CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 223

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF AUVERGNE NO. 76 SASKATCHEWAN

By

B. R. MacKay, H. H. Beach and E. L. Ruggles

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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF AUVERGNE, NO. 76, SASKATCHEWAN

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 Auvergne comprises an area of 324 square miles lying in the western part of southern Saskatchewan. The centre of the municipality is 45 miles north of the International Boundary, and about 46 miles south-southeast of the city of Swift Current. The municipality is a square block consisting of nine townships, described as tps. 7, 8, and 9, ranges 10, 11, and 12, W. 3rd mer. The Weyburn-Lethbridge branch of the Canadian Pacific railway follows a valley through the northern townships and parallels Notukeu creek in township 9, ranges 11 and 12. The villages of Aneroid, Ponteix, and Gouverneur are located along the railway line within the municipality.

Throughout the greater part of the area, the land surface is gently rolling. The maximum relief is approximately 700 feet. The valley of Notukeu creek trending through the western half of the municipality near its northern border has an approximate elevation of 2,450 feet above sea-level. The valley of Pinto creek in the south-eastern part of the area has a similar elevation.

The land rises to elevations not greatly exceeding 2,800 feet throughout the broad-topped hill to the south of Pinto creek. In the southwestern township the surface becomes more irregular and rises more steeply to an elevation of a little over 3,200 feet in the extreme southwest corner of the municipality. The two creeks mentioned above form the principal drainage of the area. The subsidiary drainage consists of a few small streams that flow in ravines and coulées, in the spring.

Figure 2, of the map accompanying this report, indicates the approximate relief of the area by means of 100-foot contour lines. Certain discrepancies exist, however, between the elevations of well sites as indicated by the map, and those determined by aneroid barometer during the course of this investigation.

On most of the farms in the municipality, adequate ground water supplies have been obtained, but at points scattered throughout the whole area, considerable difficulty has been experienced in finding water. This situation is most acute in township 9, range 10, where a large number of wells have been dug, but very few give adequate supplies. The ground water supply in parts of the area is obtained from the unconsolidated Recent and glacial deposits, and to a lesser extent in other parts from the bedrock formations.

Water-bearing Horizons in the Unconsolidated Deposits

The Recent deposits are confined to the valleys of Notukeu and Pinto creeks. They have been laid down by flood waters and consist of sandy clay and silt in which occur pockets and occasionally more extensive beds of sand and gravel. Ground water is obtained from the silt and clay, but generally in small quantities. Little testing with an auger or by digging is as a rule necessary, however, to locate sands or gravels that may yield large supplies of water. Such beds usually occur at depths of 10 to 20 feet, but at a few places it has been necessary to dig wells to a depth of 35 feet before an adequate supply was obtained. Individual wells produce enough water for 15 to 50 or more head of stock. In the valley of Notukeu creek, a sand aquifer forms a fairly continuous horizon at an elevation of about 2,430 feet above sea-level, and appears to be more extensive and more productive than the aquifers encountered in these deposits in the valley of Pinto creek. The water is hard and generally contains appreciable amounts of dissolved mineral salts in solution. In only two wells, however, was water obtained that was considered unfit for drinking. It is possible that these wells have penetrated the shale forming the bedrock which generally yields water of very poor quality. The shale is exposed at the surface along the valley of Notukeu creek, in the northern part of township 9, range 11. Seepages of highly mineralized water from the bedrock outcrops

probably will greatly affect the quality of waters in the Recent deposits in this part of the channel. Remote from this area along the streams little difficulty should be experienced in obtaining adequate supplies of drinkable water at shallow depths. These deposits are the best source of ground water in the municipality.

A mantle of glacial drift, largely boulder clay, which varies considerably in thickness, covers the bedrock throughout the entire municipality and in the stream valley bottoms the drift is overlain by Recent deposits. The various types of glacial deposits owe their origin to a great continental ice-sheet that, many thousands of years ago, advanced and retreated across the province, and to the action of waters resulting from the melting ice. As this ice-sheet advanced and retreated it deposited a heterogenous mixture of buff weathering, bluish grey clay interspersed with boulders and irregular beds and pockets of sands and gravels. This material is known as till or ground moraine, and covers the greater part of the township. At places where the ice front paused in its retreat for any considerable periods of time, thicker deposits of drift were laid down. Such deposits have an irregular surface and knolls, ridges, and undrained depressions are common. These deposits are known as moraines. In this municipality, moraine is confined to small areas on the uplands in the northeast and southwest corner townships, and to two isolated areas in township 8, ranges 10 and 12. Waters issuing from the melting ice carried considerable amounts of sands and gravels, which were deposited over the till in an area of approximately one mile in width, extending diagonally from the northeast to the southwest corner of township 7, range 10, and into the southeast corner of township 7, range 11. A still narrower area of these outwash sands and gravels extends along the northern border of township 8, range 10, and thence trends northwesterly into the southeast corner of township 9, range 11. In some places lakes were formed and the finer sediments washed into the lake were deposited on the bottom to form layers of

light bluish grey lake clay. The western extent of one of these now extinct lakes is marked by thin deposits of clay covering the valley bottom of the southern branch of Pinto creek in the extreme southeast corner of the municipality. Another area of lake clay extends over approximately 8 square miles in the central part of the municipality.

The areal distribution of these different forms of the drift is indicated on Figure 1, of the accompanying map.

The light blue lake clays are generally too compact and impervious to yield more than very small seepages of water. Residents of these areas have found it advisable to dig wells through the 10 to 15 feet of clay to penetrate sand beds occurring in places at the contact of the lake clay and the underlying boulder clay or to continue to greater depths on the chance of tapping water-bearing sand pockets in the till. These wells vary in depth from 15 to 40 feet. Most of the wells that have been dug in these areas produce enough water for 10 to 30 head of stock. The water from a well on sec. 21, tp. 8, range 11, is too "alkaline" for drinking, but all the other wells yield drinkable water. Water supplies similar to those in use probably can be obtained by digging other wells in the areas of lake clay.

The glacial outwash gravels are of limited extent in the area. Few wells have been sunk into them, and their variations in thickness and water-bearing possibilities at all points are not definitely known. Wells that have been sunk into these deposits in townships 7 and 8, range 10, derive their water from sands and gravels at depths of 10 to 30 feet. Enough water is available from each well to water 10 to 75 head of stock, and one 17-foot well, located on the SW. $\frac{1}{4}$, sec. 17, tp. 7, range 10, provides a sufficient supply for 20 head of stock and 200 sheep. The quality of the water is characteristic of that found in sand and gravel deposits near the surface. It is moderately hard and not highly charged with sulphate salts such as are generally found in solution in waters from gravel pockets in the till.

The water being obtained from the 11-foot well on the NW. ¼, sec. 33, tp. 8, range 10, is considered of suitable quality to form part of the supply for the residents of Aneroid. Wherever gravels are found at or near the surface they appear to be worthy of prospecting even if the supply derived is adequate only for domestic needs.

Very few wells have been dug in the small areas of moraine. Owing to the rather rough character of the topography, such areas are not as thickly settled as the surrounding plains, and hence have not been carefully explored for ground water except in township 9, range 10, where a number of holes have been sunk into the moraine. It would appear that water-bearing sand or gravel pockets occur only sparingly in the boulder clay and may be very difficult to locate. However, since the aquifers do not have any great lateral extent the fact that one or more dry holes have been dug does not necessarily indicate the entire absence of aquifers in the immediate vicinity. The water-bearing beds that have been found occur at depths of 10 to 55 feet. The water is of good quality and each well will water 10 to 30 head of stock.

Ground water conditions vary greatly from place to place in the till that covers the bedrock throughout the area and underlies the Recent deposits wherever they are present. Such conditions are to be expected since the till itself varies in composition and porosity within limited areas. It is composed essentially of boulder clay which is very compact and generally poorly productive. The clay contains large amounts of readily dissolvable mineral salts which pass into solution in waters percolating down from the surface. Wells that have been sunk into the compact clay yield water that is unfit for drinking and may be unsuitable for watering stock. In many places the clay contains a considerable amount of sand, which renders it more porous. Several wells have penetrated sandy clay and yield water that can be used in the household, and also in sufficient quantities to

water 10 to 35 head of stock. Sand and gravel pockets scattered irregularly through the boulder clay form more productive beds. The aquifers occur at depths of 12 to 60 feet. As in the morainic deposits, the water-producing beds are not continuous and considerable testing may be required in some places to determine their location. The yield from these wells depends to a large degree upon the areal extent of the aquifer tapped. In some of the wells the production is adequate only for household use, but in most places sufficient water is obtained from these beds to water also 10 to 50 or more head of stock. The water is generally hard. In supplies from the shallower wells the dissolved mineral salt content is not excessive, and these wells provide a satisfactory supply for domestic requirements. In many of the deeper wells in which the producing aquifer is covered by 30 feet or more of boulder clay, a more highly mineralized, occasionally undrinkable, water is obtained.

The glacial drift in its various forms in this municipality is a better source of ground water than the underlying bedrock. Residents seeking a ground water supply are advised to test carefully for aquifers in the drift before extending wells into the bedrock.

Water-bearing Horizons in the Bedrock

Three bedrock formations occur beneath the drift or outcrop at the surface in this municipality. These are the Ravenscrag, the Eastend, and the Bearpaw formations. The Ravenscrag is uppermost, and overlies the Eastend, which in turn overlies the Bearpaw formation. The Ravenscrag and Eastend formations occur only in the southwest corner where they form the upper parts of the highlands. Throughout the remainder of the municipality the Bearpaw formation immediately underlies the glacial drift. Since the Ravenscrag and Eastend formations are confined entirely to township 7, range 12, they will be discussed under the section of this report dealing with that township.

The Bearpaw formation is believed to underlie the lowland parts of the municipality at a depth of a few feet to about 80 feet and to have a thickness of 400 feet or more. In the upland area in the southwestern part of the municipality it underlies the Eastend formation at greater depths. The formation consists of dark grey to nearly black, compact marine shale. The shale when fresh, has a dull, earthy appearance, but upon weathering it becomes light grey to buff in colour and crumbles into small, roughly cubical fragments. The absence of pebbles in the material, the presence in some places of fossil shells, and its dark colour and soapy feel are criteria by which the Bearpaw shale may be readily distinguished from the overlying blue-grey boulder clay. In general, the Bearpaw formation is too compact to form a source of any large supplies of ground water, and, being of marine origin, it contains inherently large quantities of readily dissolvable mineral salts. These salts render much of the water from this source undrinkable, and in some wells the water is unfit for any farm use.

The uppermost part of the formation contains thin beds of sand and silt interspersed through the shale. These sands are more porous and hence more productive than the compact shale. A lack of detailed information in the well logs and the absence of exposures make it impossible to indicate on the map the areal extent of the sandy phase of this formation in this municipality. In the southwest and central parts of the municipality wells sunk to depths of 40 to 100 feet yield fairly large supplies of hard, "alkaline", but generally drinkable water from the upper part of the formation. In the northern and eastern parts of the municipality, however, lower beds of the formation underlie the drift. In this part of the formation sandy phases of the shale are almost entirely absent and the shales are more compact. At many places no water was found in the bedrock, and the only possibility of obtaining any appreciable amounts of water in it is

in the uppermost 10 to 20 feet. The water is usually of such poor quality as to be unfit for drinking, and may even produce scour in stock.

Evidence from the deeper wells suggests that drilling below a depth of 90 to 100 feet in the southwestern half or below 60 to 70 feet in the northeastern half of the area, cannot be expected to yield more than very small quantities of water that will undoubtedly be too bitter and salty for any farm use.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 7, Range 10

Most of the farms in the township are adequately supplied with ground water which is derived from the Recent alluvium washed into Pinto creek from the belt of glacial outwash gravels that extend along the NE.-SW. diagonal of the township, and from the glacial till that mantles the remainder of the township. In a few places, the wells do not yield adequate supplies.

Four wells situated in the valley of Pinto creek draw water from beds of sand or sandy clay at depths of 10 to 20 feet. Supplies from these wells are sufficient for 3 to 12 head of stock. The water from three of the wells is hard and of suitable quality for drinking, but in the well on section 31 a black "muck" was penetrated, and the water from it is "alkaline" and is suitable for stock only. It is possible that the base of this well is in the Bearpaw formation. Deep drilling in the valley is considered useless, but small supplies of mineralized but generally drinkable water are to be expected at most points within 20 feet of the surface.

As shown on the accompanying map, Figure 1, glacial lake clay occurs in small areas in the northeast and southeast corners of the township. The clay is usually almost entirely unproductive, but thin beds of sand and gravel are believed to occur between the lake clay and the underlying boulder clay. On section 1, a well that taps such a gravel bed, 12 feet below the surface, produces enough water for more than 26 head of stock, but on section 36 only a small supply is being obtained from sand in the bottom of a 20-foot well. The water from both wells is hard and has a fairly high content of dissolved mineral salts, but is being used for all domestic purposes.

A belt of glacial outwash deposits about one mile in width, extends from sections 6 and 7 in a northeasterly direction to sections 34 and 35. Beds of sand and gravel separated by sandy clays form

reservoirs for ground water. Wells on sections 7, 17, 21, and 27 have tapped these aquifers at depths of 14 to 30 feet. The yields from the various wells differ, depending upon favourable topography. Some wells yield sufficient water for 15 head of stock and others for as many as 75 or more head. Water from the sands and gravels is not generally highly mineralized, but the wells that have passed through the gravels into the underlying till yield water of poorer quality. With the exception of the water obtained from the 50-foot well on the NW. $\frac{1}{4}$, section 7, in which the aquifer is largely sandy clay all waters being derived from these deposits are drinkable. Little difficulty should be experienced in most places where these glacial outwash deposits are present in obtaining a satisfactory water supply within 30 feet of the surface. Outwash sands and gravels also occur in the northern part of section 31, and although they are un tapped by wells, their ground water possibilities probably are similar to those in the larger area of glacial outwash.

More difficulty has been experienced in locating suitable ground water supplies in the glacial till that covers the remaining parts of the township. Sand and gravel pockets that form aquifers appear to be scattered so sparingly through the boulder clay that they are not encountered at all points. However, careful prospecting on most sections should locate such pockets, and in many places better supplies than those now in use should be available. It should not be necessary to sink wells to depths exceeding 50 feet. Several of the existing wells supply only enough water for household use, but others water 10 to 15 head of stock. All the existing wells yield water that can be used for domestic purposes, but in some places it has an appreciable sulphate salt content.

No water is being obtained from the Bearpaw formation that underlies the drift at depths probably nowhere exceeding 60 feet. A 70-foot dry hole on section 4 is the only one reported as having penetrated the formation. The Bearpaw, in this township, is composed almost entirely

of shale and therefore, is not a probable source of ground water. Any further search for water in this township should be confined to the glacial drift.

Township 7, Range 11

The quantity of available ground water in this township decreased markedly during the years of prolonged drought. In few places do the existing wells yield sufficient water, and many residents depend for additional supplies upon the creeks or surface water stored by means of dams in coulées and in dugouts.

The thin layers of Recent sands, silts, and gravels occurring along the valley of Pinto creek form a possible source of fairly large supplies of drinkable water. As yet only one well, however, has been sunk in the valley. This well located on the SW. $\frac{1}{4}$, section 25, was dug 15 feet deep and provides adequate supplies of hard, "alkaline", but drinkable, water for domestic requirements, and for watering 15 head of stock. Deep boring is not advisable in the valley, but prospecting to depths not greatly exceeding 30 feet is recommended. Outwash sands and gravels occur in section 1, the eastern part of section 2, and in section 36. These gravels are not present at all places in these sections, as two wells 20 and 48 feet deep were sunk on the SE. $\frac{1}{4}$, section 2, and encountered only clay. The shallower well yields small supplies of drinkable water, whereas the supply obtained from the deeper one is large, but the water is so highly mineralized that it is unfit for use. Despite these findings, careful prospecting at shallow depths on or near gravel knolls or in sand and gravel accumulations at the bases of slopes in these areas probably will reveal at least moderately large supplies of usable water.

The mantle of till, or boulder clay, that covers the bedrock throughout this township is about 35 to 60 feet thick. Sand or gravel pockets interspersed through the boulder clay have been tapped on a few farms at depths of 18 and 58 feet. The yields are small; only one

well located on section 35 gives a supply sufficient to water 25 head of stock. The sand and gravel pockets evidently occur sparingly and are of limited areal extent. Careful prospecting with a 2-inch auger or by digging test-holes will be necessary to locate them in many sections of the township. Small seepages have been derived from the boulder clay, but the water is generally inferior in quality to that from the more porous beds.

The lower 20 to 30 feet of the drift is composed almost entirely of boulder clay. A thin bed of sand and gravel occurs at some places between the boulder clay and the shales of the underlying bedrock. Such beds are considered to form the aquifers in the 70-foot well on section 18, and in the 58-foot well on section 35. Both of these wells yield large quantities of drinkable water. This horizon is not everywhere productive, as no less than nine wells in various sections have continued into the Bearpaw shale before water was found. The water from the upper few feet of the shale is generally suitable for stock, but at greater depths the water is almost invariably too highly charged with dissolved sulphate salts and common salt to be fit for any farm use. It is improbable that boring much below a depth of 80 feet, in any part of this township, will give a water supply that will be usable either in the household or for watering stock.

Township 7, Range 12

This township is in the irregularly rolling uplands. The surface rises from 2,800 feet above sea-level in the northeast corner to heights exceeding 3,200 feet in the southwest corner, the highest point in the municipality. Few wells have been sunk in the area, and the water-bearing possibilities over much of the township have not been determined. The glacial drift or the bedrock formations supply water at a number of localities in the northeastern, southern, and central parts of the township and elsewhere they form potential sources. The mantle of glacial drift is thin or absent over much of the southwestern quarter

of the area, but increases to 50 feet or more along the northern border. It is improbable that any uniformity exists either in size or distribution of the sand and gravel pockets that form the aquifers in the boulder clay. Two wells dug 15 feet deep, on sections 21 and 28, each yield sufficient water for 40 head of stock, whereas a 10-foot well one mile south in section 16 yields only a meagre supply. Near the bottoms of the hill slopes, and in the coulées, sands and gravels are probably present in sufficient quantities to form aquifers worthy of prospecting. The productive pockets do not occur at all places, and the sinking of test-holes, systematically arranged to cover as large an area as possible, may be necessary before a supply is found at shallow depths. Should prospecting near the surface yield inadequate supplies, deeper boring to depths of 75 to 100 feet seems advisable. Wells located along the northern border have encountered a bed of sand at depths ranging from 35 to 45 feet. This sand is considered to be at the contact of the till and the underlying Bearpaw shale. This sand bed is not present at all points, as wells sunk to depths of 76 and 96 feet penetrated the shale on the southern part of section 35 before an adequate water supply was obtained; and on the SE. $\frac{1}{4}$, section 36, a 75-foot hole that entered the shale at approximately 40 feet yielded no water.

Moraine covers the northwest corner of the township. No wells have been sunk in the area, and the water conditions are not known. The deposits forming the moraine are generally more porous than those of the till, and hence less difficulty should be experienced in obtaining a water supply at shallow depths.

Three bedrock formations underlie the glacial drift in different parts of this township, namely the Ravenscrag, Eastend, and Bearpaw formations. The Ravenscrag forms the southwestern uplands above an approximate elevation of 3,025 feet above sea-level. Its lower part consists of greenish grey, and grey sandstone, and unconsolidated beds of fine sands and silts with thin bands of clay

ironstone. At higher levels it consists mostly of dark and light-coloured plastic clays and shaly silts. No wells have been reported in this corner of the municipality, but water-bearing horizons in this formation, which are producing in the township adjoining on the west, probably extend into this area. The thickness of the overlying glacial drift is not known, but it seems reasonable to assume that wells, 75 feet deep or less, would encounter the water-bearing horizons and yield moderately large supplies of drinkable water.

The exact thickness of the Eastend formation underlying the Ravenscrag has not been determined in this area, but it probably does not greatly exceed 40 feet. It extends for approximately one-half mile further down the slopes of the uplands than does the Ravenscrag. It consists of fine grey sands, and silts, in the upper part, but is noticeably more shaly at the base, finally grading into the sandy shales of the Bearpaw formation at an approximate elevation of 2,985 feet above sea-level. No wells have been sunk in this formation, but a spring occurring in section 4 appears to have its origin in the sandy beds of the upper part of the Eastend formation. Ground water of good quality is to be expected from this formation at shallow depths in the areas in which it occurs immediately beneath the drift, and at corresponding depths to the southwest, where it is overlain by increasing thicknesses of the beds comprising the Ravenscrag formation.

The upper and generally more sandy part of the Bearpaw formation underlies the drift throughout all but the southwest corner and western border of this township. A 100-foot well on section 3 yields a supply of hard, drinkable water that is reported to be adequate for watering 100 head of stock. No other wells have penetrated the shale in this part of the township, but several springs in section 3 appear to be drawing their supplies from higher horizons in

this formation. It is reasonable to assume, therefore, that elsewhere the formation will not only prove to be water-bearing, but will yield a large supply of better quality than is found in the more compact shales of the lower part of the formation. In the northeast corner the formation is composed almost entirely of shale and more difficulty is experienced in obtaining water from the bedrock. A small supply is derived from the shale at a depth of 40 feet on the NE. ¼, section 34, but a 125-foot well on the same quarter section is dry. A 75-foot hole on section 36 is also dry, but a moderately large supply was found at a depth of 96 feet on section 35. The water has a large content of dissolved mineral salts that render it unfit for domestic use. The resident has obtained a satisfactory household supply at a depth of 76 feet in a nearby well. It would appear that there can be no definite assurance of obtaining water from the shale in the northeastern part, or that such supplies as do exist will necessarily be suitable for drinking. Drilling below a depth of 100 feet from the surface is not considered advisable in the northeastern parts of the township.

Township 8, Range 10

Adequate supplies of ground water are obtained on most of the farms in the township. Only in sections 13, 19, and 27 are the yields from the existing wells reported to be insufficient for local requirements.

The Recent stream deposits that occur along the southern part of sections 1, 2, and 3, will probably be found to be water bearing at shallow depths, but as yet no wells have been sunk in this part of the area.

Glacial lake clays mantle small areas in sections 1 and 36, and a more extensive area embracing parts of sections 7, 8, 17, and 18. A well on the NE. ¼, section 7, is the only well sunk in these deposits in this township. This well is 39 feet deep and obtains a good supply of soft water from an aquifer of sand that is believed to

occur in the boulder clay underlying the lake clay. Other wells dug in this area may obtain similar water supplies.

A narrow belt of glacial outwash deposits extends across the northern part of the township from section 32 to section 36. These deposits are composed of clay, sand, and gravel and probably do not greatly exceed 12 feet in thickness. On the NW. $\frac{1}{4}$, section 33, a well 11 feet deep is drawing water of good quality from a sand bed that is probably at the base of the outwash. Another well located in glacial outwash deposits in the NW. $\frac{1}{4}$, section 32, is 25 feet deep and furnishes part of the water supply of the village of Aneroid. This well is obtaining its supply from a water-bearing sand pocket in the underlying boulder clay. Generally, however, these deposits are sufficiently thick and porous to form a source of ground water of good quality, and are worthy of further prospecting.

An 18-foot well on section 23 represents the only reported attempt to find ground water in the moraine-covered area in the east-central part of the township. This well taps one of the sand pockets that are interspersed through the boulder clay, and a good supply of soft water is obtained. The drift composing the moraine is generally quite porous, and water-bearing pockets should be readily located at most points.

The glacial till that covers the remaining parts of the township is composed of sandy boulder clay in which scattered sand and gravel pockets probably occur more sparingly than in the moraine. However, wells at many points in the township have tapped these aquifers at depths of 25 to 65 feet, and the water supplies obtained are, in nearly all places, sufficient for local needs. A few wells yield only enough water for the household, and 4 or 5 head of stock, but from most of the wells, 10 to 35 head of stock can be watered. An exceptionally large supply, sufficient for watering at least 100 head of stock, is derived from a 60-foot well on section 2, but

quantities such as this are not to be expected at all points. The water from some of the shallower wells is reported as soft, but generally the water is hard. The dissolved mineral salt content of the waters from three wells is sufficiently high to render it unfit for drinking, although it is satisfactory for stock use. Most of the supplies from the till are drinkable. Some wells have not struck sand or gravel aquifers, but seepagos are obtained directly from the boulder clay. Supplies in such wells are generally small, and the water is more highly mineralized than that from the sands or gravels. Two such wells, located on sections 17 and 31, yield undrinkable water.

The Bearpaw formation immediately underlies the glacial drift at depths of about 50 to 70 feet throughout the township. A well 94 feet deep on section 5 is supplying sufficient quantities of water of good quality for 20 head of stock. It is possible that the water in this well is being derived from an aquifer in the drift at a depth of 20 feet rather than from the bedrock. The water from a 60-foot well on section 19 is known definitely to come from the Bearpaw shale and is unfit for use. Moderately large supplies of drinkable water might be secured from the upper few feet of the Bearpaw formation at some points in the township, but it cannot be considered as a reliable source of ground water. The glacial drift offers greater possibilities for good supplies and should be carefully prospected before sinking wells into the Bearpaw. Deep drilling in any part of this township is not recommended.

Township 8, Range 11

The mantle of glacial drift overlying the bedrock throughout this township probably nowhere greatly exceeds 35 feet in thickness, and at points along the northern border is known to be only 20 feet thick.

In the area covered by lake clay, including sections 9 to 16 and the northern parts of sections 2, 3, and 4, ground water is obtainable at depths generally between 18 and 30 feet. From the information available, it is probable that the water is obtained from sand or gravel beds that occur either at the contact of the lake clay and the underlying boulder clay or in the boulder clay itself. The yields from individual wells are not large, but most wells give sufficient water for 10 to 20 head of stock. The water is not highly mineralized, and is considered suitable for all domestic requirements. Prospecting at shallow depths directed to cover as large an area as possible, is preferable to deep drilling in any part of the lake clay area.

The glacial till covering the remainder of the area varies greatly in character from place to place as does the quantity and quality of ground water that it produces. Much of the boulder clay is compact and nearly impervious, and the water-bearing sand and gravel pockets occur only sparingly. In the southeast corner, along the western border, and in sections 23 and 24, wells have encountered such pockets within 40 feet of the surface, and obtain moderately large supplies of water. The shallower wells, less than 20 feet deep, yield soft water, but at greater depths the water is hard and may contain appreciable amounts of dissolved sulphate salts. At other places no pockets were found and small seepages of a much more highly mineralized water are obtained. The 18-foot well dug on section 26 yields a supply that is unfit for drinking, but rarely is the water from the boulder clay unsuited for stock use. The irregularity of occurrence of the more productive pockets makes it impossible, with the information available at the present time, to predict their locations. Careful prospecting within 40 feet of the surface, directed to cover systematically as large an area as possible, should, however, produce an adequate ground water supply in most sections in

the southern two-thirds of the area.

In the northern third of the township, porous beds carrying water are almost entirely wanting in the thin mantle of boulder clay. Residents have been obliged to continue wells to depths of 50 to 60 feet. The water supply may come in part from sandy beds at the contact between the drift and the bedrock, but the greater part is contained in the upper 20 to 35 feet of the shale. In this area wells not exceeding 60 feet in depth generally yield a water that, although mineralized, can be used in the household. At greater depths the quantity of dissolved salts in the water increases markedly, and the water is undrinkable and may be unfit for stock use. Small supplies of usable water, generally sufficient for 10 to 20 head of stock, are found in the upper part of the shale throughout the remainder of the township, but there again deeper drilling yields a bitter water that cannot be considered satisfactory for farm use.

Township 8, Range 12

The mantle of till covering this township probably nowhere exceeds 45 feet in thickness. It appears to contain more porous beds and is thus a better source of ground water than is the till covering the township to the east. Throughout the greater part of the area, residents have been able to obtain sufficient quantities of soft or only moderately hard drinking water from dug wells ranging in depth from 10 to 20 feet. Other wells 20 to 40 feet deep provide water for stock from beds either at the base of the drift, or at its contact with the underlying shale. The yields from a few of these wells are sufficient for not more than 10 head of stock, but the majority of the wells will each yield water for 35 to 50 head. The water from the deeper wells is usually "alkaline", but can be used for drinking.

Only one shallow well has been sunk in the rough, rolling area of moraine in the central part of the area. It is presumable,

however, that water conditions will be similar to those existing in the till.

Throughout the central and western thirds of the township the generally productive character of the till has made deeper drilling unnecessary. In the NE. $\frac{1}{4}$, section 7, and the SE. $\frac{1}{4}$, section 18, wells have entered the Bearpaw shale. The wells are 60 feet deep. The depths at which they penetrated the shale is not known. The well on section 18 yields sufficient quantities of hard, mineralized water for at least 25 head of stock. The other yields smaller amounts of less highly mineralized water from a higher horizon. Few wells have found productive horizons in the till, in the eastern third of the township. Most of the wells have, therefore, been continued into the shale, which is encountered at depths of 35 to 40 feet. The wells that have found water in the upper few feet of the shale yield a hard, not highly mineralized, drinkable water. Wells 35 to 40 feet deep, on sections 23 and 36, yield water that cannot be used for drinking, but is being used for watering stock with no reported ill effects. It is improbable that the quality or the quantity of water will improve at greater depths. It is better to prospect for water in the drift or upper few feet of the shales rather than to sink wells much below a depth of 75 feet at any point in the area.

Township 9, Range 10

Much difficulty has been experienced in obtaining adequate supplies of drinkable ground water in many parts of this township. This condition appears to be due to the rare occurrence of porous water-bearing sand beds either in the drift, at the contact of the drift and the bedrock, or in the underlying bedrock. The glacial drift, which underlies the whole township, varies irregularly in thickness from 20 feet or less in the northwest corner to over 60 feet in the central and east-central parts of the township. In a small area in the

southwest corner the unsorted drift is covered with glacial outwash deposits composed largely of stratified sands and gravels. The areal extent of these deposits is shown on the accompanying map, Figure 1. No wells are recorded as having been dug in the glacial outwash deposits of this area, but adequate supplies of ground water are being obtained at shallow depths in the outwash in the township to the south, and they will likely prove to be similarly productive in this township.

Two wells are drawing water from the moraine in the east-central part of the township. On section 25 a well 57 feet deep tapped a sand bed that yields enough water for 30 head of stock. On section 24 an 18-foot well draws water from the sandy boulder clay. Apparently, water-bearing sand and gravel pockets occur very sparingly in the drift of this locality, as forty-eight dry holes were sunk on section 25 before the sand aquifer was located.

Difficulty has also been experienced in locating ground water supplies in the glacial till, which covers the greater part of the township. Sand or gravel pockets have been tapped on some sections at depths of 15 to 60 feet, and yield supplies of water sufficient for 16 to 30, and from a few wells, 100, head of stock. The water is generally hard and suitable for all farm uses, but from two wells, located on section 16, the water is reported to be too "alkaline" for drinking. Other wells, 14 to 75 feet deep, obtain water from the boulder clay. In some places these supplies are only sufficient for household use, but other wells serve to water 20 to 35 head of stock. Dry holes are numerous in the till in many parts, and careful prospecting over considerable areas seems essential to finding an adequate water supply.

Four wells are recorded as drawing their water supplies from the Bearpaw formation that underlies the glacial drift throughout the entire township. These wells range in depth from 28 to 70 feet. The upper few feet of the shale yield a large supply of drinkable water in

the 51-foot well on section 11. It is also possible that at least a part of this water comes from the contact of the shale and the till. All other wells that have penetrated the shale yield water that is generally too highly mineralized to be drinkable, and one well yielded water that proved to be harmful to stock. On many sections, efforts to find water in the shale have been fruitless. On section 25 holes have been drilled to depths of 510 and 800 feet without obtaining any water. Drilling to such depths is not advisable, and it seems questionable if water suitable for any farm use will be found at depths greater than 15 to 25 feet below the point in the well at which the dark grey shales are penetrated. Should the village of Aneroid consider increasing its present water supply, extensive prospecting, within 60 to 75 feet of the surface, is advised rather than deep drilling.

Township 9, Range 11

The Recent deposits of sands and silts that floor the valley of Notukeu creek and the glacial till covering the rest of the township, are the chief sources of ground water. Several shallow seepage wells have been dug close to the creek and give small supplies of water. Six other wells in the valley in sections 17, 19, 20, and 21, varying in depth from 12 to 35 feet, tap what appears to be a fairly continuous sand aquifer, that lies at an elevation of about 2,430 feet above sea-level. The well on section 17 supplies only enough water for household use, but the other wells yield supplies adequate for 15 to 50 or more head of stock. Two of these wells located on the SW. $\frac{1}{4}$, section 19, supply the village of Ponteix. The water is of good quality except that derived from the well on the NW. $\frac{1}{4}$, section 20, which is too "alkaline" for drinking. This sand aquifer probably continues down the valley, but along the stream banks in section 27, 28, 32, and 33, the shales of the Bearpaw formation are exposed. Seepages from these exposures probably contain appreciable

quantities of dissolved mineral salts, and this would affect the quality of the water from the Recent deposits.

A narrow belt of glacial outwash sands and gravels extends through the northeast corner of section 1, and diagonally across section 12. No wells have been dug into these deposits, but supplies of ground water probably can be obtained from them at depths of 25 feet or less.

Sand and gravel pockets are scattered through the boulder clay that covers the remaining parts of the township, and some of these pockets have been tapped by wells 16 to 60 feet deep. The yield of water from these wells is, generally, sufficient for 20 to 50 head of stock. Most of the water is hard and of good quality, but the water from a well on section 25, and from another on the SW. $\frac{1}{4}$, section 36, is too highly mineralized to be used for drinking. In places where only boulder clay is encountered the water supplies obtained are small. It is probable that careful prospecting in the vicinity of these wells will find more productive sand pockets interspersed through the clay.

Several wells have penetrated the Bearpaw formation, which underlies the entire township, but this formation cannot be considered a good source of ground water in this locality. Water has been obtained in wells ranging in depth from 14 to 70 feet, but supplies are either very small or the water is unfit for use owing to the excessive amounts of sulphate salts that are present in solution. Dry holes have been drilled from 70 to 475 feet deep in various places. When seeking ground water supplies in this township, well digging should be discontinued when the Bearpaw shales or soapstone are reached, and further tests should be made in the drift. The drift varies considerably in thickness in different parts of the township, the Bearpaw formation being found at depths of 20 feet or less in the northern sections, and at gradually increasing depths to the south; along the southern boundary the depths to the shale are 60 to 80 feet.

Township 9, Range 12

The ground water supplies of the township are being derived from the Recent deposits in the valley of Notukeu creek, from the glacial drift, and from the underlying Bearpaw formation.

Two wells are recorded as having been dug into the Recent deposits in the valley flat of the creek. On section 27 a good supply of water is obtained from a sand bed at a depth of 10 feet. On section 25 a 12-foot well produces a small supply of water as seepage from the creek. Water-bearing sand beds probably do not extend continuously through the sandy silts of the Recent deposits, but should be sufficiently numerous to assure the finding of water at most places in the valley.

The glacial till or boulder clay underlies the Recent deposits, and blankets the remainder of the area. The till has been tested as a source of ground water in nearly every section of the township. Sand and gravel pockets are scattered irregularly through the boulder clay at depths of 12 to 45 feet. The water obtained is generally of good quality, but in places the concentration of dissolved mineral salts is excessive. From four wells the water is reported as being unfit for drinking, and from one well unfit even for watering stock. On account of the variations in size of the individual porous beds, the yields to be expected from point to point vary considerably. A few of the existing wells produce only enough water for household use, but as a rule adequate supplies for 10 to 40 or more head of stock are obtainable. Small supplies have been found in the boulder clay in a few wells, but the water is generally of poor quality. Deep holes have been drilled in some sections, but no water was found, and further deep drilling should not be attempted. An adequate water supply should be obtainable from the glacial drift on nearly every section, although several test-holes may be necessary before an aquifer is located.

The glacial drift nowhere exceeds 50 feet in thickness, and in most places is less than 25 feet thick. The 45-foot well on the SW. ¼, section 30, and the 35-foot well on the NE. ¼, section 32, are believed to obtain their moderately large supplies from the contact of the drift and the bedrock. The water from the first-mentioned well is suitable for all farm requirements, but the other well yields a water that is unfit even for stock.

Wells have been dug into the Bearpaw shale, which underlies the entire township, and most of these wells have found water supplies. These wells are scattered over the area and do not appear to be tapping any continuous aquifer, but rather obtain water that has collected in the weathered upper part of the shale. The water is hard, "alkaline", and usually undrinkable, and from four of the wells is considered to be unfit for any farm use. It has not been determined whether the 14-foot well on section 10 derives its supply from sand beds in the glacial drift at the contact, or from the bedrock. It yields sufficient water for 80 head of stock, but supplies such as this are not to be expected from the Bearpaw shale in most places.

Sinking wells below the upper few feet of the shale is not advisable. One well was drilled nearly 400 feet into the shale on section 6 without obtaining any water, and similar conditions were found in the 70-foot well on section 10, and the 313-foot well on section 22. If no water is obtained after the upper 10 to 15 feet of the shale is penetrated, residents are better advised to cease digging and continue to search at a new site. Nowhere in the township is it considered advisable to sink wells deeper than 50 feet.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF AUVERGNE, NO. 76, SASKATCHEWAN.

West of 3rd meridian — Township	7	7	7	8	8	8	9	9	9	Total No. in municipality
Range	10	11	12	10	11	12	10	11	12	
Total No. of Wells in Township	48	18	34	29	42	39	160	35	36	441
No. of wells in bedrock	1	10	21	2	15	7	90	10	11	167
No. of wells in glacial drift	43	7	13	27	27	32	70	19	23	261
No. of wells in alluvium	4	1	0	0	0	0	0	6	2	13
Permanency of Water Supply										
No. with permanent supply	47	16	28	28	42	38	50	30	31	310
No. with intermittent supply	0	1	0	1	0	1	0	2	2	7
No. dry holes	1	1	6	0	0	0	110	3	3	124
Types of Wells										
No. of flowing artesian wells	0	0	0	0	0	0	0	0	0	0
No. of non-flowing artesian wells	3	1	1	9	1	2	8	4	6	35
No. of non-artesian wells	44	16	27	20	41	37	42	28	27	282
Quality of Water										
No. with hard water	34	17	26	19	34	37	43	29	28	267
No. with soft water	13	0	2	10	8	2	7	3	5	50
No. with salty water	0	0	0	0	0	0	0	0	0	0
No. with "alkaline" water	12	9	9	11	21	14	35	15	17	141
Depth of Wells										
No. from 0 to 50 feet deep	42	9	25	22	36	35	91	25	31	316
No. from 51 to 100 feet deep	6	8	7	7	4	4	39	6	3	86
No. from 101 to 150 feet deep	0	1	1	0	1	0	20	0	0	23
No. from 151 to 200 feet deep	0	0	1	0	1	0	4	0	0	6
No. from 201 to 500 feet deep	0	0	0	0	0	0	3	2	2	7
No. from 501 to 1,000 feet deep	0	0	0	0	0	0	3	0	0	3
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	35	10	27	20	28	34	21	24	21	220
No. not usable for domestic purposes	12	7	1	9	14	5	29	8	12	97
No. usable for stock	45	13	28	29	39	39	25	31	31	280
No. not usable for stock	2	4	0	0	3	0	25	1	2	37
Sufficiency of Water Supply										
No. sufficient for domestic needs	47	16	28	27	41	37	49	30	31	306
No. insufficient for domestic needs	0	1	0	2	1	2	1	2	2	11
No. sufficient for stock needs	23	12	18	21	30	32	36	21	27	220
No. insufficient for stock needs	24	5	10	8	12	7	14	11	6	97

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 Auvergne, No. 76, 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.	Alka-linity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	
1.	NE.	35	7	12	3	35	1,380	300	240	120	14	475	30	58	693	624	1,518	54		121		294	1,026	23	*1
2.	SW.	6	8	11	3	106	4,000	1,800	1,700	100	24	350	280	320	2,435	1,000	3,807	350	204		956		2,257	40	*2
3.	NW.	13	8	11	3	21	1,800												(2)		(3)	(4)	(1)	(5)	*1
4.	N.½	27	9	10	3	23	740												(2)		(4)	(3)	(1)	(5)	*1
5.	NW.	8	9	12	3	43	3,700	2,500	2,400	100	43	265	710	263	2,440	579	3,734	265	1,366		784		1,248	71	*1

Water samples indicated thus, * 1, are from glacial drift.
Water samples indicated thus, * 2, 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. 3 and 4, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

No samples of ground water from the Recent deposits occurring along the creeks were taken for analysis. Residents deriving supplies from this source report the water to be hard and to contain appreciable amounts of dissolved mineral salts of which the sulphates of sodium and magnesium are probably in greatest concentration. The water is generally drinkable, but in places where the wells have penetrated the underlying shale, or where the water from the Recent deposits is derived by seepage from outcrops of shale along the valley sides, a much more highly mineralized and in many cases undrinkable water is obtained.

Waters from the glacial deposits show a general similarity in the mineral salts present in solution, and in the relative proportions in which they occur. The boulder clay is considered to be the main source of the sulphate salts of sodium (Na_2SO_4), magnesium ($MgSO_4$), and calcium ($CaSO_4$). In places where porous beds occur near to the surface, and are not covered by any appreicable thickness of boulder clay, a soft or moderately hard, only slightly mineralized water may be found. Analysis No. 4 on the accompanying table is of water from a 23-foot well sunk into a gravel bed in the till on the N. $\frac{1}{2}$, sec. 27, tp. 9, range 10. Only 740 parts per million of total solids are reported as occurring in this water. The total solids are made up largely of sulphate salts, although an appreciable amount of black "alkali" (Na_2CO_3), is also present. This latter salt is probably not in sufficient concentration to give any noticeable taste to the water, or to cause any marked effects if used for watering plants.

The 21-foot well on the NW. $\frac{1}{4}$, sec. 13, tp. 8, range 11, derives its water (Analysis No. 3), from a thin sand bed overlain by lake clay, and boulder clay. As is to be expected, a greater concentration of mineral salts is found. This water has a distinctly "alkaline" taste due to the presence of sodium, calcium, and magnesium sulphates in

solution, but may not be laxative to persons accustomed to its use. Small amounts of sodium carbonate and common salt are also reported, but are not present in sufficient amounts to have harmful effects on vegetation.

Analysis No. 1 on the table is of water from sand in a 35-foot well on the NE. ¼, sec. 35, tp. 7, range 12, and is similar in character to the water described above. It is hard, the hardness being largely permanent and not removable by boiling the water.

Analysis No. 5 is of water from a 43-foot well on sec. 8, tp. 9, range 12. The much greater concentration of total dissolved solids, 3,700 parts per million, may be attributed to the greater thickness of boulder clay overlying the aquifer. This well probably derives its water from the contact between the drift and the Bearpaw shale and a part of its mineral salt content may come from the shale. This water is exceedingly hard; of the 2,500 parts per million of hardness, 2,400 parts are permanent. Such water cannot be regarded as satisfactory for household use. It is improbable that water of appreciably better quality will be found at the contact throughout the northern parts of the municipality, although at several points water from this horizon is used with no reported ill effects.

Water from the Bedrock

As no water is being derived from the Ravenscrag formation in this municipality, the quality of the water to be expected can only be estimated from the quality of the waters obtained from the formation in other places. Sodium sulphate will probably be present in solution in the largest amounts, with magnesium and calcium sulphate in lesser amounts. Sodium carbonate is to be expected in increasing relative quantities at greater depths. The water will probably be hard, but the quantity of dissolved mineral salts will not be excessive, and the water will be of good quality for all farm purposes.

The water from the spring on sec. 4, tp. 7, range 12, which is believed to come from sand beds in the Eastend formation, is reported to be soft. Of the salts in solution in this water sodium carbonate is probably present in the largest amounts, with the sulphates occurring next in order of relative concentration. Water from the lower and more shaly parts of the formation may be hard, but should be satisfactory for domestic use.

Nearly all the water obtained from the Bearpaw shale is excessively hard, and has a high dissolved sulphate salt content. Sodium sulphate is the predominant dissolved salt, and in many places is present in sufficient concentration to make the water unfit for use. Magnesium sulphate is also present in amounts large enough to cause the water to have a decided laxative effect. On a few farms in the region, water from the upper few feet of the Bearpaw is not highly mineralized, and can be used in the household. In most places, however, the water is of very poor quality. Analysis No. 2 in the table is of a sample of water from a well on the SW. ¼, sec. 6, tp. 8, range 11, that has penetrated at least 73 feet of the shale. This water is not drinkable owing to the very high content of sodium and magnesium sulphates in solution. Such water also tends to cause scour among stock. Even greater concentrations of dissolved sulphate salts and increased amounts of common salt are to be expected at greater depths in the shales. So common is the occurrence of highly mineralized water from the bedrock over the greater part of the area, that prospecting in the drift is strongly recommended rather than drilling into the bedrock in all but the extreme southwest corner of this municipality.

WELL RECORDS—Rural Municipality of AUVERGNE NO. 76, 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	SE.	1	7	10	3	Dug	14	2,532	- 12	2,520	12	2,520	Glacial gravel	Hard, iron, "alkaline" reddish sediment		D, S	Oversufficient for 26 head stock.
2	SE.	3	"	"	"	Dug	27	2,610	- 22	2,588	22	2,588	Glacial gravelly clay	Soft, clear		D, S	Ample supply; waters 14 head stock.
3	SW.	4	"	"	"	Dug	28	2,674	- 24	2,650	24	2,650	Glacial sand	Hard		D, S	Sufficient supply; also a 70-foot dry hole.
4	SE.	5	"	"	"	Bored	50	2,632	- 40	2,592	49	2,583	Glacial gravel	Hard		S	Not sufficient; second well for household.
5	NW.	7	"	"	"	Bored	50	2,527	- 30	2,497	30	2,497	Glacial clay	Hard, "alkaline"		S	Ample supply; but usable only for stock.
6	NE.	7	"	"	"	Dug	16	2,627	- 15	2,612	15	2,612	Glacial sand	Hard, clear	45	D, S	Sufficient for 15 head stock.
7	SE.	9	"	"	"	Bored	50	2,622					Glacial clay	Hard, clear, "alkaline"	45	D, S	Not enough for steady use.
8	NE.	13	"	"	"	Dug	20	2,500	- 18	2,482	18	2,482	Glacial clay	Hard, iron, "alkaline" red sediment		D, S	Sufficient supply; waters 15 head stock.
9	SE.	14	"	"	"	Bored	40	2,410	- 25	2,385			Glacial sandy clay	Hard, iron, sulphur red sediment		D, S	Insufficient supply.
10	NE.	14	"	"	"	Bored	35	2,465	- 31	2,434	31	2,434	Glacial sandy clay	Hard, clear	45	D, S	Not sufficient in dry seasons.
11	SE.	16	"	"	"	Dug	20	2,700	- 17	2,683	17	2,683	Glacial quicksand	Soft, clear	45	D, S	Insufficient supply.
12	NE.	16	"	"	"	Dug	20	2,657	- 16	2,641	16	2,641	Glacial sandy clay	Soft, clear	45	D, S	Sufficient supply; waters 15 head stock.
13	SW.	17	"	"	"	Dug	17	2,632	- 11	2,621			Glacial drift	Hard, clear, iron		D, S	Hardly enough for 29 head stock and 200 sheep
14	SW.	18	"	"	"	Dug	20	2,750	- 14	2,736	14	2,736	Glacial sandy clay	Hard, "alkaline"	45	D, S	Sufficient for 15 head stock.
15	SW.	21	"	"	"	Dug	24	2,587	- 20	2,567	23	2,564	Glacial gravel	Hard, "alkaline"		D, S	Sufficient supply; waters 25 head stock.
16	NW.	22	"	"	"	Bored	60	2,570	- 20	2,550	60	2,510	Glacial sand	Soft, clear		D, S	Sufficient supply; waters 13 head stock.
17	NE.	22	"	"	"	Dug	15	2,465	- 11	2,454	11	2,454	Glacial sandy clay	Soft, clear	45	D, S	Sufficient supply; waters 9 head stock.
18	NE.	23	"	"	"	Bored	20	2,457	- 12	2,445	12	2,445	Glacial sandy loam	Soft, clear		D	Second well supplies stock.
19	SE.	24	"	"	"		40						Glacial drift			S	Sufficient for stock needs; also a 15-foot well for domestic needs.
20	SE.	25	"	"	"	Bored	60	2,570	- 50	2,520			Glacial clay	Hard, "alkaline"		D, S	Not sufficient supply; uses a second well.
21	SE.	27	"	"	"	Dug	14	2,460	- 10	2,450	14	2,446	Glacial sandy clay	Soft, clear	45	D, S	Sufficient supply; waters 75 head stock.
22	NW.	28	"	"	"	Dug	14	2,500	- 9	2,491	9	2,491	Recent alluvial sand	Hard	45	D, S	Sufficient supply; waters 12 head stock.
23	NW.	30	"	"	"	Bored	20	2,507					Recent alluvial sand	Hard	45	D, S	Sufficient supply.
24	SE.	31	"	"	"	Dug	10	2,488	- 6	2,482			Recent alluvial black muck	Hard, "alkaline", strong odour, clear		S	Usable only by stock; requires frequent cleaning.

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 AUVERGNE NO. 67, 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
25	SE.	35	7	10	3	Bored	56	2,480	- 44	2,436	44	2,436	Glacial stony clay	Hard,"alkaline"		S	Sufficient for 30 head stock; second well for household .
26	NW.	35	"	"	"	Dug	13	2,475	- 15	2,460	15	2,460	Recent alluvium sandy clay	Hard,"alkaline"	45	D, S	Sufficient supply; waters 11 head stock.
27	NE.	36	"	"	"	Dug	20	2,457	- 14	2,443	14	2,443	Glacial sand	Hard,"alkaline"		D, S	Not sufficient in dry seasons.
1	SE.	2	7	11	3	Dug	20	2,720	- 17	2,703	17	2,703	Glacial drift	Hard,clear		S	Not enough for stock; intermittent supply.
2	SW.	3	"	"	"	Dug	18	2,738	- 15	2,723	15	2,723	Glacial gravel	Hard,clear		D	Insufficient supply.
—3	SE.	4	"	"	"	Bored	35	2,720	- 17	2,703			Bearpaw clay	Hard,"alkaline"		D, S	Sufficient supply; constant supply; waters 15 head stock.
4	SW.	6	"	"	"	Bored	40	2,770	- 20	2,750	20	2,750	Glacial yellow clay	Hard		D, S	Insufficient supply; also an 80-foot well with poor water of poor quality.
5	NW.	13	"	"	"	Bored	60	2,634			60	2,574	Bearpaw blue clay	Hard,"alkaline"		S	Sufficient supply; waters 15 head stock.
6	SE.	14	"	"	"	Bored	25	2,607									Dry hole in Bearpaw clay. A 52-foot well yields water unfit for use.
7	SE.	15	"	"	"	Bored	42	2,746	- 27	2,719	27	2,719	Glacial sandy clay	Hard,clear		D, S	Insufficient supply.
8	SE.	16	"	"	"	Bored	60	2,655	- 43	2,612	43	2,612	Bearpaw blue clay	Hard,clear, "alkaline"		D, S	Usually enough for 15 head stock.
9	NW.	18	"	"	"	Bored	70	2,720	- 35	2,685	35	2,685	Bearpaw clay	Hard,clear, "alkaline"		D, S	Good supply; waters 80 head stock.
10	SE.	23	"	"	"	Bored	34	2,638	- 19	2,619	19	2,619	Glacial clay	Hard,clear		D, S	Sufficient for 29 head stock; water from a 110-foot well too "alkaline" for use.
11	SW.	25	"	"	"	Dug	14	2,585	- 11	2,574	13	2,572	Recent alluvial sand and gravel	Hard,clear, "alkaline"		D, S	Sufficient supply;waters 15 head stock.
12	SE.	28	"	"	"	Dug	70	2,625	- 35	2,590			Bearpaw clay	Hard,clear, "alkaline"		D, S	Sufficient supply; waters 50 head stock.
13	NW.	32	"	"	"	Dug	80	2,830	- 60	2,770	60	2,770	Bearpaw blue clay	Hard,clear, "alkaline" iron		S	Sufficient supply; waters 40 head stock.
14	NE.	35	"	"	"	Bored	58	2,620	- 46	2,574	58	2,562	Glacial gravel	Hard,clear		D, S	Sufficient for 25 head stock.
1	NW.	3	7	12	3	Bored	100	2,925					Bearpaw clay	Hard,clear		D, S	Sufficient for 100 head stock. Also springs for stock.
2	SW.	4	"	"	"	Spring	6	2,890					Eastend? clay	Soft,clear		D, S	Sufficient supply.
3	NE.	16	"	"	"	Dug	10	2,840	- 8	2,832	8	2,832	Glacial clay	Hard,clear, "alkaline"		D	Sufficient supply.
4	NE.	21	"	"	"	Dug	15	2,740	- 9	2,731	9	2,731	Glacial sand	Hard,clear		D, S	Sufficient supply; waters 40 head stock.
5	SE.	25	"	"	"	Dug	20	2,800	- 10	2,790	14	2,786	Glacial gravel	Hard,clear		D, S	Sufficient supply; waters 6 head stock.
6	SW.	28	"	"	"	Dug	15	2,850	- 9	2,841			Glacial blue clay	Hard,clear		D, S	Sufficient supply.
—7	NE.	34	"	"	"	Bored	40	2,640	- 25	2,615	25	2,615	Bearpaw blue clay	Hard,clear, "alkaline"		D, S	Just sufficient for 6 head stock; also 125-foot dry hole.
—8	SE.	35	"	"	"	Bored	96	2,630	- 80	2,550	80	2,550	Bearpaw blue clay	Hard,"alkaline"		S	Sufficient for 15 head stock; second well used for household.
9	NE.	35	"	"	"	Dug	35	2,645	- 32	2,613	33	2,612	Glacial sand	Hard,clear		D, S	Sufficient supply; waters 30 head stock.

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 AUVERGNE NO. 76, 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
10	SE.	36	7	12	3	Bored	75	2,775									Dry hole in Bearpaw soapstone.
11	NE.	36	"	"	"	Dug	45	2,715	- 42	2,673			Glacial sand	Hard, clear		D, S	Sufficient supply; waters 8 head stock. 160-foot well in Bearpaw gives small supply.
1	NE.	2	8	10	3	Bored	60	2,537	- 40	2,497	60	2,477	Glacial sand	Hard, "alkaline"	45	S	Ample supply; water 100 head stock; second well for household.
2	NW.	3	"	"	"	Bored	30	2,537	- 26	2,511	28	2,509	Glacial gravel	Hard, "alkaline"		D, S	Sufficient supply; waters 35 head stock.
3	NW.	4	"	"	"	Bored	35	2,520	- 20	2,500	20	2,500	Glacial sand	Hard, "alkaline"		S	Sufficient supply.
4	SW.	5	"	"	"	Bored	94	2,624	- 76	2,548			Bearpaw blue clay	Soft	45	S	Supply barely sufficient.
5	NE.	6	"	"	"	Bored	39	2,642	- 31	2,611	36	2,608	Glacial sandy clay	Hard		D, S	Sufficient supply; waters 8 head stock.
6	NE.	7	"	"	"	Dug	39	2,600	- 25	2,575	39	2,561	Glacial sand	Soft, clear		D	Large supply; used by neighbours.
7	NE.	9	"	"	"	Bored	33	2,615	- 19	2,596	31	2,584	Glacial clay	Hard, clear		D, S	Sufficient supply; waters 20 head stock.
8	NW.	10	"	"	"	Bored	30	2,615	- 18	2,597	30	2,585	Glacial gravel	Soft, clear		D, S	Sufficient supply.
9	NE.	10	"	"	"	Bored	38	2,600	- 6	2,594	6	2,594	Glacial gravel	Soft, clear		D	Sufficient only for household.
10	SW.	13	"	"	"	Bored	60	2,655	- 59	2,596	59	2,596	Glacial drift	Soft, clear		D	Insufficient supply in dry seasons.
11	NE.	16	"	"	"	Bored	25	2,654	- 17	2,637	22	2,632	Glacial gravel	Soft, clear		D, S	Sufficient supply.
12	SE.	17	"	"	"	Bored	60	2,600	- 38	2,562	38	2,562	Glacial blue clay	Hard, "alkaline"		S	Sufficient supply.
13	NE.	19	"	"	"	Bored	45	2,540	- 43	2,497	43	2,497	Glacial clay	Hard, clear		D	Insufficient supply. 60-foot well gives small supply of poor water.
14	NW.	20	"	"	"	Bored	50	2,567	- 20	2,547			Glacial clay	Hard, "alkaline"		D, S	Sufficient supply.
15	NE.	21	"	"	"	Bored	40	2,605	- 25	2,580	40	2,565	Glacial sand	Hard, clear		D, S	Sufficient supply.
16	SE.	23	"	"	"	Dug	18	2,642	- 10	2,632	10	2,632	Glacial sand	Soft, clear		D, S	Sufficient supply.
17	SW.	25	"	"	"	Bored	65	2,560	- 45	2,515	65	2,495	Glacial sand	Hard, "alkaline"		S	Sufficient supply; 25-foot well yields soft water from gravel aquifer.
18	NE.	26	"	"	"	Bored	32	2,442	- 20	2,422	32	2,410	Glacial sand	Hard		D, S	Sufficient supply; waters 35 head stock.
19	SW.	27	"	"	"	Bored	30	2,590	- 10	2,580			Glacial drift	Hard, "alkaline"		D, S	Usually sufficient; intermittent supply.
20	SE.	28	"	"	"	Bored	40	2,563					Glacial drift	Hard, "alkaline"		S	Sufficient suppky; but usable for stock only. Shallow well supplies household.
21	SE.	31	"	"	"	Bored	50	2,500	- 16	2,484			Glacial clay	Hard, "alkaline"		S	Sufficient supply.
22	NW.	32	"	"	"	Bored	25	2,480	- 21	2,459	21	2,459	Glacial sand	Soft, clear		D	Sufficient for household.
23	NW.	33	"	"	"	Dug	11	2,510	- 9	2,501	9	2,501	Glacial sand	Hard, clear		D, S, M	Large supply; used by village of Anoroid.
24	SE.	33	"	"	"	Bored	40	2,500			40	2,460	Glacial sand	Hard, clear		D, S	Ample supply; waters 20 head stock.
25	SW.	34	"	"	"	Bored	60	2,500			60	2,440	Glacial sand	Hard, clear, "alkaline"		S	Sufficient supply.

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 AUVERGNE NO. 76, 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	NE.	1	8	11	3	Dug	13	2,665			12	2,653	Glacial sand	Hard,clear, "alkaline"		D, S	Sufficient supply; waters 10 head stock.
2	SW.	1	"	"	"	Dug	26	2,680	- 16	2,664	16	2,664	Glacial sand	Hard,clear		D, S	Insufficient supply.
3	SE.	2	"	"	"	Dug	26	2,633	- 20	2,613	24	2,609	Glacial gravel	Soft,clear		D, S	Sufficient supply; waters 10 head stock.
4	NE.	3	"	"	"	Dug	24	2,610	- 16	2,594	16	2,594	Glacial sand	Hard,clear		D, S	Sufficient supply; waters 30 head stock.
5	NE.	4	"	"	"	Dug	30	2,585	- 26	2,559	26	2,559	Glacial sandy clay	Hard,clear		D	Insufficient supply.
6	SW.	5	"	"	"	Bored	50	2,720	- 35	2,685	35	2,685	Glacial gravel	Hard,"alkaline" iron, clear		D, S	Sufficient supply; waters 20 head stock.
7	SW.	6	"	"	"	Bored	106	2,720	- 36	2,684	36	2,684	Bearpaw shale	Hard,clear, "alkaline"		S	Sufficient supply; second well for household.
8	NW.	6	"	"	"	Dug	24	2,655	- 22	2,633			Glacial blue clay	Soft,clear		D, S	Not sufficient supply; waters 22 head stock.
9	SW.	9	"	"	"	Dug	22	2,615	- 20	2,595	20	2,595	Glacial gravel	Soft,clear		D, S	Sufficient supply; waters 10 head stock.
10	SW.	10	"	"	"	Dug	18	2,600	- 15	2,585	18	2,582	Glacial sand	Soft,clear		D, S	Insufficient supply.
11	SW.	12	"	"	"	Bored	20	2,650	- 10	2,640			Glacial clay	Hard,clear		D, S	Insufficient supply.
12	NW.	13	"	"	"	Bored	21	2,575	- 17	2,558	19	2,556	Glacial sand	Hard,clear, iron,"alkaline"		S	Sufficient supply; waters 20 head stock. #
13	NE.	15	"	"	"	Dug	19	2,590	- 12	2,578	17	2,573	Glacial sand	Hard,clear, "alkaline"		S	Sufficient supply; second well for household.
14	NE.	16	"	"	"	Dug	20	2,585	- 17	2,568			Glacial gravel	Soft,clear		D, S	Sufficient supply; waters 15 head stock.
15	SW.	16	"	"	"	Dug	40	2,625					Bearpaw blue clay	Hard,clear, "alkaline"		S	Sufficient supply; waters 10 head stock.
16	SE.	18	"	"	"	Bored	40	2,650	- 25	2,625			Bearpaw blue clay	Hard,clear, "alkaline"		D, S	Sufficient supply; waters 20 head stock.
17	SW.	18	"	"	"	Dug	22	2,660	- 18	2,642	18	2,642	Glacial blue sand	Soft,clear		D, S	Sufficient supply; waters 15 head stock.
18	SW.	20	"	"	"	Bored	41	2,650	- 21	2,629			Bearpaw clay	Hard,clear, "alkaline"		S	Sufficient supply; waters 10 head stock.
19	SE.	21	"	"	"	Dug	30	2,605	- 24	2,581	24	2,581	Glacial blue clay	Hard,clear, iron,"alkaline"		S	Sufficient supply; waters 20 head stock.
20	SW.	22	"	"	"								Glacial sand	Hard,clear		D	Sufficient supply;waters household use.
21	SW.	23	"	"	"	Bored	40	2,595					Bearpaw blue clay	Hard,clear, "alkaline"		D, S	Sufficient supply; waters 10 head stock.
22	NW.	23	"	"	"	Dug	22	2,575	- 18	2,557	18	2,557	Glacial sandy clay	Hard,clear,		D	Insufficient supply.
23	SW.	24	"	"	"	Dug	20	2,575	- 15	2,560	10	2,565	Glacial sand	Soft,clear		D, S	Sufficient supply; waters 12 head stock.
24	SE.	26	"	"	"	Dug	18	2,580	- 10	2,570	10	2,570	Glacial clay	Hard,"alkaline"		S	Sufficient supply; waters 23 head stock.
25	SW.	28	"	"	"	Bored	60	2,645	- 45	2,600	45	2,600	Bearpaw blue clay	Hard,clear, "alkaline"		D, S	Sufficient supply; waters 15 head stock.
26	SW.	30	"	"	"	Dug	30	2,630	- 20	2,610	16	2,614	Bearpaw sand	Hard,clear, "alkaline"		D, S	Limited supply; waters only 10 head stock.

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 5 AUVERGNE NO. 76, 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
27	SE.	31	8	11	3	Drilled	162	2,675	- 82	2,593			Bearpaw shale	Hard,clear, "alkaline"		S	Sufficient supply; waters 15 head stock.
28	SW.	32	"	"	"	Bored	60	2,685	- 35	2,650	35	2,650	Bearpaw blue clay	Hard,clear, "alkaline"		D, S	Sufficient supply; waters 10 head stock.
29	NW.	33	"	"	"	Bored	60	2,685	- 25	2,660	25	2,660	Bearpaw clay	Hard,clear		D, S	Sufficient supply; waters 10 head stock.
30	NW.	34	"	"	"	Dug	20	2,615					Bearpaw blue clay	Hard,clear, "alkaline"			Has bad effects on man and stock.
31	NW.	35	"	"	"	Dug	50	2,600	- 48	2,552	48	2,552	Bearpaw blue clay	Hard,clear, "alkaline"		D, S	Sufficient supply; waters 15 head stock.
32	NE.	36	"	"	"	Bored	60	2,630	- 40	2,590	60	2,570	Bearpaw blue clay	Hard,clear, "alkaline"		S	Sufficient supply; waters 50 head stock.
1	NE.	1	8	12	3	Bored	60	2,682	- 42	2,640			Bearpaw blue clay	Hard,clear,		D, S	Only sufficient for 10 head stock; also an 8-foot well in coulee.
2	NE.	2	"	"	"	Bored	68	2,665	- 45	2,620	45	2,620	Bearpaw shale	Soft,clear		D, S	Sufficient supply; waters 30 head stock.
3	SE.	3	"	"	"	Bored	35	2,640	- 20	2,620	20	2,620	Glacial sand	Hard,clear, "alkaline"		D	Insufficient supply.
4	NE.	4	"	"	"	Dug	20	2,620	- 16	2,604	16	2,604	Glacial sand	Hard,"alkaline"		S	Sufficient supply; waters 10 head stock.
5	SE.	5	"	"	"	Dug	20	2,695	- 17	2,678	17	2,678	Glacial sand	Hard,clear		D	Sufficient for household; waters stock at spring.
6	NE.	5	"	"	"	Dug	28	2,710	- 20	2,690	20	2,690	Glacial sand	Hard,clear		D, S	Sufficient supply; waters 15 head stock.
7	NE.	7	"	"	"	Bored	60	2,720	- 48	2,672	48	2,672	Bearpaw blue clay	Hard,clear		D, S	Sufficient supply; waters 18 head stock.
8	SW.	9	"	"	"	Bored	30	2,700	- 12	2,688	12	2,688	Glacial blue clay	Hard,clear		D, S	Sufficient supply; waters 15 head stock.
9	NE.	14	"	"	"	Dug	33	2,625	- 25	2,600			Bearpaw blue clay	Hard,clear		D, S	Sufficient supply; waters 16 head stock.
10	NE.	16	"	"	"	Dug	30	2,580	- 26	2,554	26	2,554	Glacial sand	Hard,"alkaline"clear		D, S	Sufficient supply; waters 30 head stock.
11	SW.	17	"	"	"	Dug	25	2,710	- 20	2,690	20	2,690	Glacial gravel	Hard,clear		D, S	Insufficient supply; waters 10 head stock.
12	SE.	18	"	"	"	Bored	60	2,660	- 50	2,610	50	2,610	Bearpaw sand	Hard,clear, "alkaline"		S	Waters 25 head stock; also a shallow household well.
13	NW.	19	"	"	"	Dug	18	2,570	- 16	2,554	16	2,554	Glacial sand	Hard,clear, "alkaline"		D, S	Sufficient supply; waters 15 head stock.
14	NE.	19	"	"	"	Dug	24	2,575	- 21	2,554	21	2,554	Glacial sand	Hard,clear		D, S	Sufficient supply; waters 20 head stock.
15	SE.	21	"	"	"	Dug	21	2,535	- 20	2,515	20	2,515	Glacial sand	Hard,clear, "alkaline"		D, S	Sufficient supply; waters 40 head stock.
16	SW.	22	"	"	"	Dug	14	2,555	- 11	2,544	11	2,544	Glacial sand	Hard,clear, "alkaline"		D, S	Sufficient supply; waters 21 head stock.
17	SE.	23	"	"	"	Bored	35	2,615	- 30	2,585			Bearpaw blue clay	Hard,clear, "alkaline"		S	Sufficient supply for 15 head stock; hauls drinking water.
18	SE.	25	"	"	"	Bored	35	2,625	- 25	2,600			Glacial blue clay	Hard,clear, "alkaline"		D, S	Sufficient supply. Also a 15-foot well in coulee.
19	SW.	30	"	"	"	Dug	22	2,610	- 12	2,598	22	2,588	Glacial sand	Hard,clear, "alkaline"		S	Waters 50 head stock; 16-foot well for household.
20	NW.	31	"	"	"	Dug	20	2,650	- 15	2,635			Glacial clay	Hard,clear, "alkaline"		D, S	Ample supply; waters 50 head stock.
21	NW.	35	"	"	"	Dug	35	2,545	- 28	2,517	28	2,517	Glacial sand	Hard,clear		D, S	Sufficient supply; waters 50 head stock.

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 AUVERGNE NO.76, 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
22	SE.	36	8	12	3	Dug	50	2,600					Bearpaw				Good supply.
23	NW.	36	"	"	"	Bored	40	2,575	- 20	2,555	38	2,537	Bearpaw shale	[illegible] "alkaline"		S	Sufficient supply; has bad effects on man.
1	SW.	1	9	10	3	Bored	15	2,450	- 11	2,439	11	2,439	Glacial sand and gravel	Soft, clear		D, S	Sufficient for 30 head stock. Dry hole 29 feet deep in blue clay. Also 15-foot well.
2	NW.	1	"	"	"	Bored	60	2,500	- 30	2,470	60	2,440	Glacial [illegible]	Hard, "alka-line"	42	S	Fair supply of non-usable water.
3	E½	3	"	"	"	Bored	20	2,420	- 16	2,404			Glacial clay	[illegible], clear	43	S	Insufficient supply; has bad effects on man.
4	SE.	7	"	"	"	Bored	32	2,460	- 20	2,440	17	2,443	Glacial clay and gravel	Hard, iron, "alkaline" sulphur		D, S	Sufficient strong supply.
5	W½	7	"	"	"	Bored	60	2,460	- 20	2,440	40	2,420	Glacial sand	Hard, clear		D, S	Sufficient supply; waters 100 head stock.
6	SE.	9	"	"	"	Bored	75	2,460	- 50	2,410			Glacial clay	Hard, clear		D, M	Aneroid village well, inadequate supply.
7	SW.	10	"	"	"	Bored	50	2,450	- 20	2,430			Glacial blue clay	Hard, clear		S	Sufficient supply; uses a dam.
8	SE.	11	"	"	"	Bored	51	2,470	- 3	2,467	50	2,420	Bearpaw shale	Soft		D, S	Good supply; also a seepage well from dam.
9	NW.	14	"	"	"	Bored	67	2,630	- 50	2,580			Glacial clay	Soft, clear		D, S	Sufficient supply; a similar well 77 feet deep.
10	SE.	16	"	"	"	Bored	45	2,490	- 32	2,458	32	2,458	Glacial blue clay	Hard, "alka-line"		S	Sufficient supply; will pump dry.
11	SW.	16	"	"	"	Bored	48	2,500	- 14	2,486	48	2,452	Glacial gravel	Hard, "alka-line"			Good supply, but not fit for use. Several other wells yield poor water.
12	NE.	16	"	"	"	Bored	37	2,525	- 21	2,504	21	2,504	Glacial yellow clay	Hard, clear		D, S	Sufficient supply; waters 20 head stock. Also 2 dry holes.
13	SE.	17	"	"	"	Dug	30	2,510									Dry hole with Bearpaw at base. A 20-foot well supplies household.
14	W½	17	"	"	"	Bored	60	2,470									Two dry holes in Bearpaw shale.
15	NE.	20	"	"	"	Dug	22	2,485									Fifteen dry holes have been sunk into the Bearpaw shale.
16	NE.	21	"	"	"	Dug	30	2,610	- 22	2,588			Glacial clay			D, S	Sufficient supply.
17	NW.	23	"	"	"	Borod	70	2,600	- 55	2,545			Bearpaw clay	Hard, "alka-line"		N	Not usable, bad effect on man and stock; several other wells with poor water.
18	S½	24	"	"	"	Dug	18	2,620	- 12	2,608			Glacial blue clay	Hard, "alka-line"	42	D, S	Sufficient supply.
19	NW.	24	"	"	"	Dug	40	2,620									Dry hole.
20	SE.	25	"	"	"	Bored	510	2,650									Dry hole in Bearpaw clay and shale.
21	NW.	25	"	"	"	Drilled	800	2,615									Dry hole in Bearpaw shale.
22	SW.	25	"	"	"	Bored	57	2,615	- 20	2,595	55	2,560	Glacial blue sand	Hard, "alka-line"	42	D, S	Sufficient supply; waters 30 head stock. Several deep dry holes in Bearpaw.
23	N½	27	"	"	"	Bored	23	2,550	- 19	2,531	19	2,531	Glacial coarse gravel	Hard, clear		D	Insufficient supply. #
24	E½	28	"	"	"	Dug	14	2,575	- 6	2,569			Glacial clay	Hard	43	D, S	Sufficient supply; dug several dry holes.

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 AUVERGNE NO. 76, 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
25	E½	29	9	10	3	Dug	28	2,530	- 25	2,505	25	2,505	Bearpaw shale and sand	Hard, clear	43	S	Insufficient supply; 10 dry holes here.
26	NE.	30	"	"	"	Bored	80	2,570									Ten dry holes have been dug into the Bearpaw clays and shales.
27	NE.	31	"	"	"	Bored	50	2,535	- 40	2,495	30	2,505	Bearpaw shale and sand	Hard, "alkaline"	42	S	Sufficient for stock; bad effects on man.
28	E½	32	"	"	"	Bored	60	2,535									Dry hole in Bearpaw shale; small supply from 35-foot well.
29	SW.	32	"	"	"	Bored	22	2,580	- 11	2,569	20	2,560	Glacial sand	Soft		D, S	Sufficient supply; waters 16 head stock. A 50-foot well not fit for use.
30	E½	33	"	"	"	Bored	30	2,480	- 15	2,465	15	2,465	Glacial clay	Hard	42	D, S	Sufficient supply; waters 35 head stock.
31	NW.	33	"	"	"	Bored	28	2,530	- 10	2,520	28	2,502	Glacial sand	Hard		D, S	Good supply; 30-foot well gives good water for house.
32	NE.	36	"	"	"	Bored	26	2,550	- 12	2,538	26	2,524	Glacial sand	Soft		D, S	Sufficient supply.
1	SW.	1	9	11	3	Bored	80	2,560	- 60	2,500	80	2,480	Glacial sand	Hard, clear, "alkaline" sulphur		D, S	Sufficient supply; waters 20 head stock.
2	NW.	1	"	"	"	Bored	35	2,500	- 20	2,480	32	2,468	Glacial sand	Soft, clear		D, S	Sufficient supply; waters 20 head stock.
3	SE.	2	"	"	"	Bored	40	2,545	- 38	2,507			Bearpaw clay	Hard, clear, "alkaline"		S	Very small supply; has bad effects on man or stock.
4	NW.	2	"	"	"	Dug	20	2,520					Glacial drift				Seepage well close to dam.
5	NE.	3	"	"	"	Dug	12	2,540	+ 4	2,536	8	2,532	Glacial gravelly clay	Hard, clear		D, S	Usually sufficient supply.
6	NE.	4	"	"	"	Bored	70	2,540	- 50	2,490	50	2,490	Bearpaw clay	Hard, clear, "alkaline"		D, S	Insufficient supply; comes in slowly.
7	NE.	5	"	"	"	Dug	30	2,570	- 27	2,543	20	2,550	Glacial gravelly clay	Hard, clear, "alkaline"		D, S	Sufficient; waters 50 head stock.
8	SE.	6	"	"	"	Dug	24	2,600	- 16	2,584	24	2,576	Glacial sand	Hard, clear		D	Sufficient supply; has no stock.
9	NW.	8	"	"	"	Drilled	475	2,565									Dry hole in Bearpaw clay and shale.
10	NW.	9	"	"	"	Dug	60	2,540	+ 54	2,486	54	2,486	Glacial sand	Soft, clear		D, S	Sufficient supply; waters 48 head stock.
11	SW.	10	"	"	"	Spring		2,500					Glacial drift	Hard			
12	NW.	14	"	"	"	Dug	16	2,450	- 13	2,437	13	2,437	Glacial coarse gravel	Hard, "alkaline"		S	Sufficient supply; waters 50 head stock.
13	NW.	17	"	"	"	Dug	28	2,460	- 25	2,435	25	2,435	Recent sand	Hard, clear		D	Enough for household only.
14	SW.	19	"	"	"	Dug	26	2,455	- 24	2,431	24	2,431	Recent sand	Hard, clear		D, S	Ample supply; dry hole 80 feet deep in Bearpaw clay.
15	SW.	19	"	"	"	Bored	35	2,444	- 24	2,420			Recent sand	Hard, clear		D	Abundant supply; small supply from 60-foot well in Bearpaw clay.
16	SE.	19	"	"	"	Dug	20	2,441	- 16	2,425	16	2,425	Recent sand	Hard, "alkaline"		D, S	Sufficient supply.
17	NW.	20	"	"	"	Dug	30	2,460	- 27	2,433	27	2,433	Recent sand	Hard, clear, "alkaline"		S	Sufficient supply; waters 50 head cattle; a 70-foot well plugged with sand.
18	SW.	21	"	"	"	Dug	13	2,440	- 11	2,429	6	2,434	Recent sand	Soft, clear		D, S	Sufficient supply.
19	SW.	23	"	"	"	Bored	52	2,470	- 14	2,456	14	2,456	Glacial sandy gravel	Hard, clear "alkaline"		D, S	Ample supply; waters 40 head stock.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of AUVERGNE NO. 76, 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	NE.	23	9	11	3	Dug	22	2,510	- 10	2,500			Glacial yellow clay	Hard,clear, iron		D	Sufficient for household use. Uses 20-foot well beside dam.
21	SE.	24	"	"	"	Dug	18	2,500	- 14	2,486			Glacial drift	Hard,clear, "alkaline"		D	Not enough for stock.
22	SW.	25	"	"	"	Dug	60	2,535	- 40	2,495	27	2,507	Glacial drift	Hard,clear, "alkaline"		S	Sufficient supply; but usable only for stoc
23	SE.	26	"	"	"	Dug	22	2,520	- 17	2,503			Glacial blue clay	Hard,clear		D, S	Intermittent and insufficient. A 35-foot wel supplies some stock water.
24	NE.	28	"	"	"	Dug	14	2,540	- 13	2,527	13	2,527	Bearpaw blue clay	Hard,clear, "alkaline"		D, S	Insufficient supply.
25	SE.	30	"	"	"	Drilled	250	2,470									Dry hole in Bearpaw shale; use a seepage wel for household supply.
26	NW.	30	"	"	"	Dug	12	2,530	- 10	2,520	4	2,526	Recent sand	Hard,iron, "alkaline" red sediment		S	Sufficient supply; waters 15 head stock.
27	SE.	33	"	"	"	Bored	60	2,520	- 45	2,475	60	2,460	Bearpaw blue clay	Hard,iron clear,"alka-line"		N	Unfit for use.
28	NE.	35	"	"	"	Bored	60	2,530	- 48	2,482	48	2,482	Bearpaw blue clay	Hard,clear		D	Insufficient supply.
29	SW.	36	"	"	"	Dug	38	2,555	- 34	2,521			Glacial sand	Hard,"alka-line"		D, S	Sufficient supply.
30	NW.	36	"	"	"	Dug	40	2,520	- 24	2,496	40	2,480	Bearpaw blue clay	Hard,"alka-line"		D, S	Sufficient supply.
1	SE.	1	9	12	3	Bored	66	2,550	- 63	2,487	63	2,487	Glacial clay	Hard,clear		D	Enough for household. A 14-foot well suppli water for 20 head stock.
2	NW.	4	"	"	"	Dug							Bearpaw	Hard,"alka-line"		S	Suitable only for stock.
3	NE.	5	"	"	"	Dug	20	2,590	- 14	2,576	14	2,576	Bearpaw	Hard,"alka-line"		S	Enough for stock; not usable by man.
4	NW.	5	"	"	"	Dug	21	2,600	- 13	2,587	13	2,587	Bearpaw white clay	Hard,clear, "alkaline"		S	Enough for stock, not usable by man.
5	NE.	6	"	"	"	Drilled	400	2,600									Dry hole in Bearpaw clay and shale.
6	NE.	6	"	"	"	Dug	12	2,600	- 6	2,594	11	2,589	Glacial sand	Soft,clear		D	Sufficient supply for household.
7	NE.	6	"	"	"	Dug	30	2,600	- 15	2,585	30	2,570	Glacial blue clay	Hard,"alka-line"		S	Sufficient supply for stock.
8	SW.	7	"	"	"	Dug	20	2,600	- 15	2,585	18	2,582	Glacial gravel	Hard,clear, "alkaline"		S	Sufficient supply; but usable only by stock
9	NW.	8	"	"	"	Bored	43	2,600	- 20	2,580	40	2,560	Glacial gravelly clay	Hard,clear		D, S	Never pumped dry. #
10	NE.	9	"	"	"		11	2,600	- 5	2,595	5	2,595	Glacial sand	Hard,clear, "alkaline"		D	Sufficient for household use and 10 head stock.
11	NW.	10	"	"	"	Dug	14	2,555	- 6	2,549	14	2,541	Bearpaw blue clay	Hard,clear, "alkaline"		D, S	Abundant supply; waters 80 head stock. One well 70 feet deep in Bearpaw clay.
12	SW.	13	"	"	"	Dug	18	2,490	- 12	2,478	18	2,472	Glacial sand	Hard,clear, "alkaline"		D, S	Waters 40 head stock.
13	SW.	14	"	"	"	Dug	22	2,480	- 18	2,462	18	2,462	Bearpaw clay	Soft,clear		D, S	Sufficient supply.
14	NE.	15	"	"	"	Dug	14	2,550	- 12	2,538	12	2,538	Glacial sand	Hard,clear		D, S	Sufficient supply.
15	NE.	15	"	"	"	...	55	2,555					Glacial blue clay			S	Small supply for stock.

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

WELL RECORDS—Rural Municipality of AUVERGNE NO. 76, 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
16	NW.	16	9	12	3	Dug	14	2,590	- 10	2,580	11	2,579	Glacial sand	Hard, clear, "alkaline"		D, S	Waters 40 head stock.
17	SW.	17	"	"	"	Bored	35	2,600	- 18	2,582	35	2,565	Glacial sand	Hard, clear, iron, "alkaline"		S	Ample supply; but usable only by stock.
18	SW.	19	"	"	"	Dug	14	2,585	- 10	2,575	11	2,574	Glacial sand	Hard, "alkaline", bitter, clear		S	Sufficient supply.
19	NE.	19	"	"	"	Dug	18	2,580	- 14	2,566	14	2,566	Bearpaw soapstone	Hard, "alkaline", clear, white sediment		S	Sufficient supply; not good water for stock. Waters 12 head stock.
20	NE.	20	"	"	"	Dug	24	2,560	- 16	2,544			Glacial clay	Hard, clear		D, S	Insufficient supply.
21	NE.	21	"	"	"	Bored	25	2,560	- 13	2,547	13	2,547	Bearpaw, soapstone	Hard, "alkaline"		N	Unfit for stock or man.
22	N.	22	"	"	"	Drilled	315	2,550									Dry hole in Bearpaw clay.
23	SW.	22	"	"	"	Bored	35	2,560	- 16	2,544			Glacial clay	Soft		S	Sufficient supply; but used only for stock.
24	SE.	22	"	"	"	Bored	30	2,560	- 20	2,540	30	2,530	Glacial gravel	Hard, clear		D, S	Sufficient supply; waters 30 head stock. A 16-foot well formerly gave supply.
25	SE.	25	"	"	"	Dug	22	2,450	- 20	2,430	20	2,430	Glacial blue clay	Hard, "alkaline"		D, S	Sufficient supply; has a 12-foot seepage well close to creek.
26	SE.	27	"	"	"	Dug	10	2,450	- 4	2,446	4	2,446	Recent sand	Hard, clear		D, S	Sufficient supply.
27	SW.	30	"	"	"	Dug	45	2,520	- 41	2,479	41	2,479	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient supply.
28	NW.	31	"	"	"	Bored	22	2,480	- 18	2,462	18	2,462	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient supply; waters 32 head stock.
29	NE.	32	"	"	"	Dug	35	2,510	- 29	2,481	29	2,481	Glacial sand	Hard, clear, "alkaline"		S	Sufficient supply; waters 20 head stock.
30	NE.	34	"	"	"	Dug	16	2,520	- 12	2,508	12	2,508	Glacial sand	Soft, clear		D, S	Insufficient supply.
31	SE.	36	"	"	"	Dug	14	2,540	- 9	2,531	9	2,531	Glacial sand	Soft, clear		D, S	Sufficient supply; waters 21 head stock. A 12-foot well supplies poor water.

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.