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BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF WREFORD No. 280 SASKATCHEWAN

BY

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

Water Supply Paper No. 56

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CONTENTS

	Page
Introduction	1
Glossary of terms used	5
Names and descriptions of geological formations referred to	8
Water-bearing horizons of the municipality	10
Water-bearing horizons in the unconsolidated deposits	11
Water-bearing horizons in the bedrock	13
Ground water conditions by townships:	
Township 28, range 22, west of 2nd meridian	14
Township 28, range 23, " " " "	15
Township 28, range 24, " " " "	16
Township 29, range 22, " " " "	17
Township 29, range 23, " " " "	18
Township 29, range 24, " " " "	19
Township 30, range 22, " " " "	20
Township 30, range 23, " " " "	22
Township 30, range 24, " " " "	23
Statistical summary of well information	24
Analyses and quality of water	25
General statement	25
Table of analyses of water samples	29
Water from the unconsolidated deposits	30
Water from the bedrock	30
Well records	32

Illustrations

Map of the municipality.

Figure 1. Map showing surface and bedrock geology that affect the ground water supply.

Figure 2. Map showing relief and the location and types of wells.

GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF WREFORD, NO. 280 SASKATCHEWAN

INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

is given on some or all of the contour lines on the figure.

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Bearpaw Formation. The Bearpaw consists mostly of incoherent dark grey to dark brownish grey, partly bentonitic shales, weathering light grey, or, in places where much iron

is present, buff. Beds of sand occur in places in the lower part of the formation. It forms the uppermost bedrock formation over much of western and southwestern Saskatchewan and has a maximum thickness of 700 feet or somewhat more.

Belly River Formation. The Belly River consists mostly of non-marine sand, shale, and coal, and underlies the Bearpaw in the western part of the area. It passes eastward and northeastward into marine shale. The principal area of transition is in the western half of the area where the Belly River is mostly thinner than it is to the west and includes marine zones. In the southwestern corner of the area it has a thickness of several hundred feet.

Marine Shale Series. This series of beds consists of dark grey to dark brownish grey, plastic shales, and underlies the central and northeastern parts of Saskatchewan. It includes beds equivalent to the Bearpaw, Belly River, and older formations that underlie the western part of the area.

WATER BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Wreford is an area of 324 square miles in central Saskatchewan. It consists of nine townships described as tps. 28, 29, and 30, ranges 22, 23, and 24, W. 2nd mer. The centre of the area lies approximately half-way between the cities of Saskatoon and Regina. The town of Nokomis, near the eastern border of the municipality, is a junction point of the main line of the Canadian National railways, and of the Regina-Saskatoon, and Prince Albert branch of the Canadian Pacific railway.

The centre of the municipality is occupied by a broad depression in which occur the northern extension of Last Mountain lake and its tributary streams, Lanigan and Undora brooks, that drain into it from the north, and Saline creek, that drains into Lanigan creek from the east. This valley has an elevation of approximately 1,610 to 1,639 feet above sea-level, and the greatest relief, which occurs between it and the southeastern corner of the municipality, is 140 feet. The surface is relatively flat and is characterized by numerous small lakes.

Over the western half of the area, and much of the eastern half, the predominant glacial covering is composed of glacial till or boulder clay. In the southeastern part along Saline creek, and in the north-central part of the municipality, northeast of Bank lake, are two broad areas underlain by glacial lake clays. Glacial outwash sands and gravels occupy a narrow belt along Lanigan creek, whereas bordering Last Mountain lake, particularly on the east, are small areas covered by Recent lake sands and silts, or by flood-plain deposits. An area of terminal moraine extends from Nokomis northeastward over the northwest quarter of the adjacent municipality. The thickness of the glacial covering within the municipality is at least 150 feet, and in some areas it is known to be in excess of 300 feet in thickness.

Water-bearing Horizons in the Unconsolidated Deposits

Small supplies of medium soft to hard water are obtained at shallow depths from the deposits of recent alluvium that occur along the eastern shore of Last Mountain lake, and in other small, isolated areas. The water derived from these deposits is usually usable and is sufficient for local needs.

The first water-bearing horizon encountered in the glacial drift is formed by scattered deposits of sand and gravel that occur as pockets in the upper weathered zone of the glacial clay. These pockets are found at depths ranging from 10 to 35 feet of the surface. The wells that tap them are non-artesian and yield varying quantities of medium soft to medium hard water. In years of average rainfall they yield a supply that is ample for local requirements, but in periods of drought the supply is not sufficient for local needs.

The second aquifer is encountered in the lower part of the drift, at depths ranging from 40 to 100 feet. It consists of scattered deposits of sands and gravel, which occur as pockets throughout the clay and yield varying quantities of hard water. The wells encountering this horizon are not numerous and the sand and gravel pockets give no appearance of continuity throughout the area.

The third aquifer in the drift appears to be continuous over an area outlined in township 28, range 23, and township 29, ranges 22, 23, and 24. This water-bearing horizon is encountered at depths varying from 60 to 160 feet of the surface, or at an elevation of 1,500 to 1,600 feet above sea-level. The water is under hydrostatic pressure, sufficient in some cases to cause some of the wells to flow and in all others to raise the water to within a few feet of the ground surface. The wells encountering this aquifer yield ample supplies of hard water. The water generally contains iron which is present in some cases in such concentration as to make it unfit for domestic needs. Outside the area outlined it appears probable that this aquifer either disappears, or thins out to such

an extent, as to be of no value for water supply purposes. This conclusion is based on the fact that a number of wells outside the area have been drilled to depths beyond this horizon without encountering a supply of water.

A fourth aquifer is encountered in isolated areas in the municipality. The boundaries of these areas are marked "B" on the accompanying map. Water is being obtained from the areas at depths varying from 115 to 195 feet from the surface, and the elevation of the aquifer ranges from 1,505 to 1,600 feet above sea-level. There appears to be a very strong relationship between the two areas, in range 24, and it is not unlikely that the two could be joined. In the area outlined in township 28, range 22, the horizon is encountered at slightly greater depths, 175 to 195 feet, but conditions are similar to those in the areas in range 24, and it appears probable that this fourth aquifer has an areal extent covering all the southwestern half of the municipality. The water is under hydrostatic pressure and generally rises to within 10 to 40 feet of the surface. The water from wells tapping this horizon is of sufficient quantity, but it is highly charged with mineral salts and in a great many cases is usable only for stock.

The fifth and last water-bearing horizon of any great areal extent is found in part of township 29, range 22, part of township 30, range 23, and all of township 30, range 22. The wells tapping this horizon vary in depth from 175 to 350 feet and the elevation of the aquifer ranges from 1,315 to 1,550 feet. This wide range in depth leads to the belief that two horizons may be present, and this is further borne out by the fact that many of the wells encounter a horizon in the neighbourhood of 1,530 feet, or at an approximate depth of 180 feet, whereas the deeper wells tap water horizons at from 1,315 to 1,400 feet above sea-level. When drilling in this area it would be advisable to be sure that a horizon in the vicinity of 1,530 feet above sea-level or at an

approximate depth of 180 feet of the surface is not passed through unnoticed. The waters from all of the wells encountering this horizon are under hydrostatic pressure. Where the topographical relief is low, the water in some of the wells flows above the surface, and in all the other wells it rises to within only a few feet of the surface. These wells yield abundant supplies of hard water that contains fairly large amounts of salts in solution, but in most cases the water is usable for domestic purposes as well as for stock. There seems little doubt that this aquifer is at the base of the drift and is formed by sand and gravel deposits overlying the bedrock. In some cases it is probable the bedrock has been pierced, but it does not seem probable that this water-bearing horizon is in the bedrock. The extent of the horizon towards the southwest is not known, but towards the north and east it is again encountered.

Water-bearing Horizons in the Bedrock

The marine shales formation underlie the glacial drift throughout this municipality. The elevation of the top of this formation, from the meagre information available, is at 1,400 to 1,600 feet above sea-level. As mentioned previously it is not certain if the last aquifer mentioned under those of the glacial drift occurs in the drift or in bedrock, but the quality of the water does not appear to be similar to that derived elsewhere from a bedrock aquifer.

Two wells located on secs. 3 and 5, tp. 28, range 24, have definitely tapped a water-bearing horizon in the bedrock. They reach to depths of 420 and 300 feet, respectively, or to elevations of 1,240 and 1,375 feet above sea-level. In the first well the water is soft, whereas in the second it is hard. In both cases the yield is abundant and the water is under hydrostatic pressure. However, the high saline content of the water makes it unfit for domestic or stock consumption. Moreover, it is probable

that, if other wells were drilled to similar depths in this immediate vicinity, water of equally poor quality would be encountered.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 28, Range 22

This township is comparatively flat except for the shallow depression of Saline creek, which flows through it in a northwesterly direction. A few alkaline lakes occur in the western half of the township. The northeastern and southwestern corners of the township are mantled with glacial till; the southeastern corner of the township enters the belt of terminal moraine deposits. The remainder of the township is covered by glacial lake clays.

Small deposits of sand and gravel that occur as pockets in the upper weathered zone of the glacial till and lake clays form the first water-bearing horizon. The wells tapping this horizon are rarely over 30 feet in depth. They yield a supply of hard, usable water that is sufficient for local requirements.

A few wells scattered throughout the township obtain water from sand or gravel deposits that occur as pockets in the glacial deposits at depths of from 50-130 feet. The elevation of this second horizon varies from 1,540 to 1,620 feet above sea-level. The water derived from this source is hard and contains some iron. In a few cases salts occur in sufficient quantities to render the water unsuitable for drinking. In the majority of the wells the supply is abundant, and the pressure is sufficient to raise the water to within 10 to 20 feet of the surface.

In the southeastern part of the township a third aquifer is encountered at depths of 175 to 195 feet from the surface, or at an approximate elevation of 1,510 feet above sea-level. It yields a varying supply of hard water that is often "alkaline" in character. This aquifer is probably formed by deposits of sand and gravel that occur at the base of the drift. Its areal extent over the remainder

of the township is not known.

Township 28, Range 23

The surface of this township as a whole is quite flat, but gentle undulations occur in places. Saline creek has cut a small channel in the northeastern corner, and the north end of Last Mountain lake lies in the southwestern corner of the township.

The glacial deposits that mantle this township are of several types. A fairly extensive deposit of glacial outwash sands and gravels occurs in the northwestern corner. Glacial till or boulder clay covers the southeastern part of the township, glacial lake clays mantle its northeastern corner and recent flood-plain deposits floor the lowland lying to the north and east of Last Mountain lake.

The first water-bearing horizon occurs within 25 feet of the surface. In the northwestern corner of the township fair supplies of hard, usable water are obtained from the outwash sands and gravels at shallow depths. In the eastern part of the township, the water is obtained from scattered pockets of sand and gravel that occur within the upper 25 feet of the glacial deposits. In the latter area the water is medium soft to hard and the supply is usually sufficient for local needs.

A second water-bearing horizon is encountered in the glacial drift at depths ranging from 50 to 125 feet of the surface, or at an elevation of from 1,540 to 1,600 feet above sea-level. This difference in depth is in part due to the surface irregularity, but is partly due to the varying depths at which the sand and gravel deposits occur in the drift, there being no continuous aquifer. The water from this horizon is under considerable hydrostatic pressure. The wells located on the SW.$\frac{1}{4}$, section 4, the SW.$\frac{1}{4}$, section 10, and on the SE.$\frac{1}{4}$, section 16, are flowing wells, whereas in the remainder the water usually rises to within 15 feet of the surface, where it maintains a constant level. The

wells tapping this aquifer yield a fairly abundant supply of hard water. It contains relatively large amounts of mineral salts in solution, but in most cases it is used for drinking as well as for stock.

What appears to be a third water-bearing horizon in the drift is tapped by a well located on the NE.$\frac{1}{4}$, section 34, at a depth of 208 feet or at an elevation of 1,440 feet, more than 100 feet lower than the second water-bearing horizon. This well is flowing-artesian in character. This horizon may be encountered elsewhere in the township at a depth of 210 to 225 feet.

Township 28, Range 24

The land surface of this township slopes gently from 1,660 feet in the west, to an approximate elevation of 1,600 feet in the vicinity of Last Mountain lake. With the exception of a small area in the southwestern corner, which is covered by flood-plain deposits, the township is mantled with deposits of glacial till or boulder clay.

A few wells obtain a small supply of hard, usable water from scattered sand and gravel deposits occurring at shallow depths in the weathered zone of the drift. The first main water-bearing horizon is formed by pockets of sand and gravel that occur in the drift, at depths of from 40 to 80 feet from the surface. This aquifer appears to be fairly continuous at an elevation of approximately 1,600 feet above sea-level. It yields a moderate supply of hard water, which in some cases is "alkaline", but is used for drinking as well as for stock. The water is under hydrostatic pressure and rises to within 25 feet of the surface.

Three wells, located on the NE.$\frac{1}{4}$, section 28, the SW.$\frac{1}{4}$, section 35, and the NW.$\frac{1}{4}$, section 36, are deriving an abundant supply of hard, usable water from a second water-bearing horizon that occurs at an elevation of 1,500 feet above sea-level, and is

reached at depths ranging from 125 to 160 feet from the surface. This aquifer is probably formed by sand and gravel deposits that occur at the base of the drift, and that immediately overlie the bedrock. What appears to be the same aquifer is present in township 29, range 23, and township 30, range 23. It has not been encountered outside of the sections mentioned, so its areal extent throughout the township is unknown.

Two wells, located on the SW.$\frac{1}{4}$, section 3, and the SW.$\frac{1}{4}$, section 5, are deriving an abundant supply of water from bedrock aquifers at depths of 420 and 300 feet, respectively. Both wells yield salty water that is unfit even for stock. It appears that this supply is being derived from the Marine shales. This formation will probably be found to yield water of similar quality elsewhere.

Township 29, Range 22

The surface of this township rises gently from an elevation of 1,660 feet in the southwest to 1,750 feet in the northeast. The western and southwestern parts of the township are occupied by "alkaline" flats; the southwestern corner of the township is mantled by glacial lake clays and flood-plain deposits; the northeastern area by terminal moraine deposits; and the remainder of the township is blanketed by deposits of glacial till or boulder clay.

Fair supplies of hard, usable water are obtained throughout the township from pockets of sands and gravel that occur within the upper part of the glacial drift. These deposits are not continuous and dry holes are often dug within short distances of producing wells.

A fairly continuous water-bearing horizon occurs over a large part of the township at depths ranging from 90 to 160 feet from the surface, or at an elevation of 1,550 to 1,610 feet above sea-level. This horizon extends into township 29, range 23. The

water from it is under considerable hydrostatic pressure which causes it to rise a little above the surface in the low areas and to within a few feet of the surface in the higher areas. These wells yield an abundant supply of hard water that contains iron but in most cases the water is used for domestic purposes.

Along the eastern boundary, and in the northern part of the township a third aquifer is found at depths of 230 to 300 feet from the surface, or at an elevation of 1,410 to 1,500 feet above sea-level. It appears that this aquifer is formed by sand and gravel deposits that immediately overlie the bedrock. There is sufficient hydrostatic pressure to cause the water to rise to within 25 feet of the surface. This horizon yields a fairly abundant supply of hard, usable water. The areal extent of the horizon in the township under discussion is not known, but it extends northward into township 30, range 22, and westward into townships 29 and 30, range 21. It may also extend southward into township 28, range 22, as a similar horizon occurs in that area.

Township 29, Range 23

The surface of the township is flat, except where the shallow valleys of Lanigan creek, and Undora brook occur. These streams are intermittent in character. Axe and Camp lakes also occur in the central part of the township. The western part is mantled by deposits of outwash sands and gravel, and by unmodified till. The eastern half is covered with glacial lake clays and glacial till or boulder clay.

The first water-bearing horizon in the upper part of the glacial till is formed by the outwash sands and gravels at the surface and by scattered pockets of sand and gravel. A fairly abundant supply of usable water is obtained at shallow depths in the glacial outwash deposits, but the pockets of gravel yield only small amounts of usable water. Little trouble should be experienced in obtaining a water supply from the glacial outwash deposits,

but several dry holes may be dug before a pocket of water-bearing gravel is encountered in the glacial till.

Throughout the southern part of the township a second water-bearing horizon is tapped in the glacial drift at depths of from 100 to 160 feet, or at elevations of from 1,500 to 1,560 feet. This horizon appears to be fairly continuous. The water derived from this horizon is under sufficient hydrostatic pressure to cause it to flow above the surface in some wells or to rise to within a short distance of it in others. This aquifer is a continuation of the water-bearing horizon referred to in township 29, ranges 22 and 24. It probably continues into the township to the south, but its northern limit was not defined. There is an abundant supply of hard water being obtained from this horizon and although it contains a relatively large amount of mineral salts it is used for drinking as well as for stock.

No deeper aquifer appears to be present in the drift or underlying bedrock in this township.

Township 29, Range 24

The surface of this township is quite flat and it is mantled by boulder clay or till.

A water-bearing horizon is formed by pockets of sand and gravel that are scattered throughout the weathered zone of the drift. These pockets are tapped at depths of 10 to 30 feet from the surface and yield varying supplies of medium soft to medium hard, usable water. In many cases the supply is insufficient for local needs, there being only enough for domestic purposes. This aquifer appears to be more continuous in the northwestern part than elsewhere in the township.

A few wells along the eastern boundary appear to be deriving their water from a second water-bearing horizon. This horizon is also encountered in township 29, range 23. The wells range in depth from 60 to 100 feet and the aquifer lies at

elevations from 1,550 to 1,600 feet above sea-level. The hydrostatic pressure is sufficient to cause the water to rise to within 20 feet of the surface. One well, located on the NE.$\frac{1}{4}$, section 12, used to flow, but the pressure has been decreased due to the casings becoming partly plugged by quicksand. A shallow well, 40 feet in depth, located on the SW.$\frac{1}{4}$, section 24, also flows, and it may be tapping this same aquifer. All of these wells yield abundant supplies of hard water containing iron, but the water is being used for domestic purposes and for stock.

Three wells located on the SW.$\frac{1}{4}$, section 2, the NE.$\frac{1}{4}$, section 3, and on the NE.$\frac{1}{4}$, section 34, are obtaining their supply from depths of 120 to 150 feet of the surface. They appear to have tapped the same aquifer at elevations ranging from 1,500 to 1,540 feet above sea-level. This aquifer continues south into township 28, range 24, and north into township 30, range 24, and appears to be fairly continuous throughout the three townships. There is a large area, however, in this township on which no information is available, so that it cannot be stated definitely that the aquifer is general throughout the whole area. The water is very hard, and in two cases it was unfit for domestic use due to its high mineral salt content.

Township 30, Range 22

This township is comparatively flat throughout. "Alkali" flats occur along the small intermittent creek in the northwestern part. The southeastern part of the township is mantled with terminal moraine deposits. In the western part a small area is covered by glacial lake deposits and the remainder is mantled with glacial till or boulder clay.

A few shallow wells in the vicinity of Undora brook are obtaining from isolated deposits of recent alluvium small supplies of hard water that is used for drinking.

Scattered deposits of sand and gravel, occurring as pockets in the weathered zone of the glacial drift, form the uppermost water-bearing horizon. The wells range from 10 to 30 feet in depth and yield a supply of hard, usable water that is sufficient for local needs. A second water-bearing horizon, which appears to be fairly continuous throughout the township, is encountered at depths ranging from 130 to 310 feet from the surface or at elevations of 1,415 to 1,550 feet above sea-level. It is possible that two horizons may be present here and that the first was passed through unnoticed in some of the wells. A number of wells tap the horizon at about 1,530 feet and many others at 1,430 to 1,480 feet above sea-level. When a well is being drilled in this area, care should be taken that an aquifer is not passed through at a depth of 140 to 200 feet. The water in all the wells is under hydrostatic pressure and rises to within a few feet of the surface. In a few low places the wells flow. Although some of these deeper wells may be obtaining their water from a bedrock aquifer it is more likely that they are all deriving their supply from deposits of sand and gravel that overlie the bedrock and occur at the base of the glacial drift. This aquifer appears to extend into all the adjoining townships. The supply of water obtained from it is abundant. It is hard, and is used for drinking although in most cases it is highly charged with mineral salts.

One flowing artesian well, located in the NW.$\frac{1}{4}$, section 31, is tapping a horizon at a depth of 365 feet or at an elevation of 1,315 feet above sea-level. It yields an abundant quantity of hard water that contains iron in solution. This aquifer can doubtless be correlated with a similar aquifer occurring in township 30, range 23, and township 31, range 22, but its areal extent is not definable in this township. In the above-mentioned well it is possible that one, and perhaps two, water-bearing horizons were passed through unnoticed by the drillers. It is probable that this well is tapping the Marine shales.

Township 30, Range 23

Most of this township is mantled with glacial lake clays. Extensive deposits of glacial outwash sand and gravel occur along the western boundary. Small deposits of glacial till occur in the northeastern and southeastern corners of the township.

A number of wells, from 10 to 30 feet in depth, are obtaining a good supply of usable water from the outwash sands and gravels. These outwash deposits and the deposits of sand and gravel that occur as pockets in the weathered zone of the glacial lake clays form the uppermost water-bearing horizon in the drift mantle. Small supplies of water are obtained from this source. The water in some wells is hard and in others soft, and it is not always sufficient for local needs.

Three wells located on the NE.$\frac{1}{4}$, section 24, the NE.$\frac{1}{4}$, section 34, and the SW.$\frac{1}{4}$, section 35, are tapping an aquifer at depths of approximately 160 feet from the surface or at an elevation of 1,500 feet above sea-level. The deposits that form this horizon probably occur at the base of the drift and immediately overlie the bedrock. The water in these wells is under sufficient hydrostatic pressure to cause it to flow and there appears little doubt that this water-bearing horizon is a continuation of the one mentioned in township 29, range 22. The areal extent of this horizon in a southwest direction is not defined.

One well located on the SE.$\frac{1}{4}$, section 14, is tapping an aquifer that possibly occurs in the bedrock. It obtains an abundant supply of hard water that is not used for drinking because of its high mineral salt content. The well is 285 feet deep and the horizon is at an elevation of 1,390 feet above sea-level. The water is under sufficient pressure to flow. This well has tapped the same aquifer as that mentioned in township 30, range 22, and also in townships 31, ranges 22 and 23.

Township 30, Range 24

With the exception of a small area along part of the eastern boundary that is mantled by deposits of glacial outwash sands and gravel, and a small area of modified till, the remainder of the township is covered by glacial till or boulder clay.

One well located on the NW.$\frac{1}{4}$, section 1, is obtaining a good supply of soft water from a shallow depth in the glacial outwash deposits. An abundant supply should be obtained elsewhere from these deposits. In this township a great many wells are tapping pockets of sand and gravel in the uppermost 30 feet of the drift. These wells yield, with only a few exceptions, supplies of water sufficient for local requirements. The water is medium soft in some wells and very hard in others, and is used for drinking as well as for stock.

Other aquifers appear to be present in the central portion, and along the northern and southern boundaries of the township. They are tapped at depths of 100 to 170 feet from the surface or at an elevation of from 1,530 to 1,600 feet above sea-level, and appear to be correlated with aquifers found at approximately the same depths in township 28, range 22, and townships 28 and 29, ranges 24. Their areal extent in this township is not defined. The hydrostatic pressure is sufficient to cause the water to rise to within a few feet of the surface in some wells and to flow above the surface in a few others. The water supply from the wells tapping this horizon is fair; the water is hard, and is usually too "alkaline" for human consumption, although it is usable for stock.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF WREFORD, NO. 280, SASKATCHEWAN

West of 2nd mer. Township / Range	28 / 22	28 / 23	28 / 24	29 / 22	29 / 23	29 / 24	30 / 22	30 / 23	30 / 24	Total No. in Municipality
Total No. of Wells in Township	35	27	50	36	29	39	45	23	75	359
No. of wells in bedrock	0	0	2	5	0	0	6	1	0	14
No. of wells in glacial drift	35	23	48	31	18	39	35	20	74	323
No. of wells in alluvium	0	4	0	0	11	0	4	2	1	22
Permanency of Water Supply										
No. with permanent supply	29	27	49	36	28	38	39	23	49	318
No. with intermittent supply	1	0	1	0	1	1	0	0	1	5
No. dry holes	5	0	0	0	0	0	6	0	25	36
Types of Wells										
No. of flowing artesian wells	0	2	0	3	4	1	3	4	1	18
No. of non-flowing artesian wells	16	10	30	28	2	14	22	4	15	141
No. of non-artesian wells	14	15	20	5	23	74	14	15	34	164
Quality of Water										
No. with hard water	28	25	47	33	24	36	35	21	42	291
No. with soft water	2	2	3	3	5	3	4	2	8	32
No. with salty water	0	0	2	0	0	0	0	0	0	2
No. with "alkaline" water	21	11	23	12	4	10	15	6	12	114
Depths of Wells										
No. of 0 to 50 feet deep	24	17	28	5	23	30	19	18	63	227
No. from 51 to 100 feet deep	5	6	17	10	2	6	4	1	3	54
No. from 101 to 150 feet deep	1	2	2	9	3	3	1	2	8	31
No. from 151 to 200 feet deep	5	0	1	5	1	0	7	1	2	22
No. from 201 to 500 feet deep	0	2	2	7	0	0	13	1	0	25
No. from 501 to 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
How the Water is used										
No. usable for domestic purposes	21	22	38	32	23	33	32	20	33	254
No. not usable for domestic purposes	9	5	12	4	6	6	7	3	17	69
No. usable for stock	29	27	48	36	29	39	39	23	50	320
No. not usable for stock	1	0	2	0	0	0	0	0	0	3
Sufficiency of Water Supply										
No. sufficient for domestic needs	29	26	47	36	27	38	36	23	50	312
No. insufficient for domestic needs	1	1	3	0	2	1	3	0	0	11
No. sufficient for stock needs	21	22	36	34	23	29	31	16	35	247
No. insufficient for stock needs	9	5	14	2	6	10	8	7	15	76

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 Wreford, No. 280, 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	
1	SE	13	29	22	2	270	2,220	650	650		180	125	150	148	1,210	621	2,121	125	194	-	441	-	1,064	297	*2
2	NW.	26	30	22	2	125	2,140	900	850	50	162	275	270	180	1,378	626	2,469	275	282	-	536	-	1,109	267	*1
3	NW.	31	30	22	2	365	3,000	700	650	50	450	350	250	112	1,394	1,061	3,088	350	131	-	334	-	1,530	743	*2

Water samples indicated thus, *1, are from glacial drift or other unconsolidated deposits.
Water samples indicated thus, *2, are from bedrock, Bearpaw formation.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
For interpretation of this table read the section on Analyses and quality of Water.

Water from the Unconsolidated Deposits

Only one sample of water that is known definitely to be from the glacial drift was analysed. The waters from the shallow wells, 10 to 40 feet in depth, vary from moderately soft to hard, and are reported to contain only relatively small quantities of mineral salts. Iron is present in some of the water, but it is not of sufficient concentration to make the water suitable for domestic use.

In the deeper wells, 80 to 150 feet in depth, the water contains greater amounts of salts in solution. The sample analysed has a total dissolved solid content of 2,140 parts per million. The total hardness is 900 parts per million, of which only 50 parts is temporary. The temporary hardness of water can usually be eliminated by boiling.

The waters from a number of wells scattered throughout the municipality are so "alkaline" as to be unfit for domestic use. In such waters the sulphate salts are present in large amounts and give them a laxative effect. In the sample analysed these salts were present to the total extent of 1,927 parts per million. Sodium sulphate is the most abundant salt present, and small amounts of common salt also occur.

In most of the waters from the deeper wells in this municipality, iron is present in varying quantities. In many of the waters they are in sufficient concentration to cause them to be suitable only for stock. By letting the water stand in contact with the air for a considerable time before using, most of the iron content will become oxidized and settle out as a reddish precipitate. If the water is allowed to pass over a sheet of corrugated iron between pump and trough the settling out of the iron will be speeded up.

Water from the Bedrock

There is some doubt regarding the source of the two samples analysed and listed as being from the bedrock, but it seems probable

that they are derived from a bedrock aquifer. The waters from the bedrock are very soft in places and extremely hard in other places. In the samples analysed the waters are extremely hard, due to the high percentage of the salts of calcium and magnesium present. Most of the hardness is permanent and cannot be eliminated by boiling. In the waters from one well the NaCl (common salt) content is 743 parts per million. This is more than sufficient to give the water a salty taste and it should be used only for stock purposes. It is probable that wells drilled in the vicinity of the two wells referred to above would yield a water somewhat similar in quality. Two wells in the southern part of township 28, range 24, encountered a water that was very salty. The water from one of these wells was hard and from the other soft, but the waters were unfit for either domestic or stock use.

WELL RECORDS—Rural Municipality of WREFORD NO. 280, 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	NW.	1	28	22	2	Dug	14	1,700	- 10	1,690	14	1,686	Glacial sand	Hard, "alkaline"		S,	Sufficient for 20 head stock.
2	NE.	2	"	"	"	Drilled	175	1,700	- 10	1,690	175	1,525	"	Hard, clear		D, S	" " 25 " " .
3	NE.	3	"	"	"	"	180	1,700			180	1,520	"	" " iron		N	.
4	NW.	3	"	"	"	Bored	30	1,700	- 21	1,679	30	1,670	" sand and gravel	Hard, clear		D, S	Sufficient for 30 head stock.
5	NW.	6	"	"	"	"	100	1,680					Glacial sand and gravel	" "			This place vacant.
6	SW.	6	"	"	"	Drilled	92	1,680	- 10	1,670	92	1,588	Glacial sand	" " iron		S	Large supply; laxative.
7	NW.	12	"	"	"	"	128	1,700	- 15	1,685	128	1,572	" "	Hard, clear, iron		S	Sufficient for 25 head stock; laxative.
8	SE.	12	"	"	"	Dug	12	1,700	- 6	1,694	12	1,688	" "	Hard		D, S	" " 36 " " " .
8a	NW.	13	"	"	"	Drilled	185	1,700	-100	1,600	185	1,515	" "	" clear		D, S	" " local needs.
9	NE.	14	"	"	"	Bored	60	1,700	- 15	1,685	60	1,640	" "	" "alkaline"		D, S	" " 35 head stock.
10	SW.	15	"	"	"	Drilled	195	1,700	0	1,700	195	1,505	" "	" clear, iron		D, S	Abundant supply.
11	NE.	16	"	"	"	Bored	21	1,690	- 18	1,672	21	1,669	" "	Hard, clear		D, S	Sufficient for 30 head stock; laxative.
12	SW.	16	"	"	"	Dug	25	1,690	- 6	1,684	25	1,665	" gravel	" "		D, S	" " 20 " " .
13	NW.	18	"	"	"	Drilled	123	1,665	- 14	1,651	123	1,542	" "	" "		D, S	" " 80 " " .
14	SW.	18	"	"	"	Bored	45	1,665	- 9	1,656	45	1,620	" "	" "		D, S	" " 25 " " .
15	NW.	20	"	"	"	Dug	11	1,670	- 9	1,661	11	1,659	" sand	" "		D, S	" " 30 " " .
16	SE.	22	"	"	"	Bored	30	1,700	- 8	1,692	30	1,670	"	" "		S	Insufficient for 20 head stock.
16a	NW.	22	"	"	"	"	85	1,700	- 45	1,655	85	1,615	" gravel	" "		D, S	" " local needs.
17	NE.	23	"	"	"	"	48	1,700	- 16	1,684	48	1,652	" sand	" "		S	Sufficient for 40 head stock; laxative.
18	SW.	25	"	"	"	Dug	17	1,700	- 7	1,693	17	1,683	" "	" "		S	" " 30 " " " .
19	SW.	26	"	"	"	"	25	1,710	- 20	1,690	25	1,685	" gravel	" "		S	" " 15 " " " .
20	SE.	27	"	"	"	"	20	1,690	- 14	1,676	20	1,670	" clay	Soft, "		D	" " domestic use.
21	NE.	35	"	"	"	Bored	82	1,690	- 12	1,678	82	1,608	" ?	Hard, iron, "alkaline"		D, S	" " local needs.
1	NE.	1	28	23	2	Dug	17	1,680	- 15	1,665	17	1,663	" sand	Soft,	42	D, S	" " 25 head stock.
2	NE.	2	"	"	"	Drilled	75	1,675	- 20	1,655	75	1,600	" "	Hard, iron	43	D, S	" " 20 " " , laxative.
3	SW.	4	"	"	"	Bored	60	1,650	0	1,650	60	1,590	" gravel and sand	" " "alkaline"	43	D, S	Abundant supply.
4	NW.	9	"	"	"	Drilled	85	1,640	- 25	1,615	85	1,555	Glacial gravel and sand	Hard		S	" " .

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 WREFORD NO. 280, 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	NE.	10	28	23	2	Drilled	80	1,660	- 15	1,645	80	1,580	Glacial gravel and sand	Hard, iron, "alkaline"	42	D, S	Insufficient; 3 bbls. a day.
6	SW.	10	"	"	"	"	50	1,660	+ 3	1,663	50	1,610	Glacial gravel and sand	Hard, iron, "alkaline"	44	D, S	Abundant supply.
7	NW.	11	"	"	"	"	22	1,670	- 14	1,656	22	1,648	Glacial sand and gravel	Hard, "alkaline"	41	D, S	Abundant supply; laxative.
8	SE.	12	"	"	"	Dug	40	1,680	- 32	1,648	40	1,640	Glacial clay	Hard, iron, "alkaline"	42	S	" " " .
9	NE.	12	"	"	"	"	15	1,675	- 12	1,663	15	1,660	" sand	Soft,	44	D, S	Sufficient for 15 head stock.
10	NW.	14	"	"	"	"	12	1,660	- 9	1,651	12	1,648	" "	Hard, iron, "alkaline"	44	D, S	Insufficient for 35 head stock.
11	NW.	15	"	"	"	Drilled	125	1,650			125	1,525	?	"		N	
12	SE.	16	"	"	"	"	65	1,650	+ 5	1,655	65	1,585	Glacial sand	Hard, iron	43	D, S	Abundant supply.
13	NE.	16	"	"	"	Bored	46	1,650	- 15	1,635	46	1,604	" "	" "alkaline"	42	D, S	Sufficient for 25 head stock.
14	SE.	22	"	"	"	Drilled	90	1,650	- 9	1,641	90	1,560	" "	" " iron	43	D, S	" " 30 " " .
15	SE.	24	"	"	"	"	125	1,670	- 10	1,660	125	1,545	"	Hard, iron, "alkaline"		D, S	" " 50 " " .
16	SE.	25	"	"	"	Dug	15	1,670	- 12	1,658	15	1,655	" gravel	Hard, "alkaline"	42	D, S	" " 30 " " .
17	SW.	28	"	"	"	"	14	1,620	- 11	1,609	14	1,606	" sand	Hard	42	D, S	" " local needs.
18	SW.	30	"	"	"	"	24	1,620	- 16	1,604	24	1,596	" "	"alkaline"		D, S	Abundant supply.
19	NW.	32	"	"	"	"	15	1,640	- 13	1,627	15	1,625	" gravel and sand	"	42	D, S	Sufficient for 30 head stock.
20	NE.	33	"	"	"	"	12	1,640	- 7	1,633	12	1,628	Glacial clay	"	41	D, S	" " 100 " " .
21	NE.	34	"	"	"	Drilled	208	1,650	+ 18	1,668	208	1,442	Glacial sand	Hard,	43	D, S	" " local needs.
1	NE.	3	28	24	2	Bored	56	1,640	- 36	1,604	56	1,584	Glacial sand	"alkaline"	42	S	Insufficient.
2	SW.	3	"	"	"	Drilled	420	1,660	- 40	1,620	420	1,240	Bedrock	Soft, salty	43		Too salty for use.
3	NW.	4	"	"	"	Bored	35	1,660	- 16	1,644	35	1,625	Glacial sand and gravel	Hard, "alkaline"	42	D, S	Sufficient for 100 head stock.
4	SW.	5	"	"	"	Drilled	300	1,670	-100	1,570	300	1,370	Bedrock	Hard, salty	42		Too salty for use.
5	NE.	6	"	"	"	Bored	53	1,670	- 20	1,650	53	1,617	Glacial clay	" iron "alkaline"	43	D, S	Sufficient for 35 head stock.
6	SW.	6	"	"	"	"	80	1,675	- 20	1,655	80	1,595	"	Hard, "alkaline"	42	S	Insufficient; 2 bbls. a day.
7	NE.	7	"	"	"	"	60	1,675	- 40	1,635	60	1,615	" clay	Hard, iron, "alkaline"	42	D, S	Sufficient for 10 head stock.
8	NW.	8	"	"	"	"	55	1,660	- 50	1,610	55	1,605	" sand	Hard, "alkaline"	42	S	Insufficient.
9	NE.	9	"	"	"	Dug	40	1,650	- 20	1,630	40	1,610	" "	Hard, "alkaline"		D, S	Abundant supply.
10	SE.	10	"	"	"	Bored	56	1,640	- 36	1,604	56	1,584	" "	Hard, iron, "alkaline"	40	D, S	Sufficient for 70 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 WREFORD NO. 280, 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
11	NW.	14	28	24	2	Dug	44	1,650	- 20	1,630	44	1,606	Glacial gravel	Hard	42	D, S	Abundant supply.
12	NE.	15	"	"	"	"	64	1,650	- 34	1,616	64	1,586	" "	"	42	D, S	Sufficient for 50 head stock.
13	SE.	16	"	"	"	Bored	50	1,650	- 20	1,630	50	1,600	" sand	" "alkaline"		D, S	Abundant supply.
14	NW.	17	"	"	"	"	47	1,670	- 30	1,640	47	1,623	" "	" iron		D, S	Sufficient for 30 head stock.
15	NE.	18	"	"	"	"	40	1,670	- 22	1,648	40	1,630	"	" " "alkaline"	42	D, S	" " 50 " " .
16	SE.	18	"	"	"	"	70	1,660	- 40	1,620	70	1,590	" clay	Hard, iron, "alkaline"	42	S	Insufficient for stock.
17	SE.	22	"	"	"	"	50	1,650	- 24	1,626	50	1,600	" gravel	Hard,	41	D, S	Sufficient for 20 head stock.
18	NE.	22	"	"	"	Drilled	80	1,650	- 20	1,630	80	1,570	" sand	" iron	43	D, S	" " 40 " " .
19	NE.	24	"	"	"	Dug	26	1,630	- 16	1,614	26	1,604	" gravel	" " "alkaline"	42	D, S	" " 100 " " .
20	NE.	25	"	"	"	Bored	35	1,630	- 15	1,615	35	1,595	" sand	Hard, iron, "alkaline"	42	D, S	" " 30 " " .
21	SE.	25	"	"	"	"	30	1,620	- 22	1,598	30	1,590	" "	Hard, "alkaline"	42	S	" " 20 " " .
22	SW.	27	"	"	"	"	55	1,660	- 40	1,620	55	1,605	" clay	Hard, iron	43	D, S	" " 25 " " .
23	SE.	28	"	"	"	"	83	1,660	- 20	1,640	83	1,577	" gravel	Soft,	42	D, S	" " 35 " " .
24	NE.	28	"	"	"	Drilled	159	1,660	- 8	1,652	159	1,501	" "	Hard	42	D, S	Abundant supply.
25	SE.	29	"	"	"	Bored	58	1,670	- 38	1,632	48	1,612	" clay	" iron	42	D, S	Sufficient for 50 head stock.
26	NE.	30	"	"	"	Dug	28	1,680	- 20	1,660	28	1,652	" sand	" "		S	" " 25 " " .
27	SE.	30	"	"	"	Drilled	70	1,675	- 10	1,665	70	1,605	" "	" "alkaline"	42	D, S	Abundant supply.
28	NE.	32	"	"	"	Dug	24	1,670	- 22	1,648	24	1,646	" "	"	43	D, S	Sufficient for 10 head stock.
29	SW.	35	"	"	"	Drilled	130	1,650	- 20	1,630	130	1,520	" "	"	41	D, S	" " 15 " " .
30	NW.	36	"	"	"	"	124	1,640	- 20	1,620	124	1,516	" "	" "alkaline" iron	43	D, S	" " 15 " " .
31	SE.	36	"	"	"	Bored	48	1,630	- 15	1,615	48	1,582	" "	Hard iron		S	
32	NW.	18	"	"	"	Dug	20	1,680	- 18	1,662	20	1,660	" gravel	"	41	D, S	Sufficient for 50 head stock.
1	NW.	2	29	22	2	Drilled	96	1,700	- 25	1,675	96	1,604	"	" "alkaline" iron		D, S	Over sufficient for 30 head stock.
2	NE.	3	"	"	"	"	96	1,700	- 16	1,684	96	1,604	" gravel	Hard, "alkaline"		D, S	" " " 20 " " .
3	NE.	3	"	"	"	"	120	1,700	- 3	1,703	120	1,580	"	Hard, iron, "alkaline"		S	" " " 60 " " .
4	SE.	10	"	"	"	Bored	75	1,700	- 10	1,690	75	1,625	" sand	Hard, "alkaline"		D, S	" " " 23 " " .
6	NE.	11	"	"	"	"	60	1,710	- 56	1,654	60	1,650	" "	Hard		D, S	Insufficient; 3 bbls. a day.

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 WREFORD NO. 280, 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
6	NW.	11	29	22	2	Drilled	90	1,710	- 8	1,702	90	1,620	Glacial gravel	Hard, iron, "alkaline"		D, S	Sufficient for 60 head stock.
7	SE.	13	"	"	"	"	270	1,720	- 80	1,640	270	1,450	Bedrock shale	Hard, iron, "alkaline"		D, S	" " 75 " " .
8	SE.	14	"	"	"	Dug	12	1,700	- 8	1,692	12	1,688	Glacial sand	Soft,		D, S	" " 15 gallons a minute.
9	NW.	15	"	"	"	Drilled	87	1,700	- 10	1,690	87	1,613	" gravel and sand	Hard, iron		D, S	" " 30 head stock.
10	NE.	15	"	"	"	"	95	1,710	- 7	1,703	95	1,615	Glacial gravel and sand	" "		D, S	" " 18 " " .
11	SE.	16	"	"	"	"	122	1,700	+ 2	1,702	122	1,578	Glacial fine sand	" "		D, S	" " 25 " " .
12	NW.	16	"	"	"	Dug	12	1,700	- 10	1,690	12	1,688	Glacial sand	"		S	" " 20 " " , in summer.
13	NE.	16	"	"	"	Bored	60	1,700	- 52	1,648	60	1,640	" "	" bitter		S	" " 10 " " .
14	NW.	20	"	"	"	Drilled	70	1,685	- 10	1,675	70	1,615	" "	" iron, "alkaline"		D, S	" " 80 " " .Laxative.
15	SW.	22	"	"	"	"	108	1,700	- 8	1,692	108	1,592	" "	Hard, iron		D, S	Oversufficient for 45 head stock.
16	SW.	22	"	"	"	"	150	1,700	- 15	1,685	150	1,550	" "	" "		D, S	Sufficient for 20 head stock.
17	NW.	22	"	"	"	"	140	1,710	- 40	1,670	140	1,570	" "	"		D, S	" " 50 bbls. a day.
18	SW.	23	"	"	"	"	160	1,720	- 20	1,700	160	1,560	" gravel	" iron		D, S	" " 20 head stock.
19	SW.	24	"	"	"	"	265	1,720	- 25	1,695	265	1,455	Bedrock	" "		D, S	Oversufficient for 15 head stock.
20	SE.	24	"	"	"	"	235	1,720	- 20	1,700	235	1,485	Glacial gravel	" "		D, S	" " 20 " " .
21	NW.	24	"	"	"	"	252	1,720	- 36	1,684	252	1,468	" "	" "		D, S	" " 20 " " .
22	SW.	25	"	"	"	"	260	1,720	- 36	1,684	260	1,460	Bedrock "	" " "alkaline"		D, S	" " 40 " " .
23	SW.	26	"	"	"	Bored	127	1,720	- 30	1,690	127	1,593	Glacial sand	Hard, iron, "alkaline"		D, S	Sufficient for local needs.
24	SW.	27	"	"	"	Drilled	225	1,720	- 40	1,680	225	1,495	" "	Hard, iron		D, S	" " 50 head stock.
25	SE.	27	"	"	"	Bored	28	1,720	- 8	1,712	28	1,692	" " alkaline	" " "alkaline"		D, S	" " local needs.
26	SE.	27	"	"	"	Drilled	277	1,720	- 40	1,680	277	1,443	Bedrock sand	Hard, irom		D, S	" " " " .
27	SE.	28	"	"	"	"	108	1,710	- 8	1,702	108	1,602	Glacial sand	" "		D, S	Oversufficient for 20 head stock.
28	SW.	28	"	"	"	"	300	1,710	- 28	1,682	300	1,410	Bedrock gravel	" "		D, S	Sufficient for 15 head stock.
29	NE.	30	"	"	"	Bored	70	1,700	+ 1	1,701	70	1,630	Glacial gravel	Fairly soft		D, S	" " 6 " " .
30	SW.	34	"	"	"	Drilled	135	1,720	- 35	1,685	135	1,585	" "	Hard,		D, S	" " 40 " " .
31	SW.	34	"	"	"	"	192	1,720	- 30	1,690	192	1,528	" sand	" "alkaline"		D, S	Oversufficient for 20 head stock.
32	SW.	35	"	"	"	Bored	140	1,725	- 15	1,710	140	1,585	"	" iron		S	" " 35 " " .

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 WREFORD NO. 280, 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	NE.	36	29	22	2	Drilled	260	1,740	- 40	1,700	260	1,480	Glacial gravel	Hard, iron		D, S	Oversufficient for 100 head stock.
34	SW.	36	"	"	"	"	230	1,735	- 50	1,685	230	1,505	" "	" "		D, S	" " 15 " " .
1	NW.	2	29	23	2	Drilled	108	1,640	+ 8	1,648	108	1,532	" ? gravel	" "		D, S	" " 35 " " .
2	SE.	2	"	"	"	Dug	6	1,640	- 4	1,636	6	1,634	" quicksand	Fairly soft		D, S	" " 50 " " .
3	NW.	6	"	"	"	Drilled	99	1,650	+ 2	1,652	99	1,551	" gravel	Hard, iron		D, S	" " 200 " " .
4	NW.	12	"	"	"	Dug	35	1,650	- 20	1,630	35	1,615	" clay	" "alkaline"		S	" " 15 " " .
5	SE.	12	"	"	"	"	26	1,640	- 24	1,616	26	1,614	" quicksand	"		D, S	" " 20 " " .
6	NE.	13	"	"	"	Drilled	100	1,660	- 2	1,658	100	1,560	"	" iron		D, S	" " 90 " " .
7	SW.	14	"	"	"	Bored	30	1,640	- 28	1,612	30	1,610	" clay	" "alkaline"		S	Insufficient.
8	SE.	14	"	"	"	Drilled	108	1,650	+ 12	1,662	108	1,542	" gravel	"		?	Flowed 2,000 gallons a minute. Now choked.
9	SE.	15	"	"	"	Bored	25	1,640	- 23	1,617	25	1,615	Recent clay	" "alkaline"		S	Insufficient; ½ bbl . a day.
10	SE.	16	"	"	"	Dug	14	1,640	- 3	1,637	14	1,626	" sand and gravel	Fairly soft		D, S	Oversufficient.
11	SE.	18	"	"	"	Drilled	160	1,650	+ 2	1,652	160	1,490	Glacial gravel	Hard, iron			Plugged now.
12	NE.	22	"	"	"	Dug	12	1,650	- 9	1,641	12	1,638	" sand	"		D, S	Sufficient for local needs.
13	NE.	24	"	"	"	Drilled	150	1,675	- 4	1,671	150	1,525	Bedrock ?	" iron		S	Oversufficient for 45 head stock.
14	NW.	31	"	"	"	Dug	18	1,640	- 12	1,628	18	1,622	Recent sand	Soft,		D, S	" " 18 bbls. a day.
15	NE.	32	"	"	"	"	18	1,650	- 17	1,633	18	1,632	" gravel	Hard		D	Just sufficient for house use.
16	NE.	33	"	"	"	"	10	1,650	- 7	1,643	10	1,640	Glacial sand	Soft,		S	Good supply, unused now.
17	NW.	35	"	"	"	"	12	1,650	- 9	1,641	12	1,638	" quicksand	Hard, "alkaline"		S	Oversufficient for 20 head stock.
1	NW.	1	29	24	2	Bored	65	1,650	- 18	1,632	65	1,585	Glacial sand	Hard		D, S	Inexhaustible.
2	SW.	2	"	"	"	Drilled	140	1,650	- 14	1,636	140	1,510	" ? "	" iron		D, S	Oversufficient for 25 head stock.
3	NE.	2	"	"	"	Bored	50	1,650	- 28	1,622	50	1,600	" "	" "alkaline"		D, S	Sufficient for 15 head stock.
4	NE.	3	"	"	"	Drilled	150	1,650	- 12	1,638	150	1,500	" ? "	" "		S	" " 50 " " .
5	SW.	4	"	"	"	Dug	20	1,670	- 18	1,652	20	1,650	" quicksand	"		D, S	" " 30 " " .
6	SW.	6	"	"	"	"	25	1,680	- 21	1,659	25	1,655	" clay	" "alkaline"		D, S	" " 20 " " .
7	NW.	8	"	"	"	Drilled	60	1,680	- 20	1,660	60	1,620	" gravel	"		D, S	" " 50 " " .
8	NE.	12	"	"	"	"	98	1,650	- 20	1,630	98	1,552	" quicksand	" iron, "alkaline"		D, S	" " 40 " " . Did flow.

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 WREFORD NO. 280 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
9	NE.	13	29	24	2	Dug	65	1,650	- 18	1,632	65	1,585	Glacial sand	Hard, iron, "alkaline"		D, S	Sufficient for 35 head stock.
10	NE.	14	"	"	"	"	60	1,645	- 18	1,627	60	1,585	" "	Hard, iron, "alkaline"		S	" " 40 " " .
11	SW.	16	"	"	"	"	16	1,670	- 12	1,658	16	1,654	" quicksand	Hard		D, S	Hardly sufficient for 10 head stock.
12	N½.	17	"	"	"	Bored	35	1,680	- 31	1,649	35	1,645	" clay	"		S	Insufficient for 12 head stock.
13	SE.	18	"	"	"	Dug	12	1,675	- 6	1,669	12	1,663	" quicksand	"		D, S	Oversufficient.
14	NW.	20	"	"	"	"	12	1,680	- 9	1,671	12	1,668	" "	Soft,		D, S	Sufficient only for house.
15	NE.	20	"	"	"	Bored	75	1,680	- 55	1,625	75	1,605	" clay	Hard, iron, "alkaline"		S	" for 16 head stock.
16	NE.	21	"	"	"	Dug	18	1,650	- 6	1,644	18	1,632	"	Hard,		D, S	Oversufficient.
17	NE.	22	"	"	"	"	32	1,650	- 30	1,620	32	1,618	" quicksand	"		D, S	Ample supply.
18	SW.	24	"	"	"	Bored	37	1,650	+ 1	1,651	37	1,613	" sand	" iron, "alkaline"		D, S	Oversufficient for 40 head stock.
19	SE.	25	"	"	"	Dug	8	1,640	- 6	1,634	8	1,632	" gravel	Soft,		D, S	Vacant house.
20	NW.	26	"	"	"	Bored	36	1,650	- 30	1,620	36	1,614	" sand	Hard, iron, "alkaline"		D, S	Sufficient for 30 head stock.
21	NW.	28	"	"	"	Dug	35	1,670	- 29	1,641	35	1,635	" "	Hard, iron		D, S	Oversufficient for 10 head stock.
22	NE.	28	"	"	"	"	19	1,660	- 17	1,643	19	1,641	" "	" "		D, S	Insufficient; 4 bbls. a day.
23	SW.	29	"	"	"	"	24	1,680	- 18	1,662	24	1,656	" quicksand	"		D, S	Oversufficient for house only.
24	NE.	29	"	"	"	"	18	1,670	- 16	1,654	18	1,652	" clay	"		D	Sufficient " " " " .
25	SE.	30	"	"	"	"	24	1,680	- 15	1,665	24	1,656	" quicksand	"		D, S	Oversufficient for 100 head stock.
26	NE.	30	"	"	"	"	15	1,680	- 10	1,670	15	1,665	" sand	Soft,		D, S	Barely " " 15 " " .
27	SE.	31	"	"	"	"	10	1,680	- 6	1,674	10	1,670	" "	Hard,		D, S	Just " " 7 " " .
28	SE.	32	"	"	"	"	10	1,670	- 6	1,664	10	1,660	" gravel	"		S	Sufficient " 60 " " .
29	SW.	32	"	"	"	"	3	1,680	0	1,680	3	1,677	" sand	"		D, S	Abundant supply.
30	SE.	34	"	"	"	Bored	50	1,660	- 44	1,616	50	1,610	" "	" iron		D, S	Insufficient for 35 head stock.
31	NE.	34	"	"	"	Drilled	120	1,660	- 20	1,640	120	1,540	" quicksand	" " "alkaline"		S	Sufficient for 80 head stock.
32	NE.	34	"	"	"	Bored	30	1,660	- 29	1,631	30	1,630	" clay	Hard, iron		D	Insufficient.
1	SW.	2	30	22	2	Drilled	310	1,725	- 30	1,695	310	1,415	Bedrock? gravel	" " "alkaline"		D, S	Sufficient for 25 head stock.
2	SE.	4	"	"	"	"	265	1,720	-100	1,620	265	1,455	Glacial? sand	Hard, iron, "alkaline"		D, S	Oversufficient for 30 head stock.
3	SW.	4	"	"	"	"	260	1,710	- 30	1,680	260	1,450	" quick-sand	Hard, iron		S	" " " 15 " " .

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 WREFORD NO. 280, 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	SW.	4	30	22	2	Bored	70	1,710	- 20	1,690	70	1,640	Glacial sand	Soft,		D, S	Oversufficient.
5	NW.	4	"	"	"	Drilled	246	1,720	- 80	1,640	246	1,474	" ? gravel	Hard, iron		D, S	Just sufficient.
6	SE.	5	"	"	"	"	172	1,710	- 20	1,690	172	1,538	" "	" " "alkaline"		D, S	Sufficient for 50 head stock.
7	SE.	6	"	"	"	"	175	1,700	- 2	1,698	175	1,525	" sand	Hard, iron "alkaline"		D, S	" " 25 " " .
8	NW.	8	"	"	"	Bored	22	1,680	- 12	1,668	22	1,658	" "	Hard, bitter		S	" " 30 " " .
9	SE.	9	"	"	"	Drilled	241	1,720	- 20	1,700	241	1,479	" "	" iron		D, S	" " 25 " " .
10	SW.	10	"	"	"	"	246	1,720	- 23	1,697	246	1,474	" "	"		D, S	Oversufficient for 10 head stock.
11	NW.	12	"	"	"	"	265	1,730	- 8	1,722	265	1,465	" "	" iron		D, S	Sufficient " 26 " " .
12	SE.	14	"	"	"	Dug	14	1,750	- 12	1,738	14	1,736	" "	Soft,		D, S	" " " for school needs.
13	SW.	14	"	"	"	Drilled	296	1,725	- 30	1,695	296	1,429	Bedrock? quicksand	Hard, iron		D, S	" " 30 head stock.
14	NW.	14	"	"	"	"	260	1,725	- 34	1,691	260	1,465	Glacial? gravel	" " "alkaline"		D, S	" " 100 " " .
15	SW.	15	"	"	"	"	246	1,720	- 36	1,684	246	1,474	" sand	Hard, iron, "alkaline"		D, S	?
16	NE.	16	"	"	"	Bored	80	1,700	- 72	1,628	80	1,620	" quicksand	Hard, "alkaline"		S	Sufficient for 8 head stock.
17	SW.	16	"	"	"	Drilled	231	1,700	- 35	1,665	231	1,469	Bedrock? gravel	Hard, "alkaline"		S	Oversufficient for 40 head stock.
18	NW.	16	"	"	"	"	184	1,700	+ 3	1,703	184	1,516	" "	Hard, iron, "alkaline"		D, S	Inexhaustible.
19	SE.	18	"	"	"	Dug	18	1,680	- 14	1,666	18	1,662	Recent quicksand	Hard,		D, S	Insufficient; 3 bbls. a day.
20	SW.	21	"	"	"	"	14	1,725	- 8	1,717	14	1,711	" "	" "alkaline"		D, S	Sufficient for 30 head stock.
21	SW.	22	"	"	"	Drilled	160	1,710	- 12	1,698	160	1,550	Glacial? gravel	" iron		S	Inexhaustible.
22	NW.	22	"	"	"	Dug	12	1,700	- 9	1,691	12	1,688	" "	Soft,		D	Sufficient; 50 bbls. a day.
23	NE.	22	"	"	"	Drilled	173	1,700	- 24	1,676	173	1,527	" sand	Hard, iron		D, S	" for 35 head stock.
24	NW.	24	"	"	"	"	270	1,750	- 50	1,700	270	1,480	" "	" " "alkaline"		S	Large supply.
25	NW.	26	"	"	"	"	125	1,680	+ 3	1,683	125	1,555	" "	Hard, iron		D, S	Very large supply; 1 bbl. in 3 minutes.
26	SE.	28	"	"	"	Dug	18	1,690	- 15	1,675	18	1,672	" quicksand	Soft,		D, S	Sufficient; 2 bbls. a day.
27	SW.	28	"	"	"	Bored	32	1,690	- 16	1,674	32	1,658	" gravel	Hard,		D, S	" for 90 head stock.
28	SE.	30	"	"	"	Dug	24	1,675	- 14	1,661	24	1,651	Recent sand	" "alkaline"		S	" " 40 " ".
29	NW.	31	"	"	"	Drilled	365	1,680	+ 4	1,684	365	1,315	Bedrock sand	" iron		S	Oversufficient; 15 gallons a minute.
30	NW.	31	"	"	"	Dug	30	1,690	- 26	1,664	30	1,660	Glacial sand	"		D	Sufficient for house use.

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 WREFORD NO. 280, 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	NW.	34	30	22	2	Dug	25	1,700	- 15	1,685	25	1,675	Glacial sand	Hard, "alkaline"		D, S	Sufficient for 15 head stock.
32	SE.	36	"	"	"	Drilled	170	1,750	- 8	1,742	170	1,580	" gravel	Hard, iron, "alkaline"		D, S	" " local needs.
1	SE.	1	30	23	2	Dug	25	1,680	- 21	1,659	25	1,655	Glacial quick-sand	Soft,		D, S	" " 30 head stock.
2	SW.	2	"	"	"	"	25	1,650	- 23	1,627	25	1,625	Glacial quick-sand	Hard, iron, "alkaline"		S	" " 20 " " .
3	SE.	2	"	"	"	"	25	1,670	- 22	1,648	25	1,645	Glacial sand	Hard, iron, "alkaline"		D, S	Insufficient.
4	NE.	2	"	"	"	"	15	1,670	- 10	1,660	15	1,655	" clay	Soft,		D, S	Sufficient for 20 head stock.
5	NW.	6	"	"	"	"	19	1,650	- 13	1,637	19	1,631	Recent gravel	Hard, iron		D, S	" " 30 " " .
6	SE.	14	"	"	"	"	21	1,675	- 17	1,658	21	1,654	Glacial	"		D	" " house.
7	SE.	14	"	"	"	Drilled	285	1,675	+ 4	1,679	285	1,390	Bedrock	" iron, "alkaline"		S	Abundant supply.
8	SW.	15	"	"	"	Dug	10	1,658	- 5	1,653	10	1,648	Glacial sand	Soft,		D, S	Sufficient for house only.
9	SE.	16	"	"	"	"	12	1,660	- 10	1,650	12	1,648	" "	Hard,		D, S	" " " " .
10	SE.	16	"	"	"	"	10	1,660	+ 10	1,670	10	1,650	" "	"		D, S	Inexhaustible.
11	SE.	22	"	"	"	"	18	1,670	- 15	1,655	18	1,652	" clay	"		D, S	Sufficient for house only.
12	NE.	24	"	"	"	Drilled	160	1,658	+ 4	1,662	160	1,495	"	" iron, "alkaline"		D, S	Inexhaustible.
13	NW.	28	"	"	"	Dug	14	1,660	- 8	1,652	14	1,646	" sand	Hard,		D, S	Sufficient for 50 head stock.
14	SE.	32	"	"	"	"	12	1,675	- 9	1,666	12	1,663	Recent sand	"		D, S	" " 50 " " .
15	NW.	33	"	"	"	"	12	1,675	- 9	1,666	12	1,663	Glacial gravel	" iron		D, S	?
16	SE.	34	"	"	"	"	12	1,675	- 10	1,665	12	1,663	" clay	Soft,		D, S	?
17	NE.	34	"	"	"	Drilled	150	1,675	+ 3	1,678	150	1,525	" gravel	Hard, iron		D, S	Inexhaustible.
18	SW.	35	"	"	"	"	150	1,675	+ 4	1,679	150	1,525	" "	" "		D, S	" .
19	NE.	36	"	"	"	Dug	9	1,680	- 3	1,677	9	1,671	" quicksand	" " "alkaline"		D, S	Oversufficient for 15 head stock.
1	NW.	1	30	24	2	Dug	8	1,650	- 6	1,644	8	1,642	Recent sand	Hard		S	" " 10 " " .
2	NW.	2	"	"	"	"	20	1,675	- 17	1,658	20	1,655	Glacial sand	" iron		S	" 10 bbls. a day.
3	NE.	2	"	"	"	"	20	1,665	- 15	1,650	20	1,645	" "	" "		D, S	Sufficient for 20 head stock.
4	SE.	5	"	"	"	Drilled	174	1,700	- 70	1,630	174	1,526	" gravel	" "		S	" " 20 " " .
5	SW.	6	"	"	"	"	165	1,700	- 37	1,663	165	1,535	" "	" "		S	" " 5 bbls. a day.
6	SW.	7	"	"	"	Dug	12	1,700	- 10	1,690	12	1,688	" "	"		D, S	" " 16 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 WREFORD NO. 280, 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
7	NW.	8	30	24	2	Dug	13	1,700	- 10	1,690	13	1,687	Glacial gravel	Hard,		D, S	Sufficient for 27 head stock.
8	NE.	8	"	"	"	"	12	1,700	- 10	1,690	12	1,688	" "	"		D, S	" " 20 " " .
9	SW.	9	"	"	"	"	13	1,690	- 11	1,679	13	1,677	" gravel and sand	Soft,		D, S	" " 22 " " .
10	NE.	10	"	"	"	"	18	1,675	- 16	1,659	18	1,657	" "	Hard, iron, "alkaline"		S	" " 20 " " .
11	SW.	11	"	"	"	"	18	1,675	- 15	1,660	18	1,657	" sand	Hard,		D	Oversufficient; 10 bbls. a day.
12	NW.	11	"	"	"	"	18	1,675	- 15	1,660	18	1,657	" sand	"		D, S	Sufficient for 10 head stock.
13	SW.	14	"	"	"	"	15	1,675	- 14	1,661	15	1,660	" gravel	Soft,		D, S	Insufficient for 20 head stock.
14	NW.	14	"	"	"	"	14	1,675	- 12	1,663	14	1,661	" sand gravel	"		D, S	" " 6 bbls. a day.
15	NE.	15	"	"	"	"	10	1,675	- 8	1,667	10	1,665	Glacial gravel	Hard, iron		D, S	Sufficient for 6 bbls. a day.
16	NE.	16	"	"	"	"	12	1,685	- 9	1,676	12	1,673	" "	" "		D, S	Oversufficient for 25 head stock.
17	SE.	17	"	"	"	"	20	1,700	- 19	1,681	20	1,680	" "	Soft,		D, S	Sufficient for 20 head stock.
18	SE.	18	"	"	"	"	18	1,700	- 14	1,686	18	1,682	" " and clay	Hard, "alkaline"		D, S	" " 30 " " .
19	NE.	18	"	"	"	"	18	1,700	- 14	1,686	18	1,682	Glacial gravel	Hard,		D, S	Just sufficient for 60 head stock.
20	NE.	19	"	"	"	"	16	1,700	- 12	1,688	16	1,684	" "	" iron		D, S	" " " 30 " " .
21	NW.	20	"	"	"	"	10	1,700	- 7	1,693	10	1,690	" "	"		D, S	" " " 30 " " .
22	NE.	20	"	"	"	"	20	1,700	- 18	1,682	20	1,680	" quicksand	" iron		S	Insufficient; 1 bbl. a day.
23	NE.	21	"	"	"	Bored	88	1,690	- 40	1,650	88	1,602	" gravel	" " "alkaline"		S	Sufficient.
24	SE.	22	"	"	"	Drilled	138	1,675	- 10	1,665	138	1,537	" "	Hard, iron, "alkaline"		S,	Oversufficient for 12 head stock.
25	NE.	22	"	"	"	Dug	14	1,680	- 11	1,669	14	1,666	" "	Soft,		D, S	Sufficient for 8 head stock.
26	NE.	22	"	"	"	Bored	43	1,680	- 38	1,642	43	1,637	" sand	Hard, iron		S	Insufficient; 1 bbl. a day, laxative.
27	SW.	24	"	"	"	"	37	1,660	- 15	1,645	37	1,623	" "	"		S	Oversufficient.
28	NW.	24	"	"	"	Dug	12	1,660	- 3	1,657	12	1,648	" gravel	Soft,		D, S	" for 20 head stock.
29	NE.	25	"	"	"	"	14	1,660	- 12	1,648	14	1,646	" "	Hard,		D, S	Sufficient; 5 bbls. a day.
30	NW.	26	"	"	"	Drilled	132	1,680	- 38	1,642	132	1,548	" sand	" "alkaline"		S	" for 30 head stock.
31	NW.	27	"	"	"	"	134	1,690	- 30	1,660	134	1,556	" gravel	" iron		S	" " 50 " " .
32	NW.	27	"	"	"	"	102	1,690	- 6	1,684	102	1,588	" "	" " "alkaline"		S	" " 25 " " .
33	NE.	27	"	"	"	Dug	21	1,680	- 9	1,671	21	1,659	" clay	Hard,		D, S	Insufficient for 4 head stock.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of WREFORD NO. 280, 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
34	SE.	30	30	24	2	Dug	10	1,700	- 6	1,694	10	1,690	Glacial gravel	Hard,		D, S	Sufficient for 40 head stock.
35	SW.	31	"	"	"	"	22	1,710	- 21	1,689	22	1,688	" "	"		D, S	" " 20 " " .
36	NW.	31	"	"	"	Drilled	120	1,720	- 30	1,690	120	1,600	" sand	" iron		D, S	" " 75 " " .
37a	NW.	32	"	"	"	"	112	1,675	- 10	1,665	112	1,563	" gravel	" "		D, S	?
37	NE.	32	"	"	"	Dug	18	1,700	- 8	1,692	18	1,682	" sand	" "		D, S	Sufficient for 30 head stock.
38	SE.	33	"	"	"	"	12	1,695	- 9	1,686	12	1,683	" "	"		D, S	?
39	SW.	34	"	"	"	Drilled	112	1,694	- 2	1,692	112	1,582	" gravel	" "alkaline"		S,	Oversufficient.
40	SE.	35	"	"	"	"	114	1,675	- 6	1,669	114	1,561	" "	Hard, iron, "alkaline"		S	Oversufficient.
41	NW.	35	"	"	"	Dug	44	1,680	- 42	1,638	44	1,636	" clay	Hard, iron,		D, S	Insufficient, 4 head stock only; laxative.
42	NW.	36	"	"	"	Drilled	84	1,660	0	1,660	84	1,576	" gravel	Hard, iron, "alkaline"		S	Oversufficient for 12 head stock.

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