CANADA
DEPARTMENT OF MINES
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PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF MONTROSE NO. 315 SASKATCHEWAN

By
B. R. MacKay, H. N. Hainstock and G. Graham

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CONTENTS

Illustrations

GROUND WATER RESOURCES OF PART OF THE RURAL MUNICIPALITY OF MONTROSE, NO. 315, 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 Montrose, No. 315, consists of eight full townships and three partial townships west of the Third meridian, and comprises an approximate area of 344 square miles. Since South Saskatchewan river forms the eastern boundary of the municipality, and the field investigation extended only to the northern boundary of township 32, this report deals only with those parts of township 31, range 7, and township 32, range 6, that lie west of the river, and township 32, range 7, and townships 31 and 32, ranges 8 and 9, an area of approximately 207 square miles. The centre of the area under discussion lies 28 miles south and 16 miles west of the city of Saskatoon. The Delisle-Elrose branch of the Canadian National railways enters the area in sec. 31, tp. 32, range 8, and runs directly south for 6 miles, and thence southwesterly, leaving the township in sec. 4, tp. 31, range 9. On it are located the villages of Ardath and Swanson, and the hamlet of Donavon. Ardath is located just south of the southern boundary, and Donavon is situated just north of the northern boundary of the municipality.

The eastern and southern parts of the area are drained by South Saskatchewan river, and part of the drainage in the northwestern part is towards Goose lake in township 32, range 10. In township 31, range 7, the river banks are fairly steep and in some sections are more than 100 feet high, but in township 31, range 6, they are less steep and in some places are less than 50 feet high. The elevation of the river where it leaves the municipality is 1,587 feet above sea-level, whereas at the point where the river enters the municipality the water-level is at an approximate elevation of 1,605 feet above sea-level. The maximum elevation of more than 1,800 feet above sea-level is attained in

the southwestern corner of the area under discussion. Swanson is at an elevation of 1,767 feet above sea-level. Except where cut by the river the ground surface of the municipality is fairly level, being somewhat undulating in the areas covered by dune sand.

Recent dune sand and glacial lake sands cover most of the municipality, but the greater part of township 31, range 9, and a small area in the northwestern corner of township 32, range 9, are covered by glacial lake clays. Glacial till or boulder clay underlies the dune sand and glacial lake deposits throughout the municipality. In no place in this area are the deposits that overlie the boulder clay thought to be greater than 35 feet in thickness. The boulder clay or glacial till extends to the underlying bedrock.

Water-bearing Horizons in the Unconsolidated Deposits

With few exceptions the wells in this area are less than 40 feet in depth and little difficulty is experienced in obtaining water. In some areas it is necessary to sink more than one well to obtain sufficient supplies for farm requirements, but in other areas the supply from a single well is more than adequate for local needs.

In the areas covered by Recent dune sand it should be possible to obtain water at shallow depth. Existing wells have tapped water-bearing deposits at depths generally less than 25 feet. Throughout these areas no dry holes were recorded and the water-bearing horizons may be fairly continuous. Many of the residents in the areas covered by dune sand often use two or more wells. This is not altogether because the supply from one well is insufficient for local needs, but two or more wells are used for convenience, one being located near the barn and the other near the house. The fine sand of the aquifer flows into the

well in many cases and partly shuts off the available supply. It is very difficult to deepen such wells. The water is usually only moderately hard and that from most of the wells has been found suitable for domestic purposes and for stock needs.

The water conditions in the areas covered by glacial lake sands are somewhat similar to those covered by Recent dune sands. Wells obtain water at shallow depth and no dry holes were recorded. There appears to be a fairly continuous horizon over most of the area covered by glacial lake sands and little difficulty should be experienced in obtaining water within 30 feet of the surface. In a few areas, however, it has been found necessary to use a second well to provide sufficient water for local requirements. The water is usually only moderately hard and was recorded in most places as being suitable for domestic use.

The glacial lake clays are not thought to yield water, but wells sunk in the areas covered by these clays are obtaining water within 25 feet of the surface. The wells have probably tapped sand and gravel deposits that occur at the contact of the lake clays and the underlying boulder clay, or they may be obtaining water from sand and gravel deposits within the boulder clay. The supply from the individual wells in this area is in a number of places inadequate for local needs and one or more wells are often used. The water, however, is recorded to be of fairly good quality and as a rule it can be used for domestic purposes as well as for stock.

The "A" boundary line outlines an area in which water should be obtained with little difficulty from shallow wells. The conditions throughout this area are very similar and a fairly continuous water-bearing horizon appears to be present. Some of the wells, however, yield insufficient supplies for local needs, due to the fine sand partly shutting off the supply,

or to the difficulty of deepening the well. It is always advisable, however, to prospect a selected well site with a small test auger to ascertain the quality and quantity of water to be obtained. In some sections dugouts are used to collect surface water for stock use. The topography is not suitable for the construction of dams.

A few wells in the area have been sunk below the deposits overlying the boulder clay and tap deposits of sand and gravel in the boulder clay. Very little information regarding this part of the drift was collected and the areal distribution of the water-bearing deposits is not known. They are not thought to form a continuous water-bearing horizon, however, and dry holes will no doubt be dug in some sections before a producing well is obtained. It is difficult to attempt to forecast with accuracy the supply of water that may be obtained from deposits in the lower part of the drift. No doubt it will depend largely on the size of the deposit tapped. The water will probably contain more mineral salts in solution than that obtained from shallower wells, but in most cases it will probably be found usable for domestic needs and it should always be satisfactory for stock.

Water-bearing Horizons in the Bedrock

The Belly River formation is thought to underlie the glacial drift throughout the municipality, although a large part of the northeastern corner of the area is still unmapped. No outcrops were observed along South Saskatchewan river or in other parts of the area, but outcrops are recorded along the river near Outlook, approximately 9 miles south of the southern boundary of this municipality. These outcrops occur at an approximate elevation of 1,650 feet above sea-level. Bedrock in the part of the municipality under discussion probably lies at a slightly lower elevation.

A few wells along the northern boundary of the area and one near the river in township 31, range 8, obtain water from aquifers in the bedrock. The intervening area has not been prospected for bedrock aquifers, but it is possible that the bedrock will contain water-bearing horizons throughout the area under discussion. The horizons, however, may not be continuous.

The group of wells along the northern part of the area do not appear to tap a common aquifer. Two wells located in sec. 32, tp. 32, range 9, may obtain water from the same source, but the other wells appear to tap individual, localized pockets of sand in the bedrock. The evidence at hand appears to indicate that with the possible exception of township 31, range 9, water should be obtained from the bedrock if wells are drilled to elevations of at least 1,400 feet above sea-level. The water from the bedrock wells is reported as soft and usable for all farm needs. The supply is abundant and the water is under considerable hydrostatic pressure.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 31, Range 7

That part of the township lying to the north of South Saskatchewan river, an area of approximately 12 square miles, occurs in the municipality of Montrose. The banks of the river are fairly steep, rising approximately 100 feet above the water-level. The plain above the river is quite level, the difference in topographic relief being less than 50 feet. Dune sand covers a large part of the northwestern corner of the township, and glacial lake sands mantle the remainder of the area. Boulder clay or glacial till underlies both the glacial lake sands and the Recent dune sands.

Three wells in the western part of the township are drawing water from aquifers occurring at depths ranging from 25 to 35 feet. The dune sands are not thought to attain this thickness in the area, and the aquifers are no doubt formed by sand deposits located within the boulder clay. Usually in areas covered by dune sand water is easily obtained, but the deposits in this area do not appear to contain much water. The supply from two wells located in section 19 is inadequate for local requirements. Two wells in the NE.$\frac{1}{4}$, section 31, yield an adequate supply for local needs. The water obtained from wells sunk in the dune sand should be found satisfactory for drinking.

Two wells located in sections 33 and 35 obtain water from the glacial lake sands, and a well in section 34 derives its supply from a sand deposit in the boulder clay that underlies the glacial lake sands. Water should be encountered in the lake sands without much difficulty, but the deposits in the underlying till are thought to be widely spaced, and dry holes may be encountered before a deposit is tapped. To save needless expense

it is advisable to locate the shallow water-bearing deposits by means of a test auger before digging wells. The supply from the well in section 33 is inadequate for local needs, whereas that from the well in section 35 is adequate, and that from the well in section 34 is much more than sufficient for local requirements. In parts of section 35 it is possible to excavate shallow dugouts to tap the sand aquifers, and the water so obtained can be used for stock. There should be no difficulty in obtaining a sufficient supply of water in this township.

Township 31, Range 8

The difference in topographic relief on the uplands of this township is approximately 50 feet; the ground surface is quite flat. South Saskatchewan river has cut its valley in the southeastern part of section 6. The northeastern part of the township is covered by Recent dune sand, whereas the remainder of the area is mantled by glacial lake sands.

No great difficulty is experienced in this township in obtaining water from wells sunk to depths of 20 to 30 feet. The dune sands have not been as fully prospected as the glacial lake sands, but the wells that have been sunk show that water is present at shallow depth. The water-bearing sands in this township are widely distributed and over most of the township they probably form a fairly continuous water-bearing horizon. The "A" boundary line outlines an area in which water is obtained with little difficulty. Nevertheless test augers should be used to locate water before a well is sunk. Sand-points are quite widely used in this township. The supply from the wells is usually sufficient for farm needs, although in some sections a number of wells are used for convenience. The water from most of the wells is moderately soft, and is satisfactory for all farm needs.

Springs occur in sections 8 and 12, the one in section 12 flowing throughout the year and yielding sufficient water for 25 head of stock. The overflow from the springs can be conserved by the use of artificial reservoirs.

One well located in section 12 was drilled to a depth of 250 feet, and taps an aquifer in the Belly River formation at an elevation of 1,460 feet above sea-level. It is not improbable that the same aquifer extends southwards, but its areal extent in the other directions has not been defined. The supply from this well is abundant, but the hydrostatic pressure of the water is not recorded. The water is moderately soft and it has been found suitable for domestic purposes as well as for stock.

Township 31, Range 9

With the exception of a few square miles in the western part of the township the surface of this area is fairly level. The elevation varies from 1,760 feet to 1,840 feet above sea-level. The hamlet of Swanson in section 36 is at an approximate elevation of 1,767 feet above sea-level. Most of the surface of this township is covered by glacial lake clays. Glacial lake sands cover parts of sections 27, 34, and 35, and a narrow area along the southern part of the eastern border. Small areas in the northwestern and southwestern parts are mantled by Recent dune sands.

No great difficulty is experienced in obtaining water in this area, but the supply from a number of wells is inadequate for farm needs. In the area outlined by the "A" boundary line water is usually obtained from wells less than 25 feet deep. This area is for the most part covered by glacial lake sands. The Recent dune sands will no doubt also prove productive, although they have not been thoroughly prospected. Over most

of the area covered by glacial lake clays water is obtained at depths varying from 10 to 30 feet, but in section 26 the water is derived from a depth of 42 feet. The deposits that form the aquifers in the lake clay-covered area are probably located at or near the contact of the clay with the underlying boulder clay, as the lake clays themselves are not thought to yield much water. Test augers should be used to locate the water-bearing deposits before digging a well, even though the deposits are thought to be of fairly numerous occurrence. In some of the lake clay-covered sections it is necessary in many places to use two or more wells to obtain an adequate supply for farm needs. In the other areas of the township the supply from individual wells is sufficient. With few exceptions the water from the wells can be used for drinking, although that from the wells in the lake clay-covered area is somewhat inferior in quality to that obtained from the wells in other parts of the township.

The boulder clay probably contains scattered deposits of water-bearing sand and gravel, but it has not been necessary to investigate this part of the drift as sufficient water is obtained from the overlying deposits. A few dugouts are used to collect surface water for stock. In section 34 it was found necessary to remove only a few feet of top soil to encounter a fine sand aquifer that yields an abundant supply of water.

The bedrock has not been tested in this township. It would probably be necessary to drill to elevations below 1,500 feet above sea-level before water-bearing horizons in the Belly River formation would be encountered.

Township 32, Range 6

Approximately 16 square miles of this township are included in the municipality of Montrose. The ground surface of the uplands is undulating. The river valley is quite deep

in the southern part of the area, but it becomes fairly shallow in the northern part. Under normal conditions river-level at the northern boundary of the township is at an elevation of 1,587 feet above sea-level, and the highest areas in the township do not rise to more than 1,725 feet above sea-level. A very small area in the northeastern corner of the township is covered by Recent dune sand, whereas the remainder of the surface is mantled by glacial lake sands. Glacial till or boulder clay underlies these deposits throughout the township. Bedrock was not reported to outcrop along the river.

No difficulty has been experienced in obtaining sufficient water for farm needs in this township. The wells vary from 10 to 44 feet deep and those over 25 feet deep probably obtain their supply from sand and gravel deposits that occur in the boulder clay underlying the lake sands. In most sections, however, water is obtained from the lake sands. There should be little necessity to sink wells deeper than 50 feet in this area. If the supply from one well is insufficient for local needs it is advisable to sink a second well to augment the supply rather than to deepen the existing well in hopes of obtaining a larger supply of water. Test augers should be used to locate water at shallow depth before digging a well. The supply from most of the shallow wells in this area is adequate for farm needs. The water is generally moderately soft to hard and it is used for domestic purposes as well as for stock.

The boulder clay that underlies the lake sands probably contains many deposits of water-bearing sand and gravel, but very few wells have been dug through the lake sands. A few wells probably derive water from the boulder clay, but the areal distribution of the aquifers cannot be ascertained. No dry holes, however, were recorded. The supply from the wells tapping deposits in the boulder clay is adequate for farm needs, and the

water obtained from two of the wells is used for domestic purposes as well as for stock. There should be no great difficulty experienced in obtaining water from the boulder clay in this township.

No wells tap the bedrock in this township, but it is possible that water would be obtained in most parts from wells sunk to depths of approximately 250 feet.

Township 32, Range 7

The surface of this township is fairly level, although it is somewhat rolling in the eastern part. The difference in topographic relief is less than 50 feet throughout the area. Two small lakes in section 14, and sections 3 and 4, contain water during wet years. A narrow strip along the western border and part of the southern border, a large area in the north-central part, and two small areas near the central part and southeastern corner of the township, are mantled by dune sands. The remainder of the area is covered by glacial lake sands.

The Recent dune sands should contain water, but no wells are deriving water from these deposits in this township. Should water be obtained from the sands it will be moderately soft and suitable for all farm needs. The supply from an individual well may not be sufficient for local requirements.

Most of the wells in the township obtain water from the glacial lake sands or from sand and gravel deposits in the boulder clay immediately underlying the lake sands. Wells deeper than 25 feet probably obtain water from sand and gravel deposits in the boulder clay. No great difficulty should be experienced in obtaining ground water in this area, but it is advisable to prospect the well site by means of a small test auger before digging a well. Only one well in the township yields an insufficient supply of water. In some sections two

or more wells are used, one well being for domestic use and one or more for stock needs. The water varies from moderately soft to hard, and it does not contain a large quantity of mineral salts in solution. It should be found satisfactory for domestic purposes, although care should be taken to see that it does not become contaminated by surface waters containing animal refuse.

The bedrock should contain water-bearing horizons, but no wells have been drilled into it in this township.

Township 32, Range 8

The greater part of this township is covered by Recent dune sands, but a small area in the southwestern corner and a large area in the northwestern corner are mantled by glacial lake sands. The ground surface is fairly level and the elevation varies from 1,730 to 1,755 feet above sea-level.

Little difficulty is experienced in obtaining water in this township, but the supply is not large. In the area lying within the "A" boundary line it should be possible to obtain water within 25 feet of the surface. The small supply is mainly due to the fact that the fine sand partly shuts off the supply and prevents the well from being dug deep enough to form a reservoir. By using two or more shallow wells, however, an adequate supply for local needs should be obtained. The water from the shallow wells is of fairly good quality and should be found suitable for domestic needs as well as for stock.

The boulder clay that underlies the glacial lake sand and Recent dune sand has not been prospected for water to any great extent. It probably contains scattered deposits of sand and gravel that would yield water, but if water can be obtained at shallow depth in the overlying deposits, there does not appear to be any necessity to sink wells into the boulder clay. The

water obtained from it would probably be hard and contain more mineral salts in solution than that obtained from the shallower wells.

The bedrock, thought to be the Belly River formation, has been encountered by one well located in section 34. The depth of this well is 326 feet and a sand aquifer is tapped at an elevation of 1,404 feet above sea-level. The areal extent of the aquifer is not known, but other wells sunk to the same elevation in this vicinity should obtain water. The supply from the producing well is abundant and the hydrostatic pressure is sufficient to raise the water to a point 29 feet below the surface. The water is soft and tastes of soda, but is usable for domestic purposes. The presence of sodium carbonate in solution, however, may have an injurious effect on vegetation should the water be used for irrigation.

Township 32, Range 9

The surface of this township is fairly level and the difference in topographic relief is approximately 75 feet. The area covered by dune sands in the western part of the township is slightly undulating. The northwestern corner of the township is covered by glacial lake clays, whereas the remainder is mantled by glacial lake sands.

Over most of this township and especially within the area bordered by the "A" boundary line, little trouble should be experienced in obtaining water within 25 feet of the surface. It is advisable to locate the water-bearing deposits by means of a small test auger before digging a well, however, as by so doing the chances of digging dry holes are lessened. In section 3 it has been recorded that water is obtainable almost any place at depths of 8 to 10 feet. Dugouts excavated in sections 16, 20, 21, and 22, encounter water-bearing sands at shallow depths. In

some of the wells, however, the supply is insufficient as the fine sand encountered washes into the well and fills up the catchment pit. Two or more wells can be used, however, and sufficient water obtained. The water is moderately hard and does not contain a large amount of mineral salts in solution. The glacial lake clays have not been extensively prospected. One shallow well in section 31 yields a supply of water that is sufficient for local needs, but it is thought that the aquifer is formed by deposits of sand and gravel that occur at the contact of the lake clays and boulder clay. The lake clays themselves, however, are not thought to contain water.

A few wells have been dug into the boulder clay or glacial till that underlies the dune sand and glacial lake deposits throughout the township. Two wells located in sections 23 and 27 are being used, but a well located in section 24 has been filled in. The water-bearing deposits do not form continuous aquifers and each well is thought to tap a local pocket of sand or gravel. The supply from the well in section 27 is very abundant, whereas that from the well in section 23 is sufficient only for domestic needs. The water from both wells is hard, fairly highly mineralized, but is satisfactory for domestic use.

Four wells located in sections 32, 34, and 36 obtain water from aquifers that occur in the bedrock at depths of 325, 234, 200, and 303 feet, or at elevations of 1,395±, 1,466, 1,505, and 1,452 feet above sea-level, respectively. The two wells in section 32 are apparently obtaining water from a common aquifer which may be of considerable areal extent, but no correlation can be noted in the aquifers of the wells in sections 34 and 36. It appears, however, that wells drilled to an approximate depth of 300 feet in most parts of the township would tap aquifers in the bedrock. The producing wells yield an abundant supply of

water, and the hydrostatic pressure is sufficient to raise the water at least 200 feet above the aquifer. The water from the wells in section 32 is recorded as soft, whereas that from the others is hard. It contains a considerable amount of mineral salts in solution, but it is being used for domestic needs as well as for stock.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF MONTROSE, NO. 315, SASKATCHEWAN

Township	31	31	31	32	32	32	32	Total No. in municipality
West of 3rd meridian Range	7	8	9	6	7	8	9	
Total No. of Wells in township	8	25	39	17	18	23	33	163
No. of wells in bedrock	0	1	0	0	0	1	4	6
No. of wells in glacial drift	2	15	33	16	15	13	15	109
No. of wells in alluvium	6	9	6	1	3	9	14	48
Permanency of Water Supply								
No. with permanent supply	8	25	38	17	18	23	33	162
No. with intermittent supply	0	0	1	0	0	0	0	1
No. dry holes	0	0	0	0	0	0	0	0
Types of Wells								
No. of flowing artesian wells	0	1	0	0	0	0	0	1
No. of non-flowing artesian wells	2	1	1	0	0	1	7	12
No. of non-artesian wells	6	23	38	17	18	22	26	150
Quality of Water								
No. with hard water	7	21	35	12	15	22	27	139
No. with soft water	1	4	4	5	3	1	6	24
No. with salty water	0	0	0	0	0	0	1	1
No. with "alkaline" water	0	1	4	0	1	1	2	9
Depths of Wells								
No. from 0 to 50 feet deep	8	24	39	17	18	22	26	154
No. from 51 to 100 feet deep	0	0	0	0	0	0	1	1
No. from 101 to 150 feet deep	0	0	0	0	0	0	2	2
No. from 151 to 200 feet deep	0	0	0	0	0	0	1	1
No. from 201 to 500 feet deep	0	1	0	0	0	1	3	5
No. from 501 to 1,000 feet deep	0	0	0	0	0	0	0	0
No. over 1,000 feet deep	0	0	0	0	0	0	0	0
How the Water is Used								
No. usable for domestic purposes	7	21	36	15	17	18	31	145
No.not usable for domestic purposes	1	4	3	2	1	5	2	18
No. usable for stock	8	25	39	17	18	23	33	163
No. not usable for stock	0	0	0	0	0	0	0	0
Sufficiency of Water Supply								
No. sufficient for domestic needs	7	24	33	17	18	23	32	154
No.insufficient for domestic needs	1	1	6	0	0	0	1	9
No. sufficient for stock needs	4	20	25	13	15	16	25	118
No. insufficient for stock needs	4	5	14	4	3	7	8	45

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 Montrose, No. 315, 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.	12	31	8	3rd	250	3,000	200	70	130	225	410	90	22	1,443	1,246	2,923	101		46		206	2,136	371	⁎2
2	NE.	32	32	9	3	234	2,100	130	70	00	03	305	60	18	1,070	877	2,059	107		38		226	1,584	104	⁎2
3	NW.	32	32	9	3	325	2,180	140	40	100	108	315	50	14	1,111	928	2,142	89		29		202	1,644	178	⁎2
4	NW.	34	32	8	3	320	2,400	280	160	120	285	420	110	43	1,013	973	2,379	197		90		123	1,499	470	⁎2
5	NE.	36	32	9	3	303	2,200	550	450	100	197	505	140	05	910	816	2,157	250		136		99	1,347	325	⁎2

Water samples indicated thus, ⁎2, are from bedrock, Belly River formation.
Analyses are reported in parts per million.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

No samples of water from the unconsolidated deposits in the municipality of Montrose were collected by the field party. The following discussion is, therefore, based on the results of samples analysed from similar deposits in other municipalities, and on observations in the field.

The water obtained from wells sunk in the Recent dune sand should be moderately soft and should not contain a large quantity of mineral salts in solution. It is usually suitable for drinking as well as for stock. The water from the glacial lake sands may be slightly harder than that from the Recent dune sands, and may contain a greater amount of mineral salts in solution, but as a rule it will be found entirely satisfactory for domestic and stock needs. The glacial lake clays themselves do not yield water, but water of fairly good quality is obtained at the contact of the lake clays and underlying boulder clay. It is moderately hard, but that from most wells is, in most cases, used for domestic purposes as well as for stock. Water derived from wells dug near sloughs and undrained depressions is usually moderately soft and slightly mineralized. Care should be taken to see that the water in the shallow wells does not become contaminated by polluted surface waters.

Only a few wells are drawing water from the boulder clay that underlies the dune sand and glacial lake deposits in this township. The water is usually satisfactory for drinking, although it is hard and more highly mineralized than that from the surface deposits.

Water from the Bedrock

Five samples of water from the bedrock were collected by the field party for analysis and the results are recorded on the accompanying table. Only six wells are thought to be

obtaining water from the bedrock. The water analysed probably is representative of that obtained from the bedrock in this municipality. Samples Nos. 1, 2, 3, and 4 are recorded as soft, and the analyses show that they are only moderately hard as compared with many of the waters. The mineral salt content in solution is fairly uniform in amount and character in all the samples and sodium sulphate is the chief salt in solution. The water is not very satisfactory, but is usable for drinking as well as for stock. It may prove injurious to vegetation if used for irrigation.

WELL RECORDS—Rural Municipality of MONTROSE NO. 315, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SW.	19	31	7	3	Bored	35	1,760	- 25	1,735			Recent dune sand	Hard	43	D, S	Insufficient supply; 16-foot well with small supply used for stock.
2	NW.	19	"	"	"	Bored	30	1,760					Recent dune sand	Hard,"alkaline"	42	D, S	Insufficient in winter; usually waters 40 to 50 head stock.
3	NE.	31	"	"	"	Dug	25	1,790	- 20	1,770	20	1,770	Recent dune sand	Hard	42	D, S	Sufficient; waters 20 head stock; 18-foot well yields good supply.
4	NE.	33	"	"	"	Dug	20	1,755	- 16	1,739	16	1,739	Recent dune sand	Hard,iron	42	D, S	Insufficient for house and 8 head stock.
5	NE.	34	"	"	"	Sand-point	45	1,745	- 27	1,718	45	1,700	Glacial sand	Hard	43	D, S	Sufficient supply.
6	NW.	35	"	"	"	Sand-point	27	1,740	- 18	1,722	27	1,713	Glacial sand	Fairly soft	43	D, S	Ample supply; also dugout which is never dry
1	SW.	5	31	8	3	Sand-point	24	1,735	- 8	1,727	8	1,727	Glacial sand	Hard,slightly"alkaline"	43	D, S	Ample for 40 head stock.
2	NE.	6	"	"	"	Dug & Bored		1,750					Glacial sand	Hard,iron	43	D, S	Ample for 60 head stock.
3	NW.	7	"	"	"	Dug	10	1,775	- 8	1,767	8	1,767	Glacial sand	Hard	42	D, S	Sufficient; waters 25 head stock; 12-foot well, large supply; used for stock.
4	SE.	12	"	"	"	Sand-point	15	1,670					Glacial sand	Soft	43	D	Sufficient for house use; spring supplies 25 head stock all year.
5	NE.	12	"	"	"	Drilled	250	1,710			250	1,460	Belly River	Soft	44	D, S	Sufficient for 50 head stock. #
6	SE.	17	"	"	"	Sand-point	15	1,780	- 11	1,769	11	1,769	Recent dune sand	Slightly hard	43	D, S	Sufficient; waters 80 head stock.
7	SW.	17	"	"	"	Dug & Sand-point	25	1,775	- 16	1,759	17	1,758	Glacial sand	Hard	42	D, S	Sufficient; waters 75 head stock; dugout also used for stock.
8	NW.	18	"	"	"	Sand-point	20	1,798					Glacial sand	Hard	42	D, S	Sufficient supply.
9	SE.	20	"	"	"	Sand-point	16	1,780					Recent dune sand	Hard	44	D, S	Sufficient; waters 20 head stock.
10	NW.	21	"	"	"	Dug	8	1,760	- 6	1,754	6	1,754	Recent dune sand	Soft	42	D, S	Ample supply.
11	SE.	24	"	"	"	Bored	30	1,760	- 10	1,750			Recent dune sand	Hard	42	D, S	Insufficient supply; waters 75 head stock with aid of two 13-foot wells and an 8-foot well.
12	SE.	30	"	"	"	Sand-point	28	1,760					Glacial sand	Soft	42	S	Sufficient; waters 40 head stock; 22-foot well for house use.
13	SW.	30	"	"	"	Sand-point	18	1,775					Glacial sand	Hard	42	D, S	Sufficient for 25 head stock.
14	NW.	30	"	"	"	Sand-point	25	1,760					Glacial sand	Hard	42	D, S	Sufficient; waters 180 head stock; sand-point well for house use.
15	SW.	31	"	"	"	Dug	22	1,765	- 16	1,749	16	1,749	Glacial fine sand	Hard	42	D, S	Sufficient for 35 head stock during winter.
16	NE.	32	"	"	"	Dug	20	1,720	- 16	1,704	16	1,704	Recent dune sand	Fairly hard	42	D, S	Sufficient; waters 25 head stock; 14-foot well yields good supply.
17	NW.	36	"	"	"	Dug	10	1,745	- 5	1,740	5	1,740	Recent dune sand	Hard	43	D, S	Ample supply.
1	SE.	1	31	9	3	Sand-point		1,775					Glacial sand	Hard,"alkaline"	44	D, S	Sufficient supply; 18-foot well aids supply in dry seasons.
2	SW.	1	"	"	"	Dug		1,790					Glacial sand	Very hard, "alkaline"	42	D, S	Barely sufficient;; supplies 17 head stock.
3	NE.	4	"	"	"	Dug	10	1,835	- 8	1,827	8	1,827	Glacial drift	Hard	43	D, S	Insufficient; 18-foot well yields limited supply; together water 9 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 MONTROSE NO.315, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
4	NW.	4	31	9	3	Dug	13	1,835	- 10	1,825	10	1,825	Glacial drift	Hard	42	D, S	Sufficient supply; waters 5 head stock; also similar well.
5	SW.	6	"	"	"	Dug	18	1,835	- 17	1,818	17	1,818	Glacial gravel	Hard	47	D, S	Sufficient for 20 to 24 head stock; spring waters stock during summer.
6	NW.	9	"	"	"	Dug	14	1,830	- 10	1,820	10	1,820	Recent drift ?	Hard	42	D, S	Insufficient supply; water hauled.
7	SE.	9	"	"	"	Dug	22	1,839	- 14	1,825	14	1,825	Glacial drift	Hard	42	D, S	Sufficient for 14 head stock;a second 22-foot well yields smaller quantity.
8	SE.	10	"	"	"	Dug	20	1,830	- 14	1,816	14	1,816	Glacial sand	Hard	42	S	Insufficient; two 16-foot wells aid stock requirements; also 16-foot house well.
9	NE.	10	"	"	"	Bored	30	1,805					Glacial sand	Hard	42	D, S	Sufficient for 15 head stock; also 15-foot well for house use; dugout.
10	SW.	12	"	"	"	Dug	20	1,795	- 18	1,777	18	1,777	Glacial sand	Hard	42	D, S	Sufficient; waters 30 head stock.
11	SE.	12	"	"	"	Sand-point	12	1,785					Glacial sand	Soft	42	D, S	Sufficient; waters 15 head stock.
12	SE.	15	"	"	"	Dug	20	1,805	- 16	1,789	16	1,789	Glacial sand	Hard	42	D, S	Sufficient; waters 6 head stock.
13	SE.	16	"	"	"	Dug	12	1,835	- 8	1,827	8	1,827	Glacial drift	Hard, iron, slightly "alkaline"	43	D, S	Insufficient; intermittent supply; also 31-18- and 16-foot wells, but total supply insufficient for 50 head stock.
14	NW.	16	"	"	"	Dug	14	1,815	- 8	1,807	8	1,807	Glacial drift	Hard	42	D, S	Sufficient; waters 40 head stock.
15	NE.	17	"	"	"	Dug	14						Recent dune sand	Hard		S	Sufficient supply.
16	SW.	19	"	"	"	Dug	18	1,780	- 6	1,774	6	1,774	Recent dune sand	Hard	42	D, S	Sufficient; waters 30 head stock.
17	SE.	21	"	"	"	Dug	18	1,840	- 14	1,826	14	1,826	Glacial sand	Hard	42	D, S	Sufficient; waters 9 head stock; 14-foot well sometimes used for stock.
18	SE.	22	"	"	"	Dug	20	1,800	- 15	1,785	15	1,785	Glacial sand	Hard	42	D, S	Sufficient; ample for needs.
19	SW.	26	"	"	"	Bored	42	1,780	- 11	1,769	42	1,738	Glacial sand	Hard	42	D, S	Sufficient; never pumped dry; 15-foot well supplies house.
20	SE.	30	"	"	"	Dug	14	1,810	- 4	1,806	6	1,804	Glacial sand	Soft	43	D,	Sufficient; used only for house.16-foot well supplies 40 head stock.
21	SE.	33	"	"	"	Dug	14	1,790	- 10	1,780	10	1,780	Recent dune sand	Soft	43	D, S	Ample for house and 3 head stock; dugout present.
22	NE.	34	"	"	"	Dug	28	1,780	- 22	1,758	22	1,758	Recent ?	Fairly hard	45	D, S	Sufficient; waters 25 head stock. Dugout on the NW.¼,sec. 34, tp.31, range 99; never dry.
23	NE.	35	"	"	"	Dug	14	1,760	- 10	1,750	10	1,750	Recent ?	Hard	42	D, S	Ample supply.
24	NW.	36	"	"	"	Dug	24	1,755	- 21	1,734	21	1,734	Glacial sand	Hard	42	D, S	Ample supply.
25	NE.	36	"	"	"	Sand-point	23	1,775					Glacial fine sand	Hard, slightly "alkaline"	42	D, S	Ample supply.
1	SE.	6	32	6	3	Dug	15	1,675	- 11	1,664	11	1,664	Glacial sand	Fairly soft	43	D, S	Sufficient; never pumped dry.
2	NE.	6	"	"	"	Dug	15	1,690	- 11	1,679	11	1,679	Glacial sand	Fairly soft	43	D, S	Sufficient; never pumped dry.
3	NW.	6	"	"	"	Dug	40	1,715					Glacial sand	Fairly soft	42	D, S	Sufficient; never pumped dry.
4	SW.	16	"	"	"	Dug	15	1,670	- 12	1,658	12	1,658	Glacial sand	Hard	42	D	Sufficient for house; spring supplies stock throughout year.

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 MONTROSE NO. 315, 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
5	SE.	20	32	6	3	Sand-point	20	1,670					Glacial sand	Hard	41	D, S	Sufficient, waters 27 head stock.
6	NE.	20	"	"	"	Dug	10	1,680	- 8	1,672	8	1,672	Glacial sand	Hard, "alkaline"	41	S	Insufficient; waters 6 head stock; 25-foot well for house purposes.
7	NE.	21	"	"	"	Dug	10	1,600					Glacial sand	Hard	43	D, S	Sufficient supply.
8	NE.	28	"	"	"	Sand-point	15	1,660	- 10	1,650	10	1,650	Recent ?	Hard	42	D, S	Sufficient; waters 20 head stock.
9	SE.	30	"	"	"	Dug	44	1,715					Glacial gravel	Soft	43	D, S	Sufficient; waters 11 head stock.
10	SE.	31	"	"	"	Sand-point	20	1,710					Glacial sand	Hard	42	D, S	Sufficient; waters 30 head stock.
11	NE.	31	"	"	"		40						Glacial sand	Hard		S	Sufficient supply.
12	NW.	32	"	"	"	Dug	40	1,695					Glacial sand	Hard	42	S	Sufficient; waters 15 head stock; sand-point well supplies house.
13	NE.	32	"	"	"	Dug	30	1,685						Soft	42	D, S	Sufficient supply.
14	SE.	32	"	"	"	Sand-point	20	1,685						Hard	43	D, S	Sufficient; waters 10 head stock.
1	SE.	1	32	7	3	Dug	38	1,715					Glacial sand	Fairly hard	43	D, S	Sufficient; never pumped dry.
2	SW.	4	"	"	"	Dug	30	1,770					Recent ?	Fairly hard	43	D	Sufficient; used only for house; 25-foot well supplies 10 head stock.
3	NW.	4	"	"	"	Sand-point	35	1,790					Recent ?	Fairly soft	43	D, S	Insufficient; waters 10 head stock.
4	SE.	14	"	"	"	Dug	12	1,700	- 8	1,692	8	1,692	Glacial sand	Hard	44	D, S	Sufficient; waters 8 head stock; also similar wells.
5	NE.	14	"	"	"	Dug	30	1,705	- 22	1,683	22	1,683	Glacial sand	Hard	42	D, S	Sufficient; waters 30 head stock; also similar well.
6	NE.	15	"	"	"	Dug	20	1,705	- 14	1,691	14	1,691	Glacial sand	Hard	43	D, S	Ample supply; also similar well.
7	SW.	18	"	"	"	Dug	24	1,745	- 21	1,724	21	1,724	Recent dune sand	Fairly soft	43	D, S	Sufficient; waters 50 head stock.
8	SW.	24	"	"	"	Dug	16	1,703	- 10	1,693	10	1,693	Recent ?	Hard	42	D, S	Sufficient; waters 50 head stock.
9	NW.	24	"	"	"	Dug	20	1,710	- 18	1,692	18	1,692	Recent dune sand	Hard	42	D, S	Sufficient; ample for 6 head stock.
10	SE.	25	"	"	"	Dug & Sand-point	38	1,710					Glacial sand	Hard, slightly, iron	42	D, S	Sufficient; waters 30 head stock; 12-foot well with soft water; ample supply.
11	NE.	25	"	"	"	Dug & Sand-point	24	1,708					Glacial sand	Fairly soft	43	D, S	Never pumped dry.
12	NE.	32	"	"	"	Dug	11	1,745	- 7	1,738	7	1,738	Recent dune sand	Hard	43	D, S	Sufficient; waters 31 head stock.
1	SW.	1	32	8	3	Dug	14	1,728	- 10	1,718	10	1,718	Recent dune sand	Hard	43	D, S	Sufficient; waters 30 head stock; also 12-foot well with good supply.
2	NW.	5	"	"	"	Dug	14	1,740	- 12	1,728	12	1,728	Recent dune sand	Hard	42	D, S	Sufficient; waters 8 head stock.
3	SE.	6	"	"	"	Dug	14	1,735	- 12	1,723	12	1,723	Glacial sand	Hard, slightly "alkaline" iron	42	D	Sufficient; used only for house; 11-foot well for 10 head stock; also similar wells.

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 MONTROSE NO. 315, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
4	NW.	6	32	8	3	Dug	10	1,745					Glacial sand	Hard	48	D	Sufficient; 8-foot well waters 20 head stock.
5	NE.	13	"	"	"	Dug	24	1,735	- 16	1,719	16	1,719	Recent dune sand	Hard	43	D, S	Insufficient; waters 5 head stock; 12-foot well of soft water supplies 25 head stock, which fills local needs.
6	SW.	18	"	"	"	Dug	10	1,755	- 6	1,749	6	1,749	Recent dune sand	Hard	43	S	Insufficient for 10 head stock.
7	NW.	20	"	"	"	Dug	16	1,755	- 14	1,741	14	1,741	Recent ?	Hard	43	D, S	Insufficient; waters 8 head stock.
8	NE.	20	"	"	"	Dug	17	1,745	- 16	1,729	16	1,729	Recent ?	Hard	43	D, S	Sufficient; waters 14 head stock.
9	NE.	24	"	"	"	Dug	18	1,735	- 12	1,723	12	1,723	Recent dune sand	Hard	42	D, S	Sufficient; waters 8 head stock.
10	SW.	31	"	"	"	Dug	30	1,755	- 29	1,726	29	1,726	Glacial drift	Hard	42	D, S	Insufficient; water house and 4 head stock; similar well waters 10 head stock.
11	SE.	31	"	"	"	Dug	19	1,745	- 16	1,729	16	1,729	Glacial sand	Hard	42	D, S	Sufficient; also a similar well.
12	NW.	32	"	"	"	Dug	22	1,750	- 18	1,732	18	1,732	Glacial sand	Hard	42	D, S	Sufficient; waters 14 head stock; a second similar well for stock.
13	NW.	34	"	"	"	Drilled	326	1,730	- 29	1,701	326	1,404	Belly River	Soft, soda, iron		D, S	Ample supply. #
14	SE.	36	"	"	"	Dug	20	1,725	- 16	1,709	16	1,709	Recent dune sand	Hard	43	D, S	Sufficient; waters 25 head stock; also dugouts for stock use.
1	NE.	2	32	9	3	Dug	16	1,760	- 14	1,746	14	1,746	Glacial fine sand	Hard	42	D, S	Sufficient; waters 48 head stock.
2	NW.	2	"	"	"	Dug	25	1,775	- 16	1,759	16	1,759	Glacial gravel	Hard, iron	42	D, S	Ample supply.
3	SE.	7	"	"	"	Dug	8	1,775	- 4	1,771	4	1,771	Recent dune sand	Soft	42	D, S	Ample supply.
4	NE.	10	"	"	"	Dug	16	1,760	- 13	1,747	13	1,747	Recent dune sand	Hard	42	D, S	Sufficient for 20 head stock.
5	NW.	12	"	"	"	Dug	16	1,760	- 12	1,748	12	1,748	Recent dune sand	Hard	42	D, S	Sufficient; waters 10 head stock; water hauled if more stock is kept.
6	SE.	12	"	"	"	Dug	24	1,760	- 22	1,738	22	1,738	Recent dune sand	Hard	43	D, S	Insufficient; will not water more than 12 head stock; 18-foot well almost dry.
7	NE.	12	"	"	"	Dug	25	1,765	- 23	1,742	23	1,742	Recent dune sand	Hard	43	D, S	Sufficient; waters 12 head stock.
8	SW.	18	"	"	"	Dug	10	1,760	- 8	1,752	8	1,752	Recent dune sand	Fairly soft	42	D, S	Ample supply.
9	NW.	19	"	"	"	Dug	12	1,788	- 9	1,779	9	1,779	Recent dune sand	Fairly soft	44	D, S	Ample supply; also 9-foot and 6-foot wells, with good supplies.
10	NE.	22	"	"	"	Dug	20	1,725	- 18	1,707	18	1,707	Recent dune sand	Hard	42	D, S	Barely sufficient; 19-foot well for house; water hole in pasture; 40 head stock.
11	SW.	23	"	"	"	Dug	20	1,750					Glacial drift	Hard, "alkaline"	42	S	Sufficient for 6 head stock; 128-foot well, small supply hard, iron water used for drinking
12	SW.	24	"	"	"	Dug	15	1,750	- 10	1,740	10	1,740	Recent ?	Hard, iron	42	D, S	Sufficient; just enough for 20 head stock.
13	NW.	24	"	"	"	Dug	23	1,750	- 19	1,731	19	1,731	Glacial gravel	Fairly hard	42	D	Sufficient; 14-foot well for stock.
14	NE.	24	"	"	"	Dug	16	1,760					Glacial fine sand	Fairly hard	43	D, S	Insufficient; waters 10 head stock; also similar wells; 90-foot well with abundant supply caved in.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of MONTROSE NO. 315, 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
15	NW.	27	32	9	3	Drilled	120	1,695	- 5	1,690	120	1,575	Glacial gravel	Hard, iron	41	D, S	Ample supply for 150 head stock; dugouts on the NE.¼, section 16, NE.¼, section 20, [illegible], section 22, also into water-bearing sand.
16	SW.	31	"	"	"	Dug	12	1,745	- 9	1,736	99	1,736	Recent dune sand	Fairly hard	44	D, S	Ample supply.
17	NW.	32	"	"	"	Drilled	325	1,720	- 50	1,670	325	1,395	Belly River	Soft		D, S	Large supply. #
18	NE.	32	"	"	"	Drilled	234	1,700	- 30	1,670	234	1,466	Belly River	Soft, gaseous	42	D, S	Abundant supply. #
19	SW.	34	"	"	"	Drilled	200	1,705			200	1,505	Belly River	Hard, iron		D, S	Sufficient; waters 20 head stock.
20	SE.	34	"	"	"	Dug	28	1,725	- 20	1,705	20	1,705	Glacial sand	Hard, slightly "alkaline"	42	D, S	Ample; supplies 40 head stock.
21	NE.	34	"	"	"	Dug & Bored	36	1,720					Glacial sand	Fairly hard	42	D, S	Sufficient; waters 30 head stock.
22	SW.	36	"	"	"	Dug	28	1,760	- 22	1,738	22	1,738	Glacial sand	Fairly soft	42	D, S	Just sufficient; waters about 10 head stock.
23	NE.	36	"	"	"	Drilled	303	1,755	- 8	1,747	303	1,425	Belly River	Hard, salty, yellow sediment	42	S	Abundant supply. #

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