CANADA
DEPARTMENT OF MINES

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

BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF GRAVELBOURG No. 104 SASKATCHEWAN

BY

B. R. MacKay, H. H. Beach & J. M. Cameron

Water Supply Paper No. 115

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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF GRAVELBOURG NO. 104 SASKATCHEWAN

INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

If one intends to sink a well and wishes to fine the approximate depth to a water-bearing horizon, be must learn: (1) the elevation of the site, and (2) the probable elevation of the water-bearing bed. The elevation of the well site is obtained by marking its position on the map, Figure 2, and estimating its elevation with respect to the two contour lines between which it lies and whose elevations are given on the figure. Where contour lines are not shown on the figure, the elevations of adjacent wells as indicated in the Table of Well Records accompanying each report can be used. The approximate elevation of the water-bearing horizon at the well-site can be obtained from the Table of Well Records by noting the elevation of the water-bearing horizon in surrounding wells and by estimating from these known elevations its elevation at the well-site.[1] If the water-bearing horizon is in bedrock the depth to water can be estimated fairly accurately in this way. If the water-bearing horizon is in unconsolidated deposits such as gravel, sand, clay, or glacial debris, however, the estimated elevation is less reliable, because the water-bearing horizon may be inclined, or may be in lenses or in sand beds which may lie at various horizons and may be of small lateral extent. In calculating the depth to water, care should be taken that the water-bearing horizons selected from the Table of Well Records be all in the same geologic l 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 côteau. 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 Gravelbourg covers an area of 324 square miles in the south-central part of Saskatchewan. It consists of nine townships, described as tps. 10, 11, and 12, ranges 4, 5, and 6, W. 3rd mer. Gravelbourg near the centre of the municipality, lies approximately 36 miles south and 44 miles west of Moose Jaw. The Gravelbourg branch of the Canadian National railways enters the municipality in sec. 36, tp. 10, range 4, and runs in a northwesterly direction to a mile beyond Gravelbourg, located in the southeast corner of township 11, range 5, where it turns abruptly and runs northwest to St. Boswells at the northwest corner of the municipality. On the railway are also the station of Coppen and the village of Bateman, located, respectively, 8 and 15 miles northwest of Gravelbourg.

The central part of the area is a flat plain lying at an elevation of about 2,300 feet above sea-level. The land surface rises towards the southwest and northeast. The topography of the southwestern corner of the township is strongly rolling and elevations range from 2,350 to over 2,500 feet. The land surface in the northeast corner is more gently rolling and elevations do not exceed 2,350 feet above sea-level.

Wood river flows with a meandering course through a broad, shallow valley from south to north through the eastern half of the municipality. Notukeu creek enters the municipality near the northwest corner and flows in a general southeasterly direction to join Wood river in township 11, range 4. These streams constitute the main drainage of the area. Sloughs and marshes occur in many of the low-lying spots in the southern and northern parts of the municipality.

Wood river flows throughout all but the driest years and provides a pasture supply for stock on farms situated along its course. Notukeu creek flows only during the spring and early summer, at which times it is used for watering stock. Many residents in the municipality have constructed dugouts and dams to conserve surface water and to supplement such stock supplies as are obtained from wells. Drinking water is difficult to obtain in many parts of the area; and residents rather than prospect for ground water resort to catching rainfall in cisterns or to storing ice collected from Wood river during the winter.

The greater number of the wells in the area are sunk into the unconsolidated deposits, consisting of Recent deposits along the stream valleys, glacial lake clays, and the glacial till and moraine that mantles the remainder of the area. Only in a few places is water being obtained from the Bearpaw bedrock formation that underlies the unconsolidated deposits.

Throughout the greater part of the municipality residents using wells, dugouts, and dams have been able to obtain an adequate water supply. East of Wood river, however, careful prospecting is required, and on many farms much difficulty has been experienced in obtaining water suitable for drinking or in quantity adequate for the local stock requirements.

Water-bearing Horizons in the Unconsolidated Deposits

The Recent deposits occurring along the channels of Wood river and Notukeu creek consist of thin beds of silts and sands, interbedded in places with thin layers of gravels. The silts in most places yield only small supplies of water, but little prospecting should be necessary to locate more porous sand and gravel pockets from which small supplies of drinkable water can be obtained. The sinking of shallow wells to tap these beds is an inexpensive way of obtaining a household supply.

The various types of glacial deposits found in the area collectively referred to as the glacial drift were deposited many thousands of years ago by a great continental ice-sheet that advanced in a southwesterly direction over southern Saskatchewan, and upon melting gradually retreated to the northeast. This ice-sheet deposited a layer of boulder clay or till consisting essentially of bluish grey, plastic clay, through which are scattered boulders of varying sizes and occasionally well-sorted beds or pockets of sands and gravels. These beds are generally water bearing. The upper 20 to 30 feet of the drift due to weathering is light buff to yellowish brown, and is generally more porous than the lower, compact boulder clay. In places where the retreating ice front paused for any considerable length of time a greater accumulation of generally more porous glacial drift, known as "moraine", was laid down. Within this municipality the moraine is confined to the areas of higher relief. It is characterized by a rolling land surface with many low knolls and ridges and intervening undrained depressions, in contrast with the flat prairie land of the till plain and lake clay-covered areas.

Waters formed by the melting ice gathered to form lakes in the lower lands. Fine sediments were carried into the lakes and gradually there was formed a layer of compact lake clays. The extent of such an extinct lake is evidenced by the presence of a deposit of grey lake clays covering a wide area that extends over all but the southwest and northeast corners of this municipality. The areal distribution of the several types of deposits mentioned above is shown on Figure 1 of the map accompanying the report.

The thickness of glacial drift mantling the bedrock varies greatly in different parts of the municipality. Throughout the central parts, the lake clay area, the underlying boulder clay probably extends in many places to depths of 100 to 150 feet. Toward the west and southeast the thickness decreases and along the western border and in the southern part of township 10, range 4, the drift does not exceed 20 to 50 feet in thickness.

The glacial lake clays are more or less impervious to the passage of ground water, and do not in themselves form sources of water supplies. However, water-bearing sand and gravel pockets occur discontinuously at or near the contact between the lake clays and the underlying boulder clay. These porous beds together with pockets of sand and gravel that occur scattered through the underlying boulder clay provide water supplies in this area. In townships 12, ranges 5 and 6, and the northern part of township 11, range 6, many of these pockets have a widespread occurrence within 45 feet of the surface. Wells tapping these beds generally obtain water of good quality in quantities adequate for household and stock needs. Elsewhere in the lake clay area shallow productive beds occur very sparingly, and it is generally necessary to sink wells to greater depths. Throughout the remaining part of the area lying outside of the "A" line as drawn on the accompanying map the greater number of the wells are dry, many yield insufficient supplies, and only in isolated places have pockets been encountered that are sufficiently large to provide adequate farm supplies. Water conditions both in the lake clay and in underlying boulder clay are particularly poor east of Wood river where most of the wells are either dry or obtain from the deep pockets in the drift water so highly mineralized as to be unfit for ordinary farm purposes.

Along the borders of the basin in the northeast and southwest corners of the township the till that underlies the lake clay comes to the surface to form till plains. More remote from the basin the till grades into areas of irregularly rolling topography with numerous hillocks and undrained depressions termed "moraine". Pockets of sand and gravel scattered irregularly through the moraine form the principal water-bearing beds in this type of deposit. The pockets follow no definite horizon nor pattern of occurrence, but are encountered at depths ranging from 10 to 105 feet, and in some intervening areas the wells are wholly in boulder clay. The supply obtained varies with the size and porosity of the productive pockets penetrated. Individual wells generally yield sufficient water for about 20 head of stock. Waters from the shallower pockets are hard and fairly highly mineralized, but are generally suitable for household and stock use. Water from the deeper pockets usually contains larger amounts of mineral salts in solution and is suitable only for stock use.

Water conditions are similar in the till except in township 10, range 6, where apparently sand and gravel pockets are very sparing in their occurrence. In this township many wells have penetrated only the blue-grey clay and are dry. Waters from the pockets at depths greater than 60 feet are highly mineralized and many of them are harmful even for stock.

An unusual mode of occurrence of ground water in the drift exists in parts of the municipalities lying to the east, north, and northeast, and has been traced into this municipality in a narrow area averaging 4 miles wide that extends from north to south through the central part of the municipality. The area within this municipality is outlined by the "A" line on the accompanying map (Figure 1). Nearly all the residents that have sunk wells to the lower part of the drift in this area have encountered beds of fine grey sands, and silts, immediately overlying gravels. In these silts are frequently found fossil shells, pieces of coal and branches of twigs of plants. When wet this silt has the consistency of mud and is designated generally by drillers and residents throughout the district as "sea-mud". Such beds are more correctly termed "interglacial" deposits. It is considered that the ice-sheet advanced and retreated at least twice over this area, depositing a layer of till with each advance and retreat. Many thousands of years elapsed between successive advances, during which time climatic conditions were warm and favourable for the formation of swamps and lakes in the lowlands over the first till sheet. With a later advance of the ice the deposits formed in these depressions were buried beneath layers of boulder clay. These interglacial deposits probably do not form continuous beds over large areas, but more probably occur as isolated pockets. The pockets encountered in this area between elevations of 2,210 and 2,145 feet above sea-level are generally sufficiently porous to form sources of water supply. Wells tapping them range in depth from 80 to 150 feet, and generally obtain supplies of water that are quite adequate for stock needs. It is probable that these interglacial beds occur at greater depths in the central part of the basin. The water occurring in this aquifer is under sufficient hydrostatic pressure to rise above the aquifer. Within a narrow area extending from Gravelbourg in a northwesterly direction for approximately 4 miles the pressure is sufficient to cause the water to flow 3 or 4 feet above the top of the wells. The defining of the actual area within which flowing artesian wells occur, or may be expected, by drilling to approximate elevations of 2,000 feet, is rendered difficult by the fact that several wells that were known to flow have been plugged by residents so that the water does not now reach the surface. Immediately surrounding the area of flowing wells, the pressure is sufficient to cause the water to rise to within a few feet of the surface. Toward the borders of the area bounded by the "A" line the pressure decreases and in some of the wells sunk to this horizon the water rises only to within 50 to 70 feet of the surface. The three town wells in Gravelbourg sunk to this horizon yield a hard water that is suitable for domestic use. Elsewhere, in township 10, range 5, and in the southern part of township 11, range 5, the water from this horizon is hard and highly mineralized and not generally satisfactory for domestic use. The beds in the northern part of the area yield water of better quality that is used for household purposes as well as for stock.

West of the area bounded by the "A" line few wells have been sunk sufficiently deep to determine whether or not this horizon is productive. Due to the rise in surface elevation, however, it would be necessary to drill there to depths of 300 to 350 feet, and no assurance can be given that the interglacial beds exist in those parts or if present will be water bearing. In township 12, range 4, these beds have been found at isolated places, but dry holes in intervening areas suggest that they are not continuous. Farther south, in the area east of the river, many dry holes have been sunk, some entering the bedrock but none indicating the presence of any interglacial beds.

Water-bearing Horizons in the Bedrock

The Bearpaw formation underlies the glacial drift throughout the municipality. This formation consists of greyish blue shales that are too compact to be a source of water supply. The thin sand beds that occur in places at the top of the shales sometimes yield water, but it is highly mineralized and generally unfit even for stock use. Drilling for water in this township should be discontinued when the shales of the formation are reached. The shale may be distinguished from the blue-grey boulder clay by its darker colour and soapy feel when wet, and by the small, roughly cubical fragments into which it crumbles when dry. Stones and boulders common in the boulder clay do not occur in the shales, although fossil shells and concretions have been found in several places. Such fossils do not occur in the glacial drift except possibly in the form of boulders.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 10, Range 4

The difficulty experienced in this township in obtaining adequate water supplies by sinking wells has necessitated the excavation in many areas of dugouts and the construction of dams in coulées to conserve surface water. Wood river flowing through the northwestern corner of the township, contains water throughout the year. It provides water for the stock of nearby residents and ice taken from the river in winter is stored for drinking water on many farms during the summer months. Wells in the area have been sunk into Recent stream deposits, glacial lake clays, boulder clay, the underlying Bearpaw formation. The small yields generally obtained from the wells has made it necessary to supplement the supply by storing surface water or ice on nearly every farm.

Recent deposits consisting of sand, silts, and, occasionally, thin beds of gravels, occur along Wood River valley. During the time of the year when the river is flowing shallow wells in these deposits would derive a seepage supply from the stream suitable for domestic purposes. Sands and gravels that have in places been washed down into the bottoms of ravines collect and retain the surface water. A 30-foot well in the SW. 1/4, section 14, obtains water of good quality, sufficient for 20 head of stock, from such a source, but a similarly situated well on the SE. 1/4, section 25, encountered only 2 feet of porous, water-bearing sand beds, and yields only enough water for 2 head of stock. Despite the variations in thickness of these deposits in the ravines and coulées they are worthy of systematic prospecting.

Compact, light bluish grey, glacial lake clays cover all but a narrow belt along the southern border of the township, but in Wood River valley they are overlain by stream deposits. The thickness of the clay deposit varies greatly. It averages 15 feet thick along the southern border of the area, but increases fairly uniformly towards the north and reaches a maximum thickness of about 50 feet along the northern boundary. In the southern sections the drift consists entirely of boulder clay. This deposit underlies the glacial lake clays throughout the remainder of the township, and has an average thickness of 40 to 50 feet.

The lake clays are impervious and are not themselves a source of water. However, in the areas covered by these deposits water-bearing sand and gravel pockets occur discontinuously at the contact of the lake clays and the underlying boulder clay. In the area lying to the east of Wood river the pockets below the lake clays occur only very sparingly, but wells on sections 10, 14, 16, and 18, tap such pockets within 50 feet of the surface, and obtain a satisfactory water supply.

At several places wells failed to encounter porous beds below the lake clays, and were continued down to water-bearing beds occurring at or near the base of the underlying boulder clay. These wells, 60 to 90 feet in depth, generally obtain large supplies, but the water from most wells is highly mineralized and in some places is unsuitable even for stock. The 70-foot well on the NE. $\frac{1}{4}$, section 9, taps one of the pockets and obtains a good quality water, suitable for household use, in sufficient quantity to supply 50 head of stock. Other wells in the area have been sunk without encountering water-bearing pockets either immediately below the lake clays or at the base of the boulder clay. These wells are dry or obtain only small supplies of highly mineralized water as seepage from the clays. Since there is no indication on the surface of the occurrence of these pockets at depth, systematic prospecting is necessary to locate them; if the upper contact is unproductive there remains the possibility that water will be found at the lower horizon.

In the area of lake clays west of Wood river wells 80 to 115 feet deep tap water-bearing sand beds in the lower part of the boulder clay that underlies the lake clay. This horizon may possibly represent that of the interglacial deposits described in an earlier section of the report. The supplies obtained are large and adequate for stock needs, and only the water from the 80-foot well on the NW. $\frac{1}{4}$, section 19, is unsuitable for household use. It is believed that wells in this area sunk to similar depths will be equally successful. East of the river prospecting for water supplies is best directed to the locating of shallower pockets occurring immediately below the glacial lake clay.

Water conditions vary considerably throughout the boulder clay-covered sections along the southern boundary of the township. Wells less than 45 feet deep, located on sections 4 and 5, tap water-bearing sand beds that appear to lie fairly continuously at or near the contact of the glacial drift and the underlying Bearpaw formation. The 28-foot well on the NW. $\frac{1}{4}$, section 4, yields a supply sufficient for 100 head of stock, whereas the 45-foot well on the NE. $\frac{1}{4}$ of the same section fails to obtain enough water for local stock needs. The water from these beds is generally fairly highly mineralized, and that from the 42-foot well on the SW. $\frac{1}{4}$, section 4, is not suitable for domestic use. A 75-foot well on the SW. $\frac{1}{4}$, section 6, obtains an adequate stock supply from a more deeply buried, porous bed. Elsewhere in this section wells have been sunk to depths of 100 feet and more without penetrating productive pockets in the boulder clay. The irregularity with which the pockets occur in this area and the fact that their presence at depth is not indicated at the surface make systematic prospecting, directed to cover as large an area as possible, necessary.

The Bearpaw formation underlies the drift throughout the township. The formation is not considered a source of good water and many holes have been sunk into it without obtaining any water. A 102-foot well, located on the NW. $\frac{1}{4}$, section 2, has obtained water but it is so highly mineralized that it is unfit even for stock use.

Further drilling into the bedrock in this township is not recommended.

Township 10, Range 5

Wood river flows through the southeastern corner of the township and provides a pasture supply of water for the stock of nearby residents. Wells provide household and stock supplies throughout the area. In many places, however, water from wells is highly mineralized and unsuitable for drinking. In these places domestic supplies are obtained either by catching the rainfall in cisterns, or by harvesting and storing ice from Wood river. Dugouts and small dams across coulées collect surface water and supplement the stock supplies available from wells. Shallow seepage wells sunk beside these catchment basins can be used to supply household requirements. The wells in the township are sunk into the glacial drift. The total thickness of glacial drift in this area has not been determined as no wells are known to have penetrated into the underlying bedrock. Boulder clay covers the bedrock throughout the area and is exposed at the surface as a till plain in the southwestern part of the township. It becomes gradually more rolling and is in the form of moraine in the extreme southwest corner. A deposit of 20 to 40 feet of light grey, gumbo-like, glacial lake clay overlies the boulder clay throughout the northeastern half of the township. Along the valley of Wood river thin deposits of Recent stream sands and silts cover the lake clays. The approximate areal extent of each type of deposit is shown on Figure 1 of the accompanying map. It is probable that small supplies of drinkable water could be obtained at shallow depths from the Recent deposits, but no records of any wells having been located in the valley were obtained.

The area of "moraine" is only thinly settled and consequently, little is known as to its potential water supply. Wells dug near the bases of slopes and in coulées and depressions offer the best possibilities of obtaining water at shallow depths in this area. A 105-foot well on the NE. $\frac{1}{4}$, section 6, obtains a large supply of highly mineralized water from a sand bed lying near the base of the glacial drift. The resident has a dugout, and uses the water from this well for stock only during the winter months. Elsewhere in this area residents rely entirely on dugouts or small dams for their stock supplies. Water for the householder is generally obtained from seepage wells sunk beside the surface reservoirs. Prospecting the upper 30 feet of the "moraine" will probably locate productive sand and gravel pockets that are believed to be interspersed at random through it. In the till-covered area wells tap sand pockets in the boulder clay at depths between 25 and 115 feet below the surface and obtain generally fairly large supplies of water which are adequate for stock needs. The water is hard, contains a considerable amount of sulphate salts in solution, and with the exception of that from a few of the shallower wells is unsuitable for household use. Water of similar quality can probably be obtained from sand pockets in the clay in other parts of this area, but it is doubtful whether suitable household waters can be obtained except from seepage wells, or by preserving the rainfall in cisterns.

Water conditions vary considerably in the area covered by lake clays. Little water can be expected from the clays themselves, due to their compact, impervious nature. In a few places on sections 12, 13, and 31, wells ranging in depth between 10 and 40 feet have encountered sand pockets that occur between the lake clays and the underlying boulder clay. The yield depends upon the areal extent of the pockets tapped, but all of these wells yield moderately large supplies of water that is hard but generally drinkable. The water from the 40-foot well on the SE. $\frac{1}{4}$, section 13, however, is more highly mineralized than is usual for waters from this horizon, and is reported to be unsuitable for any farm use. These pockets occur either sparingly or not at all in the central parts of the township, as all existing wells have penetrated lower horizons without obtaining water at the contact of the lake clay and boulder clay. Within the area bounded by the "A" line interglacial beds of gravel, sand, and fine silts are encountered in wells 90 to 150 feet deep. These wells yield large supplies of highly mineralized water which is used only for stock. The waters in the Jesus Mary Convent well, the Mathieu college well, and the No. 2 Gravelbourg town well, located in the northeast corners of the township, are under sufficient hydrostatic pressure to cause them to rise to the surface and flow. These waters, however, are also highly mineralized and drinking water is procured from the Gravelbourg town supply. The water in wells on sections 24, 26, and 27 is also under considerable pressure and rises to within 10 feet of the surface in each well. In a southwesterly direction the pressure on the water at this horizon is slightly less, and with the greater elevations of the well sites the water may rise only to points from 35 to 40 feet below the surface. In the lake clay area outside of the "A" line and east of Wood river water supplies suitable for farm use are difficult to obtain.

Three holes were sunk to a depth of 100 feet on section 1, but did not obtain water. These wells are not sufficiently deep to reach the interglacial deposits. No other wells have been sunk deeper than 65 feet in the area outside of the "A" line east of the river, but it is possible that water suitable for stock use will be found at depths not exceeding 150 feet. In the northwest corner of the township, outside of the "A" line, water-bearing pockets are difficult to locate, and generally wells obtain only small supplies of highly mineralized water. A thorough and systematic prospecting of the upper 65 feet of drift in this area, however, would probably locate adequate productive pockets, although deeper drilling cannot be expected to yield water suitable for drinking.

The Bearpaw bedrock formation underlies the glacial deposits throughout the entire township. The formation is not believed to be a source of good water, and when a well has definitely entered the soft shales of the formation drilling should be discontinued. The shales probably lie 100 to 150 feet below the surface in all parts of the township.

Township 10, Range 6

Water supplies for stock in this township are obtained to some extent from wells, but in many places the supply must be supplemented by the use of dugouts and dams constructed in coulée bottoms. Drinking water supplies come from seepage wells sunk beside reservoirs, or from shallow wells tapping near-surface sand or gravel pockets in the drift. Generally throughout the area it is difficult to obtain from wells any large supplies of water that are not too highly mineralized for farm use. Most wells are sunk into the glacial drift. The few wells that have penetrated the underlying Bearpaw bedrock formation obtained no water.

Three types of deposits, namely, lake clays, moraine, and till, are found in this township, the distribution of each being shown on the accompanying map (Figure 1). The thickness of the drift is probably 100 to 125 feet over the greater part of the township, but thicknesses of only 30 to 50 feet occur in certain places in the north.

A well dug 12 feet deep, on the NW. $\frac{1}{4}$, section 35, is the only one known to have been sunk in the lake clay area. This well passed through the impervious, chocolate-coloured lake clays and draws a supply of water of good quality, adequate for the household and 60 head of stock, from a bed of fine sand lying immediately beneath the clay. This bed is not believed to be continuous beneath the clays, but it is possible that wells in other parts of this area would encounter similar pockets at least within 35 feet of the surface.

The moraine and till consist in general, in descending order, of a few feet of top soil; 20 to 30 feet of yellow boulder clay containing scattered sand and gravel pockets; and a thick deposit of blue boulder clay which also contains sand and gravel pockets that occur fairly continuously over fairly large areas. The water supplies obtained from these deposits come from the sand and gravel pockets. In a few localities wells tap the pockets within 30 feet of the surface, from which they generally obtain only small supplies of water, but which is of good quality and suitable for domestic use. In most places, however, wells encounter the pockets between 40 and 80 feet from the surface, and less commonly at depths as great as 115 feet. Yields from these pockets are larger and generally adequate for the local stock needs; the water, however, is highly mineralized and in nearly all places is unsuitable for domestic use, and in a few places even for stock. The water from the deeper pockets is of particularly poor quality in the southwest corner of the township where stock are reported to have died as a result of drinking it. Extensive prospecting to locate productive pockets at shallow depths is recommended in this area. The bottoms of coulées and at the bases of slopes are considered to be good locations for shallow wells. Should such prospecting prove unsuccessful, residents are well advised to construct dams or excavate dugouts to conserve surface water rather than to undertake deep drilling.

The Bearpaw bedrock formation underlies the glacial drift throughout the township. It is not considered to be a source of good water supplies and drilling into it is not advisable. Wells have been sunk into the Bearpaw formation on sections 13, 30, and 34, but all were dry.

Township 11, Range 4

Wood river flows in a south to north direction through the central part of the township. Notukeu creek enters the township in section 19 and joins Wood river in section 27. Wood river contains water throughout all but the driest years, but Notukeu creek contains water generally only in the spring and early summer. Both provide seasonal pasture supplies for the stock of residents along their valleys. The wells in the township that obtain water derive it almost wholly from the till that underlies the lake clays throughout the township, but in the area east of Wood river and south of Notukeu creek these deposits are almost entirely unproductive, and it is seemingly impossible to obtain an adequate water supply. Reliance for stock supplies in this area must of necessity be placed upon dams and dugouts conserving surface water. Shallow wells sunk beside these reservoirs derive small seepage supplies suitable for domestic use.

The thin beds of sands and silts lying along the creek and river channels are not known to have been prospected, but careful testing at shallow depths with an auger should eventually encounter water sufficiently low in mineral salts to be used for drinking. The supply to be expected probably would not be sufficient for more than a few head of stock. The glacial lake clays that cover all but the northeastern corner of the township have an average thickness of 25 feet or more. In a small area in sections 25 and 36 boulder clay occurs at the surface. The drift appears to be between 40 and 90 feet thick over the greater part of the township, but the thickness varies considerably; at some places in the central part of the township the meagre information available would suggest that the Bearpaw bedrock formation lies within 20 feet of the surface.

Glacial lake clays, due to their compact nature, are a source of only small seepages of water, and unless porous sand or gravel pockets are encountered in them no satisfactory yields of water can be expected from them. Such pockets appear to occur only in the area east of Wood river and south of Notukeu creek. In some parts of the municipality sand beds occur at the contact of the lake clay and the underlying boulder clay, or in the boulder clay itself. In the area east of the river and south of the creek no wells have encountered sands either at the contact of the glacial lake clays and the boulder clay, in the boulder clay, or at the top of the bedrock. The small seepages of water that have been obtained from the clays are generally too "alkaline" to be usable in the household, and they may be unsuitable for watering stock. Residents of this area are advised to construct dams or dugouts to obtain water supplies rather than risk the uncertainties attendant on sinking wells. In the area lying to the west of the river and to the north of Notukeu creek less difficulty has been experienced in obtaining adequate water supplies by sinking wells. Productive sand beds have been tapped beneath the lake clay at depths of 30 and 25 feet, on sections 30 and 34, and moderately large supplies of hard, drinkable water were obtained, although several other wells in adjoining sections failed to locate such beds and, consequently, yield only small supplies of highly "alkaline" water which has seeped from the clay. Two wells, 76 and 75 feet deep, located on sections 28 and 32, respectively, have tapped silty sand beds that may represent isolated pockets of interglacial material in the lower part of the drift. Since, however, the yields from these wells are large, it is more probable that the aquifers may be of considerable areal extent. The water is hard but not highly mineralized, and hence suitable for domestic use. Sinking wells down to elevations of approximately 2,215 feet above sea-level seems to be a worthwhile venture in this part of the area.

The Bearpaw formation underlies the glacial deposits in all parts of the township. The formation is not considered a source of water supplies, and many holes have been sunk into it in many parts of the township without obtaining more than very small seepages. In many places in the township the top of the formation is characterized by an abundance of gypsum crystals, or by iron nodules. Residents are well advised to discontinue drilling when the top of the formation has been definitely reached.

Township 11, Range 5

Notukeu creek, a small, sluggish creek, flows through the northeast corner of the township and provides a pasture supply of water for the stock of nearby residents during the spring and early summer. The existing wells in the township have all been sunk into the unconsolidated deposits. In places, particularly along the western boundary of the township, well supplies are inadequate for stock needs, and residents have constructed dugouts to supplement the well supplies. Waters from the wells in many places are highly "alkaline", and drinking water must be obtained from seepage wells located beside dugouts or by catching rainfall and storing it in cisterns.

The entire township lies within an old glacial lake basin. Hence, the upper 20 to 50 feet of deposits covering the area consist of lake clays. These clays are underlain by an equal or greater thickness of boulder clay. These clays, due to their compact nature, are not a source of water supplies, but water-bearing sand and gravel beds occur at the contact between the lake clays and the boulder clay, and in the boulder clay itself, and especially near its base. The individual sand beds under the lake clays are not continuous over any large areas, but several wells, ranging from 18 to 48 feet deep, and located in the western and northern sections of the township, tap them and obtain water supplies of good quality in amounts adequate for household needs and for a few head of stock. Thorough prospecting in other places in this part of the township would probably locate similarly productive pockets below the lake clays. Only in a very few places have any porous beds been encountered in the upper part of the boulder clay. It is generally necessary to sink wells to the beds of silts (sea-mud), fine sands, and gravels that occur near the base of the boulder clay. These deposits are believed to be of interglacial origin, as described in an earlier section of the report, and appear to occur fairly continuously in the lower part of the drift over the area bounded on the map by the "A" line.

Wells reach these beds at depths of 100 to 125 feet in the southern sections, but at slightly greater depths, to 166 feet, in the northern parts. These beds occur at elevations between 2,210 and 2,160 feet above sea-level, most of the wells tapping them at approximately 2,190 feet. The water supplies derived from individual wells are generally smaller in the western and northern parts of the area, but they are reported as being adequate for local stock needs. The water in the aquifers at this horizon is under hydrostatic pressure. In the western and northeastern parts of the township the water rises to points between 40 and 70 feet below the surface. The hydrostatic head increases toward the southeastern corner, and within the narrow area indicated on the map, extending from Gravelbourg northwest to section 14 and possibly to section 22, the pressure is sufficient to cause the water to flow at the surface. The waters in a number of wells in the northern part of the township are also under considerable pressure, but some wells undoubtedly were not sunk sufficiently deep to encounter the aquifer containing water with the greatest head. The water from these beds is hard and "alkaline", and although generally unsuitable for domestic use it is satisfactory for watering stock. Wells sunk 100 to 160 feet deep in other places in this part of the township can be expected to obtain similar supplies from these beds which lie near the base of the glacial drift.

The town of Gravelbourg obtains its water supply from three wells that tap interglacial beds at this horizon in section 36 of the township to the south. Two of the wells are reported to each yield 20,000 gallons of water a day, and the supply from the three is amply sufficient for the town's requirements of 30,000 gallons a day. The water is fairly soft, but contains appreciable amounts of sodium salts, and particularly of sodium sulphate in solution. The water used for domestic supplies in the town is untreated.

The glacial drift throughout the entire township is underlain by the compact shales of the Bearpaw formation. This formation is not considered to be a source of satisfactory supplies of water in this area and residents are advised to confine prospecting for water entirely to the glacial and interglacial deposits.

Township 11, Range 6

Natural sources of surface water are scarce in this township and residents depend largely upon wells sunk into the glacial deposits for their water supplies. Dugouts and dams across small draws and coulées in many places supplement stock supplies available from wells.

Over three-fourths of the township is mantled by glacial lake clay. Lying beneath the clays and exposed along their southwestern border in a belt $\frac{1}{2}$ to 2 miles wide is boulder clay or till. A 6-square mile area in the southwest corner is covered by moraine. The areal distribution of each type of deposit is shown on the map accompanying this report (Figure 1).

The lake clays are 20 to 50 feet thick, and the underlying boulder clay probably does not exceed 50 feet in any place. The clays are compact and are not a source of water, but water-bearing sand beds occur fairly continuously at the contact of the lake clays and the underlying boulder clay. Most of the wells in the lake clay-covered area obtain their supplies from these beds. The wells range between 14 and 45 feet in depth, the water is generally of good quality, and the supplies in most places are adequate for the needs of the household and a few head of stock. The fine sand encountered in some of these aquifers, particularly in the northern sections, has partly plugged some of the wells and greatly diminished the yield. A succession of dry years, as have been experienced in Saskatchewan since 1930, has seriously decreased the water supplies available from shallow beds, and several of the wells tapping such beds in this township that formerly provided large supplies now yield barely sufficient water for a few head of stock.

Several wells in the lake clay-covered area tap gravel and sand beds at depths greater than 45 feet below the surface, but less than 85 feet. Most of the wells obtain highly mineralized water that is not drinkable, but is generally satisfactory for stock. Some wells have been sunk in the area without encountering either the shallow or deeper pockets, and these wells obtain only small seepages of generally highly mineralized water from the clays. It is believed, however, that in most places wells should encounter a pocket yielding a supply satisfactory, at least, for stock within 85 feet of the surface. It is probable, however, that several wells will be necessary to maintain an adequate supply where shallow pockets are tapped.

The thickness of the moraine and boulder clay deposits in the southwest part of the township is unknown, but it probably varies between 50 and 100 feet. Water supplies in this area are in most places obtained from wells tapping sand and gravel pockets in the upper 40 feet of the drift, but similar pockets were tapped at 90 feet by a well located on the SE. $\frac{1}{4}$, section 4, and at 55 and 60 feet by wells located on the SW. $\frac{1}{4}$, section 16, and SE. $\frac{1}{4}$, section 17, respectively. The supplies are generally adequate for stock needs, and from only some of the deeper wells is the water too highly mineralized for domestic use. Holes have been sunk to depths of 140 feet in this area without obtaining a supply, but it is believed that intensive prospecting at depths not exceeding 100 feet at most places in the area would encounter sand and gravel pockets capable of yielding adequate water supplies.

The entire township is underlain by the shales of the Bearpaw formation which are not considered a source of good supplies of water. Drilling into them, consequently, is not recommended.

Township 12, Range 4

Wood river follows a meandering course from south to north through the central part of the township. With the exception of the late summer months of the driest years the river contains water, thus providing a pasture supply for the stock of nearby residents. Wells provide the water supplies in most places, but in many places the supply from this source is inadequate for stock requirements, and dams and dugouts have been used to conserve surface water for supplementary supplies. Wells are sunk into the Recent deposits lying along the bottom of Wood River valley and into the glacial lake clays, till, and moraine that mantle their respective areas.

Shallow wells sunk into the Recent valley sands and silts provide small supplies of water of good quality. The quantities obtained are adequate for household needs, and in some places for a few head of stock.

Glacial lake clay underlies the greater part of the township. The lake clay is underlain by boulder clay or till which is exposed along the northern and eastern margins of the township. Toward the northern boundary and in the northeastern corner of the township the till plain gradually merges into more irregularly rolling moraine. The areal extent of each of these types of deposit is shown on the accompanying map (Figure 1). The thickness of the drift has not been determined, since no wells are known to have penetrated the underlying bedrock. The thickness probably ranges between 100 and 150 feet over the greater part of the township. Water supplies are obtained from isolated sand and gravel pockets that occur scattered through the deposits and from porous, interglacial sands and silts that extend over small areas in the lower part of the boulder clay.

Wells located on the SW. $\frac{1}{4}$, section 7, NW. $\frac{1}{4}$, section 13, and E. $\frac{1}{2}$, section 21, 48, 16, and 24 feet deep obtain supplies of water, of good quality, adequate for the household and stock needs of the residents. Elsewhere in the township wells have failed to encounter pockets at such shallow depths. In the sections lying east of Wood river many wells did not penetrate productive pockets even at greater depths, but wells located on sections 4, 8, 30, and 32, 55 to 86 feet deep, tap sand and gravel pockets and obtain supplies generally adequate for stock needs. The water in most places, however, is more highly mineralized than from the shallower wells, and is unsuitable for domestic purposes. Other wells located on sections 5, 7, 21, and 30, 75 to 140 feet deep, tap isolated beds considered to represent interglacial deposits in the lower part of the drift. Deep wells in adjoining areas did not encounter these beds and it is probable that they are of limited areal extent rather than that they underlie any large areas in the township. These wells obtain supplies of water of good quality, adequate for household and stock needs. In the sections lying east of Wood river the deeper wells, with the exception of those located on sections 23, 24, and 26, fail to obtain satisfactory water supplies. The 80-foot well bored on section 26 taps a sandy pocket in the drift and obtains an adequate stock supply. The water, however, is highly mineralized and unsuitable for domestic use. The wells on sections 23 and 24, 120 and 100 feet deep, respectively, draw sufficient quantities of good quality water for 30 or more head of stock from interglacial beds of silt (sea-mud) and gravel.

Shallow prospecting in the drift is recommended in all parts of the township. Within the area enclosed by the "A" line on the map, and especially in sections 23, 24, and 25, the possibilities of obtaining water at depths of 100 to 150 feet are fairly good, but elsewhere in the township if no productive pockets are found at shallow depths residents are well advised to obtain supplies by conserving surface waters by means of dugouts or dams.

The Bearpaw bedrock formation underlies the glacial till throughout the entire township, and as it is not believed to be a source of good water drilling to depths greater than 150 feet is not advisable in any part of the area.

Township 12, Range 5

Notukeu creek, a small, intermittent stream, extends across the southwestern corner of the township and provides a pasture supply for the stock of nearby residents during the spring and early summer. Springs deriving their supply as seepage from the drift flow in places from the banks of the creek, and some of them have sufficient flow to provide year round stock supplies. The wells of the area have been sunk into the drift that covers the township. Dugouts and dams constructed across Notukeu creek or the smaller stream courses and in coulées are used in many places to supplement stock supplies available from wells.

Dune sands and silts occur along the bottom of Notukeu Creek valley, and although as yet unprospected would possibly provide at shallow depths small supplies of water suitable for domestic use.

The greater part of the area is covered by glacial lake clays. These are underlain by boulder clay, which in the extreme northeastern parts of the township, at the northern border of the lake basin, is exposed at the surface in the form of a till plain. To the north of this the drift becomes more irregularly rolling and merges into the moraine-covered highlands that underlie much of the municipality to the north. The distribution of these types of drift is shown on the accompanying map (Figure 1). The combined thickness of the lake clay and underlying boulder clay probably does not greatly exceed 50 feet in the western and central sections, but in the eastern parts it is known to exceed 100 feet at several points.

The glacial lake clays in general consist of 20 to 50 feet of yellow, sandy clay underlain fairly continuously by beds of fine sand. The clays are compact and not a source of water, but wells sunk in the area derive supplies from the underlying sand. In the western and central sections these beds are the source of the present ground water supply. These beds do not form a continuous deposit over the entire township, and where they do not occur wells fail to obtain more than very small seepages of water. Hence, most careful prospecting, directed to cover as large an area as possible, will be necessary to ensure a satisfactory supply in some sections. Most of the existing wells obtain supplies adequate for stock needs. The water is hard, and rather highly mineralized, but generally can be used for domestic purposes. Conditions for obtaining water supplies at shallow depths are particularly good along the ridge running east from section 19 across the township. Since no wells have been sunk to depths exceeding 45 feet in the western and central parts of the township, the possibilities of obtaining water from pockets in the lower part of the drift have not been determined. At several points in the township to the south and in the eastern part of this township water has been found at depths between 100 and 150 feet. Sinking wells to such depths in order to find water for stock appears to be a worthwhile venture in this part of the area. In the eastern part of the township a few wells are deriving water from shallow pockets lying immediately below the lake clays, but most of the wells in this area tap interglacial beds of silts (sea-mud), fine sands, and gravels that lie in the lower part of the drift at depths ranging from 60 to 90 feet. The supplies obtained are adequate for stock. The water from the 90-foot well on the SE. $\frac{1}{4}$, section 12, and an 84-foot well in the SE. $\frac{1}{4}$, section 13, is suitable for household use, but from the other wells it is highly mineralized and used only for stock. In the area bounded by the "A" line, and possibly in the unprospected western parts, should a shallow pocket not be located or be found to yield an inadequate supply, residents are reasonably certain of obtaining water which will be at least satisfactory for stock, from the deeper interglacial beds at depths of slightly less than 100 feet.

The uplands area in the northern part of the township, overlain by the boulder clay and moraine deposits, is not settled and, consequently, little is known as to its water conditions. It is possible, however, that productive sand and gravel pockets occur in the upper 30 to 50 feet of these deposits.

The Bearpaw bedrock formation is believed to underlie the drift throughout the township. Although no wells have penetrated into the shales in this area it is improbable that it will be appreciably more productive than in other parts of the municipality.

Township 12, Range 6

Notukeu creek flows through the central part of the township and provides a pasture supply for the stock of nearby residents during the spring and early summer. The greater part of the water supply of the township is derived from wells less than 50 feet deep.

The Recent sands and silts lying along the bottom of Notukeu creek are a possible source of small supplies of water, and shallow wells sunk in them would possibly obtain a supply adequate for the household needs of residents along the valley.

The township lies entirely within the old glacial lake basin, and hence is covered by some 20 to 50 feet of lake clays. These clays are underlain by boulder clay, and it in turn by the shales of the bedrock. The thickness of this underlying boulder clay has not been determined, as no wells in the area are known to have penetrated into the bedrock. Neither the lake clay nor the boulder clay yields more than very small seepages of water. Lying between the lake clay and the boulder clay, however, are beds of sands and more occasionally gravels that are water bearing, and a few wells have penetrated isolated pockets of sands and gravels in the upper part of the underlying boulder clay. The porous beds at the contact may not be present at all points, but no difficulty has been experienced in obtaining sufficient water for 25 or more head of stock from wells not exceeding 50 feet in depth at nearly all sections. Only in the southeast corner has the supply from this horizon proved inadequate, and residents have used dugouts to supplement the well supply. The water is hard and not highly mineralized and is being used in households. Water of poor quality was reported on only one farm. A 20-foot well, dug on the SE. $\frac{1}{4}$, section 18, yields water that is too highly mineralized for household or stock use. Although large supplies of water are available at shallow depths in the lowland flats area lying northwest of Bateman it may prove to be more "alkaline" than supplies from wells in other parts of the area.

Water may occur in sand beds at the contact of the boulder clay and the shales of the bedrock. Blue-grey clay, reported as occurring at the bottoms of the 22-foot well on section 31, and the 40-foot well on section 21, may represent the Bearpaw shales. Should this be the case it would suggest that the shale is possibly within 50 to 75 feet of the surface throughout the greater part of the area. Since the shale has been found to be almost entirely unproductive in many parts of this township, it is improbable that sinking wells into it will yield satisfactory water supplies in this area. Residents are better advised to confine prospecting for water to within 50 feet of the surface.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF GRAVELBOURG, NO. 104, SASKATCHEWAN

West of 3rd mer. — Township	10	10	10	11	11	11	12	12	12	Total No. in Municipality
Range	4	5	6	4	5	6	4	5	6	
Total No. of Wells in Township	43	29	55	36	47	54	43	55	33	395
No. of wells in bedrock	9	0	6	8	0	3	0	0	0	26
No. of wells in glacial drift	32	29	49	28	47	51	43	55	33	367
No. of wells in alluvium	2	0	0	0	0	0	0	0	0	2
Permanency of Water Supply										
No. with permanent supply	31	25	42	22	40	44	25	45	31	305
No. with intermittent supply	3	1	1	4	0	0	3	0	2	14
No. dry holes	9	3	12	10	7	10	15	10	0	76
Types of Wells										
No. of flowing artesian wells	0	3	0	0	3	0	0	1	0	7
No. of non-flowing artesian wells	6	13	18	2	25	12	11	9	1	97
No. of non-artesian wells	28	10	25	24	12	32	17	35	32	215
Quality of Water										
No. with hard water	32	22	39	26	39	41	25	41	32	297
No. with soft water	2	4	4	0	1	3	3	4	1	22
No. with salty water	0	0	0	1	5	0	2	0	0	8
No. with "alkaline" water	10	20	27	8	25	13	13	8	7	131
Depths of Wells										
No. from 0 to 50 feet deep	26	9	24	23	16	35	9	46	33	221
No. from 51 to 100 feet deep	13	11	25	11	9	14	27	9	0	119
No. from 101 to 150 feet deep	3	9	6	1	22	5	7	0	0	53
No. from 151 to 200 feet deep	1	0	0	0	0	0	0	0	0	1
No. from 201 to 500 feet deep	0	0	0	1	0	0	0	0	0	1
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	18	28	25	34	35	17	44	31	253
No. not usable for domestic purposes	13	3	15	1	6	9	11	1	2	66
No. usable for stock	26	25	38	24	40	44	25	45	32	299
No. not usable for stock	8	1	5	2	0	0	3	0	1	20
Sufficiency of Water Supply										
No. sufficient for domestic needs	26	25	42	20	40	43	25	44	31	296
No. insufficient for domestic needs	8	1	1	6	0	1	3	1	2	23
No. sufficient for stock needs	18	22	28	12	34	30	21	31	27	223
No. insufficient for stock needs	16	4	15	14	6	14	7	14	6	96

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 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 Gravelbourg, No. 104, 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	SW.	10	10	4	3	40	800	700	550	150	11	555	10	119	156	259	771	18		249		255	231	18	x 1
2	NE.	36	10	5	3	143	3,200	600	600	nil	88	725	170	104	1,636	1,233	3,261	304		217		173	2,422	145	x 1
3	NE.	7	10	6	3	66	6,420	3,000+	3,000+	n.d.	139	110	290	673	4,059	1,455	5,951	110	554		2,006		3,052	229	x 1
4	NW.	18	10	6	3	75	5,260	2,300	2,300	nil	172	415	240	536	3,192	1,380	5,145	415	19		1,597		2,830	284	x 1
5	NW.	18	10	6	3	75	5,886																		x 1
6	NE.	29	11	5	3	125	3,000											(3)			(1)		(2)	(4)	x 1
7	N.½	25	11	6	3	44	3,300	1,800	1,800	nil	131	470	290	306	1,796	770	3,172	470	66		912		1,508	216	x 1
8	NW.	28	11	6	3	33	1,460	1,400	1,400	nil	27	350	170	18	742	256	1,399	304		40	480		530	45	x 1
9	SW.	6	12	6	3	15	560	375	375	nil	15	310	60	47	152	166	546	107		98		91	225	25	x 1
10	SE.	18	12	6	3	20	2,023																		x 1
11	NW.	31	12	6	3	22	800	560	540	20	13	165	130	83	53	--	anomolous								x 1

Water samples indicated thus, x 1, are from glacial drift.
Analyses are reported in parts per million; where numbers (1), (2), (3), and (4) are used instead of parts per million, they represent the relative amounts in which the four main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
Analyses Nos. 5 and 10, by Provincial Analyst, Regina; Analysis No. 6, by V.A. Vigfusson.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

No samples of water from Wood river or Notukeu creek were taken for analysis. These waters do not contain large amounts of mineral salts in solution and are considered to be satisfactory for watering stock. Streams are readily polluted by decaying organic matter and sewage, and hence are not generally reliable sources of drinking water. During periods of drought when the creek ceases to flow water that remains in depressions in the stream channel may become highly "alkaline", due to the concentration of the dissolved salts by evaporation of the water. The mineral salt content does not usually become so high as to render the water unfit for stock.

Shallow wells sunk in the sands, silts, and gravels lying along the stream courses derive small supplies of seepage water. The water does not contain a large amount of mineral salts in solution and generally may be used without ill effects in the household, unless polluted by refuse washed into the valley.

Eight samples of ground water from various sources in the glacial drift were collected and analysed by the Geological Survey. The results of three other analyses of waters from similar sources made by the Provincial Analyst of Saskatchewan are available and are included in the accompanying table. The following generalizations are based upon these analyses, observations at the well sites, and analyses of water from similar sources in adjoining municipalities.

The character of the sediments comprising the glacial drift may change greatly from place to place. Corresponding variations are noted in the quality of the waters from the drift in different places. One well may yield a moderately hard, drinkable water, whereas another well sunk to a similar depth a short distance away may contain a water that is excessively hard and too highly mineralized to be suitable for any farm use.

The compact, bluish grey boulder clay is considered to be the chief source of the mineral salts that occur in waters from the drift. Hence, wells that derive their supply almost entirely by seepage from the clay yield water of very poor quality. The third analysis given on the accompanying table is of water from a 66-foot well sunk into the boulder clay on the NE. $\frac{1}{4}$, sec. 7, tp. 10, range 6. This water is extremely hard; the hardness, largely permanent and not removable by boiling, exceeds 3,000 parts per million. The total dissolved mineral salt content was found to be 6,420 parts per million. The sulphate salts are predominant in solution. Sodium sulphate (Na_2SO_4) is present as 3,052 parts per million, magnesium sulphate ($MgSO_4$) as 2,006 parts, and calcium sulphate as 554 parts per million. Common salt (NaCl) is present as 229 parts per million. Although the calcium sulphate has no marked effects other than contributing to the hardness, the presence of the other two sulphates in such concentrations renders this water unfit for domestic or stock raising requirements due to their strong laxative effects. Analyses 4 and 5, made at different times, are of waters from a 75-foot well also deriving its supply by seepage from the boulder clay. Although the total solid contents are slightly lower than in analysis No. 3, the same salts are present and are in approximately the same relative proportions. This water is extremely hard, bitter, and salty, and has such strong laxative effects that it is reported to have killed stock that have drunk it. Such conditions of mineral salt concentration might be found at shallower depths from wells sunk in undrained depressions. Surface evaporation causes the gradual accumulation of the salts.

Waters derived from sand and gravel pockets are much less highly mineralized. If such pockets are extensive and not covered by any large thickness of boulder clay that would contribute to the salt content, the waters should be satisfactory for domestic use.

The first analysis on the table is of water from a sand bed encountered within 40 feet of the surface on the SW. ¼, sec. 10, tp. 10, range 4. This water is hard, but the total dissolved salt content is only 800 parts per million. Here sodium carbonate (Na_2CO_3), or black alkali, is present in the largest amounts of the individual salts. Due to the harmful effects of this salt upon vegetation this water is not considered to be suitable for garden irrigation. This water differs from many waters in the drift in the presence of a large concentration of sodium carbonate, and in the absence of magnesium sulphate. This water is satisfactory for drinking and watering stock. Water from sand and gravel pockets at greater depths in the till are correspondingly more highly mineralized, with the sulphate salts usually predominating. As has been previously noted, little water can be expected from the lake clays. The sand beds immediately underlying the clays are often fairly continuous over large areas and allow the contained water to circulate readily. At places where the sand beds are thick and near the surface the waters contained are of good quality. Analyses Nos. 9 and 11 are illustrative of this type of water. Evidently the sand bed encountered in the 20-foot well on the SE. ¼, sec. 18, tp. 12, range 6, is of limited extent or occupies a depression in the underlying boulder clay, as this water contains 2,023 parts per million of dissolved salts, probably sulphates, and is suitable only for watering stock. Should the wells derive some or all of their supply from pockets in the upper part of the underlying boulder clay a more highly mineralized water is to be expected. Analyses 7 and 8 of waters from wells 44 and 33 feet deep, tapping pockets in the till beneath the lake clay, are typical of waters from this source. Although the water from the 44-foot well is being used for drinking it cannot be regarded as satisfactory for this purpose, as it contains 3,300 parts per million of dissolved mineral salts, of which sodium and magnesium sulphate are present in the greatest concentrations. This water would undoubtedly prove harmful to persons unaccustomed to the use of highly mineralized waters. It would appear that the shallower wells, not only in the till but in the lake clay-covered area, yield the better quality of water for domestic use.

The other analyses in the table, Nos. 2 and 6, are of water from deeper, porous beds, described as interglacial deposits, that form a more or less continuous aquifer near the base of the glacial drift throughout the area bounded by the "A" line on the map (Figure 1). The analyses of waters from these beds generally show a similarity to the analyses of water from Johnstone lake. Analysis No. 2 is of the water from one of the Gravelbourg town wells. This water has a total salt content of 3,200 parts per million, consisting of 2,422 parts of sodium sulphate with minor amounts of calcium carbonate, magnesium carbonate, sodium carbonate, and sodium chloride. The high amount of sodium sulphate probably renders the water laxative to persons unaccustomed to its use. This salt, together with the 173 parts of sodium carbonate that the water contains, may render it harmful to vegetation and, consequently, the water should be used sparingly for garden irrigation. This water is much more highly mineralized than are the supplies used by many towns in Saskatchewan. The 3,000 parts per million of salts that sample No. 6 contains is made up, in the order of relative abundance, of magnesium sulphate, sodium sulphate, calcium carbonate, and sodium chloride. The magnesium sulphate renders the water harmful when taken by human beings, but it is being used satisfactorily for watering stock. Much of the water derived from this deep aquifer, particularly in the northern parts, is even more highly mineralized than from the Gravelbourg wells and can be used only for stock.

Water from the Bedrock

The Bearpaw formation underlies the glacial drift throughout this municipality, and throughout the district any waters obtained from it have been so highly mineralized as to be unfit for any ordinary farm purpose. Waters from sand beds at the top of the shales of the formation would probably have dissolved salt contents ranging between 4,000 and 6,000 parts per million, but seepages from the shale may contain salts in still greater amounts, up to 10,000 parts per million, with sodium sulphate and common salt predominating. Since such water is unfit for either domestic or stock use the sinking of wells into the shales appears inadvisable in this municipality.

WELL RECORDS—Rural Municipality of GRAVELBOURG, NO. 104, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SE.	1	10	4	3	Bored	50	2,360									Dry hole; base in Bearpaw formation.
2	NW.	1	"	"	"	Bored	40	2,355									Dry holes; bases in Bearpaw formation.
3	NW.	2	"	"	"	Bored	102	2,350	− 77	2,273	102	2,248	Bearpaw sand	Hard, cloudy, "alkaline"		N	Water too "alkaline" for use; well filled in
4	NE.	2	"	"	"	Bored	60	2,350									Dry hole; base in Bearpaw formation. A seepage well beside dugout.
5	SW.	3	"	"	"	Bored	90	2,350									Dry hole; wells yield very little seepage water which is too "alkaline" for use.
6	SW.	4	"	"	"	Bored	42	2,350	− 28	2,322	28	2,322	Glacial sand and clay	Hard, clear, "alkaline"		S	Sufficient for stock; water unfit for humans; three wells with insufficient supply.
7	NW.	4	"	"	"	Bored	28	2,345	− 17	2,328	28	2,317	Glacial sand and clay	Hard, clear, gas		D, S	Sufficient for 100 head stock; laxative; Neighbours also use well.
8	NE.	4	"	"	"	Bored	45	2,320	− 40	2,280	40	2,280	Glacial quick-sand	Hard, clear		D, S	Insufficient supply.
9	NE.	4	"	"	"	Bored	80	2,320									Dry hole in Bearpaw.
10	SE.	5	"	"	"	Dug	34	2,365	− 20	2,345	34	2,331	Glacial drift	Hard		D, S	Oversufficient for 20 head stock.
11	SW.	6	"	"	"	Bored	75	2,370	− 30	2,340	75	2,295	Glacial drift	Hard, iron, clear, brown sediment, "alkaline"	43	D, S	Sufficient supply.
12	NW.	9	"	"	"	Dug	60	2,325	− 30	2,295	60	2,265	Glacial drift	Hard, clear, "alkaline"		S	Oversufficient for 20 head stock.
13	NE.	9	"	"	"	Bored	70	2,335	− 50	2,285	50	2,285	Glacial gravel and sand	Hard, iron, clear	42	D, S	Sufficient for 50 head stock.
14	SE.	10	"	"	"	Bored	24	2,320	− 10	2,310	10	2,310	Glacial black quicksand	Soft, clear	42	D, S	Sufficient supply.
15	SW.	10	"	"	"	Dug	40	2,320	− 16	2,305	16	2,304	Glacial sand	Soft, clear, gas, odour	42	D, S	Sufficient supply; a 60-foot well; stock will not drink water.
16	NW.	12	"	"	"		105	2,305									Dry hole in Bearpaw beside dugout.
17	SW.	14	"	"	"	Dug	30	2,310	− 15	2,295	15	2,295	Recent fine yellow sand	Hard, clear, gas	42	D, S	Sufficient for 20 head stock; depends on rainfall.
18	NE.	15	"	"	"	Bored	182	2,300									Dry hole in Bearpaw.
19	SW.	16	"	"	"	Bored	85	2,315	− 70	2,245	70	2,245	Glacial sand	Hard, clear, "alkaline"	42	N	Well not used; insufficient supply owing to quicksand filling in well.
20		16	"	"	"	Dug	35	2,320	− 25	2,295	25	2,295	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
21	SE.	18	"	"	"	Dug	47	2,315	− 27	2,288	27	2,288	Glacial sand	Hard, clear, slightly "alkaline"		D, S	Sufficient for 8 head stock; used to water 70 head; needs cleaning.
22	NW.	18	"	"	"			2,300					Glacial drift				Shallow seepage well beside dugout.
23	NW.	19	"	"	"	Bored	80	2,300	− 40	2,260	80	2,220	Glacial sand	Hard, iron, "alkaline", clear	42	S	Sufficient for 20 to 25 head stock; drinking water hauled.
24	SE.	21	"	"	"	Bored	42	2,305	− 32	2,273	32	2,273	Glacial sand	Hard, clear		D, S	Insufficient supply; well caved in.
25	NE.	21	"	"	"			2,305					Glacial drift				Seepage well beside dugout.

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 GRAVELBOURG, NO. 104, 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
26	NE.	22	10	4	3	Bored	100	2,310									Several dry holes up to 100 feet; probably in Bearpaw. A seepage well beside dugout used.
27	SE.	23	"	"	"	Dug	20	2,285	- 10	2,275	10	2,275	Glacial clay	Hard, clear	42	D	Intermittent supply; well depends on slough seepage for supply.
28	SW.	24	"	"	"	Dug	25	2,300	- 10	2,290	10	2,290	Glacial clay	Hard, clear, "alkaline"	42	S	Intermittent, insufficient supply; laxative effect on humans; haul drinking water.
29	SE.	25	"	"	"	Dug	30	2,345	- 17	2,328	17	2,328	Recent sand	Hard, iron, clear	43	D, S	Insufficient for 2 head stock; use dugout also.
30	NW.	25	"	"	"	Bored	70	2,345					Glacial sand			N	Well filled in; water too "alkaline" for any use. Dugout used; poor supply.
31	NE.	26	"	"	"		15	2,330					Glacial drift				Dam in coulée never goes dry; seepage well beside dam; sufficient supply.
32	NW.	27	"	"	"	Dug	15	2,310	- 12	2,298	12	2,298	Glacial sand	Hard, clear		D, S	Intermittent and insufficient supply; seepage water from dugout.
33	NW.	30	"	"	"		15	2,295					Glacial drift				Seepage well.
34	SW.	31	"	"	"	Bored	90	2,297	- 2	2,295	90	2,207	Glacial sand	Hard, iron, clear, red sediment	42	D, S	Sufficient supply.
35	NW.	31	"	"	"	Bored	115	2,297	- 6	2,291	115	2,182	Glacial quick-sand	Hard, clear	42	D, S	Sufficient supply.
36	NE.	34	"	"	"	Bored	90	2,318			90	2,228	Glacial sand	"Alkaline"		N	Poor supply; too "alkaline" for use; well filled in.
	NE.	35	"	"	"												Dugout used; no well; haul drinking water.
37	W.½	36	"	"	"	Dug	34	2,340									Dry hole in Glacial drift; haul water for drinking; use pond for watering stock.
1	SW.	1	10	5	3	Dug	24	2,350	- 20	2,340	20	2,340	Glacial sand	Hard, iron, "alkaline", red sediment, clear	43	S	Insufficient supply; three dry holes up to 100 feet.
2	NE.	3	"	"	"	Bored	59	2,340	- 40	2,300	40	2,300	Glacial sand	Hard, clear, "alkaline"	42	D, S	Intermittent, insufficient supply; several soft water seepage wells.
3	NE.	3	"	"	"	Bored	115	2,350	- 50	2,300	115	2,235	Glacial sand	Hard, clear, "alkaline", iron	45	S	Sufficient supply; drinking water hauled.
4	NE.	6	"	"	"	Bored	105	2,440	- 76	2,364	105	2,335	Glacial drift	Hard, clear, "alkaline", sulphur		S	Strong, sufficient supply.
5	NE.	9	"	"	"	Bored	100	2,350	- 35	2,315	100	2,250	Glacial drift	Hard, iron, clear, "alkaline"	43	S	Sufficient supply; a 12-foot well used for house; three feet of good water.
6	SE.	10	"	"	"	Bored	25	2,335	- 15	2,320	15	2,320	Glacial sand	Soft, clear		D, S	Large supply.
7	NE.	12	"	"	"	Dug	65	2,300	- 30	2,270			Glacial sand	Hard, clear, slightly "alkaline"	42	D, S	Sufficient supply.
8	SE.	13	"	"	"	Bored	40	2,320	- 20	2,300	40	2,280	Glacial sand	Hard, clear, red sediment, "alkaline", iron	42	N	Sufficient supply; too "alkaline" for use.
9	NE.	13	"	"	"	Bored	40	2,320	- 7	2,313	40	2,280	Glacial sand	Hard, clear, "alkaline"	42	D, S	Sufficient supply; creek flows through this quarter.

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 GRAVELBOURG, NO. 104, 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
10	SW.	16	10	5	3	Bored	55	2,340	- 5	2,335	55	2,285	Glacial sand	Hard, clear, "alkaline"	44	S	Sufficient supply; too "alkaline" for house use.
11	NE.	17	"	"	"	Bored	58	2,340	- 20	2,320	58	2,282	Glacial sand	Hard, clear, "alkaline"		S	Sufficient supply; drinking water hauled.
12	NE.	19	"	"	"	Bored	115	2,300	- 46	2,254	116	2,184	Glacial sand	Soft, clear, "alkaline"		S	Sufficient supply; a 16-foot well used for drinking.
13	SW.	21	"	"	"	Bored	110	2,310	- 30	2,280	30	2,280	Glacial sand	Hard, clear, "alkaline"			Insufficient supply.
14	NW.	24	"	"	"	Bored	100	2,300	- 10	2,290	100	2,200	Glacial gravel	Hard, clear, iron, brown sediment		S	Sufficient supply; rain water for drinking.
15	NE.	26	"	"	"	Bored	90	2,300	- 3	2,297	90	2,210	Glacial sand	Hard, clear, "alkaline"	43	S	Similar well 95 feet deep; rain water for drinking.
16	SE.	27	"	"	"	Bored	128	2,312	- 15	2,297	128	2,184	Glacial quick-sand	Hard, iron, "alkaline", clear	42	S	Sufficient supply; laxative on humans.
17	SE.	31	"	"	"	Dug	10	2,310	- 2	2,308	2	2,308	Glacial sand	Hard, clear	44	D, S	Sufficient supply; also use slough for stock.
18	SW.	31	"	"	"	Bored	33	2,340	- 8	2,332	8	2,332	Glacial drift	Hard, clear		D, S	Constant seepage from dugout.
19	SE.	32	"	"	"	Bored	120	2,340	- 70	2,270	120	2,220	Glacial sand	Hard, clear, "alkaline", iron		S	Will water 10 head stock; a dug well 120 feet deep; good supply in dugout.
20	NW.	32	"	"	"	Bored	65	2,340	- 45	2,295	65	2,275	Glacial drift	Hard, clear, "alkaline", iron		S	Sufficient supply; a 90-foot dry hole.
21	NE.	35	"	"	"	Bored	104	2,300	+ 4	2,304	104	2,196	Glacial coarse sand	Hard, clear, red sediment, "alkaline"		S	Flows 2 gallons a minute; similar to water at Gravelbourg.
22		36	"	"	"	Bored	150	2,300	+ 4	2,304	150	2,150	Glacial gravel	Hard, clear, "alkaline", brown sediment, iron	42	S	Well plugged with quicksand; used to flow 1½ gallons a minute.
23	NE.	36	"	"	"	Drilled	150	2,300	+ 4	2,304	150	2,150	Glacial gravel and sand	Hard, iron, "alkaline", cloudy		D, S	Flows approximately 20,000 gallons a day.
1	N.½	1	10	6	3	Bored	40	2,510	- 24	2,486	24	2,486	Glacial gravel	Medium hard, "alkaline", clear	43	D, S	Insufficient supply; only 2 barrels a day.
2	SW.	2	"	"	"	Dug	42	2,450	- 41	2,409	41	2,409	Glacial gravel	Hard, clear, "alkaline"		S	Sufficient supply; poor quality.
3	SE.	3	"	"	"	Bored	40	2,460	- 36	2,424	36	2,424	Glacial drift	Hard, cloudy, "alkaline"		S	Insufficient for 4 head stock.
4	SW.	3	"	"	"	Bored	45	2,455	- 30	2,425	40	2,415	Glacial sand	Hard, cloudy, "alkaline"		S	Sufficient supply; a 10-foot well with sand aquifer for drinking.
5	SE.	4	"	"	"	Bored	20	2,510	- 12	2,498	12	2,498	Glacial sandy clay	Hard, clear		D, S	Sufficient supply.
6	N.½	5	"	"	"	Bored	60	2,530	- 20	2,510	60	2,470	Glacial drift	Hard, clear, slightly "alkaline"	42	D, S	Sufficient supply.
7	SE.	6	"	"	"	Dug	12	2,540	- 5	2,535	5	2,535	Glacial gravel	Soft, clear		D, S S	Sufficient supply; an 80-foot dry hole.

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 GRAVELBOURG, NO. 104, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
8	SW.	6	10	6	3	Bored	45	2,540	− 40	2,500	40	2,500	Glacial drift	Hard, clear	42	D, S	Insufficient supply.
9	NE.	7	"	"	"	Bored	66	2,500	− 36	2,464	66	2,434	Glacial sand and gravel	Hard, clear, strongly "alkaline"	42	S	Sufficient supply; very poor quality for stock; laxative; haul drinking water.
10	SW.	8	"	"	"	Bored	84	2,520	− 25	2,495	84	2,436	Glacial drift	"Alkaline", clear		S	Sufficient for stock.
11	NE.	8	"	"	"	Bored	112	2,500	− 40	2,460	112	2,388	Glacial drift	Hard, clear, iron, strongly "alkaline"	42	N	Sufficient supply; stock will not drink water; another 80-foot well with "alkaline" water.
12	NE.	9	"	"	"	Bored	80	2,480	− 50	2,430	80	2,400	Glacial sand	Hard, iron, "alkaline", cloudy, yellow		S	Sufficient for stock; laxative on humans.
13	SE.	11	"	"	"	Bored	56	2,510	− 38	2,472	56	2,454	Glacial sand and gravel	Hard, clear, iron		DS	Insufficient for stock.
14	NE.	13	"	"	"	Bored	60	2,370	− 45	2,325	45	2,325	Glacial sandy clay	Hard, clear, iron, "alkaline"		D, S	Sufficient supply; laxative effect; dry hole 115 feet deep in Bearpaw(?).
15	NW.	13	"	"	"	Bored	125	2,370									Dry hole in Bearpaw.
16	SE.	15	"	"	"	Bored	45	2,440	− 35	2,405	45	2,395	Glacial sand	Hard, clear, "alkaline"		S	Sufficient supply; haul drinking water.
17	SW.	17	"	"	"	Bored	85	2,475	− 30	2,445	85	2,390	Glacial sand and gravel	Hard, clear, "alkaline", red sediment, iron		S	Sufficient supply; scours stock; use dugout also.
18	SE.	18	"	"	"	Bored	77	2,475	− 40	2,435	77	2,398	Glacial sand and gravel	Hard, clear, "alkaline", iron		N	Sufficient supply; scours stock; well has not been used for five years.
19	NW.	18	"	"	"	Bored	75	2,475	− 30	2,445	75	2,400	Glacial drift	Hard, iron, "alkaline", clear	42	N	Water killed 3 head stock; haul water at present.
20	NW.	20	"	"	"	Dug	10	2,445	− 6	2,439	6	2,439	Glacial sand	Soft, clear		D, S	Sufficient supply.
21	NW.	21	"	"	"	Bored	61	2,500	− 45	2,455	45	2,455	Glacial sand	Hard, clear, "alkaline", iron, yellow, cloudy	42	S	Sufficient supply; laxative on humans.
22	NE.	21	"	"	"	Bored	60	2,510	− 40	2,470	40	2,470	Glacial gravel	Hard, clear, "alkaline"		S	Insufficient, intermittent supply; a seepage well for house use.
23	W.½	23	"	"	"	Bored	50	2,375	− 20	2,355	50	2,325	Glacial sand	Hard, clear, "alkaline", iron		S	Sufficient for 15 head stock.
24	SW.	24	"	"	"	Dug	14	2,360	− 8	2,352	8	2,352	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient supply; good drinking water.
25	NW.	24	"	"	"	Bored	85	2,360	− 50	2,310	85	2,275	Glacial blue clay?	Hard, clear, "alkaline"		S	Strong supply; poor quality; two other shallow seepage wells; small supply.
26	NE.	24	"	"	"	Bored	100	2,330	− 50	2,280			Glacial drift	Hard, clear, "alkaline", red sediment, iron	41	S	Sufficient supply; drinking water hauled.

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 GRAVELBOURG, NO. 104, 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
27	SE.	25	10	6	3	Bored	80	2,345	− 40	2,305	80	2,265	Glacial sandy clay	Hard, iron, "alkaline"		N	Scours stock; used dugout for watering stock now.
28	W.½	27	"	"	"	Dug	30	2,400	− 21	2,379	21	2,379	Glacial gravel and clay	Hard, clear, mineralized, red sediment, iron		D, S	Sufficient supply; a 25-foot well with strong supply of better, softer water.
29	NE.	27	"	"	"	Dug	23	2,370	− 13	2,357	13	2,357	Glacial sand and gravel	Soft, clear		D, S	Sufficient supply; surplus water obtained from SE.¼, section 34, at 30 feet deep.
30	SE.	28	"	"	"	Bored	85	2,500	− 72	2,428	72	2,428	Glacial clay, sand and gravel	Hard, clear, "alkaline"	43	D, S	Insufficient supply; a shallow seepage well used; five dry holes 85 feet deep.
31	SE.	30	"	"	"	Bored	80	2,475	− 45	2,430	45	2,430	Glacial sand	Hard, clear, slightly "alkaline"	42	D, S	Insufficient supply; two other similar wells to supply 8 head stock.
32	NE.	30	"	"	"	Bored	103	2,475									Several dry holes over 100 feet in Bearpaw.
33	NW.	32	"	"	"	Dug	32	2,480	− 25	2,455	32	2,448	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient supply; neighbours haul water from here.
34	NE.	32	"	"	"	Bored	80	2,510	− 60	2,450	80	2,430	Glacial sand	Hard, clear, iron, "alkaline"		S	Sufficient for 15 head stock.
35	SE.	34	"	"	"	Bored	50	2,350									Dry hole in Bearpaw; a seepage well near pond for house use.
36	NW.	35	"	"	"	Dug	12	2,350	− 9	2,341	12	2,338	Glacial quicksand	Hard, clear, "alkaline"		D, S	Very strong supply for 60 head stock. Can obtain water anywhere on the section at 12 feet.
1	SW.	2	11	4	3	Bored	60	2,325	− 18	2,307	18	2,307	Glacial drift	Hard, clear, "alkaline"		S	Sufficient for 10 head stock; laxative on man; a 26-foot well sufficient for house use.
2	NW.	2	"	"	"	Bored	37	2,335	− 23	2,312	23	2,312	Glacial clay and gravel	Hard, clear, "alkaline"		N	Water too "alkaline" for use; haul drinking water; use dugout for stock.
3	SW.	3	"	"	"	Bored	150	2,315									Dry hole in Bearpaw.
4	NW.	4	"	"	"	Bored	85	2,300									Dry holes in Bearpaw; a 24-foot well with seepage water from dugout.
5	S.½	8	"	"	"	Bored	75	2,300									Dry hole in Bearpaw; also one 300-foot dry hole; no water obtained; a seepage well beside dugout.
6	SW.	10	"	"	"	Dug	24	2,300	− 18	2,282	18	2,282	Glacial drift	Fairly good water, clear		D, S	Insufficient supply; also a seepage well.
7	NE.	10	"	"	"	Dug	18	2,320									Well went dry after five years; probably in glacial drift; use dugout now.
8	SW.	12	"	"	"	Bored	50	2,360	− 20	2,340	20	2,340	Glacial drift	Hard, clear, iron		D, S	Sufficient supply; cistern water used for house purposes.
9	SW.	13	"	"	"	Bored	75	2,360					Glacial drift	Hard, cloudy, "alkaline"	43	N	Seepage is too slow; haul water for drinking.
10	NW.	13	"	"	"	Bored	13	2,355	− 5	2,350	5	2,350	Glacial drift	Hard, clear	46	D, S	Insufficient supply; intermittent; seepage from dugouts.
11	NE.	13	"	"	"	Bored	44	2,375	− 10	2,365	10	2,365	Glacial drift	Hard, clear, slightly "alkaline"	43	D, S	Insufficient, intermittent supply; cannot obtain enough water for stock.
12	NW.	14	"	"	"	Bored	16	2,325									Dry hole in glacial drift; use a 16-foot well for house.
13	NE.	16	"	"	"	Dug	90	2,310									Dry hole; possibly in Bearpaw; depends on Wood river for summer supply.

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.

B 4-4
R. 7526

WELL RECORDS—Rural Municipality of GRAVELBOURG, NO. 104, 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
14	SE.	17	11	4	3			2,300									Insufficient supply; a small seepage well beside dugout.
15	SW.	17	"	"	"	Bored	70	2,300	− 60	2,240	60	2,240	Glacial drift	Hard, clear, "alkaline"	43	D, S	Only sufficient for 13 head stock at times; intermittent supply.
16	N.½	17	"	"	"	Bored	100	2,300									Dry hole; probably in Bearpaw; depend on Wood river water filtered through sand.
17	NW.	19	"	"	"	Bored	32	2,285	− 9	2,276	9	2,276	Glacial drift	Hard, salty, "alkaline", clear	42	S	Insufficient, intermittent supply; laxative; well depends on creek for seepage water.
18	W.½	22	"	"	"			2,310									Dry hole in glacial drift; use river for stock.
19	NE.	23	"	"	"		50	2,350	− 25	2,325	25	2,325	Glacial sand			D	1 barrel a day of good drinking water.
20	NE.	26	"	"	"	Bored	20	2,330	− 5	2,325			Glacial drift	Hard, clear, "alkaline"	42	S	Insufficient supply; use dam for stock.
21	SW.	28	"	"	"	Bored	76	2,300	− 15	2,285	76	2,224	Glacial quicksand	Hard	42	D, S	Sufficient for 40 head stock.
22	SE.	30	"	"	"	Bored	50	2,300	− 45	2,255	45	2,255	Glacial drift	Hard, clear	42	D, S	Insufficient, intermittent supply.
23	SW.	30	"	"	"	Dug	30	2,300	− 21	2,279	21	2,279	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
24	NE.	30	"	"	"	Dug	30	2,300	− 20	2,280	20	2,280	Glacial quicksand	Hard, clear	42	D, S	Sufficient supply.
25	NE.	31	"	"	"	Bored	45	2,285	− 35	2,250	35	2,250	Glacial drift	Hard, clear, "alkaline", iron	42	S	Insufficient supply;use dugout; haul drinking water.
26	SE.	32	"	"	"	Bored	75	2,300	− 55	2,245	75	2,225	Glacial clay and gravel		42	D, S	Sufficient supply.
27	NW.	34	"	"	"	Dug	25	2,210	− 18	2,192	18	2,192	Glacial gravel and sand	Hard, clear	42	D, S	Sufficient supply.
28	NW.	36	"	"	"	Bored	75	2,310	− 45	2,265	45	2,265	Bearpaw shale	Very "alkaline"		N	Intermittent, insufficient supply; well filled in; too "alkaline" for use; dugout used at present.
1	SE.	1	11	5	3	Drilled	141	2,300	+ 3	2,303	80	2,220	Glacial gravel and sand	Hard, "alkaline"			Good supply of water.
2	NW.	2	"	"	"	Bored	100	2,300	0	2,300	100	2,200	Glacial quicksand	Hard, clear, "alkaline"	42	S	Sufficient for 50 to 75 head stock; laxative on humans.
3	NE.	2	"	"	"	Bored	95	2,290	+ 14	2,304	95	2,195	Glacial very fine sand	Hard, iron, "alkaline", clear	42	S	Strong supply could water 1,000 head stock; could easily be used for house.
4	SW.	4	"	"	"	Bored	120	2,300	− 70	2,230	120	2,180	Glacial sand	Hard, clear, "alkaline"		S	Sufficient supply.
5	NW.	5	"	"	"	Dug	45	2,305	− 43	2,262	43	2,262	Glacial sand	Soft, clear	40	D, S	Sufficient supply.
6	SE.	6	"	"	"	Bored	60	2,310	− 20	2,290	60	2,250	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
7	SW.	7	"	"	"	Bored	28	2,315	− 14	2,301	14	2,301	Glacial coarse sand	Hard, clear	43	D, S	Sufficient supply for house; dry holes.
8	NE.	7	"	"	"	Dug	50	2,320									Dry hole in glacial drift; haul water.
9	SW.	8	"	"	"	Bored	125	2,310	− 40	2,270	125	2,185	Glacial gravel	Hard, clear, "alkaline"	45	S	Sufficient supply; laxative; cistern for house water; one dfy hole.
10	SE.	10	"	"	"	Dug	105	2,330	− 30	2,300	100	2,230	Glacial quicksand	Hard, iron, clear	42	D, S	Sufficient supply.

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 GRAVELBOURG, NO. 104, 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	SW.	10	11	5	3	Bored	110	2,300	- 60	2,240	100	2,200	Glacial sea-mud	Hard, iron, "alkaline", red sediment, iron	42	S	Probably sufficient for stock.
12	SW.	12	"	"	"	Bored	130	2,300	- 60	2,240	130	2,170	Glacial sea-mud	Hard, clear, "alkaline"		S	Sufficient supply; use reservoir for house purposes.
13	SW.	12	"	"	"	Bored	98	2,285	- 0	2,285	98	2,187	Glacial drift	Hard, clear, iron, very "alkaline", red sediment		S	Sufficient supply; laxative on humans; scours stock.
14	SW.	12	"	"	"	Bored	97	2,285	- 0	2,285	97	2,188	Glacial sandy clay	Hard, iron, clear, "alkaline"	42	D, S	Sufficient supply; laxative.
15	NW.	14	"	"	"	Dug	102	2,300	+ 3	2,303	102	2,198	Glacial quick-sand	Hard, clear, iron, brown sediment, "alkaline"	42	D, S	Well does not flow now because it is filled with quicksand; needs cleaning.
16	NE.	14	"	"	"	Bored	119	2,300	- 6	2,294	119	2,181	Glacial quick-sand	Hard, iron, "alkaline", clear	42	D, S	Sufficient supply; laxative on humans.
17	SW.	16	"	"	"	Bored	140	2,300	- 60	2,240	140	2,160	Glacial sand	Hard, clear, "alkaline", salty	42	S	Sufficient supply.
18	NW.	16	"	"	"	Bored	127	2,310	- 25	2,285	127	2,183	Glacial quick-sand	Hard, clear, iron, red sediment, "alkaline"	42	S	Large supply; could be used for drinking; cistern used for house purposes.
19	NE.	16	"	"	"	Bored	77	2,310	- 25	2,285	77	2,233	Glacial sand	Hard, iron, "alkaline", clear		D, S	Sufficient supply.
20	SW.	18	"	"	"	Bored	100	2,315	- 85	2,230	85	2,230	Glacial drift	Hard, clear		S	Insufficient supply.
21	SW.	19	"	"	"	Bored	48	2,315	- 42	2,273	42	2,273	Glacial drift	Hard, clear, "alkaline", salty	42	D, S	Laxative; sufficient supply.
22	SW.	20	"	"	"	Bored	120	2,330	- 60	2,270	120	2,210	Glacial drift	Hard, iron, "alkaline", clear	43	S	Sufficient supply; a similar well.
23	NE.	23	"	"	"	Bored	166	2,300	- 26	2,274	166	2,134	Glacial gravel	Hard, clear, "alkaline"	43	D, S	Sufficient supply.
24	SE.	24	"	"	"	Bored	140	2,300	- 40	2,260	140	2,160	Glacial sea-mud	Hard, iron, clear		D, S	Sufficient supply.
25	SW.	24	"	"	"	Bored	100	2,290	- 25	2,265	100	2,190	Glacial sand	Hard, iron, "alkaline"		D	Sufficient supply.
26	SW.	26	"	"	"	Dug	28	2,300	- 20	2,280	20	2,280	Glacial drift	Hard, clear	43	D, S	Insufficient supply; two shallow dry holes; use river for laundry.
27	SE.	27	"	"	"	Bored	125	2,300	- 10	2,290	125	2,275	Glacial sea-mud?	Hard, clear, "alkaline", iron, salty, red sediment	42	S	Probably sufficient supply; a 14-foot well for drinking.
28	SW.	27	"	"	"	Bored	110	2,300	- 80	2,220	110	2,190	Glacial drift	Hard, clear, "alkaline", iron	43	D, S	Insufficient supply.

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 GRAVELBOURG, NO. 104, 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
29	NE.	27	11	5	3	Dug	14	2,300	- 9	2,291	9	2,291	Glacial drift	Hard, iron, clear, brown sediment	43	D, S	Sufficient, strong supply; poor quality.
30	SW.	28	"	"	"	Bored	130	2,305	- 40	2,265	130	2,175	Glacial sand	Hard, clear, "alkaline", iron	42	S	Sufficient supply; laxative; use rain water for drinking.
31	NE.	29	"	"	"	Bored	125	2,315	- 25	2,290	125	2,190	Glacial sea-mud?	Hard, salty, "alkaline", sulphur			Sufficient supply; #.
32	SE.	30	"	"	"	Bored	124	2,350	- 70	2,280			Glacial sand	Hard, salty, iron, clear, "alkaline", red sediment	42	S	Insufficient supply; haul water in summer months.
33	NE.	30	"	"	"	Bored	130	2,340	- 70	2,270	70	2,270	Glacial sand	Hard, clear, iron	43	S, D	Sufficient supply.
34	SW.	31	"	"	"	Bored	114	2,330	- 35	2,295	114	2,216	Glacial sand	Hard, clear, "alkaline", salty	42	S	Probably sufficient.
35	NW.	32	"	"	"	Bored	28	2,324	- 22	2,302	22	2,302	Glacial sand	Hard, clear	43	D	Only sufficient for house use.
36	NW.	35	"	"	"	Dug	35	2,300	- 18	2,282	35	2,265	Glacial sand	Hard, iron, clear, red sediment	42	D, S	Sufficient supply.
37	SE.	36	"	"	"	Dug	24	2,310	- 20	2,290	20	2,290	Glacial quick-sand	Hard, clear, slightly "alkaline"	45	D, S	Insufficient supply.
38	NW.	36	"	"	"		135	2,310	- 12	2,298	135	2,175	Glacial drift	Hard, clear, slightly "alkaline"	40	S	Sufficient supply; a 55-foot dry hole; water stock at creek.
39	NE.	36	"	"	"	Dug	30	2,300	- 23	2,277	30	2,270	Glacial quick-sand	Hard, clear		D, S	Insufficient supply; only waters 12 head stock.
1	SE.	1	11	6	3	Dug	30	2,345	- 20	2,325	30	2,315	Glacial sand	Soft, clear	43	D, S	Sufficient supply; good water; stock use dugouts also.
2	SE.	2	"	"	"	Bored	105	2,345									Three dry holes in glacial drift over 100 feet.
3	NW.	3	"	"	"	Dug	35	2,365	- 25	2,340	25	2,340	Glacial sand	Hard, clear	43	D, S	Sufficient supply.
4	SE.	4	"	"	"	Bored	90	2,450	- 35	2,415	90	2,360	Glacial sand	Hard, clear, "alkaline", iron	42	S	Sufficient for stock; laxative on humans.
5	NW.	4	"	"	"	Bored	140	2,490									Dry hole in Bearpaw; shallow seepage wells with sufficient supply; also a dugout used.
6	SE.	6	"	"	"	Bored	149	2,480									Dry hole in Bearpaw; also one 66 feet deep; a 10-foot seepage well in sand with fair supply.
7	NW.	6	"	"	"	Bored	60	2,510									Dry hole in glacial drift; a seepage well beside dugout.
8	NE.	7	"	"	"	Dug	16	2,400	- 10	2,390	16	2,384	Glacial sand	Hard, clear, "alkaline"		D, S	Steady supply; well can be emptied, but supply comes back soon.
9	SE.	8	"	"	"	Dug	12	2,400	- 9	2,391	9	2,391	Glacial quick-sand	Soft, clear	43	D, S	Sufficient supply; good quality.
10	SE.	9	"	"	"	Bored	40	2,350	- 25	2,325	25	2,325	Glacial sand	Very hard, "alkaline", clear	42	D, S	Sufficient supply; a similar well; also a fair supply in dugout.

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.

B 4-4
R. 7526

WELL RECORDS—Rural Municipality of GRAVELBOURG, NO. 104, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE: Elev.	PRINCIPAL WATER-BEARING BED: Depth	PRINCIPAL WATER-BEARING BED: Elev.	PRINCIPAL WATER-BEARING BED: Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
11	SW.	12	11	6	3	Bored	35	2,340	- 30	2,310	30	2,310	Glacial sand	Hard, clear	42	S	Sufficient supply; a 20-foot well with soft water.
12	NW.	12	"	"	"	Dug	70	2,335	- 50	2,285	50	2,285	Glacial drift	Very hard, clear	42	S	Insufficient for stock; very poor quality; a cistern used for drinking.
13	SE.	14	"	"	"	Bored	72	2,335	- 40	2,295	40	2,295	Glacial drift	Hard, clear, "alkaline"	42	S	Sufficient for 15 head stock; laxative on humans; too "alkaline" for house purposes.
14	NW.	14	"	"	"	Bored	60	2,340	- 30	2,310	60	2,280	Glacial sand	Hard, clear	42	D, S	Insufficient supply; only waters 12 head stock at present.
15	SW.	16	"	"	"	Bored	55	2,340	- 38	2,302	55	2,285	Glacial sand	Hard, cloudy, yellow, iron, "alkaline"	42	S	Sufficient supply; laxative on humans; a shallow seepage well for house purposes.
16	SE.	17	"	"	"	Bored	60	2,415	- 30	2,385	60	2,355	Glacial sand	Hard, clear	43	D, S	Sufficient supply; needs cleaning; fifteen dry holes about 50 feet deep.
17	NE.	17	"	"	"	Dug	40	2,355					Glacial drift	Hard, clear	43	D, S	Insufficient supply.
18	SW.	18	"	"	"	Bored	40	2,400	- 25	2,375	25	2,375	Glacial drift	Hard, clear, "alkaline"	43	S	Poor supply; not used except when shortage in dam; a shallow seepage well also.
19	E.½	20	"	"	"	Dug	45	2,345	- 40	2,305	40	2,305	Glacial drift	Hard, clear, "alkaline"	43	S	Insufficient supply; a 22-foot well for house with good supply.
20	SE.	22	"	"	"	Bored	51	2,330	- 27	2,303	51	2,279	Glacial sand	Hard, clear	43	D, S	Insufficient for 7 head stock; a dry hole 35 feet in Bearpaw shale.
21	NW.	22	"	"	"	Bored	30	2,320									Five dry holes similar depth; bases probably in Bearpaw formation; a small seepage well.
22	SE.	24	"	"	"	Bored	60	2,340	- 30	2,310	30	2,310	Glacial sand and gravel	Hard, clear, "alkaline"	42	S	Sufficient supply; too "alkaline" for humans.
23	SW.	24	"	"	"	Bored	84	2,340	- 55	2,285	55	2,285	Glacial drift	Hard, iron, cloudy, yellow strongly "alkaline"	42	N	Insufficient supply; water too "alkaline" for use.
24	N.½	25	"	"	"	Bored	44	2,345	- 31	2,314	44	2,301	Glacial clay and gravel	Hard, clear, iron	43	D, S	Sufficient supply.
25	SW.	26	"	"	"	Dug	16	2,345	- 12	2,333	12	2,333	Glacial drift	Hard, clear, "alkaline", iron	43	S	Sufficient supply; a 35-foot dug well also.
26	SE.	28	"	"	"	Dug	35	2,330	- 27	2,303	35	2,295	Glacial fine sand	Hard, clear, "alkaline"	42	D, S	Sufficient supply; another similar well with smaller supply.
27	NW.	28	"	"	"	Dug	33	2,360	- 25	2,335	25	2,335	Glacial sand	Hard, iron, "alkaline", cloudy, yellow	43	D, S	No information; #.
28	SE.	31	"	"	"	Dug	36	2,360	- 26	2,334	26	2,334	Glacial sandy clay	Soft, iron, clear	43	D, S	Sufficient supply; probably contains $CaCO_3$.
29	NW.	32	"	"	"	Dug	38	2,360	- 35	2,325	35	2,325	Glacial quicksand	Hard, clear	43	D, S	Insufficient supply; several similar wells yield sufficient supply.
30	NE.	32	"	"	"	Dug	30	2,370	- 25	2,345	25	2,345	Glacial quicksand	Hard, clear	43	D, S	Sufficient supply; water conditions good.
31	SE.	33	"	"	"	Bored	32	2,360	- 28	2,332	28	2,332	Glacial sandy clay	Hard, clear	43	D, S	Sufficient supply.
32	SW.	33	"	"	"	Bored	52	2,375	- 47	2,328	52	2,323	Glacial sandy clay	Hard, clear	42	D, S	Well abandoned, filled with quicksand; a 20-foot seepage well, fair supply.
33	NE.	33	"	"	"	Bored	64	2,350	- 44	2,306	64	2,286	Glacial quicksand	Hard, clear	43	S	Insufficient; well filled with quicksand; haul water in winter.

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

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

WELL RECORDS—Rural Municipality of GRAVELBOURG, NO. 104, 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.	34	11	6	3	Dug	18	2,370	- 13	2,357	13	2,357	Glacial drift	Hard, clear, good	42	D, S	Insufficient supply.
35	NW.	36	"	"	"	Dug	21	2,360	- 14	2,346	14	2,346	Glacial sand	Hard, clear, slightly "alkaline"	42	D, S	Sufficient supply; comes in slowly.
1	NW.	4	12	4	3	Bored	86	2,300	- 38	2,262	86	2,214	Glacial sand and gravel	Hard, clear, iron, salty, "alkaline", red sediment		S	Sufficient supply; use rain water for drinking.
2	NW.	5	"	"	"	Bored	115	2,280	- 70	2,210	115	2,165	Glacial drift	Hard, clear, iron, salty, "alkaline"	42	D, S	Sufficient supply; laxative on humans.
3	NE.	6	"	"	"	Bored	24	2,290	- 24	2,266	24	2,266	Glacial drift	Hard, clear		D, S	Sufficient supply; another similar well.
4	SW.	7	"	"	"	Bored	48	2,310	- 28	2,282	28	2,282	Glacial quick-sand	Hard, clear	44	D, S	Sufficient supply; five dry holes in blue clay.
5	NE.	7	"	"	"	Bored	100	2,300	- 50	2,250	50	2,250	Glacial drift	Hard, clear	42	D, S	Sufficient supply.
6	SE.	8	"	"	"	Bored	76	2,300	- 30	2,270	76	2,224	Glacial sand	Hard, clear, "alkaline"			Insufficient supply; laxative.
7	NE.	12	"	"	"	Bored	100	2,295	- 65	2,230	100	2,195	Glacial sand	Hard, cloudy, "alkaline"		N	Sufficient supply; too "alkaline" for use.
8	NW.	12	"	"	"	Bored	90	2,300					Glacial drift	"Alkaline"		N	Steady supply; has bad effect on humans and stock.
9	NW.	13	"	"	"	Dug	16	2,280	- 13	2,267	13	2,267	Glacial white clay	Hard, clear		D, S	Sufficient supply; neighbours haul water for drinking.
10	NE.	13	"	"	"	Bored	65	2,315	- 20	2,295	65	2,250	Glacial sand	Hard, cloudy, "alkaline"		N	Strong supply; too "alkaline" for stock or humans; use dam.
11	SW.	14	"	"	"	Bored	60	2,280									Two dry holes 60 feet and 120 feet; glacial drift.
12	SE.	18	"	"	"	Bored	60	2,300	- 56	2,244	56	2,244	Glacial drift	Hard, clear		D, S	Insufficient supply.
13	NW.	18	"	"	"	Bored	80	2,300	- 50	2,250	50	2,250	Glacial gravel	Hard, "alkaline"		S	Insufficient supply; two dry holes in glacial drift.
14	SW.	20	"	"	"	Bored	98	2,290	- 70	2,220	70	2,220	Glacial drift	Hard, iron, clear		D, S	Intermittent, insufficient supply; requires second similar well to water 7 horses.
15	E.½	21	"	"	"	Bored	25	2,265	- 18	2,247	18	2,247	Glacial gravel	Soft, clear		D, S	Sufficient supply; another well beside river with gravel aquifer.
16	W.½	21	"	"	"	Bored	104	2,275	- 40	2,235	140	2,135	Glacial silt	Hard, iron, clear		D, S	Excellent supply; laxative on humans; two dry holes 100 feet and 130 feet.
17	NE.	22	"	"	"	Bored	105	2,275	- 90	2,185	90	2,185	Glacial drift	Hard, brown sediment, "alkaline"		D	Intermittent supply; use dam also.
18	NW.	23	"	"	"	Bired	120	2,305	- 90	2,215	120	2,185	Glacial gravel	Hard, clear		D, S	Excellent supply; waters 30 head stock.
19	NW.	24	"	"	"	Bored	100	2,320	- 50	2,270	100	2,220	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient supply.
20	NW.	26	"	"	"	Bored	80	2,270	- 70	2,200	70	2,200	Glacial sandy clay	Hard, clear, "alkaline"	42	S	Sufficient supply; a 14-foot well; soft water for drinking; also a dugout.
21	SE.	30	"	"	"	Bored	55	2,230	- 35	2,195	35	2,195	Glacial drift	Hard, clear, "alkaline"		D, S	Only sufficient for 15 head stock; laxative on humans.
22	SE.	30	"	"	"	Bored	75	2,225	- 8	2,217	75	2,150	Glacial silt	Hard, sulphur, iron, clear, red sediment, "alkaline"	42	D, S	Sufficient supply; river flows through farm.

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 GRAVELBOURG, NO. 104, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
23	NW.	32	12	4	3	Bored	60	2,270	− 15	2,255	60	2,210	Glacial sand	Hard, cloudy, "alkaline"		S	Sufficient supply; laxative on humans; a 60-foot well for drinking; two other 60-foot dry holes.
24	S.½ 33	"	"	"		Dug	20	2,300	− 18	2,282	18	2,282	Glacial drift	Soft, clear		D, S	Intermittent supply; a dry hole 72 feet deep.
1	SW.	1	12	5	3	Dug	40	2,320	− 25	2,295	25	2,295	Glacial quick-sand	Hard, clear, "alkaline"	44	D, S	Insufficient for 6 horses; well filled in to 28 feet.
2	NW.	1	"	"	"	Dug	38	2,305	− 28	2,277	38	2,267	Glacial drift	Hard, clear	42	D, S	Sufficient for 20 head stock.
3	NE.	1	"	"	"	Bored	44	2,300	− 38	2,262	38	2,262	Glacial quick-sand	Hard, clear, good	43	D, S, I	Supplies 2 barrels in 2 hours; used for garden.
4	SW.	2	"	"	"	Dug	20	2,300	− 16	2,284	20	2,280	Glacial sand	Hard, clear	42	D, S	Excellent supply.
5	NW.	2	"	"	"	Bored	47	2,325	− 27	2,298	47	2,278	Glacial quick-sand	Hard, clear	42	D, S	Excellent supply.
6	NW.	4	"	"	"	Spring		2,310	+ 3	2,313			Glacial drift				Spring on river bank; when river water is low the spring flows 3 feet above surface of ground.
7	SE.	5	"	"	"	Dug	20	2,324	− 15	2,309	15	2,309	Glacial drift			D, S	Insufficient supply; only waters 6 horses.
8	NW.	6	"	"	"	Dug	22	2,350	− 10	2,340	10	2,340	Glacial sand and clay	Hard, clear	42	D, S	Sufficient supply; a seepage well and a 30-foot dry hole.
9	NE.	6	"	"	"	Dug	25	2,340	− 18	2,322	18	2,322	Glacial sandy clay	Hard, clear	42	D, S	Insufficient supply; use creek for stock.
10	NE.	9	"	"	"	Dug	26	2,310	− 24	2,286	24	2,286	Glacial quick-sand	Soft, clear	44	D, S	Sufficient supply.
11	NW.	10	"	"	"	Dug	28	2,310	− 20	2,290	20	2,290	Glacial quick-sand	Hard, clear, "alkaline"	42	D, S	Insufficient supply.
12	NE.	10	"	"	"	Dug	28	2,300	− 24	2,276	24	2,276	Glacial quick-sand	Soft, clear		D, S	Sufficient supply.
13	SE.	12	"	"	"	Bored	90	2,300	− 80	2,220	80	2,220	Glacial sand	Hard, clear	43	D, S	Sufficient supply; another well with good supply of hard water not used.
14	SE.	13	"	"	"	Bored	84	2,300	− 60	2,240	80	2,220	Glacial sea-mud?	Hard, iron, "alkaline", clear	44	D, S, I	Sufficient supply; use water for garden.
15	SW.	14	"	"	"	Bored	40	2,310	− 30	2,285	40	2,275	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
16	SW.	14	"	"	"	Bored	40	2,310	− 30	2,285	30	2,285	Glacial drift	Hard, iron, clear, good	45	D, S	Sufficient supply.
17	NW.	15	"	"	"	Dug	20	2,330	− 26	2,304	26	2,304	Glacial quick-sand	Hard, clear, iron	46	D, S	Insufficient supply; two dry holes 70 feet deep; several other shallow seepage wells.
18	NE.	16	"	"	"	Dug	28	2,330	− 25	2,305	25	2,305	Glacial quick-sand	Hard, iron, clear	45	D, S	Sufficient supply; two wells in pasture, one 10 feet, the other 48 feet; good supply in sand.
19	SE.	17	"	"	"	Dug	32	2,340	− 28	2,312	28	2,312	Glacial sand	Hard, clear	45	D, S	Insufficient supply; only waters 16 head stock; also several dry holes.
20	SE.	18	"	"	"	Dug	12	2,300	− 3	2,297	3	2,297	Glacial sand	Hard, iron, clear, good		D, S	Strong supply; waters 26 head stock; source of water is from spring in bank of stream.
21	SW.	18	"	"	"	Dug	26	2,300	− 20	2,280	20	2,280	Glacial yellow clay	Hard, clear	45	D, S	Very insufficient supply; several wells almost dry.
22	SE.	19	"	"	"	Dug	28	2,350	− 25	2,325	25	2,325	Glacial quicksand	Soft, clear	42	D, S	Sufficient supply; water found along ridge lying east and west.

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 GRAVELBOURG, NO. 104, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
23	SW.	20	12	5	3	Dug	45	2,340	- 40	2,300	40	2,300	Glacial quick-sand	Hard, iron, clear, red sediment	45	D, S	Sufficient supply; yields 10 barrels a day; a 35-foot well with good supply.
24	NE.	20	"	"	"	Dug	19	2,330	- 8	2,322	8	2,322	Glacial sand	Hard, clear	42	S	Insufficient supply.
25	SE.	22	"	"	"	Bored	40	2,320	- 36	2,284	36	2,284	Glacial quick-sand	Hard, clear	45	D, S	Yields 2 barrels a day; another 36-foot well similar.
26	W.½	22	"	"	"	Dug	35	2,300	- 5	2,295	5	2,295	Glacial clay and sand	Hard, cloudy, brown colour, "alkaline"	46	S	Insufficient supply; a 30-foot well with a fair supply.
27	SW.	23	"	"	"	Bored	60	2,290	- 48	2,242	48	2,242	Glacial drift	Hard, clear, iron	44	D, S	
28	NW.	23	"	"	"	Bored	80	2,240	- 30	2,210	80	2,160	Glacial sand	Hard, sulphur, dark colour	44	S	Sufficient supply; neighbours used to water stock from this well.
29	SW.	24	"	"	"	Bored	60	2,280	- 20	2,260	33	2,247	Glacial quick-sand	Hard, iron, "alkaline" red sediment	45	D, S	Sufficient yield of 4 to 5 barrels a day; laxative; a 50-foot well good supply of "alkaline" water for stock; two dry holes.
30	NE.	26	"	"	"	Dug	20	2,235	- 12	2,223	20	2,215	Glacial sand	Hard, clear		D, S	Sufficient supply.
31	SW.	29	"	"	"	Dug	40	2,300	- 36	2,264	36	2,264	Glacial quick-sand	Hard, clear, "alkaline", good	43	D, S	Sufficient yield of 10 barrels a day.
32	SE.	30	"	"	"		35	2,340					Glacial drift			D	Only sufficient for house; use coulée for watering stock; 40-foot dry hole.
33	SW.	30	"	"	"	Dug	24	2,340	- 22	2,318	22	2,318	Glacial quick-sand	Soft, clear	42	D, S	Just sufficient for 9 head stock.
34	SW.	34	"	"	"	Dug	38	2,240	- 26	2,214	26	2,214	Glacial blue sand	Hard, iron, "alkaline", brown sediment	42	D, S	Insufficient supply; very poor quality.
35	SE.	36	"	"	"	Bored	95	2,240	- 50	2,190	95	2,145	Glacial drift	Hard, clear, "alkaline"		S	Sufficient supply.
36	SW.	36	"	"	"	Bored	80	2,240	- 10	2,230			Glacial silt	Hard, iron, "alkaline" clear	43	S	Sufficient supply.
1	SE.	1	12	6	3	Dug	35	2,350	- 27	2,323	27	2,323	Glacial sand	Hard, clear, "alkaline"	45	D, S	Sufficient for 15 head stock.
2	SE.	2	"	"	"	Dug	28	2,360	- 24	2,336	24	2,336	Glacial sand	Hard, iron, "alkaline", cloudy, yell-	44	S	Intermittent supply; laxative on humans; a 12-foot well for house purposes.
3	E.½	3	"	"	"	Dug	40	2,375	- 35	2,340	35	2,340	Glacial sandy clay	Hard, clear	43	D, S	Insufficient supply with several similar wells; also use dugouts.
4	SE.	4	"	"	"	Dug	24	2,345	- 16	2,329	16	2,329	Glacial quick-sand	Hard, clear	43	D, S	Sufficient supply; one other seepage well with "alkaline" water.
5	SW.	6	"	"	"	Dug	15	2,350	- 8	2,342	8	2,342	Glacial muddy sand	Hard, clear	42	D, S	Sufficient supply.
6	SE.	7	"	"	"	Dug	14	2,350	- 10	2,340	10	2,340	Glacial sand	Hard, clear		D, S	Insufficient supply.
7	NW.	9	"	"	"	Dug	35	2,330	- 32	2,298	32	2,298	Glacial quick-sand	Hard, clear	42	D, S	Sufficient supply.
8	NE.	9	"	"	"	Dug	35	2,340	- 32	2,308	32	2,308	Glacial quick-sand	Hard, clear	43	D, S	Intermittent supply; well goes dry during dry seasons.
9	SE.	10	"	"	"	Dug	8	2,340	0	2,340	8	2,332	Glacial quick-sand	Hard, clear	43	D	Excellent supply.

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

WELL RECORDS—Rural Municipality of GRAVELBOURG, NO. 104, 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
10	SE.	13	12	6	3	Dug	35	2,330	- 18	2,312	18	2,312	Glacial quick-sand	Hard, clear, iron	43	D, S	Sufficient supply.
11	SE.	14	"	"	"	Spring		2,330					Glacial quick-sand	Hard, clear		D, S	Spring flows out of bank of creek; good supply.
12	SW.	14	"	"	"	Bored	48	2,340	- 35	2,305	35	2,305	Glacial sand and clay	Hard, clear	42	D, S	Sufficient supply.
13	NW.	15	"	"	"	Dug	40	2,355	- 30	2,325	30	2,325	Glacial sandy clay	Hard, clear	42	D, S	Sufficient supply.
14	S.½	16	"	"	"	Dug	16	2,325	- 12	2,313	12	2,313	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient for 18 head stock.
15	SE.	17	"	"	"	Dug	24	2,350	- 12	2,338	12	2,338	Glacial sand seam	Hard, clear, "alkaline"	42	D, S	Sufficient supply; had another well with water unfit for use.
16	SE.	18	"	"	"	Dug	20	2,350	- 15	2,335	15	2,335	Glacial sandy clay	Hard, cloudy, "alkaline"	48	S	Insufficient supply; water cannot be used; laxative; #.
17	NW.	18	"	"	"	Dug	20	2,350	- 18	2,332	18	2,332	Glacial quick-sand	Soft, clear		D, S	Sufficient supply.
18	NE.	19	"	"	"	Bored	35	2,360	- 10	2,350	10	2,350	Glacial sand	Medium hard, clear	45	D, S	Sufficient for 13 head stock.
19	NE.	21	"	"	"	Dug	40	2,350	- 37	2,313	37	2,313	Glacial sandy clay	Hard, clear	43	D, S	Sufficient supply.
20	SW.	24	"	"	"	Dug	40	2,360	- 37	2,323	37	2,323	Glacial quick-sand	Hard, clear	45	D, S	Sufficient for 16 head stock.
21	NW.	24	"	"	"	Dug	35	2,350	- 28	2,322	28	2,322	Glacial sandy clay	Hard, clear	43	D, S	Excellent supply.
22	SW.	25	"	"	"	Dug	30	2,320	- 26	2,294	26	2,294	Glacial sand	Hard, clear	45	D, S	Sufficient for 20 head stock.
23	SE.	26	"	"	"	Dug	17	2,310					Glacial sand	Hard, clear, "alkaline"	45	D, S	Sufficient supply; 12-foot well with aquifer in sand.
24	SE.	27	"	"	"	Dug	45	2,350	- 38	2,312	38	2,312	Glacial sandy clay	Hard, clear		D, S	Sufficient supply.
25	NW.	31	"	"	"	Dug	22	2,350	- 17	2,333	17	2,333	Glacial sand and gravel	Hard, clear	42	D, S	Excellent supply; another 8-foot well can water 100 head stock.
26	SE.	35	"	"	"	Dug	10	2,250	- 5	2,245	5	2,245	Glacial sand	Hard, clear	44	D, S	Sufficient supply.
27	NE.	35	"	"	"	Dug	12	2,250	- 8	2,242	8	2,242	Glacial sand	Hard, clear	44	D, S	Sufficient supply.

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.