: 6-inch.		
Well 15/2W-34J1		
A. B. Dace. Altitude 450 ft. Drilled by T. Prather, 1950.		
Sand and gravel; sand mostly decomposed to clay, and pebbles, iron-stained	25	25
Siltstone, mostly carbonaceous	82	107
Claystone and siltstone, interbedded	38	145
Sandstone, with thin-bedded siltstone and claystone; some water at 170-180 ft. according to owner	93	238
Siltstone, sandy to clayey, fossiliferous, calcareous in part	142	380
Sandstone, with siltstone interbeds; water-bearing according to owner	21	401
Well 15/3W-25L4		
V. F. Cain. Altitude 163 ft. Drilled by O. Erdman, 1950.		
Topsoil	10	10
Gravel, sand, and clay	20	30
Sand	20	50
Gravel, water-bearing	19	69
Casing: 6-inch to 69 ft, perforated from 49 to 65 ft.		
Well 15/3W-26J2		
F. H. Watson. Altitude 150 ft. Drilled by E. King, 1952.		
Topsoil	2	2
Sand	5	7
Sand and gravel, dirty	23	30
Gravel, coarse, and some sand, water-bearing	5	35
Casing: 8-inch to 35 ft.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 15/3W-26K3		
I. Matheny. Altitude 146 ft. Drilled by C. D. Roberts, 1951.		
Sand and gravel	7	7
Sand	2	9
Gravel and sand, cemented	19	28
Gravel and sand, water-bearing	25	53
Casing: 8-inch to 53 ft, perforated from 32 to 48 ft.		
Well 15/3W-35L4		
G. G. Ingalls. Altitude 155 ft. Drilled by Bell, 1928.		
Soil	8	8
Gravel	14	22
"Hardpan"	4	26
Gravel, fine	16	42
Clay	22	64
Sand	4	68
Casing: 6(?)-inch to about 64 ft.		
Well 15/3W-36F2		
Leo Seifert. Altitude 165 ft. Drilled by J. Smith, 1941.		
Dirt	16	16
No record	2	18
"Hardpan"	6	24
Sand	4	28
Sand and gravel, water-bearing	2	30
Sand	4	34
Sand, clay	3	37
Gravel, coarse (?), water-bearing	17	54
Casing: 7-inch to 54 ft.		
Well 15/3W-36H3		
J. Gehrman. Altitude 164 ft. Drilled in 1945.		
Gravel and sand	38	38
"Hardpan"	3	41
Gravel	6	47
Gravel, water-bearing	6	53
Casing: 6-inch.		

Table 3.--Logs of selected wells in Lewis County.--Continued

Material	Thickness (feet)	Depth (feet)
Well 15/3W-36K2		
Clifford Reisinger. Altitude 165 ft. Drilled by King, 1942.		
Gravel	15	15
Sand, fine	6	21
"Hardpan"	2	23
Gravel	9	32
Sand	6	38
Gravel, heavy and boulders	16	54
Casing: 8-inch to 54 ft, perforated from 48 to 54 ft.		
Well 15/3W-36L3		
P. M. Steelhammer. Altitude 165 ft. Drilled by E. U. Posey(?), 1948.		
Dirt	8	8
Gravel	4	12
Sand	6	18
Gravel, water-bearing	25	43
Casing: 6-inch to 43 ft.		

Table 4.--Chemical analyses of ground water from Lewis County
(Parts per million, except as noted)

Well	11/1W-8E2	11/1W-14L2	11/2W-29P1	11/2W-32C1
Principal aquifer	Sand	Gravel	Sandstone	Sandstone
Date of collection	8-25-53	12/2-53	6-27-52	4-22-48
Temperature (°F)	52	51	------	------
Silica (SiO_2)	42	46	27	------
Iron (Fe)	.17	.10	10	1.0
Manganese (Mn)	------	------	------	------
Calcium (Ca)	13	12	25	8.9
Magnesium (Mg)	6.5	4.9	8.7	6.2
Sodium (Na)	12	6.5	[a]18	[a]446
Potassium (K)	2.0	.8		
Bicarbonate (HCO_3)	101	67	138	[a]271
Carbonate (CO_3)	------	------	0	------
Sulfate (SO_4)	1.9	2.3	0	0
Chloride (Cl)	3.0	1.0	17	563
Fluoride (F)	.2	.1	------	------
Nitrate (NO_3)	.1	3.8	------	------
Boron (B)	.05	.04	------	------
Dissolved solids	126	114	[a]138	[a]1,160
Hardness as $CaCO_3$	59	50	98	48
Percent sodium	30	22	------	------
Specific conductance (micromhos at 25°C)	156	126	------	------
pH	7.3	7.6	7.0	8.9
Analysis by 1/	U.S.G.S.	U.S.G.S.	N.P.R.	N.P.R.

1/ L., Laucks Laboratories; N.W., Northwest Laboratories; N.P.R., Northern Pacific Railway; U.S.G.S., U.S. Geological Survey.

2/ a - Calculated.

Table 4.--Chemical analyses of ground water from Lewis County
(Parts per million, except as noted)

Well	11/2W-32D1	12/2W-10N1	12/1E-9Q1	13/1W-19Q1
Principal aquifer	--------	Sand and gravel	Sand	Sand and gravel
Date of collection	2-17-48	1-23-53	12-2-53	8-22-53
Temperature (°F)	------	50	51	------
Silica (SiO_2)	17	38	7.9	------
Iron (Fe)	.9	1.6	.14	------
Manganese (Mn)	------	.00	------	------
Calcium (Ca)	11	6.4	4.0	56
Magnesium (Mg)	8.7	2.8	3.3	2.6
Sodium (Na)	[a]34	7.2	4.9	255
Potassium (K)		1.2	11	
Bicarbonate (HCO_3)	[a]154	51	16	------
Carbonate (CO_3)	------	------	------	------
Sulfate (SO_4)	0	1.2	2.5	Trace
Chloride (Cl)	8.3	2.4	5.0	449
Fluoride (F)	------	.1	.3	------
Nitrate (NO_3)	------	.1	28	------
Boron (B)	------	.02	.02	less than 0.5
Dissolved solids	[a]139	[a]85	109	[a]806
Hardness as CaCO	63	27	24	------
Percent sodium	------	35	22	------
Specific conductance (micromhos at 25°C)	------	87	126	------
pH	7.5	6.8	6.6	7.6
Analysis by	N.P.R.	U.S.G.S.	U.S.G.S.	L.

1/ a - Calculated

Table 4.--Chemical analyses of ground water from Lewis County
(Parts per million, except as noted)

Well	13/1W-28P1	13/2W-5H1	13/2W-15M1	13/2W-34A3
Principal aquifer	Sand	Sand and gravel	Sand	Gravel
Date of collection	2-11-53	1952	1-8-53	1957
Temperature (°F)	52	------	52	52
Silica (SiO_2)	28	34	28	59
Iron (Fe)	.42	.1	.32	0.05
Manganese (Mn)	.00	------	.00	0.00
Calcium (Ca)	11	28	41	14
Magnesium (Mg)	5.9	13	11	7.3
Sodium (Na)	44	128	155	9.7
Potassium (K)	1.6		3.7	1.6
Bicarbonate (HCO_3)	141	148	154	94
Carbonate (CO_3)	------	0	------	0.0
Sulfate (SO_4)	.3	1.3	.4	1.3
Chloride (Cl)	20	197	260	6.0
Fluoride (F)	.2	.1	.2	0.0
Nitrate (NO_3)	3.9	.1	.4	1.2
Boron (B)	.03	------	.19	------
Dissolved solids	[a]184	483	576	[a]146
Hardness as $CaCO_3$	52	123	148	65
Percent sodium	64	------	69	24
Specific conductance (micromhos at 25°C)	290	------	1,070	------
pH	7.2	7.1	7.6	6.8
Analysis by	U.S.G.S.	N.W.	U.S.G.S.	U.S.G.S.

1/ a - Calculated.

Table 4.--Chemical analyses of ground water from Lewis County
(Parts per million, except as noted)

Well	13/3W-2F1	13/5W-33J2	13/1E-19K2	14/2W-4E1
Principal aquifer	Basalt	-------	Sand and gravel	Gravel
Date of collection	12-3-53	10-14-58	5-3-54	6-27-52
Temperature (°F)	52	51	50	------
Silica (SiO_2)	36	14	60	27
Iron (Fe)	.46	1.0	.09	1.0
Manganese (Mn)	------	------	.00	------
Calcium (Ca)	4.8	188	8.7	12
Magnesium (Mg)	4.3	.1	6.0	6.2
Sodium (Na)	13	341	7.4	[a]3.9
Potassium (K)	2.0	5.5	1.7	
Bicarbonate (HCO_3)	49	32	72	[a]42
Carbonate (CO_3)	------	0	0	0
Sulfate (SO_4)	10	12	1.3	9.8
Chloride (Cl)	4.0	840	2.1	14
Fluoride (F)	.4	------	.1	------
Nitrate (NO_3)	.0	.1	.3	------
Boron (B)	.04	------	.05	------
Dissolved solids	104	1,550	111	[a]67
Hardness as $CaCO_3$	30	470	46	55
Percent sodium	47	------	25	------
Specific conductance (micromhos at 25°C)	110	2,980	120	------
pH	7.1	6.8	7.1	6.3
Analysis by	U.S.G.S.	U.S.G.S.	U.S.G.S.	N.P.R.

1/ a - Calculated.

Table 4.--Chemical analyses of ground water from Lewis County
(Parts per million, except as noted)

Well	14/2W-5F1	14/2W-5H1	14/2W-22H1	15/3W-36K2
Principal aquifer	Gravel	Gravel	Shale and sand	Gravel
Date of collection	---------	---------	10-14-58	5-24-54
Temperature (°F)	------	------	57	52
Silica (SiO_2)	32	32	4.4	26
Iron (Fe)	.15	.5	65	.04
Manganese (Mn)	------	------	------	.00
Calcium (Ca)	22	23	5,140	12
Magnesium (Mg)	6.7	5.4	821	3.1
Sodium (Na)	[a]9.9	[a]5.3	10,500	6.5
Potassium (K)			58	.9
Bicarbonate (HCO_3)	[a]69	[a]79	0	34
Carbonate (CO_3)	0	0	0	------
Sulfate (SO_4)	9.0	6.6	9.4	6.8
Chloride (Cl)	27	14	28,900	8.6
Fluoride (F)	------	------	------	.1
Nitrate (NO_3)	------	------	80	13
Boron (B)	------	------	------	.03
Dissolved solids	[a]141	[a]126	45,500	96
Hardness as $CaCO_3$	82	80	16,200	43
Percent sodium	------	------	------	24
Specific conductance (micromhos at 25°C)	------	------	63,600	128
pH	7.1	7.2	4.3	6.5
Analysis by	N.P.R.	N.P.R.	U.S.G.S.	U.S.G.S.

1/ a - Calculated.

Table 5.--Analyses 1/ of water from wells and springs in Lewis County

Well	Depth (feet)	Principal water-bearing material	Hardness (as $CaCO_3$) (parts per million)	Chloride (Cl) (parts per million)	Bicarbonate (HCO_3) (parts per million)
11/1W-1D1	13	Gravel, fine	42	10	55
-1R1s	----	----------------------------	37	6	58
-2G1	15	Sandstone	34	6	49
-2H1	18	Gravel, coarse, cemented	28	8	----
-5H4	70	Gravel	62	8	73
-5N1	44	Gravel and sand	58	6	92
-6D1	201	Sand	22	8	122
-7R1s	----	----------------------------	6	8	98
-11G1s	----	----------------------------	48	6	85
-14E1	55	Gravel and sand	56	6	79
-15C1	113	----------------------------	66	10	110
-16E2	156	Gravel, cemented	67	3	116
-16P2	36	Gravel, fine	62	6	165
-19K1s	----	----------------------------	74	6	116
-19M1s	----	----------------------------	66	6	104
-20L1s	----	----------------------------	118	12	189
-20N1	55	Gravel	82	6	140
-24C1s	----	----------------------------	48	8	98
-28M1s	----	----------------------------	68	10	98
-29M1	38	Gravel	71	20	110
-30M1	26	----------------------------	70	10	128
11/2W-1A2	22	Gravel	22	48	----
-3R1	59	----------------------------	11	5	98
-4A1	98	Gravel and sand	24	6	54
-5J1s	----	----------------------------	42	4	----

1/ Analyses made in the field by U.S. Geological Survey (?).

11/2W-9P1	287	Gravel and sand	30	10	83
-11N1	64	------------Do--------------	80	12	165
-11R1s	----	---------------------------	----	----	61
-12R1	53	Gravel	60	4	98
-15A1	44	Sand and gravel	76	18	150
-22H1	67	Gravel	66	10	----
-23H1s	----	---------------------------	66	14	98
-34R2	60	Sandy clay	50	8	79
-35E1	36	---------------------------	35	12	49
-36A2	67	Gravel, loose	34	36	9(?)
11/1-14D1	23	Rock, volcanic(?)	56	20	67
-29Q1	200	---------------------------	118	392	140
11/2-10J1s	----	---------------------------	30	8	55
12/1W-4K1	35	---------------------------	14	7	----
-5E1	128	Sand and gravel	40	8	----
-5H1	33	---------------------------	81	15	----
-8Q1	22	Clay	14	8	----
-9A1	33	---------------------------	47	6	----
-9B2	35	---------------------------	56	20	24
-9J2	29	---------------------------	32	8	----
-10C1	38	Clay and gravel	14	8	18
-10G3	29+	---------------------------	13	6	----
-11C1	22	Gravel	24	7	----
-12P2	40	Sand(?)	----	8	----
-13J2	120	Gravel and sand	42	8	----
-16K2	104	Sand	104	14	122
-18E1	26	Gravel	10	6	18
-18M1	87	Gravel and sand	64	6	----
-19N1	44	---------------------------	32	14	13
-21P2	15	Sand, cemented	100	12	----
-23N1	22	Sand and cobbles, cemented	40	10	----
-23R1	32	Gravel, cemented(?)	14	8	12
-24A2	43	Gravel, cemented	33	6	----
-24N1	38	Gravel, cemented(?)	26	8	----
-25R1	36	Gravel	32	7	----
-27H1	19	---------------------------	20	8	----
-28F1	16	---------------------------	38	15	43

Table 5.--Field analyses of water from wells and springs in Lewis County--Continued

Well	Depth (feet)	Principal water-bearing material	Hardness (as $CaCO_3$)	Chloride (Cl)	Bicarbonate (HCO_3)
			(parts per million)		
12/1W-28P1	16	----------------------------	16	8	----
-32G1	20	----------------------------	30	13	18
-32Q1	21	----------------------------	26	12	28
-33L1	40	----------------------------	64	12	38
-34D2	30	----------------------------	26	6	----
-34J1	32	----------------------------	54	6	----
-34R1	51	----------------------------	56	10	----
-36D1	60	Cobbles and boulders	48	6	----
12/2W-1N1	29	----------------------------	13	5	----
-2N1	48	Clay and weathered gravel	16	6	----
-3F1	84	Sand	48	5	----
-3N1	42	----------------------------	18	4	----
-6C1	65	Clay, sandy, consolidated	20	6	----
-7J2	75	Basalt, fractured	30	8	----
-8H1	48	Cobbles	22	8	----
-8Q1	140	"Rock," jointed	88	10	128
-9L4	143	Gravel, fine and medium	54	7	67
-12N1	58	----------------------------	31	13	----
-16F3	154	Sand	30	10	122
-16M1	35	----------------------------	16	6	----
-16N1	5	----------------------------	14	6	----
-17B1	161	Shale(?)	82	8	----
-17R1	15	----------------------------	16	5	----
-18G1	47	----------------------------	28	6	----
-19A1	42	----------------------------	40	6	----
-20G1	39	----------------------------	24	6	----
-20L1	27	----------------------------	20	5	----
-21D1	4	Gravel and clay, hard	40	9	----

12/2W-23R1	11	------------------------------	30	8	----
-24B2	72	Sand, coarse	52	5	----
-29A1	18	Gravel and clay	18	9	----
12/4W-2G1	19	Silt	88	34	73
-12M1	12	Gravel	42	6	48
12/1-2E1	248	Sand and gravel	52	10	101
-3Q1	52	Gravel	17	7	20
-8P2	112	Sand and gravel	56	6	88
-8Q2	141	Gravel and sand	66	8	104
-12P1	357	Sand and gravel, fine	19	153	88
-12Q1	354	Gravel, fine	94	12	149
-13B1	170	Gravel, fine	67	14	73
-13E1	47	Clay(?)	24	6	35
-13N1	284	------------------------------	6,040	11,300	55
-15J1	173	"Shale," sandy	80	52	122
-22Q1s	----	------------------------------	27	5	46
-33J1	120	Sand, black	46	14	61
12/2-1G1s	----	------------------------------	46	8	73
-4K1	270	Clay, sand, and gravel	38	5	58
-4P2	240	Boulders and gravel, cemented	83	7	122
-8M1	220	Gravel	51	4	116
-10L1s	----	------------------------------	26	6	79
-11F1s	----	------------------------------	31	5	79
-13B1	117	Gravel and sand	37	5	79
-14B1	144	Numerous beds of sand and gravel	83	6	----
-17Q1	193	Sand	60	7	94
-18C1	83	Gravel	49	6	79
-21Q1s	----	------------------------------	39	4	61
12/3-7D1s	----	------------------------------	46	8	92
-17B1	30	Sand(?)	54	12	37
-22D1	190	Sand, black	58	10	98
-24C1	73	Gravel	42	12	49
-26D1	246	Sand	10	48	85
-28L1	52	Sand, gray	20	7	34
12/4-2C1	53	------------------------------	50	6	67
-3M1s	----	------------------------------	40	4	73

Table 5.--Analyses of water from wells and springs in Lewis County--Continued

Well	Depth (feet)	Principal water-bearing material	Hardness (as $CaCO_3$)	Chloride (Cl)	Bicarbonate (HCO_3)
			(parts per million)		
12/5-7K1	100	Sand	----	10	122
-14H1	222	Gravel	42	8	----
-14N1	24	----------------------------	36	6	----
-28G1	39	Sand and gravel	68	8	104
12/6-9E1s	----	----------------------------	44	10	79
13/1W-2A1	85	Sand	90	56	262
-2G1	51	Gravel	18	72	----
-4F1	22	----------------------------	10	8	19
-5H2	108	Gravel, fine, and sand	45	6	88
-6D1	49	Gravel	18	7	----
-6R1	53	----------------------------	8	8	----
-8H1	53	----------------------------	35	14	----
-9E1	28	Gravel, sand, and clay	12	5	15
-9N1	45	Sand, fine	152	24	260
-11C1	26	Clay and gravel	25	9	----
-17H2	150	Sand	67	92	271
-18H1	24	----------------------------	14	13	12
-18R1	541	Shale, sandy, sandstone, sand(?)	102	166	177
-19D1	115	Sand, fine	43	21	174
-20F1	35	Gravel, cemented	27	10	43
-21H1	25	Sand	50	8	104
-22P1	127	Gravel	66	9	67
-23Q1	18	----------------------------	8	8	18
-29A1	515(?)	Sand and shale	88	137	165
-29R1	250	Sand and clay, pumice	68	80	165
-30A3	320	Sand, gray	90	146	165
-31K1	33	Clay and gravel	15	10	----
-31P3	50	Gravel and clay	110	31	156
-32A1	205	Sand, fine	52	28	150
-32N1	122	Gravel	44	8	67

13/1W-33D1	70	Gravel, fine	53	26	152
-33M1	65	--------------------------	54	8	----
-34N1	54	--------------------------	12	8	----
-35A1	185	Sand and pumice pebbles	39	7	183
-35B1	183	Sand(?)	46	10	189
-35M2	78	Gravel	46	7	----
-36C1	65	Sand, fine	68	6	128
13/2W-3G1	150	Sand and gravel	36	6	----
-8E1	25	Gravel, fine	64	8	----
-9Q1	37	Gravel	74	12	----
-12F3	180	--------------------------	81	8	178
-14C1	47	Clay, sandy	----	8	----
-15K1	306	Gravel and sand, fine	137	248	165
-15R1	435	Sand	100	144	206
-15R2	400	Gravel, fine	96	188	187
-16F1	260	Sand	173	374	149
-16H1	208	Sand	184	360	152
-16J1	105	Clay, sandy	111	187	162
-17E1	44	Gravel, polished	34	24	----
-17F2	28	Clay and gravel	30	8	----
-19H1	89	Gravel, fine, and sand	30	12	----
-21D2	25	Clay and gravel	10	6	18
-21D3	140	Gravel, fine	25	7	82
-21E1	612	Sand and gravel	38	8	76
-21K2	175	Gravel and sand	34	10	68
-21R1	32	Gravel and clay	20	10	----
-22E1s	----	--------------------------	56	4	----
-22G1	130	Sand and gravel	62	8	----
-25G1	33	"Rocks"	60	11	----
-26A1	17	Sand	28	12	----
-26L1	145	Sand, fine	41	6	146
-26M1	19	--------------------------	18	8	----
-26M2	160	Sand, fine	24	9	46
-27Q2	34	Gravel and clay	22	8	----
-28A1	175	Gravel and sand	34	8	79
-28J1	17	--------------------------	12	5	----
-30L1s	----	--------------------------	12	4	----
-31C1	50	Sand, coarse	64	7	----

Table 5.--Analyses of water from wells and springs in Lewis County--Continued

Well	Depth (feet)	Principal water-bearing material	Hardness (as $CaCO_3$)	Chloride (Cl)	Bicarbonate (HCO_3)
			(parts per million)		
13/2W-31R1	222	"Shale," sandy	66	10	104
-32M1	33	Sand	80	8	----
-35D2	25	--------------------------	10	8	----
-36N1	80	Sand, fine	42	8	----
13/3W-2D1	108	Sand	25	8	----
-2G2	78	--------------------------	40	4	----
-2M1	122	Sand, white	25	16	----
-3Q1	72	--------------------------	206	818	273
-3R5	75	Sand	116	234	134
-6R1	230	Sandstone	34	22	275
-7J2	160	------------Do------------	12	7	156
-8K1	175	Sand, dark green	12	6	171
-11M2	19	--------------------------	56	8	48
-15B1	185	Sand and "muck"	15	10	335
-27J1	16	Sandstone(?)	5	5	12
-30C1	118	--------------------------	74	361	468
-30P1	212	Sand	12	160	388
13/4W-3L1	81	"Sandstone"	34	44	275
-24F1	20	Gravel	62	8	85
-25H1	53	Sand	182	144	323
13/5W-3N1	136	--------------------------	60	14	116
13/1-9J1	34	Clay	10	4	37
-14C1	38	--------------------------	12	4	24
-14E1	330	Gravel	56	5	122
-16L1	140	Sand	52	6	88
-17R1	125	Gravel(?)	47	5	85
-20F2	405	Sand	60	5	110
-20R1s	----	--------------------------	44	10	----
-21C1	36	Gravel	23	8	37

13/1-22G1	33	Clay	47	28	43
-22R2	149	Sand	44	4	104
-23B1	6	Gravel	32	6	49
-25K1	36	Clay, "rocky"	26	10	24
-28C1	37	Sand	54	6	110
-28N1	97	Gravel	74	3	140
-30D1	108	Gravel	32	5	62
-31P1	125	Sand	30	8	104
-32B1	130	Sand	67	4	137
-32C1	52	Gravel, fine	86	6	152
-32M2	210	Sand, fine(?)	48	5	113
-33A1	125	Clay	56	4	101
13/2-14Q1	32	Sand and gravel	14	6	24
-20M1	28	---------------------------	19	2	37
-34N2	90	Gravel, cemented	40	8	68
13/4-25R1s	----	---------------------------	20	3	34
14/2W-3K1	15	---------------------------	8	10	12
-3N1	70	Shale, clayey	70	8	225
-4R2	20	---------------------------	49	20	37
-6L3	45	Gravel	38	6	30
-6M2	33	---------------------------	67	13	----
-6M13	40	Gravel	160	150	----
-7F2	52	Sand(?)	70	14	----
-7M2	75	Gravel	42	7	----
-7Q1	68	Gravel	84	10	159
-9H3	18	---------------------------	12	8	18
-11A1	15	---------------------------	26	6	43
-11E1	185	Gravel, fine	34	6	67
-12E1	34	Sand	40	20	----
-16J1	79	Sandstone	88	6	----
-17D3	62	Sand(?)	95	6	148
-19A1	55	Gravel	150	80	----
-19F1	12	"Quicksand"	95	8	----
-19H1	30	"Quicksand"	74	10	----
-19H2	65	Gravel	300	1,560(?)	----
-19N1	33	---------------------------	50	8	61
-20B1	55	Gravel	145	20	----
-22K1	1,800	Sand	36	11	39
-23A1	29	Clay and gravel, weathered	46	6	61

Table 5.--Analyses of water from wells and springs in Lewis County--Continued

Well	Depth (feet)	Principal water-bearing material	Hardness (as $CaCO_3$)	Chloride (Cl)	Bicarbonate (HCO_3)
			(parts per million)		
14/2W-23P1	32	Gravel, fine	22	10	18
-24H1	10	Siltstone	134	6	----
-28Q1	75	Sand, coarse	154	88	146
-31C1	127	Gravel, clay	54	6	102
-35G2	31	Gravel and clay	35	6	----
14/3W-11F3	28	Gravel	28	10	18
-18D1	20	Shale	50	30	238
-26R1	36	Shale	30	12	55
-34Q1	135	Basalt, jointed	74	10	134
-35P1	96	Basalt, jointed	36	8	----
-35Q1	73	Sand	45	8	----
-36H1	138	--------------------------	92	8	128
-36Q1	220	Sandstone	45	350	----
14/4W-3D1	22	Sandstone	76	10	92
-6L1	45(?)	--------------------------	38	22	220
-15C1	90	--------------------------	18	12	83
15/1W-27F1	107	--------------------------	26	10	805
-29M1	313	--------------------------	26	6	61
15/2W-26K1	119	Sand, fine	82	216	159
-29B2s	----	--------------------------	40	10	24
-29J1	100	Gravel	58	36	43
-31F5	112	Gravel and sand	52	26	85
15/3W-34R1	140	Sandstone	10	10	195
-35B1	33	Sand	54	18	67
-35F1	100	Sand	90	10	201
-35L4	64	Sand	60	16	120
-36G1	53	Sand and gravel	50	16	43
15/4W-15H1s	----	--------------------------	24	10	48