CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 213

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF DUNDURN NO. 314 SASKATCHEWAN

By

B. R. MacKay, and D. C. Maddox

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BUREAU OF ECONOMIC GEOLOGY

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INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

<u>Belly River Formation</u>. 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.

<u>Marine Shale Series</u>. 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 part of the rural municipality of Dundurn, No. 314, that is covered by this report is about 145 square miles, and comprises townships 32, ranges 3, 4, and 5, and that part of township 32, range 6, east of South Saskatchewan river. The Saskatoon and Duck Lake branch of the Canadian National railways and No. 11 highway pass northwards through township 32, range 4. There are no towns or villages in this part of the municipality. Dundurn Forest Reserve, which is largely unsettled, occupies all of township 32, range 5, and parts of the adjacent townships. Most of the population is located east of the railway.

Brightwater lake, which is dry or nearly dry except in wet seasons, occupies a valley in the western third of township 32, range 4, that is about 1,697 feet above sea-level, and within this part of the municipality the lake is about 4 miles long. Brightwater creek, which is a permanent stream, flows northwards into the southern end of Brightwater lake, but the flow of the creek is small except in the spring or in wet seasons. Blackstrap coulée trends in a generally northeasterly direction through the eastern half of township 32, range 4. The northern part of Indi lake, the water-level of which is about 1,727 feet above sea-level, and the whole of Thressa lake, the water-level of which is about 1,730 feet above sea-level, lie in the part of this valley that is included in the municipality of Dundurn. The lakes are shallow and undrained and the water is probably of poor quality.

West of Brightwater lake there is a plain that slopes gently towards the western border of the municipality, the slopes in the immediate vicinity of South Saskatchewan river being somewhat steeper. At the line where the northern boundary of township 32 crosses South Saskatchewan river, water-level in the river is about 1,587 feet above sea-level.

In the southwest corner of the municipality South Saskatchewan river lies about 80 feet below prairie-level. Between Brightwater lake and Blackstrap coulée the country is undulating and rises very little over 1,850 feet above sea-level. East of Blackstrap coulée the country is more elevated than the country west of the coulée. The eastern bank of Thressa lake is about 100 feet higher than the western bank, and the country rises westward to a maximum elevation of about 2,200 feet in the southeastern part of township 32, range 3.

In the area west of Brightwater lake the surface drainage is to Brightwater lake, to Brightwater creek, to a shallow lake in the southern part of township 32, range 5, or to South Saskatchewan river. In the area between Brightwater lake and Blackstrap coulée the drainage is eastward or westward depending upon the position of the divide between the two drainage basins. East of Blackstrap coulée the drainage is northward or westward to Blackstrap coulée or to the valleys that lead to it.

Dune sands underlie most of the western part of the municipality. The eastern boundary of the dune sand area is formed by the western shore of Brightwater lake and by a curved line that extends south from the mouth of Brightwater creek to the southwest corner of township 32, range 4. The western boundary of the dune sand area is formed by a curved line that extends from the northwest corner of that part of Dundurn Forest Reserve that is included in this municipality to the centre of the southern boundary of sec. 4, tp. 32, range 6. West of the dune sand area a narrow band of glacial lake clays, which is about a mile wide in the north but narrows to a little less than half a mile in the south, underlies the valley of South Saskatchewan river.

Glacial lake sands and gravels underlie Brightwater lake and extend eastwards from the lake in a narrow belt less than half a mile wide. At the south end of the lake the belt of sands and gravels is about half a mile wide, but southwards the band widens and at the southern boundary of the municipality it borders Indi lake on the east and extends west to the southwest corner of township 32, range 4.

East of the area of glacial lake sands and gravels there is a belt of glacial lake clays that extends from the northern boundary nearly to the southern boundary of township 32, range 4. North of Indi station the belt is from 1½ to 2 miles wide, but south of Indi the belt tapers off considerably.

Blackstrap coulée and the lakes that lie in it are underlain by boulder clay. East of the coulée a narrow belt less than ½ mile wide is underlain by boulder clay and a belt of boulder clay extends west from the coulée for ¾ mile to 1½ miles southward to within ½ mile of the southern boundary of the municipality.

The part of the municipality east of Blackstrap coulée is underlain by moraine.

There are no bedrock exposures and the nature of the bedrock is not known, but it is probable that the Belly River formation underlies the glacial drift over the greater part of the municipality.

South Saskatchewan river provides very large supplies of water that is comparatively soft and is easily accessible, especially in the north. Thressa lake, Indi lake, an unnamed lake in the southern part of township 32, range 5, and three small lakes in secs. 20, 22, and 24, tp. 32, range 3, are shallow undrained lakes in which the water is probably not of good quality. Brightwater creek usually contains enough water for stock.

Water-bearing Horizons in the Unconsolidated Deposits

Water is found in the dune sands at depths of less than 30 feet. Sand-points are generally used in place of dug wells. The water in the dune sands as a rule is soft or only slightly hard.

In one well, 17 feet deep, near the eastern margin of the dune sand area the water is "alkaline". This well has probably passed through the dune sands into the underlying boulder clay. The supplies of water from most of the wells in the dune sand area are large.

In the western belt of glacial lake clay that borders South Saskatchewan river moderate supplies of water are obtained at less than 25 feet from the surface. The central belt of glacial lake clays does not appear to provide much water, as most wells in this belt are over 50 feet deep. An exception is an auxiliary well, 16 feet deep, in this area that probably obtains water from the glacial lake clay. No wells obtain water from the eastern belt of glacial lake sands, but one well 150 feet deep has passed through them to the boulder clay.

Ground water in the boulder clay and moraine is found in lenses, pockets, or irregularly distributed beds of sand and gravel that are enclosed in the clay. A few of the wells used for supplying drinking water are less than 25 feet deep, but most of them are from 50 to 100 feet, and a few are over 100 feet.

The distribution of the aquifers in the boulder clay and moraine is very erratic, and it is very difficult to outline the extent of any individual aquifer. If a group of wells obtain water from about the same elevation, or if the elevation of the aquifers shows a uniform slope in any direction, and if the elevation of the water-level in the wells conforms to the same general conditions as the aquifers, then it is assumed that the same aquifer is continuous over the area covered by the group of wells, so that should other wells be put down within the limits of the group they will very probably obtain water at about the same elevation as the wells of the group.

Seepage springs are caused by outcropping aquifers that are underlain by impervious beds. The aquifer that supplies a spring may in many cases be traced back from the spring to a group of wells in the vicinity. The supply in spring-fed wells is in most cases large and the quality of the water is usually good.

The aquifers in this municipality are confined to individual townships, and they are discussed under the township in which they occur.

In the area west of Brightwater lake and creek the wells are 8 to 26 feet deep. Between the depression occupied by Brightwater lake and creek and the depression of Blackstrap coulée the wells in the glacial drift are 20 to 200 feet deep, but most of them are over 50 feet deep. East of Blackstrap coulée the producing wells are 18 to 119 feet deep, but most of them are from 35 to 75 feet deep.

Ground water conditions in this municipality are fairly good. At a number of farms in that part of the municipality east of Brightwater lake the water of the deep wells is used for stock and the domestic supply is obtained from shallow wells. Two dry holes 50 and 60 feet deep were put down in the northeast part of township 32, range 3.

West of Brightwater lake most of the wells in the dune sands yield large quantities of good water.

At two wells on secs. 16 and 17, tp. 32, range 4, 235 and 270 feet deep, respectively, the water rises above the surface. The aquifers are about 1,546 and 1,511 feet above sea-level. The water is very hard, contains no sodium carbonate, and is quite unlike the water from bedrock aquifers in the district. The flow of water in the well on section 17 was very large when it was first drilled, and the water rose to at least 31 feet above the surface. The flow has greatly decreased since the well was drilled. There is an area of flowing artesian wells in township 31, range 4, but it appears to have no connexion with the area under discussion as the water is soft and the aquifer is apparently in the bedrock. The conditions that cause the two flowing wells in township 32, range 4, do not appear to extend far into the northern half of the township, as a well on section 22 did not apparently tap the aquifer. The aquifers are in the glacial drift and their southward extent is difficult to estimate, but they may extend to the southern limit of township 32, range 4.

Experience in many of the areas of artesian flow in Canada and the United States has proved that the water-level declines rather rapidly unless the flowing wells are shut in. A well with a large flow produces far more water than is used locally and the remainder is allowed to run to waste and causes the level of the water in the adjacent wells to fall.

Water-bearing Horizons in the Bedrock

All the bedrock wells in this part of the municipality of Dundurn are in township 32, range 4.

An aquifer that is about 1,330 feet above sea-level supplies a well 600 feet deep, on the SE. ¼, section 25, with soft water that contains soda. The well is not now in use, and no analysis of the water is available. This aquifer appears to supply several wells in the municipality to the south, and a well on sec. 28, tp. 32, range 1. The aquifer probably underlies townships 32, range 3 and 4, and may extend westwards from these townships.

A well 365 feet deep, on section 22, tapped an aquifer that is about 1,410 feet above sea-level. This aquifer appears to extend into the municipality to the south, but the well on section 25 did not obtain water from it and it may not extend far westwards from section 22. Its continuation northwards is unknown.

An aquifer that is about 1,705 feet above sea-level, on the SE. ¼, sec. 33, tp. 32, range 4, supplies a well 65 feet deep with soft water that is a typical bedrock water. This aquifer seems to be confined to the northwestern part of this township, as wells to the south and east obtained hard water at elevations below 1,705 feet above sea-level, and the deep well on section 22 did not apparently obtain water at or near this elevation.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 32, Range 3

Blackstrap coulée passes through the northwest corner of the township, and Thressa lake, the water-level of which is about 1,730 feet above sea-level, extends eastward into section 31 for about $\frac{1}{4}$ mile. From Blackstrap coulée a valley, probably once occupied by a stream, extends south and east for about 4 miles. The ground surface in the township rises southwards and eastwards towards the southeast corner, where elevations of over 2,150 feet above sea-level occur, and in the SE. $\frac{1}{4}$, section 3, a small hill rises to over 2,200 feet above sea-level. There are no streams in the township, but there are three small lakes, in section 20, 22, and 23. The topography is rolling and there are several coulées that extend back from the low areas in the north and west.

Moraine underlies all the township except the valley of Blackstrap coulée, which is underlain by boulder clay.

The depth of the producing wells in this township ranges from 3 to 119 feet. In the northeast quarter two dry holes, 50 and 60 feet deep, were put down. In sections 31 and 32 several wells in Blackstrap coulée and the coulée leading south from it are 18 to 35 feet deep.

In a valley on the SE. $\frac{1}{4}$, section 29, there is a spring at about 1,915 feet above sea-level, the aquifer of which appears to rise towards the southeast and to supply a number of wells in sections 14, 20 to 23, and 27 and 28 with water, in the wells on sections 20 and 28 the supplies of water are large.

In sections 30 and 32 there is an aquifer about 1,870 to 1,882 feet above sea-level that supplies three wells 40 to 65 feet deep. This aquifer appears to extend a short distance into the township to the west. In the southeast there are three wells, 30 to 70 feet deep, that are on a northeasterly trending line from the SW. $\frac{1}{4}$, section 4, to the SE. $\frac{1}{4}$, section 15. All the wells obtain water from an aquifer at about 2,070 to 2,081 feet above sea-level. This may be a buried sand deposit of interglacial origin.

The supply of ground water in this township is not very satisfactory. At about half the farms the water is inadequate either for house use or for stock. In four wells, 25 to 119 feet deep, the water is "alkaline" and in two of these the water is too "alkaline" to be fit for drinking.

Township 32, Range 4

Brightwater lake, which is dry except in wet seasons, and Blackstrap coulée, in which Thressa lake and the northern part of Indi lake lie, are the chief topographical features. Brightwater lake occupies a shallow depression about ½ to ¾ mile wide, and is about 1,697 feet above sea-level. Blackstrap coulée is a narrow valley that is steep-sided, especially on the east. This valley is about 30 feet above the valley occupied by Brightwater lake. East of Blackstrap coulée the land surface is rather hilly and rises to over 2,050 feet above sea-level in the southeast. Between Blackstrap coulée and Brightwater lake the surface does not rise much over 1,850 feet above sea-level. West and south of Brightwater lake the surface is nearly flat.

Boulder clay underlies Blackstrap coulée and a belt about a mile wide west of it. Glacial lake clays occupy a belt about 1½ to 2 miles wide west of the boulder clay. Glacial lake sands underlie Brightwater lake, a narrow belt east of it, and a belt south of it. Dune sand occupies that part of the township west of Brightwater lake and a narrow strip about ½ mile wide south of the lake.

West of Brightwater lake the wells are less than 20 feet deep, but east and south of the lake the wells in the glacial drift are from 8 to 270 feet deep, and few are less than 50 feet deep. There is a spring in section 11, at about 1,780 feet above sea-level, on the eastern bank of Blackstrap coulée, but no wells in the vicinity appear to have tapped the aquifer that supplies it. A spring in a coulée on section 27 contains water that is too "alkaline" for use.

An aquifer that is about 1,643 to 1,678 feet above sea-level supplies two wells 112 and 72 feet deep, in sections 4 and 5, with large amounts of water. In sections 21 and 29 an aquifer that is about 1,710 to 1,715 feet above sea-level supplies two wells 50 and 60 feet deep with large supplies of water that is too "alkaline" for drinking. The wells in the bedrock and the flowing artesian area in the glacial drift have been described in the general section of this report.

The supply of water in this township is not very satisfactory. At eight farms the supply is inadequate for stock requirements and at four farms the domestic supply is hauled. In some of the deeper wells the supply of water is very large and in a few wells the water is laxative.

Township 32, Range 5

This township is underlain by dune sand except an area of about ¼ square mile in the northwest corner which is underlain by glacial lake clays. The topography is flat to hummocky and is typical of dune sand areas. The surface rises gently southeastwards from a depression less than 1,600 feet above sea-level in the northwest to elevations over 1,700 feet above sea-level.

The township is very thinly settled. All well records were obtained from the southern two-thirds of the township. All wells are less than 25 feet deep and sand-points are used at most farms. The supply of water is sufficient and the quality good at four farms. The fifth farm was deserted and no information was obtainable.

Township 32, Range 6

Dune sands underlie the whole township except for a belt from ¼ mile to 1½ miles wide bordering the banks of South Saskatchewan river which is underlain by glacial lake clays. The banks of South Saskatchewan river are low, especially in the north. Ground surface rises to the south, but all elevations are less than 1,750 feet above sea-level.

The wells in this township are less than 25 feet deep. Sand-points are used in all the wells except one. The supply of water in most of the wells is abundant. In four wells the water is soft or fairly soft. In two wells the water is hard and in one well, 22 feet deep, the water is reported as slightly "alkaline". It is, however, not too "alkaline" for drinking, and is used for irrigating the garden.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF DUNDURN, NO. 314, SASKATCHEWAN

	Township	32	32	32	32	Total No. in Muni-cipality
West of 3rd mer.	Range	3	4	5	6	
Total No. of Wells in Township		36	32	5	12	85
No. of wells in bedrock		0	5	0	0	5
No. of wells in glacial drift		35	24	0	4	63
No. of wells in alluvium		1	3	5	8	17
Permanency of Water Supply						
No. with permanent supply		30	32	5	12	79
No. with intermittent supply		2	0	0	0	2
No. dry holes		4	0	0	0	4
Types of Wells						
No. of flowing artesian wells		1	2	0	0	3
No. of non-flowing artesian wells		14	16	0	0	30
No. of non-artesian wells		17	14	5	12	48
Quality of Water						
No. with hard water		32	29	0	8	69
No. with soft water		0	3	5	4	12
No. with salty water		0	1	0	0	1
No. with "alkaline" water		6	6	0	1	13
Depths of Wells						
No. from 0 to 50 feet deep		21	14	5	12	52
No. from 51 to 100 feet deep		14	9	0	0	23
No. from 101 to 150 feet deep		1	3	0	0	4
No. from 151 to 200 feet deep		0	2	0	0	2
No. from 201 to 500 feet deep		0	3	0	0	3
No. from 501 to 1,000 feet deep		0	1	0	0	1
No. over 1,000 feet deep		0	0	0	0	0
How the Water is Used						
No. usable for domestic purposes		27	20	5	12	64
No. not usable for domestic purposes		5	12	0	0	17
No. usable for stock		32	31	5	12	80
No. not usable for stock		0	1	0	0	1
Sufficiency of Water Supply						
No. sufficient for domestic needs		28	32	5	12	77
No. insufficient for domestic needs		4	0	0	0	4
No. sufficient for stock needs		17	24	5	11	57
No. insufficient for stock needs		15	8	0	1	24

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. Resident 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 he 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 differance between the total hardness and the permanent hardness and represents the amount of mineral salts hat ban be removed by boiling. Temporary hardness is due mainly to the bicarbonates of calcium and magnesium and iron, and permanent hardness to the sulphates and chlorides of calcium and magnesium. The permanent hardness can be partly eliminated by adding simple chemical softeners such as ammonia or sodium carbonate, or many prepared softeners. Water that contains a large amount of sodium carbonate and small amounts of calcium and magnesium salts is soft, but if the calcium and magnesium salts are present in large amounts the water is hard. Water that has a total hardness of 300 parts per million or more is usually classed as excessively hard. Many of the Saskatchewan water samples have a total hardness greatly in excesss 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 Dundurn, No. 314, Saskatchewan

LOCATION						Depth of well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS										Source of Water
No.	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alkalinity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	SW.	16	32	4	3	235	2,040	800	700	100	39	390	220	122	1,136	576	2,068	390	5		364		1,245	64		* 1
2	SW.	16	32	4	3	16	2,260											(3)	(1)		(2)				(4)	* 1
3	NE.	17	32	4	3	270	2,120	1,400	1,300	100	38	285	200	223	1,185	410	1,965	285	97		654		866	63		* 1
4	SE.	33	32	4	3	65	2,180	55	10	45	44	480	20	32	1,164	1,013	2,284	36	67			386	1,722	73		* 2

Water samples indicated thus, * 1, are from glacial drift or other unconsolidated deposits.
Water samples indicated thus, * 2, are from bedrock, Belly River formation.
Analyses are reported in parts per million; where numbers (1), (2), (3), (4), and (5) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
Analysis No. 1 by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

The analyses show the predominance of sulphates in the waters, but the effect of the various sulphates on the suitability of the water for drinking varies widely. Calcium sulphate ($CaSO_4$) is tasteless, is not laxative, and water containing a considerable proportion of it can be taken without ill effects. The magnesium sulphate ($MgSO_4$) content given in the table of analyses corresponds in its laxative effect to about twice the same amount of Epsom salts when dried at a high temperature. For purposes of comparison it should be remembered that 1,000 parts per million is equivalent to 70 grains per gallon. Sodium sulphate (Na_2SO_4) is also laxative, but is less bitter than magnesium sulphate. Glauber's salt (Na_2SO_4) contains about half its weight of water of crystallization, and, therefore, the laxative effect of the dried salt is about twice that of the crystalline salt. In the water from the unconsolidated deposit sodium carbonate (Na_2CO_3) and sodium chloride ($NaCl$) are not generally present in sufficient concentrations to affect the taste or use of the water. Calcium carbonate ($CaCO_3$) and magnesium carbonate ($MgCO_3$) are practically tasteless. Magnesium carbonate is slightly laxative, but it is seldom present in sufficient concentrations to affect the use of the water for drinking.

"Black alkali" (Na_2CO_3) is the most harmful constituent of water used for irrigation. Ground water from the glacial drift usually contains little "black alkali" and the calcium sulphate that is almost invariably present in ground water from the glacial drift tends to counteract its effect. "White alkali" (Na_2SO_4, $MgSO_4$) is less harmful than "black alkali", but in large concentrations it makes water unfit for irrigation.

The glacial drift in this municipality is a mixture of sediments that has resulted from the advance and retreat of probably three ice-sheets. The materials of the glacial drift have been derived from a number of sources, some local and some distant. This material has been subjected to a number of processes during transportation and after deposition and the water from the glacial drift is, therefore, very variable in composition. The small amount of rainfall and the generally flat topography of the prairies also affect the composition of the water on the Great Plains. In this municipality there is some through drainage to South Saskatchewan river, but the rainfall is so small that there are very few streams, and over a large part of the land surface the water accumulates in local depressions and the salts are not washed out of the soil or the subsoil.

The relation between the composition of ground water and the nature of the sediment in which the water is found is well illustrated in this municipality. Most of the waters from the dune sand are comparatively soft and contain a small proportion of dissolved solids, because circulation of water through dune sands is comparatively rapid and because most of the minerals of the sands are insoluble or very slightly soluble in water. Most of the waters from the fine-grained sediments of the boulder clay and moraine are very hard and contain a fairly large proportion of dissolved solids.

In the table of analyses waters Nos. 1 and 3 are from flowing wells in the glacial drift. The composition of these waters varies slightly; both are very hard, but the water from the deeper well is much the harder. Both waters are slightly laxative due to the presence of sodium sulphate and magnesium sulphate.

Water No. 2 is from a shallow well on the same farm as the well that supplies water No. 1. This water differs from the water of the deep well in that it contains a large proportion of calcium sulphate and no sodium sulphate. This water will be excessively hard, as all the constituents are salts of calcium and magnesium; the calcium chloride ($CaCl_2$) present increases the permanent hardness. The amount of magnesium sulphate was not determined, but the water is apparently not too laxative for domestic use.

Water from the Bedrock

Water No. 4 is from a well in the Belly River formation. The softness of the water is thought to be due to a process of base exchange similar to that of artificial water softeners, in which the calcium and magnesium of the water is exchanged for the sodium of the minerals in the sand. The water is of a type very common in the bedrock wells in this general area, in which sodium sulphate, sodium carbonate, and sodium chloride are present in relative abundance, in the order given. The water is slightly laxative due to the large proportion of sodium sulphate present. The sodium carbonate will give to the water a "soda" taste that will be especially noticeable when the water is not quite cold. Waters of this general chemical type have been drunk in the Darmody-Riverhurst artesian area to the south for many years with impunity. This water, however, contains about 50 per cent more dissolved solids than the average water in the Darmody-Riverhurst artesian area. It is not fit for irrigation as it contains "black alkali" and "white alkali" and very little calcium sulphate.

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WELL RECORDS—Rural Municipality of DUNDURN, NO. 314, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SW.	4	32	3	3	Bored	69	2,150	- 54	2,096	69	2,081	Glacial sand	Hard, iron	43	D, S	Just sufficient for 18 head stock.
2	NE.	4	"	"	"	Bored	70	2,140	- 40	2,100	70	2,070	Glacial sand	Hard, "alkaline"	43	D, S	Just sufficient for 16 head stock with aid of 36-foot well.
3	NE.	14	"	"	"	Bored		2,075	- 62	2,013	70	2,005	Glacial gravel and sand	Hard	43	D, S	Sufficient supply.
4	SE.	15	"	"	"	Dug	30	2,105	- 27	2,078	30	2,075	Glacial drift	Hard	44	D, S	Insufficient for house use.
5	NW.	15	"	"	"	Bored	75	2,060	- 10	2,050	75	1,985	Glacial gravel	Hard, iron, slightly "alkaline"	42	D, S	Sufficient for 30 head stock.
6	SW.	18	"	"	"	Bored	60	2,040	- 50	1,990	60	1,980	Glacial drift	Hard, iron	42	D, S	Barely sufficient for 25 head stock.
7	NW.	18	"	"	"	Bored	119	2,005	- 89	1,916	119	1,886	Glacial drift	Hard, iron, "alkaline"	42	S	Sufficient for 26 head stock; house water hauled.
8	NE.	19	"	"	"	Bored	85	1,950	- 70	1,880	85	1,865	Glacial sand	Hard, iron	43	S	Insufficient for 6 head stock; also a 45-foot well, D, S, insufficient.
9	SW.	20	"	"	"	Bored	85	1,997	- 20	1,977	85	1,912	Glacial drift	Hard, iron	45	D, S	Sufficient for 40 head stock or more.
10	SE.	22	"	"	"	Bored	70	2,030	- 23	2,007	70	1,960	Glacial drift	Hard, iron	43	D, S	Oversufficient for 9 head stock.
11	SW.	22	"	"	"	Bored	80	2,060	- 15	2,045	80	1,980	Glacial gravel	Hard, iron, red sediment	42	S	Sufficient for 30 head stock; 18-foot well, soft water, used for house.
12	NW.	22	"	"	"	Dug and bored	30	2,025	- 12	2,013	30	1,995	Glacial sand	Hard, iron	42	D, S	Intermittent; usually sufficient for 25 head stock.
13	NE.	24	"	"	"	Bored	81	2,026	- 66	1,960	81	1,945	Glacial drift	Hard, iron		D, S	Insufficient; waters 10 to 12 head stock.
14	SE.	25	"	"	"	Dug	9	2,020	- 4	2,016	9	2,011	Glacial quicksand	Slightly hard	43	D, S	Sufficient for 25 head stock.
15	NE.	26	"	"	"	Bored	97	2,005	- 92	1,913	97	1,908	Glacial drift	Hard, iron	42	D, S	Insufficient; waters 10 head stock; 50-foot dry hole; base in glacial drift.
16	SW.	27	"	"	"	Bored	40	2,000	- 25	1,975	40	1,960	Glacial sand	Hard, iron	43	D, S	Oversufficient for 130 head stock.
17	NE.	28	"	"	"	Bored	68	1,975	- 30	1,945	68	1,907	Glacial sand	Hard, iron	43	D, S	Oversufficient for 40 head stock.
18	SE.	29	"	"	"	Dug	3	1,915					Glacial gravel	Hard	43	D, S	Flows; abundant supply.
19	NW.	29	"	"	"	Bored	40	1,910	- 34	1,876	40	1,870	Glacial drift	Hard, iron	43	D	Sufficient supply.
20	SW.	30	"	"	"	Bored	65	1,947	- 42	1,905	65	1,882	Glacial drift	Hard, iron	43	D, S	Insufficient; waters 25 head stock only. 15-foot well with intermittent supply.
21	NE.	31	"	"	"	Dug	21	1,740	- 18	1,722	21	1,719	Recent gravel	Hard, slightly "alkaline"	42	D, S	Sufficient for 40 head stock; also 18-foot well with small supply.
22	SW.	32	"	"	"	Bored	50	1,930	- 43	1,887	50	1,880	Glacial quicksand	Hard, iron	43	D, S	Sufficient for house; 15-foot well waters 20 head stock.
23	NE.	32	"	"	"	Bored	35	1,890	- 25	1,865	35	1,855	Glacial drift	Hard, cloudy		D, S	Sufficient supply.
24	NW.	32	"	"	"	Dug	28	1,850	- 25	1,825	28	1,822	Glacial drift	Hard, iron, "alkaline"	44	S	Insufficient for 14 head stock; 25-foot well for house.
25	NW.	34	"	"	"	Dug	25	1,930	- 21	1,909	25	1,905	Glacial drift	Hard, "alkaline"	42	D, S	Sufficient only for house; several dry holes; one 60 feet deep.
1	SE.	1	32	4	3	Bored	70	2,060	- 54	2,006	70	1,990	Glacial drift	Hard	43	D, S	Sufficient only 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 DUNDURN, NO.314, 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
2	NW.	4	32	4	3	Drilled	112	1,755	- 32	1,723	112	1,643	Glacial gravel	Hard, iron, "alkaline"		S	Abundant supply.
3	SE.	5	"	"	"	Drilled	72	1,750	- 8	1,742	72	1,678	Glacial gravel	Hard, iron	43	D, S	Ample supply.
4	SW.	8	"	"	"	Drilled	150	1,740	- 50	1,690	150	1,590	Glacial drift	Hard, iron		S	Supplies 35 head stock; domestic water hauled.
5	SW.	11	"	"	"	Bored	32	1,780	- 10	1,770	32	1,748	Glacial gravel	Hard, trace of iron, "alkaline"	41	D	Ample supply; springs supply stock needs.
6	NW.	15	"	"	"	Bored	60	1,810			60	1,750	Glacial drift	Hard, iron	42	D, S	Just sufficient for 15 head stock; also bored well; too "alkaline" for use.
7	SE.	16	"	"	"	Drilled	100	1,780			100	1,680	Glacial drift	Hard, iron, "alkaline"		S	Fair supply; not used much; laxative.
8	SW.	16	"	"	"	Dug	16	1,786	- 14	1,772	16	1,770	Glacial sand and gravel	Hard	42	D	Sufficient for house use; #.
9	SW.	16	"	"	"	Drilled	235	1,781	+ 30	1,811	235	1,546	Glacial drift	Hard, iron	37	S	Abundant supply; #.
10	NE.	16	"	"	"	Bored	60	1,820	- 37	1,783	60	1,760	Glacial drift	Hard, iron	43	D, S	Sufficient for 35 head stock.
11	NE.	17	"	"	"	Drilled	270	1,781	+ 30	1,811	270	1,511	Glacial drift	Hard	37	D, S	Abundant supply; #.
12	SW.	18	"	"	"	Dug	14	1,710	- 9	1,701	14	1,696	Recent sand	Hard		D	Sufficient for household; similar 12-foot well supplies 60 head stock.
13	NE.	21	"	"	"	Bored	60	1,775	- 10	1,765	60	1,715	Glacial drift	Hard, "alkaline"	43	S	Ample supply; domestic supply hauled.
14	NW.	22	"	"	"	Drilled	365	1,775	- 15	1,760	365	1,410	Belly River	Soft, salty	43	S	Sufficient supply; 45-foot well for drinking.
15	SW.	24	"	"	"	Dug	14	1,934	- 10	1,924	14	1,920	Recent alluvium	Hard		D, S	Sufficient for 100 head stock.
16	NE.	24	"	"	"	Drilled	100	1,950	- 70	1,880	100	1,850	Glacial gravel	Hard, iron	45	D, S	Insufficient; comes in slowly.
17	SE.	25	"	"	"	Drilled	600	1,930			600	1,330		Soft, soda		N	Not used; pump broken; supply hauled.
18	SW.	25	"	"	"	Bored	134	1,920	-115	1,805	134	1,786	Glacial drift	Hard, iron	44	D, S	Sufficient; waters 20 head stock; also 8-foot well for stock; good supply.
19	SE.	27	"	"	"	Drilled	160	1,810	-140	1,670	160	1,650	Glacial drift	Hard, iron	44	S	Insufficient; waters only 25 head stock; 30-foot well waters 5 head stock; spring in coulée, too "alkaline" for use; domestic water hauled.
20	SE.	29	"	"	"	Bored	50	1,760	- 32	1,728	50	1,710	Glacial drift	Hard, very "alkaline"	43	S	Sufficient; waters 90 head stock; 20-foot well for house use.
21	SW.	31	"	"	"	Bored	17	1,760	- 15	1,745	17	1,743	Recent alluvium	Hard, "alkaline"	43	D, S	Sufficient; waters 20 head stock.
22	SE.	33	"	"	"	Bored	65	1,770	- 30	1,740	65	1,705	Belly River	Soft, soda	43	D, S	Sufficient for 25 head stock; #.
23	SE.	34	"	"	"	Dug	86	1,800	- 85	1,715	86	1,714	Glacial drift	Hard, "alkaline"	42	S	Supplies 2 head stock; strongly laxative; domestic water hauled.
24	NW.	36	"	"	"	Drilled	200	1,880			200	1,680	Glacial drift	Hard, iron		D, S	Oversufficient for 150 head stock.
1	NE.	2	32	5	3	Sand-point	26	1,710			26	1,684	Recent sand	Soft		D, S	Sufficient for 60 head stock.
2	NE.	3	"	"	"	Dug	16	1,710	- 15	1,695	16	1,694	Recent sand	Soft		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 DUNDURN, NO. 314, 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
3	SE.	14	32	5	3	Sand-point	24	1,690			24	1,666	Recent sand	Soft		D	Sufficient supply.
4	SE.	19	"	"	"		11	1,700	- 10	1,690	11	1,689	Recent sand			N	Farm not occupied.
5	SE.	20	"	"	"	Dug and sandpoint	15	1,705			15	1,690	Recent sand	Soft		D, S	Sufficient for 60 head stock.
1	NE.	2	32	6	3	Dug and sandpoint	18	1,710			18	1,692	Recent sand	Hard, iron		D, S	Sufficient for house and large number of stock.
2	NW.	2	"	"	"	Dug and sandpoint	20	1,710			20	1,690	Recent sand	Fairly soft	45	D, S	Oversufficient for house and 25 head stock; three similar wells.
3	SW.	2	"	"	"	Sand-point	18	1,710	- 4	1,706	18	1,692	Recent sand	Fairly soft	46	D	Oversufficient; similar well.
4	NE.	14	"	"	"	Sand-point	8	1,700			8	1,692	Recent sand	Soft		D, S	Abundant supply.
5	NW.	22	"	"	"	Sand-point	22	1,620			22	1,598	Glacial gravel and quicksand	Hard, slightly "alkaline"	40	D, S, I	Sufficient supply; waters gardens.
6	NW.	23	"	"	"	Sand-point		1,635					Glacial drift	Hard			Sufficient along with well near slough for stock.
7	SE.	35	"	"	"	Dug	14	1,620	- 12	1,608	14	1,606	Glacial drift	Soft	42	D, S	Supplies house and 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.