CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 54

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF WHITE VALLEY NO. 49

SASKATCHEWAN

By

B. R. MacKay, H. H. Beach, and D. P. Goodall

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INTRODUCTION

Lack of rainfall during the years 1930 to 1934 over a large part of the Prairie Provinces brought about an acute shortage both in the larger supplies of surface water used for irrigation and the smaller supplies of ground water required for domestic purposes and for stock. In an effort to relieve the serious situation the Geological Survey began an extensive study of the problem from the standpoint of domestic uses and stock raising. During the field season of 1935 an area of 80,000 square miles, comprising all that part of Saskatchewan south of the north boundary of township 32, was systematically examined, records of approximately 60,000 wells were obtained, and 720 samples of water were collected for analyses. The facts obtained have been classified and the information pertaining to any well is readily accessible. The examination of so large an area and the interpretation of the data collected were possible because the bedrock geology and the Pleistocene deposits had been studied previously by McLearn, Warren, Rose, Stansfield, Wickenden, Russell, and others of the Geological Survey. The Department of Natural Resources of Saskatchewan and local well drillers assisted considerably in supplying several hundred well records. The base maps used were supplied by the Topographical Surveys Branch of the Department of the Interior.

Publication of Results

The essential information pertaining to the ground water conditions is being published in reports, one being issued for each municipality. Copies of these reports are being sent to the secretary treasurers of the municipalities and to certain Provincial and Federal Departments, where they can be consulted by residents of the municipalities or by other persons, or they may be obtained by writing direct to the Director, Bureau of Economic Geology, Department of Mines, Ottawa. Should anyone require more detailed information than that contained in the reports such additional information as the Geological Survey possesses can be obtained on application to the director. In making such request the applicant should indicate the exact location of the area by giving the quarter section, township, range, and meridian concerning which further information is desired.

The reports are written principally for farm residents, municipal bodies, and well drillers who are either planning to sink new wells or to deepen existing wells. Technical terms used in the reports are defined in the glossary,

How to Use the Report

Anyone desiring information about ground water in any particular locality should read first the part dealing with the municipality as a whole in order to understand more fully the part of the report that deals with the place in which he is interested. At the same time he should study the two figures accompanying the report. Figure 1 shows the surface and bedrock geology as related to the ground water supply, and Figure 2 shows the relief and the location and type of water wells. Relief is shown by lines of equal elevation called "contours". The elevation above sea-level is given on some or all of the contour lines on the figure.

If one intends to sink a well and wishes to find the approximate depth to a water-bearing horizon, he must learn: (1) the elevation of the site, and (2) the probable elevation of the water-bearing bed. The elevation of the well site is obtained by marking its position on the map, Figure 2, and estimating its elevation with respect to the two contour lines between which it lies and whose elevations are given on the figure. Where contour lines are not shown on the figure, the elevations of adjacent wells as indicated in the Table of Well Records accompanying each report can be used. The approximate elevation of the water-bearing horizon at the well-site can be obtained from the Table of Well Records by noting the elevation of the water-bearing horizon in surrounding wells and by estimating from these known elevations its elevation at the well-site.[1] If the water-bearing horizon is in bedrock the depth to water can be estimated fairly accurately in this way. If the water-bearing horizon is in unconsolidated deposits such as gravel, sand, clay, or glacial debris, however, the estimated elevation is less reliable, because the water-bearing horizon may be inclined, or may be in lenses or in sand beds which may lie at various horizons and may be of small lateral extent. In calculating the depth to water, care should be taken that the water-bearing horizons selected from the Table of Well Records be all in the same geological horizon either in the glacial drift or in the bedrock. From the data in the Table

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[1] If the well-site is near the edge of the municipality, the map and report dealing with the adjoining municipality should be consulted in order to obtain the needed information about nearby wells.

of Well Records it is also possible to form some idea of the quality and quantity of the water likely to be found in the proposed well.

GLOSSARY OF TERMS USED

Alkaline. The term "alkaline" has been applied rather loosely to some ground-waters. In the Prairie Provinces, a water is usually described as "alkaline" when it contains a large amount of salts, chiefly sodium sulphate and magnesium sulphate in solution. Water that tastes strongly of common salt is described as "salty". Many "alkaline" waters may be used for stock. Most of the so-called "alkaline" waters are more correctly termed "sulphate waters".

Alluvium. Deposits of earth, clay, silt, sand, gravel, and other material on the flood-plains of modern streams and in lake beds.

Aquifer or Water-bearing Horizon. A water-bearing bed, lens, or pocket in unconsolidated deposits or in bedrock.

Buried pre-Glacial Stream Channels. A channel carved into the bedrock by a stream before the advance of the continental ice-sheet, and subsequently either partly or wholly filled in by sands, gravels, and boulder clay deposited by the ice-sheet or later agencies.

Bedrock. Bedrock, as here used, refers to partly or wholly consolidated deposits of gravel, sand, silt, clay, and marl that are older than the glacial drift.

Coal Seam. The same as a coal bed. A deposit of carbonaceous material formed from the remains of plants by partial decomposition and burial.

Contour. A line on a map joining points that have the same elevation above sea-level.

Continental Ice-sheet. The great ice-sheet that covered most of the surface of Canada many thousands of years age.

Escarpment. A cliff or a relatively steep slope separating level or gently sloping areas.

Flood-plain. A flat part in a river valley ordinarily above water but covered by water when the river is in flood.

Glacial Drift. The loose, unconsolidated surface deposits of sand, gravel, and clay, or a mixture of these, that were deposited by the continental ice-sheet. Clay containing boulders forms part of the drift and is referred to as glacial till or boulder clay. The glacial drift occurs in several forms:

(1) Ground Moraine. A boulder clay or till plain (includes areas where the glacial drift is very thin and the surface uneven).

(2) Terminal Moraine or Moraine. A hilly tract of country formed by glacial drift that was laid down at the margin of the continental ice-sheet during its retreat. The surface is characterized by irregular hills and undrained basins.

(3) Glacial Outwash. Sand and gravel plains or deltas formed by streams that issued from the continental ice-sheet.

(4) Glacial Lake Deposits. Sand and clay plains formed in glacial lakes during the retreat of the ice-sheet.

Ground Water. Sub-surface water, or water that occurs below the surface of the land.

Hydrostatic Pressure. The pressure that causes water in a well to rise above the point at which it is struck.

Impervious or Impermeable. Beds, such as fine clays or shale, are considered to be impervious or impermeable when they do not permit of the perceptible passage or movement of the ground water.

Pervious or Permeable. Beds are pervious when they permit of the perceptible passage or movement of ground water, as for example porous sands, gravel, and sandstone.

Pre-Glacial Land Surface. The surface of the land before it was covered by the continental ice-sheet.

Recent Deposits. Deposits that have been laid down by the agencies of water and wind since the disappearance of the continental ice-sheet.

Unconsolidated Deposits. The mantle or covering of alluvium and glacial drift consisting of loose sand, gravel, clay, and boulders that overlie the bedrock.

Water Table. The upper limit of the part of the ground wholly saturated with water. This may be very near the surface or many feet below it.

Wells. Holes sunk into the earth so as to reach a supply of water. When no water is obtained they are referred to as dry holes. Wells in which water is encountered are of three classes.

(1) Wells in which the water is under sufficient pressure to flow above the surface of the ground. These are called Flowing Artesian Wells.

(2) Wells in which the water is under pressure but does not rise to the surface. These wells are called Non-Flowing Artesian Wells.

(3) Wells in which the water does not rise above the water table. These wells are called Non-Artesian Wells.

NAMES AND DESCRIPTIONS OF GEOLOGICAL FORMATIONS, REFERRED TO IN THESE REPORTS

Wood Mountain Formation. The name given to a series of gravel and sand beds which have a maximum thickness of 50 feet, and which occur as isolated patches on the higher parts of Wood Mountain. This is the youngest bedrock formation and, where present, overlies the Ravenscrag formation.

Cypress Hills Formation. The name given to a series of conglomerates and sand beds which occur in the southwest corner of Saskatchewan, and rests upon the Ravenscrag or older formations. The formation is 30 to 125 feet thick.

Ravenscrag Formation. The name given to a thick series of light-coloured sandstones and shales containing one or more thick lignite coal seams. This formation is 500 to 1,000 feet thick, and covers a large part of southern Saskatchewan. The principal coal deposits of the province occur in this formation.

Whitemud Formation. The name given to a series of white, grey, and buff coloured clays and sands. The formation is 10 to 75 feet thick. At its base this formation grades in places into coarse, limy sand beds having a maximum thickness of 40 feet.

Eastend Formation. The name given to a series of fine-grained sands and silts. It has been recognized at various localities over the southern part of the province, from the Alberta boundary east to the escarpment of Missouri coteau. The thickness of the formation seldom exceeds 40 feet.

Bearpaw Formation. The Bearpaw consists mostly of incoherent dark grey to dark brownish grey, partly bentonitic shales, weathering light grey, or, in places where much iron is present, buff. Beds of sand occur in places in the lower part of the formation. It forms the uppermost bedrock formation over much of western and southwestern Saskatchewan and has a maximum thickness of 700 feet or somewhat more.

Belly River Formation. The Belly River consists mostly of non-marine sand, shale, and coal, and underlies the Bearpaw in the western part of the area. It passes eastward and northeastward into marine shale. The principal area of transition is in the western half of the area where the Belly River is mostly thinner than it is to the west and includes marine zones. In the southwestern corner of the area it has a thickness of several hundred feet.

Marine Shale Series. This series of beds consists of dark grey to dark brownish grey, plastic shales, and underlies the central and northeastern parts of Saskatchewan. It includes beds equivalent to the Bearpaw, Belly River, and older formations that underlie the western part of the area.

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of White Valley, No. 49, is an area of 324 square miles in the southwestern part of southern Saskatchewan. The municipality consists of nine townships, described as tps. 4, 5, and 6, ranges 19, 20, and 21, W. 3rd mer. The town of Eastend, situated on the Weyburn-Lethbridge line of the Canadian Pacific railway in the northwestern corner of the municipality, lies about 68 miles southwest of Swift Current and 35 miles north of the International Boundary. The railway crosses the northwestern corner of the area in secs. 31 and 32, tp. 6, range 21. In the vicinity of Eastend and westward it occupies the valley of Frenchman river, known locally as Whitemud river. A mile east of town, however, it swings north through a dry coulée that cuts across the height of land to the headwaters of Swiftcurrent creek several miles north of the municipality. Frenchman river flows from the northwest corner in a southeasterly direction across the municipality and crosses the eastern boundary of the area in the northeastern corner of township 4, range 19. The river valley is a deep, flat-bottomed trench with steep banks. It has an average width of about 2 miles and a depth of 200 to 250 feet. Slumping has taken place along the banks and forms a belt of rough, hillocky terrain along both sides of the valley bottom. Broad reaches of flat hay meadows extend throughout the full length of the valley floor. The size of the river is insignificant in comparison with the large valley it occupies. It is not over 50 feet in width and meanders along the valley with a fall of only about 90 feet in the 21 miles traversed across the municipality. Although this stream may carry a large flow of water during the period of the spring run-off it usually ceases to flow in August. Numerous basins and cut-off "oxbows" in the stream channel, however, conserve ample water for stock during the remainder of the grazing season.

The land surface south of the river valley is comparatively level, with an average elevation of about 3,100 feet above sea-level. The western part of this area is characterized by broad flats which form part of the drainage system of Frenchman river and occupy most of townships 4, 5, and 6, range 21.

North of the river the land surface rises gradually in an easterly direction from an average elevation of about 3,050 feet along the western side of township 6, range 20, to elevations exceeding 3,380 feet on the eastern side of townships 5 and 6, range 19.

As only townships 5 and 6, ranges 20 and 21, have been topographically mapped the relief in the remaining townships is not shown by contour lines on Figure 2, of the accompanying map. The elevations quoted for this part of the municipality were determined by aneroid barometer readings and were checked where possible during the course of this investigation by reference to railway and topographic bench-marks. As established points of elevation were not conveniently located to all parts of the area errors are bound to exist, and the elevations given must be regarded as only approximately correct in the eastern and southern townships.

Frenchman river provides water for the stock of nearby residents, but the water is not regarded as being satisfactory for domestic use. Throughout the greater part of the area farm supplies are derived from wells, although in a few places where the surface clays are impervious to the passage of water farmers have excavated dugouts for stock. The wells have been sunk into the unconsolidated Recent stream deposits and the glacial deposits mantling the uplands and into the Ravenscrag, Eastend, and Bearpaw bedrock formations.

Water-bearing Horizons in the Unconsolidated Deposits

Stream deposits of silt, fine sand, and gravel floor Frenchman River valley and the valleys of several of its larger tributaries. Wells sunk in the river flats generally encounter water within 20 feet of the surface, but owing to its high concentration of dissolved mineral salts it is not generally satisfactory for domestic use. Much of the river flat deposits is comprised of fine, compact silts, derived from the Bearpaw shales forming the lower sides of the valley. Water moves slowly through these sediments and ample opportunity is afforded for the dissolving of mineral salts from them. Careful prospecting across the valley might reveal the presence of more or less continuous gravel beds interbedded in the silts, from which less highly mineralized water is to be expected. Water of better quality is in some places encountered in the generally more porous stream deposits of the smaller coulées extending from the uplands on both sides of the river valley. These deposits are derived largely by the erosion of the fresh water, sandy sediments of the upper bedrock formations, which contain considerably smaller amounts of readily soluble salts than do the Bearpaw shales.

A mantle of glacial drift was deposited over this area by the great continental ice-sheet that many thousands of years ago advanced and retreated over the province of Saskatchewan. The drift now covers the land surface of the area to depths of 10 feet or less along the valley sides, but increases to thicknesses as great as 100 feet over the upland parts of the municipality. At places along the river valley, and along some of the larger tributary coulées, the drift has been entirely removed by erosion, and the underlying bedrock is exposed. A deposit of till characterized by a gently rolling ground surface forms the greater part of the glacial drift over the area. The till is composed principally of bluish grey boulder clays interspersed with scattered pockets of sand and gravel.

The upper few feet of the boulder clay is weathered and takes on a light buff to yellow-brown appearance. The boulder clay is not generally sufficiently porous to allow for the accumulation of more than small supplies of ground water, and such waters usually contain fairly large amounts of mineral salts in solution. Larger supplies of water are concentrated in the sand and gravel pockets. These deposits are very irregular in their occurrence, and individual beds may be of very limited areal extent. Since there is generally little or no indication on the surface of their presence at depth residents often find it necessary to dig a number of test holes before a suitable water supply is obtained. The quantity of water obtainable from this source depends upon the depth and areal extent of the porous beds and upon the amount of surface precipitation and the ease with which it can seep down through the overlying materials. The water-bearing beds of the drift lying at depths of 30 feet or more are usually less affected by seasonal changes in precipitation than those nearer the surface. Most of the sand and gravel pockets of the drift in this municipality occur at shallow depths and cannot be depended upon for water supplies during prolonged dry seasons. A few wells in the southern, low-lying parts of the municipality have encountered beds of sand or gravel occurring at or near the contact of the drift with the underlying bedrock at depths of 70 to 100 feet from the surface. Waters from these wells show a wide variation in quality, but in most places the water is moderately soft and drinkable and occurs in sufficient quantity to water 20 to 40 head of stock. A generally more porous phase of the glacial drift referred to as "moraine" covers irregular areas in the uplands. The moraine is believed to have been formed where the ice-sheet paused for a considerable period of time, and like the till it is composed largely of boulder clay. The sand and gravel pockets are more numerous, however, and are occasionally of considerable areal extent. The moraine has an irregularly rolling surface and is characterized by low knolls and ridges and undrained depressions. The largest area of moraine extends as a belt approximately 4 miles wide along the uplands south of the river in township 4, range 20, and the southern part of township 5, range 20. Smaller areas of moraine also occur along the eastern border of township 6, range 19, and along the southern border of the municipality. Shallow wells sunk on or near gravel accumulations, either on knolls at the bases of slopes or in coulées, provide small supplies of water that can be used satisfactorily in the households. A few wells even produce sufficiently constant and adequate supplies to make possible the watering of 20 or more head of stock. In the greater part of the moraine-covered districts, however, residents have deepened the wells through the drift into the bedrock to obtain water for stock.

Water-bearing Horizons in the Bedrock

Four bedrock formations, known as the Ravenscrag, Whitemud, Eastend, and Bearpaw formations, are known to immediately underlie the unconsolidated deposits in different parts of the municipality. All of these formations at one time or another prior to the deposition of the glacial drift presumably extended over the entire municipality, in the descending order given. Erosion has greatly reduced the areal extent of the higher formations, so that the uppermost formation, the Ravenscrag, is confined to areas of highest relief whereas the Whitemud, Eastend, and Bearpaw have increasingly greater extents at lower elevations. Frenchman valley has been eroded so deeply that all of the formations are exposed at different levels along the sides, with the Bearpaw formation underlying the valley floor.

The Ravenscrag formation underlies the drift in the eastern half of the municipality with the exception of the river valley and a small area extending along the southern border. The formation consists essentially of fine, medium grey to blue-grey sands, dark to medium grey shales, and thin seams of lignite coal. Outcrops of these beds occur at intervals along the upper slopes of Frenchman River valley.

The Ravenscrag formation was deposited on an unevenly eroded land surface, and hence its base does not everywhere lie at the same elevation. In the north-central part of the area, in township 6, range 20, it overlies the Whitemud beds at an elevation of about 3,125 feet above sea-level. On the eastern side of the area, particularly in township 5, range 19, the Whitemud and the underlying Eastend formations have been removed by erosion prior to the deposition of the Ravenscrag, so that here it immediately overlies the Bearpaw shales. The thickness of the formation varies considerably, due not only to the irregularity of its base but also to the uneven land surface. It probably attains a maximum thickness of about 350 feet in the highest part of the area located in the northeastern corner of the municipality.

Water is obtained from wells sunk to various depths in the Ravenscrag formation. The water occurs in sand beds and sometimes in the coal seams. From most of the wells the water is reported to be hard and quite suitable for drinking, although iron is frequently present in sufficient quantities to form a red precipitate in the water. The yield from wells varies from place to place, and individual aquifers are traceable only for short distances. An attempt is made in Figure 1, of the accompanying geological map, to outline areas in which water may be obtained within a definite elevation range. Wells east of the "A" line obtain water at elevations ranging from 3,310 to 3,260 feet above sea-level. Those situated between the "A" and "B" lines obtain water at elevations between 3,170 and 3,140 feet, and between the "B" and "C" lines water is found at elevations of 3,090 to 3,060 feet. Little or no water is encountered in the Ravenscrag formation west of the "C" line, where the formation is very thin. The lower zones of water-bearing beds are expected to extend eastward below those of higher elevations, so that if an insufficient supply is obtained on the eastern side of the area at elevations indicated by the "A" line, the wells may be deepened so as to encounter the lower water-bearing zones at their respective depths.

South of Frenchman river only the lower beds of the Ravenscrag occur and water is generally obtained at elevations ranging from 3,130 to 3,000 feet above sea-level, or at depths of 45 to 170 feet from the surface.

The Whitemud formation consists of a series of white to light grey clays and sandy clays with an average thickness of about 30 feet. Outcrops of these clays form a very prominent white band extending along on both sides of Frenchman valley through range 20. This formation probably does not extend for more than 2 to 3 miles south of the river, but is known to underlie quite an extensive area north of the river in the north-central part of the municipality. Water obtained from the Whitemud formation is invariably "alkaline" and often cloudy, and it is questionable if it is fit even for stock use.

The Eastend formation has a much wider areal extent than the Whitemud and is known to extend over all of ranges 20 and 21, with the exception of the river valley and possibly a narrow area extending along the southern border in the southwestern part of the municipality. The exact eastern extent of this formation is not known, but erosion that occurred before the deposition of the Ravenscrag is thought to have removed all of the Eastend beds in the east-central part of the municipality. The fine, medium to dark grey sands and silts comprising this formation may attain a maximum thickness of about 100 feet in the north-central part of the municipality, where they are overlain by the Whitemud formation. The base of the Eastend is shaly and not well defined, as its lower beds apparently merge without a break into the underlying Bearpaw formation. Wells definitely known to produce from the Eastend sands are widely scattered throughout the area, but the individual aquifers are apparently of small extent. These waters where obtained in range 21, on the western side of the area, are reported to be soft or moderately hard, and at most places are being used for the household drinking supply. Waters from the Eastend become more highly mineralized toward the east, however, and in range 20 some of the wells yield water suitable only for watering stock.

The Bearpaw formation immediately underlies the stream deposits in Frenchman River valley, and it is also believed to underlie the glacial drift in the southern part of the municipality, including a narrow belt along the southern border of township 4, range 19, and most of the southwestern and southeastern halves, respectively, of townships 4, ranges 20 and 21. Throughout the remainder of the area it underlies the Eastend or, in the absence of the Eastend, the Ravenscrag formation. The Bearpaw formation outcrops at intervals along the lower banks of the river valley, and has been encountered in a number of wells situated in the western two-thirds of the municipality. The formation is thought to have a maximum thickness of 700 to 800 feet. The upper beds, where encountered in drilled wells, are difficult to distinguish from the overlying Eastend. At depth, however, the Bearpaw contains less sand beds, and in its middle and lower part is composed almost entirely of dark grey shales. These shales are referred to locally as "soapstone".

The upper beds of the Bearpaw formation form an excellent water-bearing horizon which is tapped by wells situated in townships 4, 5, and 6, range 20. In the southern part of the area the water-bearing sands occur at a depth of 145 feet, or at an elevation of about 2,855 feet above sea-level. Although the general land surface rises toward the north the water-bearing horizon also rises perceptibly in a northerly direction, so that in township 5 it is encountered by three wells at an elevation of about 2,880 feet, or at depths of 240 to 253 feet. Still farther north, in the central part of township 5, several wells are producing from this horizon at an average depth of about 180 feet, or at an elevation of about 2,960 feet above sea-level.

The wells in the latter group vary considerably in depth, and some of them may obtain their water from the lower Eastend beds. Water from this horizon is generally soft and in some of the wells is brownish. It contains relatively small amounts of mineral salts in solution and is reported to be quite suitable for domestic requirements.

It is doubtful if these aquifers form a continuous horizon through the area described above. Individual aquifers may be fairly extensive in some localities, however, as indicated by the high water-level maintained in several wells. Only three wells in the western third of the municipality, all situated in the town of Eastend, are definitely known to be obtaining water from the Bearpaw, although dry holes have been sunk to depths as great as 625 feet. In the eastern third of the area wells are all yielding water from the overlying formations and none is known to have been sunk to a sufficient depth to encounter the Bearpaw horizon. Deep drilling into the middle or lower part of the Bearpaw formation is not recommended, since the compact dark shales yield little water and such seepages as have been found are too highly charged with dissolved mineral salts to be suitable for any farm use.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 4, Range 19

Recent deposits, consisting of sand and silt, occur in the valley of Frenchman river in the northeastern part of this township, and may provide supplies of hard, "alkaline" water. Although water from this source may be used for watering stock it is probably too highly mineralized for use in the households.

On the highlands south of the river small supplies of hard, drinkable water are obtained from isolated pockets of sand or gravel interspersed through the boulder clays of both the till and moraine. These water-bearing beds usually lie within 20 feet of the surface, and, where found, seldom yield more than sufficient water for about 10 head of stock. Most of the residents are obliged to sink wells to the underlying bedrock formation for their water supplies. Several water-bearing beds of grey to blue-grey sand interbedded with grey shale occur near the base of the Ravenscrag formation, and are the most reliable source of ground water supplies in the township. This formation underlies the glacial drift throughout the entire area with the possible exception of a belt ½ mile to 1½ miles in width extending along the southern border of the township and an area of 3 square miles in the northeastern corner. Wells sunk to depths of 70 to 170 feet in this area have encountered an abundance of water in these sands. In most of the wells the water does not rise more than a few feet above the aquifer. Wells situated on the eastern and western borders of the township produce waters with such a high concentration of dissolved mineral salts that they are used only for watering stock. Throughout the central and northern parts of the township, including sections 9, 15, 21, 22, 28, 32, and 33, the water is not highly mineralized and apparently is quite suitable for household use.

All waters from the Ravenscrag formation in this township are hard and iron is present in most of them, although seldom in sufficient quantities to render the water unsuitable for drinking.

Where the Ravenscrag is absent, along the southern border of the township, drilling in the Eastend or into the upper part of the Bearpaw formation, at depths of 180 to 200 feet should prove productive. A dry hole has been sunk to a depth of 140 feet in the NW. $\frac{1}{4}$, section 5. Shale was encountered at depths of 100 to 140 feet, where drilling was suspended. This well was probably not deep enough to reach the water-bearing horizon that is believed to occur in the upper beds of the Bearpaw formation, and should be carried down to a depth of at least 200 feet.

Township 4, Range 20

Water is obtained from two different horizons in the glacial drift in this township. The upper horizon consists of small, isolated pockets of sand interspersed through the boulder clay within 20 feet of the surface. Only a few of these water-bearing sand pockets have been located, but where found they yield fair supplies of hard water that is reported to be quite suitable for drinking. The largest supply of water obtained from this type of deposit is from a 25-foot well situated on a hill on the SW. $\frac{1}{4}$, section 21. This water maintains a constant level in the well within a few feet of the ground surface. The second water-bearing horizon occurs in beds of sand and quicksand lying at or near the contact of the glacial drift with the underlying bedrock at depths of 50 to 75 feet from the surface. Wells situated in sections 15, 16, and 22 are producing from this horizon. The water is hard, and that from the well in section 16 is highly mineralized and is being used only for watering stock. Quicksand was also encountered at this horizon in the deep wells put down in sections 12 and 28. This sand partly plugged the wells and the water supply is insufficient for local requirements.

Adequate supplies of hard water are obtained from the lower beds of the Ravenscrag formation in the northeastern part of the township.

This water-bearing horizon apparently does not extend southeast of a line passing northwesterly through sections 13, 22, 27, and 33. In most places the waters contain appreciable amounts of iron compounds in addition to other mineral salts, and hence are not suitable for domestic use although they are being used for watering stock without any apparent ill effects.

The Eastend formation is not known to be water bearing in this township. These beds are thought to underlie only the northeastern half of the area, and are probably too thin or too impervious to contain any large ground water supplies.

The Bearpaw formation underlies the glacial drift in the southwestern half of the township, and the Eastend in the northeastern half. It contains at least one definite water-bearing horizon in its upper part. Two wells situated in section 12 tap this horizon at a depth of 145 feet, or at an elevation of about 2,855 feet above sea-level. A well in section 18 also taps this, or a similar, aquifer at a depth of 160 feet or at an elevation of 2,895 feet. The water occurs in bluish grey sand. The supply obtained from individual wells is sufficient only for household use and a few head of stock, but the water is soft and drinkable. The areal extent of this horizon has not been determined. Similar soft waters are obtained from wells sunk to depths of about 250 feet in the southwest part of the township bordering on the north, suggesting a fairly wide distribution for these water-bearing sands. It is doubtful, however, if they are everywhere present in this township. Several dry holes have been sunk to depths of 80 to 110 feet in the SE. $\frac{1}{4}$, section 28. The surface elevation at this point is relatively low, but a depth of at least 170 feet may be required to reach the soft water horizon in this locality.

Township 4, Range 21

Very few well records were obtained from this area in 1935, as most of the settlers have abandoned their farms on account of repeated crop failures in this district. Extensive deposits of sand

and gravel occur in the bottoms of the wide, shallow valleys extending over a large part of the southeastern half of this township. These sand and gravel deposits continue for several miles south of this township, and where wells have been sunk in them a moderate supply of water is usually available at depths of 20 to 40 feet. It is reasonable to suppose that similar ground water conditions also prevail throughout the southern part of this township.

In the northwestern half of the township water-bearing sands and gravels are apparently sparing in occurrence in the glacial drift but adequate supplies of water have been located at a number of places in the underlying Eastend formation at depths ranging from 75 to 157 feet. The deepest wells are situated on the western side of the area where surface elevations are relatively high. The water occurs in beds of fine sand that occur interspersed through the shales, at elevations ranging from 3,160 to 2,990 feet above sea-level. Some of the wells obtaining water from the lower aquifers, listed in the table of well logs accompanying this report as being in the Eastend formation, may be in the underlying Bearpaw formation. The waters are variable in character, ranging from soft, drinkable water to the hard and highly mineralized type that can be used only for watering stock.

In the southeastern half of the township the general land surface is relatively low, and the glacial drift is thought to be immediately underlain by the Bearpaw formation. A 90-foot dry hole, located in section 3, is the only test reported to have been made in this formation in the township. Although water may occur in the upper beds of the Bearpaw in some parts of the area drilling to elevations lower than about 2,850 feet is not recommended.

Township 5, Range 19

In the southwestern part of this township moderately large supplies of ground water may be obtained at shallow depths from the fine sand and silt in the bottom of the river valley.

Waters from these sediments are usually fairly highly mineralized, and are not particularly suitable for drinking but may be used for watering stock. Drinking water of better quality may be expected from gravel or sand beds in the smaller coulées on either side of the valley and on the uplands.

Small supplies of water are obtained in the glacial drift from wells sunk to depths of 20 to 60 feet. These water-bearing beds are apparently small pockets of sand and gravel interspersed through the boulder clay, and are more numerous in the drift along the north and eastern sides of the township. The water from this source is hard and is usually not too "alkaline" to be used for drinking. The supply obtained from most of the wells is sufficient only for household use and for a few head of stock.

The largest and most reliable source of ground water supplies of this township occurs in the Ravenscrag formation. This formation is exposed at intervals along the upper banks of Frenchman River valley and on the uplands remote from the valley it underlies the drift at depths ranging from about 20 to 80 feet from the surface. The water occurs in coal seams or in beds of blue-grey sand that occur interspersed at irregular intervals throughout the shales and clays comprising the greater part of the formation. At no place north of the river has it been necessary to sink wells to a depth greater than 110 feet, or south of the river, to a depth greater than 150 feet in order to obtain an adequate water supply from one of these aquifers. A few natural flowing springs occur in the deep coulées and along the river bank where some of these aquifers outcrop at the surface. The water in the wells seldom rises more than a few feet above the aquifer. The water is hard, but does not generally contain a high concentration of mineral salts, especially if precautions have been taken to case off any highly mineralized seepage waters that issue from the overlying drift. Iron compounds are present, however, in many of these waters from the Ravenscrag, especially in the northwestern and southwestern parts of the township. Here several wells are reported to yield water that is so highly charged with iron as to be unpalatable, but it is being used for stock watering. Water of much better quality is obtained from this formation in the eastern half of the township. Most of the wells in this area yield water that is or can be used for drinking, although some of the waters have sufficient iron present to form a red precipitate.

The Ravenscrag formation is thought to be underlain by the Eastend formation only in the northwestern part of the township. The Bearpaw formation occurs below the Eastend and, in the absence of the Eastend, immediately underlies the Ravenscrag. The Bearpaw also forms the bedrock below the Recent flood-plain deposits in the bottom of Frenchman River valley.

Although to date there is no report of wells having been put down to either the Eastend or the Bearpaw formation in this township they may both prove to be water-bearing. Such waters as they may contain are expected to be more highly mineralized than the average type of water from the Ravenscrag formation.

Township 5, Range 20

Ground water conditions in the unconsolidated deposits occurring along the bottom of the river valley in this township are considered to be generally similar to those described in the preceding section dealing with township 5, range 19. No records of wells having been sunk in these deposits in this township were obtained.

A few isolated pockets of sand and gravel occur in the boulder clay of the glacial drift in the moraine-covered area lying to the south of the river valley. Wells sunk to these porous beds yield small supplies of hard water; usually in sufficient quantity only for household use and for 5 to 10 head of stock. Some of the residents in this area have constructed dams in the coulées to conserve water for their stock and obtain drinking water from shallow seepage wells dug near these surface water supplies or near sloughs. The till covering the valley slopes is seldom of sufficient thickness to form a source for any large supply of water. The few wells that have been sunk to bedrock in the township show a wide variation as to depth to the productive bed and the quality of water obtained. The Ravenscrag formation, of which only the lower part is present, is confined to the uplands of the eastern half of the township. Three wells, situated in sections 1, 2, and 3, struck water in a sand bed at depths of 120, 60, and 45 feet, respectively, and at an elevation of about 3,090 feet above sea-level. This sand bed probably lies at the base of this formation. Large yields of water are obtained from these wells, but the water from the well on section 1 is reported to contain iron and common salt in solution, and is used only for watering stock. This water-bearing horizon may extend north to the river, but to date no other deep wells are known to have been sunk in this area that might substantiate this assumption. No water has been encountered in this formation north of the river. Two wells on section 36 have encountered coal at the base of the Ravenscrag and after passing through the Whitemud obtained water in a sandstone member of the Eastend formation. The supply of water from these wells is inadequate for the average farm requirements and is rendered unsuitable for household use through the large quantities of mineral salts in solution. In the east-central part of the township south of the river small supplies of highly "alkaline" water which are being used for stock watering only are obtained from beds of grey sandstone in the upper part of the Eastend formation.

The most satisfactory source of ground water in this township is sandstone at the base of the Eastend or in the upper part of the underlying Bearpaw formation. This water-bearing horizon has been encountered in three wells situated in the southwestern part of the township at depths of 240 and 253 feet. The waters from wells in sections 4 and 17 are soft and have a light brownish colour. The third well, on section 18, produces moderately hard, clear water. The exact areal extent of this horizon can only be ascertained by drilling. It is thought to have a fairly wide distribution, as a similar horizon has been encountered 2 to 3 miles north of the township, suggesting a possible occurrence of these water-bearing sands through most of the intervening area. The sands are not everywhere present, however. A dry hole put down to a depth of 302 feet in the SW. $\frac{1}{4}$, section 19, should have reached production at this horizon at a depth of about 245 feet. This test hole has probably reached the lower limits at which adequate supplies of drinkable water may be expected from the Bearpaw formation. Sinking wells to elevations lower than 2,800 feet above sea-level is not recommended in any part of this township.

Township 5, Range 21

Stream erosion has played an important part in carving the surface features of this township. From an elevation of 3,200 feet in the western border of the township the land surface falls away rapidly to about 3,100 feet approximately 2 miles to the east. Farther east the slope is more gradual, reaching an elevation of about 3,000 feet on the banks of a wide, falt-bottomed coulée that extends in a northerly direction through the eastern part of the township. From the coulée eastward the surface rises gently to an elevation of about 3,075 feet on the eastern border of the township. Another stream channel with its headwaters in marshy land in the southwest corner of the area follows a north and northeasterly course down and across the slope to leave the township in sections 32 and 33. Both stream channels carry water only during flood seasons.

Sediments comprising the drift covering the uplands have been eroded and redeposited by stream action in the depressions and along the bottoms of the valleys. Although only a few wells are reported to have been sunk in the stream deposits they are regarded as being the best potential source of ground water supply in the unconsolidated deposits of the area. The possibility of obtaining an adequate supply of drinkable water from these deposits is particularly promising on the western side of the township where the streams flowing from the uplands are replenished in some places by springs. Wells sunk in the fine sediments that occur in the wide, flat bottomed coulées in the lowlands are more likely to obtain water that is highly charged with mineral salts.

The glacial drift deposits consisting largely of till, form a relatively thin blanket over the bedrock throughout most of the township. Its thickness probably does not greatly exceed 20 feet in most places.

Several shallow wells situated in the southern part and along the western side of the township are apparently obtaining water from the drift. The water-bearing beds consist of sands and gravels interspersed at irregular intervals through the boulder clays. These water supplies are generally concentrated in the thicker drift deposits that occur in the depressions and along the bases of the steeper slopes where porous materials have washed down from the points of higher elevation.

Few wells in the area are definitely known to be yielding water from the bedrock formations.

The Ravenscrag formation probably occurs on the upper slopes on the western side of sections 6 and 7, at elevations about 3,300 feet above sea-level. A small marsh in section 6 may be formed by springs issuing from the Ravenscrag or more probably from the upper part of the underlying Eastend formation.

This latter formation underlies the unconsolidated deposits throughout the rest of the township with the exception of some of the coulée bottoms in the northern part. Here the Bearpaw shales may occur below the stream deposits.

The Eastend formation is known to be water bearing only on the western side of the area. A spring and a 25-foot well in section 19 and a 60-foot well in section 31 are believed to be obtaining their supplies from sand beds in this formation at an elevation of about 3,170 feet above sea-level. This horizon has been encountered in other wells in the township bordering on the west. The water obtained is moderately soft to hard, and is reported to be suitable for domestic requirements. This horizon is confined to the uplands along the western side of the township. Throughout the rest of the township little water is obtained from the bedrock although several wells have been sunk to depths ranging from 160 to 625 feet in different parts of the area. More extensive prospecting of the unconsolidated Recent and glacial deposits seems preferable to deep drilling in this part of the township.

Township 6, Range 19

The land surface of this township rises toward the east from an average elevation of about 3,250 feet above sea-level on the western border to elevations ranging from 3,350 to 3,380 feet in the eastern part.

Glacial drift covers the irregular bedrock surface to depths of about 20 to 80 feet. The surface of the drift forms a moderately rolling till plain over the western two-thirds of the area. A glacial moraine with a slightly more irregular land surface covers most of the eastern third of the township.

Water is obtained in some places from isolated pockets of sand, and more rarely of gravel, that occur interspersed at irregular intervals through the boulder clay. Wells drawing from these aquifers are widely scattered through both the till plain and moraine-covered areas. They are generally not over 30 feet in depth. The supply of water obtained from individual wells is generally sufficient for only a few head of stock and for domestic requirements. These waters, however, are soft to only moderately hard and are often of better quality than water from the underlying bedrock.

The Ravenscrag formation underlies the drift throughout the entire township. Wells sunk into this formation encounter water in sand beds and coal seams at depths ranging from 14 to 212 feet from the surface. Throughout the northern part and along the eastern side of the township east of the "A" line, as shown on Figure 1 of the accompanying map, wells obtaining water from higher aquifers in the Ravenscrag range in depth from about 40 to 127 feet. The water occurs in sand and sandstone beds interspersed at irregular intervals through the shales. The individual aquifers are apparently of small extent, as water is seldom encountered at similar elevations in neighbouring wells. Most of these waters are hard and some are noticeably mineralized, but none is reported as being unfit for domestic use. The deepest wells have been sunk in the eastern central part of the area west of the "A" line. The water in this part of the area occurs in quicksand at elevations of 3,150 to 3,190 feet above sea-level. This horizon has been encountered in sections 2, 11, 13, 22, and 23, at depths ranging from 160 to 212 feet. The areal extent of this horizon has not been determined beyond the above sections, as in other parts of the township water-bearing beds have been encountered at shallower depths. Water from this horizon is hard and is reported to be suitable for drinking. Some of these wells have become choked with sand, but those remaining clear yield adequate supplies of water.

Ground water conditions in the sand and coal seams that occur at lower elevations west of the "B" line are not essentially different from conditions prevailing along the northern and eastern side of the area. The waters are generally more highly mineralized, however, although only one well, situated in section 19, is reported to yield water that is undrinkable.

No wells are known to have been sunk through the Ravenscrag to the underlying Eastend or Bearpaw formations. The Eastend may occur only in the western part of the township. Where the Eastend is absent the Ravenscrag directly overlies the Bearpaw formation. No prediction can be made as to the ground water conditions existing in either of these formations below the Ravenscrag.

Township 6, Range 20

Shallow deposits of sand and gravel occur in the coulée bottoms in the southern and western parts of this township. These porous beds can be expected to yield fair supplies of water at places where the stream gradient is not steep. These ground water supplies are little utilized at present, however, in that they are inconveniently situated with respect to the dwellings of the neighbourhood. The fine sands and silts that occur in the bottom of Frenchman valley where it passes through the southwestern corner of the township are also a potential source of ground water supply, although the waters may contain a relatively high concentration of mineral salts, rendering them in some places unsuitable for drinking.

Throughout the rest of the township the glacial drift, consisting mostly of till or boulder clays, overlies the bedrock to depths ranging from only a few feet or less on the valley slopes to about 60 feet in the northeast corner. Water-bearing beds of sand are known to occur in the drift in only a few isolated localities. These aquifers yield small to moderately large supplies of hard, generally "alkaline" water. At several places the water is reported to be too highly charged with mineral salts to be used for the domestic drinking supply, but it is being used for watering stock. Where no definite bedrock horizons have been encountered, such as Ravenscrag coal seams or Whitemud formation the depth to bedrock is uncertain, and some of the wells indicated in the tables as producing from bedrock aquifers may be obtaining some or all their water from the glacial drift.

In the northeastern part of the township large supplies of water are obtained from coal and sand beds that occur near the base of the Ravenscrag formation at various elevations ranging from about 3,060 to 3,160 feet above sea-level, or at depths of 60 to 125 feet from the surface. The western limit of these aquifers apparently does not extend beyond the intervening area between the NE. $\frac{1}{4}$, section 32, and the NW. $\frac{1}{4}$, section 12, as shown by the "C" line on Figure 1 of the accompanying map. The waters vary greatly in quality, ranging from exceptionally hard to soft waters containing soda. At no place, however, is the water reported to be too highly mineralized for domestic use. Waters from some of these wells may be contaminated by water from the overlying drift seeping down outside of the well casing. Some of the deeper wells may derive part of their soluble salts and soda from the underlying Whitemud formation.

Small supplies of water occur in the fine white sands and sandy clays of the Whitemud formation. These beds underlie the Ravenscrag formation and the drift throughout the township, with the exception of a small area of lower elevation in its northwestern corner and in the deep coulées and the river valley. Where encountered, waters from these sediments are usually cloudy and are so highly charged with mineral salts as to be seldom fit even for stock.

In the Eastend formation and the underlying Bearpaw formation abundant supplies of generally soft, slightly brown to clear water are obtained from beds of fine, grey sandstone at depths of 85 to 190 feet, or at elevations of about 2,950 feet to 3,050 feet above sea-level. These water-bearing beds are encountered by wells sunk over an extensive area throughout the southern half of the township, including sections 9, 10, 12, 13, 14, 15, and 16, and may also be present where the Eastend occurs in other parts of the township. Five wells, situated in sections 9, 15, 16, and 17, have tapped the lowest aquifer known to exist in this area in what is probably the upper beds of the Bearpaw at depths ranging from 138 to 192 feet. This water is reported to be soft, and is being used for the domestic drinking supply and for watering stock. The water is under hydrostatic pressure and rises in the wells 40 to 90 feet above the aquifer. Waters obtained from the higher aquifers are more variable in character. Most of those are hard, and one of the wells is reported to yield water that is "alkaline".

As no wells have been drilled below the lower soft water horizon little is known as to the ground water conditions existing at greater depths. It is probable, however, that adequate supplies of ground water will be found at higher horizons, thus obviating the necessity of deep drilling at any part of the area.

Township 6, Range 21

The variations in the surface relief of this township are largely due to the extensive post-glacial erosion by Frenchman river and its tributaries. Elevations range from about 2,980 feet in the vicinity of the river to over 3,200 feet on the upland bench extending over a width of approximately one mile on the western side of the township. Lower elevations of 3,100 to 3,050 feet prevail throughout the remainder of the highlands intervening between the coulées and north of the river valley.

Abundant supplies of ground water occur in the stream deposits of fine sands and silts in the bottom of Frenchman River valley. These are the principal water supplies available for the residents of the town of Eastend, situated in section 31. Water is encountered at an average depth of 18 feet in the wells of this area. The water is hard and contains a relatively high concentration of the mineral salts, but apparently is not detrimental to the health of residents of this community.

Deposits of coarser sands and gravels, distributed to depths of 10 to 20 feet, occur in the depressions and small draws in the lowlands south of the river valley. Fairly large supplies of water have been encountered in these sediments by the few residents situated in this part of the township. Some of these waters are soft, but noticeable amounts of soluble salts are present in most of them.

Waters of a similar quality are to be expected from stream deposits in the deeper coulées of this area.

Only a thin veneer of drift covers part of the areas of higher elevation in this township. No wells are reported to yield water from these deposits. The Eastend formation underlies the Recent and glacial deposits throughout this township, with the exception of the deep coulée bottoms and Frenchman River valley that lie at elevations lower than 2,975 feet above sea-level. Only two wells situated in the southwestern part of the township are known to be yielding water from sand beds of this formation. One of these, situated on the NW. $\frac{1}{4}$, section 5, produces highly mineralized water, unfit even for watering stock, at an elevation of about 3,051 feet, or at a depth of 70 feet from the surface. The other well, situated on the NW. $\frac{1}{4}$, section 6, at about 90 feet higher elevation, yields a large supply of soft, drinkable water from a depth of 60 feet from the surface. The Eastend formation may be water bearing in other parts of the area. No prediction can be made as to the type of water to be expected, since this formation is exposed at or near the surface in many different localities and surface waters carrying varying amounts of dissolved salts come in contact with the porous beds.

The marine shales of the Bearpaw formation underlie the Eastend and immediately underlie the unconsolidated deposits where the Eastend is absent. These shales are exposed in a few places along the bottom of Frenchman valley on the eastern side of the township. Water bearing beds of fine grey sand occur near the top of the formation in the vicinity of the town of Eastend and have been tapped by several drilled wells in this locality. These wells yield fair supplies of water that is reported to be suitable for household use from two aquifers at depths of 115 and 135 feet, or at elevations of 2,860 and 2,880 feet, respectively. The water from the 115-foot sand is soft and rises in the well to within 20 feet of the surface. Water from the

135-foot horizon is hard and contains relatively large amounts of iron and magnesium sulphate in solution. The areal extent of these aquifers has not been determined, as no other wells are known to have been sunk to this elevation throughout the township. It is possible, however, that other similar water supplies may occur in the upper Bearpaw sands in other localities.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF WHITE VALLEY, NO. 49, SASKATCHEWAN

West of 3rd meridian — Township / Range	4 / 19	4 / 20	4 / 21	5 / 19	5 / 20	5 / 21	6 / 19	6 / 20	6 / 21	Total No. in Municipality
Total No. of Wells in Township	24	38	15	33	26	41	50	34	31	292
No. of wells in bedrock	15	9	9	22	14	23	25	29	5	151
No. of wells in glacial drift	8	29	6	11	12	14	25	5	2	112
No. of wells in alluvium	1	0	0	0	0	4	0	0	24	29
Permanency of Water Supply										
No. with permanent supply	22	27	14	33	21	13	44	33	31	238
No. with intermittent supply	1	1	0	0	0	1	0	0	0	3
No. dry holes	1	10	1	0	5	27	6	1	0	51
Types of Wells										
No. of flowing artesian wells	0	0	0	0	0	0	0	0	0	0
No. of non-flowing artesian wells	4	9	10	6	4	2	18	16	6	75
No. of non-artesian wells	19	19	4	27	17	12	26	17	25	166
Quality of Water										
No. with hard water	20	18	8	28	18	8	34	22	25	181
No. with soft water	3	10	6	5	3	6	10	11	6	60
No. with salty water	0	0	0	0	2	0	0	0	0	2
No. with "alkaline" water	5	8	5	6	3	3	11	15	4	60
Depths of Wells										
No. from 0 to 50 feet deep	9	13	3	13	12	23	19	5	26	123
No. from 51 to 100 feet deep	4	15	10	16	6	9	18	18	2	98
No. from 101 to 150 feet deep	8	7	0	4	2	4	7	7	3	42
No. from 151 to 200 feet deep	3	2	2	0	1	3	5	4	0	20
No. from 201 to 500 feet deep	0	1	0	0	5	1	1	0	0	8
No. from 501 to 1,000 feet deep	0	0	0	0	0	1	0	0	0	1
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
How the Water is Used										
No. usable for domestic purposes	18	21	9	24	16	12	37	24	30	191
No. not usable for domestic purposes	5	7	5	9	5	2	7	9	1	50
No. usable for stock	23	26	10	31	21	13	42	30	30	226
No. not usable for stock	0	2	4	2	0	1	2	3	1	15
Sufficiency of Water Supply										
No. sufficient for domestic needs	22	27	14	32	20	11	40	31	30	227
No. insufficient for domestic needs	1	1	0	1	1	3	4	2	1	14
No. sufficient for stock needs	17	9	13	26	9	10	31	27	9	151
No. insufficient for stock needs	6	19	1	7	12	4	13	6	22	90

ANALYSES AND QUALITY OF WATER

General Statement

Samples of water from representative wells in surface deposits and bedrock were taken for analyses. Except as otherwise stated in the table of analyses the samples were analysed in the laboratory of the Borings Division of the Geological Survey by the usual standard methods. The quantities of the following constituents were determined; total dissolved mineral solids, calcium oxide, magnesium oxide, sodium oxide by difference, sulphate, chloride, and alkalinity. The alkalinity referred to here is the calcium carbonate equivalent of all acid used in neutralizing the carbonates of sodium, calcium, and magnesium. The results of the analyses are given in parts per million--that is, parts by weight of the constituents in 1,000,000 parts of water; for example, 1 ounce of material dissolved in 10 gallons of water is equal to 625 parts per million. The samples were not examined for bacteria, and thus a water that may be termed suitable for use on the basis of its mineral salt content might be condemned on account of its bacteria content. Waters that are high in bacteria content have usually been polluted by surface waters.

Total Dissolved Mineral Solids

The term "total dissolved mineral solids" as here used refers to the residue remaining when a sample of water is evaporated to dryness. It is generally considered that waters that have less than 1,000 parts per million of dissolved solids are suitable for ordinary uses, but in the Prairie Provinces this figure is often exceeded. Nearly all waters that contain more than 1,000 parts per million of total solids have a taste due to the dissolved mineral matter. Residents accustomed to the waters may use those that have much more than 1,000 parts per million of dissolved solids without any marked inconvenience, although most persons not used to highly mineralized water would find such waters highly objectionable.

Mineral Substances Present

Calcium and Magnesium

The calcium (Ca) and magnesium (Mg) content of water is dissolved from rocks and soils, but mostly from limestone, dolomite, and gypsum. The calcium and magnesium salts impart hardness to water. The magnesium salts are laxative, especially magnesium sulphate (Epsom salts, $MgSO_4$), and they are more detrimental to health than the lime or calcium salts. The calcium salts have no laxative or other deleterious effects. The scale found on the inside of steam boilders and tea-kettles is formed from these mineral salts.

Sodium

The salts of sodium are next in importance to those of calcium and magnesium. Of these, sodium sulphate (Glauber's salt, Na_2SO_4) is usually in excess of sodium chloride (common salt, NaCl). These sodium salts are dissolved from rocks and soils. When there is a large amount of sodium sulphate present the water is laxative and unfit for domestic use. Sodium carbonate (Na_2CO_3) "black alkali", sodium sulphate "white alkali", and sodium chloride are injurious to vegetation.

Sulphates

Sulphates (SO_4) are one of the common constituents of natural water. The sulphate salts most commonly found are sodium sulphate, magnesium sulphate, and calcium sulphate ($CaSO_4$). When the water contains large quantities of the sulphate of sodium it is injurious to vegetation.

Chlorides

Chlorides are common constituents of all natural water and are dissolved in small quantities from rocks. They usually occur as sodium chloride and if the quantity of salt is much over 400 parts per million the water has a brackish taste.

Iron

Iron (Fe) is dissolved from many rocks and the surface deposits derived from them, and also from well casings, water pipes, and other fixtures. More than 0.1 part per million of iron in solution will settle as a red precipitate upon exposure to the air. A water that contains a considerable amount of iron will stain porcelain, enamelled ware, and clothing that is washed in it, and when used for drinking purposes has a tendency to cause constipation, but the iron can be almost completely removed by aeration and filtration of the water.

Hardness

Calcium and magnesium salts impart hardness to water. Hardness of water is commonly recognized by its soap-destroying powers as shown by the difficulty of obtaining lather with soap. The total hardness of a water is the hardness of the water in its original state. Total hardness is divided into "permanent hardness" and "temporary hardness". Permanent hardness is the hardness of the water remaining after the sample has been boiled and it represents the amount of mineral salts that cannot be removed by boiling. Temporary hardness is the difference between the total hardness and the permanent hardness and represents the amount of mineral salts that can be removed by boiling. Temporary hardness is due mainly to the bicarbonates of calcium and magnesium and iron, and permanent hardness to the sulphates and chlorides of calcium and magnesium. The permanent hardness can be partly eliminated by adding simple chemical softeners such as ammonia or sodium carbonate, or many prepared softeners. Water that contains a large amount of sodium carbonate and small amounts of calcium and magnesium salts is soft, but if the calcium and magnesium salts are present in large amounts the water is hard. Water that has a total hardness of 300 parts per million or more is usually classed as excessively hard. Many of the Saskatchewan water samples have a total hardness greatly in excess of 300 parts per million; when the total hardness exceeded 3,000 parts per million no exact hardness determination was made. Also no determination for temporary hardness was made on waters having a total hardness less than 50 parts per million. As the determinations of the soap hardness in some cases were made after the samples had been stored for some time, the temporary hardness of some of the waters as they come from the wells probably is higher than that given in the table of analyses.

Analyses of Water Samples from the Municipality of White Valley, No. 49, Saskatchewan.

LOCATION						Depth of Well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of Water
No	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alkalinity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	NW.	27	4	19	3	Spring	1,326												(2)		(5)	(3)	(1)	(4)		* 2
2	NW.	22	4	20	3	50	2,337											(3)	(2)		(4)		(1)	(5)		* 1
3	SE.	18	5	20	3	246	809											(1)		(2)	$MgCl_2$=(4)				(3)	* 4
4	NW.	4	5	21	3	5	280	220	100	120	9	205	20	58	29	43	242	36		121		27	43	15		* 1
5	SW.	14	6	20	3	145	1,320																			* 3
6	S½	31	6	21	3	17	2,780	1,600	1,600	Nil.	250	295	30	479	1,538	624	2,738	54		203	1,138		930	413		* 1
7	S.½	31	6	21	3	134	1,857												(2)		(5)	(3)	(1)	(4)		* 4
8	S.½	31	6	21	3	115																(2)	(1)	(3)		* 4

Water samples indicated thus, * 1, are from glacial drift or other unconsolidated deposits.
Water samples indicated thus, * 2, are from bedrock, Ravenscrag formation.
Water samples indicated thus, * 3, are from bedrock, Eastend formation.
Water samples indicated thus, * 4, are from bedrock, Bearpaw formation.
Analyses are reported in parts per million; where numbers (1), (2), (3), (4), and (5) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).

Analyses Nos. 1, 2, 3, 5, 7, and 8, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

Waters from stream deposits of this municipality show a wide variation in the amounts of total dissolved solids, and in the relative abundance of the individual salts. Several factors contribute to these variations. Waters reaching the valley sediments as seepages from the Ravenscrag and the upper sandy beds of the Eastend formation are less highly mineralized than seepages from the shale of the lower part of the Eastend, and particularly the shales of the Bearpaw. The porosity of the stream beds, into which the run-off from the uplands enters, also has an important bearing on the concentration of the dissolved salts. Fine silts and sands do not permit of a ready circulation of the water, and hence continual surface and near surface evaporation will concentrate the salts in solution to such an extent that waters found at shallow depths on the wider flats may be unfit for drinking. Water circulates more readily in the gravels and coarse sands, and less opportunity for concentrating the dissolved salts near the surface is afforded.

Waters occurring in the fine sand and silt deposits of Frenchman valley, and some of its larger tributaries, contain a relatively high concentration of the soluble salts. The sixth analysis in the accompanying table of analyses is of water from a well sunk in river silt in the town of Eastend. The proportion of the individual salts is fairly representative of these waters, although the total dissolved solids are possibly higher than the average. The large amount of 1,138 parts per million of magnesium sulphate ($MgSO_4$ or Epsom salts) would no doubt have a laxative effect upon persons not accustomed to highly sulphated waters. No representative analysis can be given for waters from the alluvium deposits in the small stream channels, as these vary greatly. Water from a spring issuing from these sediments on the NW. $\frac{1}{4}$, sec. 4, tp. 5, range 21, as shown in the table of analyses, contains only small amounts of the sulphate salts, and is quite suitable for human consumption. The total hardness of 220 parts per million is not excessive, and is lower than is common for waters from the drift or the bedrock. The sodium carbonate (Na_2CO_3 or "black alkali") content was calculated to be 27 parts per million. This figure does not indicate a sufficient concentration to render the water harmful to vegetation, should it be used for irrigation. Larger amounts of sodium carbonate may be present in some of the soft waters of the alluvium deposits, as listed in the table of well logs. About 400 parts per million is considered the upper limit of "soda" content for waters used for irrigation.

Waters from glacial drift also vary greatly in the amounts and relative proportions of soluble salts they contain. The boulder clay forming the greater part of the drift is considered to be the source of the sulphate salts found in the waters from the drift. Small seepages directly from boulder clay may show a combined sulphate salt content exceeding 3,000 parts per million. Such water is undrinkable, and may not be suitable for watering stock. Water from sand and gravel pockets occurring near the surface, and hence not covered by any appreciable thickness of drift, is only moderately hard and not highly mineralized. At greater depths the water is more highly mineralized. An analysis was made of water from a 50-foot well located on the NW. $\frac{1}{4}$, sec. 22, tp. 4, range 20, by the Provincial Analyst, Regina, and the relative proportions of the various salts present are indicated by numbers. The total dissolved solid content is 2,337 parts per million and is made up largely of sodium and calcium sulphate. These salts are in sufficient concentration to give the water a bitter taste. This water is of better quality, however, than many of the supplies from still greater depths, or from less porous beds in the drift.

Water from the Bedrock

Waters from the Ravenscrag formation are usually suitable for drinking unless contaminated by mineralized waters from another source. The Provincial Analyst, Regina, has determined the relative amounts of the constituents contained in spring waters derived from the lower Ravenscrag, in the NW. $\frac{1}{4}$, sec. 27, tp. 4, range 19. The total dissolved solids of this water are quite within the range of potable waters, and the sodium sulphate, the most abundant salt present, is not in sufficient quantities to cause any ill effects upon persons drinking it. Compounds of iron (Fe) are often present in these waters, and form a red precipitate on exposure to the air. Iron imparts hardness to the water, but is not harmful for drinking unless present in excessive amounts.

No analyses were made of waters from the Whitemud formation. These waters are highly mineralized, usually containing over 3,000 parts per million of total solids, and are seldom suitable for the domestic drinking supply, but are used for watering stock where waters of a better quality are not available.

Waters from the upper Eastend formation vary greatly in different localities. Relatively large proportions of sodium chloride (common salt) and magnesium sulphate are present in some of these supplies. Soft waters are common in the upper Eastend; such waters generally contain large amounts of sodium carbonate or "black alkali". These sodium carbonate-bearing waters have a flat taste and are not suitable for irrigation. Waters of a more uniform type occur in the lower part of the Eastend, and in the upper beds of the Bearpaw formation. The third analysis given in the accompanying table shows the relative amounts of the dissolved solids found in a water from one of these aquifers, in a 246-foot well, sunk on the SE. $\frac{1}{4}$, sec. 18, tp. 5, range 20. As found by the Provincial Analyst, the total dissolved solids are only 809 parts per million, composed principally of the carbonates and chlorides of magnesium and calcium. This water differs greatly from the preceding types in the absence of sodium and magnesium sulphate and sodium carbonate. This water is hard owing to the presence of the carbonates and chlorides of calcium and magnesium. Other waters from these aquifers are soft, and probably contain even smaller proportions of these salts. The light brown colour of this water may be due to the presence of organic material in the sands. This water is considered to be quite suitable for household use and for irrigation.

Two deep wells situated in the town of Eastend yield a type of water that is more typical of waters from the Bearpaw formation obtained in other parts of the province. The last two analyses listed in the table of water analysis are of waters from these wells. The total dissolved solid content of 1,857 parts per million is not excessive for water from these sediments. Sodium sulphate is usually the most abundant salt present, with magnesium or calcium sulphate ranking second. It is probable that at still greater depths the shales of the Bearpaw formation waters of poorer quality will be found. Sulphate salts and common salt may be present, together exceeding several thousand parts per million. Such water is not generally suitable for any farm use.

WELL RECORDS—Rural Municipality of WHITE VALLEY NO. 49, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SW.	1	4	19	3	Dug	20	3,240	- 15	3,225	15	3,225	Glacial sand	Hard, clear	47	D	Sufficient for household use.
2	SE.	2	"	"	"	Dug	20	3,140			17	3,123	Glacial gravel	Hard, clear		D, S	Insufficient for local needs; hauls drinking water.
3	NE.	4	"	"	"	Dug	21	3,155	- 8	3,147			Glacial sand	Soft, clear		D, S	
4	NW.	5	"	"	"	Bored	140	3,108									Dry hole; Eastend shale at base.
5	NE.	5	"	"	"	Bored	54	3,220	- 26	3,194			Glacial sand	Hard, clear		D, S	Sufficient for local needs.
6	SW.	9	"	"	"	Bored	120	3,165	-105	3,060	100	3,065	Ravenscrag shale and sand	Hard, iron		D, S	Sufficient for local needs.
7	NW.	12	"	"	"	Dug	20	3,200	- 10	3,190			Glacial clay	Hard, clear		D, S	Sufficient for local needs.
8	SW.	14	"	"	"	Bored	135	3,200	-125	3,075			Ravenscrag blue clay	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
9	SW.	15	"	"	"	Drilled	156	3,200	-131	3,069			Ravenscrag sand	Hard, clear		D, S	Sufficient for local needs.
10	SW.	19	"	"	"	Dug	83	3,192			73	3,119	Ravenscrag shale	Hard, clear, "alkaline"		S	Sufficient for local needs; also a shallow well for household use in coulee.
11	NE.	19	"	"	"	Dug	21	3,220	- 12	3,208			Glacial sand	Hard, clear		D, S	Insufficient for local needs.
12	NW.	20	"	"	"	Bored	140	3,230	-120	3,110	80	3,150	Ravenscrag sand and shale	Hard, "alkaline"		S	Sufficient for local needs; hauls water for household use.
13	SW.	21	"	"	"	Dug	18	3,220	- 8	3,212			Glacial gravel	Hard, clear	45	D, S	Barely sufficient for local needs.
14	NW.	21	"	"	"	Bored	67	3,190	- 50	3,140	67	3,123	Ravenscrag shale	Hard, iron		D, S	Sufficient for local needs.
15	NW.	22	"	"	"	Bored	170	3,220	-150	3,070	150	3,070	Ravenscrag sand	Hard, clear		D, S	Sufficient for local needs.
16	SE.	24	"	"	"	Drilled	169	3,205	-109	3,096	109	3,096	Ravenscrag shale	Hard, clear, "alkaline"		S	Sufficient for 13 head stock; hauls water for household use.
17	NW.	24	"	"	"	Dug	14	3,180	- 5	3,175			Glacial sand	Soft, clear		D, S	Sufficient for local needs.
18	NW.	27	"	"	"	Spring		2,960	0	2,960	0	2,960	Ravenscrag sand	Hard, clear		D, S	Sufficient for local needs; # flows 2 inch stream.
19	SW.	28	"	"	"	Bored	70	3,210	- 60	3,150	70	3,140	Ravenscrag shale	Hard, iron		D, S	Sufficient for local needs.
20	NW.	30	"	"	"	Dug	102	3,200			80	3,120	Ravenscrag sand and shale	Hard, iron, "alkaline"		S	Sufficient for stock; hauls water for household use.
21	SE.	32	"	"	"	Bored	133	3,215	-122	3,093	75	3,140	Ravenscrag sand and shale	Hard, iron		D, S	Sufficient for local needs.
22	NW.	32	"	"	"	Bored	148	3,220	-133	3,087	130	3,090	Ravenscrag sand and shale	Hard, iron		S	Sufficient for stock; hauls water for household use.
23	SW.	33	"	"	"	Bored	125	3,210	-110	3,100	80	3,130	Ravenscrag sand	Hard, iron		D, S	Sufficient for local needs.
1	SW.	2	4	20	3	Bored	100	3,030	- 30	3,000	95	2,935	Bearpaw sand	Soft, clear	46	D, S	Sufficient for local needs.
2	NE.	6	"	"	"	Bored	85	2,900	- 20	2,880	85	2,815	Bearpaw sand	Soft, clear		N	Had a good supply, now caved in.
3	SW.	10	"	"	"	Bored	85	3,035	- 25	3,010	70	2,965	Bearpaw blue sand	Hard, clear, "alkaline"	46	D, S	Sufficient for local needs.

NOTE—All depths, altitudes, heights and elevations given above are in feet.

(D) Domestic; (S) Stock; (I) Irrigation; (M) Municipality; (N) Not used.
(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of WHITE VALLEY NO. 49, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
4	SW.	12	4	20	3	Drilled	275	3,000	- 95	2,905	145	2,855	Bearpaw blue sand	Soft, cloudy, "alkaline"		D, S	Insufficient for stock; several other wells dug 75 feet deep; plugged with quicksand.
5	NW.	12	"	"	"	Bored	145	3,000	- 95	2,905	140	2,860	Bearpaw sand	Soft, brown		D, S	Insufficient for local needs.
6	NE.	12	"	"	"	Dug	18	3,000	- 2	2,998			Glacial brown clay	Soft, clear		D, S	Insufficient for stock.
7	SW.	15	"	"	"	Bored	70	3,040	- 60	2,980	60	2,980	Glacial sand	Hard, clear, "alkaline"	46	S	Insufficient for local needs; water not suitable for household use, another similar well.
8	SW.	16	"	"	"	Bored	70	3,040	- 20	3,020	65	2,975	Glacial blue sand	Hard, clear, "alkaline"	46	D, S	Sufficient for local needs.
9	SW.	17	"	"	"	Dug	13	3,040	- 10	3,030	10	3,030	Glacial sand	Soft, clear	48	D, S	Insufficient for local needs.
10	NW.	18	"	"	"	Bored	160	3,045	-140	2,905	150	2,895	Bearpaw blue sand	Soft, clear	46	D, S	Insufficient for local needs; also a shallow seepage well.
11	SW	21	"	"	"	Dug	25	2,986	- 1	2,985	1	2,985	Glacial sand	Hard, clear		D, S	Sufficient for local needs; a large supply.
12	NW.	22	"	"	"	Dug	50	2,999	- 45	2,954	45	2,954	Glacial sand	Hard, clear, "alkaline"		D, S	Insufficient; 1 barrel a day; also a dry hole 130 feet deep. #
13	NW.	24	"	"	"	Bored	130	3,070	- 50	3,020	130	2,940	Ravenscrag sand	Hard, clear, "alkaline"		S	Sufficient for local needs; a 98-foot well for household use.
14	NE.	25	"	"	"	Dug	100	3,110	- 92	3,018	98	3,012	Ravenscrag blue sand	Hard, clear		S	Sufficient for local needs; also a shallow well for household use.
15	SE.	26	"	"	"	Dug	14	3,055	- 6	3,049			Glacial clay	Hard, clear		D	Sufficient for household use.
16	NE.	27	"	"	"	Bored	66	3,055	- 36	3,019	63	2,992	Ravenscrag grey sand	Hard, clear, iron, "alkaline"		D, S	Sufficient for local needs.
17	SE.	28	"	"	"	Bored	110	2,994									Dry hole base in Eastend? Other dry holes 86 to 110 feet deep.
18	SW.	34	"	"	"	Bored	45	3,059	- 33	3,026	42	3,017	Ravenscrag blue sand	Hard, clear, iron		S	Sufficient for local needs.
19	NW.	36	"	"	"	Dug	16	3,142	- 8	3,134			Glacial clay	Soft, clear		N	Dry at present.
1	SW.	3	4	21	3	Dug	90	3,038									Dry hole in Bearpaw shale.
2	E½.	17	"	"	"	Bored	80	3,020	- 60	2,960	60	2,960	Glacial sand and gravel	Hard		D, S	Sufficient for 20 head stock.
3	NE.	20	"	"	"	Drilled	157	3,190	- 57	3,133	157	3,033	Eastend sand	Hard, clear, iron	42	D, S	Sufficient for local needs.
4	NW.	24	"	"	"	Drilled	92	3,274	- 78	3,196	78	3,196	Glacial clay and rock	Soft, clear	42	D, S	Sufficient for local needs.
5	NW.	27	"	"	"	Bored	83	3,075	- 53	3,022	83	2,992	Eastend clay	Soft, clear, "alkaline"	42	D, S	Sufficient for local needs.
6	NE.	28	"	"	"	Bored	87	3,152	- 43	3,109	87	3,065	Eastend sand	Soft, clear	42	D, S	Sufficient for local needs.
7	NW.	28	"	"	"	Dug	80	3,105	- 35	3,070	71	3,034	Eastend blue clay			N	Well abandoned "cribbing" caved in.
8	SW.	30	"	"	"	Drilled	156	3,284	-125	3,159	125	3,159	Eastend sand	Hard, clear	42	D, S	Sufficient for local needs.
9	SW.	32	"	"	"	Bored	48	3,187	- 20	3,167	48	3,139	Glacial fine gravel	Hard, clear, "alkaline"	42	D, S	Sufficient for local needs.
10	SW.	32	"	"	"	Bored	50	3,178	- 16	3,162	48	3,130	Glacial gravel	Hard		N	Well now filled in.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of WHITE VALLEY NO.49, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
11	SW.	33	4	21	3	Dug	80	3,165	- 55	3,110	80	3,085	Eastend sand	Hard, clear, "alkaline"	42	S	Sufficient for stock.
12	SW	33	"	"	"	Dug	60	3,160	- 35	3,125	60	3,100	Eastend black clay	Soft, "alkaline" black sediment	42	D, S	Sufficient for local needs.
13	SW.	33	"	"	"	Bored	44	3,105	- 18	3,087	43	3,062	Glacial sand	Hard		N	Filled in now.
14	NW.	33	"	"	"	Bored	54	3,105	- 28	3,077	52	3,053	Glacial sand	Hard		N	
15	NW.	35	"	"	"	Bored	75	3,072	- 56	3,016	56	3,016	Eastend clay	Soft, clear, "alkaline"		D, S	Insufficient for local needs.
1	SW.	5	5	19	3	Bored	148	3,255	-143	3,112			Ravenscrag blue sand	Hard, iron, yellow		N	Fit for stock only; good supply when it was used.
2	SE.	6	"	"	"	Bored	130	3,235	-115	3,120			Ravenscrag blue sand	Hard, clear, iron		S	Sufficient for local needs.
3	SW.	6	"	"	"	Dug	96	3,220	- 88	3,122			Ravenscrag coal	Hard, clear, iron, "alkaline"		D, S	Sufficient for local needs; also a shallow well for household use.
4	NW.	12	"	"	"	Bored	20	3,230	- 10	3,220			Glacial drift	Hard, clear		D	Sufficient for household needs only; also a spring for stock use.
5	NE.	13	"	"	"	Bored	112	3,325	-110	3,215			Ravenscrag ?	Hard, clear, iron		D, S	Sufficient for local needs.
6	NE.	14	"	"	"	Dug	58	3,300	- 38	3,262	58	3,242	Ravenscrag hard sand	Hard, clear, "alkaline"		D, S	Sufficient for 100 head stock.
7	NW.	14	"	"	"	Dug	50	3,280	- 36	3,244	25	3,255	Ravenscrag blue sand	Hard, clear, iron, "alkaline"		D, S	Insufficient for local needs.
8	SE.	15	"	"	"	Dug	15	3,220	- 11	3,209			Glacial blue clay	Hard, clear		D, S	Sufficient for 5 head stock.
9	NW.	15	"	"	"	Spring	0	3,180	0	3,180	0	3,180	Ravenscrag blue sand	Soft, clear		S	Sufficient for 8 head stock.
10	SW.	22	"	"	"	Dug	8	3,180	- 3	3,177			Ravenscrag sand	Soft, clear		D	Sufficient for local needs; also a spring on NW.¼, section.
11	SE.	23	"	"	"	Bored	100	3,300	- 84	3,216	90	3,210	Ravenscrag coal	Hard, clear		D, S	Sufficient for local needs.
12	NW.	23	"	"	"	Bored	94	3,000	- 55	2,945	60	2,940	Ravenscrag sand	Hard, clear		D, S	Oversufficient for local needs.
13	NE.	23	"	"	"	Dug	30	3,290	0	3,290			Glacial clayey sand	Hard, clear		S	Sufficient for 3 head stock in dry years.
14	SW.	24	"	"	"	Dug	50	3,340	- 46	3,294			Glacial gravel	Hard, rusty		S	Sufficient for 5 head stock.
15	NE.	24	"	"	"	Bored	60	3,340	- 58	3,282			Ravenscrag black sand	Hard, clear, iron		D, S	Insufficient for local needs.
16	SW.	25	"	"	"	Bored	100	3,380	- 90	3,290			Ravenscrag clay	Soft, clear		D	Sufficient for household needs only.
17	SE.	26	"	"	"	Dug	21	3,314	- 11	3,303	21	3,293	Ravenscrag	Hard, clear		D, S	Sufficient for 10 head stock.
18	NE.	26	"	"	"	Dug	40	3,345	- 31	3,314			Glacial drift	Soft, clear		D, S	Insufficient for 7 head stock.
19	NE.	27	"	"	"	Dug	23	3,330	- 13	3,317	20	3,310	Ravenscrag coal	Hard, clear		D	Sufficient for local needs.
20	NW.	27	"	"	"	Bored	65	3,300	- 40	3,260	65	3,235	Glacial clay	Hard, clear, "alkaline"		D, S	Sufficient for local needs.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of WHITE VALLEY NO. 49, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
21	NE.	28	5	19	3	Dug	85	3,270	- 70	3,200			Ravenscrag coal	Hard, clear, "alkaline"		D, S	Sufficient for 10 head stock; also a spring in Ravenscrag coal.
22	NE.	30	"	"	"	Dug	65	3,240	- 53	3,187	28	3,212	Ravenscrag sandstone	Hard, clear		D, S	Sufficient for local needs.
23	NW.	30	"	"	"	Dug	54	3,240	- 43	3,197	50	3,190	Ravenscrag sandstone	Hard, clear		S	Sufficient for local needs.
24	NW.	31	"	"	"	Drilled	80	3,245	- 47	3,198			Ravenscrag coal and sand	Hard, clear		S	Sufficient for local needs; a similar well for household use.
25	SW.	32	"	"	"	Bored	80	3,245					Ravenscrag	Hard, clear, iron		D, S	Sufficient for local needs.
26	NW.	32	"	"	"	Bored	110	3,255	-100	3,155			Ravenscrag	Soft, clear		D, S	Sufficient for 20 head stock.
27	SE.	33	"	"	"	Dug	12	3,215	- 2	3,213	12	3,203	Glacial clay	Hard, clear, "alkaline"		S	Sufficient for local needs.
28	NW.	33	"	"	"	Dug	40	3,246	- 36	3,210	36	3,210	Glacial sand	Hard, clear		D, S	Sufficient for local needs.
29	SE.	34	"	"	"	Bored	80	3,340	- 30	3,310	64	3,276	Ravenscrag sand	Hard, clear		D, S	Sufficient for 60 head stock; also a 96-foot well, large yield of water.
30	SW.	34	"	"	"	Bored	90	3,290	- 80	3,210			Ravenscrag ?	Hard, clear		D, S	Insufficient; only 2 barrels a day.
31	SE.	35	"	"	"	Bored	60	3,365	- 48	3,317			Ravenscrag ?	Hard, clear		D, S	Sufficient for 25 head stock.
32	SE.	36	"	"	"	Bored	33	3,360	- 32	3,328			Glacial clay			N	No one living on farm.
33	NW.	36	"	"	"	Bored	91	3,395	- 79	3,316			Ravenscrag sand			D	
1	SE.	1	5	20	3	Bored	140	3,200	-120	3,080	120	3,080	Ravenscrag blue sand	Hard, clear, iron, salty		S	Sufficient for stock; a shallow well for household use.
2	NW.	2	"	"	"	Dug	91	3,160	- 85	3,075	60	3,100	Ravenscrag sandstone	Hard, clear, iron		D, S	Sufficient for local needs.
3	SW.	3	"	"	"	Bored	65	3,110	- 40	3,070			Ravenscrag clay and sand	Hard, clear, iron		D, S	Sufficient for local needs.
4	NE.	3	"	"	"	Dug	14	3,150	- 10	3,140	10	3,140	Glacial sand and gravel	Hard, clear		D	Sufficient for local needs.
5	SW.	4	"	"	"	Drilled	253	3,080	-100	2,980	252	2,828	Bearpaw sandstone	Soft, brownish		D, S	Sufficient for local needs; a large supply.
6	SE.	7	"	"	"	Dug	20	3,060	- 14	3,046	18	3,042	Glacial sand and gravel	Hard, clear		S	Insufficient for local needs.
7	NE.	7	"	"	"	Bored	22	3,070	- 10	3,060			Glacial clay	Hard, clear		D, S	Sufficient for local needs; another similar well.
8	SW.	13	"	"	"	Dug	20	3,175	- 4	3,171			Glacial clay and gravel	Soft		S	Insufficient for local needs; several dry holes 20 feet deep.
9	NW.	14	"	"	"	Dug	22	3,175					Glacial clay	Hard, clear		D, S	Sufficient during wet years.
10	SE.	15	"	"	"	Dug	16	3,180	0	3,180			Glacial clay	Hard, clear		D, S	Insufficient for local needs.
11	SW.	16	"	"	"	Dug	12	3,150	- 8	3,142			Glacial clay	Hard, clear		D	Insufficient for local needs; has a similar well small supply.
12	SE.	17	"	"	"	Drilled	240	3,125	- 80	3,045	240	2,885	Bearpaw sandstone	Soft, brown		D, S	Oversufficient for local needs.
13	SE.	18	"	"	"	Drilled	246	3,100	- 86	3,014			Bearpaw sand	Hard, brown		D, S	Oversufficient for local needs; had several 70-foot wells with insufficient supply. #
14	SW.	19	"	"	"	Drilled	302	3,125									Dry hole, Bearpaw shale at base.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of WHITE VALLEY NO. 49, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE Elev.	PRINCIPAL WATER-BEARING BED Depth	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
15	NW.	20	5	20	3	Dug	69	3,125	- 68	3,057	65	3,060	Eastend blue sand	Hard, clear, iron, "alkaline"		D, S	Insufficient for 3 head stock; two dry holes 40 feet deep.
16	SE.	21	"	"	"	Dug	12	3,150	- 4	3,146			Glacial clay	Hard		D	Sufficient for household needs.
17	SW	30	"	"	"	Dug	25	3,120	- 19	3,101			Glacial clay	Hard, clear, "alkaline"		D, S	Insufficient for local needs.
18	SE.	31	"	"	"	Bored	38	3,025	- 28	2,997			Eastend blue hardpan	Hard, clear, iron, "alkaline"		S	Insufficient for 50 head stock; hauls water for household use.
19	SE.	36	"	"	"	Dug	85	3,220					Eastend	Hard, clear		S	Barely sufficient for stock.
20	NW.	36	"	"	"	Dug	116	3,260	-112	3,148	116	3,144	Eastend sandstone	Hard, clear, salty, iron		D, S	Insufficient for local needs; water unfit for humans; dry holes 192 feet and 245 feet deep.
1	S½.	3	5	21	3	Drilled	625	3,125									Dry hole in Bearpaw shale.
2	NW.	4	"	"	"	Dug	5	3,171	0	3,171	5	3,166	Glacial silt	Hard, clear	42	D, S	Sufficient for local needs. #
3	NE.	9	"	"	"	Dug	12	3,082	- 8	3,074	8	3,074	Stream sand	Soft, clear	42	D	Sufficient for household use.
4	NE.	9	"	"	"	Dug	16	3,000	- 4	2,996	16	2,984	Glacial clay and sand	Hard, clear, "alkaline"		D, S	
5	NW.	19	"	"	"	Dug	25	3,190	- 20	3,170			Eastend sand	Hard, clear	42	D, S	Insufficient for local needs; also a spring near well.
6	SE.	21	"	"	"	Bored	23	3,125	- 11	3,114	11	3,114	Glacial gravel	Hard		D, S	Sufficient for local needs.
7	SW.	22	"	"	"	Dug	20	3,066	- 15	3,051	15	3,051	Eastend sand	Soft, clear	42	N	Supply limited; about 1 barrel a week.
8	SW.	22	"	"	"	Bored	160	3,066									Dry hole in Bearpaw shale; twenty-four dry holes from 20 to 160 feet deep.
9	NE.	22	"	"	"	Dug	15	3,047	- 4	3,043	4	3,043	Eastend sand	Soft, clear	41	D, S	Sufficient for local needs.
10	SE.	29	"	"	"	Dug	5	3,043	0	3,043	5	3,038	Stream gravels	Soft, clear, "alkaline"	42	S	Sufficient for local needs.
11	E½.	30	"	"	"	Bored	26	3,125	0	3,125	1	3,124	Glacial sand	Hard, "alkaline"		D, S	Good supply.
12	SW.	30	"	"	"	Dug	6	3,190	- 2	3,188	0	3,190	Stream sand	Soft, clear		D, S	Sufficient for local needs.
13	NW.	30	"	"	"	Dug	24	3,198	- 12	3,186	12	3,186	Stream sand	Soft, clear	42	D, S	Sufficient for local needs.
14	SW.	31	"	"	"	Bored	60	3,214	- 25	3,189	39	3,175	Eastend clay	Soft, clear	42	D, S	Sufficient for local needs.
15	NW.	35	"	"	"	Drilled	350	3,040									Dry hole in Bearpaw shale.
1	SE.	1	6	19	3	Dug	104	3,380	-100	3,280	103	3,277	Ravenscrag sandstone	Hard, clear		D, S	Sufficient for 150 head stock.
2	NE.	2	"	"	"	Drilled	212	3,370	-127	3,243	212	3,158	Ravenscrag sand	Hard, clear, iron		D	Oversufficient for local needs.
3	SE.	3	"	"	"	Dug	18	3,340	- 8	3,332	16	3,324	Glacial gravel	Hard, clear	40	D, S	Sufficient for local needs.
4	NW.	3	"	"	"	Dug	23	3,340	- 20	3,320	20	3,320	Glacial sand	Hard, clear		D, S	Sufficient for local needs; another similar well.
5	SE.	5	"	"	"	Dug	14	3,220	- 2	3,218	14	3,206	Ravenscrag ? sandstone	Soft, clear		D, S	Insufficient for local needs.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of WHITE VALLEY NO.49, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (–) Surface	HEIGHT TO WHICH WATER WILL RISE Elev.	PRINCIPAL WATER-BEARING BED Depth	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
6	S½.	6	6	19	3	Bored	135	3,290	-130	3,160			Ravenscrag clay	Soft, clear, soda		D, S	Insufficient for local needs.
7	SW.	7	"	"	"	Dug	85	3,250	- 77	3,173			Ravenscrag	Hard, clear, "alkaline"		D, S	Sufficient for 10 head stock.
8	NW.	7	"	"	"	Drilled	104	3,250	- 80	3,170	95	3,155	Ravenscrag hard blue sand	Hard, clear, iron		D, S	Sufficient for local needs.
9	SW.	8	"	"	"	Bored	80	3,280			78	3,202	Ravenscrag sand	Hard, clear		D, S	
10	SW.	10	"	"	"	Dug	60	3,330	- 56	3,274			Ravenscrag	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
11	NW.	11	"	"	"	Bored	200	3,345	-190	3,155			Ravenscrag sand			N	Filled in with quicksand; also five dry hole
12	SW.	12	"	"	"	Bored	135	3,388	-120	3,268			Ravenscrag hard yellow sand	Hard, clear		D, S	Sufficient for local needs.
13	SW.	13	"	"	"	Drilled	170	3,360	- 70	3,290	81	3,279	Ravenscrag sand	Soft		D	Sufficient for local needs.
14	SE.	14	"	"	"	Bored	80	3,358	- 60	3,298	75	3,283	Ravenscrag	Hard, clear		D, S	Supplies 15 barrels a day.
15	NW.	16	"	"	"	Dug	26	3,230	- 23	3,207			Glacial sand	Soft, clear		D, S	Sufficient for 10 head stock.
16	SW.	17	"	"	"	Bored	80	3,245	- 50	3,195			Ravenscrag	Hard, clear, iron		S	Sufficient for local needs; 20-foot well on NE.¼, supplies drinking water.
17	NW.	17	"	"	"	Dug	30	3,358	- 22	3,336			Glacial clay	Hard, clear		D, S	Sufficient supply; also a 200-foot dry hole, base in Ravenscrag?
18	SW.	18	"	"	"	Dug	60	3,245	- 52	3,193			Ravenscrag ?	Hard, clear		D, S	Sufficient for local needs.
19	NW.	18	"	"	"	Drilled	150	3,260	- 80	3,180			Ravenscrag ?	Hard, cloudy, iron, "alkaline"		D, S	Sufficient for local needs; large supply.
20	NW.	19	"	"	"	Dug	54	3,240					Ravenscrag coal	Hard, clear, iron, "alkaline"		D, S	Sufficient for 30 head stock.
21	NE.	21	"	"	"	Bored	120	3,304	-100	3,204			Ravenscrag	Hard, clear, iron		D, S	Sufficient for local needs.
22	NE.	22	"	"	"	Drilled	190	3,350	-150	3,200	190	3,160	Ravenscrag sand	Hard, clear, "alkaline"		S	Sufficient for local needs; a 25-foot well f household use.
23	SW.	23	"	"	"	Drilled	160	3,350	-125	3,225	160	3,190	Ravenscrag sand	Hard, clear, iron		D, S	Oversufficient for local needs.
24	NW.	24	"	"	"	Dug	55	3,330	- 43	3,287			Ravenscrag sand	Hard, clear, iron		D, S	Sufficient for 50 head stock.
25	SE.	25	"	"	"	Dug	22	3,360	- 20	3,340	22	3,338	Glacial sand	Hard, clear		D	Sufficient for household needs only; had an 80-foot well, gravel at base.
26	NE.	25	"	"	"	Dug	80	3,350	- 77	3,273	77	3,273	Ravenscrag? sandstone	Hard, clear		S	Sufficient for local needs.
27	NW.	27	"	"	"	Dug	66	3,330	- 58	3,272	62	3,268	Ravenscrag sand	Hard, clear, iron		D, S	Sufficient for local needs.
28	SE.	28	"	"	"	Dug	30	3,270	- 24	3,246	4	3,266	Glacial sand	Hard, clear		D, S	Sufficient for 100 head stock.
29	NW.	28	"	"	"	Dug	10	3,280	- 7	3,273			Glacial clay	Soft, clear		D	Sufficient for household needs.
30	SW.	30	"	"	"	Dug	70	3,255	- 62	3,193			Ravenscrag	Hard, clear		D, S	Sufficient for local needs.
31	NE.	31	"	"	"	Bored	64	3,240	- 32	3,208			Ravenscrag coal	Hard, clear, "alkaline" iron		S	Sufficient for 100 head stock.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of WHITE VALLEY NO. 49, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (—) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
32	SW.	32	6	19	3	Bored	65	3,255	- 45	3,210	65	3,190	Ravenscrag sand	Hard, clear, "alkaline"		D, S	Sufficient for local needs; also a shallow well in coulee.
33	SE.	32	"	"	"	Dug	30	3,125					Ravenscrag hard	Hard, "alka-line"		N	Caved in.
34	SE	33	"	"	"	Bored	65	3,280	- 59	3,221	59	3,221	Ravenscrag sand	Soft, clear		S	Insufficient for local needs.
35	SW.	33	"	"	"	Dug	30	3,215	- 16	3,199	30	3,185	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
36	NE.	33	"	"	"	Bored	90	3,315	- 72	3,243	60	3,255	Ravenscrag sand	Hard, clear, iron	42	D, S	Sufficient for 50 head stock.
37	SW.	34	"	"	"	Bored	127	3,300	-100	3,200	127	3,173	Ravenscrag sand	Soft, clear		D, S	Sufficient for local needs.
38	SE.	35	"	"	"	Dug	40	3,300	- 25	3,275	40	3,260	Ravenscrag sand	Hard, clear, "alkaline"		D, S, I	Sufficient for local needs; another well same depth.
1	NE.	1	6	20	3	Dug	100	3,200	- 85	3,115			Ravenscrag ?	Hard, clear, "alkaline"	44	D	Sufficient for household needs.
2	NE.	9	"	"	"	Drilled	192	3,150	-100	3,050	192	2,958	Bearpaw sand	Soft, brown		D, S	Sufficient for local needs.
3	NE.	10	"	"	"	Bored	77	3,150	- 50	3,100	75	3,075	Eastend sand	Hard, clear		D, S	Sufficient for local needs.
4	NE.	12	"	"	"	Dug	113	3,190			113	3,077	Eastend sand	Hard, clear, "alkaline"		N	Not used at present.
5	SW.	13	"	"	"	Drilled	145	3,200	- 80	3,120	145	3,055	Eastend sand	Soft, clear		D, S	Sufficient for local needs.
6	SW.	14	"	"	"	Drilled	145	3,180	- 45	3,135	145	3,035	Eastend sand	Hard, iron	44	D, S	Sufficient for local needs. #
7	SW.	15	"	"	"	Drilled	160	3,150	-100	3,050	160	2,990	Bearpaw sand	Soft, clear		D, S	Sufficient for local needs.
8	NW.	15	"	"	"	Drilled	142	3,150	-102	3,048	142	3,008	Bearpaw grey sand	Soft, clear	44	D, S	Sufficient for local needs.
9	NE.	16	"	"	"	Drilled	138	3,150	-105	3,045	138	3,012	Bearpaw grey sandstone	Soft, clear	44	D, S	Sufficient for local needs.
10	SE.	17	"	"	"	Drilled	185	3,150	-173	2,977			Bearpaw sand	Soft, clear, iron		D, S	Sufficient for local needs.
11	SW.	17	"	"	"	Drilled	100	3,110	- 93	3,017			Whitemud	Hard, clear		D, S	Sufficient for 6 head stock.
12	SE.	20	"	"	"	Dug	30	3,030	- 24	3,006			Eastend sand	Hard, clear		D, S	Insufficient for local needs.
13	NE.	22	"	"	"	Bored	65	3,180			65	3,115	Ravenscrag sand	Hard, clear		D, S	Sufficient for local needs.
14	SE.	24	"	"	"	Dug	75	3,200	- 72	3,128			Ravenscrag ?	Hard, clear, "alkaline"		N	Needs cleaning; will water 12 head stock.
15	SW.	24	"	"	"	Bored	110	3,200	- 85	3,115			Ravenscrag coal	Hard, clear, "alkaline"		D, S	Sufficient for 25 head stock.
16	SW.	25	"	"	"	Bored	60	3,170	- 40	3,130			Ravenscrag ?	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
17	NE.	26	"	"	"	Bored	46	3,180	- 30	3,150	46	3,134	Ravenscrag coal	Soft, clear		D, S	Sufficient for local needs.
18	SE.	27	"	"	"	Dug	50	3,180	- 40	3,140			Ravenscrag coal	Hard, clear, "alkaline" iron		S	
19	NE.	27	"	"	"	Drilled	157	3,190	- 80	3,110			Ravenscrag sand	Soft, clear		D, S	

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of WHITE VALLEY NO. 49, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (—) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
20	NW.	29	6	20	3	Dug	15	3,080	- 8	3,072			Glacial sand	Hard, clear, "alkaline"		N	Not in use at present.
21	SW	31	"	"	"	Dug	21	3,060	- 18	3,042			Glacial clay	Hard, "alkaline"		S	Sufficient for local needs.
22	SE.	33	"	"	"	Bored	124	3,200	-104	3,096			Ravenscrag sand	Hard, clear, "alkaline" iron		D, S	Sufficient for local needs.
23	NW.	33	"	"	"	Dug	80	3,140	- 55	3,085	80	3,060	Ravenscrag sand	Soft, clear		D, S	Sufficient for local needs.
24	SE.	35	"	"	"	Bored	75	3,200	- 50	3,150	50	3,150	Ravenscrag coal	Hard, clear, "alkaline"		D, S	Sufficient for 15 head stock.
25	NW.	35	"	"	"	Dug	90	3,175	- 87	3,088	87	3,088	Ravenscrag fine gravel	Soft, clear		D, S	Sufficient for local needs.
26	SE.	36	"	"	"	Dug	85	3,150	- 65	3,085	82	3,068	Ravenscrag coal	Hard, clear		D, S	Sufficient for 100 head stock and more.
1	SE.	3	6	21	3	Dug	20	3,048	- 10	3,038	10	3,038	Glacial silt	Hard, clear		D	Sufficient for local needs.
2	SW.	4	"	"	"	Dug	7	3,100	- 5	3,095	5	3,095	Stream gravel	Soft, cloudy, "alkaline"	42	D, S	Sufficient for local needs.
3	NW	5	"	"	"	Bored	70	3,111	- 60	3,051	60	3,051	Eastend clay	Hard, clear, "alkaline"	42	N	
4	NW.	6	"	"	"	Bored	60	3,200	- 42	3,158	51	3,149	Eastend clay	Soft, clear	42	D, S	Sufficient for local needs.
5		6	"	"	"	Dug	18	3,250					Glacial sand	Hard		D	Sufficient for local needs.
6	NE.	8	"	"	"	Dug	16	3,036	- 12	3,024	12	3,024	Stream gravel	Hard, clear, "alkaline"	42	D, S	Sufficient for local needs.
7	NW.	9	"	"	"	Dug	12	3,118	- 2	3,116	2	3,116	Stream gravel	Soft, clear, "alkaline"	42	D, S	Sufficient for local needs.
8	SE.	15	"	"	"	Dug	16	2,997	- 11	2,986	11	2,986	Alluvial sandy clay	Soft, clear	42	D, S	Sufficient for local needs.
9	SW.	31	"	"	"	Drilled	150	2,995	- 12	2,983	135	2,860	Bearpaw sand	Hard, clear, iron	42	D	Sufficient for local needs.
10	S½.	31	"	"	"	Drilled	115	2,995	- 6	2,989	115	2,880	Bearpaw sand	Soft, clear	42	D	Sufficient for local needs. #
11		31	"	"	"	Dug	17	2,995	- 15	2,980	15	2,980	Alluvial sand	Hard, clear	42	D, S	Sufficient for local needs.
12		31	"	"	"	Dug	12	2,995	- 2	2,993	2	2,993	Alluvial sand	Hard, cloudy	42	D	Sufficient for local needs.
13		31	"	"	"	Dug	12	2,995	- 2	2,993	2	2,993	Alluvial sand	Hard, clear	42	D	Sufficient for local needs.
14		31	"	"	"	Dug	18	2,995	- 14	2,981	18	2,977	Alluvial sand	Hard, clear	42	D, S	Sufficient for local needs.
15		31	"	"	"	Dug	13	2,995	- 10	2,985	13	2,982	Alluvial sand	Hard, clear	42	D, I	Sufficient for local needs.
16		31	"	"	"	Dug	16	2,995	- 13	2,982	13	2,982	Alluvial sand	Hard, clear, iron	42	D, I	Sufficient for local needs.
17		31	"	"	"	Drilled	134	2,995	- 17	2,978	134	2,861	Bearpaw sand	Hard, clear, iron	42	D	Sufficient for local needs. #
18		31	"	"	"	Dug	15	2,995	- 13	2,982	13	2,982	Alluvial sand	Hard, clear	42	D	Sufficient for local needs.
19		31	"	"	"	Dug	18	2,995	- 15	2,980	15	2,980	Alluvial sand	Hard, clear	42	D	Sufficient for local needs.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of WHITE VALLEY NO. 49, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
20		31	6	21	3	Dug	18	2,995	- 15	2,980	15	2,980	Alluvial sand	Hard, clear	42	D	Sufficient for local needs.
21		31	"	"	"	Dug	8	2,995	- 4	2,991	4	2,991	Alluvial sand	Hard, clear	42	D	Sufficient for local needs.
22		31	"	"	"	Dug	13	2,995	- 11	2,984	11	2,984	Alluvial sand	Hard, clear	42	D, S	Sufficient for local needs.
23		31	"	"	"	Dug	17	2,995	- 12	2,983	12	2,983	Alluvial silt	Hard, clear	42	D, S	Sufficient for local needs. #
24		31	"	"	"	Dug	18	2,995	- 15	2,980	15	2,980	Alluvial sand	Hard, clear	42	D	Sufficient for local needs.
25		31	"	"	"	Dug	15	2,995	- 12	2,983	12	2,983	Alluvial sand	Hard, clear	42	D	Sufficient for local needs.
26		31	"	"	"	Dug	16	2,995	- 13	2,982	13	2,982	Alluvial sand	Soft, clear	42	D	Sufficient for local needs.
27		31	"	"	"	Dug	18	2,995	- 16	2,979	16	2,979	Alluvial sand	Hard, clear	42	D	Sufficient for local needs.
28		31	"	"	"	Dug	18	2,995	- 15	2,980	15	2,980	Alluvial sand	Hard, clear,	42	D	Sufficient for local needs.
29		31	"	"	"	Dug	18	2,995	- 15	2,980	15	2,980	Alluvial sand	Hard, clear	42	D	Sufficient for local needs.
30		31	"	"	"	Dug	16	2,995	- 12	2,983	12	2,983	Alluvial sand	Hard, clear	42	D, I	Sufficient for local needs.
31		31	"	"	"	Dug	18	2,995	- 16	2,979	16	2,979	Alluvial sand	Hard, clear, iron	42	D, I	Insufficient for local needs.

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(#) Sample taken for analysis.