CANADA
DEPARTMENT OF MINES

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BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF SARNIA No. 221 SASKATCHEWAN

BY

B. R. MacKay, H. N. Hainstock & J. A. Chalmers

Water Supply Paper No. 166

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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF SARNIA, O. 221 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 fine the approximate depth to a water-bearing horizon, be 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 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

The rural municipality of Sárnia, No. 221, comprises an area of approximately 340 square miles in the central part of southern Saskatchewan. It is bounded on the east by Last Mountain lake. The centre of the municipality is approximately 5 miles east and 40 miles north of the city of Moose Jaw. It consists of eight full townships described as tps. 22, 23, and 24, ranges 25 and 26, and tps. 22 and 23, range 24; and parts of three townships described as tp. 24, range 24, and tps. 22 and 23, range 23, all W. 2nd mer. The area is drained by Arm river, which crosses the southwestern corner of the municipality, and by numerous, small, intermittent creeks flowing into Last Mountain lake. The Saskatoon-Regina branch of the Canadian National railways crosses the southwestern corner of the municipality and the village of Chamberlain is located on this line. The Saskatoon-Regina branch of the Canadian Pacific railways runs through the centre of the municipality and the villages of Dilke, Holdfast, and Penzance are located on it.

With the exception of an area, approximately 4 miles by 12 miles, in the south-central part of the municipality and a small area in the southwestern corner, which are covered by moraine, the municipality is mantled by boulder clay or glacial till. The deposits of moraine and till consist of a few feet of loam top-soil, underlain by yellow boulder clay, which is underlain by blue boulder clay. The yellow and blue boulder clays contain scattered pockets of water-bearing sand and gravel.

Water-bearing Horizons in the Unconsolidated Deposits

No extensive water-bearing horizons occur in the glacial drift of this municipality, but in some areas small, local aquifers serve as a source of supply for two or three wells.

Water is obtained in the glacial drift at three general levels. Wells sunk to a maximum depth of 35 feet have encountered sand and gravel pockets located in the yellow boulder clay or weathered part of the drift, or at its contact with the underlying blue boulder clay. In an area in the vicinity of Holdfast the yellow clay appears to be absent and some of the wells are dug entirely in sand or gravel. The water in the shallow wells is seldom under any hydrostatic pressure. It ranges from soft to hard, and may be "alkaline". The water from most of the shallow wells, however, is suitable for household needs and stock. The supply from the wells varies, some yielding small, intermittent supplies, whereas others yield abundant supplies.

Wells ranging in depth from 30 to 93 feet obtain water from scattered pockets of sand and gravel encountered in the blue clay. The water in most of these wells is under hydrostatic pressure. It is hard and much of it is "alkaline", and may be unfit for domestic use, but is usually suitable for stock. The supply obtained from these wells varies considerably, but is usually somewhat better than that obtained from shallower wells.

A number of wells located in the north-central part of township 23, range 24, the northern part of township 22, range 24, and the central part of township 23, range 26, obtain water from an aquifer that may or may not be in the glacial drift. It appears probable that a pre-glacial valley extends through the central part of township 23, range 26, the southern part of township 23, range 25, and the northern part of township 22, range 24. The wells located in this area probably obtain water from sand beds lying at the contact of the glacial drift and the Marine Shale series. A pre-glacial valley may also be present in the northern part of township 23, range 24, as wells in this area appear to be drawing water from the contact zone,

although sunk to a lower elevation than nearby bedrock wells. The water obtained at this contact is hard and usually too salty to be used for drinking, but is usable for stock. The supply from this source is abundant, and the water is under considerable hydrostatic pressure, one well located in the SW.$\frac{1}{4}$, sec. 34, tp. 23, range 24, being flowing artesian in type.

Water-bearing Horizons in the Bedrock

Approximately one-fifth of the recorded wells in the municipality of Sarnia obtain water from the Bearpaw formation. The aquifers are not continuous throughout the area, but many wells undoubtedly obtain water from the same horizon. It appears that the pre-glacial land surface was dissected by numerous valleys that probably slope towards the valley now occupied by Last Mountain lake. This uneven, pre-glacial land surface probably accounts for the absence of aquifers in some localities. In general the aquifers in the bedrock may be grouped into three zones. The uppermost horizon is encountered at elevations ranging from 1,510 to 1,610 feet above sea-level; the second between 1,400 and 1,500 feet above sea-level; and the third between 1,240 and 1,395 feet above sea-level. Most of the bedrock wells yield soft water; much of the water has a "soda" taste, and some of it is slightly salty, but it is usable as a rule for domestic purposes and for stock. The water from many of the wells that tap the lowest zone is hard and too salty for domestic use, but is suitable for stock. The wells yield abundant supplies of water under hydrostatic pressure. An area is outlined on the accompanying maps in which the water is under sufficient pressure to flow above the ground surface. The flowing artesian wells are not all obtaining water from the same aquifer. The pressure probably results from increased elevation of the aquifers in the bedrock to the west. No trouble should be experienced in obtaining abundant supplies of water in the bedrock throughout this municipality.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 22, Range 23

Approximately one-half of this township, or that part lying to the west of Last Mountain lake, is included in the municipality of Sarnia. With the exception of parts of sections 5, 6, and 7, which are covered by moraine, this area is mantled by boulder clay or glacial till.

Water supplies are obtained from wells, springs, and Last Mountain lake. One well located on the NW.$\frac{1}{4}$, section 15, near the lake, is sunk to a depth of 12 feet to a gravel aquifer, probably of Recent origin. The water is soft, and suitable for domestic purposes, and the supply is sufficient for local needs. Wells sunk to depths of 15 to 30 feet on the uplands obtain water from scattered pockets of sand and gravel. Most of these wells have passed through 2 to 4 feet of soil, and 10 to 20 feet of sandy, yellow clay which in many places contains stones, before encountering the sand and gravel pockets at or near the contact of the yellow and blue boulder clays. The water is under little or no pressure, but the supply obtained is sufficient for 10 to 30 head of stock. The quality varies from moderately soft to hard, but the water is usable for domestic and stock purposes.

Wells 40 to 70 feet deep obtain water from sand and gravel pockets in the blue boulder clay. These aquifers are not continuous over large areas, as dry holes 60 feet in depth have been sunk quite close to producing wells in sections 4, 6, 8, and 15. However, two wells located in the SW.$\frac{1}{4}$ and NE.$\frac{1}{4}$, section 9, probably tap the same aquifer at an approximate elevation of 1,655 feet. The well in the SW.$\frac{1}{4}$ is at an elevation of 1,720 feet and the water rises to a point 45 feet below the surface. The well in the NE.$\frac{1}{4}$ is at an elevation of 1,670 feet and the water flows above the surface. Both wells yield a large supply

of soft water. The water from other wells ranges from soft to moderately hard, but that from the well in the SE.¼, section 31, is "alkaline" and not usable for domestic purposes. The remaining wells of this group yield water of good quality, suitable for domestic or stock raising purposes. The supply from two wells in the NE.¼, section 8, and the NW.¼, section 17, is insufficient for local needs and shallow wells are used to augment the supply, but the yields from the other wells are sufficient for local needs.

The water conditions in this township are on the whole very good. In those areas where there is a shortage of water it appears advisable to prospect the upper part of the drift in order to locate deposits of water-bearing sand and gravel. The largest supplies are obtained from wells 40 to 70 feet deep, but plentiful supplies may also be obtained within 30 feet of the surface. Dugouts and dams can be used to collect and retain surface water for stock use.

Township 22, Range 24

The southern half of this township is mantled by moraine. The surface is very uneven, and undrained depressions are common. A small lake immediately north of the village of Dilke becomes almost dry in drought seasons. The northern part of the township is covered by glacial till and the ground surface is gently rolling. The surface slopes from 1,800 feet above sea-level in the southwestern corner to 1,650 feet in the northeastern corner.

Wells sunk to a maximum depth of 40 feet in the upper part of the drift obtain water from pockets of sand and gravel. The aquifers do not appear to be continuous and the materials passed through vary considerably. Most of these wells, however, have passed through 10 to 25 feet of clay before encountering an

aquifer. Only one well, located in the NE.¼, section 33, yields water under hydrostatic pressure. The water is hard and "alkaline", and has a laxative effect on humans. The supply, however, is sufficient for local needs. The aquifer for this well is located in the upper part of the blue boulder clay. The aquifers of the other wells are located at various levels in the weathered or yellow boulder clay. Approximately one-half of these wells yield moderately soft water that is usually suitable for drinking. The supply is adequate for 10 to 25 head of stock.

Wells sunk to depths of 50 to 85 feet obtain water from scattered pockets of sand and gravel that occur in the blue boulder clay. The water is hard and that from a well in the SE.¼, section 2, is too "alkaline" for domestic use. The water from the other wells of this group is suitable for domestic purposes and for stock. The supply obtained is fairly abundant.

Two wells located in the NE.¼, section 31, and the NE.¼, section 32, obtain soft water from what is believed to be the Marine Shale series at depths of 104 and 85 feet, respectively. The water from the well in section 31, has a "soda" taste, whereas that from the well in section 32 is salty and contains iron. Another well, drilled to a similar elevation of 1,594 feet, in the NE.¼, section 28, yields hard, salty water having an oil-like scum. This well has probably not penetrated the Bearpaw formation, but the aquifer is undoubtedly quite near the contact. The two wells in sections 28 and 32 yield water that has a laxative effect on humans. None of these wells is usable for domestic purposes, but they are satisfactory for stock. The supply obtained is sufficient for local stock needs, but for domestic purposes shallow wells are used and water is hauled.

One well located in the SW.¼, section 26, is drilled to a depth of 400 feet and obtains water from a sand aquifer in the Marine Shale series. The water is hard and suitable for domestic use or for stock. The supply is sufficient for local needs.

The water conditions of this township are very good. Before sinking shallow wells it is advisable to locate the water-bearing deposits by means of a small test auger. It does not appear that there is a continuous water-bearing horizon in the bedrock, but local aquifers probably could be located in the upper part of the Marine Shale series, at a depth of 80 to 125 feet, in the northern part of the township. The water obtained, however, will probably be suitable only for stock.

Township 22, Range 25

The greater part of this township is mantled by moraine and the surface is characterized by hills and undrained depressions. Narrow strips along the north and west sides of the area are covered by glacial till and the ground surface is rolling. Arm river cuts through the moraine in sections 5 and 6, and exposes underlying boulder clay or glacial till. The supply of water in this township is obtained from wells, springs, and dugouts, and from Arm river.

A number of wells 40 feet or less deep obtain water from scattered pockets of sand and gravel. The water in these wells is not under hydrostatic pressure. Data as to the materials pierced are lacking, but it is probable that the aquifers are located in the yellow or weathered boulder clay of the drift, or at the contact of the yellow and blue boulder clays. Dry holes to a maximum depth of 80 feet have been sunk in sections 1, 6, 10, and 31, indicating the local distribution of the aquifers encountered in other wells. Approximately two-thirds of these shallow wells yield soft water that is suitable for domestic use

and for stock. Only one well, situated in the SE.¼, section 4, is reported as yielding "alkaline" water. The supply obtained from these wells varies with the nature and size of the aquifer tapped. Some wells yield only a very small supply and the farmer is forced to use dugouts or haul water, whereas others yield large supplies. For example, the well in the SW.¼, section 4, yields a very small supply and the wells in the NW.¼, section 14, the NE.¼, section 22, and the NW.¼, section 27, yield abundant supplies.

A number of wells tap aquifers at depths of 40 to 87 feet. The aquifers are not continuous, as dry holes have been sunk in the vicinity of producing wells. Information is lacking, but it appears that several of these wells tap water-bearing deposits in the blue boulder clay that underlies the yellow clay. The water is hard, and that from many of the wells is "alkaline", and under hydrostatic pressure. The water from two of these wells, situated in the west half of section 18, is too "alkaline" for domestic use. The supply from most of the wells is fairly abundant, but three wells situated in the SW.¼, section 14, the NW.¼, section 18, and the NE.¼, section 24, yield insufficient supplies.

One well located in the NE.¼, section 36, taps an aquifer of sand at an approximate elevation of 1,565 feet. This is at a lower elevation than other wells to the east that obtain water from the bedrock, but the quality of the water from this well appears to indicate that it is from the glacial drift. It is probable, however, that the aquifer is located near the contact of the drift and the Marine Shale series. The water is hard and "alkaline", and suitable only for stock. The supply is sufficient for local needs.

Two wells located in the SW.¼, section 2, and the SW.¼, section 31, tap aquifers located in the Marine Shale series at depths of 345 and 321 feet, respectively. Both wells yield large supplies of soft water under considerable hydrostatic pressure. The water from the well in section 2 is slightly salty.

A fair supply of water is obtained in this township. Testing to depths of 40 feet should locate aquifers in the weathered zone of the glacial drift. Should finances permit the drilling of wells into the bedrock, an abundant supply of water should be obtained.

Township 22, Range 26

Most of this township is mantled by glacial till or boulder clay and the ground surface is gently rolling. The area lying to the west of Arm river in the southwestern corner is mantled by moraine, and moraine also occurs in parts of sections 1, 2, and 12. The moraine-covered areas are characterized by prominent knolls and many undrained depressions. A small lake, locally called Chamberlain lake, occupies one of these depressions and extends from the municipality to the west in section 6.

Water supplies in this township are obtained chiefly from wells and sloughs. Shallow seepage wells yield the entire supply for some farms, but on others they are used as a standby. Some of these shallow wells are sunk beside sloughs and obtain water by direct seepage from the impounded surface water, but others encounter small pockets of sand or gravel quite close to the surface. Two wells of this type are located in the NW.¼, section 18, and the SW.¼, section 33, and are 6 and 14 feet deep. The water is hard, suitable for domestic use and for stock, and is not under pressure. The supply is sufficient for local needs. Similar water-bearing deposits should be located in other localities in the township.

At least ten wells encounter water in beds of sand or gravel at depths of 45 to 75 feet. No dry holes were recorded, but the water-bearing deposits are not thought to be continuous, as the quality and quantity of the water obtained varies greatly within short distances. Most of these wells yield large supplies of water and in five of them the water is under hydrostatic pressure. Only two of the recorded wells yield very small supplies of "alkaline" water that is unsuitable for domestic purposes. On these two farms water for domestic use is hauled, and stock are watered at sloughs.

Six wells in the northwestern corner of the township, drilled to depths of 300 to 400 feet, obtain water from the Marine Shale series. The nature of the aquifers is not known, and it is doubtful if the same aquifer is encountered by all the wells. The wells, with the exception of one located in the SW.$\frac{1}{4}$, section 20, yield soft water. The water from four wells is reported as having a "soda" taste, and that from two is too salty for domestic use. The yield from these wells is not abundant, but they are capable of supplying at least one tank of water a day.

The water conditions are very good in this township, but it appears that few wells will encounter large supplies at depths less than 50 feet. If capital is available, and large supplies of water are required, drilling to depth, especially in the northern half of the township, should encounter water-bearing deposits in the Marine Shale series within 400 feet of the surface.

Township 23, Range 23

Only that part of this township lying west of Last Mountain lake, comprising approximately 6$\frac{1}{2}$ square miles, is included in the municipality of Sarnia. The entire area is covered by glacial till or boulder clay. The surface elevation decreases from 1,660 feet above sea-level in the southwestern

corner to 1,606 feet at Last Mountain lake.

Wells in this part of the township do not exceed 40 feet in depth and obtain water from pockets of sand and gravel that occur near the contact of the weathered or yellow boulder clay, and the unweathered blue clay. These wells passed through 2 to 4 feet of soil, and 10 to 20 feet of sandy, yellow clay before encountering pockets of sand or gravel. The well in the NE.$\frac{1}{4}$, section 18, however, passed through 30 feet of sand after penetrating 10 feet of clay. The water from three wells is soft and drinkable, whereas that from others is so strongly "alkaline" that it is not suitable for domestic use, and water for household purposes must be hauled. The supply from most wells is sufficient for local needs, but in the SW.$\frac{1}{4}$, section 5, and the SW.$\frac{1}{4}$, section 18, it is necessary to use more than one well to obtain sufficient water for local needs.

No wells have been sunk into the bedrock in this township, but it is probable that water-bearing horizons could be located at depth.

Township 23, Range 24

This township is mantled by glacial till or boulder clay and the ground surface is gently rolling. The elevation decreases from 1,750 feet in the southwestern corner to 1,606 feet above sea-level at the lake. Few ravines occur in the township and hence small lakes, sloughs, and marshy lowlands are numerous, especially in the northern and northeastern parts of the area. Last Mountain lake covers the eastern parts of sections 25 and 36.

A number of wells sunk to depths of 8 to 25 feet obtain water from lenses of sand and gravel located in the weathered part of the drift. The aquifers encountered are of small areal extent, the largest probably not exceeding one

square mile in area. Four wells located in sections 10, 14, and 15 may tap the same aquifer of gravel at an approximate elevation of 1,635 feet above sea-level. These four wells, with the exception of that in the NE.$\frac{1}{4}$, section 10, yield a sufficient quantity of soft water for local needs. Three wells located in the SW.$\frac{1}{4}$, section 18, the NW.$\frac{1}{4}$, section 19, and the SE.$\frac{1}{4}$, section 26, also yield soft water, but the supply is not always sufficient for local needs. The water from the other wells that tap pockets of sand or gravel contains a considerable amount of mineral salts in solution, but it is rarely unsuitable for domestic use. A well in the SE.$\frac{1}{4}$, section 11, 20 feet deep, is reported to yield sufficient water for 75 head of stock. The water in the well in the SE.$\frac{1}{4}$, section 12, is under slight hydrostatic pressure, but the other wells are non-artesian.

Four wells have been sunk to depths of 40 to 67 feet and obtain water from pockets of sand and gravel. Two of these wells, in the SW.$\frac{1}{4}$, section 4, and the SW.$\frac{1}{4}$, section 32, yield water that is unsuitable for domestic use. The water in the wells in sections 4, 24, and 28 is under hydrostatic pressure. These wells yield a large supply of water, whereas the well in section 32 yields a small supply of "alkaline" water that is not under pressure.

Seven wells located in the north-central part of the township obtain water from aquifers 120 to 190 feet below the surface. It appears that two fairly continuous aquifers occur within this range of depth. The uppermost horizon yields hard, "alkaline" water from the glacial drift, whereas the deeper wells tap an aquifer located at the contact of the glacial drift and the Marine Shale series. The water from the lower horizon is salty and appears to be a mixture of waters from the bedrock and the glacial drift. Common salt is present in sufficient quantities to render the water undesirable for domestic use. The water from

the upper horizon, although not salty, is highly mineralized and is also unfit for drinking. The water is under strong hydrostatic pressure, rising to a point 20 feet below the surface in the well in the SE.$\frac{1}{4}$, section 28, and 12 feet above the surface in the well in the SW.$\frac{1}{4}$, section 34. These wells all yield abundant supplies of water for stock. Water for domestic use is hauled or obtained from shallow seepage wells.

A number of wells obtain water from the Marine Shale series. The surface of the bedrock appears to be very uneven, and wells appear to tap aquifers in it at three general levels. The uppermost aquifer was encountered in a 90-foot well in the NE.$\frac{1}{4}$, section 18, at an elevation of 1,600 feet. The water is soft, has a soda taste, and is too salty for domestic use. It is not under pressure, but the supply is sufficient for local needs. The second aquifer is encountered at elevations of 1,470 to 1,520 feet above sea-level. The aquifer is fairly continuous and is tapped in sections 20, 25, 31, 32, and 36, but a well sunk to a depth of 225 feet in the SW.$\frac{1}{4}$, section 32, failed to obtain water. Most of these wells yield soft, salty water that has a "soda" taste, and is undesirable for domestic use. This horizon may be encountered at other localities. The third bedrock aquifer is tapped by a 300-foot well in the NW.$\frac{1}{4}$, section 23, at an approximate elevation of 1,320 feet. The water is soft, has a "soda" taste, and is undesirable but not harmful for drinking. The hydrostatic pressure is sufficient to cause the water to rise 12 feet above the surface. This well flows 24 barrels of water a day.

The water conditions in this township are very good, but extensive prospecting is usually done before an adequate supply of water is located in the upper part of the drift. Water obtained at shallow depth is usually of good quality and is the only water that is suitable for domestic use. Abundant water for

stock use should be obtained at depths of approximately 200 feet in the northern part of the township.

Township 23, Range 25

This township is mantled throughout with glacial till or boulder clay. The surface is gently rolling and becomes quite flat in the central part of the area. Water conditions are very good over most of the township, but some difficulty has been experienced in obtaining water at shallow depths in the central and northern parts of the area. In the southern part of the township a number of wells tap gravel aquifers that underlie 1 to 3 feet of top soil and 15 to 20 feet of yellow clay. In the central part of the township, and especially in the vicinity of Holdfast, the yellow clay appears to be absent and the wells are dug into blue boulder clay; a well located in the NE.$\frac{1}{4}$, section 16, derives water from sand that underlies 3 feet of loam and 14 feet of blue boulder clay. In the northern part of the township the blue boulder clay is in many places covered by gravel or sand. The pockets of sand and gravel that occur in the upper 30 feet of the drift are not thought to form continuous aquifers over widespread areas, as several dry holes have been sunk in the SE.$\frac{1}{4}$, section 16, to a depth of 25 feet. The water in the shallow wells is not under pressure, and it varies from moderately soft to hard and "alkaline". A 30-foot well in the SW.$\frac{1}{4}$, section 30, yields water that is too "alkaline" for domestic use, a 14-foot well being used for household needs. The supply obtained from these wells varies considerably. A 16-foot well in the NE.$\frac{1}{4}$, section 25, yields sufficient water for 60 head of stock, whereas a 12-foot well on the NW.$\frac{1}{4}$, section 12, waters only 10 head of stock. Most of the wells, however, yield sufficient water to meet local requirements.

A number of wells ranging in depth from 30 to 90 feet obtain water from pockets of sand and gravel that occur in the blue boulder clay. The water in these wells is under hydrostatic pressure and rises to points 10 to 30 feet below the surface. The water from approximately one-half these wells is too highly mineralized to be usable for domestic purposes, and that from a 70-foot well located in the NW.¼, section 15, is not usable for stock. Several of these wells yield sufficient water to meet local needs, but few yield abundant supplies.

A well situated in the NW.¼, section 15, sunk to a depth of 205 feet, encounters a sand aquifer that is thought to occur near the contact of the glacial drift and the Marine Shale series. The water is too salty for use and the supply is not abundant. Five wells have tapped sand aquifers at elevations ranging from 1,411 to 1,469 feet above sea-level, or at depths of 221 to 370 feet. In at least four of these wells the aquifer is located in the bedrock. The water is soft, salty, and has a "soda" taste. One well located in the NW.¼, section 6, is reported as yielding hard water and the aquifer may be near the contact of the glacial drift and the Marine Shale series. The water from this well is salty and has a "soda" taste. The supply from these deep wells is abundant, but the water is not suitable for domestic purposes. The bedrock should yield abundant supplies of water that would be satisfactory for stock. Little trouble should be experienced in obtaining a sufficient supply of water for local needs in this township.

Township 23, Range 26

This township is mantled by glacial till or boulder clay. The ground surface is rolling, and the elevation decreases from 1,875 feet in the southwestern corner to approximately 1,760 feet in the northeastern corner.

A number of wells ranging in depth from 47 to 93 feet obtain water from scattered pockets of sand and gravel in the boulder clay. Most of these wells pass through 1 to 3 feet of loam, 20 to 40 feet of yellow boulder clay, and obtain water from sand or gravel near the contact of the yellow and blue boulder clay, or at some distance within the blue boulder clay. Water obtained from pockets encountered in the blue boulder clay is in many cases under pressure. The water from these wells is hard, but is usually quite suitable for domestic use. Most of the wells yield a sufficient supply of water, but wells in the NW.$\frac{1}{4}$, section 20, and the NE.$\frac{1}{4}$, section 24, yield insufficient supplies. The aquifers do not appear to be continuous as several dry holes have been sunk to depths of 75 feet.

One well situated in the SE.$\frac{1}{4}$, section 28, obtains water from a depth of 250 feet. It is not definitely known if the aquifer of this well occurs in bedrock or glacial drift, but the quality of the water would appear to indicate that the aquifer is in the glacial drift. The water is hard and unsuitable for domestic use, but it is suitable for stock and the supply is abundant.

Eight wells ranging from 300 to 400 feet deep tap a fairly continuous aquifer in the bedrock at an approximate elevation of 1,475 feet above sea-level. The bedrock surface appears to be very uneven in this township and it is probable that some of these wells may be deriving water from the drift. Three wells located in the SE.$\frac{1}{4}$, section 17, although undoubtedly tapping an aquifer in the upper part of the bedrock, may also be deriving water from the glacial drift. The water is hard and only that from the well in section 17 is suitable for domestic use. The remainder of the wells yield soft water that tastes of "soda", and that from some of them is slightly salty, but it

is usable as a rule for domestic purposes and for stock. All of these wells yield an abundant supply of water that is under strong hydrostatic pressure.

Two wells drilled to depths of 417 and 490 feet in the NE.¼, section 26, and the [illegible] ¼, section 23, failed to encounter water at an elevation of 1,475 feet, but obtain moderate supplies of water at an elevation of approximately 1,360 feet. The water is soft, contains iron, and has a "soda" taste, and that from the well in section 26 is slightly salty.

Little trouble should be experienced in obtaining an abundant supply of water at depth in this township. If water cannot be located at shallow depth, and finances do not permit of drilling deep wells, surface water could be collected and retained in dugouts for stock use.

Township 24, Range 24

That part of this township that lies to the west of Last Mountain lake, totalling 23 square miles, occurs within the municipality of Sarnia. This part of the township is covered by glacial till or boulder clay. The surface slopes from an elevation of 1,680 feet in the southwestern corner to 1,608 feet at Last Mountain lake. The area is poorly drained, and marshy lowlands and undrained depressions are common.

A number of wells obtain water from scattered pockets of sand and gravel within the upper 20 feet of the drift. The pockets do not form a continuous horizon and dry holes have been sunk on sections 15 and 21 to a maximum depth of 82 feet. The quality of water obtained from the shallow wells ranges from soft to hard, and that from some wells is "alkaline", and too highly mineralized to be used for drinking. Only one well, located in the NW.¼, section 6, yields a sufficient supply of water to meet local requirements, and this well only supplies 10 head of stock.

Farmers owning shallow wells are forced to supplement the supply by using Last Mountain Lake, or by hauling water from deeper wells.

A few wells from 35 to 60 feet deep tap scattered pockets of sand and gravel that usually occur within the blue boulder clay. The water is in many places under slight hydrostatic and the supply is more abundant than that from the shallower wells. A 50-foot well located in the SW.$\frac{1}{4}$, section 2, does not yield sufficient water for local needs, and the water is not suitable for domestic use. The water from the rest of the wells of this group is suitable for domestic purposes and for stock. In some areas the supply is supplemented by using shallow seepage wells and by hauling from Last Mountain lake.

An aquifer is encountered at an elevation of 1,460 feet in the SE.$\frac{1}{4}$, section 32, and although information is lacking as to its continuity it is believed to form a fairly continuous water-bearing horizon throughout the township at elevations ranging from 1,420 to 1,460 feet above sea-level, or at depths of 190 to 290 feet. A well in the SW.$\frac{1}{4}$, section 6, apparently did not locate an aquifer at this level, as it derives an insufficient supply at an elevation of 1,390 feet. Some of the wells may tap aquifers at the contact of the drift and bedrock, but most of them are thought to be obtaining their supplies from aquifers in the Marine Shale series. Three wells situated in the SE.$\frac{1}{4}$, and NE.$\frac{1}{4}$, section 4, and the NE.$\frac{1}{4}$, section 19, yield hard water. That from the wells in the NE.$\frac{1}{4}$, section 4, and the NE.$\frac{1}{4}$, section 19, is too salty for drinking, and shallow dug wells are used for household needs. Sufficient water is obtained from each of the three wells to meet local requirements. The other wells drilled to these elevations yield large supplies of soft, salty water that is unsuitable for drinking but satisfactory for stock. The water from some of the wells has a

slight "soda" taste, and that from a well in the SE.¼, section 32, is reported to contain iron. The water is under strong pressure; one well in the SE.¼, section 7, is flowing artesian, the water rising 1 foot above the ground surface.

An abundant supply of water is not to be expected from the upper part of the drift in this township. Drilled wells should obtain abundant supplies of water from the bedrock or lower part of the drift at an approximate depth of 200 feet. The water will probably not be usable for drinking, but it will be satisfactory for stock

Township 24, Range 25

This township is mantled by glacial till or boulder clay. The surface is gently undulating, but in some sections it is dissected by a few intermittent creeks. The surface slopes from an elevation of 1,750 feet along the western boundary of the township to approximately 1,625 feet in the northeastern corner of the township.

Scattered pockets of sand and gravel occurring in the weathered zone of the drift supply water to a number of shallow wells, none of which is more than 21 feet deep. The water is not under pressure, and varies considerably in the amount of mineral salts contained in solution, but only that from one well, located in the SE.¼, section 30, is unfit for domestic use. The supply obtained from those wells is usually sufficient for 15 to 30 head of stock. Springs are also used as a source of supply in sections 30 and 33. This water-bearing horizon is not continuous throughout the township, as dry holes have been sunk to a maximum depth of 80 feet in sections 6, 13, 20, and 30.

Two wells located in the SE.¼, section 5, and the SE.¼, section 12, sunk to depths of 38 and 50 feet respectively, pass

through the upper or weathered portion of the drift, and obtain water under pressure from pockets of sand in the blue boulder clay. The water is hard and that from the well in section 12 is slightly "alkaline", but is used for domestic purposes and for stock. The supply is not abundant, but is sufficient for local needs.

Wells drilled into the Marine Shale series appear to be obtaining water from three general levels. One well located in the SW.$\frac{1}{4}$, section 8, taps an aquifer at an approximate elevation of 1,540 feet above sea-level, or at a depth of 200 feet. The water is soft, has a "soda" taste, but is usable for domestic purposes and for stock. This aquifer is not encountered elsewhere in the township. The second water-bearing horizon is pierced at elevations ranging from 1,415 to 1,499 feet, or at depths of 208 to 316 feet. The water is under considerable pressure, and in wells located in sections 14, 30, 31, and 32 the water rises a short distance above the surface. The water is soft and has a "soda" taste, but that from wells located in sections 26 and 36 is salty. These wells yield an abundant supply of water suitable for stock, but the wells yielding salty water are not used for domestic purposes. The extent of this aquifer is not known, but it appears to be discontinuous as many wells sunk to this level failed to obtain water. A number of wells obtain water at elevations of 1,392 to 1,240 feet above sea-level, or at depths of 308 to 400 feet. Four of these wells yield an abundant supply of soft water. The water has a "soda" taste, but is used for domestic purposes and for stock. It is under strong hydrostatic pressure and in three wells located in the NE.$\frac{1}{4}$, section 8, the SW.$\frac{1}{4}$, section 14, the SW.$\frac{1}{4}$, section 17, the SE.$\frac{1}{4}$, section 22, and the SW.$\frac{1}{4}$, section 27, it rises above the surface. The remainder of the wells of this group yield hard water. The water contains common salt in varying amounts and only that from

the well located in the SE.¼, section 22, is usable for domestic purposes. The water from this well has a "soda" taste and has a slight laxative effect on humans. The water from the well in the SW.¼, section 27, is so salty that it is unfit for stock. Fairly abundant supplies of water suitable for stock use should be obtained throughout the township at depths of 400 feet or less. Where finances do not permit the drilling of deep wells, and adequate supplies cannot be obtained from the upper part of the glacial drift, dugouts could be excavated to retain surface water for stock use. These artificial reservoirs should be located so as to collect the maximum amount of surface water, and should be at least 12 feet deep.

Township 24, Range 26

This township is mantled by glacial till or boulder clay. The surface slopes from an elevation of 1,875 feet along the western boundary of the township to an elevation of 1,700 feet at the eastern boundary.

Wells sunk to depths of 10 to 40 feet obtain water from scattered pockets of sand and gravel. These wells pass through 1 to 3 feet of soil, 10 to 30 feet of yellow boulder clay, and obtain water in sand or gravel pockets encountered at or near the contact of the yellow and blue boulder clays. The water varies from soft to hard and is quite suitable for domestic use and for stock. The supply obtained is quite small, rarely exceeding two barrels a day, and one well in the SE.¼, section 30, becomes dry in drought periods.

A number of wells from 42 to 93 feet deep obtain a better supply of water from pockets of sand and gravel encountered in the blue boulder clay. The water is under pressure and is hard, but in some cases it is too "alkaline" for domestic use. It is usable for stock. Some of these wells yield abundant supplies of

water and have never been pumped dry, and all of them are reported to yield sufficient water for local needs.

One well located in the SE.¼, section 35, drilled to a depth of 127 feet, obtains a fairly abundant supply of soft water under hydrostatic pressure. It is not known if the aquifer is in the glacial drift or in the bedrock. A number of wells from 240 to 409 feet deep have encountered aquifers in the Marine Shale series at elevations ranging from 1,421 to 1,525 feet above sea-level. The aquifers do not appear to be continuous over large areas. The water is under hydrostatic pressure, but does not rise above the surface. It is soft and has a "soda" taste, but is usable for domestic needs and for stock.

Wells sunk to depths of 375 to 560 feet also obtain abundant supplies of water from a sand aquifer in the bedrock. Little is known as to the continuity of this aquifer, but it appears to be encountered at elevations ranging from 1,380 to 1,285 feet above sea-level throughout much of the township. The water is under pressure and rises to points 22 to 100 feet below the surface. It is soft, tastes of soda, but is usable for domestic purposes and for stock.

The supply of water obtained in this township is fairly abundant. Suitable water for domestic purposes can be obtained from the upper part of the drift, and an abundant supply of water for stock use can be obtained from the Marine Shale series.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF SARNIA, No. 221, SASKATCHEWAN

Township	22	22	22	22	23	23	23	23	24	24	24	Total No. in municipality
West of 2nd meridian Range	23	24	25	26	23	24	25	26	24	25	26	
Total No. of Wells in Township	33	47	65	22	9	48	64	26	31	52	40	437
No. of wells in bedrock	0	3	2	7	0	8	5	10	11	21	17	84
No. of wells in glacial drift	31	44	63	15	9	40	59	16	20	31	23	351
No. of wells in alluvium	2	0	0	0	0	0	0	0	0	0	0	2
Permanency of Water Supply												
No. with permanent supply	29	44	51	21	9	43	61	23	29	48	38	396
No. with intermittent supply	0	0	0	1	0	0	0	1	0	0	1	3
No. dry holes	4	3	14	0	0	5	3	2	2	4	1	38
Types of Wells												
No. of flowing artesian wells	1	0	0	0	0	2	0	0	1	11	0	15
No. of non-flowing artesian wells	0	7	14	14	0	15	22	17	13	12	32	152
No. of non-artesian wells	22	37	37	8	9	26	39	7	15	25	7	232
Quality of Water												
No. with hard water	18	34	42	15	6	29	48	17	19	27	18	273
No. with soft water	11	10	9	7	3	14	13	7	10	21	21	126
No. with salty water	0	2	1	2	0	6	4	3	11	0	0	35
No. with "alkaline" water	2	0	14	6	3	16	16	5	5	6	9	88
Depths of Wells												
No. from 0 to 50 feet deep	24	32	36	8	9	28	48	4	17	30	12	248
No. from 51 to 100 feet deep	9	12	26	7	0	5	10	11	3	1	10	94
No. from 101 to 150 feet deep	0	3	0	0	0	8	6	0	0	0	1	18
No. from 151 to 200 feet deep	0	0	1	0	0	5	0	0	7	6	0	19
No. from 201 to 500 feet deep	0	0	2	7	0	2	0	11	4	15	17	58
No. from 501 to 1,000 feet deep	0	0	0	0	0	0	0	0	0	0	0	0
No. over 1,000 feet deep	0	0	0	0	0	0	2	0	0	0	0	2
How the Water is Used												
No. usable for domestic purposes	27	37	40	19	5	27	48	19	16	30	35	309
No. not usable for domestic purposes	2	7	11	3	4	10	13	5	13	12	4	90
No. usable for stock	29	44	51	22	9	43	59	24	29	48	39	397
No. not usable for stock	0	0	0	0	0	0	2	0	0	0	0	2
Sufficiency of Water Supply												
No. sufficient for domestic needs	29	44	51	21	9	43	61	23	29	48	38	396
No. insufficient for domestic needs	0	0	0	1	0	0	0	1	0	0	1	3
No. sufficient for stock needs	22	34	30	16	4	26	33	19	15	37	34	270
No. insufficient for stock needs	7	10	21	6	5	17	28	5	14	11	5	129

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 Sarnia, No. 221, 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	$CaCl_2$	
1	NW.	17	22	23	2nd	56	1,249												(2)		(3)	(4)	(1)	(5)		x1
2	SE.	8	22	26	2nd	45	2,079												(2)		(3)	(4)	(1)	(5)		x1
3	NW.	21	23	24	2nd	126	6,380	1,050	950	100	944	260	60	198	3,130	2,524	6,343	260	36		590		00	1,557		
4	SW.	30	23	26	2nd	73	3,666											(4)	(1)		(2)		(3)		(5)	x1
5	NE.	8	24	25	2nd	308	1,960	35	Not	det'd	726	430	30	11	250	1,013	2,013	54		23		370	370	1,196		x2
6	SW.	32	24	25	2nd	208	2,740	45	Not	det'd	793	275	20	22	886	1,378	2,897	36		46		195	1,312	1,308		x2
7	SE.	2	24	26	2nd	360	1,800	25	Not	det'd	502	500	20	7	287	894	1,778	36		15		474	425	828		x2
8	NE.	16	24	26	2nd	370	2,500															(3)	(1)	(2)		x2

Water samples indicated thus, x1, are from glacial drift.
Water samples indicated thus, x2, are from bedrock, Marine Shale series.
Analyses are reported in parts per million; where numbers (1), (2), (3), (4), and (5) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
Analyses Nos. 1, 2, and 4, by Provincial Analyst, Regina; Analyses No. 8, by University of Saskatchewan.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

Three samples of water from the glacial drift were analysed and the results are listed in the accompanying table. They are from wells 45, 56, and 73 feet deep. The total dissolved solid content varies from 1,349 to 3,666 parts per million, and the individual mineral salts contained in solution are sodium sulphate, magnesium sulphate, calcium sulphate, sodium carbonate, and sodium chloride, their abundance decreasing in the order given. These waters are suitable for stock, but may have a slight laxative effect upon those not accustomed to the use of highly mineralized water. These samples should be representative of the type of water obtained at that depth in the glacial drift.

The water from shallower wells that tap fairly large pockets of sand and gravel in the yellow boulder clay should not contain as large an amount of mineral salts in solution. It should be found suitable for all farm needs.

Sample 3, taken from a 126-foot well, appears to be a mixture of water from the drift and bedrock. It has a total dissolved solid content of 6,380 parts per million. It contains large amounts of Glauber's salt and common salt. It is unfit for domestic use and may produce scour among stock.

Water from the Bedrock

Four samples of water from the Bearpaw formation were analysed. The water contains a total dissolved solid content of 1,800 to 2,740 parts per million. Common salt is the predominant mineral salt present, with sodium sulphate and sodium carbonate next in abundance. The water is very soft. It generally has a salty and "soda" taste, and although it does not have any injurious effects on the human system if used for drinking, it is rarely used

for domestic needs. The water from the well in the SW.¼, sec. 27, tp. 24, range 25, is too salty to be used even for stock. It will not be satisfactory for irrigation due to its relatively large content of sodium carbonate or "black alkali". Some of the bedrock wells yield hard, salty water.

WELL RECORDS—Rural Municipality of SARNIA, NO. 221, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	NE.	3	22	23	2	Dug	14	1,670	- 9	1,661	9	1,661	Glacial drift	Hard, clear	40	D, S	Insufficient for local needs; also uses lake.
2	NE.	4	"	"	"	Dug	10	1,725					Glacial drift				Good supply.
3	NW.	4	"	"	"	Dug	16	1,730	- 12	1,718	12	1,718	Glacial sand	Soft, clear	42	D, S	Sufficient for local needs.
4	SW.	4	"	"	"	Bored	56	1,740	- 54	1,686	54	1,686	Glacial sand	Soft, clear	40	D, S	Sufficient for 40 head stock; also a 60-foot dry hole.
5	NE.	6	"	"	"	Bored	43	1,755	- 35	1,720	35	1,720	Glacial drift	Hard, clear	42	D, S	Sufficient for 20 head stock; also a 20-foot seepage well.
6	NW.	6	"	"	"	Bored	65	1,760	- 32	1,728	32	1,728	Glacial sand	Soft, clear	40	D, S	Oversufficient for 40 head stock; other dry holes.
7	NW.	8	"	"	"	Dug	20	1,725	- 16	1,709	16	1,709	Glacial gravel	Soft, clear	40	D, S	Sufficient for 20 head stock; other dry holes.
8	NE.	8	"	"	"	Bored	70	1,710	- 62	1,648	62	1,648	Glacial silt	Hard, clear, iron	42	D, S	Insufficient for 10 head stock.
9	SW.	9	"	"	"	Bored	65	1,720	- 45	1,675	65	1,655	Glacial gravel	Soft, clear	42	D, S	Sufficient for 15 head stock; several shallow wells in ravine.
10	NE.	9	"	"	"	Spring	18	1,670					Glacial sand	Soft, clear		D, S	Oversufficient for local needs.
11	NE.	15	"	"	"	Dug	12	1,660	- 8	1,652	8	1,652	Recent gravel	Soft, clear		D, S	Sufficient for local needs; also a 40-foot dry hole.
12	SE.	15	"	"	"	Spring		1,645					Recent deposits				Good supply.
13	NE.	16	"	"	"	Bored	60	1,680	- 30	1,650	60	1,620	Glacial gravel	Soft, clear	41	D, S	Sufficient for 65 head stock.
14	SE.	16	"	"	"	Bored	65	1,660	- 45	1,615	65	1,595	Glacial drift	Hard, clear	40	D, S	Good supply; farm vacant.
15	NW.	17	"	"	"	Bored	56	1,720	- 40	1,680	56	1,664	Glacial sand	Hard, iron, cloudy		D, S	Insufficient for local needs; also two 80-foot wells in ravine; #.
16	NW.	18	"	"	"	Dug	30	1,700	- 26	1,674	26	1,674	Glacial sand and gravel	Hard, clear, "alkaline"	43	D, S	Almost sufficient for local needs.
17	NW.	18	"	"	"	Dug	15	1,700	- 7	1,693	7	1,693	Glacial sand	Soft, clear	45	D, S	Oversufficient for local needs.
18	NW.	20	"	"	"	Dug	24	1,620	- 20	1,600	20	1,600	Glacial gravel	Soft, clear	40	D, S	Oversufficient for local needs; also a 50-foot well not used.
19	SE.	21	"	"	"	Spring		1,650					Glacial drift	Hard		D, S	Good supply.
20	NE.	30	"	"	"	Bored	51	1,648	- 39	1,609	51	1,597	Glacial sand	Hard, clear	40	D, S	Sufficient for 50 head stock; also was a 20-foot well, filled in.
21	NW.	30	"	"	"		15	1,650					Glacial drift				Good supply located in ravine.
22	SE.	31	"	"	"	Bored	50	1,640	- 20	1,620	50	1,590	Glacial sand	Hard, clear, "alkaline"	40	S	Oversufficient for 50 head stock; also a 15-foot seepage well for house use.
23	SW.	32	"	"	"	Dug	18	1,640	- 10	1,630			Glacial gravel	Soft, clear	40	D, S	Oversufficient for 12 head stock.
1	SE.	2	22	24	2	Bored	35	1,760	- 31	1,679	31	1,679	Glacial drift	Hard, clear, "alkaline", sulphur		S.	Sufficient for 6 head stock; also an 18-foot well for house use.
2	SE.	3	"	"	"	Dug	35	1,775	- 32	1,743	32	1,743	Glacial drift	Soft, clear, iron	44	D, S	
3	SW.	3	"	"	"	Bored	57	1,780	- 43	1,737	57	1,723	Glacial sandy clay	Hard, clear	42	D, S	Oversufficient for 30 head stock.

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

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

WELL RECORDS—Rural Municipality of SARNIA, NO. 221, 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	22	24	2	Dug	25	1,775	- 12	1,763			Glacial drift	Soft, clear	42	D, S	Sufficient for 8 head stock.
5	SW.	5	"	"	"	Dug	25	1,800	- 10	1,790	10	1,790	Glacial gravel	Soft, clear	41	D, S	Sufficient for local needs; also two similar wells.
6	NW.	7	"	"	"	Bored	18	1,800	- 12	1,788			Glacial sand	Hard, clear	42	D, S	Sufficient for 30 head stock.
7	SE.	7	"	"	"	Dug	14	1,790	- 9	1,781	9	1,781	Glacial gravel	Hard, clear, iron	40	D, S	
8	NE.	9	"	"	"	Bored	35	1,750	- 32	1,727	32	1,723	Glacial sand	Soft, clear	42	D, S	Sufficient for 9 head stock.
9	SE.	9	"	"	"	Bored	55	1,770	- 52	1,718	52	1,718	Glacial drift	Hard, clear		D, S	Sufficient for local needs.
10	NW.	12	"	"	"	Dug	32	1,750	- 28	1,722	28	1,722	Glacial sand	Soft, clear, iron	42	D, S	Abundant supply; spring in pasture.
11	SE.	14	"	"	"	Dug	15	1,725	- 9	1,716			Glacial drift	Hard, clear	41	D, S	Oversufficient for 20 head stock.
12	SW.	15	"	"	"	Bored	60	1,750	- 57	1,693	57	1,693	Glacial sand	Hard, clear, iron	40	D, S	Supplies village of Dilke; three other wells in town and deep dry holes.
13	SE.	17	"	"	"	Bored	54	1,750	- 46	1,704	46	1,704	Glacial gravel	Hard, clear, iron, "alkaline"	43	D, S	Insufficient for local needs; also seepage well by dam. Two dry holes 60 to 80 feet deep.
14	NW.	17	"	"	"	Dug	34	1,750	- 27	1,723	27	1,723	Glacial sandy clay	Hard, clear, "alkaline"	42	D, S	Sufficient for local needs.
15	NW.	18	"	"	"	Bored	36	1,800	- 20	1,780			Glacial sand	Soft, clear, iron	44	D, S	Sufficient for local needs; also three wells 14 to 18 feet deep; good supply.
16	SW.	21	"	"	"	Dug	12	1,750	- 6	1,744	6	1,744	Glacial sand	Soft, iron	43	S	Sufficient for 26 head stock; also a 60-foot well; haul drinking water.
17	SW.	23	"	"	"	Dug	19	1,750	- 17	1,733	17	1,733	Glacial gravel	Soft, clear	40	D, S	Sufficient for local needs; several holes to 50 feet in depth.
18	SE.	24	"	"	"	Bored	60	1,695	- 58	1,637	58	1,637	Glacial sand	Hard, clear, "alkaline", iron	42	D, S	Abundant supply.
19	SW.	25	"	"	"	Dug	22	1,700	- 20	1,680	20	1,680	Glacial sand	Hard, clear		D, S	Suffidient for local needs; also a 16-foot well not used.
20	SW.	26	"	"	"	Drilled	400	1,725	-340	1,385	400	1,325	Marine Shale series sand	Hard, clear,	41	D, S	Sufficient for local needs; also a 90-foot well with fair supply.
21	NE.	27	"	"	"	Bored	50	1,700	- 38	1,662			Glacial sand	Hard, clear, iron	43	D, S	Sufficient for local needs.
22	NE.	28	"	"	"	Drilled	106	1,700	- 40	1,660	106	1,594	Glacial? sand	Hard, cloudy, "alkaline", salt, oil	43	S	Sufficient for 20 head stock; haul drinking water.
23	SW.	30	"	"	"	Bored	35	1,750	- 27	1,723			Glacial gravel	Hard, clear, iron, "alkaline"	42	D, S	Sufficient for 25 head stock.
24	NE.	31	"	"	"	Bored	104	1,690	- 34	1,656	104	1,586	Marine shale?	Soft, clear, soda	42	S	Another well is used for drinking.
25	NE.	32	"	"	"	Drilled	85	1,680	- 10	1,670	85	1,595	Marine shale?	Soft, salty, iron, clear	42	S	Sufficient for local needs.
26	NE.	33	"	"	"	Bored	40	1,660	- 20	1,640	40	1,620	Glacial drift	Hard, iron, "alkaline", cloudy	41	S	Sufficient for 60 head stock.
27	SW.	34	"	"	"	Dug	22	1,660	- 20	1,640	20	1,640	Glacial sand	Hard, clear	44	D, S	Sufficient for 30 head stock.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of SARNIA, NO. 221, 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
28	SE.	34	22	24	2	Dug	15	1,690	- 8	1,682			Glacial gravel	Hard, clear, iron		D, S	Sufficient for 20 head stock; also a 15-foot well with poor supply.
29	NW.	35	"	"	"	Dug	11	1,695	- 7	1,688			Glacial sand	Hard, clear,	42	D, S	Sufficient for 21 head stock.
1	SW.	1	22	25	2	Bored	50	1,800									Dry hole; base in glacial drift. Also three dry holes 13 to 25 feet deep.
2	SW.	2	"	"	"	Drilled	345	1,800	-160	1,640	345	1,455	Marine Shale series sand	Soft, clear, salty		D, S	Sufficient for local needs; four holes 25 to 70 feet deep, small yield of seepage water.
3	SE.	4	"	"	"	Dug	30	1,800	- 25	1,775			Glacial sand	Hard, clear, "alkaline", iron	42	S	13-foot well used for house.
4	SW.	4	"	"	"	Dug	12	1,800	- 10	1,790	10	1,790	Glacial gravel	Soft, clear	44	D, S	Insufficient for local needs; also 15 dry holes in gravel; spring on Arm river.
5	SW.	6	"	"	"	Bored	34	1,850	- 39	1,811	64	1,786	Glacial drift	Hard, clear	42	D, S	Sufficient for 20 head stock; also uses water from Arm river.
6	NW.	6	"	"	"	Bored	60	1,800									Dry hole in glacial drift; also two other dry holes; seepage well for house.
7	SE.	10	"	"	"	Dug	30	1,800									Dry hole in glacial drift; several seepage wells; hauls water from Arm river and other wells.
8	NW.	10	"	"	"	Bored	87	1,800	- 67	1,733	87	1,713	Glacial sand	Hard, clear, "alkaline"	42	D, S	Sufficient for 28 head stock.
9	NE.	13	"	"	"	Dug	20	1,800	- 15	1,785			Glacial sand	Hard, iron, "alkaline"	42	D, S	Sufficient for local needs.
10	SW.	14	"	"	"	Dug	58	1,810	- 56	1,754	56	1,754	Glacial sand	Hard, clear, "alkaline"	40	D, S	Small supply; farm vacant.
11	NW.	14	"	"	"	Dug	35	1,800	- 31	1,769	31	1,769	Glacial sand	Soft, clear	40	D, S	Oversufficient for local needs.
12	SE.	15	"	"	"	Bored	67	1,820	- 50	1,770	67	1,753	Glacial sand	Hard, clear, "alkaline"		D, S	Oversufficient for local needs; other seepage wells not used.
13	SE.	16	"	"	"	Bored	55	1,800	- 45	1,755	45	1,755	Glacial drift	Hard, clear	43	D, S	
14	NE.	18	"	"	"	Bored	62	1,800	- 31	1,769	62	1,738	Glacial silt	Hard, clear, "alkaline", iron	40	D, S	Sufficient for local needs.
15	SW.	18	"	"	"	Bored	60	1,810	- 58	1,752	58	1,752	Glacial sand	Hard, clear, "alkaline"	43	S	Sufficient for 14 head stock.
16	NW.	18	"	"	"	Bored	55	1,800	- 54	1,746	54	1,746	Glacial gravel	Hard, cloudy, "alkaline", iron		S	Insufficient for local needs; hauls water from Arm river, neighbours and uses dugout.
17	SE.	20	"	"	"	Bored	52	1,815	- 40	1,775	52	1,763	Glacial sand	Hard, clear, "alkaline"	40	S	Uses 50-foot well for stock and a 30½-foot well for house; total supply is sufficient.
18	NW.	20	"	"	"	Bored	63	1,810	- 60	1,750	60	1,750	Glacial clay	Hard, clear, "alkaline", iron	41	S	Insufficient for local needs; also an 18-foot well in ravine for stock; hauls water for house.
19	SE.	22	"	"	"	Dug	45	1,830	- 40	1,790	40	1,790	Glacial drift	Soft, cloudy	41	D, S	Oversufficient for 16 head stock; also uses sloughs in pasture for stock.
20	NE.	22	"	"	"	Dug	35	1,820	- 32	1,788	32	1,788	Glacial sand	Soft, clear	40	D, S	Sufficient for local needs.
21	NW.	22	"	"	"	Bored	41	1,800	- 33	1,767	41	1,759	Glacial sand	Hard, clear	42	D, S	Sufficient for 25 head stock.
22	SE.	23	"	"	"	Bored	35	1,800	- 25	1,775	25	1,775	Glacial gravel	Soft, clear	42	D, S	Sufficient for 32 head stock.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of SARNIA, NO. 221, 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
23	NE.	24	22	25	2	Bored	60	1,750	- 54	1,696	54	1,696	Glacial drift	Hard, clear		D, S	Insufficient for local needs.
24	SE.	25	"	"	"	Bored	60	1,775	- 40	1,735	60	1,715	Glacial drift	Hard, clear, "alkaline", iron	42	D, S	Sufficient for 30 head; also a similar 60-foot well.
25	NW.	27	"	"	"	Bored	28	1,800	- 24	1,776	24	1,776	Glacial sand	Hard, clear	41	D, S	Abundant supply; also a similar 24-foot well.
26	NE.	28	"	"	"	Bored	28	1,820	- 25	1,795	25	1,795	Glacial sand	Soft, clear	40	D, S	Sufficient for local needs.
27	SW.	28	"	"	"	Bored	53	1,800	- 8	1,792	53	1,747	Glacial drift	Hard		S	Sufficient for local needs.
28	SE.	30	"	"	"	Bored	52	1,800	- 20	1,780	52	1,748	Glacial silt	Hard, clear, "alkaline"	40	D, S	Oversufficient for local needs; also a 12-foot well in ravine.
29	SE.	31	"	"	"	Bored	50	1,810	- 32	1,778	50	1,760	Glacial gravel	Hard, bitter, cloudy		D, S	Sufficient for local needs; also a 20-foot seepage well and two 60-foot wells.
30	SW.	31	"	"	"	Drilled	321	1,810	-125	1,685	321	1,489	Marine shale	Soft, clear		D, S	Sufficient for local needs; also 6 dry holes as deep as 80 feet.
31	NE.	33	"	"	"	Dug	35	1,800	- 25	1,775	25	1,775	Glacial sand and gravel	Hard, clear, iron	43	D,S	
32	NE.	34	"	"	"	Bored	40	1,800	- 35	1,765	35	1,765	Glacial sand	Soft, clear	40	D, S	Sufficient for 35 head stock.
33	SW.	34	"	"	"	Bored	30	1,800	- 27	1,773	27	1,773	Glacial gravel	Hard, clear	43	D, S	Insufficient for local needs.
34	NW.	35	"	"	"	Spring		1,790					Glacial drift	Hard, clear			Oversufficient for local needs; also a 10-foot hole with large supply.
35	NE.	36	"	"	"	Drilled	160	1,725	-100	1,625	160	1,565	Glacial? sand	Hard, clear, "alkaline", iron	41	S	Sufficient for local needs.
1	SE.	3	22	26	2	Dug	45	1,881	- 35	1,846	35	1,846	Glacial drift	Hard, clear	45	D, S	Used by village of Chamberlain; #.
2	SE.	3	"	"	"	Bored	47	1,881	- 25	1,856	47	1,834	Glacial drift	Hard, clear, "alkaline"	44	D, S	Sufficient for local needs.
3	NW.	12	"	"	"	Drilled	55	1,800	- 50	1,750	50	1,750	Glacial drift	Hard, "alkaline"		S	Very poor supply; hauls domestic supply.
4	NW.	18	"	"	"	Dug	6	1,815	- 3	1,812	6	1,809	Glacial sand	Hard, clear, "alkaline"		D, S	Yields 1 tank a day.
5	SW.	20	"	"	"	Drilled	397	1,850	-175	1,675	397	1,453	Marine shale	Hard, clear, iron	44	D, S	Yields 1 tank a day.
6	NE.	20	"	"	"	Dug	50	1,850	- 33	1,817	33	1,817	Glacial drift	Hard, clear	46	D, S	Yields four barrels a day.
7	NE.	22	"	"	"	Bored	75	1,850	- 40	1,810	75	1,775	Glacial drift	Hard, clear, iron	46	D, S	Yields 1 tank a day ; also a seepage well.
8	SE.	25	"	"	"	Bored	75	1,820	- 45	1,775			Glacial drift	Hard, cloudy, "alkaline"		S	Intermittent supply; sloughs also used for stock.
9	SW.	25	"	"	"	Bored	60	1,820	- 25	1,795	60	1,760	Glacial gravel	Hard, clear, iron, "alkaline"	44	D, S	Yields 2 tanks a day; slough also used for stock.
10	SE.	28	"	"	"	Drilled	360	1,860	-160	1,700	360	1,500	Marine shale	Soft, clear, soda	48	D, S	Oversufficient for local needs; uses only 1 tank a day.
11	NE.	28	"	"	"	Bored	75	1,850	- 43	1,807	75	1,775	Glacial gravel	Hard, clear, iron	44	D, S	Yields ½ tank a day.
12	SE.	30	"	"	"	Drilled	395	1,850	-170	1,680	395	1,455	Marine shale	Soft	44		

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WELL RECORDS—Rural Municipality of SARNIA, NO. 221, 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
13	SE.	31	22	26	2	Drilled	396	1,850	-170	1,680	393	1,452	Marine shale	Soft, cloudy, salty, iron	44	S	Large yield.
14	SW.	32	"	"	"	Drilled	390	1,850	-160	1,690	390	1,460	Marine shale	Soft, soda		D, S	Large yield.
15	NW.	32	"	"	"	Drilled	393	1,850	-160	1,690	393	1,457	Marine shale	Soft, clear, soda	43	D, S	Yields 5 barrels a day; also a 76-foot well; water not usable.
16	SE.	33	"	"	"	Bored	74	1,850	- 52	1,798	74	1,776	Glacial gravel	Hard, clear, iron	42	D, S	Yields 16 barrels a day.
17	SW.	33	"	"	"	Dug	14	1,850	- 8	1,842			Glacial gravel	Hard, clear		D,S	Sufficient for local needs.
18	NE.	34	"	"	"	Drilled	300	1,825	-100	1,725	300	1,525	Marine shale	Soft, clear, soda, salty	44	S	Large yield; seepage well for domestic use.
19	NE.	36	"	"	"	Bored	50	1,800	- 33	1,767	50	1,750	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient for 20 head stock.
1	SW.	5	23	23	2	Dug	14	1,650	- 11	1,639	11	1,639	Glacial sandy clay	Hard, clear, "alkaline"	42	S	Insufficient for local needs; three similar wells.
2	SE.	6	"	"	"	Dug	14	1,650	- 11	1,639	11	1,639	Glacial gravel	Soft	40	D, S	Sufficient for 60 head stock.
3	SW.	7	"	"	"	Dug	20	1,640	- 18	1,622	18	1,622	Glacial clay	Hard, clear, "alkaline", iron		S	Insufficient for local needs.
4	SW.	7	"	"	"	Dug	16	1,640	- 12	1,628	12	1,628	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
5	NW.	7	"	"	"	Dug	22	1,640	- 17	1,623	17	1,623	Glacial sandy clay	Soft, clear	42	D, S	Sufficient for local needs.
6	NE.	18	"	"	"	Dug	40	1,625	- 10	1,615			Glacial sand	Soft, clear	42	D, S	Sufficient for local needs.
7	SW.	18	"	"	"	Dug	17	1,630	- 16	1,614	16	1,614	Glacial sand	Hard, clear	43	D, S	Insufficient for local needs; also two seepage wells; poor supply.
1	SE.	2	23	24	2	Dug	8	1,650	- 6	1,644	6	1,644	Glacial sand	Hard, clear		D, S	Sufficient for 20 head stock.
2	SW.	2	"	"	"	Dug	9	1,650	- 6	1,644	6	1,644	Glacial sand	Hard, clear, "alkaline"	42	D, S	Oversufficient for 20 head stock.
3	SW.	4	"	"	"	Bored	67	1,680	- 27	1,653	67	1,613	Glacial black sand	Hard, clear, "alkaline"	40	S	Oversufficient for local needs; also two seepage wells 12 and 14 feet deep.
4	NE.	6	"	"	"	Dug	20	1,680	- 17	1,663	17	1,663	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient for 18 head stock; also an 8-foot well.
5	SW.	8	"	"	"	Dug	16	1,675	- 15	1,660	15	1,660	Glacial gravel	Hard, clear, "alkaline"	43	D, S	Sufficient for 12 head stock.
6	NE.	10	"	"	"	Dug	10	1,650	- 7	1,643	7	1,643	Glacial sand	Soft, clear	48	D, S	Supply insufficient for local needs; also a 90-foot dry hole.
7	NW.	10	"	"	"	Dug	12	1,640	- 8	1,632	8	1,632	Glacial sandy gravel	Soft, clear	45	D, S	Sufficient for local needs.
8	SE.	11	"	"	"	Dug	20	1,650	- 15	1,635	15	1,635	Glacial gravel	Hard, clear	42	D, S	Sufficient for 75 head stock.
9	SE.	12	"	"	"	Dug	25	1,640	- 8	1,632	25	1,615	Glacial drift	Hard, clear, "alkaline"	42	D, S	Sufficient for 30 head stock.
10	SW.	14	"	"	"	Dug	14	1,640	- 10	1,630	10	1,630	Glacial gravel	Soft, clear	40	D, S	Also a similar 10-foot well; total supply sufficient for local needs.
11	SE.	15	"	"	"	Dug	14	1,640	- 12	1,628	12	1,628	Glacial sand	Soft, clear	45	D, S	Oversufficient for local needs; also another hole, not used.
12	NE.	18	"	"	"	Drilled	90	1,690	- 82	1,608	82	1,608	Marine shale?	Soft, clear, soda, iron, salty			

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 SARNIA, NO. 221, 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
13	SW.	18	23	24	2	Dug	20	1,700	- 18	1,682	18	1,682	Glacial gravel	Soft, clear	44	D, S	Sufficient for 50 head stock.
14	NW.	19	"	"	"	Dug	15	1,680	- 11	1,669	11	1,669	Glacial sand	Soft, clear	41	D, S	Sufficient for 40 head stock.
15	NW.	20	"	"	"	Drilled	150	1,670	-130	1,540	150	1,520	Marine shale	Soft, clear, soda, salty	42	S	Large yield; also a 12-foot well for domestic use.
16	NW.	21	"	"	"	Drilled	126	1,650	- 9	1,641	126	1,524	Glacial? sand	Hard, clear, salty	40	S	Oversufficient for local needs; also a 41-foot seepage well for house use. #.
17	NW.	23	"	"	"	Drilled	300	1,620	+ 12	1,632	300	1,320	Marine Shale series	Soft, clear, soda		S	Oversufficient for local needs; several dry holes 155 to 180 feet deep.
18	NW.	24	"	"	"	Bored	40	1,620	- 20	1,600	40	1,580	Glacial gravel	Hard, clear	40	D, S	Insufficient for local needs; other wells also used.
19	NE.	25	"	"	"	Bored	137	1,620	- 12	1,608	137	1,483	Marine shale	Soft, clear, "alkaline"	43	S	Oversufficient for local needs; hauls drinking water.
20	SE.	26	"	"	"	Dug	12	1,620	- 2	1,618			Glacial sand	Soft, clear	43	D	Sufficient for domestic needs.
21	SE.	28	"	"	"	Drilled	120	1,640	- 20	1,620	120	1,520	Glacial? drift	Hard, clear, "alkaline", salty	41	S	Also a 12-foot well for house use.
22	SW.	28	"	"	"	Dug	40	1,640	- 30	1,610	40	1,600	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient for 30 head stock.
23	SW.	30	"	"	"	Dug	20	1,680	- 14	1,666	14	1,666	Glacial gravel	Hard, cloudy, "alkaline"	42	S	12-foot well used for house.
24	NE.	31	"	"	"	Drilled	192	1,670	- 20	1,650	190	1,480	Marine shale	Soft, clear, soda, salty		D, S	Sufficient for local needs; also two 60-foot dry holes.
25	SW.	32	"	"	"	Bored	56	1,660	- 54	1,606	54	1,606	Glacial sand	Hard, clear, "alkaline", iron	43	S	Insufficient for local needs; hauls water; 43-foot well for house and two dry holes 45 and 225 feet deep.
26	NW.	32	"	"	"	Drilled	190	1,660	-175	1,485	190	1,470	Marine shale	Soft, clear, salty, soda	43	S	Sufficient for 20 head stock; also a 32-foot well for domestic use.
27	SE.	34	"	"	"	Drilled	124	1,625	- 12	1,613	124	1,501	Glacial drift	Hard, clear, "alkaline"	42	S	Oversufficient for local needs; hauls drinking water.
28	NE.	34	"	"	"	Drilled	180	1,625	- 2	1,623	180	1,445	Glacial? drift	Hard, clear, salty, "alkaline"	43	S	Oversufficient for local needs; hauls drinking water.
29	SW.	34	"	"	"	Drilled	190	1,625	+ 12	1,637	190	1,435	Glacial? drift	Hard, salty, "alkaline"	43	S	Flows 8 barrels a day.
30	NW.	34	"	"	"	Drilled	124	1,625	- 12	1,613	124	1,501	Glacial drift	Hard, clear, "alkaline"	42	S	Oversufficient for local needs; hauls drinking water.
31	SW.	35	"	"	"	Drilled	127	1,620	- 9	1,611	125	1,495	Glacial sand	Hard, clear, "alkaline"	42	S	Sufficient for local needs; also a 10-foot well for house use.
32	SW.	36	"	"	"	Drilled	128	1,620	- 12	1,608	128	1,492	Marine Shale series	Soft, clear, "alkaline", salty		S	Sufficient for 30 head stock; hauls drinking water.
1	SE.	2	23	25	2	Bored	75	1,775					Glacial sand	"Alkaline", clear		D, S	
2	SW.	3	"	"	"	Bored	30	1,800	- 22	1,778	22	1,778	Glacial sand	Hard, clear, "alkaline"		S	Oversufficient for 50 head stock; 14-foot well for house use.
3	NE.	4	"	"	"	Dug	30	1,790	- 22	1,768	22	1,768	Glacial gravel and sand	Hard, clear, "alkaline"	42	D, S	Sufficient for 12 head stock.
4	SW.	5	"	"	"	Bored	40	1,800	- 20	1,780	40	1,760	Glacial gravel	Hard, clear, iron	40	D, S	Sufficient for 20 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 SARNIA, NO. 221, 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		5	23	25	2	Bored	50	1,800	- 44	1,756	44	1,756	Glacial drift	Hard, clear, "alkaline"		D, S	Insufficient for local needs.
6	NW.	6	"	"	"	Drilled	370	1,800	- 40	1,760	370	1,430	Marine Shale series	Hard, soda, iron		D, S	Abundant supply.
7	NE.	8	"	"	"	Dug	25	1,780	- 19	1,761	19	1,761	Glacial gravel	Hard, clear	42	D, S	Sufficient for 18 head stock.
8	NW.	10	"	"	"	Dug	40	1,775	- 25	1,750	40	1,735	Glacial sandy clay	Hard, clear, "alkaline"	43	S	Sufficient for local needs; also two 20-foot wells, good supply.
9	SE.	10	"	"	"	Bored	40	1,775	- 24	1,751	40	1,735	Glacial gravel	Hard, cloudy, "alkaline"	43	S	Sufficient for only 20 head stock; also two wells 10 and 12 feet deep; small supply.
10	NE.	10	"	"	"	Dug	16	1,770	- 13	1,757	13	1,757	Glacial sand	Soft, clear	42	D, S	Sufficient for local needs.
11	NE.	10	"	"	"	Dug	16	1,760	- 12	1,748	12	1,748	Glacial sand	Soft, iron, cloudy	42	D	Sufficient for village of Holdfast.
12	NW.	12	"	"	"	Dug	12	1,750	- 8	1,742	8	1,742	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient for [illegible] stock; also a 14-foot well, poor quality water.
13	SW.	13	"	"	"	Drilled	300	1,740	- 40	1,700	300	1,440	Bearpaw sand	Soft, clear, salty		S	Sufficient for local needs; also a 60-foot well for domestic use.
14	SE.	14	"	"	"	Dug	14	1,750	- 7	1,743	14	1,736	Glacial gravel	Hard, clear, "alkaline"	44	D, S	Sufficient for 25 head stock; also a similar well.
15	NW.	14	"	"	"	Bored	50	1,750	- 20	1,730	50	1,700	Glacial clay	Hard, clear, "alkaline"	41	S	Sufficient for local needs; also a 9-foot house well.
16	NW.	15	"	"	"	Drilled	205	1,790			203	1,587	Glacial? sand	Salty		N	Not usable.
17	NW.	15	"	"	"	Bored	70	1,780	- 20	1,760	70	1,710	Glacial drift	Hard, clear, salty		N	Also a similar 80-foot well in village; small supply.
18	NW.	15	"	"	"	Dug	20	1,760	- 12	1,748	20	1,740	Glacial gravel	Hard, clear	40	D, S	Also a similar 15-foot well.
19	NE.	15	"	"	"	Bored	52	1,760	- 30	1,730	52	1,708	Glacial sand	Hard, clear, "alkaline"		S	Insufficient for local needs; also a 30-foot well, not used.
20	SE.	16	"	"	"	Bored	21	1,780									Dry hole; base in glacial drift. Also 5 wells 20 to 27 feet deep; small supply.
21	NE.	16	"	"	"	Dug	17	1,770	- 7	1,763			Glacial sand	Hard, clear, "alkaline", iron	42	D, S	Sufficient for 34 head stock; also a 14-foot well.
22	NE.	16	"	"	"	Dug	20	1,770	- 16	1,754	16	1,754	Glacial sand	Soft, clear, iron	42	D, S	Sufficient for 20 head stock.
23	NW.	16	"	"	"	Dug	92	1,780	- 86	1,694	86	1,694	Glacial clay	Hard, clear	42	D, S	Sufficient for 20 head stock.
24	SE.	17	"	"	"	Dug	22	1,780	- 20	1,760	20	1,760	Glacial gravel	Soft, clear		D, S	Sufficient for local needs.
25	SW.	18	"	"	"	Dug	70	1,780	- 36	1,744	70	1,710	Glacial sand	Soft, clear	42	D, S	Sufficient for local needs; also a 40-foot well used for house.
26	SW.	20	"	"	"	Dug	32	1,770	- 30	1,740	30	1,740	Glacial gravel	Soft, clear	44	D, S	Sufficient for 10 head stock.
27	SE.	23	"	"	"	Bored	46	1,740	- 26	1,714	46	1,694	Glacial gravel	Soft, clear, iron	42	D, S	Sufficient for 80 head stock.
28	NW.	24	"	"	"	Bored	90	1,710	- 30	1,780	90	1,620	Glacial gravel	Hard, clear, "alkaline"	42	S	Sufficient for local needs; also a 14-foot dry hole; hauls drinking water.
29	NW.	24	"	"	"	Dug	22	1,700	- 12	1,688	22	1,678	Glacial gravel	Hard, clear,	42	D, S	Sufficient for only 18 head stock; also a 24-foot well, caved in.
30	NE.	25	"	"	"	Dug	16	1,680	- 14	1,666	14	1,666	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient for 60 head stock.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of SARNIA, NO. 221, 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
31	SW.	27	23	25	2	Drilled	339	1,750	- 80	1,670	339	1,411	Marine Shale	Soft, clear, soda, iron	41	D, S	Sufficient for local needs; 12-foot well used for house.
32	SW.	30	"	"	"	Bored	35	1,775	- 30	1,745	30	1,745	Glacial sand	Hard, clear	43	D, S	Sufficient for local needs.
33	NW.	30	"	"	"	Bored	80	1,770	- 60	1,710	80	1,690	Glacial sand	Hard, clear, "alkaline"		S	Sufficient for local needs; 20-foot well, caved in; hauls drinking water.
34	NE.	30	"	"	"	Bored	60	1,750	- 40	1,710	60	1,690	Glacial drift	Hard, clear, iron	44	D, S	Sufficient for local needs.
35	SW.	31	"	"	"	Dug	11	1,750	- 9	1,741	9	1,741	Glacial sand	Soft, clear	42	D, S	Sufficient for local needs; also a 20-foot dry hole.
36	SE.	31	"	"	"	Bored	35	1,750	- 23	1,727			Glacial sand	Hard, clear, iron	40	D, S	Sufficient for local needs; also a 36-foot well, not used.
37	NW.	32	"	"	"	Bored	50	1,740	- 40	1,700	50	1,690	Glacial sand	Hard, clear, iron	43	D, S	Sufficient for 10 head stock.
38	SE.	34	"	"	"	Drilled	299	1,710	- 5	1,705	299	1,411	Marine Shale series	Soft, clear, salty, iron, soda	41	S	Sufficient for local needs; also a 20-foot well used for house.
39	NE.	35	"	"	"	Drilled	221?	1,690	~~-190~~ -61.8'	~~1,540~~ 1,628	221	1,469	Marine Shale	Soft, clear, soda	40	S	Good supply; also a 12-foot well used for stock; hauls water for house use.
40	NW.	36	"	"	"	Bored	32	1,675	- 18	1,657	32	1,643	Glacial sand	Hard, cloudy, "alkaline", iron	42	D, S	Sufficient for 10 head stock.
1	NE.	1	23	26	2	Bored	62	1,800	- 27	1,773	62	1,738	Glacial gravel	Hard, clear, "alkaline", iron	40	D, S	Yields 8 barrels a day.
2	NE.	4	"	"	"	Bored	52	1,840	- 12	1,828	52	1,788	Glacial sand	Hard, clear	46	D, S	Sufficient for local needs.
3	SE.	5	"	"	"	Drilled	400	1,875	-180	1,695	400	1,475	Marine Shale	Soft, clear, soda		D, S	Oversufficient for local needs.
4	NW.	6	"	"	"	Drilled	400	1,875	-170	1,705	400	1,475	Marine Shale	Soft			Sufficient for local needs.
5	NE.	7	"	"	"	Bored	70	1,875	- 68	1,807	68	1,807	Glacial sand	Hard, clear, iron	43	D, S	Yields 7 tanks a day.
6	NW.	10	"	"	"	Drilled	300	1,840	-100	1,740	300	1,540	Marine Shale	Soft, cloudy, soda, iron		D, S	Oversufficient for local needs.
7	SE.	14	"	"	"	Drilled	330	1,800	- 80	1,720	330	1,470	Marine Shale	Hard, clear, iron		S	Sufficient for local needs.
8	SE.	15	"	"	"	Drilled	350	1,825	- 80	1,745	350	1,475	Marine Shale series	Hard, clear, soda		S	Large yield.
9	SW.	17	"	"	"	Drilled	350	1,860			350	1,510	Marine Shale	Hard, clear		D, S	Yields 5 tanks a day.
10	SW.	18	"	"	"	Bored	62	1,860	- 50	1,810	62	1,798	Glacial stones	Hard, clear, iron		S	Yields 2 tanks a day; also a similar well 44 feet deep.
11	SW.	18	"	"	"	Bored	47	1,860	- 37	1,823	37	1,823	Glacial drift	Hard, clear		D	Small yields; also a similar well not used.
12	NW.	20	"	"	"	Bored	47	1,850					Glacial drift	Hard, clear		D	Intermittent supply; also a 24-foot intermittent well and two 75-foot dry holes.
13	SW.	22	"	"	"	Bored	93	1,825	- 63	1,762	93	1,732	Glacial drift	Hard, clear, "alkaline"		D, S	Yields 20 barrels a day.
14	SE.	23	"	"	"	Drilled*	490	1,790	- 60	1,730	490	1300	Marine Shale	Soft, clear, soda, iron		D, S	Yields only a small supply.
15	NE.	23	"	"	"	Drilled	350	1,790	- 60	1,730	350	1,440	Marine Shale	Soft, iron, salty	44	S	Large yield.

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(#) Sample taken for analysis.

* June 25, 1964; Lawson, well may have been damaged during seismic operations.

WELL RECORDS—Rural Municipality of SARNIA, NO. 221, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
16	SE.	24	23	26	2	Dug	80	1,780	- 68	1,712	80	1,700	Glacial drift	Hard, iron, "alkaline", yellow		D	Will yield 8 barfels.
17	NE.	24	"	"	"	Dug	60	1,775	- 58	1,717	58	1,717	Glacial sand	Hard, iron, cloudy		D, S	Insufficient for local needs.
18	NE.	26	"	"	"	Drilled	417'	1,775	- 80	1,695	417	1,358	Marine Shale	Soft, clear, iron, salty	43	D, S	Yields 3 barrels a day.
19	SE.	28	"	"	"	Drilled	250	1,825			250	1,575	Glacial? drift	Hard, iron, yellow		S	Yields 10 barrels a day.
20	SW.	30	"	"	"	Bored	73	1,860	- 25	1,835			Glacial drift	Hard, iron, "alkaline", cloudy		D, S	Yields 10 barrels a day. #.
21	NE.	33	"	"	"	Bored	78	1,825	- 18	1,807	78	1,747	Glacial gravel	Hard, clear, "alkaline"		D, S	Yields 10 barrels a day.
22	NW.	36	"	"	"	Drilled	375	1,780	- 80	1,700	375	1,405	Marine Shale	Soft, clear, salty		D, S	Suffitient for local needs.
1	SW.	2	24	24	2	Bored	50	1,630	- 49	1,581	49	1,581	Glacial gravel	Hard, iron, cloudy	42	S	Insufficient for local needs; hauls water from lake for stock and from neighbours for house.
2	NW.	2	"	"	"	Bored	20	1,620	- 16	1,604	16	1,604	Glacial drift	Hard, clear, "alkaline", salty		S	Insufficient for local needs; also a 12-foot well for drinking.
3	SE.	4	"	"	"	Drilled	190	1,630	- 40	1,590	190	1,440	Marine Shale	Hard, clear	42	D, S	Sufficient for local needs.
4	NE.	4	"	"	"	Drilled	191	1,630	- 21	1,609	191	1,439	Marine Shale	Hard, clear, "alkaline", salty	42	S	Sufficient for 50 head stock; also a 25-foot well for house use.
5	NW.	4	"	"	"	Drilled	196	1,640	- 20	1,620	196	1,444	Marine Shale	Soft, clear, soda, salty		S	Sufficient for 50 head stock; also a 12-foot seepage well for house.
6	SW.	6	"	"	"	Drilled	290'	1,660	-100	1,580	290	1,390	Marine Shale	Soft, clear, salty		D, S	Insufficient for local needs; also a 30-foot well for house use.
7	NW.	6	"	"	"	Dug	25	1,660	- 20	1,640	20	1,640	Glacial sand	Hard, clear, "alkaline"	42	D, S	Sufficient for 10 head stock.
8	SE.	7	"	"	"	Drilled	220	1,645	+ 1	1,646	220	1,425	Marine Shale	Soft, clear, salty	43	S	Sufficient for 100 head stock; hauls drinking water.
9	NW.	9	"	"	"	Drilled	190	1,630	- 30	1,600	190	1,440	Marine Shale	Salty, clear		S	Sufficient for local needs.
10	NW.	15	"	"	"	Dug	15	1,615									Dry hole in glacial drift; hauls water from lake for stock, and from neighbours for house.
11	SE.	16	"	"	"	Dug	20	1,620	- 5	1,615			Glacial clay	Soft, cloudy	42	S	Insufficient for local needs; haul water from neighbours.
12	SW.	17	"	"	"	Drilled	195	1,645	- 16	1,629	195	1,450	Marine Shale	Soft, clear, salty	40	S	Sufficient for 40 head stock; also a 16-foot well for house.
13	SE.	18	"	"	"	Drilled	212	1,645	- 10	1,635	212	1,433	Marine Shale	Soft, clear, salty	43	S	Sufficient for 100 head stock; hauls drinking water.
14	SW.	18	"	"	"	Bored	60	1,640	- 50	1,590	60	1,580	Glacial sand	Hard, clear, "alkaline"	42	D, S	Sufficient for 20 head stock.
15	NW.	19	"	"	"	Drilled	70	1,640					Glacial gravel	Hard, clear	42	S	Sufficient for 20 head stock; haul drinking water.
16	NE.	19	"	"	"	Drilled	210	1,630	- 60	1,570	210	1,420	Marine Shale	Hard, salty, cloudy	40	S	Sufficient for local needs; also a 28-foot well for house use.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of SARNIA, NO. 221, 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
17	SW.	20	24	24	2	Drilled	195	1,640	- 15	1,625	195	1,445	Marine Shale	Soft, clear, salty	40	S	Sufficient for 30 head stock; also an 18-foot well for house.
18	NW.	21	"	"	"	Borei	36	1,620	- 34	1,586	34	1,586	Glacial sand	Hard, clear, "alkaline"	42	D,S	Sufficient for local needs; also a 14-foot well by slough for house and an 82-foot dry hole.
19	SW.	22	"	"	"	Dug	12	1,610	- 4	1,606			Glacial clay	Soft, cloudy	44	D, S	Insufficient for local needs.
20	SW.	32	"	"	"	Borei	40	1,620	- 8	1,612	40	1,580	Glacial sand	Soft, iron, cloudy, salty	42	D, S	Sufficient for 11 head stock.
21	SE.	32	"	"	"	Drilled	160	1,620	- 20	1,600	160	1,460	Marine Shale	Hard, clear, soda, iron, salty	41	S	Sufficient for 50 head stock; also a 20-foot seepage well for house use.
1	SE.	2	24	25	2	Dug	15	1,670	- 11	1,659	11	1,659	Glacial sand and gravel	Hard, clear	45	D, S	Sufficient for 15 head stock; several shallow similar wells.
2	SE.	4	"	"	"	Dug	12	1,640	- 4	1,636	4	1,636	Glacial sand	Hard, clear	42	D, S	Sufficient for 20 head stock; also a 20-foot well, good supply.
3	SE.	5	"	"	"	Dug	33	1,710	- 20	1,690	33	1,677	Glacial gravel	Hard, iron, clear	42	D, S	Sufficient for 100 head stock; also an 8-foot well.
4	NE.	6	"	"	"	Drilled	310	1,740	- 25	1,715	310	1,430	Marine Shale	Soft, soda, clear	40	D, S	Oversufficient for 30 head stock; also has shallow wells not used.
5	SW.	6	"	"	"	Drilled	300	1,740	- 40	1,700	300	1,440	Marine Shale series	Soft, clear, soda	40	D, S	Oversufficient for local needs; also a 90-foot bored well and shallow wells, poor supply.
6	NE.	7	"	"	"			1,740					Marine Shale	Soda			Good supply.
7	SW.	8	"	"	"	Drilled	200	1,740			200	1,540	Marine Shale	Soft, clear, soda, iron	42	D,S	Oversufficient for local needs; also shallow well, abandoned.
8	NE.	8	"	"	"	Drilled	308	1,700	+ 3	1,703	308	1,392	Marine Shale series	Soft, clear, soda	42	D, S	Sufficient for 25 head stock; stock watered at dam also.
9	NE.	10	"	"	"	Dug	8	1,665	- 4	1,661	4	1,661	Glacial sand	Soft, clear	42	D, S	Sufficient for 25 head stock.
10	SW.	10	"	"	"	Dug	18	1,685	- 14	1,671	14	1,671	Glacial sand	Hard, clear, iron, "alkaline"	43	D, S	Sufficient for 30 head stock.
11	SE.	12	"	"	"	Bored	50	1,660	- 34	1,626	50	1,610	Glacial drift	Hard, clear, "alkaline"	41	D, S	Sufficient for 30 head stock.
12	SW.	13	"	"	"	Drilled	342√	1,660	- 10	1,650	342	1,318	Marine Shale series	Soft, clear, soda	40	D, S	Oversufficient for local needs; also a 20-foot well, good supply and several 20-foot dry holes.
13	NW.	14	"	"	"	Drilled	185	1,640	+ 1	1,641	185	1,455	Marine Shale series	Soft, clear	40	D, S	Oversufficient for local needs; also a 10-foot well in ravine.
14	SW.	14	"	"	"	Drilled	400√	1,660			400	1,260	Marine Shale	Soft, soda, cloudy		S	Sufficient for local needs.
15	SW.	17	"	"	"	Drilled	342√	1,720	+ 8	1,728	342	1,378	Marine Shale	Soft, clear	42	D, S	Oversufficient for local needs; also a 30-foot well, poor quality, abandoned.
16	SE.	18	"	"	"	Drilled	316	1,730	- 16	1,714	315	1,415	Marine Shale series	Soft, clear, soda	45	D, S	Oversufficient for local needs; several 40-foot wells, poor supply.
17	SE.	20	"	"	"	Dug	50	1,690									Dry hole in glacial clay.
18	NW.	21	"	"	"	Dug	21	1,670	- 19	1,651	19	1,651	Glacial gravel	Hard, clear	41	D, S	Sufficient for local needs.
19	NW.	21	"	"	"	Dug	18	1,675	- 12	1,663	12	1,663	Glacial sand	Soft, clear	43	S	Sufficient for local needs; several shallow wells in house of Penzance.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of SARNIA, NO. 221, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
20	NW.	21	24	25	2	Dug	20	1,670	- 16	1,654	16	1,654	Glacial sand	Hard, clear, "alkaline"		S	**Sufficient** for 25 head stock; haul drinking water.
21	SE.	22	"	"	"	Drilled	360	1,650	+ 10	1,660	360	1,290	Marine Shale	Hard, clear, soda, salty		D, S	Sufficient for local needs; also a 50-foot well, poor quality water.
22	NE.	25	"	"	"	Drilled	189	1,630	- 12	1,618	189	1,441	Marine Shale series	Soft, clear, salty, iron	42	S	Sufficient for 10 head stock; hauls water for house use.
23	SW.	25	"	"	"	Drilled	180	1,640			180	1,460	Marine Shale	Soft, clear, salty	42	D, S	Sufficient for 15 head stock.
24	SW.	25	"	"	"	Drilled	400	1,640	+ 10	1,650	400	1,240	Marine Shale	Hard, clear, salty	40	S	Oversufficient for local needs.
25	NE.	26	"	"	"	Drilled	181	1,640	- 2	1,638	181	1,459	Marine Shale	Salty, clear	43	S	Sufficient for local needs; several shallow wells; small supply.
26	SW.	27	"	"	"	Drilled	345	1,653	0	1,653	345	1,308	Marine Shale	Hard, salty		N	Good yield; not usable.
27	SE.	28	"	"	"	Dug	15	1,660	- 10	1,650	10	1,650	Glacial gravel	Hard, clear	42	D, S	Sufficient for local needs.
28	SE.	29	"	"	"	Dug	14	1,680	- 11	1,669	11	1,669	Glacial gravel	Hard, clear	42	D, S	Sufficient for local needs.
29	SE.	30	"	"	"	Dug	20	1,725					Glacial sand	Hard, clear, "alkaline"	40	S	Good supply of very poor water; also an 8-foot intermittent well and an intermittent spring.
30	NE.	30	"	"	"	Drilled	230	1,718	+ 2	1,720	230	1,488	Marine Shale series	Soft, clear	42	D, S	Sufficient for local needs; other shallow wells, small supply.
31	NW.	30	"	"	"	Dug	6	1,730	- 4	1,726	4	1,726	Glacial drift	Hard, clear, iron	40	D, S	Sufficient for local needs; also an 18-foot well with good supply, and a 680foot dry hole.
32	SW.	31	"	"	"	Drilled	291	1,740	+ 3	1,743	291	1,449	Marine Shale	Soft, clear, soda	40	D, S	Sufficient for local needs.
33	SW.	32	"	"	"	Drilled	208	1,707	+ 3	1,710	208	1,499	Marine Shale series	Soft, clear, iron	44	D, S	Sufficient for 50 head stock; #.
34	SE.	33	"	"	"	Drilled	287	1,650	+ 3	1,653	287	1,363	Marine Shale	Hard, clear, "alkaline", salty		S	Sufficient for 20 head stock; spring used for house use.
35	NE.	36	"	"	"	Drilled	180	1,630	- 12	1,618	180	1,450	Marine Shale	Soft, clear, salty	43	S	Sufficient for local needs; also a 24-foot well; hauls drinking water.
1	SE.	2	24	26	2	Drilled	360	1,780	- 70	1,710	360	1,420	Marine Shale	Soft, clear, "alkaline"		D, S	Large yield; #.
2	SE.	3	"	"	"	Dug	11	1,800	- 5	1,795	5	1,795	Glacial gravel	Hard, clear		D, S	Sufficient for local needs.
3	NE.	3	"	"	"	Drilled	376	1,810	- 60	1,750	376	1,434	Marine Shale series	Soft, clear, iron		D, S	Oversufficient for 25 head stock.
4	SW.	5	"	"	"	Bored	42	1,855	- 10	1,845	42	1,813	Glacial sand	Hard, iron		D, S	Sufficient for local needs; also a similar 42-foot well.
5	NW.	5	"	"	"	Bored	42	1,855	- 17	1,838	42	1,813	Glacial gravel	Hard, clear, "alkaline", iron		S	Oversufficient for 20 head stock; also a 15-foot well in draw.
6	NW	6	"	"	"	Bored	64	1,865	- 40	1,825	64	1,801	Glacial gravel	Hard, clear, "alkaline"		D, S	Oversufficient for local needs.
7	NE.	7	"	"	"	Bored	60	1,870	- 20	1,850	60	1,810	Glacial sandy clay	Hard, iron, "alkaline" yellow		D, S	Sufficient for local needs.

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WELL RECORDS—Rural Municipality of SARNIA, NO. 221, 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
8	SW.	10	24	26	2	Bored	90	1,825	- 45	1,780	90	1,735	Glacial gravel	Hard, clear, iron		S	Sufficient for local needs.
9	SW.	10	"	"	"	Bored	12	1,820	- 8	1,812	8	1,812	Glacial gravel	Soft, clear		D, S	Oversufficient for local needs.
10	NE.	10	"	"	"	Dug	12	1,820	- 6	1,814	6	1,814	Glacial gravel	Soft, clear		D, S	Sufficient for local needs.
11	NE.	12	"	"	"	Drilled	475	1,760	- 35	1,725	475	1,285	Marine Shale	Soft, clear, soda		D, S	Oversufficient for local needs.
12	NE.	13	"	"	"	Drilled	375	1,755	- 32	1,723	375	1,380	Marine Shale series	Soft, clear, slightly "alkaline"		D, S	Good yield.
13	NW.	14	"	"	"	Drilled	372	1,810	- 60	1,750	372	1,438	Marine Shale	Soft, clear, soda		D, S	Sufficient for local needs.
14	SE.	16	"	"	"	Bored	80	1,845	- 30	1,815	80	1,765	Glacial drift	Hard, clear, "alkaline", iron		D, S	Oversufficient for local needs.
15	NE.	16	"	"	"	Drilled	370	1,830	- 80	1,750	370	1,460	Marine Shale series	Soft, clear, soda, iron	44	D, S	Oversufficient for local needs. #.
16	SE.	17	"	"	"	Bored	74	1,850	- 34	1,816	74	1,776	Glacial drift	Hard, clear, iron	40	D, S	Sufficient for local needs.
17	NE.	18	"	"	"	Bored	93	1,860	- 60	1,800	93	1,767	Glacial drift	Hard, clear, "alkaline"		D, S	Oversufficient for local needs.
18	SW.	20	"	"	"	Drilled	548	1,860	-100	1,760	548	1,312	Marine Shale	Soft, clear, soda		D, S	Sufficient for local needs.
19	NE.	20	"	"	"	Bored	57	1,855	- 16	1,839	50	1,805	Glacial gravel	Hard, iron		D, S	Oversufficient for 8 head stock.
20	SW.	22	"	"	"	Drilled	350	1,830	- 70	1,760	350	1,480	Marine Shale	Soft, clear, soda	42	D, S	Sufficient for local needs.
21	NE.	22	"	"	"	Drilled	384	1,820	- 70	1,750	384	1,456	Marine Shale	Soft, soda		D, S	Oversufficient for 16 head stock.
22	SE.	24	"	"	"	Drilled	324	1,755	- 18	1,737	324	1,431	Marine Shale series	Soft, clear, soda	44	D, S	Oversufficient for local needs.
23	SW.	25	"	"	"	Drilled (omit 3rd)	240	1,760	- 29	1,731	240	1,520	Marine Shale series	Soft, clear		D, S	Oversufficient for 20 head stock.
24	SE.	26	"	"	"	Dug	11	1,790	- 8	1,782	8	1,782	Glacial drift	Hard, clear		D, S	Insufficient for local needs; also a 30-foot dry hole.
25	SW.	26	"	"	"	Drilled	295	1,790	- 40	1,750	295	1,495	Marine Shale	Soft, clear, soda, iron		D, S	Oversufficient for 9 head stock.
26	NE.	26	"	"	"	Drilled	275	1,780			275	1,505	Marine Shale	Soft, clear, soda		D, S	Oversufficient for local needs.
27	SW.	28	"	"	"	Bored	60	1,850	- 35	1,815	60	1,790	Glacial gravel	Hard, clear, "alkaline"		S	Sufficient for local needs; a 55-foot well is used for drinking.
28	NW.	28	"	"	"	Bored	60	1,845	- 20	1,825	60	1,785	Glacial gravel	Hard		S	Oversufficient for local needs.
29	SE.	30	"	"	"	Bored	37	1,870	- 7	1,863			Glacial sand	Hard, clear, "alkaline"		D, S	Intermittent supply.
30	SE.	32	"	"	"	Drilled	560	1,855	- 80	1,775	560	1,295	Marine Shale series	Soft, clear, soda		D, S	Oversufficient for 12 head stock.
31	SW.	32	"	"	"	Bored	55	1,860	- 20	1,840			Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
32	SW.	34	"	"	"	Drilled	300	1,825	- 30	1,795	300	1,525	Marine Shale	Soft, clear, soda		D, S	Sufficient for local needs.

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WELL RECORDS—Rural Municipality of SARNIA, NO. 221, 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
33	NW.	34	24	26	2	Drilled	409	1,830	- 62	1,768	409	1,421	Marine Shale	Soft, clear, soda		D, S	Oversufficient for 24 head stock.
34	SE.	35	"	"	"	Drilled	127	1,775			127	1,648	Glacial? drift	Soft, clear, iron		D, S	Sufficient for local needs.
35	NW.	36	"	"	"	Drilled	313	1,775	- 18	1,757	313	1,462	Marine Shale series	Soft, clear		D, S	Oversufficient for 20 head stock.
36	NW.	36	"	"	"	Dug	14	1,780	- 11	1,769	11	1,769	Glacial gravel	Soft, clear		D, S, I	Sufficient for local needs.

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(#) Sample taken for analysis.