CANADA

DEPARTMENT OF MINES

AND

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WATER SUPPLY PAPER No. 127

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF SHAMROCK NO. 134

SASKATCHEWAN

By

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

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INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

Continental Ice-sheet. The great ice-sheet that covered most of the surface of Canada many thousands of years 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 rests upon the Ravenscrag or older formations. The formation is 30 to 125 feet thick.

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

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

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

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

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 Shamrock covers an area of approximately 300 square miles in the central part of southern Saskatchewan. It embraces seven full townships and parts of two others described as tps. 13 and 14, ranges 4, 5, and 6; those parts of tp. 15, ranges 4 and 5, lying to the southwest of Chaplin Creek valley, and tp. 15, range 6, all W. 3rd mer. The village of Shamrock, situated near the centre of the municipality, lies approximately 48 miles west and 15 miles south of Moose Jaw. The Coderre branch of the Canadian Pacific railway extends in a general east-west direction across the central part of the township and on it are located the stations of Koplay, Trewdale, and the village of Shamrock.

The northeastern edge of the municipality is a marshy lowland lying at an approximate elevation of 2,000 feet above sea-level. The ground surface rises gradually southwest over an irregularly rolling area that extends as a belt 8 to 10 miles wide in a northwest-southeast direction across the municipality. Elevations vary irregularly throughout this area and beyond it they gradually increase to culminate in elevations of over 2,400 feet on the tops of a range of hills that extends from the central part of the southern boundary to the northwest corner of the municipality. From these hills the land falls away gradually toward the southwest corner to elevations not greatly exceeding 2,250 feet in the broad valley of Wiwa creek and to even lower levels in the more deeply eroded valley of Wood river in the southeast corner of the municipality.

Wood river drains the southeast corner, and the intermittently flowing Wiwa creek drains the southwestern lowlands. The drainage of the northeastern lowlands is not well developed, although in periods of ample precipitation surface water that collects in the flats forms the headwaters of Chaplin creek which flows southeast and joins Wood river in the municipality adjoining on the east. No well-established drainage exists in the rolling uplands, but many sloughs and small lakes occur in undrained depressions intervening between the low hills and ranges.

Wood river contains water throughout all but the driest years and provides a pasture supply of water for stock of nearby residents. Wiwa creek is a small, intermittently flowing stream that provides water for stock only during the wet seasons of the year. Small ponds, sloughs, dugouts, and dams constructed across creeks and coulées are used in many places in the municipality to furnish stock water supplies to supplement those available from springs and wells. Springs occur in this area, generally in depressions in the rolling areas. They are caused by surface water percolating down through the porous material in the hills, collecting on the top of more impervious beds and following along them to issue at the surface as seepage springs.

The wells of the municipality obtain water from the Recent stream deposits, from glacial lake clays, from till and moraine that mantle the greater part of the area, and in one small area from the underlying Bearpaw bedrock formation. The generally unproductive character of the bedrock throughout the area and the glacial lake clays have confined the search for ground water to the Recent and glacial drift in most places.

Throughout most areas in this municipality, adequate supplies of water are obtained from wells. In places, however, where shallow wells depending upon the local precipitation for their supply are used, the dry years since 1928 have resulted in shortages of water supply. It has been necessary in such places to excavate dugouts or construct dams across small coulées to conserve surface water for watering stock. Shallow wells dug beside these constructed reservoirs provide drinking water on some farms.

Water-bearing Horizons in the Unconsolidated Deposits

Recent deposits consisting of sands, silts, and gravels are deposited in thicknesses rarely exceeding 10 to 20 feet along the bottoms of the stream valleys. Shallow wells sunk in these deposits obtain in places, by seepage, small supplies of water of good quality that are adequate for household purposes and possibly for the needs of a few head of stock. Recent sands and silts have been washed down into the bottom of some depressions in the uplands of townships 13 and 14, range 6. These deposits collect surface water and in some places yield adequate household and stock supplies. Water from these shallow sources is easily contaminated and, when being used for a household supply, care should be exercised to keep the catchment area free from sewage, and decaying organic materials.

Five distinct types of glacial deposits are found in the area, namely till, moraine, glacial lake clays, glacial lake sands, and glacial outwash sands and gravels. These deposits were laid down by a great continental ice-sheet that many thousands of years ago passed over the province of Saskatchewan and by the waters that were formed from the melting ice. The areal distribution of each of the different types of deposit is shown on the map (Figure 1) accompanying this report.

As the ice-sheet advanced and retreated it deposited over the land surface a layer of drift consisting largely of bluish grey boulder clay or till. In places where the drift has a flat or generally rolling surface it is referred to as till plain. Such an area occurs in a narrow belt that extends from the centre of the southern border of township 13, range 5, to beyond the northeastern corner of township 14, range 6. Over the greater part of this municipality the retreating ice front is believed to have remained stationary for considerable periods of time. Consequently much greater thicknesses of drift accumulated, forming a moraine. The ground surface of the moraine-covered area is irregularly rolling and characterized by many low knolls, hills, gravel ridges, and intervening undrained depressions.

Pockets and occasionally beds of well-sorted sands and gravels are scattered irregularly through the boulder clay of the till and of the moraine and form the only sources of water supply in these deposits. These porous beds have been found at four horizons, namely: as pockets occurring at shallow depths in the boulder clay; pockets irregularly scattered through the lower part of the boulder clay; more or less extensive interglacial deposits of sand and silt that lie near the base of the drift in certain areas; and beds or pockets lying at the contact of the boulder clay and the underlying shales of the Bearpaw formation. Most residents in the till or moraine-covered areas obtain water supplies from the shallow pockets that lie within 40 feet of the surface. Many supplies from such pockets are adequate for 10 to 15 head of stock, but as these pockets depend on the local precipitation for their replenishment during dry seasons a shortage of water for stock is experienced in many places. The water from the pockets is generally not highly mineralized and is suitable for household use. Shallow wells are best located in depressions near the base of steep slopes, or on or near low gravel ridges.

The deeper pockets in the boulder clay, at depths of 40 to 100 feet, generally yield more stable supplies as they are not so seriously affected by drought conditions. The amount of mineral salts in water from pockets in the boulder clay is generally found to increase with the depth of the pocket from the surface and it is also found that in some places water from the deeper pockets contains too great an amount of mineral salts in solution to be suitable for household use.

Pockets lying at the contact between the boulder clay and the underlying Bearpaw occur fairly continuously in townships 13, 14, and 15, range 6. Several wells ranging in depth from 60 to 115 feet are sunk to tap these beds in this area and generally obtain adequate stock supplies. The water from several of the wells, however, is highly mineralized and unsuitable for household use.

The beds of interglacial material that are struck by many wells in the area enclosed by the "A" line on the map and in isolated areas in the northern parts of township 15, ranges 5 and 6, are of a similar origin to other interglacial beds encountered in the adjacent municipalities lying to the east, south, and southeast. The beds lie between 60 and 137 feet below the surface and consist of fine grey sands and silts, which generally overlie gravels. Fossil shells, pieces of coal, and branches and twigs of plants are found commonly in the silts. When wet, the silt has the plasticity of clay, and is known generally throughout the district as "sea-mud". 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 probably lapsed between the successive advances, and during such times warmer climatic conditions were favourable for the formation of swamps and lakes in the lowlands upon the first till. The later advance of the ice buried these deposits beneath a layer of boulder clay. The variation in elevation at which the beds are encountered and their mode of occurrence would suggest that the beds have an isolated occurrence rather than that they form a continuous bed over an extensive area. The beds are porous and, in places, yield fairly large supplies of water of good quality. The areal distribution and water supplies obtainable from these beds are further discussed in the section of the report dealing with the individual townships.

During the last stages of glaciation in this area, streams issuing from the melting ice-sheet deposited, in certain places, beds of glacial outwash sands and gravels. Within this municipality these glacial outwash deposits are confined to a small area in the central part of township 14, range 4. Due to their porosity these deposits generally form excellent reservoirs for ground water accumulation, and a few shallow wells obtain from them fairly large supplies of hard, drinkable water. In some places, however, the deposits are thin and correspondingly less productive. It is possible that larger water supplies could be obtained by sinking deeper wells to tap water-bearing pockets in the underlying boulder clay, but it is advisable to thoroughly prospect the shallow deposits before resorting to deeper drilling.

When the continental ice-sheet retreated from this region, water resulting from the melting ice formed large large lakes. One of these lakes extended over the northeastern corner of the municipality. Another that centred about the village of Bateman extended over the southwestern corner of this area. The areal extent of these glacial lakes is indicated by the sediments that were washed into the lake to form deposits covering the bottoms. The sediments in the northeast corner are for the most part of glacial lake sands, but those in the southeast corner consist of compact, light, bluish grey lake clays.

The glacial lake sands in the northeast corner range irregularly in thickness from 1 or 2 feet to about 25 feet. Wells sunk in the sands in many places obtain adequate household and stock supplies. The supply of water in the sands, however, is dependant upon the local precipitation and during dry seasons shortages are apt to be experienced. Some residents in the lake sand-covered areas have sunk wells to tap water-bearing pockets in the underlying boulder clay. These wells, generally less than 40 feet deep, obtain slightly better supplies than those sunk in the lake sands.

The glacial lake clays covering the southwest corner of the municipality are largely impervious and are a source of only small seepage supplies of water. The clays probably nowhere exceed 20 feet in thickness, and in many places water-bearing sand and gravel pockets intervene between the lake clays and the underlying boulder clay. A few wells in this area obtain from such pockets supplies of water of good quality and adequate for household and stock needs, but most wells in the lake clay-covered areas are sunk to tap water-bearing pockets thatlie either in the boulder clay, at the contact of the boulder clay and underlying Bearpaw shales, or in the shale bedrock itself. These wells, 40 to 150 feet deep, generally obtain adequate supplies of water for local stock-watering requirements. The water from some of the wells, however, is highly mineralized and not suitable for household use.

In general, shallow wells, in the glacial deposits, yield satisfactory water for domestic requirements, but since these wells cannot be depended upon as sources of the large supplies, necessary to water stock, residents are obliged to sink wells to the lower horizons in the drift.

Water-bearing Horizons in the Bedrock

The glacial drift throughout the entire municipality is underlain by the Bearpaw formation. This formation consists almost entirely of dark grey to black, compact marine shales. These shales may be differentiated from the overlying boulder clay by their more soapy feel, their darker colour, the absence in them of boulders, stones, or pebbles, and by the small, roughly cubical fragments into which they crumble when dry. The Bearpaw shales are generally too compact and impervious to form reservoirs for any large supplies of water and such supplies as they do contain are usually too highly mineralized to be used for any farm requirement.

Wells located on the SW. $\frac{1}{4}$, sec. 4, and on sec. 6, tp. 14, range 6, are believed to obtain water from what are probably thin layers of sands interbedded in the shales of the Bearpaw formation. The water from the wells on section 6 is reported as being soft, but no information is available regarding its suitability for household or stock purposes. The water probably contains a considerable amount of sodium sulphate in solution, and is possibly unsuitable at least for the household. The water from the wells on the SW. $\frac{1}{4}$, section 4, can not be used even for stock. The poor quality of these waters and the fact that wells sunk into the shales elsewhere in the area were dry, make it inadvisable for residents to sink wells below the base of the glacial drift in any part of the municipality. Careful prospecting of the drift, it is believed, would locate water-bearing beds almost anywhere in the municipality.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 13, Range 4

Wood river flows through the southern section of the township. It provides a pasture supply of water for stock on nearby farms and many of the residents in the western part who control sections where the well supplies are poor have their stock watered from it. The wells of the township are sunk into the Recent deposits along the river bed and into the moraine that covers all of the remaining area. Dugouts are used in some places to supplement stock supplies available from wells. The many draws and coulées in the township provide good sites for dams and for the storage of surface water. Larger dams could be located across Wood river.

The Recent deposits along the river bed consist of sands, silts, and occasional beds of gravel. Wells, 4 to 10 feet deep, tap the gravel beds and obtain small supplies of water of good quality that are usually adequate for household needs.

The moraine consists, in general, of a few feet of top soil; 20 to 40 feet of yellowish brown boulder clay; and 10 to 100 feet of more compact, blue-grey boulder clay. Sand and gravel pockets occur scattered through the boulder clays, most commonly in the upper 40 feet, but in some places at depths between 65 and 100 feet from the surface. These pockets form the only source of water in the moraine. The pockets are fairly widespread, and no difficulty has been experienced in locating them in the northern and northeastern sections. In these parts, wells less than 40 feet deep generally obtain adequate household and stock supplies. In the west-central sections the pockets are more sparing in their occurrence and many wells in this area have penetrated only boulder clay and did not yield water. Residents in this area are advised to confine prospecting for water to the upper 40 feet of glacial drift as it is not believed that supplies are available at depth. The prospecting should be directed to cover thoroughly as extensive an area as possible.

Most wells in the area lying to the southeast of the "A" line, as indicated on Figure 1 of the accompanying map, obtain water supplies from beds of interglacial "sea-mud" described in an earlier section of the report. The wells, ranging from 80 to 147 feet in depth, reach the beds at elevations of 2,180 to 2,130 feet above sea-level, and most of them obtain adequate supplies of water for local stock requirements. The waters are hard, and slightly "alkaline", but with the exception of the supplies from the wells on the SW. $\frac{1}{4}$, section 22, and the SE. $\frac{1}{4}$, section 14, they are used in the household without apparent ill effects. Elsewhere in the area bounded by the "A" lines it is believed that wells less than 150 feet deep would obtain supplies adequate for stock. These interglacial beds of "sea-mud" are encountered at higher elevations in wells located on the SW. $\frac{1}{4}$, and the NE. $\frac{1}{4}$, section 19. The wells on the SW. $\frac{1}{4}$ are dry and the well on the NE. $\frac{1}{4}$ obtains only a small supply of highly mineralized water. Further drilling to tap these beds, which were encountered at 100 feet below the surface on the NE. $\frac{1}{4}$, section 19, is not recommended in this area. It is improbable that such beds will be found to be more productive in the northwest corner where much deeper drilling would be necessary to reach this horizon.

The glacial deposits throughout the township are underlain by the compact and unproductive shales of the Bearpaw formation. Drilling below the glacial drift is, therefore, not believed advisable in any part of this area.

Township 13, Range 5

Wells in this township obtain water from the glacial deposits that mantle the entire area. Sloughs and marshes occurring in many of the undrained depressions in the northern sections of the township provide pasture supplies of water for the stock of some residents. The draws and coulées in the township are suitable sites for dams to conserve surface water. Moraine covers the greater part of the township, but grades into a less rolling till plain that forms a narrow belt extending from section 3 to section 18. In the southwestern corner of the township the till is overlain by a deposit of lake clays. The thickness of the moraine over the northern uplands has not been determined. Wells sunk in sections 1 and 18 reached the bedrock at depths of 120 and 98 feet, respectively, and it is probable that the moraine has a thickness of 75 to 150 feet over the greater part of the southern half of the area.

The glacial lake clays covering the flats of the southwest corner probably do not exceed a thickness of 10 to 20 feet. They are impervious and not a source of water supplies. However, sand and gravel pockets occur discontinuously in the drift under the lake clays and are water bearing. Two wells, 20 and 11 feet deep, located on the SW. $\frac{1}{4}$, section 4, and the SE. $\frac{1}{4}$, section 5, respectively, obtain adequate household and stock supplies from such beds. The only other well known to be sunk in the lake clay-covered area evidently failed to obtain an adequate supply at this horizon as it was sunk 130 feet to tap a bed of "sea-mud" at the base of the drift. It yields a supply of hard, "alkaline" water that is adequate for stock use but not suitable for household purposes.

The till and moraine consist of boulder clay that is yellowish brown in the weathered, upper 20 or 30 feet and bluish grey at depth. Sand and gravel pockets interspersed through the boulder clay form the only water-bearing beds. Most wells in the township obtain water from such pockets lying within 40 feet of the surface. Supplies vary considerably with the local rainfall, but in wet years are generally adequate for stock requirements. The water is generally hard but not highly mineralized and is suitable for household use. The most favourable sites for shallow wells in the northern sections of the township are in depressions or beside sloughs or marshes.

Wells, 50 to 110 feet deep, located in the central and northeastern sections of the township, obtain more constant supplies from deeply lying sand and gravel pockets in the boulder clay. The supplies in most places are adequate for stock requirements, but from many of the wells the water is highly mineralized and not suitable for household use.

Wells, located on the SW. $\frac{1}{4}$, section 7, the NW. $\frac{1}{4}$, section 10, the NW. $\frac{1}{4}$, section 17, and the SE. $\frac{1}{4}$, section 20, within the area enclosed by the "A" line on the map, obtain supplies from beds of interglacial "sea-mud" that occur at elevations varying widely between 2,320 and 2,160 feet above sea-level. The supply from the well on the SW. $\frac{1}{4}$, section 7, has already been discussed. The other wells obtain supplies of hard water of good quality that are adequate for household and stock needs. It is probable that elsewhere in the area enclosed by the "A" lines, wells less than 130 feet deep would obtain adequate supplies of water. A 120-foot well on the NE. $\frac{1}{4}$, section 1, and a 60-foot well on the NE. $\frac{1}{4}$, section 12, struck dry beds of "sea-mud" at their bases. Drilling to these depths in this area consequently seems less advisable, and here as elsewhere outside of the area bounded by the "A" lines prospecting for water is best confined to the upper 40 feet of the drift.

The glacial drift is underlain by impervious and unproductive shales of the Bearpaw bedrock formation. It is possible that the large supply of highly mineralized water derived from the 130-foot well on section 7 may, in part, come from the upper few feet of the shale. A 120-foot well penetrated the shale in section 1, but failed to obtain any water, and it is possible that the 98-foot dry hole on section 18 has penetrated at least a few feet of the shale. Highly mineralized water, which may be suitable for watering stock, undoubtedly occurs in some places at the contact of the boulder clay and the shales. Sinking wells into the shales, however, in any part of the township, cannot be expected to yield water that will be satisfactory for any farm requirement.

Township 13, Range 6

Wiwa creek, a small, intermittent, flowing stream, crosses the southern sections of the township and provides a pasture supply of water for stock of nearby residents during the spring and early summer. Wells in the township obtain water from Recent deposits, from porous pockets in the glacial deposits, and from thin beds of sands or gravels that lie at the contact of the glacial drift and the bedrock.

Recent deposits consisting of sands and silts occur in thicknesses nowhere exceeding 25 feet along the flood-plain of Wiwa creek and in the bottoms of some of the valleys in the northern sections. Wells, located on the NE. ¼, section 4, the SE. ¼, section 7, and the NW. ¼, section 24, 22, 14, and 18 feet deep, respectively, obtain adequate supplies for 12 to 25 head of stock from sand beds in the deposits. The water from the wells on sections 17 and 24 is soft, but from the well on section 4 it is hard and slightly "alkaline". In all cases, however, it is suitable for household use.

The glacial lake clays mantle the flats area extending over slightly more than the southwestern half of the township; moraine covers the northeastern corner of the township; and till covers a narrow belt lying between the flats of the lake clays and the rolling lands of moraine. The areal distribution of each type is shown on the accompanying map (Figure 1). The thickness of the drift is, for the most part, unknown. It is possible that the 100-foot dry hole on section 10 has penetrated the shale, but definite evidence is lacking. From data obtained from wells in adjoining townships it would seem that the thickness ranges from 85 to 150 feet in the eastern sections, and from 50 to 80 feet in the western sections, of the township.

The glacial lake clays in the flats have a probable thickness of 15 to 40 feet and overlie boulder clay that extends down to bedrock. Little water is obtainable from the compact, almost impervious lake clays. Two wells, however, 30 and 20 feet deep, located on the NW. $\frac{1}{4}$, section 21, and the SE. $\frac{1}{4}$, section 30, respectively, are reported to obtain from the clay supplies of hard, slightly "alkaline" water that are, on each farm, adequate for the household requirements and the needs of as many as 25 head of stock. It is more probable, however, that these wells have penetrated thin beds of sand either in the clays or at the contact of the lake clay with the underlying boulder clay. Throughout this area, however, the porous beds at the contact seem to be sparing in their occurrence. Wells, 20, 15, and 40 feet deep, located on the SE. $\frac{1}{4}$, section 2, the SW. $\frac{1}{4}$, section 10, and the SW. $\frac{1}{4}$, section 19, obtain water from such pockets. Only the supplies from the wells on sections 2 and 10 are adequate for local stock needs. The yield from the well on section 19 is insufficient for 20 head. The waters, except from the well on section 10, are suitable for household use. Other wells in the lake clay area have failed to obtain water from this horizon and it was found necessary to extend the wells down to the contact between the drift and the underlying bedrock.

The moraine and till consist largely of boulder clay through which are scattered water-bearing pockets of sand and gravel.

Wells less than 60 feet deep, located in the northern sections of the township, obtain supplies that are usually adequate for 10 to 15 head of stock, by seepage from the clay or from small sand and gravel pockets. The waters are hard and slightly "alkaline". With one exception, the 35-foot well on the SW. $\frac{1}{4}$, section 34, the waters obtained are suitable for household use.

Water-bearing beds appear to lie fairly continuous throughout the township at the contact of the drift and underlying bedrock, and wells 52 to 150 feet deep, sunk to tap them, obtain stock water supplies that are usually adequate. The waters are hard and quite highly mineralized. Only two wells, namely the 85-foot well on the SW. $\frac{1}{4}$, section 23, and the 45-foot well on the SW. $\frac{1}{4}$, section 26, yield water that is unfit for household use. All other wells, to this lower horizon, yield water that may be used by persons accustomed to the more highly mineralized type of water. Residents can be fairly certain of obtaining supplies from these contact beds anywhere in the township. The depth to the contact will vary from place to place. In general, however, this depth should not exceed 150 feet in the southeast corner, 115 feet in the northeast corner, about 60 in the northwest corner, or 80 feet in the west-central sections. Drilling or boring greatly below these depths will enter the compact shales of the Bearpaw formation which are not considered a source of water suitable for farm requirements.

Township 14, Range 4

The ground water supplies of the township are obtained entirely from the unconsolidated deposits. The yield from wells is not adequate in many places and some residents have excavated dugouts for conserving further supplies for watering stock. In a few places, in the rolling southern uplands, springs occur at the bases of hills and in the depressions, and provide drinking water for the household or for a few head of stock. Small dams located in couléos could also be used to advantage on farms with large herds of stock.

Boulder clay overlies the bedrock throughout the area, forming an irregularly rolling area of moraine over the southern half and along the western and eastern boundaries of the township. In a small area covering parts of sections 10, 11, 14, and 15, the moraine is overlain by a layer of glacial outwash sands and gravels. The remaining lowlands of the northern part of the township are overlain by glacial lake sands and sandy clays. The areal distribution of each type of deposit is indicated on Figure 1 of the accompanying map.

Glacial outwash sands and gravels are generally excellent sources of water supply. In this township, however, they are thin, which permits the rainfall caught to be quickly evaporated, so that the wells sunk in these deposits do not generally obtain adequate supplies throughout the year. However, a well 20 feet deep, located in the NW. ¼, section 10, obtains from these deposits the year round supplies of hard water of good quality that are adequate for household and stock needs.

The glacial lake sands occurring over the northern flats vary in thickness from 1 or 2 feet at the southern margin to over 20 feet along the northern boundary. Several shallow wells, sunk into the sands, obtain supplies of hard water of good quality that are adequate for household and stock needs. In places, however, the sands are too thin to form reservoirs for any large supplies of water and wells have been sunk through the sands into the underlying boulder clay. Some of these wells have encountered satisfactory supplies at depths, in porous sand beds, within 50 feet of the surface. At other locations these deeper wells have failed to yield more than small seepages of water. It seems better to confine prospecting to the upper sands within 20 or 25 feet of the surface rather than to extend wells into the sparingly productive underlying clays.

The moraine consists mainly of boulder clay through which are scattered sand and gravel pockets. Small water supplies are obtained by seepage from the clay in some places, but the sand and gravel pockets provide the larger well supplies in this area. The pockets within 45 feet of the surface depend upon the local rainfall for their supplies and the yields from them decrease considerably during dry seasons. Most wells in the moraine-covered area, therefore, have been sunk to tap deeper pockets lying between 50 and 110 feet below the surface. From these they obtain supplies of hard water of good quality that are generally adequate for household and stock purposes. Holes were sunk to depths up to 100 feet on the SE. ¼, section 1, and the SW. ¼, section 10, without encountering productive pockets, but it is believed that in the greater part of the moraine-covered area prospecting carried out over as wide an area as possible would discover pockets yielding adequate supplies within this depth.

The glacial drift is underlain throughout the township by the compact shales of the Bearpaw formation. Although no definite evidence is available it is possible that some of the deeper dry holes that have reported compact dark clay at the base have penetrated the Bearpaw formation. The shales are to be expected at depths not greatly exceeding 100 feet in any part of the area. The shales are not considered a source of water and drilling into them in any place in this township is not advisable.

Township 14, Range 5

Sloughs in depressions are the only sources of surface water in the township. In some places they provide pasture supplies for stock during the spring and early summer. All the wells in this township derive their water from the glacial drift. Springs drawing supplies from glacial aquifers occur on the SW. ¼, section 4, and the SE. ¼, section 23, and yield large supplies for stock throughout the year. Dugouts, and in at least one place dams constructed across coulées, conserve surface water and provide additional supplies for stock.

The glacial drift consists of moraine, which covers all but the extreme northeast corner of the township. In the northern part of section 36 the boulder clay is overlain by at least 12 feet of lake sands.

Only one well, so far as is known, has been sunk in the glacial lake sands. This well on the NE. $\frac{1}{4}$, section 36, is 12 feet deep and obtains a supply of hard water of good quality that is adequate for household as well as local stock needs.

The moraine consists of a thickness of 100 feet or more of boulder clay containing scattered pockets of sands and gravels, but only some of the deeper porous beds appear to form continuous beds over any large areas. The boulder clay itself yields only small seepages, but the pockets of sand and gravel yield fairly large supplies of water. Shallow pockets, however, are dependant upon the local precipitation for their supply, and consequently yields from them decrease considerably during dry seasons. Most of the wells in this township tap such pockets within 30 feet of the surface, and generally additional water must be obtained from some other source to maintain an adequate stock supply. The water from shallow pockets is, in most places, not highly mineralized, and is suitable for household use. As a rule the best sites for shallow wells are in depressions and residents prospecting for water are advised to test such locations first.

Wells located on the SE. $\frac{1}{4}$, section 3, the SW. $\frac{1}{4}$, section 4, the S. $\frac{1}{2}$, section 11, the NW. $\frac{1}{4}$, section 19, the NE. $\frac{1}{4}$, section 26, and the N. $\frac{1}{2}$, section 30, tap deeper sand and gravel pockets in the boulder clay. These wells, ranging between 60 and 100 feet deep, generally obtain adequate stock supplies. The supply from the well on the NE. $\frac{1}{4}$, section 26, was lost when the thick sand bed encountered at the bottom of the well caved in. The water is invariably hard and fairly highly mineralized, but only from the wells on sections 4 and 30 is it considered to be too "alkaline" for domestic use.

Water-bearing pockets appear to have a fairly widespread occurrence in this township at depths between 60 and 100 feet, and it is probable that wells sunk to these depths would obtain water in most parts of the area. Residents are perhaps better advised to rely on shallow wells and dugouts for their water supplies, as large supplies of drinkable water cannot always be found at depth.

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

Township 14, Range 6

Wells in this township obtain water from Recent deposits, glacial deposits, and water-bearing beds in the underlying Bearpaw bedrock formation. A spring flowing from a porous bed in the glacial drift on the NW. $\frac{1}{4}$, section 28, provides a pasture supply of water for stock in the vicinity. Sloughs in depressions, dams across coulées, and dugouts supplement in many places the stock supplies available from wells.

Recent deposits consisting of sands and silts have been washed down from the hill-sides into the bottoms of some of the valleys in the eastern half of the township. The deposits act as reservoirs for surface water from the hill-sides and in places where sufficiently thick they are possible sources of small supplies of water that is usually drinkable. A 10-foot well, located in a depression on the NW. $\frac{1}{4}$, section 24, obtains from a Recent sand bed a supply of soft water of good quality that is adequate for household purposes and the needs of 6 head of stock. It is possible that similar supplies of water could be obtained from shallow wells sunk in the bottoms of depressions elsewhere in this area.

Three types of glacial deposits, namely lake clays, moraine, and till, are found covering different parts of this township, the areal distribution of each type being shown on the accompanying map (Figure 1).

The impervious, bluish grey lake clays cover sections 6 and 7 and parts of 18 and 19 to depths ranging from 20 to 40 feet. A 25-foot well located on the SW. ¼, section 6, obtains a small seepage supply of water from the clay and it is believed that supplies obtained from the clay in other places in this area will be similarly inadequate. Sand and gravel pockets, however, capable of yielding better supplies, probably occur in scattered places at the contact of the lake clays and the underlying shales of the bedrock. Wells tapping such pockets would probably yield supplies of water of good quality adequate for household purposes and the needs of 10 to 15 head of stock. Most wells located in the lake clay-covered area are sunk to tap water-bearing horizons that are believed to lie in the upper part of the Bearpaw bedrock formation.

The till probably is not much more than 50 or 60 feet thick, but findings in the 136-foot Canadian Pacific Railway well at Koplay, and in other wells on the uplands exceeding 60 feet in depth, would suggest that the moraine has a thickness of 70 to 140 feet over the uplands. The boulder clay of which these deposits are largely composed is productive of small seepages of water that provide household supplies in some places in the area, but the larger well supplies are obtained either from the sand and gravel pockets in the boulder clay, or from porous pockets that lie at the contact of the boulder clay and the underlying bedrock. Wells tapping pockets in the boulder clay range in depth from 18 to 68 feet and obtain stock supplies that are usually adequate. The water is hard and fairly highly mineralized, but in most places it is used in the household without apparent harmful effects. Wells tapping porous pockets lying at the contact of the boulder clay and the bedrock are located on sections 2, 10, 19, 21, 20, and 31 and range in depth from 40 to 136 feet. Supplies from most of the wells are adequate for stock needs, but the water is hard and highly charged with dissolved sulphate salts and is generally unsuitable for household use. Holes have been sunk in the glacial drift without obtaining water, but it is believed that thorough prospecting over as wide areas as possible would probably locate adequately productive pockets.

Prospecting should be limited to depths of 40 to 80 feet in the northwest corner, but water is obtained at depths as great as 136 feet in the southeast corner.

The glacial drift is underlain by the Bearpaw bedrock formation. This formation is made up largely of bluish grey, compact shales that are generally not considered to be a source of good water. Wells located on the SW. ¼, section 4, and section 6, however, obtain water from sandy places in the shale. The water from the well on section 4 is reported as being hard, "alkaline" and unfit for either household or stock use. The wells on section 6 obtain soft water and although no information is available as to its character it possibly contains a large amount of sodium sulphate in solution and is possibly not of particularly good quality even for watering stock. The waters are typical of those from the Bearpaw formation in surrounding districts, and as it is improbable that water of better quality will be found by deeper drilling, residents in this township are advised to confine prospecting for water to the glacial drift.

Township 15, Range 4

Only the southern and southwestern sections of this township lie within the rural municipality of Shamrock. The great part of this area is flat lowlands that are marshy in years of normal precipitation. Such land has not been considered suitable for farming and more remote from the marshes soil drifting has lead to the abandonment of all but one or two of the few farms of the area.

Sands of glacial lake origin underlie the top soil to a depth of about 10 feet or more over the entire area. These sands are in turn underlain by at least 40 or 50 feet of boulder clay. The only recorded well in the area, 8 feet deep, located on the SE. $\frac{1}{4}$, section 5, obtains from the lake sands a small supply of water of good quality that is adequate for household use. A dugout is used to supply stock water on this farm. It is reported that wells less than 15 feet deep could obtain good supplies in the northern part of the area that borders the bed of lake Chaplin.

The Bearpaw formation underlies the boulder clay, and residents seeking water supplies in this township are advised to rely on the supplies available from lake sands, as both the glacial boulder clay and the shales of this formation are probably only sparingly productive.

Township 15, Range 5

All of township 15 except section 36 and the northeastern part of section 35 lies in this municipality. Settlement in the township is confined largely to the upland, the northeastern marshy lowlands not being particularly suited to farming.

The water supply of the area is derived largely from wells, although in many places the yields are inadequate for local requirements and surface water is conserved in dugouts. Springs that are reported to flow throughout the year occur at the bases of some of the hills in the moraine-covered districts and yield sufficient quantities of hard, "alkaline" water for a limited number of stock in the neighbourhood.

The drift consists of glacial lake sands that mantle the low-lying eastern part of the township and moraine that covers the western and southern parts of the township. The areal distribution of both of these deposits is shown on the accompanying map (Figure 1).

The glacial lake sands range in thickness from 2 or 3 feet along the margin of the moraine to over 25 feet in the marsh lands. These sands are in turn underlain by an undetermined thickness of boulder clay. Wells less than 24 feet deep, in the area covered by the lake sands, obtain from the sands small supplies of hard, slightly "alkaline" water suitable for household use.. These supplies are dependant upon local precipitation and become unreliable during dry seasons. It is probable that the dissolved mineral salt content of the water in the sands will be found to increase toward the lowlands where surface evaporation tends to concentrate the salts.

The moraine consists mainly of boulder clay through which are irregularly scattered pockets of sand and gravel. The boulder clay is productive of only small seepage supplies of water, and wells in the area are sunk to tap water supplies available in sand and gravel pockets. On several farms scattered over the western half of the township, wells less than 40 feet deep obtain supplies of water of good quality adequate for household purposes. One such well and a dugout usually provide sufficient water for stock requirements on these farms.

Two 70-foot wells on the SW. $\frac{1}{4}$, and the NW. $\frac{1}{4}$, section 7, and an 80-foot well on the SW. $\frac{1}{4}$, section 28, obtain supplies from pockets lying at, or near, the base of the boulder clay.

The aquifer in the well on the NW. $\frac{1}{4}$, section 7, is "sea-mud" of interglacial origin, as described in an earlier part of this report. Yields from the other wells come from sand beds. Supplies in all cases are adequate for stock requirements. The waters from the wells on the NW. $\frac{1}{4}$, section 7, and the SW. $\frac{1}{4}$, section 28, however, are hard and "alkaline" and unsuitable for household use. A sufficient number of deep wells have not been sunk in this area as yet to determine whether these interglacial deposits are confined to the areas where they have been encountered or are more extensive. It is probable that stock supplies can be obtained from pockets within 100 feet of the surface almost anywhere in the western sections of the township. In the eastern sections it is more advisable to rely upon shallow wells and dugouts. In all parts of the township, drilling should not be continued below the glacial drift as everywhere it is immediately underlain by the shales of the Bearpaw bedrock formation from which it is not possible to obtain water of satisfactory quality for any farm use.

Township 15, Range 6

Wells in this township derive water from pockets in the glacial deposits that mantle the entire area. Dugouts in some places supplement stock supplies available from the wells. The entire area is covered by glacial drift forming a gently rolling till plain in the extreme southwest corner, but grading into an irregularly rolling, hilly area of moraine throughout the remainder of the township.

The drift has a thickness of 70 to 100 feet throughout this township except in the low-lying, northeastern sections of the area where it is believed to be thinner. It consists largely of boulder clay through which sand and gravel pockets are scattered irregularly.

The irregularity with which these productive beds occur has rendered it practically impossible to trace any definite productive horizons. In sinking wells the striking of such beds is largely a matter of chance, and wells that fail to penetrate a sand or gravel pocket yield only small quantities of hard, highly mineralized water from the boulder clay. Wells that have encountered porous beds in the weathered zone of the drift, within 50 feet of the surface, yield a hard water that is generally not too highly "alkaline" for domestic use. The yields from shallow wells fluctuate with the local rainfall, but generally they are sufficient for 10 to 25 head of stock.

Should wells fail to penetrate a productive bed within 50 feet of the surface, or the supply obtained be inadequate for local requirements, it is advisable to deepen the wells as in many places these yield larger and more stable supplies. In such cases they should be extended to near the base of the drift, as the intervening boulder clay is generally too compact to yield water. Wells located on sections 9, 10, 12, 25, 32, and 33 are believed to be drawing their supplies from sand beds at the contact of the boulder clay and the underlying shales of the bedrock. The depths vary with the thickness of the drift but all existing wells to this horizon have reached it at depths between 70 and 90 feet. The water from some of these wells is being used for drinking, but in most places the dissolved sulphate salt content of the water restricts its use to the watering of stock. Shallow wells must then be depended upon for household supplies.

The yields from individual wells sunk to the contact vary from place to place, but most of them are sufficient for the requirements of 20 to 30 head of stock.

Highly mineralized water is obtained from an isolated bed of interglacial "sea-mud" lying 68 feet below the surface on the SE. $\frac{1}{4}$, section 33. This well was continued to a depth of 94 feet, reaching gravels at the base of the drift. It is probable that the larger amount of water comes from the lower horizon as the interglacial deposits were encountered in other wells on this quarter section and were found to be dry.

The shales of the Bearpaw formation underlying the glacial drift throughout the township probably nowhere greatly exceed 100 feet in depth. Although no wells have penetrated the shale they are not expected to be water-bearing, and residents are advised to confine prospecting for water supplies to the glacial deposits or to the contact of the drift with the bedrock.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL
MUNICIPALITY OF SHAMROCK, NO. 134, SASKATCHEWAN

West of 3rd meridian — Township / Range	13 / 4	13 / 5	13 / 6	14 / 4	14 / 5	14 / 6	15 / 4	15 / 5	15 / 6	Total No. in municipality
Total No. of Wells in Township	78	64	37	56	53	51	3	43	44	429
No. of wells in bedrock	0	1	3	0	0	9	0	0	0	13
No. of wells in glacial drift	75	63	31	56	53	40	3	43	44	408
No. of wells in alluvium	3	0	3	0	0	2	0	0	0	8
Permanency of Water Supply										
No. with permanent supply	44	39	35	41	38	41	3	18	31	290
No. with intermittent supply	4	2	0	6	5	5	0	4	0	26
No. dry holes	30	23	2	9	10	5	0	21	13	113
Types of Wells										
No. of flowing artesian wells	0	0	0	2	1	0	0	0	0	3
No. of non-flowing artesian wells	17	21	13	9	12	9	0	3	7	91
No. of non-artesian wells	31	20	22	36	30	37	3	19	24	222
Quality of Water										
No. with hard water	39	39	32	43	36	40	3	20	30	282
No. with soft water	9	2	3	4	7	6	0	2	1	34
No. with salty water	0	0	0	0	0	0	0	0	0	0
No. with "alkaline" water	13	7	16	8	9	11	0	4	2	70
Depths of Wells										
No. from 0 to 50 feet deep	43	44	24	44	43	32	3	40	37	310
No. from 51 to 100 feet deep	23	14	10	11	10	14	0	3	7	92
No. from 101 to 150 feet deep	12	6	3	1	0	4	0	0	0	26
No. from 151 to 200 feet deep	0	0	0	0	0	1	0	0	0	1
No. from 201 to 500 feet deep	0	0	0	0	0	0	0	0	0	0
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	45	35	32	44	36	37	3	22	28	282
No. not usable for domestic purposes	3	6	3	3	7	9	0	0	3	34
No. usable for stock	48	39	34	47	41	41	3	22	31	306
No. not usable for stock	0	2	1	0	2	5	0	0	0	10
Sufficiency of Water Supply										
No. sufficient for domestic needs	44	38	33	31	36	34	3	17	30	266
No. insufficient for domestic needs	4	3	2	16	7	12	0	5	1	50
No. sufficient for stock needs	30	31	27	25	32	29	1	13	26	214
No. insufficient for stock needs	18	10	8	22	11	17	2	9	5	102

ANALYSES AND QUALITY OF WATER

General Statement

Samples of water from representative wells in surface deposits and bedrock were taken for analyses. Except as otherwise stated in the table of analyses the samples were analysed in the laboratory of the Borings Division of the Geological Survey by the usual standard methods. The quantities of the following constituents were determined; total dissolved mineral solids, calcium oxide, magnesium oxide, sodium oxide by difference, sulphate, chloride, and alkalinity. The alkalinity referred to here is the calcium carbonate equivalent of all acid used in neutralizing the carbonates of sodium, calcium, and magnesium. The results of the analyses are given in parts per million--that is, parts by weight of the constituents in 1,000,000 parts of water; for example, 1 ounce of material dissolved in 10 gallons of water is equal to 625 parts per million. The samples were not examined for bacteria, and thus a water that may be termed suitable for use on the basis of its mineral salt content might be condemned on account of its bacteria content. Waters that are high in bacteria content have usually been polluted by surface waters.

Total Dissolved Mineral Solids

The term "total dissolved mineral solids" as here used refers to the residue remaining when a sample of water is evaporated to dryness. It is generally considered that waters that have less than 1,000 parts per million of dissolved solids are suitable for ordinary uses, but in the Prairie Provinces this figure is often exceeded. Nearly all waters that contain more than 1,000 parts per million of total solids have a taste due to the dissolved mineral matter. Residents accustomed to the waters may use those that have much more than 1,000 parts per million of dissolved solids without any marked inconvenience, although most persons not used to highly mineralized water would find such waters highly objectionable.

Mineral Substances Present

Calcium and Magnesium

The calcium (Ca) and magnesium (Mg) content of water is dissolved from rocks and soils, but mostly from limestone, dolomite, and gypsum. The calcium and magnesium salts impart hardness to water. The magnesium salts are laxative, especially magnesium sulphate (Epsom salts, $MgSO_4$), and they are more detrimental to health than the lime or calcium salts. The calcium salts have no laxative or other deleterious effects. The scale found on the inside of steam boilders 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 hardness to the sulphates and chlorides of calcium and magnesium. The permanent hardness can be partly eliminated by adding simple chemical softeners such as ammonia or sodium carbonate, or many prepared softeners. Water that contains a large amount of sodium carbonate and small amounts of calcium and magnesium salts is soft, but if the calcium and magnesium salts are present in large amounts the water is hard. Water that has a total hardness of 300 parts per million or more is usually classed as excessively hard. Many of the Saskatchewan water samples have a total hardness greatly in 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 Shamrock, No. 134, Saskatchewan

LOCATION						Depth of well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of water
No.	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alka-linity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	SW.	3	13	4	3	120	4,860											(4)	(1)		(2)		(3)		(5)	x 1
2	SE.	14	13	4	3	80	3,060	1,600	1,100	500	87	950	310	252	1,423	849	3,084	555		333	277		1,776	143		x 1
3	SW.	22	13	4	3	137	4,140	2,800	2,000	800	228	955	90	512	1,886	1,117	3,889	161		667	572		2,113	376		x 1
4	SE.	12	13	6	3	150	3,943												(2)		(1)			(3)		x 1
5	NW.	28	13	6	3	80	1,660	1,300	1,200	100	31	400	140	209	804	316	1,535	251		125	444		664	51		x 1
6	NE.	9	14	5	3	?	397											(2)	(1)		(3)				(4)	x 1
7	NW.	10	14	6	3	104	3,500	3,000+	3,000+	n.d.	47	460	500	522	2,198	387	3,475	460	588		1,556		793	78		x 1
8	SW.	33	15	6	3	94	2,820	1,900	1,700	200	264	955	60	324	906	839	2,605	107		678		43	1,341	436		x 1

Water samples indicated thus, x 1, are from glacial drift.
Analyses are reported in parts per million; where numbers (1), (2), (3), (4), and (5) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
Analyses Nos. 1, 4 and 6 by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

Five analyses made by the Geological Survey, and three others by the Provincial Analyst, Saskatchewan, are available of waters from the glacial drift in this municipality.

No analyses have been made of waters from the deposits of Recent origin. Hence the following generalizations regarding the quality of water from this source are based upon the reports of residents and observations at the well sites. Water in the Recent sands and gravels that is derived by direct seepage from streams or by the downward percolation of surface water does not generally contain large amounts of mineral salts in solution, and rarely is any salt in sufficient concentration to have any harmful effects. Such waters if free from pollution by decaying organic matter and particularly sewage are generally suitable for all farm purposes. Recent silts that form the greater part of the valley alluvium do not permit the free circulation of water, and the water consequently has a greater opportunity to dissolve the salts present in them. Hence, water from the silts as a rule is fairly highly mineralized and not as suitable for household use as the water from sands or gravels.

Large variations in the quality of waters from the glacial deposits are found even within small areas. This is to be expected since the deposits themselves vary greatly in composition from place to place. Boulder clays, and probably to a lesser extent glacial lake clays, are believed to be the source of the sulphate salts which are the chief mineral constituents of waters from the drift. Porous beds of sands and gravels occurring at or near the surface, and hence not covered by any large thickness of clays, yield waters that are soft or only moderately hard, and generally satisfactory for household use.

Analysis No. 6, on the accompanying table, is of water having a mineral salt content typical of waters from shallow sand and gravel pockets. The total dissolved salt content of this water is 397 parts per million and the water is only moderately hard. As is usual, calcium and magnesium sulphate are present, but together are not in sufficient concentration to have harmful effects. The calcium carbonate ($CaCO_3$) and calcium chloride ($CaCl_2$) reported in the water tend only to increase the hardness. The analysis shows bacillus coli to be present in the water in large numbers, and the water is undoubtedly contaminated by sewage and is not a suitable household supply.

Waters derived from the compact clay or from porous beds at depth in the clay, show appreciably higher concentrations of dissolved salts. In general, the total salt content seems to increase with increasing depth into the boulder clay. The fifth analysis on the accompanying table is of water from a sand bed lying beneath 80 feet of clay. The water contains 1,660 parts per million of salts made up largely of the sulphates of sodium and magnesium. The concentration of this latter salt renders the water very hard and both create slightly laxative effects. It is used, however, for both domestic and stock watering purposes.

The waters obtained from interglacial beds in this municipality have a high mineral salt content, which is generally made up predominately of sodium sulphate, with lesser amounts of the more harmful magnesium sulphate. However, the magnesium sulphate in solution in many of the waters from these beds is not of sufficient concentration to prohibit the waters from being used for domestic purposes. Analyses 2 and 3 on the accompanying table are of waters from these beds and show salts content of 3,060 and 4,140 parts per million, with 1,776 and 2,113 parts of sodium sulphate, respectively. Magnesium sulphate, sodium chloride, and the carbonates of magnesium and calcium are also present in these waters. The salts are in greater concentration than is general in waters from such beds. Neither water is used for domestic purposes. The first analysis on the table is of water from an interglacial bed. It contains 4,860 parts per million of salts made up of, in the relative order of their abundance, calcium sulphate, magnesium sulphate, sodium sulphate, calcium carbonate, and calcium chloride. The excessive amount of salts in this water would seem to prohibit its use, at least domestically, but the resident uses it for his household and reports only an apparently harmless laxative effect. Iron and hydrogen sulphide, which many of the waters from interglacial beds contain, adds to the disagreeable properties of such water.

Waters taken from porous beds lying at the contact between the glacial drift and underlying Bearpaw formation are invariably highly mineralized, and are of two types. One type derives its dissolved salts mainly from the boulder clay, is excessively hard, and contains predominately sulphate salts. The other type derives its salts from the Bearpaw. It is generally softer, contains sodium sulphate in fairly large amounts, but little if any of the sulphates of calcium and magnesium, and contains sodium carbonate and sodium chloride in considerable amounts. Analyses 4 and 7 are of waters of the first type, both being very hard and containing predominately sulphate salts. These waters are notconsidered suitable for domestic use, and probably would cause some scouring in stock. They are both used, however, for stock, and the water of No. 4 is reported as being used even for drinking with no apparent ill effects. Analyses No. 8, on the accompanying table, is of the second type of waters from the drift-bedrock contact and has a total salt content of 2,820 parts per million, consisting of 1,341 parts of sodium sulphate, 436 parts of sodium chloride, 43 parts of sodium carbonate, and negligible amounts of magnesium and calcium carbonates.

No magnesium and calcium sulphate were reported. The sodium sulphate and chloride in this water render it unfit for household use, but it is used satisfactorily for stock. Sodium carbonate in sufficient concentration is harmful to vegetation and waters containing it in any large amount should not be used for garden irrigation. The 43 parts per million of this salt in the water is believed to be negligible, but combined as it is with considerable amounts of other sodium salts, which are also somewhat harmful to vegetation, the water is probably of doubtful value for irrigation.

Iron forms an objectionable feature in many waters of this municipality. Much of this iron may be removed by allowing the water to stand for a period of time in a trough or container having a large water surface exposed to the air. Agitation of the water is also helpful in removing iron. One method that has proved successful is to allow the water to pass over a sheet of corrugated, galvanized iron suspended between the pump and the trough. The iron upon coming in contact with air is oxidized, and settles as a brown precipitate on the bottom of the trough.

Water from the Bedrock

No samples of water from the Bearpaw bedrock formation were collected for analysis in this municipality. The following generalizations are based upon analyses made of waters from the formation in adjoining municipalities.

The Bearpaw due to its marine origin contains inherently larger quantities of readily dissolvable mineral salts than do the glacial deposits. Waters from the formation almost invariably contain large amounts of mineral salts in solution. Sodium sulphate is usually in the greatest concentration, with successively lesser amounts of sodium chloride, sodium carbonate, magnesium, and calcium carbonates and sulphates. Water from the Bearpaw is generally unsuitable for domestic purposes and in many places, particularly from great depths in the shales, is unsuitable even for stock. However, sandy beds do occur interbedded with the shales of the formation and yield water that is generally not so highly mineralized as seepages from the compact clays and shales. Analysis No. 8, on the accompanying table, although the water comes from a bed lying at the contact of the drift and the underlying Bearpaw formation, is believed to be typical of water from the upper sandy phases in the Bearpaw formation, and is probably not unlike the water obtained from the formation in sec. 6, tp. 14, range 6, of this municipality.

WELL RECORDS—Rural Municipality of SHAMROCK NO.134, 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	13	4	3	Bored	60	2,200	- 20	2,180	60	2,140	Glacial gravel	Hard,iron, clear	45	D	Sufficient supply.
2	SE.	2	"	"	"	Dug	6	2,200	- 4	2,196	4	2,196	Recent gravel	Hard,clear		D	
3	E½.	2	"	"	"	Bored	122	2,260	- 60	2,200	122	2,138	Interglacial deposits ?	Hard,iron, "alkaline" clear	45	D, S	Sufficient supply.
4	SW.	3	"	"	"	Bored	120	2,280	- 60	2,220	120	2,160	Interglacial "sea-mud"	Hard,clear, "alkaline"		D, S	Sufficient supply; laxative, 3 dry holes 80 feet deep.
5	NW.	3	"	"	"	Dug	4	2,200	- 2	2,198	2	2,198	Recent gravel	Hard,clear	43	D	Sufficient supply.
6	NW.	4	"	"	"	Dug	8	2,200	- 4	2,196	4	2,196	Recent gravel	Hard,clear	47	D, S	
7	NE.	5	"	"	"	Dug	8	2,210	- 4	2,206	4	2,206	Glacial gravel	Hard,clear	45	D, S	Insufficient supply.
8	SE.	9	"	"	"	Dug	10	2,210	- 6	2,204	6	2,204	Glacial gravel	Hard,iron, "alkaline" red sediment	45	D	Sufficient supply.
9	SE.	12	"	"	"	Bored	117	2,260	- 65	2,195	117	2,143	Interglacial gravel ?	Hard,clear, "alkaline"		D, S	Sufficient supply.
10	N½.	12	"	"	"	Bored	130	2,260	- 40	2,220	130	2,130	Interglacial "sea-mud"	Hard,iron, red sediment	43	D, S	Sufficient supply.
11	SE.	14	"	"	"	Bored	80	2,240	- 30	2,210	80	2,160	Interglacial "sea-mud"	Hard,iron, "alkaline"odour,"sulphur"	44	S	Sufficient sup ly. #
12	SW.	14	"	"	"	Dug	18	2,250					Glacial drift	Hard			Small s upply, good water.
13	NW.	14	"	"	"	Bored	36	2,250	- 31	2,219	31	2,219	Glacial gravel	Hard,clear, "alkaline"	44	D, S	Intermittent; insufficient supply, laxative.
14	NE.	17	"	"	"	Dug	35	2,290									Dry hole in glacial drift. A 25-foot well.
15	SE.	19	"	"	"	Dug	16	2,310	- 12	2,298	12	2,298	Glacial gravel	Soft,clear	42	D, S	Very insufficient supply.
16	SW.	19	"	"	"	Dug	18	2,310	- 16	2,294	16	2,294	Glacial sand	Soft,clear	44	D, S	Strong supply; 5 dry hole in glacial "sea-mud" up to 160 feet deep.
17	SW.	19	"	"	"	Bored	26	2,310	- 20	2,290	26	2,284	Glacial quick-sand	Hard,clear	42	D, S	Sufficient supply; a 100-foot dry hole in glacial drift.
18	NE.	19	"	"	"	Bored	100	2,315	- 85	2,230	100	2,215	Interglacial "sea-mud"	Hard,iron, sulphur,odour,clear	44	S	Insufficient supply; an intermittent well in sand for house use.
19	SE.	20	"	"	"	Dug	18	2,290	- 12	2,278	12	2,278	Glacial sand	Soft,clear	44	D, S	Sufficient supply.
20	SE.	20	"	"	"		108	2,290									Dry hole in glacial drift; several dry holes.
21	SW.	22	"	"	"	Bored	137	2,275	- 77	2,198	137	2,138	Interglacial "sea-mud"	Hard,iron, sulphur,"alkaline"cloudy brown	44	S	Sufficient supply; laxative, a 70-foot dry hole.
22	NE.	22	"	"	"	Bored	110	2,275	- 50	2,225	110	2,165	Interglacial "sea-mud"	Hard,iron, "alkaline"	42	D, S	Sufficient supply.
23	NW.	23	"	"	"	Dug	25	2,260	- 10	2,250	10	2,250	Glacial sand	Soft,clear	44	D, S	Sufficient supply.
24	SE.	24	"	"	"	Bored	100	2,250	- 60	2,190	100	2,150	Interglacial "sea-mud"	Hard,clear, "alkaline"	44	S	Sufficient supply; laxative, a seepage well 30 feet deep.

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 SHAMROCK NO.134, 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.
25	SW.	25	13	4	3	Bored	23	2,260	- 17	2,243	17	2,243	Glacial gravel	Soft		D, S	Sufficient supply.
26	NE.	25	"	"	"	Dug	11	2,250	- 10	2,240	10	2,240	Glacial quick-sand	Soft, clear	44	D, S	Sufficient supply.
27	SE.	26	"	"	"	Bored	40	2,250	- 28	2,222	28	2,222	Glacial gravel	Soft, clear	43	D, S	Strong supply; also a dry hole ~~56 feet deep.~~
28	SE.	26	"	"	"	Bored	84	2,270									Dry hole in glacial drift.
29	SE.	27	"	"	"	Bored	140	2,290	- 80	2,210	140	2,150	Interglacial "sea-mud"	Hard, clear	44	D, S	Sufficient supply. 6 dry holes in glacial drift. A 130-foot well interglacial "sea-mud".
30	NE.	27	"	"	"	Bored	144	2,270	- 65	2,205	144	2,126	Interglacial "sea-mud"	Hard, clear	42	D, S	Insufficient supply.
31	NW.	27	"	"	"	Bored	120	2,300	- 60	2,240			Interglacial deposits?	Hard		D, S	Sufficient supply.
32	SE.	28	"	"	"	Dug	14	2,250	- 10	2,240	10	2,240	Glacial sand	Hard, clear	45	D, S	Sufficient supply.
33	NE.	29	"	"	"	Dug	20	2,320	- 16	2,304	16	2,304	Glacial sand	Soft, clear	41	D, S	Strong supply.
34	SW.	30	"	"	"	Bored	40	2,316	- 31	2,285	31	2,285	Glacial sand and gravel	Hard, clear	43	D, S	Insufficient supply; another well 24 feet deep. Soft water for stock.
35	NW.	30	"	"	"	Bored	80	2,325	- 48	2,277	48	2,277	Glacial gravel	Hard, clear, "alkaline"	42	S	Insufficient supply. A dry hole 100 feet deep in glacial drift. Two intermittent shallow wells.
36	NE.	30	"	"	"	Bored	65	2,340	- 10	2,330	65	2,275	Glacial sand	Hard, iron, "alkaline" clear	42	S	Sufficient supply. A 65-foot dry hole.
37	NE.	30	"	"	"	Bored	100	2,340	- 90	2,250	90	2,250	Glacial gravel	Hard, iron, clear, "alkaline"			Very strong, sufficient supply.
38	NE.	31	"	"	"	Dug	12	2,350	- 10	2,340	10	2,340	Glacial sand	Soft, clear	42	D, S	Insufficient supply.
39	SE.	32	"	"	"	Bored	40	2,340	- 24	2,316	24	2,316	Glacial sand	Hard, clear	45	D, S	Sufficient supply.
40	NE.	32	"	"	"	Dug	14	2,350	- 10	2,340	10	2,340	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
41	SW.	34	"	"	"	Bored	34	2,310	- 14	2,296	34	2,276	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
42	SE.	35	"	"	"	Bored	100	2,290	- 50	2,240	100	2,190	Glacial sand	Hard, clear, "alkaline"#	44	S	Sufficient supply; laxative, dry holes 100 feet deep.
43	NW.	35	"	"	"	Bored	37	2,275	- 22	2,253	22	2,253	Glacial sand	Hard, clear	43	D, S	Sufficient supply.
44	W½.	36	"	"	"	Dug	13	2,270	- 11	2,259	11	2,259	Glacial gravel	Hard, clear	43	D, S	Sufficient supply; few dry holes in glacial clay.
1	NE.	1	13	5	3	Bored	120	2,300									Dry hole probably entering Bearpaw shales. Several other similar dry holes, one 100 feet deep.
2	NE.	3	"	"	"	Dug	30	2,300	- 8	2,292	30	2,270	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
3	SW.	4	"	"	"	Dug	20	2,300	- 17	2,283	20	2,280	Glacial gravel and sand	Hard, clear	46	D, S	Excellent supply.
4	NE.	4	"	"	"	Dug	20	2,298	- 11	2,287	20	2,278	Glacial sand	Hard, iron, 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.

WELL RECORDS—Rural Municipality of SHAMROCK NO.134, SASKATCHEWAN

3

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (—) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
5	SE.	5	13	5	3	Dug	11	2,250	- 8	2,242	8	2,242	Glacial sand	Soft, clear	40	D, S	Strong supply; several dry holes also.
6	SW.	7	"	"	"	Bored	130	2,290	- 30	2,260	130	2,160	Interglacial beds or Bearpaw shales	Hard, iron, odour, "alkaline", clear	44	S	Probably sufficient; laxative.
7	NE.	8	"	"	"	Dug	25	2,300	- 14	2,286	14	2,286	Glacial sand	Medium hard, odour clear		D, S	Sufficient supply; several dry holes.
8	SE.	9	"	"	"	Dug	15	2,266	- 10	2,256	15	2,251	Glacial sand	Hard, clear	43	D, S	Sufficient supply.
9	SE.	9	"	"	"	Dug	32	2,290	- 27	2,263	27	2,263	Glacial quick-sand	Hard, clear		D	Sufficient supply.
10	SE.	10	"	"	"	Dug	26	2,290	- 22	2,268	22	2,268	Glacial drift	Hard, clear	44	D, S	Sufficient supply. A 70-foot dry hole 30-feet well.
11	NW.	10	"	"	"	Bored	127	2,320	- 85	2,235	127	2,193	Interglacial sand (?)	Hard, clear, iron	42	D, S	Sufficient supply; a 75-foot well with small supply in sand.
12	NW.	11	"	"	"	Dug	20	2,315	- 11	2,304	20	2,295	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
13	SE.	12	"	"	"	Dug	22	2,260	- 13	2,247	22	2,238	Interglacial coal	Hard, clear	43	D, S	Sufficient supply.
14	NE.	12	"	"	"	Bored	60	2,270	- 25	2,245			Interglacial "sea-mud"	Hard, clear, odorous			Intermittent well, now dry.
15	NW.	13	"	"	"	Dug	93	2,290	- 10	2,280	10	2,280	Glacial sand			N	Intermittent supply.
16	SE.	13	"	"	"	Dug	14	2,270	- 12	2,258	12	2,258	Glacial drift	Hard, clear		D, S	Insufficient supply; laxative, a 25-foot dry hole.
17	SE.	14	"	"	"	Dug	22	2,272									Dry hole in glacial gravel
18	SE.	15	"	"	"	Bored	75	2,330	- 50	2,280	75	2,255	Glacial sand	Hard, clear		D, S	Sufficient supply.
19	SW.	16	"	"	"	Bored	58	2,330	- 20	2,310	20	2,310	Glacial drift	Hard, clear	42	D, S	Intermittent; insufficient supply.
20	SW.	16	"	"	"	Bored	110	2,340	- 60	2,280	90	2,250	Glacial gravel	Hard, clear, "alkaline"	42	S	Sufficient supply.
21	NW.	16	"	"	"	Spring	0	2,350					Glacial drift	Hard, clear		S	Spring in pasture.
22	NE.	16	"	"	"	Dug	10	2,345	- 6	2,339	6	2,339	Glacial drift	Hard		D, S	Excellent supply.
23	NW.	17	"	"	"	Bored	105	2,370	- 40	2,330	105	2,265	Interglacial "sea-mud"	Hard, clear, "alkaline"	42	D, S	Sufficient supply.
24	SE.	18	"	"	"	Bored	40	2,350	- 20	2,330	20	2,330	Glacial gravel	Hard, clear			Sufficient usually 2 other wells good supply.
25	SW.	18	"	"	"	Bored	36	2,340	- 23	2,317	23	2,317	Glacial drift	Hard, clear, "alkaline"	45	S	Insufficient supply; laxative.
26	NW.	18	"	"	"	Bored	98	2,360									Dry hole base in Bearpaw.
27	SE.	19	"	"	"	Bored	100	2,400	- 50	2,350	100	2,300	Glacial sand	Hard, clear	42	D, S	Excellent supply.
28	NW.	19	"	"	"	Bored	30	2,400	- 20	2,380	30	2,370	Glacial sand	Hard, clear		D, S	Excellent supply.
29	SE.	20	"	"	"	Bored	90	2,410	- 60	2,350	90	2,320	Interglacial "sea-mud"	Hard, iron, clear, odour	42	D, S	Sufficient supply.
30	SW.	20	"	"	"	Bored	17	2,385	- 10	2,375	10	2,375	Glacial sand	Hard, clear		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 SHAMROCK NO.134, 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
31	SW.	21	13	5	3	Bored	50	2,410	- 40	2,370	50	2,360	Glacial sand	Hard, clear	42	D, S	Insufficient. Dry hole 110 feet in glacial drift.
32	NE.	21	"	"	"	Dug	14	2,360	- 6	2,354	14	2,346	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient supp, slightly laxative.
33	SE.	22	"	"	"	Bored	50	2,350									Dry hole in glacial drift.
34	SW.	23	"	"	"	Bored	30	2,340	- 25	2,315	25	2,315	Glacial sand	Hard, clear	44	D, S	Sufficient supply.
35	NE.	23	"	"	"	Dug	12	2,290	- 8	2,282	8	2,282	Glacial drift	Hard, clear		D, S	Sufficient supply.
36	SE.	25	"	"	"	Dug	23	2,315	- 13	2,302	23	2,292	Glacial sand				
37	SE.	30	"	"	"	Dug	20	2,425	- 5	2,420	20	2,405	Glacial drift	Hard, clear	42	D, S	
38	SW.	30	"	"	"	Dug	20	2,430	- 10	2,420	20	2,410	Glacial quick-sand	Soft, clear	42	D, S	Sufficient supply.
39	SE.	36	"	"	"	Bored	60	2,320	- 40	2,280	60	2,260	Glacial gravel	Hard, clear, iron	40	S	Sufficient supply; shallow seepage well for house.
40	NE.	36	"	"	"	Bored	68	2,320	- 12	2,308	68	2,252	Glacial drift	Hard, iron, "alkaline"	42	S	Bad effect on humans. Stock prefer slough water.
1	SE.	2	13	6	3	Dug	20	2,250	- 16	2,234	16	2,234	Glacial sand	Hard, clear		D, S	Sufficient supply.
2	NE.	4	"	"	"	Bored	22	2,270	- 10	2,260	10	2,260	Recent alluvium clay	Hard, clear, "alkaline"		D, S	Sufficient for 20 head stock. Well 25 feet deep with 12 feet of water.
3	SW.	10	"	"	"	Dug	15	2,260	- 10	2,250	10	2,250	Glacial drift	Hard, clear, "alkaline"		S	Sufficient for 32 head stock. Dry hole 100 feet deep in glacial drift.
4	SE.	11	"	"	"	Bored	105	2,260	- 70	2,190			Glacial drift	Hard, clear		D, S	Sufficient supply.
5	SE.	12	"	"	"	Bored	150	2,250	-100	2,150	122	2,128	Glacial drift	Hard, clear		D, S	Sufficient supply.
6	SW.	13	"	"	"	Bored	100	2,310	- 70	2,240			Glacial drift	Hard, clear		D, S	Sufficient supply.
7	NE.	16	"	"	"	Bored	80	2,290	- 60	2,230			Glacial drift	Hard, clear, iron		D	Insufficient supply. Similar well with "alkaline" water used for stock.
8	NW.	16	"	"	"	Bored	60	2,310	- 30	2,280	50	2,260	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 12 head stock; shallow seepage wells also.
9	SE.	17	"	"	"	Dug	14	2,300	- 10	2,290	10	2,290	Recent alluvium sand	Soft, clear		D, S	Sufficient for 25 head stock.
10	NE.	17	"	"	"	Bored	68	2,310	- 30	2,280	40	2,270	Glacial drift	Hard, clear, "alkaline" iron		D, S	Supplies 6 head stock.
11	NE.	18	"	"	"	Dug	80	2,325	- 55	2,270			Glacial drift	Hard, clear		D, S	Sufficient supply.
12	SW.	19	"	"	"	Dug	40	2,350	- 36	2,314	36	2,314	Glacial sand	Soft, clear		D, S	Insufficient for 20 head stock.
13	NW.	21	"	"	"	Bored	30	2,335	- 15	2,320			Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 12 head stock. A 22-foot similar well.
14	NE.	22	"	"	"	Dug	35	2,370	- 15	2,355	15	2,355	Glacial drift	Hard, clear, "alkaline"		D, S	Insufficient supply.
15	SW.	23	"	"	"	Bored	85	2,360	- 25	2,335	85	2,275	Glacial drift	Hard, clear, "alkaline"		S	Sufficient for 30 head stock.
16	NW.	24	"	"	"	Dug	18	2,390	- 10	2,380	10	2,380	Recent alluvium sand	Soft, clear		D, S	Sufficient for 12 head stock.

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

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

WELL RECORDS—Rural Municipality of SHAMROCK NO. 134, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
17	SE.	26	13	6	3	Bored	60	2,400	- 30	2,370	30	2,370	Glacial drift	Hard, clear		D, S	Sufficient for 12 head stock.
18	SW.	26	"	"	"	Bored	115	2,390	- 15	2,375			Glacial drift	Hard, iron, "alkaline" cloudy		S	Sufficient supply; laxative.
19	NW.	28	"	"	"	Bored	80	2,360	- 25	2,335	32	2,328	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 15 head stock. #
20	SE.	30	"	"	"	Dug	20	2,320	- 10	2,310	10	2,310	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 25 head stock.
21	NE.	30	"	"	"	Bored	52	2,330	- 15	2,315			Glacial drift	Hard, clear, "alkaline"		S	Sufficient for 27 head stock; laxative, dry hole 90 feet deep in Bearpaw. Seepage wells.
22	NE.	32	"	"	"		30						Glacial drift	Hard, "alkaline"		N	Too "alkaline" for use
23	NW.	33	"	"	"	Bored	20	2,380	- 16	2,364	16	2,364	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for 10 head stock.
24	SW.	34	"	"	"	Dug	35	2,375	- 17	2,358	17	2,358	Glacial drift	Hard, clear, "alkaline"		S	Sufficient for 14 head stock. A 14-foot well in sand with 10 feet of water.
25	NW.	35	"	"	"	Dug	7	2,400	- 5	2,395			Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 14 head stock.
26	NW.	36	"	"	"	Dug	40	2,410	- 28	2,382	28	2,382	Glacial drift	Hard, clear, "alkaline"		D, S	Insufficient supply.
27	NE.	36	"	"	"	Dug	10										Small supply.
1	SE.	1	14	4	3	Dug	24	2,315	- 15	2,300	15	2,300	Glacial sand	Hard, clear	42	D, S	Insufficient for stock. 100-foot dry hole in glacial drift.
2	SE.	2	"	"	"	Bored	60	2,290	- 30	2,260	30	2,260	Glacial gravel	Hard, clear	42	D, S	Excellent supply.
3	SE.	3	"	"	"	Bored	52	2,320	- 22	2,298	52	2,268	Glacial drift	Hard, clear	42	D, S	Sufficient supply.
4	SW.	4	"	"	"	Bored	50	2,347	- 22	2,325	50	2,297	Glacial gravel	Hard, clear, "alkaline"	42	D, S	Sufficient supply.
5	NE.	4	"	"	"	Dug	60	2,325	- 40	2,285	60	2,265	Glacial drift	Hard, clear	42	D, S	Fair supply.
6	SE.	5	"	"	"	Bored	60	2,350	- 30	2,320	30	2,320	Glacial drift	Hard, iron, "alkaline" clear	43	D, S	Insufficient supply.
7	SW.	6	"	"	"	Drilled	75	2,320	- 30	2,290	75	2,245	Glacial drift	Hard, clear, "alkaline"	42	D, S	Excellent supply.
8	SE.	8	"	"	"	Dug	20	2,335	- 5	2,330	5	2,330	Glacial drift	Hard, clear			Intermittent, insufficient supply.
9	NE.	9	"	"	"	Bored	100	2,335	- 70	2,265			Glacial drift	Hard			Intermittent supply.
10	NW.	9	"	"	"	Dug	22	2,340	- 20	2,320	20	2,320	Glacial drift	Hard, clear	42	D	Insufficient supply.
11	NW.	10	"	"	"	Dug	20	2,345	- 14	2,331	14	2,331	Glacial drift	Hard, clear	42	D, S	Sufficient supply. Two 65-foot wells small supply.
12	SW.	10	"	"	"	Dug	100	2,345									Dry hole in glacial clay.
13	SW.	11	"	"	"	Dug	17	2,345	- 14	2,331	14	2,331	Glacial drift	Hard, clear	42	D	Insufficient supply.
14	NE.	14	"	"	"	Dug	50	2,320	- 20	2,300	50	2,270	Glacial drift	Hard, clear	42	D	Insufficient supply. A 65-foot dry hole.
15	NE.	15	"	"	"	Dug	14	2,325	- 13	2,312	13	2,312	Glacial drift	Hard			Intermittent; 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 SHAMROCK NO. 134, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE Elev.	PRINCIPAL WATER-BEARING BED Depth	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
16	SE.	16	14	4	3	Dug	13	2,340	- 10	2,330	10	2,330	Glacial sand	Hard, clear		D, S	Sufficient supply.
17	NE.	16	"	"	"	Dug	18	2,300	- 15	2,285	15	2,285	Glacial sand	Hard, clear, "alkaline" iron	50	S	Intermittent supply. Six dry holes in glacial drift. A shallow well, small supply.
18	SE.	18	"	"	"	Dug	9	2,300	- 6	2,294	6	2,294	Glacial gravelly quicksand	Soft	42	D, S	Sufficient supply.
19	NW.	18	"	"	"	Bored	102	2,320	- 22	2,298	102	2,218	Glacial gravel	Hard, clear, salty	41	S	Sufficient for 20 head stock. A 15-foot well strong supply.
20	SW.	19	"	"	"	Dug	15	2,280	- 9	2,271	9	2,271	Glacial drift	Soft, clear	44	S	Intermittent supply.
21	NE.	19	"	"	"	Dug	12	2,245	- 6	2,239	12	2,233	Glacial sand	Hard, clear	45	D, S	Excellent supply.
22	NE.	20	"	"	"	Dug	16	2,240	- 13	2,227	13	2,227	Glacial sand	Hard, clear	45	D, S	Sufficient supply; 3 dry holes in glacial drift.
23	E½.	20	"	"	"	Spring	0	2,250	+ 1	2,251			Glacial drift	Hard			Very strong supply.
24	W½.	20	"	"	"	Dug	14	2,240	- 8	2,232	8	2,232	Glacial sand	Soft, clear		D, S	Sufficient supply.
25	SW.	21	"	"	"	Dug	12	2,230	- 7	2,223	7	2,223	Glacial quicksand	"alkaline" hard, clear	45	D, S	Sufficient supply.
26	SW.	22	"	"	"	Bored	36	2,290	- 9	2,281	9	2,281	Glacial drift	Hard, clear	42		Intermittent supply.
27	SE.	23	"	"	"	Dug	12	2,330	- 4	2,326	12	2,318	Glacial sand	Hard, clear, "alkaline"	42	D, S	Excellent supply.
28	SW.	24	"	"	"	Bored	35	2,345	- 24	2,321			Glacial drift	Hard, clear	42	D	Insufficient supply.
29	NE.	24	"	"	"	Dug	45	2,340	- 40	2,300	40	2,300	Glacial drift	Hard, clear, "alkaline"	42	S	Intermittent supply; laxative.
30	NE.	28	"	"	"	Dug	14	2,240	- 11	2,229	11	2,229	Glacial drift	Hard, clear	42	D, S	Insufficient supply. #
31	NE.	29	"	"	"	Spring	0	2,222	+ 1	2,223			Glacial gravel	Soft, clear	50	D, S	Sufficient supply.
32	SE.	30	"	"	"	Dug	20	2,240	- 15	2,225	15	2,225	Glacial quicksand	Hard, clear	43	D, S	Sufficient supply.
33	SW.	30	"	"	"	Dug	19	2,260	- 11	2,249	11	2,249	Glacial drift	Hard, clear			Intermittent supply.
34	SE.	32	"	"	"	Dug	12	2,245	- 9	2,236	9	2,236	Glacial gravel	Hard, clear		D, S	Excellent supply.
35	SE.	33	"	"	"	Dug	13	2,230	- 10	2,220	10	2,220	Glacial gravel	Hard, clear	44	D, S	Sufficient supply.
36	SW.	33	"	"	"	Dug	16	2,230	- 10	2,220	16	2,214	Glacial sand	Hard, clear	45	D, S	Sufficient supply. # An 18-foot well not used.
37	SW.	34	"	"	"	Dug	20	2,232	- 16	2,216	16	2,216	Glacial drift	Hard, clear	46	D, S	Sufficient supply.
38	SE.	34	"	"	"	Dug	20	2,245	- 10	2,235	10	2,235	Glacial sand	Hard, clear	42	D, S	Intermittent supply.
39	SW.	35	"	"	"	Dug	23	2,260	- 8	2,252	8	2,252	Glacial gravel	Hard, clear			No remarks.
40	NE.	36	"	"	"	Bored	40	2,250	- 38	2,212	38	2,212	Glacial drift	Hard, clear, "alkaline"	42	D	Insufficient supply; 3 other shallow wells, insufficient supplies; laxative.
1	SE.	3	14	5	3	Bored	78	2,340	- 48	2,292	78	2,262	Glacial gravel	Hard, clear, iron		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 SHAMROCK NO. 134, 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
2	NE.	3	14	5	3	Dug	16	2,340	- 12	2,328	16	2,324	Glacial quicksand	Hard, clear	42	D, S	Sufficient supply. Several dry holes one 90 feet deep. A seepage well in glacial drift, good supply.
3	SE.	4	"	"	"	Dug	16	2,365	- 12	2,353	12	2,353	Glacial drift	Soft, clear		D, S	Sufficient supply.
4	NE.	4	"	"	"	Bored	20	2,360	- 8	2,352			Glacial drift	Hard		S	
5	SW.	4	"	"	"	Spring	0	2,350					Glacial drift			S	Waters 200 head stock.
6	SW.	4	"	"	"	Bored	100	2,380	- 50	2,330	50	2,330	Glacial gravel	Hard, clear, "alkaline"	45	S	Sufficient supply. A 20-foot well, soft water. One dry hole in glacial drift.
7	NW.	4	"	"	"	Dug	28	2,375	- 15	2,360	28	2,347	Glacial sand	Soft, clear	42	D, S	Sufficient supply.
8	SW.	5	"	"	"	Dug	18	2,375	- 10	2,365	18	2,357	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
9	NE.	7	"	"	"	Dug	18	2,390	- 13	2,377	13	2,377	Glacial gravel	Soft, clear	45	D, S	Sufficient supply. Another well not good.
10	SE.	9	"	"	"	Dug	22	2,340	- 12	2,328	22	2,318	Glacial gravel	Soft, clear	42	D, S	Sufficient supply.
11	NE.	9	"	"	"	Bored	30	2,345	- 2	2,343	2	2,343	Glacial gravel	Hard, iron, sulphur, clear	45	D	Just sufficient for house. Intermittent supply.
12	NE.	9	"	"	"	Bored	25	2,336	- 10	2,326	10	2,326	Glacial gravel	Hard, clear	41	D, S	Sufficient supply. #
13	NW.	10	"	"	"	Dug	28	2,320	- 19	2,301	24	2,296	Glacial gravel	Hard, clear	42	D, S	Abundant supply.
14	NW.	10	"	"	"	Dug	16	2,310	- 10	2,300	10	2,300	Glacial quicksand	Hard, clear, "alkaline"	45	D, S	Sufficient supply.
15	S½.	11	"	"	"	Bored	73	2,320	- 23	2,297	23	2,297	Glacial quicksand	Hard, coloured iron, "alkaline"	45	D, S	Insufficient supply. Several dry holes.
16	NW.	13	"	"	"	Bored	24	2,340	- 18	2,322	18	2,322	Glacial sand	Hard, clear		D, S	
17	NW.	16	"	"	"	Dug	15	2,390	- 9	2,381	9	2,381	Glacial gravel	Hard, clear	40	D, S	Strong supply.
18		18	"	"	"								Glacial drift	Hard		D, S	Strong supply of good water.
19	SW.	19	"	"	"	Dug	18	2,370	- 4	2,366	4	2,366	Glacial drift	Hard, clear		D, S	Intermittent supply. Dry holes 40 feet and 90 feet deep.
20	NW.	19	"	"	"	Bored	68	2,365	- 43	2,322	68	2,297	Glacial drift	Hard, clear	41	D, S	Sufficient supply.
21	NE.	20	"	"	"	Dug	21	2,370	- 11	2,359	11	2,359	Glacial quicksand	Hard, clear	42	D, S	Intermittent supply.
22	SE.	21	"	"	"	Dug	21	2,375	- 15	2,360	15	2,360	Glacial sand			D, S	Sufficient supply.
23	NW.	21	"	"	"	Dug	16	2,370	- 14	2,356	14	2,356	Glacial sand	Soft, clear	46	D, S	Intermittent supply.
24	SE.	23	"	"	"	Dug	20	2,340	- 8	2,332	20	2,320	Glacial gravel and quicksand	Hard, clear	43	S	Sufficient supply. A spring also used. Abundant supply.
25	E½.	24	"	"	"	Dug	16	2,285	- 13	2,272	13	2,272	Glacial gravel	Hard	46	D, S	Sufficient supply.
26	NW.	24	"	"	"	Dug	11	2,300	- 3	2,297	3	2,297	Glacial gravel	Hard, cloudy, "alkaline"	45	D, S	Sufficient supply. Dry hole 30 feet deep.
27	NE.	26	"	"	"	Dug	28	2,300	- 19	2,281	28	2,272	Glacial gravel	Hard, clear, "alkaline"	42	S	Sufficient supply. Laxative.

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 SHAMROCK NO. 134, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE Elev.	PRINCIPAL WATER-BEARING BED Depth	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
28	NE.	26	14	5	3	Dug	100	2,310	- 60	2,250			Glacial quick-sand	Hard		N	Well caved in.
29	NW.	27	"	"	"	Dug	13	2,350	- 11	2,339	11	2,339	Glacial drift	Hard, clear		D, S	Intermittent supply.
30	SW.	28	"	"	"	Dug	20	2,350	- 18	2,332	18	2,332	Glacial sand	Hard, clear, "alkaline"	45	D, S	Sufficient supply. A 16-foot well used only for stock.
31	NE.	28	"	"	"	Dug2	25	2,360	- 20	2,340	25	2,335	Glacial gravel	Hard, iron, "alkaline" clear	49	D, S	Sufficient supply.
32	S½.	30	"	"	"	Dug	14	2,380	- 10	2,370	10	2,370	Glacial drift	Hard, clear, "alkaline"		S	Insufficient supply. Too "alkaline" for house use.
33	N½.	30	"	"	"	Bored	60	2,375	- 45	2,330	60	2,315	Glacial gravel	Hard, clear	45	S	Sufficient for 20 head stock. Another well near barn gas at 95 feet.
34	SW.	31	"	"	"	Bored	22	2,365									Dry hole in glacial drift.
35	SE.	32	"	"	"	Dug	16	2,360	- 16	2,344	16	2,344	Glacial drift	Hard, clear, "alkaline"	47	D, S	Insufficient supply. Several dry holes.
36	N½.	34	"	"	"	Dug	10	2,340	- 8	2,332	8	2,332	Glacial gravel	Hard, clear	45	D, S	Sufficient supply.
37	NE.	35	"	"	"	Dug	22	2,285	- 15	2,270	22	2,263	Glacial gravel	Soft, clear	42	D, S	Sufficient supply.
38	NE.	36	"	"	"	Dug	12	2,275	- 10	2,265	10	2,265	Glacial drift				Sufficient supply.
1	SE.	1	14	6	3	Dug	18	2,390	- 12	2,378	12	2,378	Glacial sand	Soft, clear		D, S	Sufficient supply. A similar well.
2	NE.	1	"	"	"	Dug	33	2,410	- 28	2,382	28	2,382	Glacial drift	Hard, clear		D, S	Sufficient for 25 head stock.
3	SW.	2	"	"	"	Bored	108	2,410	- 68	2,342	108	2,302	Glacial drift	Hard, "alka-line"		S	Sufficient supply. Laxative, haul drinking water.
4	SW.	3	"	"	"	Dug	34	2,460	- 25	2,435	25	2,435	Glacial drift	Hard, clear		D, S	Insufficient supply.
5	SW.	4	"	"	"	Bored	60	2,390	- 40	2,350	40	2,350	Bearpaw shale	Hard, clear, "alkaline"		N	Intermittent supply. Unfit for use, several other wells unfit for use.
6	SE.	6	"	"	"		100	2,350	- 30	2,320	30	2,320	Bearpaw shale				Another aquifer at 85 feet. Small supply.
7	SE.	6	"	"	"		45	2,350	- 28	2,322	28	2,322	Bearpaw shale				Poor supply of poor water. Also a dry hole 30 feet deep in glacial drift.
8	SW.	6	"	"	"	Dug	25	2,335	- 4	2,331	4	2,331	Glacial drift	Hard, clear, "alkaline"		D, S	Insufficient for 11 head stock; intermittent supply.
9	NW.	6	"	"	"		75	2,325	- 50	2,275	26	2,299	Bearpaw shale	Soft			Sufficient supply. Two water-bearing horizon
10	NE.	6	"	"	"		166	2,325	- 57	2,268	63	2,262	Bearpaw shale	Soft			Sufficient supply.
11	NW.	10	"	"	"	Bored	104	2,460	- 30	2,430	30	2,430	Glacial drift	Hard, iron, sulphur, red sediment		N	Laxative. # A 136-foot well in Bearpaw shal with good water.
12	SW.	13	"	"	"	Bored	39	2,435	- 7	2,428	7	2,428	Glacial drift	Hard, clear		D, S	Insufficient supply is seepage well near dug out. Several dry holes to 120 feet deep.
13	NW.	14	"	"	"	Bored	60	2,450	- 55	2,395	55	2,395	Glacial drift	Hard, clear, "alkaline"		D, S	Sufficient for 15 head stock. A seepage well for house also.
14	NE.	16	"	"	"	Bored	28	2,445	- 25	2,420	25	2,420	Glacial gravel	Soft, clear		D, S	Sufficient supply.
15	SW.	16	"	"	"	Bored	50	2,400	- 30	2,370	50	2,350	Glacial drift	Hard, iron, clear		D, S	Sufficient for 18 head stock.

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

WELL RECORDS—Rural Municipality of SHAMROCK NO. 134, SASKATCHEWAN

WELL No.	LOCATION ¼	LOCATION Sec.	LOCATION Tp.	LOCATION Rge.	LOCATION Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE Elev.	PRINCIPAL WATER-BEARING BED Depth	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
16	NE.	17	14	6	3	Dug	16	2,410	- 8	2,402	8	2,402	Recent alluvium	Soft, clear		D, S	Intermittent supply. A similar 20-foot well. Dry hole 80 feet in Bearpaw shale.
17	SW.	17	"	"	"	Dug	36	2,380	- 21	2,359	21	2,359	Glacial sand	Hard, clear		D, S	Sufficient for 30 head stock.
18	NW.	19	"	"	"	Bored	60	2,365	- 30	2,335	60	2,305	Glacial drift	Hard, iron, "alkaline" clear		D, S	Sufficient for 15 head stock.
19	NE.	19	"	"	"	Bored	50	2,380	- 20	2,360	50	2,330	Glacial drift	Hard, clear, "alkaline"		S	Sufficient for 12 head stock.
20	NW.	20	"	"	"	Bored	80	2,400	- 60	2,340	77	2,323	Glacial drift	Hard, clear, "alkaline"		S	Sufficient for 9 head stock; laxative. A similar well.
21	NW.	21	"	"	"	Bored	80	2,420	- 65	2,355	65	2,355	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient for 12 head stock. A 40-foot well used for stock.
22	NW.	22	"	"	"	Dug	24	2,445	- 19	2,426	19	2,426	Glacial sand	Soft, clear		D, S	Sufficient for 20 head stock. A 60-foot well "alkaline" water.
23	NE.	22	"	"	"	Bored	26	2,465	- 20	2,445	20	2,445	Glacial sand	Hard, clear		D, S	Sufficient for 16 head stock. A similar well.
24	NW.	23	"	"	"	Bored	67	2,465	- 40	2,425	67	2,398	Glacial sand	Hard, clear		D	Insufficient supply.
25	NW.	24	"	"	"	Dug	10	2,390	- 3	2,387	3	2,387	Recent alluvium sand	Soft, clear		D, S	Sufficient for 6 head stock.
26	NE.	24	"	"	"	Dug	24	2,380	- 17	2,363	17	2,363	Glacial sand	Hard, clear		D, S	Sufficient for 12 head stock, A 12-foot well in sand.
27	NE.	28	"	"	"	Dug	30	2,435	- 26	2,409	26	2,409	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for 10 head stock.
28	NW.	28	"	"	"	Spring	0						Glacial drift	Hard		S	Springs.
29	SW.	31	"	"	"	Dug	40	2,380	- 20	2,360	40	2,340	Glacial drift	Hard, clear, "alkaline"		S	Sufficient for 30 head stock. A seepage well also for house use.
30	SW.	33	"	"	"	Dug	28	2,420	- 20	2,400	20	2,400	Glacial gravel	Soft, clear		D, S	Sufficient for 10 head stock.
31	NW.	36	"	"	"	Bored	60	2,360	- 23	2,337	40	2,320	Glacial sand	Hard, clear, iron		D, S	Sufficient for 10 head stock.
32	SW.	36	"	"	"	Dug	18	2,380	- 4	2,376	4	2,376	Glacial drift	Hard, clear		D	Intermittent supply. Similar well also.
1	SE.	5	15	4	3	Dug	8	2,260	- 6	2,254	6	2,254	Glacial sand	Hard, clear	47	D, S	Sufficient supply. # Several wells in quicksand caved in.
1	NW.	2	15	5	3	Dug	16	2,275	- 14	2,261	14	2,261	Glacial sand	Hard, clear		D, S	Ample supply. Several wells.
2	NE.	3	"	"	"								Glacial drift	Hard, clear			Shallow well.
3	SW.	3	"	"	"	Dug	12	2,310	- 8	2,302	12	2,298	Glacial drift	Hard, clear	42	D, S	Excellent supply.
4	NE.	3	"	"	"	Dug	15	2,260	- 11	2,249	11	2,249	Glacial quicksand	Soft, iron, clear		D, S	Intermittent supply.
5	NW.	6	"	"	"	Dug	20	2,340									Dry hole in glacial drift; three other dry holes similar.
6	SW.	7	"	"	"	Bored	70	2,345	- 25	2,320	70	2,275	Glacial sand	Hard, clear	42	D, S	Sufficient supply.
7	NW.	7	"	"	"	Bored	70	2,360	- 52	2,308	52	2,308	Interglacial "sea-mud"	Hard, iron, rusty	45	D, S	
8	SE.	9	"	"	"	Dug	8	2,265	- 6	2,259	6	2,259	Glacial drift	Soft, clear		D, S	Sufficient for 4 head stock; 6 dry holes.

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 SHAMROCK NO. 134, SASKATCHEWAN

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
9	NW.	10	15	5	3	Dug	11	2,250	- 9	2,241	9	2,241	Glacial quick-sand	Hard, clear	42	D, S	Intermittent supply; 11 dry holes.
10	SW.	14	"	"	"	Dug	17	2,210	- 15	2,195	15	2,195	Glacial quick-sand	Hard, clear, "alkaline"		D, S	Sufficient for 4 head stock. Several good springs.
11	NE.	14	"	"	"	Dug	24	2,225	- 17	2,208	17	2,208	Glacial quick-sand	Hard, sulphur, "alkaline" clear	42	D, S	Sufficient supply.
12	NE.	15	"	"	"	Dug	12	2,240	- 9	2,231	9	2,231	Glacial quick-sand	Hard, clear		D, S	Intermittent supply. Another similar well dry last year.
13	NW.	22	"	"	"	Dug	20	2,230	- 16	2,214	16	2,214	Glacial sand	Hard, clear, "alkaline"		D, S	Insufficient; intermittent supply.
14	SW.	23	"	"	"	Dug	16	2,220	- 14	2,206	14	2,206	Glacial sand	Hard, clear	45	D, S	Insufficient supply. A 10-foot well waters 7 head stock.
15	SW.	28	"	"	"	Bored	80	2,255	- 70	2,185	70	2,185		Hard, iron, "alkaline" yellow		S	Sufficient for 25 head stock. A 10-foot well with intermittent supply.
16	NW.	30	"	"	"	Dug	14	2,265	- 10	2,255	10	2,255	Glacial sand	Hard, clear		D	Sufficient for house; another well for stock.
17	SW.	33	"	"	"	Bored	40	2,220	- 30	2,190	30	2,190	Glacial quick-sand	Hard, clear		D, S	Abundant supply.
1	NE.	6	15	6	3	Dug	40	2,390	- 34	2,356			Glacial drift	Hard, clear		D, S	Sufficient for 8 head stock.
2	NW.	6	"	"	"	Bored	28	2,390	- 18	2,372			Glacial sand	Hard, clear, "alkaline"		S	Sufficient for 28 head stock. Another well for stock, poor water.
3	SW.	9	"	"	"	Bored	82	2,400	- 72	2,328			Glacial drift	Hard, clear, iron		D, S	Sufficient for 8 head stock.
4	SE.	9	"	"	"	Dug	15	2,400	- 12	2,388	12	2,388	Glacial sand	Hard, clear		D, S	Sufficient for 15 head stock. A 52-foot well for stock; small supply.
5	SE.	10	"	"	"	Bored	70	2,370	- 20	2,350			Glacial drift	Hard, clear, iron		S	Sufficient for 20 head stock. A 40-foot well good supply of drinking water.
6	NE.	12	"	"	"	Bored	70	2,350	- 20	2,330			Glacial gravel	Hard, iron	42	D, S	Sufficient for 12 head stock.
7	SE.	13	"	"	"	Dug	12	2,370	- 8	2,362	8	2,362	Glacial sand	Soft, clear	55	S	Supplies 15 head stock. A 32-foot well and a 30-foot well, hard water.
8	SW.	13	"	"	"	Bored	42	2,370	- 31	2,339			Glacial gravel	Hard, clear		D, S	Sufficient for 12 head stock.
9	SW.	16	"	"	"	Dug	42	2,390	- 20	2,370			Glacial drift	Hard, clear		D, S	Sufficient for 12 head stock.
10	SE.	25	"	"	"	Drilled	75	2,350	- 35	2,315			Glacial drift	Hard, iron, cloudy	42	D, S	Sufficient for 10 head stock.
11	SW.	30	"	"	"	Bored	45	2,410	- 30	2,380	30	2,380	Glacial drift	Hard, cloudy		S	
12	SE.	32	"	"	"	Bored	75	2,350	- 42	2,308	42	2,308	Glacial drift	Hard, "alkaline"		S	Intermittent supply. A seepage well used for house.
13	SE.	33	"	"	"	Bored	44	2,350	- 54	2,296	90	2,260	Glacial gravel	Hard, clear	42	S	Sufficient for 35 head stock. A 68-foot well in Interglacial "sea-mud" # 13 dry holes.
14	NE.	33	"	"	"	Dug	16	2,300	- 1	2,299	1	2,299	Glacial drift	Hard, clear		D, S	Fair supply. Two wells 10 feet and 16 feet deep. Another well filled by quick-sand.
15	SE.	34	"	"	"	Dug	42	2,280	- 37	2,243	37	2,243	Glacial drift	Hard, clear, iron		D, S	Sufficient for 25 head stock.
16	NW.	35	"	"	"	Dug	16	2,270	- 13	2,257	13	2,257	Glacial sand	Hard, clear		D, S	Sufficient for 32 head stock.
17	NE.	35	"	"	"	Dug	8	2,250	- 5	2,245	5	2,245	Glacial sand	Hard, clear		D, S	Sufficient supply.
18	NE.	36	"	"	"	Dug	20	2,250	- 16	2,234	16	2,234	Glacial sand	Hard, clear		D, S	Sufficient supply; 3 similar wells also used.

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.