CANADA
DEPARTMENT OF MINES

HON. T. A. CRERAR, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER

BUREAU OF ECONOMIC GEOLOGY
GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF PART OF THE RURAL MUNICIPALITY OF LOST RIVER No. 313 SASKATCHEWAN

BY

B. R. MacKay, H. N. Hainstock & G. Graham

Water Supply Paper No. 35

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INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

If one intends to sink a well and wishes to find the approximate depth to a water-bearing horizon, he must learn: (1) the elevation of the site, and (2) the probable elevation of the water-bearing bed. The elevation of the well site is obtained by marking its position on the map, Figure 2, and estimating its elevation with respect to the two contour lines between which it lies and whose elevations are give 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 ago.

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 rest 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

There are six townships in this municipality, but only the four southern townships 31 and 32, ranges 1 and 2, W. 3rd mer., are referred to in this report; they cover an area of 144 square miles, the centre of which lies 35 miles southeast of Saskatoon.

The area is mantled by glacial drift, which varies in thickness from 80 to 250 feet, or possibly more. Most of the glacial drift is in the form of terminal moraine, but the northern half of township 32, range 1, is covered with boulder clay or till.

The topography of the municipality is rough or rolling, and many undrained depressions occur. The area has a surface relief of almost 500 feet, the highest hill-tops being along the southern boundary of township 31, range 1, and scattered throughout township 31, range 2; whereas the lowest point occurs in the northeastern corner of township 32, range 1. The highest elevations exceed 2,250 feet, and the lowest elevation is approximately 1,760 feet above sea-level.

Throughout the municipality the main water-bearing horizons occur as sand and gravel deposits in the glacial drift.

Water-bearing Horizons in the Unconsolidated Deposits

Pockets of sand and gravel occur in the upper or weathered zone of the glacial drift throughout the municipality. Although these pockets are local and non-continuous they form the most general, and what is referred to as the first water-bearing horizon or aquifer. The wells tapping this horizon are a few feet to as much as 40 or more feet in depth, and give water that varies considerably in quantity and quality. Most of the wells yield a medium hard, in some cases "alkaline" water containing iron in solution, but which is usable for both humans and stock. In years of normal rainfall these wells yield a supply sufficient for local needs, but in times of drought their supply diminishes and they sometimes become completely dry. These wells are all non-artesian in type.

In township 32, range 1, and at other places in the municipality, pockets of sand and gravel are encountered at greater depths in the glacial drift, ranging all the way from the bottom of the weathered zone of the glacial drift down to the bedrock. The number of dry holes encountered prove that these deep pockets of sand and gravel do not form a continuous aquifer. The water from these wells is highly mineralized and increases in hardness with depth. It is always usable for stock, but in a number of cases it cannot be used for domestic purposes.

A few other water-bearing horizons are present in the municipality but as in most cases they are confined to individual townships they will be discussed under the particular township in which they have been proved to occur.

Water-bearing Horizons in the Bedrock.

Over the greater part most of the municipality shales of the Marine Series immediately underlie the glacial drift, but it is possible that the sands of the Belly River formation underlie some of the northern parts of the area.

The well located on the SW.$\frac{1}{4}$, sec. 28, tp. 32, range 1, is the only one known for certain to have pierced the bedrock although 5 other wells may be in the bedrock. This well gives an abundant supply of soft water that can be used for stock but is not satisfactory for drinking or for irrigation. The water sand from which it derives its supply is 738 feet from the surface and at an elevation of 1,212 feet above sea-level. Sufficient evidence from surrounding areas is not available to say whether this aquifer extends over the remainder of the municipality.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 31, Range 1

No definite information as to the thickness of the glacial drift mantling this township is available. The drift is in the form of a terminal moraine; and many undrained depressions dot the surface of the area. Scattered pockets of sand and gravel are interspersed in the morainic clay and yield small supplies of hard but usable water. In the northeastern corner, on sections 25, 26, and 36, the yield from these shallow wells is sufficient for local needs, but over the greater part of the township the yield is far below requirements. The sand and gravel pockets are of local distribution, so that the water-bearing horizon formed by them is not continuous throughout the township. A few wells are only 12 feet deep and an odd one encounters a pocket at a depth of 65 feet, but most of the wells tapping these pockets are from 20 to 30 feet deep. Conforming to the uneveness of the surface, the water horizon ranges in elevation from 1,990 to 2,180 feet above sea-level.

A second aquifer appears to be present at an approximate elevation of 2,000 feet above sea-level. The depth to this aquifer from the surface ranges from 90 to 170 feet. This wide range in depth is due to the irregularity of the surface. The water-bearing horizon yields a supply that is highly mineralized and only when water is very scarce is it used for domestic purposes. The yield is large and the water in the wells is under hydrostatic pressure so that it rises considerably above the elevation of the aquifer. Sufficient information is available to show that this horizon is continuous over the eastern part, and it is probable that it extends over all the township.

No information is available as to the possibility of obtaining water from a bedrock aquifer in this township and the data pertaining to such an aquifer in the surrounding areas are insufficient to make generalizations.

Township 31, Range 2

The glacial drift mantling this township is in the form of terminal moraine and the surface is quite rough.

An aquifer that appears to be general throughout the township is formed by sand and gravel pockets that occur within the morainic clay. These pockets range in depth from 20 to 40 feet in elevation from 2,100 to 2,200 feet above sea-level. This water-bearing horizon is not continuous throughout the township, the numerous dry holes dug showing the irregular distribution of the pockets. The wells tapping this horizon are non-artesian in type, and the yield depends for the most part on the amount of annual precipitation. As a rule the yield is no more than sufficient for domestic use.

In the central part of the northern half of the township what appears to be a continuous deposit of sand forms a second water-bearing horizon. It is tapped by wells ranging in depth from 83 to 116 feet. The yield is large when the sand can be controlled, but there is great difficulty in keeping the sand from choking off the supply. Over this particular area the aquifer appears to be fairly continuous at an elevation of approximately 2,075 feet above sea-level. The water is hard, but usable for all purposes.

One well, located on the NW.$\frac{1}{4}$, section 25, was drilled to a depth of 240 feet, and its base is at an elevation of 1,950 feet above sea-level. It seems probable that this well is deriving its supply from a third water-bearing horizon, but no data are available to show over what area this aquifer extends. Another well located on the NW.$\frac{1}{4}$, section 34, 266 feet in depth, encountered an aquifer at 1,909 feet above sea-level, that is formed by quicksand, but the well was practically choked by sand, and only a very small supply of water was being obtained. It is not known if the aquifer tapped by this well is the same as that tapped by the 240-foot well. It may even mark the continuation of a higher horizon.

Township 32, Range 1

In the southern half of this township the glacial drift is in the form of morainic deposits, whereas in the northern part it is till or boulder clay.

What may be termed the first aquifer occurs as a series of disconnected sand and gravel pockets in the upper or weathered zone of the drift. The wells tapping these pockets range in depth from 15 to 25 feet. The supply from this water-bearing horizon is sufficient for local needs and the water is usable for both domestic purposes and for stock.

The second aquifer is formed by sand and gravel pockets in the lower part of the drift. These pockets are discontinuous as is evidenced by numerous dry holes put down in the vicinity of producing wells. The depth to the pockets ranges from 45 to 120 feet, and the supply of water from them varies greatly. Moreover, the iron salts in solution in the water is much greater than from shallower wells and in some cases they are so concentrated as to make the water unfit for domestic use. In only about 50 per cent of the wells examined does this aquifer yield sufficient water for local needs.

The well located on NE.$\frac{1}{4}$, section 30, obtains a supply of highly mineralized water, which is only used for stock, at a depth of 198 feet from the surface. It is probable that the water supply is from a local pocket of sand, although indications are that this pocket is very close to the bedrock and the sand encountered may directly overlie the bedrock. Sufficient information is not available to outline the areal extent of this horizon.

The only well that has penetrated bedrock is located on the SW.$\frac{1}{4}$, section 28, and is 738 feet in depth. This well encountered bedrock at an approximate depth of 80 feet from the surface and at an elevation of 1,875 feet above sea-level. It pierced a sandy bed, which forms the aquifer, at a depth of 715 feet or at an elevation of

1,230 feet above sea-level. The well yields an abundant supply of soft water that is suitable for stock but is not satisfactory for drinking. This aquifer will probably be found to be continuous over the remainder of the township.

Township 32, Range 2

This township is mantled with glacial drift of the terminal moraine type, except in a small part in the northeastern corner which is covered with boulder clay or till.

The township, like the others of this municipality, has a non-continuous water-bearing horizon composed of sand and gravel pockets in the moraine clay, in the upper part of the glacial drift. The depths to these pockets vary from 20 to 50 feet or more and their supplies also vary widely. Several dry holes may be sunk before a gravel pocket is located that contains a sufficient supply of water. The water contains iron salts in solution, but is used for both domestic purposes and for stock.

Throughout most of the township a second water-bearing horizon is formed by a bed of quicksand. This horizon has been encountered at a depth of 240 feet on the SW.$\frac{1}{4}$, section 10; at a depth of 90 feet on the NW.$\frac{1}{4}$, section 19, and on the SE.$\frac{1}{4}$, section 26, and at intermediate depths in the intervening areas, but in most places it is encountered at an elevation of approximately 1,900 feet above sea-level. This horizon is believed to slope toward the northeastern corner of the township. An abundant supply of water is contained in this aquifer, but due to the fineness of the sand the flow cannot be controlled and the full supply cannot be utilized. The water is used only for stock, the high concentration of iron salts in solution making it unsuitable for domestic use.

The data supplied by the well located on the SE.$\frac{1}{4}$, section 36, appears to show that a third aquifer occurs at an elevation of approximately 1,715 feet above sea-level. This elevation agrees with that of the aquifer in tp. 32, range 1, W. 3rd mer., and it is probably a continuation of the same water-bearing horizon. It is possible that this aquifer directly overlies the bedrock. The supply from this particular well is abundant and the water is being used for both domestic purposes and stock. As only one well in the township draws its water from this aquifer, it is not known whether the aquifer extends over the remainder of the township, but it is probable that it does.

No bedrock wells exist in the township, but judging by the data supplied by the deep well in the adjacent township to the east it is quite possible that a sand aquifer yielding a good supply of soft water that is usable for stock will be found to occur in the bedrock at an approximate elevation of 1,200 to 1,250 feet above sea-level.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF LOST RIVER NO. 313, SASKATCHEWAN

West of 3rd meridian — Township / Range	31 / 1	31 / 2	32 / 1	32 / 2	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	Total No. in Municipality
Total No. of Wells in Township	39	42	105	78	0	0	0	0	0	264
No. of wells in bedrock	0	1	1	0	0	0	0	0	0	2
No. of wells in glacial drift	39	41	104	78	0	0	0	0	0	262
No. of wells in alluvium	0	0	0	0	0	0	0	0	0	0
Permanency of Water Supply										
No. with permanent supply	38	36	66	55	0	0	0	0	0	195
No. with intermittent supply	0	2	0	0	0	0	0	0	0	2
No. dry holes	1	4	39	23	0	0	0	0	0	67
Types of Wells										
No. of flowing artesian wells	1	2	5	0	0	0	0	0	0	8
No. of non-flowing artesian wells	11	17	29	34	0	0	0	0	0	91
No. of non-artesian wells	26	19	32	21	0	0	0	0	0	98
Quality of Water										
No. with hard water	34	37	60	55	0	0	0	0	0	186
No. with soft water	4	1	6	0	0	0	0	0	0	11
No. with salty water	0	0	2	0	0	0	0	0	0	2
No. with "alkaline" water	7	0	11	4	0	0	0	0	0	22
Depths of Wells										
No. from 0 to 50 feet deep	30	32	82	56	0	0	0	0	0	200
No. from 51 to 100 feet deep	2	5	13	8	0	0	0	0	0	28
No. from 101 to 150 feet deep	5	3	8	4	0	0	0	0	0	20
No. from 151 to 200 feet deep	2	0	1	3	0	0	0	0	0	6
No. from 201 to 500 feet deep	0	2	0	7	0	0	0	0	0	9
No. from 501 to 1,000 feet deep	0	0	1	0	0	0	0	0	0	1
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
How the Water is used										
No. usable for domestic purposes	29	34	57	41	0	0	0	0	0	161
No. not usable for domestic purposes	9	4	9	14	0	0	0	0	0	36
No. usable for stock	38	38	66	55	0	0	0	0	0	197
No. not usable for stock	0	0	0	0	0	0	0	0	0	0
Sufficiency of Water Supply										
No. sufficient for domestic needs	38	38	65	54	0	0	0	0	0	195
No. insufficient for domestic needs	0	0	1	1	0	0	0	0	0	2
No. sufficient for stock needs	21	22	43	28	0	0	0	0	0	114
No. insufficient for stock needs	17	16	23	27	0	0	0	0	0	83

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 boilers 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 harness 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 Lost River, No. 313, 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	SW.	12	32	1	3	107	3,200	2,200	2,100	100	27	65	470	407	1,919	153	2,674	65	1,055		1,213		296	45	＊1
2	SW.	28	32	1	3	738	1,700	20			400	635	20	4	291	897	1,749	36		8		614	431	660	＊2

Water samples indicated thus, ＊1, are from glacial drift.
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

As only one sample of water from the glacial drift in the municipality was analysed, the following discussion is based mainly on the results of analyses of samples from surrounding municipalities.

The waters from the drift show a marked similarity in the type of mineral salts contained in solution, but vary greatly in the amounts of these mineral salts. It is not uncommon to find that water so highly mineralized as to be unfit for domestic use is being derived from the same depth as and not far distant from wells yielding drinkable water.

The waters from the glacial drift are hard. The sample analysed has a total hardness of 2,200 parts per million. This extreme hardness is due to the abundance of calcium and magnesium salts in solution. If waters from the drift are moderately soft in character, their source can usually be traced to direct seepage from ponds or dugouts.

The total dissolved solid content of the sample analysed is 3,200 parts per million. This content is high, and the sample may not be representative of the water from the drift in this municipality. If such a total solid content is composed principally of one detrimental salt, such as magnesium sulphate, the water will probably prove to be unfit for domestic and possibly stock use. The sample analysed was from a depth of 107 feet and it is probable that waters from shallower depths will have a smaller total dissolved solid content. As the water percolates through the deposits of clay, sand, and gravel, it takes into solution some of the mineral salts contained in these deposits. If the deposits contain a large amount of mineral salts, it is very likely that the water found in contact with them will also be highly mineralized.

Magnesium sulphate (Epsom Salts) is the most abundant mineral salt present in the sample analysed. It usually is one of the predominant salts in waters from the drift. This salt gives the water a laxative effect, and in the sample analysed its content is 1,213 parts per million. This water is unfit for domestic purposes. Calcium sulphate, or gypsum, is next in abundance with 1,055 parts per million. Beyond giving the water hardness, this salt is not harmful. The sample also contains small amounts of sodium sulphate, calcium carbonate, and sodium chloride.

Many of the well waters in this municipality are high in iron. If this type of water is let stand in contact with the air for a considerable period of time before using, much of the iron will be oxidized and settle out as a reddish precipitate of iron oxide. Agitation of the water, and as much water in contact with the air as possible, speed up this process.

Generally speaking, the waters from the drift in this municipality should be satisfactory for both domestic and stock use.

Water from the Bedrock

Water from the bedrock may be medium hard to soft in character, depending upon the predominant salts present. If the calcium and magnesium salts are present in solution in quantity the water will be hard. One sample of water from the bedrock was collected and analysed. It has a total dissolved solid content of 1,749 parts per million. Of this content 1,705 parts are composed of sodium salts. Sodium chloride or common salt is the most abundant mineral salt with 660 parts per million, sodium carbonate or black alkali is second with 614 parts, and sodium sulphate (Glauber's Salt) is third with 431 parts per million. Small amounts of calcium carbonate and magnesium carbonate are also present. This water can be used for stock, but is too salty to be satisfactory for domestic use. Due to its high content of sodium carbonate (black alkali) the water is unsuitable for irrigation.

WELL RECORDS—Rural Municipality of LOST RIVER, NO. 313, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE: Elev.	PRINCIPAL WATER-BEARING BED: Depth	PRINCIPAL WATER-BEARING BED: Elev.	PRINCIPAL WATER-BEARING BED: Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SW.	1	31	1	3	Spring	6	2,205	- 0	2,205	0	2,205	Glacial sand, gravel	Hard, iron	44	S	Abundant supply.
2	SE.	1	"	"	"	Bored	170	2,205	-130	2,075	170	2,035	" greysand	"	43	D, S	Sufficient for 50 head stock.
3	SW.	5	"	"	"	Drilled	200	2,150	-110	2,040	200	1,950	" drift	" "	44	S	" " 100 " " .
4	SE.	12	"	"	"	Bored	30	2,090	- 17	2,073	20	2,070	" sand	","alkaline"	44	D, S	" " 8 " " .
5	NE.	12	"	"	"	"	105	2,117	- 80	2,037	105	2,012	" clay	", iron	43	S	" " 50 " " .
6	NW.	12	"	"	"	"	135	2,190	- 75	2,115	135	2,055	" "	"	43	D, S	Abundant supply.
7	SW.	13	"	"	"	"	123	2,165	- 65	2,100	123	2,042	" "	"	43	S	" " .
8	NE.	16	"	"	"	Dug	30	2,160	- 25	2,135	30	2,130	" ", gravel	"	43	D, S	Sufficient for 35 head stock.
9	SE.	17	"	"	"	"	20	2,135	- 17	2,118	20	2,115	" sand	","alkaline"	42	D, S	Insufficient for local needs.
10	SW.	17	"	"	"	"	15	2,130	- 11	2,119	15	2,115	" drift	" , iron	42	D, S	" " " " .
11	SE.	19	"	"	"	"	12	2,190	- 8	2,182	12	2,178	" clay, "	"	43	D, S	" " " " .
12	SE.	20	"	"	"	Bored	65	2,150	- 60	2,090	65	2,085	" sand	" ,"alkaline"	43	S	Sufficient for 9 head stock.
13	NW.	20	"	"	"	"	25	2,140	- 22	2,118	25	2,115	" clay	"	42	D	Insufficient for local needs.
14	NE.	21	"	"	"	"	25	2,150	- 20	2,130	25	2,125	" "	" "		S	Sufficient for 20 head stock.
15	SW.	22	"	"	"	Dug	12	2,160	- 6	2,154	12	2,148	" "	" iron	42	D, S	" " 6 " " .
16	NW.	22	"	"	"	Bored	40	2,165	- 35	2,130	40	2,125	" "	"	43	D, S	Insufficient for local needs.
17	NE.	23	"	"	"	"	28	2,115	- 25	2,190	28	2,087	" "	Soft	44	D	" " " " .
18	SW.	24	"	"	"	"	123	2,115	- 73	2,042	123	1,992	" "	Hard,	43	S	Never pumped dry.
19	NE.	26	"	"	"	"	20	2,065	- 13	2,052	20	2,045	" gravel	"	44	D, S	Sufficient for 20 head stock.
20	SE.	31	"	"	"	"	41	2,125	- 29	2,096	41	2,084	" ", sand	" , iron		S	" " 30 " " .
21	SW.	25	"	"	"	"	18	2,100	- 15	2,085	18	2,082	" "	Soft	42	D, S	Very large supply.
22	NE.	31	"	"	"	"	92	2,130	- 18	2,112	35	2,095	" clay	Hard	43	D, S	Sufficient for 90 head stock.
23	NW.	31	"	"	"	Dug	13	2,145	- 10	2,135	13	2,132	" "	"	43	D, S	" " 15 " " .
24	SW.	34	"	"	"	Bored	32	2,195	- 27	2,168	32	2,163	" sand, gravel	" ,"alkaline"	43	D, S	Insufficient for local needs.
26	SW.	36	"	"	"	"	20	2,008	- 18	1,990	20	1,988	" gravel	Soft	42	D, S	Very large supply.
27	SW.	16	"	"	"	Dug	18	2,145	- 15	2,130	18	2,127	" sand	Hard,"alkaline"	42	D, S	Insufficient for local needs in summer.

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 LOST RIVER, NO. 313, 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.	2	31	2	3	Bored	41	2,155	- 38	2,117	41	2,114	Glacial clay	Hard, iron	44	S	Insufficient for local needs.
2	SW.	2	"	"	"	"	65	2,150	- 55	2,095	65	2,085	" sand	" "	43	D, S	Sufficient for 65 head stock.
3	SW.	3	"	"	"	"	45	2,095	- 18	2,077	45	2,050	" "	" "	44	D, S	" " 40 " " .
4	SW.	4	"	"	"	Dug	15	2,100	- 13	2,087	15	2,085	" clay	"	44	D	Insufficient for local needs.
5	NW.	4	"	"	"	Bored	32	2,100	- 12	2,038	32	2,008	" sand	"	43	D, S	Sufficient for 30 head stock.
6	NE.	6	"	"	"	Dug	18	2,105	- 17	2,088	17	2,087	" clay	"	43	D	Insufficient for domestic needs.
7	SW.	6	"	"	"	"	19	2,100	- 17	2,083	19	2,081	" "	"	44	D	" " local needs.
8	NW.	7	"	"	"	"	12	2,135	0	2,135	?	?	" sand	"	42	D, S	Abundant supply.
9	NW.	10	"	"	"	Bored	45	2,185	- 25	2,160	45	2,140	" clay	" , iron	42	D, S	Sufficient for 20 head stock.
10	SE.	13	"	"	"	Dug	10	2,130	- 6	2,124	10	2,120	" sand	" , "	43	D, S	" " 35 " " .
11	SE.	15	"	"	"	Bored	40	2,160	- 36	2,124	40	2,120	" sandy clay	"	42	D, S	Insufficient for local needs.
12	SW.	15	"	"	"	"	60	2,180	- 36	2,144	60	2,120	" clay	" , "	43	D, S	Sufficient for 50 head stock.
13	NW.	15	"	"	"	"	44	2,165	- 27	2,138	44	2,121	" sand	"	43	D, S	" " 30 " " .
14	NE.	16	"	"	"	Dug	15	2,170	- 13	2,157	15	2,155	" "	"	42	D, S	Insufficient for local needs.
15	SE.	17	"	"	"	Bored	36	2,150	- 24	2,126	36	2,114	" "	"	43	D, S	" ; will water 17 head stock.
16	SW.	19	"	"	"	Dug	20	2,160	- 18	2,142	20	2,140	" "	"	42	D, S	" ; " " 4 " " .
17	SW.	20	"	"	"	"	18	2,160	- 14	2,146	18	2,142	" gravel, sand	"	44	D, S	Sufficient for 20 head stock.
18	NW.	21	"	"	"	Bored	40	2,190	- 35	2,155	40	2,150	" "	"	43	S	" " 20 " " .
19	SW.	23	"	"	"	"	83	2,175	- 43	2,132	83	2,082	" gravelly clay	"	42	D, S	" " 50 " " .
20	SE.	24	"	"	"	Dug	16	2,160	- 4	2,156	16	2,144	" "	"	43	D, S	Insufficient; will water 4 head stock.
21	NE.	24	"	"	"	Bored	60	2,190	- 40	2,150	60	2,130	" gravel	"	43	D, S	" ; " " 15 " " .
22	NW.	25	"	"	"	Drilled	240	2,190	- 60	2,130	240	1,950	" clay	" , iron	44	S	Sufficient for 60 head stock.
23	SE.	28	"	"	"	"	115	2,200	- 60	2,140	115	2,085	" sand	"	42	D, S	Never pumped dry.
24	NE.	28	"	"	"	Bored	116	2,190	- 76	2,114	116	2,074	" drift	"	42	S	Sufficient for 50 head stock.
25	SW.	29	"	"	"	"	25	2,200	- 21	2,179	25	2,175	" "	"	44	D, S	" " 8 " " only.
26	NE.	31	"	"	"	"	20	2,180	- 17	2,163	20	2,160	" "	"	44	D, S	Insufficient; will water 4 head stock.
27	NW.	32	"	"	"	Dug	24	2,185	- 19	2,166	24	2,161	" clay	"	43	D	" .

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

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of LOST RIVER, NO. 313, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE Elev.	PRINCIPAL WATER-BEARING BED Depth	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
28	SE.	33	31	2	3	Bored	120	2,180	- 50	2,130	120	2,060	Glacial gravel, sand	Hard, iron	42	D, S	Insufficient; will water 15 head stock.
29	NW.	34	"	"	"	"	23	2,170	- 13	2,157	23	2,147	" clay	"	43	D, S	" in winter for 25 head stock.
30	NW.	34	"	"	"	Drilled	266	2,175	-165	2,010	266	1,909	" or bedrock?	"		N	This well choked up now by sand.
31	NE.	34	"	"	"	Bored	23	2,160	- 13	2,147	23	2,137	" sand	"	43	D, S	Just sufficient for 5 head stock.
1	SW.	2	32	2	3	"	26	2,150	- 16	2,134	26	2,124	" drift	"			
2	SE.	2	"	"	"	Dug	23	2,160	- 20	2,140	23	2,137	" drift	"		D, S	Insufficient for house.
3	NE.	5	"	"	"	Bored	30	2,150	- 26	2,124	30	2,120	" sand	"		D, S	Sufficient for house use only.
3a	NE.	5	"	"	"	Drilled	203	2,150			203	1,947	" "	" , iron			Large supply.
4	SE.	6	"	"	"	Dug	12	2,175	- 11	2,16	12	2,163	" "	" , "		D, S	Sufficient for 25 head stock.
5	NE.	6	"	"	"	"	27	2,180	- 24	2,156	27	2,153	" "	"		D, S	"
6	SW	7	"	"	"	"	13	2,140	- 12	2,128	13	2,127	" drift	?		?	?
7	NE.	8	"	"	"	Bored	18	2,125	- 16	2,109	18	2,107	" drift	"		D	Insufficient; for house use only.
8	SE.	10	"	"	"	Dug							" drift			D	Seepage well in sloughs.
9	SW.	10	"	"	"	Drilled	240	2,145	- 90	2,055	240	1,905	" gravel	Very hard, iron		S	Large supply for stock.
10	NE.	10	"	"	"	Dug	12	2,160			12	2,145	" drift	Hard,			Insufficient.
12	SE.	12	"	"	"	Bored	96	2,130	- 60	2,070	96	2,034	" drift	" , "		D, S	Sufficient for local needs.
13	SW.	12	"	"	"	"	128	2,155	-108	2,047	128	2,027	" "	" "		D, S	Barely sufficient.
14	SW.	13	"	"	"	Dug	30	2,105	- 27	2,078	30	2,075	" quicksand	Very hard		D	Insufficient; only enough for house use.
15	NW.	14	"	"	"	Bored	120	2,085	- 70	2,015	120	1,965	" sand	Hard, iron		S	Sufficient for 25 head stock.
16	SE.	15	"	"	"	Dug	15	2,130	- 12	2,118	15	2,115	" drift	"		?	?
17	NW.	16	"	"	"	Bored	46	2,075	- 40	2,035	46	2,029	" ", gravel	"		D, S	Insufficient for house and a few stock.
18	SW.	16	"	"	"	"	73	2,080	- 46	2,034	73	2,007	" drift	"		D, S	" in winter.
19	NE.	17	"	"	"	Drilled	160	2,085	- 30	2,005	160	1,925	" "	" "		D, S	" for only stock.
20	SW.	18	"	"	"	Bored	93	2,120	- 77	2,043	93	2,027	" "	" "		S	Sufficient for 8 head stock.
21	NE.	19	"	"	"	"	90	2,005	- 80	1,925	90	1,915	" drift	" "		S	" " 2 " " only.
22	NW.	20	"	"	"	Drilled	140	2,025	- 50	1,975	140	1,885	" "	" "		D, S	Insufficient; will water 40 head stock.
23	NE.	20	"	"	"	Bored	126	2,015	- 60	1,955	126	1,889	" drift	", "alkaline"		D	" ; for house use only.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of LOST RIVER, NO. 313, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE Elev.	PRINCIPAL WATER-BEARING BED Depth	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
24	NE.	21	32	2	3	Dug	16	1,990	- 10	1,980	16	1,974	Glacial sand	Hard,		D, S	Sufficient for local needs.
25	SE.	22	"	"	"	Bored	85	2,060	- 70	1,990	85	1,975	" ", gravel	", iron		D, S	" " " ".
26	NE.	23	"	"	"	"	48	2,025	- 37	1,988	48	1,977	" drift	"		D	Insufficient; for house only.
27	SE.	24	"	"	"	"	16	2,030			16	2,014	" "	"		D, S	Sufficient for local needs.
28	SW.	24	"	"	"	"	24	2,040	- 8	2,032	24	2,016	" "	"		D, S	" " 15 head stock.
29	SE.	26	"	"	"	"	90	1,995			90	1,905	" sand	", iron		D, S	" " 25 " ".
30	SW.	26	"	"	"	"	26	1,975	- 9	1,966	26	1,949	" drift	" "		D, S	" " local needs.
31	NW.	28	"	"	"	"	95	1,945	- 15	1,930	95	1,850	" drift	", "alkaline"		D, S	" " 20 head stock.
32	NW.	30	"	"	"	Dug	25	1,970	- 8	1,962	25	1,945	" drift	", iron		D, S	Insufficient.
33	NE.	30	"	"	"	"	10	1,970	- 8	1,962	10	1,960	" drift	"		D, S	Sufficient for 10 head stock.
34	SE.	32	"	"	"	Bored	35	1,940			35	1,905	" drift	" "		D, S	" " local needs.
35	NE.	32	"	"	"	"	29	1,850	- 18	1,832	29	1,821	" sand	"		D, S	" " " ".
36	NW.	34	"	"	"	"	70	1,900	- 30	1,870	70	1,830	" "	", "alkaline"		D, S	" " " ".
37	SE.	36	"	"	"	Drilled	185	1,900	- 60	1,840	185	1,715	" drift	"		D, S	" " 65 head stock.
1	NE.	1	32	1	3	Dug	20	2,020	- 17	2,003	20	2,000	" gravel	Soft		D, S	" " local needs.
2	NW.	1	"	"	"	"	19	2,030	- 18	2,012	19	2,011	" drift	Hard		D, S	" " " ".
3	NE.	2	"	"	"	"	39	2,050	- 30	2,020	39	2,011	" drift	", iron		S	Insufficient; only 20 head stock.
4	NW.	2	"	"	"	"										N	Three 150 foot dry holes.
5	SE.	2	"	"	"	Bored	74	2,045	- 71	1,974	74	1,971	" drift	" " "alkaline"		D, S	Insufficient for house and 10 head stock.
6	SW.	2	"	"	"	"	101	2,105	-100	2,005	101	2,004	" drift	Hard, iron		D	Insufficient; enough for house only.
8	SE.	4	"	"	"	"	30	2,100	- 20	2,080	30	2,070	" sand	"		D, S	Sufficient for local needs.
9	NW.	4	"	"	"	"	24	2,115	- 12	2,103	24	2,091	" drift	" "		D, S	" " 30 head stock.
9a	NE.	4	"	"	"	"	44	2,125	- 42	2,083	44	2,081	" drift	"		D, S	" " house and 4 head stock only.
10	NW.	5	"	"	"	"	65	2,145	- 55	2,090	65	2,080	" sand	" "		D, S	Sufficient for local needs.
12	NW.	7	"	"	"	"	25	2,120	- 3	2,117	25	2,095	" drift	"		D	Insufficient; not enough for house.
13	SE.	7	"	"	"	Dug	14	2,130	- 12	2,118	14	2,116	" drift	"		D, S	Sufficient for 40 head stock.
14	NE.	8	"	"	"	Bored	120	2,080			120	1,960	" sand	" "		D, S	" " 70 " ".

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of LOST RIVER, NO. 313, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE Elev.	PRINCIPAL WATER-BEARING BED Depth	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
16	SE.	10	32	1	3	Bored	15	2,075	- 14	2,061	15	2,060	Glacial sand	Fairly soft		D, S	Just sufficient for local needs.
17	SW.	10	"	"	"	"	118	2,110	-111	1,999	118	1,992	" drift	Hard, iron		D, S	Sufficient for local needs.
18	SW.	12	"	"	"	"	107	2,050	- 89	1,961	107	1,943	" drift	" " "alkaline"		S	" " stock only. #
19	NW.	12	"	"	"	"	71	2,000	- 29	1,971	71	1,929	" drift	Hard, iron		D, S	Insufficient; will water 65 head stock.
20	SE.	13	"	"	"	"	60	1,990	- 30	1,960	60	1,930	" drift	" "		D, S	Sufficient for 17 head stock.
21	NW.	13	"	"	"	"	48	1,950	- 28	1,922	48	1,902	" drift	" "		D, S	?
22	NE.	14	"	"	"	"	55	1,955	- 16	1,939	55	1,900	" sand	" "		D, S	" " local needs.
23	SE.	15	"	"	"	"	88	2,040			88	1,952	" gravel	" "		D, S	" " " " .
24	NW.	15	"	"	"	"		2,030					" "	"		D, S	" " 12 head stock.
25	NW.	16	"	"	"	"	60	2,040	- 30	2,010	60	1,980	" drift	Fairly soft		D, S	" " local needs.
26	SW.	19	"	"	"	"	52	2,040			52	1,988	" sand	Hard, iron		D, S	" " 40 head stock.
27	NW.	22	"	"	"	"	26	1,950			26	1,924	" drift	Fairly soft		D, S	" " local needs.
28	NE.	22	"	"	"	"	56	1,950	- 53	1,097	56	1,894	" drift	Hard, iron,		D, S	" " 30 head stock.
29	SW.	23	"	"	"	"	25	1,945	- 21	1,924	25	1,920	" drift	" "alkaline" "		D, S	" " 15 " " .
30	NW.	24	"	"	"	Dug	10	1,850	- 8	1,842	10	1,840	" drift	"		?	?
31	SE.	24	"	"	"	"	15	1,910	- 7	1,903	15	1,895	" drift	" iron		S	Insufficient for stock.
32	SW.	25	"	"	"		74	1,860	- 53	1,807	74	1,786	" drift	" " "alkaline"		S	Barely sufficient for stock.
34	NW.	28	"	"	"	Bored	45	1,955	- 43	1,913	45	1,910	" sand	"		D	Sufficient for 200 head stock.
35	SW.	28	"	"	"	Drilled	738	1,950	- 74	1,876	738	1,212	Bedrock sand	Soft		D, S, I	Large supply.
36	NE.	28	"	"	"	Dug	4	1,900	- 0	1,900			Glacial drift	Hard, iron			
37	SW.	30	"	"	"	Bored	27	1,955			27	1,928	" drift	" "		D, S	Sufficient for 11 head stock.
38	NE.	30	"	"	"	Drilled	198	1,930	- 40	1,890	198	1,732	" sand	" "		S	" " stock only.
39	SW.	32	"	"	"	"	71	1,930	- 60	1,870	71	1,859	" "	" "		D, S	" " local needs.
40	NE.	32	"	"	"	Bored	41	1,845	- 15	1,830	41	1,604	" gravel sand	" "		D, S	" " " " .
41	NE.	33	"	"	"	Dug	2	1,810	- 0	1,810	2	1,808	" drift	", "alkaline"		D, S	" " " " .
42	SE.	34	"	"	"	Bored	43	1,795	- 36	1,759	43	1,752	" drift	", iron		D, S	" " " " .
43	SW.	36	"	"	"	"	70	1,780	- 41	1,739	70	1,710	" drift	", "alkaline"		S	Not sufficient for stock.
44	NE.	36	"	"	"	"	51	1,760	- 43	1,717	51	1,709	" drift	", "		S	" " " " .
11	NW.	6	"	"	"	"	69	2,140	- 35	2,105	69	2,071	" drift	?		?	?

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.