CANADA
DEPARTMENT OF MINES

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BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF SASKATCHEWAN LANDING No. 167 SASKATCHEWAN

BY

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

Water Supply Paper No. 143

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Saskatchewan Landing covers an area of approximately 311 square miles in southern Saskatchewan. It embraces the whole of tp. 17, ranges 13, 14, and 15, tp. 18, ranges 14 and 15, tp. 19, range 14, and those parts of tps. 18 and 19, range 13, west of Swiftcurrent creek; and of the parts of tp. 20, ranges 13, 14, and 15, and of tp. 19, range 15, that lie south of South Saskatchewan river, all W. 3rd mer. The approximate centre of the municipality is about 18 miles north and a little west of Swift Current.

A branch line of the Canadian Pacific railway passes through the eastern part of the municipality and terminates at Stewart Valley in sec. 12, tp. 1[illegible], range 14, which is the largest settlement in the municipality. No. 4 highway passes in a general northerly direction from the southern boundary of the municipality to the ferry at Saskatchewan Landing.

South Saskatchewan river forms the northern boundary of the municipality. Water-level in the river falls from about 1,788 feet above sea-level at the western boundary to about 1,752 feet above sea-level at the eastern boundary. River-level is about 450 to 500 feet below prairie-level, which in this municipality lies at about 2,200 to 2,250 feet above sea-level. The valley is generally about a mile wide, but some of the coulées extend back for several miles from the river.

Swiftcurrent creek forms the eastern boundary of that part of the municipality north of township 17. Near the mouth of the creek the valley is about 450 feet deep and is very steep sided. Towards the south the valley is much shallower and the valley slopes are more gentle. According to records of the Dominion Water and Power Bureau the mean monthly discharge of the creek from 1909 to 1931 was 80.3 cubic feet a second, the maximum was 1,351, and the minimum was 0.

The land rises gently southwards from the edge of the valley slopes to South Saskatchewan river and Swiftcurrent creek to elevations of over 2,400 feet above sea-level in township 19. Most of townships 17 and 18 is over 2,400 feet above sea-level, and in the southwest part of township 17, range 13, the surface rises to over 2,600 feet above sea-level. The relief is low and the topography is of the rolling type.

South Saskatchewan river and Swiftcurrent creek and a few springs that flow into them are the only reliable sources of surface water of good quality in this municipality. The water of the river and of the creek is comparatively soft and can be used in the natural state for all purposes except drinking; as this water is contaminated by sewage it should be well boiled or otherwise sterilized before being drunk. A lake, the water-level of which is given as 2,337 feet above sea-level, occupies a long, narrow depression in sec. 33, tp. 17, range 15, and secs. 4, 5, 8, and 9, tp. 18, range 15. A low area, marshy in wet seasons, occupies a large proportion of the southern half of township 17, range 14, and a few small lake bottoms or marshy areas accommodate surface run-off elsewhere in the municipality.

Water-bearing Horizons in the Unconsolidated Deposits

Glacial lake clays underlie a flat area less than 2,400 feet above sea-level in the western half of township 17, range 14, and adjacent parts of township 17, range 15. They also cover an area of 3 square miles in township 19, ranges 14 and 15. Moraine underlies the greater part of township 18, ranges 13, 14, and 15, west of Swiftcurrent Creek valley, and adjacent parts of township 17, and township 19, ranges 14 and 15. In the eastern part of the municipality the moraine-covered area extends to the southeast corner of township 17, range 13, and moraine also covers the southwest corner of township 17, range 15. Boulder clay or till underlies

the remainder of the municipality. The glacial lake clays do not usually yield much water to wells, but occasionally sandy beds are interbedded with the clays, and are water bearing. Two wells, 11 and 12 feet deep, in the southern part of township 17, range 14, obtain from such beds sufficient supplies of water for local use.

Ground water is found in the boulder clay and moraine in discontinuous beds and pockets of sand and gravel that are enclosed in the clay. The depth of the wells in the boulder clay and moraine varies very widely. In the southern third of the municipality, and in townships 18 and 19, range 15, most of the wells in the glacial drift are less than 75 feet deep. In the remaining four townships most of the wells are over 75 feet deep and in township 18, range 14, all the wells in the drift except two are over 100 feet deep.

In township 17, range 14, and in township 19, ranges 14 and 15, most of the wells in the glacial drift contain hard, "non-alkaline" water. In the remainder of the municipality most of the wells contain "alkaline" water, but in only a few wells is the water too "alkaline" for drinking. In a few of the shallow, seepage wells the water is soft.

The thickness of the drift is not known. In the lower part of the valley of Swiftcurrent creek the drift is at least 150 feet thick. In township 18, ranges 13 and 14, many wells, about 100 to 200 feet deep, obtain hard water from aquifers that lie probably at or near the base of the drift. In the northern third of the municipality several wells that contain hard water are from 200 to 310 feet deep and in this part erosion has removed the bedrock to a considerable depth.

The supply of ground water from the glacial drift in this municipality is generally sufficient for all purposes and the quality of the water is unusually good in view of the great average depth of the wells. Only one dry hole is reported, and the prospects of obtaining good supplies of water at depth are generally favourable.

Water-bearing Horizons in the Bedrock

The Bearpaw formation underlies the glacial drift over the entire municipality and is exposed at intervals in the lower part of the valleys of South Saskatchewan river and of Swiftcurrent creek. The Bearpaw formation consists principally of dark grey shale which is nearly impervious to water except near the surface. Interbedded with the shale, however, are beds of fine-grained sand that usually contain soft water. Beds of sand in the Bearpaw formation are known to occur at and above water-level in South Saskatchewan river near the mouth of Swiftcurrent creek. They were observed at elevations of about 2,125 feet above sea-level on the NW. ¼, sec. 10, tp. 19, range 13, and at elevations of 2,084 to 2,100 feet on the NE. ¼, sec. 34, tp. 18, range 13. Other sandy beds in the Bearpaw formation are concealed by the drift.

There are many aquifers in the Bearpaw formation, but as most of them have been penetrated by only a few wells they cannot be traced over long distances. In the northeastern part of the municipality, however, an aquifer that is about 2,100 to 2,150 feet above sea-level appears to rise towards the west. It is probably formed by the bed of sand that outcrops in the valley of Swiftcurrent creek on the NE. ¼, sec. 34, tp. 18, range 13. The Belly River formation underlies the Bearpaw formation, but is exposed only in a narrow strip near water-level in South Saskatchewan river.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 17, Range 13

The topographical relief in this township is generally low. The land surface is rolling and the elevation of most of it is over 2,400 feet above sea-level, with some of the hills rising to over 2,600 feet above sea-level. The valley of Swiftcurrent creek, which in this part of its course is about 150 feet deep, passes through the northeast part of the township; the valley slopes are comparatively gentle. There are no lakes or streams, and Swiftcurrent creek is the only dependable source of surface water. Two, small, low, marshy areas in the southeast and the northwest accommodate local surface run-off water. In the southwest the land slopes westward to a low area in township 17, range 14, which is marshy in wet seasons.

An irregularly shaped belt of moraine occupies much of the northeast half of the township. Boulder clay underlies the southwest half of the township, a large part of the northeast half of the township, and the valley of Swiftcurrent creek. The Bearpaw formation underlies the drift throughout the entire township.

The depth of the wells in this township ranges from 9 to 220 feet. In the northern half of the township all the wells except one are less than 75 feet deep.

Two wells on sections 4 and 5, 125 and 165 feet deep, obtain "alkaline" water from an aquifer that is at 2,375 and 2,335 feet, respectively, above sea-level. The log of the well on section 5 shows that dry gravel was passed through between depths of 7 and 22 feet and that a sand aquifer was passed through between depths of 122 and 165 feet. The sand layer appears to be a pocket in the boulder clay, as another well, 168 feet deep, on section 4, was dry.

An aquifer that is about 2,470 to 2,480 feet above sea-level supplies three wells, 24 to 30 feet deep, in the southern half

of sections 15 and 16. The water in the two western wells is "alkaline", but in the eastern well the water is only slightly hard and is used by the Canadian Pacific railway.

An aquifer that is about 2,380 feet above sea-level supplies two wells in section 32, each 70 feet deep, with hard water.

Three wells in the southeastern part of this township obtain soft water from aquifers thought to be in bedrock. Two of these wells, 69 and 125 feet deep, on sections 10 and 12, obtained soft water from an aquifer that is about 2,445 feet above sea-level. This aquifer does not appear to extend far eastwards, as the third well, 220 feet deep, on section 13, did not obtain water from it, but from a lower aquifer in the Bearpaw formation that is about 2,330 feet above sea-level.

The water in most of the wells in this township is hard and "alkaline", but in only one well is it too "alkaline" for human use. The water in the bedrock wells and in some of the shallower wells is soft. In the eastern half of the township three springs at elevations of about 2,390, 2,450, and 2,590 feet above sea-level supplement the well water supply at three farms.

Township 17, Range 14

Topographical relief in this township is low. A low, flat area, marshy in wet seasons, occupies about three square miles in the southwest part of the township. An intermittent stream enters the township from the east in section 12 and the stream valley is continued westward for about $3\frac{1}{2}$ miles into the township. In the northwest a low, flat area lying at less than 2,400 feet above sea-level occupies about three square miles and a narrow, sandy belt underlies the southern part of this area.

Glacial lake clays underlie the greater part of the southwest quarter and the northwest corner of the township. A belt of moraine covers an area about 4 miles long and $\frac{1}{2}$ to $1\frac{3}{4}$ miles wide

in the northeastern part of the township. Boulder clay underlies the remainder of the township. The Bearpaw formation underlies the drift over the entire township.

In the southern half of the township the depth of the wells ranges from 11 to 40 feet. In the eastern part, which is underlain by boulder clay or till, the water in the wells is hard, but not "alkaline". In the western part, which is mantled by lake clays, most of the wells yield "alkaline" water and in two wells the water is too "alkaline" for drinking. In two wells 11 and 12 feet deep the water is soft.

In the northern half of the township the depth of the wells ranges from 12 to 125 feet, but most of the wells are over 40 feet deep. Two springs on the eastern half of sections 24 and 25 are about 2,450 feet above sea-level. In the northeastern quarter of the township six wells 40 to 60 feet deep obtain water from aquifers that are about 2,350 to 2,390 feet above sea-level. In the northwestern quarter of the township three wells 75 to 125 feet deep obtain water from aquifers that are 2,304 to 2,325 feet above sea-level. The latter aquifers are probably at the base of the glacial drift and probably continue under the northern half of the township, and many extend into the southern half. No dry holes are reported in the northern half of the township. The water in the wells in this half is not "alkaline" and the supply is sufficient except at one farm.

No wells in this township have reached bedrock.

Township 17, Range 15

The southern two-thirds of the township is nearly flat, the average elevation of the land surface is about 2,400 feet above sea-level, and the surface rises to about 2,450 feet above sea-level in the southwest corner. A valley trending slightly north and west passes through the northern third of the township, and the lower part of a lake, the water-level of which is given as 2,337 feet above

sea-level, lies in the northern half of section 33.

Two small areas in the southeast and the northeast corners are underlain by glacial lake clays. Moraine covers an area of 2 square miles at the northern border of the township and another area of a little less than 2 square miles in the southwest corner. Elsewhere the township is underlain by boulder clay.

The wells in this township are from 12 to 75 feet deep. In section 6 a well 60 feet deep obtains water from an aquifer that is about 2,390 feet above sea-level. In section 36 an aquifer that is about 2,325 feet above sea-level supplies two wells each 75 feet deep. Elsewhere in the township an aquifer that is about 2,335 to 2,365 feet above sea-level supplies a number of wells from 40 to 64 feet deep with "alkaline" water. Should the supply of water from the shallow wells be inadequate it would seem advisable to attempt to reach this aquifer.

In a well 33 feet deep on section 2 and a well 22 feet on section 25, the water is soft. In all the other wells except one the water is "alkaline ", but in only two wells is it too "alkaline" for human use.

The supply of well water at all the farms visited except two is sufficient for local needs.

Township 18, Range 13

The valley of Swiftcurrent creek forms the eastern boundary of this township. Near the northern boundary of the township water-level in the creek is about 2,050 feet above sea-level, and the creek valley is about 300 feet deep. Near the southern boundary of the township water-level is about 2,250 feet above sea-level and the creek valley is about 200 feet deep. The valley slopes in this township are fairly steep.

West of the valley of Swiftcurrent creek the country is rolling. Most of this part of the township is over 2,400 feet above sea-level and in the southeast the land surface rises gently to

2,550 feet above sea-level. In the southern half of the township there are two northward-trending valleys that are less than 2,400 feet above sea-level, and in the northern half several shallow valleys, less than 2,400 feet above sea-level, extend back from the valley of Swiftcurrent creek.

Boulder clay underlies the valley of Swiftcurrent creek, and on the north extends in a narrow, irregular belt as far as the western boundary of the township. Moraine underlies the remainder of the township.

The northern third of the township is rather thinly settled. A spring-fed well on section 12, in the valley of Swiftcurrent creek, is 15 feet deep. A group of wells on sections 7, 8, and 18 are 20 to 30 feet deep. A spring-fed well on section 9 is 6 feet deep. With these exceptions the wells in the drift are 40 to 150 feet deep.

In the southeastern part of the township an aquifer that is about 2,295 to 2,330 feet above sea-level supplies seven wells, 80 to 150 feet deep, with a sufficient supply of water that is "alkaline", although not too "alkaline" for human use. This aquifer does not extend far to the northeast as two wells, 70 and 112 feet deep, on sections 14 and 22, respectively, obtain water from aquifers that are about 2,230 and 2,188 feet above sea-level.

In sections 5 and 6 an aquifer that is about 2,345 to 2,362 feet above sea-level provides an adequate supply of "alkaline" water to three wells, 40 to 60 feet deep. This aquifer may be one that supplies two wells, 45 and 85 feet deep, on sections 20 and 29, and if so the aquifer probably underlies most of the western third of the township.

A well on the NE. $\frac{1}{4}$, section 16, is 67 feet deep, and taps an aquifer at 2,350 feet above sea-level, from which it obtains soft water. As the wells in the surrounding territory obtain hard, "alkaline" water from aquifers below 2,350 feet above sea-level, the

softness of the water of the well may be due to its aquifer being located in an underground channel that connects with the valley of Swiftcurrent creek and along which the circulation of ground water is comparatively rapid.

A well in section 32, 325 feet deep, obtains soft water from an aquifer that is about 2,100 feet above sea-level. This aquifer is probably the one that is exposed on the east bank of Swiftcurrent creek on the NE. $\frac{1}{4}$, sec. 34, tp. 18, range 13, at elevations between 2,084 and 2,100 feet above sea-level. This aquifer extends into the township adjacent on the north and into township 19, range 14. The southward extent is not known, but it probably underlies the whole of township 18, range 13.

In most of the wells in the drift of this township the water is "alkaline" and in two wells in the northern part of the township the water is too "alkaline" for human use. The supply of water at all the farms except two is sufficient for local use.

Township 18, Range 14

Topographical relief in this township is very low. In the southern two-thirds the land surface is 2,400 to 2,500 feet above sea-level. In sections 27 and 34 there is an area less than 2,400 feet above sea-level. In the northwest a narrow valley in which there are two dry lake bottoms extends for about a mile into the township.

An irregular belt of boulder clay varying in width from $\frac{1}{2}$ to 2 miles extends westward along the northern border of the township for a distance of $3\frac{1}{2}$ miles. Elsewhere moraine underlies the township.

Very few of the wells in the drift of this township are less than 100 feet deep. The upper part of the drift appears to consist largely of compact clay and contains very few aquifers.

In the eastern half of the township the wells are from 78 to 295 feet deep, and obtain water from several aquifers that are

about 2,280 to 2,375 feet above sea-level.

A group of wells 87 feet to 165 feet deep, alined in a general direction a little east of north from section 4 to section 25, obtain water from an aquifer that is about 2,320 to 2,375 feet above sea-level. The aquifer may lie in a buried stream channel.

In the western half of the township the wells in the drift are 80 to 200 feet deep and obtain water from several aquifers that are about 2,225 to 2,320 feet above sea-level. This distribution of the aquifers is rather irregular, but some of them may be old stream channels trending a little east of north.

Three wells, 288 to 340 feet, in the southwestern quarter of the township, obtain soft water from an aquifer in the Bearpaw formation at about 2,135 to 2,162 feet above sea-level. This aquifer appears to slope slightly eastwards, and it is probably the same aquifer that outcrops in the NE. $\frac{1}{4}$, sec. 34, tp. 18, range 13, at 2,084 to 2,100 feet above sea-level. No other wells in this township have reached this aquifer, but it probably underlies the entire township. A well 200 feet deep, on section 35, obtains soft water from an aquifer that is about 2,200 feet above sea-level. This aquifer appears to be very limited in extent as several wells to the east and north of the well did not obtain water at this elevation and the wells west of section 35 obtain hard, "alkaline" water at elevations of about 2,200 feet above sea-level.

The water in five wells, 78 to 112 feet deep, in sections 1 to 4, is hard but not "alkaline" and the water in the well on section 1 contains so much soda that it blackens coffee. In the remaining wells in the drift of this township the water is "alkaline", but can be used for drinking. No dry holes were reported and the supply of water at the farms is sufficient for local needs.

Township 18, Range 15

The country in this township is of the rolling type; most of the surface is about 2,400 to 2,450 feet above sea-level. In the south a narrow valley is occupied by a lake, the water-level of which is about 2,337 feet above sea-level. In the northwest an eastward-trending valley extends for about 1½ miles into the township. Surface run-off of water is principally to these two valleys.

Boulder clay underlies three areas in the northwest and southwest two of which are about 2 square miles and the third of less than a square mile in the southeast corner. Moraine underlies the remainder of the township.

The wells in this township range in depth from 11 to 137 feet, but all the wells except three are less than 70 feet deep. Most of the wells in this township over 30 feet deep obtain water from aquifers that are about 2,350 to 2,400 feet above sea-level. A spring on section 30 is about 2,350 feet above sea-level, and is probably supplied by these aquifers. In the northern part of the township two wells on sections 31 and 36 are 107 and 137 feet deep, and obtain water from aquifers that are about 2,268 and 2,313 feet above sea-level, respectively. Most of the wells in the northern half of the township yield "alkaline" water that can be used for drinking, but at many of the farms the supply of water is inadequate for local needs and dams are in use at least in two farms.

In the southern half of the township the waters in three wells located near the western boundary and in three wells in the southeast part of the township are "alkaline", but can be used for drinking. A 16-foot well on section 13 yields soft water. The water in the other wells is hard, but not "alkaline". The supply of ground water in this part is more satisfactory than in the northern half, but in two wells, 18 and 25 feet deep, the supply of water is intermittent.

No wells have been put down to bedrock, but the soft water aquifer in the Bearpaw in sec. 6, tp. 18, range 14, which is about 2,135 feet above sea-level, probably rises towards the west at the rate of a few feet a mile.

Township 19, Range 13

Swiftcurrent creek forms the eastern boundary of this township. The depth of the creek valley ranges from about 300 feet in the south to about 450 feet in the north. The valley sides are steep, especially in the north. Water-level in the creek falls from about 2,050 feet above sea-level in the north to about 1,750 feet in the south. The slopes to South Saskatchewan river extend backward into the northern third of the township and the heads of some of the coulées are about 1½ miles from the northern boundary of the township. Back from the valleys of the river and the creek the surface is comparatively flat and rises gently southwestwards to about 2,400 feet above sea-level in the southwest. Boulder clay underlies the entire township.

Four wells in the glacial drift of this township are 102 to 260 feet deep. Two wells, each 260 feet deep, on the SW. ¼, section 8, and the SW. ¼, section 18, yield hard water from an aquifer that is about 2,114 to 2,120 feet above sea-level. This aquifer appears to be in an old stream channel, as wells to the north and to the south of the well, on section 8, obtained soft water from the Bearpaw formation at elevations of about 2,130 to 2,142 feet above sea-level.

Aquifers in the Bearpaw formation provide soft water for six wells 232 to 310 feet deep, in this township. An aquifer that is about 2,010 to 2,050 feet above sea-level supplies two wells each 260 feet deep on section 30. An aquifer that is about 1,955 feet above sea-level supplies a well 310 feet deep on section 16. An aquifer that is about 2,130 to 2,142 feet above sea-level supplies two wells 260 and 232 feet deep, respectively, on sections 6 and 8.

This last aquifer seems to extend eastwards and southwards into the adjacent townships, but it apparently has been eroded away towards the north, as the deep wells to the north did not obtain water at or near this elevation.

Township 19, Range 14

The valley of South Saskatchewan river cuts through the northwest corner of the township. The northern half of the township is dissected by coulées and ravines of intermittent streams that extend for several miles southwards from the valley of South Saskatchewan river. Farther south the land surface rises gently southwards to a maximum of about 2,450 feet above sea-level.

Glacial lake clays occupy about 2 square miles in sections 17, 18, 19, and 20. Moraine covers an area from 1 to 3 miles wide and over 3 miles long along the southern border of the township, extending eastwards to within a mile of the eastern boundary. Boulder clay underlies the remainder of the township.

In the southwest quarter of this township and in section 15 there are seven wells, 12 to 18 feet deep, that provide small supplies of water. In three of these wells the water is soft. Elsewhere in the township the wells in the drift are from 80 to 310 feet deep.

In the southern half of the township aquifers that are about 2,250 to 2,320 feet above sea-level supply water to six wells 80 to 167 feet deep. The water in these wells is hard and in three wells the water is also "alkaline", but is not too "alkaline" for drinking, and the supply of water from these wells is sufficient for all purposes. A well 267 feet deep, on section 1, taps an aquifer in the bedrock that is about 2,110 feet above sea-level. This aquifer probably underlies the whole of this half of the township and may extend north into section 22, where a well 200 feet deep obtained soft water from an horizon that is about 2,145 feet

above sea-level.

In the northern half of the township the wells are 160 to 310 feet deep. The bedrock aquifer that supplies soft water to the well on section 22 appears to have been removed by erosion north of this section, as several wells in the northern third of the township obtained hard water at elevations much below 2,145 feet above sea-level.

In the northeastern part of this township two wells, each 265 feet deep, obtain hard water from an aquifer that is 1,960 to 1,980 feet above sea-level. In the central third of the township six wells 160 to 310 feet deep obtain hard water from aquifers that are about 2,000 to 2,127 feet above sea-level. No well records were obtained from the northwestern part of the township. The aquifers that supply the deep water in the northern half are thought to be in the Bearpaw formation. The water in all these wells except one is described as slightly hard or medium hard. The water in the bedrock wells farther south is soft. The hardness of the water in the well in the northern half of this township may be due to the entry of hard water from the glacial drift into the bedrock aquifers.

Township 19, Range 15

The valley slopes to South Saskatchewan river and the coulées and stream valleys that head southwards from the river valley occupy a large part of the northern half of the township, and much of this part of the township is used only for ranching. The tops of the valley slopes of South Saskatchewan river in this township lie at about 2,300 feet above sea-level in the east and about 2,150 feet above sea-level in the west. Water-level in the river is about 1,780 feet above sea-level at Saskatchewan Landing.

The southern half of the township is rolling country that rises gently southwards to about 2,450 feet above sea-level at the southern boundary of the township.

About 1 square mile in sections 13, 14, 23, and 24 is underlain by glacial lake clays. Most of the southern third of the township is underlain by moraine. Boulder clay underlies the remainder of the township.

In the southern half of the township all the wells except two are less than 50 feet deep. The supply of water from six wells in this part of the township is intermittent or inadequate for local requirements. The water in three wells is soft, and in the remainder the water is hard but is usable for all purposes. A well, 200 feet deep, on section 13, obtains water from an aquifer that is about 2,150 feet above sea-level, and a well on section 1 obtains alkaline water from an aquifer that is about 2,365 feet above sea-level.

In the northern half of the township a well 240 feet deep, on section 19, obtains hard water from an aquifer in the glacial drift that is about 2,010 feet above sea-level. This well is not now in use. There are several springs in the coulées leading to South Saskatchewan river, and a strong spring supplies the ranch on the SE. $\frac{1}{4}$, section 34, with hard water.

Township 20, Range 13

About 2 square miles in sections 4, 5, and 6 are included in the rural municipality of Saskatchewan Landing. The entire area is in the lower slopes of South Saskatchewan river. Elevations range from about 1,752 to 2,050 feet above sea-level.

Boulder clay underlies the area except in the northwest where there are outcrops of the Bearpaw formation.

Only one shallow well, which probably obtains water by seepage from South Saskatchewan river, is located in this township.

Township 20, Range 14

The slopes of the valley of South Saskatchewan river underlie most of that part of this township that is included in the rural municipality of Saskatchewan Landing. The top of the valley slopes

in this part of the township lies at about 2,200 feet above sea-level. The land surface above this elevation is comparatively flat, and the land may be used for farming.

A well 300 feet deep, on section 4, obtains hard water from an aquifer that is about 1,900 feet above sea-level. Water suitable for domestic purposes will probably be found in shallow wells put down in the sands and silts near South Saskatchewan river.

Township 20, Range 15

That part of township 20, range 15, south of South Saskatchewan river, includes most of sections 5 and 6. The entire area is in the valley of South Saskatchewan river and the slopes are generally too steep for farming. A valley that is occupied by an intermittent stream passes southward through the approximate centre of this area.

Boulder clay underlies the area except for some outcrops of Bearpaw shale in the valley slopes. No records of wells were obtained from this area, but ground water conditions are probably similar to those in the township to the South. Shallow wells near South Saskatchewan river will probably obtain water in the sand and silt of the river deposits.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF SASKATCHEWAN LANDING, NO. 167, SASKATCHEWAN

West of 3rd meridian	Township	17	17	17	18	18	18	19	19	19	20	20	20	Total No. in municipality
	Range	13	14	15	13	14	15	13	14	15	13	14	15	
Total No. of Wells in Township		26	26	28	26	34	29	10	25	17	1	1	0	223
No. of wells in bedrock		3	0	0	1	6	0	6	10	0	0	1	0	27
No. of wells in glacial drift		23	26	28	25	28	29	4	15	17	1	0	0	196
No. of wells in alluvium		0	0	0	0	0	0	0	0	0	0	0	0	0
Permanency of Water Supply														
No. with permanent supply		24	23	27	26	34	21	10	24	17	1	1	0	208
No. with intermittent supply		1	3	1	1	0	8	0	1	0	0	0	0	15
No. dry holes		1	0	0	0	0	0	0	0	0	0	0	0	1
Types of Wells														
No. of flowing artesian wells		0	0	0	0	0	0	0	0	0	0	0	0	0
No. of non-flowing artesian wells		14	10	10	16	33	4	10	18	6	0	1	0	122
No. on non-artesian wells		11	16	18	11	1	25	0	7	11	1	0	0	101
Quality of Water														
No. with hard water		18	24	26	22	29	29	4	20	15	0	0	0	177
No. with soft water		17	2	2	5	5	0	6	5	2	1	1	0	46
No. with salty water		0	0	0	0	0	0	0	0	0	0	0	0	0
No. with "alkaline" water		13	5	20	10	22	17	5	7	2	0	0	0	101
Depths of Wells														
No. from 0 to 50 feet deep		17	19	21	9	0	21	0	7	14	1	0	0	109
No. from 51 to 100 feet deep		2	5	7	7	7	7	0	5	1	0	0	0	41
No. from 101 to 150 feet deep		3	2	0	9	18	2	2	2	0	0	0	0	38
No. from 151 to 200 feet deep		2	0	0	0	6	0	0	4	1	0	0	0	13
No. from 201 to 500 feet deep		1	0	0	1	3	0	7	7	1	0	1	0	21
No. from 501 to 1,000 feet deep		0	0	0	0	0	0	1	0	0	0	0	0	1
No. over 1,000 feet deep		0	0	0	0	0	0	0	0	0	0	0	0	0
How the Water is Used														
No. usable for domestic purposes		24	25	24	23	33	29	10	25	15	1	1	0	210
No. not usable for domestic purposes		1	1	4	4	1	0	0	0	2	0	0	0	13
No. usable for stock		25	26	28	27	33	29	10	25	15	1	1	0	220
No. not usable for stock		0	0	0	0	1	0	0	0	2	0	0	0	3
Sufficiency of Water Supply														
No. sufficient for domestic needs		24	23	26	26	34	18	10	23	14	1	1	0	200
No. insufficient for domestic needs		1	3	2	1	0	11	0	2	3	0	0	0	23
No. sufficient for stock needs		24	23	20	26	34	10	10	23	12	1	1	0	184
No. insufficient for stock needs		1	3	8	1	0	19	0	2	5	0	0	0	39

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 water that may be termed suitable for use on the basis of its mineral salt content might be condemned on account of its bacteria content. Waters that are high in bacteria content have usually been polluted by surface waters.

Total Dissolved Mineral Solids

The term "total dissolved mineral solids" as here used refers to the residue remaining when a sample of water is evaporated to dryness. It is generally considered that waters that have less than 1,000 parts per million of dissolved solids are suitable for ordinary uses, but in the Prairie Provinces this figure is often exceeded. Nearly all waters that contain more than 1,000 parts per million of total solids have a taste due to the dissolved mineral matter. Resident

accustomed to the waters may use those that have much more than 1,000 parts per million of dissolved solids without any marked inconvenience, although most persons not used to highly mineralized water would find such waters highly objectionable.

Mineral Substances Present

Calcium and Magnesium

The calcium (Ca) and magnesium (Mg) content of water is dissolved from rocks and soils, but mostly from limestone, dolomite, and gypsum. The calcium and magnesium salts impart hardness to water. The magnesium salts are laxative, especially magnesium sulphate (Epsom salts, $MgSO_4$), and they are more detrimental to health than the lime or calcium salts. The calcium salts have no laxative or other deleterious effects. The scale found on the inside of steam boilers and tea-kettles is formed from these mineral salts.

Sodium

The salts of sodium are next in importance to those of calcium and magnesium. Of these, sodium sulphate (Glauber's salt, Na_2SO_4) is usually in excess of sodium chloride (common salt, NaCl). These sodium salts are dissolved from rocks and soils. When there is a large amount of sodium sulphate present the water is laxative and unfit for domestic use. Sodium carbonate (Na_2CO_3) "black alkali", sodium sulphate "white alkali", and sodium chloride are injurious to vegetation.

Sulphates

Sulphates (SO_4) are one of the common constituents of natural water. The sulphate salts most commonly found are sodium sulphate, magnesium sulphate, and calcium sulphate ($CaSO_4$). When the water contains large quantities of the sulphate of sodium it is injurious to vegetation.

Chlorides

Chlorides are common constituents of all natural water and are dissolved in small quantities from rocks. They usually occur as sodium chloride and if the quantity of salt is much over 400 parts per million the water has a brackish taste.

Iron

Iron (Fe) is dissolved from many rocks and the surface deposits derived from them, and also from well casings, water pipes, and other fixtures. More than 0.1 part per million of iron in solution will settle as a red precipitate upon exposure to the air. A water that contains a considerable amount of iron will stain porcelain, enamelled ware, and clothing that is washed in it, and when used for drinking purposes has a tendency to cause constipation, but the iron can be almost completely removed by aeration and filtration of the water.

Hardness

Calcium and magnesium salts impart hardness to water. Hardness of water is commonly recognized by its soap-destroying powers as shown by the difficulty of obtaining lather with soap. The total hardness of a water is the hardness of the water in its original state. Total hardness is divided into "permanent hardness" and "temporary hardness". Permanent hardness is the hardness of the water remaining after the sample has been boiled and it represents the amount of mineral salts that cannot be removed by boiling. Temporary hardness is the difference between the total hardness and the permanent hardness and represents the amount of mineral salts that can be removed by boiling. Temporary hardness is due mainly to the bicarbonates of calcium and magnesium and iron, and permanent harness to the sulphates and chlorides of calcium and magnesium. The permanent hardness

can be partly eliminated by adding simple chemical softeners such as ammonia or sodium carbonate, or many prepared softeners. Water that contains a large amount of sodium carbonate and small amounts of calcium and magnesium salts is soft, but if the calcium and magnesium salts are present in large amounts the water is hard. Water that has a total hardness of 300 parts per million or more is usually classed as excessively hard. Many of the Saskatchewan water samples have a total hardness greatly in excess of 300 parts per million; when the total hardness exceeded 3,000 parts per million no exact hardness determination was made. Also no determination for temporary hardness was made on waters having a total hardness less than 50 parts per million. As the determinations of the soap hardness in some cases were made after the samples had been stored for some time, the temporary hardness of some of the waters as they come from the wells probably is higher than that given in the table of analyses.

Analyses of Water Samples from the Municipality of Saskatchewan Landing, No. 167, 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	SE.	15	17	13	3rd	30												58	166	119			75	7		* 1
2	SE.	15	17	13	3	5												73	3	35			34	2		* 1
3	SE.	6	18	13	3	40													1,159	297	490		534	119		* 1
4	SE.	6	18	13	3	10												108	10	66				7		* 1
5	NW.	8	18	13	3	11												174	37	88				13		* 1
6	SW.	7	18	13	3	10												242	170	115				13		* 1
7	NE.	22	18	13	3	112	1,180												(4)		(5)	(2)	(1)	(3)		* 2
8	SW.	29	18	13	3	45	4,694											(4)	(2)		(3)		(1)		(5)	* 1
9	SE.	1	19	14	3	244	1,423												(3)		(5)	(2)	(1)	(4)		* 2
10	NW.	34	19	14	3	200	1,463												(4)		(5)	(2)	(1)	(3)		* 2

Water samples indicated thus, * 1, are from glacial drift or other unconsolidated deposits.
Water samples indicated thus, * 2, are from bedrock, Bearpaw formation.
Analyses are reported in parts per million; where numbers (1), (2), (3), (4), and (5) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
Analyses Nos. 7, 8, 9, and 10, by Provincial Analyst, Regina; Analyses Nos. 1 to 6 by Canadian Pacific Railway.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

The chief uses to which water is applied on the prairie farms are for drinking, watering stock, washing, cooking, and irrigation. The gasoline engine has so largely displaced the steam engine on the prairie farms that very little water on the farms is used to produce steam.

The upper limit of the amount of dissolved mineral matter in water that is suitable for drinking varies with the composition of the solids, and as the person who drinks the water becomes accustomed to its use. The arbitrary upper limit of 1,000 parts per million of total solids is exceeded in most of the waters from the glacial drift, and water that contains twice this amount of total solids is used for drinking at many farms without any apparent ill effects to the residents, If the amount of the total solids much exceeds 2,000 parts per million it is advisable to attempt to secure a less highly mineralized water for drinking.

As regards the taste of water, calcium sulphate ($CaSO_4$), calcium carbonate ($CaCO_3$), and magnesium carbonate ($MgCO_3$) are practically tasteless. These salts are not laxative and water that contains a considerable proportion of them may be drunk with impunity.

Sodium sulphate (Na_2SO_4) and magnesium sulphate ($MgSO_4$) are laxative salts. In estimating the laxative properties of waters the following data are of interest. The purgative dose of anhydrous sodium sulphate and anhydrous magnesium sulphate is above one-half a Troy ounce, or 240 grains. A water that contains 1,000 parts per million of either of the two sulphates mentioned contains 70 grains of these salts a gallon. The continued use of mildly laxative waters usually builds up within certain limits a resistance to their laxative properties.

Magnesium sulphate ($MgSO_4$), and to a much less degree sodium sulphate, impart a bitter taste to water if they occur in

considerable proportions. Sodium chloride, NaCl, in concentrations of about 400 parts per million, gives a brackish taste to water, and water that contains much over 400 parts per million has a salty taste and at still higher concentrations of sodium chloride fails to quench thirst. Sodium carbonate (Na_2CO_3), in concentrations of about 500 parts per million, or over, gives water a flat, "soda" taste that is especially noticeable if the water is not very cold. Sodium chloride and sodium carbonate are very rarely present in large enough concentrations in water from the glacial drift to affect the taste of the water.

The upper limit of the concentration of dissolved solids in water for watering stock is usually considered to be about twice that of the concentration of water for drinking purposes. A mildly laxative water is beneficial for winter use with dry feed, but some prairie waters are so laxative that they scour the stock and the use of such waters should be discontinued.

For laundry work the hardness and the iron content of the water are important. Most waters from the drift are very hard, and as the hardness is largely due to the presence of the sulphates of calcium and magnesium this hardness cannot be removed by boiling, although boiling does remove any hardness that may be due to the presence of the carbonates of calcium and magnesium. Iron in water will stain clothes, but iron is easily removed by aerating the water or by boiling the water.

Sodium carbonate in water extracts the colouring matter from organic matter, especially when the water is hot. A few of the waters from the drift contain enough sodium carbonate to turn tea or coffee black. Iron will combine with the tannic acid of tea and coffee to produce a black, ink-like compound, but iron is removed from the water by boiling.

"Black alkali" (Na_2CO_3) is particularly harmful in water that is used for irrigation, and the presence of a few hundred parts

per million of "black alkali" makes water unsuitable for irrigation. Calcium sulphate, however, tends to counteract the deleterious effects of sodium carbonate.

"White alkali" (sodium sulphate) and sodium chloride are less detrimental to plants than "black alkali", but if water contains considerable concentrations of white alkali it cannot be used for irrigation.

Under favourable conditions of drainage, and under careful control, water containing several thousand parts of dissolved solids per million has been successfully used in irrigation, but the small rainfall, the rapid evaporation during the summer months, the poor drainage conditions, and the fine-grained nature of a large part of the soil in the prairies make water of this nature unsuitable for irrigation in southern Saskatchewan.

Waters Nos. 1 to 6 and water No. 8, in the Table of Analyses, are from the glacial drift. Waters Nos. 2, 4, 5, and 6 contain less than 500 parts per million of dissolved solids and are from shallow wells in which the water is probably largely seepage. In all these four waters the calcium salts predominate over the sodium salts and the sodium chloride is less than 15 parts per million. Water No. 2 is the softest of the group and the well from which it was taken is probably spring fed. The other three waters are slightly hard, but are much less hard than the average well water from the glacial drift.

Waters Nos. 1 and 3 are from moderately deep wells. Water No. 1 is from a well on the slope of a hill where ground water circulation is probably fairly rapid; this water contains very little sodium chloride and it is used by the Canadian Pacific railway for locomotives. Water No. 3 is from a well close to a low area in which salts will probably accumulate in the ground water. It is sulphate water that is very slighly laxative, and contains more sodium chloride than any of the other drift waters analysed. Water No. 8 is from a well that is situated at the edge of a very shallow valley that passes

through flat country. The exact amounts of the constituents in this water are not given, but the water is probably laxative due to the sulphates of sodium and magnesium present. It is very hard as it contains much calcium sulphate and magnesium sulphate. The water is unfit for drinking, and its continuous use for stock is not advisable.

Water from the Bedrock

Waters Nos. 7, 9, and 10 are from wells in the bedrock. In all the waters the total dissolved solids are less than 1,500 parts per million, and sodium sulphate and sodium carbonate are the principal salts. All the waters are slightly hard. Water No. 9 is harder than waters 7 and 10. The softness of water in the bedrock is thought to be due to a process of base exchange between the calcium salts in the water and the sodium salts in the minerals in the sand of the aquifers. In the Darmody-Riverhurst artesian area east of this municipality the soft water from the bedrock aquifers contains sodium-sulphate, carbonate, and chloride, the relative abundance being in the order given; the calcium salts are absent or present only in very small concentrations. Waters Nos. 7, 9, and 10 appear to be derived from aquifers in which the base exchange process is not completed. These waters should be used with caution for irrigation as they contain a considerable proportion of sodium carbonate, but the presence of calcium sulphate in these waters makes them less harmful to plants than the waters in the Darmody-Riverhurst artesian area. These waters are suitable for all purposes except irrigation.

WELL RECORDS—Rural Municipality of SASKATCHEWAN LANDING, NO. 167, 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.	2	17	13	3	Dug	16	2,490	- 11	2,479	16	2,474	Glacial sand	Hard	43	D, S	Sufficient supply.
2	SW.	4	"	"	"	Drilled	125	2,500	-110	2,390	125	2,375	Glacial sand	Hard, "alkaline"	42	D, S	Sufficient supply; 168-foot dry hole.
3	SE.	5	"	"	"	Drilled	165	2,500			165	2,335	Glacial sand	Very hard, iron, odour, "alkaline"	45	D, S	Sufficient supply.
4	SE.	10	"	"	"	Bored	69	2,510	- 54	2,456	69	2,441	Bearpaw	Soft	42	D, S	Sufficient supply.
5	NE.	12	"	"	"	Drilled	125	2,575	-110	2,465	125	2,450	Bearpaw	Soft	42	D, S	Sufficient supply.
6	SE.	13	"	"	"	Drilled	220	2,550	- 75	2,475	220	2,330	Bearpaw	Soft	42	D, S	Sufficient supply.
7	NE.	14	"	"	"	Spring	3	2,590	- 0	2,590	3	2,587	Glacial gravel	Medium hard	46	D, S	Sufficient for local needs.
8	SE.	15	"	"	"	Dug	30	2,500			30	2,470	Glacial drift	Soft	42	D	Sufficient; Canadian Pacific Railway well used for locomotives. Another well 5 feet deep. #.
9	SW.	15	"	"	"	Dug	24	2,505	- 18	2,487	24	2,481	Glacial sand and gravel	Hard, "alkaline"	42	D, S	
10	SW.	16	"	"	"	Dug	24	2,500	- 20	2,480	24	2,476	Glacial sand	Hard, "alkaline"	44	D, S	
11	NW.	20	"	"	"	Dug	10	2,490	- 6	2,484	10	2,480	Glacial sand	Hard, slight odour, "alkaline"	42	S	Sufficient for stock needs.
12	NE.	21	"	"	"	Dug	12	2,500	- 8	2,492	12	2,488	Glacial sand	Hard, "alkaline"	43	D, S	
13	NE.	22	"	"	"	Spring		2,450	+ 1	2,451							Yields large quantity of water all year.
14	NW.	23	"	"	"	Dug	18	2,450	- 11	2,439	18	2,432	Glacial sand	Soft	43	D, S	Sufficient supply.
15	SW.	24	"	"	"	Drilled	125	2,560	- 75	2,485	125	2,435	Glacial sand	Hard, "alkaline"	42	D, S	Sufficient supply.
16	SE.	24	"	"	"	Dug	20	2,500	- 18	2,482	20	2,480	Glacial sand	Hard, "alkaline"	43	D, S	Sufficient supply.
17	NE.	26	"	"	"	Drilled	48	2,400	- 33	2,367	48	2,352	Glacial sand	Hard, "alkaline"	42	D, S	Sufficient supply.
18	SE.	27	"	"	"	Drilled	58	2,450	- 50	2,400	58	2,392	Glacial sand	Hard, "alkaline"	46	D, S	Sufficient supply.
19	SW.	28	"	"	"	Dug	14	2,500	- 10	2,490	14	2,486	Glacial quicksand	Hard, "alkaline"	42	D, S	Sufficient supply.
20	SE.	30	"	"	"	Dug	14	2,470	- 10	2,460	14	2,456	Glacial sand	Hard, "alkaline"	44	D, S	Sufficient supply.
21	SW.	30	"	"	"	Dug	16	2,455	- 12	2,443	16	2,439	Glacial drift	Soft	42	D, S	Sufficient supply.
22	SW.	31	"	"	"	Dug	24	2,440	- 14	2,426	24	2,416	Glacial drift	Soft, cloudy, slightly odourous	41	S	Intermittent; insufficient supply.
23	NW.	32	"	"	"	Drilled	70	2,450	- 40	2,410	70	2,380	Glacial sand	Hard	44	D, S	Sufficient supply.
24	SE.	32	"	"	"	Drilled	70	2,450	- 40	2,410	70	2,380	Glacial sand	Hard	42	D, S	Sufficient supply.
25	SE.	35	"	"	"	Dug	9	2,400	- 2	2,398	9	2,391	Glacial quicksand	Hard, "alkaline"	43	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 SASKATCHEWAN LANDING, NO. 167, 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	17	14	3	Dug	40	2,510	- 25	2,485	40	2,470	Glacial quick-sand	Hard		D, S, I	Sufficient for local needs.
2	NE.	2	"	"	"	Dug	15	2,450	- 2	2,448	15	2,435	Glacial quick-sand	Hard		S	Sufficient supply.
3	NW.	3	"	"	"	Dug	30	2,405	- 20	2,385	30	2,375	Glacial gravel	Hard, iron, red sediment		D, S	Sufficient supply.
4	SE.	4	"	"	"	Dug	14	2,405	- 9	2,396	14	2,391	Glacial quick-sand	Hard, brown sediment		D, S	Sufficient supply.
5	NW.	6	"	"	"	Dug	12	2,420	- 8	2,412	12	2,408	Glacial drift	Hard, "alk-aline"		S	Sufficient for local needs.
6	NW.	7	"	"	"	Dug	20	2,415	- 14	2,401	20	2,395	Glacial drift	Hard, iron, brown sedi-ment, "alk-aline"		D, S	
7	SW.	9	"	"	"	Dug 5	11	2,415	- 8	2,407	11	2,404	Glacial quick-sand	Soft		D, S	Sufficient supply.
8	SE.	10	"	"	"	Dug	25	2,400	- 17	2,383	25	2,375	Glacial gravel	Hard		S	Sufficient supply.
9	NE.	15	"	"	"	Dug	12	2,400	- 8	2,392	12	2,388	Glacial drift	Soft		D, S	Supply intermittent.
10	SW.	16	"	"	"	Dug	16	2,400	- 12	2,388	16	2,384	Glacial quick-sand	Hard, iron, "alkaline"		D, S	Sufficient supply.
11	SE.	17	"	"	"	Dug	12	2,405	- 6	2,399	12	2,393	Glacial sand	Hard, some sediment, "alkaline"		D, S	Sufficient supply.
12	SE.	18	"	"	"	Dug	22	2,400	- 14	2,386	22	2,378	Glacial drift	Hard, iron, "alkaline"		S	Sufficient for local needs.
13	SE.	19	"	"	"	Bored	75	2,400			75	2,325	Glacial gravel	Medium hard		D, S	Sufficient supply.
14	SW.	21	"	"	"	Drilled	106	2,410	- 90	2,320	106	2,304	Glacial quick-sand	Medium hard, iron, red sediment		D, S	Sufficient for local needs.
15	SW.	22	"	"	"	Drilled	50	2,420			50	2,370	Glacial gravel	Hard, iron		D, S	Sufficient supply.
16	SE.	23	"	"	"	Dug	60	2,410	- 50	2,360	60	2,350	Glacial sand and gravel	Medium hard		D, S	Sufficient supply.
17	SE.	24	"	"	"	Dug	12	2,450	- 8	2,442	12	2,338	Glacial quick-sand	Medium hard		D, S	Sufficient supply; a spring on this section.
18	SE.	25	"	"	"	Dug	12	2,450	- 9	2,441	12	2,438	Glacial sand	Hard		D	Spring supplies stock.
19	SE.	26	"	"	"	Drilled	60	2,450	- 55	2,395	60	2,390	Glacial gravel	Medium hard		D, S	Sufficient supply.
20	NE.	27	"	"	"	Bored	55	2,430	- 45	2,385	55	2,375	Glacial gravel	Medium hard		D, S	Sufficient supply.
21	NE.	28	"	"	"	Dug	30	2,450	- 25	2,425	30	2,420	Glacial gravel	Medium hard, iron, slight sediment		D, S	Sufficient supply.
22	SE.	32	"	"	"	Dug	125	2,450			125	2,325	Glacial sand and gravel	Hard, iron, brown sedi-ment		D, S	Sufficient supply.
23	NE.	36	"	"	"	Drilled	60	2,425			60	2,365	Glacial sand	Medium hard		D, S	Sufficient supply.
24	SW.	36	"	"	"	Dug	40	2,445	- 36	2,409	40	2,405	Glacial gravel	Hard, odour-ous		D, S	Intermittent supply.

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

WELL RECORDS—Rural Municipality of SASKATCHEWAN LANDING, NO. 167, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	NW.	1	17	15	3	Dug	18	2,388	- 15	2,373	18	2,370	Glacial fine sand	Hard, "alkaline"	42	S	Sufficient supply.
2	NE.	2	"	"	"	Dug	33	2,400	- 30	2,370	33	2,367	Glacial fine sand	Soft	42	D	Insufficient supply; a second 28-foot well for stock.
3	NW.	4	"	"	"	Dug	45	2,400	- 35	2,365	45	2,355	Glacial gravel	Hard, iron, "alkaline" odourous	44	D, S	Sufficient supply.
4	SE.	4	"	"	"	Dug	45	2,400	- 36	2,364	45	2,355	Glacial gravel	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
5	SW.	6	"	"	"	Bored	60	2,450	- 52	2,398	60	2,390	Glacial fine sand	Hard, iron, "alkaline"	45	D, S	Sufficient supply.
6	SE.	10	"	"	"	Bored	40	2,400	- 36	2,364	40	2,360	Glacial gravel	Hard, "alkaline"	44	D, S	Sufficient supply.
7	SW.	12	"	"	"	Dug	14	2,385	- 11	2,374	14	2,371	Glacial drift	Hard, clear, "alkaline"	41	D, S	Sufficient supply.
8	NW.	13	"	"	"	Dug	40	2,400	- 34	2,366	40	2,360	Glacial sand	Hard, iron, brown sediment, "alkaline"	42	D, S	Sufficient supply.
9	SW.	14	"	"	"	Dug	60	2,380	- 40	2,340	60	2,320	Glacial sand	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
10	SE.	14	"	"	"	Dug	14	2,385	- 9	2,387	14	2,371	Glacial sand	Hard, iron, "alkaline"	43	S	Sufficient supply.
11	SW.	16	"	"	"	Dug	16	2,400	- 8	2,392	16	2,384	Glacial sand	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
12	SW.	18	"	"	"	Bored	40	2,400	- 0	2,400	40	2,360	Glacial drift	Hard, iron, "alkaline"	42	D, S	Intermittent supply.
13	SW.	19	"	"	"	Bored	60	2,400	- 45	2,355	60	2,340	Glacial gravel	Hard, iron, 5 "alkaline"	42	D, S	Sufficient supply.
14	NE.	20	"	"	"	Dug	30	2,400	- 24	2,376	30	2,370	Glacial sand	Hard, iron, "alkaline"	42	D, S	Sufficient supply.
15	NW.	20	"	"	"	Dug	40	2,400	- 30	2,370	40	2,360	Glacial sand	Hard, iron, alightly "alkaline"	42	D, S	Sufficient supply.
16	SE.	21	"	"	"	Dug	12	2,380	- 7	2,373	12	2,368	Glacial sand	Hard, iron, "alkaline"	42	D, S	Sufficient supply.
17	NW.	21	"	"	"	Dug	12	2,375	- 9	2,366	12	2,363	Glacial sand	Hard, iron, sediment	43	D, S	Sufficient supply.
18	SW.	22	"	"	"	Dug	40	2,375	- 30	2,345	40	2,335	Glacial sand	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
19	NE.	22	"	"	"	Dug	12	2,400	- 7	2,393	12	2,388	Glacial sand	Hard, brown, sediment, "alkaline"	43	D, S	Sufficient supply,
20	NE.	25	"	"	"	Dug	22	2,400	- 18	2,382	22	2,378	Glacial sand	Soft, some sediment	43	D, S	Sufficient supply.
21	SE.	26	"	"	"	Dug	10	2,400	- 8	2,392	10	2,390	Glacial sand	Hard, iron brown sediment, alkaline"	42		Insufficient supply.
22	SW.	27	"	"	"	Dug	10	2,400	- 8	2,392	10	2,390	Glacial sand	Hard, iron, brown sediment	42	D, S	Insufficient supply.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of SASKATCHEWAN LANDING, NO. 167, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
23	SW.	31	17	15	3	Bored	54	2,425	- 47	2,378	64	2,361	Glacial sand and gravel	Hard, "alkaline", sediment	42	D, S	Sufficient supply.
24	NE.	35	"	"	"	Dug	55	2,405	- 35	2,370	55	2,350	Glacial fine sand	Hard, "alkaline"	41	D, S	Insufficient supply; yields 2 barrels a day.
25	NW.	36	"	"	"	Bored	75	2,400	- 65	2,335	75	2,325	Glacial gravel and sand	Hard, "alkaline"	42	D	Insufficient supply; also 16-foot well for stock.
26	SW.	36	"	"	"	Bored	75	2,400	- 40	2,360	75	2,325	Glacial sand and gravel	Hard, slightly "alkaline"	42	D, S	Insufficient supply.
1	SE.	2	18	13	3	Bored	60	2,500	- 54	2,446	60	2,440	Glacial sand	Hard, cloudy, odour, "alkaline"	42	S	Sufficient supply.
2	SW.	3	"	"	"	Drilled	150	2,460	-100	2,360	150	2,310	Glacial drift	Hard, "alkaline"	41	D, S	Sufficient supply.
3	SE.	4	"	"	"	Drilled	120	2,450	- 80	2,370	120	2,330	Glacial drift	Hard, iron, odour	43	D, S	Sufficient supply.
4	NE.	4	"	"	"	Drilled	126	2,450	-102	2,348	126	2,324	Glacial drift	Hard, "alkaline"	43	D, S	Sufficient supply.
5	NW.	5	"	"	"	Drilled	58	2,410	- 28	2,382	58	2,352	Glacial quicksand	Very hard, iron, "alkaline"	42	D, S	Sufficient supply.
6	SE.	6	"	"	"	Bored	40	2,400	- 35	2,365	40	2,360	Glacial sand	Hard, "alkaline"	44	D, S	Sufficient supply; #. Another well 10 feet deep. #.
7	SW.	6	"	"	"	Bored	60	2,405	- 30	2,375	60	2,345	Glacial drift	Hard, "alkaline"	42	D, S	Sufficient supply.
8	SW.	7	"	"	"	Dug	28	2,405	- 21	2,384	28	2,377	Glacial gravel	Hard, iron, "alkaline"	42	D, S	Sufficient supply; also two 30-foot wells, one soft water, other hard; and one 10-foot well, #.
9	NW.	8	"	"	"	Dug	20	2,420	- 16	2,404	20	2,400	Glacial drift	Medium hard, odour	43	D, S	Sufficient supply; derives its supply from nearby slough and spring; another well 11 feet deep.
10	NW.	9	"	"	"	Dug	6	2,400	+ 2	2,402	6	2,394	Glacial drift	Hard	44	D, S	Sufficient supply; this well is spring-fed.
11	NE.	10	"	"	"	Bored	120	2,425	-100	2,325	120	2,305	Glacial drift	Hard, "alkaline"	43	D, S	
12	NW.	12	"	"	"	Dug	15	2,290	- 6	2,284	15	2,275	Glacial sand	Soft	48	D, S	This well is spring-fed.
13	NW.	14	"	"	"	Bored	70	2,300			70	2,230	Glacial drift	Hard, iron, "alkaline"	44	D, S	Sufficient supply.
14	SE.	16	"	"	"	Bored	135	2,430	-100	2,330	135	2,295	Glacial drift	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
15	NE.	16	"	"	"	Bored	67	2,415	- 47	2,368	67	2,348	Glacial drift	Soft	43	D, S	Sufficient supply.
16	SW.	18	"	"	"	Dug	20	2,400	- 17	2,383	20	2,380	Glacial sand	Soft	44	D, S	Sufficient supply.
17	NW.	20	"	"	"	Bored	85	2,425			85	2,340	Glacial drift	Hard	45	D, S	Sufficient supply.
18	SE.	21	"	"	"	Bored	80	2,410	- 75	2,335	80	2,330	Glacial drift	Hard, "alkaline"	43	D, S	Sufficient supply; also small dugout.
19	SW.	21	"	"	"	Drilled	130	2,425	- 90	2,335	130	2,295	Glacial drift	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
20	NE.	22	"	"	"	Bored	112	2,300	- 82	2,218	112	2,188	Glacial drift	Hard, "alkaline"	42	D, S	Sufficient supply; #.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of SASKATCHEWAN LANDING, NO. 167, 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
21	SW.	29	18	13	3	Dug	45	2,390	- 42	2,348	45	2,345	Glacial sand	Very hard, "alkaline" brown sediment	43	D, S	Intermittent supply; not used for drinking but for other household purposes; #
22	SW.	30	"	"	"	Drilled	125	2,410	-110	2,300	125	2,285	Glacial sand	Hard, iron, sulphur	42	D, S	Sufficient supply.
23	SW.	32	"	"	"	Drilled	325	2,427	-100	2,327	325	2,102	Bearpaw	Soft			Good for washing.
24	NW.	32	"	"	"	Bored	120	2,400	- 80	2,320	120	2,280	Glacial sand	Hard, iron	44	D, S	Sufficient; not used for drinking but for other household purposes.
1	SE.	1	18	14 ~~13~~	3	Drilled	108	2,410	- 90	2,320	108	2,302	Bearpaw	Hard, soda, cloudy	44	D, S	Sufficient supply.
2	SW.	2	"	"	"	Drilled	78	2,440	- 58	2,382	78	2,362	Glacial sand	Hard, trace of iron	42	D, S	Sufficient supply.
3	NE.	2	"	"	"	Drilled	112	2,430	- 97	2,333	112	2,318	Glacial sand	Hard, trace of iron	42	D, S	Sufficient supply.
4	SW.	3	"	"	"	Drilled	87	2,460	- 82	2,378	87	2,373	Glacial sand	Hard, rusty	42	D, S	Sufficient supply.
5	NE.	4	"	"	"	Drilled	103	2,445	- 83	2,362	103	2,342	Glacial sand	Hard, iron	42	D, S	Sufficient supply.
6	NW.	6	"	"	"	Drilled	288	2,450	- 80	2,370	288	2,162	Bearpaw	Soft, soda		N	Abandoned.
7	NW.	6	"	"	"	Drilled	287	2,450	-187	2,263	287	2,163	Bearpaw	Soft	42	D, S	Sufficient supply.
8	NE.	6	"	"	"	Drilled	301	2,450	- 201	2,249	301	2,149	Bearpaw	Soft	41	D, S	Sufficient supply.
9	SW.	9	"	"	"	Drilled	340	2,475	-160	2,315	340	2,135	Bearpaw	Soft	40	D, S	Sufficient supply.
10	SW.	10	"	"	"	Drilled	130	2,460	-115	2,345	130	2,330	Glacial sand	Hard, iron, "alkaline"	41	D, S	Sufficient supply.
11	NE.	10	"	"	"	Drilled	165	2,450	-150	2,300	165	2,285	Glacial sand	Hard, iron, "alkaline"	41	D, S	Sufficient supply.
12	NW.	14	"	"	"	Drilled	145	2,450	-130	2,320	145	2,305	Glacial sand	Hard, iron, "alkaline"	41	D, S	Sufficient supply.
13	NE.	15	"	"	"	Drilled	92	2,445	- 77	2,368	92	2,353	Glacial sand	Hard, iron, "alkaline"	41	D, S	Sufficient supply.
14	SW.	15	"	"	"	Drilled	112	2,450	- 97	2,353	112	2,338	Glacial sand	Hard, iron, "alkaline"	41	D, S	Sufficient supply.
15	NE.	16	"	"	"	Drilled	116	2,455	-101	2,354	116	2,339	Glacial sand	Hard, iron, "alkaline"	41	D, S	Sufficient supply.
16	NE.	17	"	"	"	Drilled	178	2,460	-163	2,297	178	2,282	Glacial sand	Hard, iron, "alkaline"	41	D, S	Sufficient supply.
17	NW.	18	"	"	"	Drilled	118	2,450	-106	2,344	118	2,332	Glacial sand	Hard, red sediment	42	D, S	Sufficient supply.
18	NE.	20	"	"	"	Drilled	187	2,450	-172	2,278	187	2,263	Glacial sand	Hard, iron, "alkaline"	41	D, S	Sufficient supply.
19	NW.	23	"	"	"	Drilled	120	2,440	-105	2,335	120	2,320	Glacial sand	Hard, iron, "alkaline"	42	D, S	Sufficient supply.
20	SW.	24	"	"	"	Drilled	108	2,460	- 90	2,370	108	2,352	Glacial sand	Hard, iron, "alkaline	43	D, S	Sufficient supply.
21	SE.	24	"	"	"	Drilled	128	2,420	-110	2,310	128	2,292	Glacial sand	Hard, iron, "alkaline"	43	D, S	Sufficient supply.

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WELL RECORDS—Rural Municipality of SASKATCHEWAN LANDING, NO. 167, 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
22	NW.	25	18	14	3	Drilled	112	2,425	- 95	2,330	112	2,313	Glacial sand	Hard, iron, red sediment, "alkaline"	44	D, S	Sufficient supply.
23	NE.	27	"	"	"	Drilled	120	2,400	-100	2,300	120	2,280	Glacial sand	Hard, iron, red sediment, "alkaline"	44	D, S	Sufficient supply.
24	SW.	27	"	"	"	Drilled	100	2,405	- 85	2,320	100	2,305	Glacial sand	Hard, iron	43	D, S	Sufficient supply.
25	SE.	28	"	"	"	Drilled	101	2,410	- 85	2,325	101	2,309	Glacial sand	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
26	NE.	28	"	"	"	Drilled	105	2,400	- 90	2,310	105	2,295	Glacial sand	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
27	SW.	28	"	"	"	Drilled	200	2,425	-180	2,245	200	2,225	Glacial sand	Hard, iron, "alkaline"	44	D, S	Sufficient supply.
28	SW.	29	"	"	"	Drilled	160	2,465	-140	2,325	160	2,305	Glacial sand	Hard, iron, "alkaline"	44	D, S	Sufficient supply.
29	NE.	30	"	"	"	Drilled	145	2,450	-125	2,325	145	2,305	Glacial sand	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
30	NW.	31	"	"	"	Drilled	187	2,425	-167	2,258	187	2,238	Glacial sand	Hard, iron, "alkaline"	45	D, S	Sufficient supply.
31	NE.	32	"	"	"	Drilled	80	2,400	- 65	2,335	80	2,320	Glacial sand	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
32	NW.	35	"	"	"	Drilled	200	2,400	-160	2,240	200	2,200	Bearpaw	Soft	44	D, S	Large yield.
33	NW.	36	"	"	"	Drilled	295	2,400	- 80	2,320	95	2,305	Glacial sand	Hard, iron, "alkaline"	44	D, S	Sufficient supply.
34	NE.	36	"	"	"	Drilled	100	2,410	- 85	2,325	100	2,310	Glacial sand	Hard, "alkaline"	42	D, S	Sufficient supply.
1	SW.	1	18	15	3	Bored	25	2,410	- 15	2,395	25	2,385	Glacial drift	Medium hard, "alkaline"	44	D, S	Intermittent supply.
2	NE.	2	"	"	"	Bored	68	2,450	- 6	2,444	68	2,382	Glacial gravel	Medium hard, "alkaline", iron	44	D, S	Sufficient supply.
3	SW.	5	"	"	"	Dug	39	2,415	- 35	2,380	39	2,376	Glacial gravel	Medium hard	44	D, S	Sufficient supply.
4	NW.	5	"	"	"	Bored	48	2,400	- 45	2,355	48	2,352	Glacial sand	Hard, sediment	44	D, S	Sufficient supply.
5	SW.	6	"	"	"	Bored	39	2,415	- 34	2,381	39	2,376	Glacial sand	Hard, iron, "alkaline"	45	D, S	Sufficient supply.
6	SW.	7	"	"	"	Bored	60	2,410	- 57	2,353	60	2,350	Glacial quicksand	Hard, iron, "alkaline"	46	D, S	Sufficient supply.
7	SE.	8	"	"	"	Dug	12	2,350	- 9	2,341	12	2,338	Glacial quicksand	Medium hard, iron	46	D, S	Sufficient supply.
8	NE.	10	"	"	"	Bored	60	2,430	- 56	2,374	60	2,370	Glacial quicksand	Hard, iron	46	D, S	Sufficient supply.
9	SW.	12	"	"	"	Bored	60	2,460	- 55	2,405	60	2,400	Glacial gravel	Hard, "alkaline"	46	D, S	Sufficient supply.
10	SE.	14	"	"	"	Dug	18	2,475	- 15	2,460	18	2,457	Glacial gravel	Hard	46	D	Intermittent supply.
11	SW.	14	"	"	"	Bored	50	2,425	- 47	2,378	50	2,375	Glacial gravel	Hard	45	D	Insufficient supply.
12	SE.	15	"	"	"	Bored	80	2,425	- 72	2,353	80	2,345	Glacial gravel	Hard, iron, sediment	44	D, S	Sufficient supply.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of SASKATCHEWAN LANDING, NO. 167, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
13	SW.	16	18	15	3	Bored	36	2,400	- 33	2,367	36	2,334	Glacial gravel	Hard, iron	45	D, S	Sufficient supply.
14	SW.	18	"	"	"	Bored	52	2,450	- 35	2,415	52	2,398	Glacial gravel	Hard, iron, "alkaline"	45	D, S	Sufficient supply.
15	NE.	18	"	"	"	Dug	16	2,450	- 15	2,435	16	2,434	Glacial gravel	Soft, colour	45	S	Sufficient supply.
16	SW.	20	"	"	"	Dug	14	2,475	- 10	2,465	14	2,461	Glacial drift	Hard, "alkaline"	45	D	Intermittent supply.
17	NE.	22	"	"	"	Bored	55	2,450	- 49	2,401	55	2,395	Glacial gravel	Hard, "alkaline"	45	D, S	Sufficient supply.
18	NW.	22	"	"	"	Dug	14	2,450	- 10	2,440	14	2,436	Glacial gravel	Hard, "alkaline"	45	D, S	Insufficient supply.
19	SW.	24	"	"	"	Dug	16	2,450	- 11	2,439	16	2,434	Glacial drift	Medium hard, sediment	45	S	Insufficient supply.
20	NW.	24	"	"	"	Dug	14	2,450	- 8	2,442	14	2,436	Glacial drift	Hard, "alkaline"	45	D	Intermittent supply.
21	SW.	27	"	"	"	Dug	11	2,450	- 7	2,443	11	2,439	Glacial quicksand	Hard, "alkaline"	45	D, S	Sufficient supply.
22	NE.	28	"	"	"	Bored	42	2,450	- 18	2,432	42	2,408	Glacial blue sand	Hard, iron	45	D, S	Intermittent supply.
23	NW.	30	"	"	"	Dug	16	2,350	- 12	2,338	16	2,334	Glacial sand	Hard, iron, "alkaline", sediment	45	D	Intermittent supply.
24	SW.	31	"	"	"	Bored	107	2,375	- 93	2,282	107	2,268	Glacial drift	Hard, iron, "alkaline"	45	D, S	Insufficient supply; a second well and dam in use at present.
25	NW.	32	"	"	"	Dug	12	2,450	- 7	2,443	12	2,438	Glacial quicksand	Hard, "alkaline"	45	D, S	Insufficient supply; intermittent.
26	NE.	33	"	"	"	Dug	12	2,450	- 8	2,442	12	2,438	Glacial drift	Hard, "alkaline", sediment	45	D, S	Intermittent supply.
27	SE.	34	"	"	"	Dug	14	2,455	- 9	2,446	14	2,441	Glacial quicksand	Hard, "alkaline"	45	D, S	Insufficient supply; has 14-foot dam.
28	NW.	34	"	"	"	Dug	17	2,450	- 11	2,439	17	2,433	Glacial quicksand	Hard, iron, "alkaline"	45	D, S	Intermittent supply.
29	SE.	36	"	"	"	Drilled	137	2,450	-122	2,328	137	2,313	Glacial blue sand	Very hard, rusty, grey sediment	42	D, S	Sufficient supply.
X 1	NW.	4	19	13	3	Drilled	250	2,342	-130	2,212	250	2,092	Bearpaw	Soft	43	D, S	Sufficient supply.
2	NW.	5	"	"	"	Drilled	102	2,382	63	2,319	102	2,280	Glacial drift	Hard	42	D, S	Sufficient supply.
X 3	NE.	6	"	"	"	Drilled	260	2,390	-180	2,210	260	2,130	Bearpaw	Soft, iron	52	D, S	Barely sufficient.
X 4	NW.	8	"	"	"	Drilled	232	2,374	-120	2,254	232	2,142	Bearpaw	Soft, cloudy, slightly "alkaline", red sediment		D, S	Sufficient supply.
X 5	SW.	8	"	"	"	Drilled	260	2,380	-150	2,230	260	2,120	Glacial drift	Very hard, "alkaline"	42	D, S	Sufficient supply.
X 6	SE.	16	"	"	"	Drilled	310	2,265	-210	2,055	310	1,955	Bearpaw	Soft	43	D, S	Sufficient supply.
7	NE.	18	"	"	"	Drilled	106	2,350	- 26	2,324	106	2,244	Glacial drift	Hard		D, S	Sufficient supply.
8	SW.	18	"	"	"	Drilled	260	2,374	-160	2,214	260	2,114	Glacial drift	Hard, odour cloudy, red sediment, "alkaline"	42	D, S	Sufficient supply.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of SASKATCHEWAN LANDING, NO. 167, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
9	SE.	30	19	13	3	Drilled	260	2,310	-160	2,150	260	2,050	Bearpaw	Soft, cloudy, red sediment, "alkaline"	43	D, S	Sufficient supply.
10	NE.	30	"	"	"	Drilled	260	2,270	-160	2,110	260	2,010	Bearpaw	Soft, cloudy, red sediment, "alkaline", odour	42	D, S	Sufficient supply.
1	SE.	1	19	14	3	Drilled	267	2,377	- 67	2,310	267	2,110	Bearpaw	Soft	43	D, S	Sufficient supply; #.
2	SE.	2	"	"	"	Drilled	80	2,390	- 65	2,325	80	2,310	Glacial sand	Hard, clear	48	D, S	Sufficient supply.
3	SW.	2	"	"	"	Drilled	102	2,400	- 85	2,315	102	2,298	Glacial sand	Hard	48	D, S	Sufficient supply.
4	SW.	3	"	"	"	Drilled	80	2,400			80	2,320	Glacial sand	Hard, iron, "alkaline"	46	D, S	Sufficient supply; at present not in use.
5	SE.	5	"	"	"	Drilled	150	2,400	- 80	2,320	150	2,250	Glacial gravel	Very hard, iron, sediment	48	D, S	Sufficient supply.
6	NE.	6	"	"	"	Dug	16	2,400			16	2,384	Glacial drift	Soft, odour	48	D, S	Not in use at present; water is seepage from slough.
7	NW.	7	"	"	"	Dug	18	2,350	- 13	2,337	18	2,332	Glacial sand	Soft	48	D, S	Sufficient supply.
8	NW.	9	"	"	"	Dug	16	2,400	- 12	2,388	16	2,384	Glacial quicksand	Soft	49	D, S	Sufficient supply.
9	SE.	12	"	"	"	Drilled	98	2,375	- 83	2,292	98	2,277	Glacial drift	Hard, slightly "alkaline"	47	D, S	Sufficient supply.
10	NE.	12	"	"	"	Drilled	167	2,213	-147	2,166	167	2,046	Glacial gravel	Hard, sediment, "alkaline"	42	D, S	Sufficient supply.
11	SW.	12	"	"	"	Drilled	98	2,365	- 88	2,277	98	2,267	Glacial gravel	Hard, "alkaline"	41	D, S	
12	NW.	14	"	"	"	Drilled	98	2,350	- 60	2,290	98	2,252	Glacial gravel	Medium hard	46	D, S	Sufficient supply.
13	SW.	15	"	"	"	Dug	12	2,350	- 8	2,342	12	2,338	Glacial sand	Hard, odour, sediment, "alkaline"	46	D, S	Intermittent supply.
14	SE.	16	"	"	"	Dug	18	2,360	- 12	2,348	18	2,342	Glacial gravel	Hard	45	D, S	Sufficient supply.
15	SW.	17	"	"	"	Dug	30	2,375	- 25	2,350	50	2,325	Glacial quicksand	Medium hard, sediment	46	D, S	
16	SE.	18	"	"	"	Dug	12	2,350	- 8	2,342	12	2,338	Glacial quicksand	Medium hard	48	D, S	Sufficient supply.
17	NW.	22	"	"	"	Drilled	200	2,345	-180	2,165	200	2,145	Bearpaw	Soft	46	D, S	Sufficient supply.
18	NE.	26	"	"	"	Drilled	265	2,225	-165	2,060	265	1,960	Glacial drift	Hard, "alkaline"	46	D, S	Sufficient supply.
19	SE.	27	"	"	"	Drilled	227	2,300	-167	2,133	227	2,073	Bearpaw	Slightly hard	48	D, S	Sufficient supply.
20	NW.	27	"	"	"	Drilled	160	2,287	-140	2,147	160	2,127	Bearpaw	Hard	46	D, S	Insufficient supply; laxative.
21	SE.	28	"	"	"	Drilled	250	2,297	-190	2,106	250	2,046	Bearpaw	Medium hard	47	D, S	Sufficient supply.
22	NW.	33	"	"	"	Drilled	225	2,225	-160	2,065	225	2,000	Bearpaw	Medium hard	45	D, S	Sufficient supply.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of ~~SASKATCHEWAN LANDING, NO. 167, SASKATCHEWAN~~.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
23	SW.	33	19	14	3	Drilled	310	2,350	-100	2,250	310	2,040	Bearpaw	Medium hard	47	D, S	Sufficient supply until quicksand filled in.
24	NW.	34	"	"	"	Drilled	200	2,252	-140	2,112	200	2,052	Bearpaw	Medium hard, s	43	D, S	Sufficient supply; #.
25	NE.	35	"	"	"	Drilled	265	2,245	-165	2,080	265	1,980	Bearpaw	Slightly hard, "alk-aline"	43	D, S	Sufficient.
1	SE.	1	19	15	3	Bored	85	2,450	- 65	2,385	85	2,365	Glacial drift	Hard, "alk-aline"	46	N	An 18-foot well in slough is used.
2	SW.	4	"	"	"	Dug	18	2,450	- 10	2,440	18	2,432	Glacial sand	Soft	44	D, S	Intermittent supply.
3	SE.	5	"	"	"	Dug	16	2,450	- 10	2,440	16	2,434	Glacial quick-sand	Medium hard	46	D, S	Sufficient supply.
4	SE.	7	"	"	"	Dug	10	2,400	- 5	2,395	10	2,390	Glacial gravel	Medium hard	46	D, S	Sufficient supply.
5	NW.	8	"	"	"	Dug	12	2,400	- 9	2,391	12	2,388	Glacial quick-sand	Medium hard	46	D, S	Sufficient supply.
6	NW.	9	"	"	"	Dug	20	2,400	- 15	2,385	20	2,380	Glacial quick-sand	Medium hard	46	D, S	Insufficient supply.
7	SE.	9	"	"	"	Bored	40	2,440	- 30	2,410	40	2,400	Glacial drift	Medium hard	46	D, S	Insufficient supply.
8	NE.	10	"	"	"	Dug	12	2,400	- 5	2,395	12	2,388	Glacial gravel	Medium hard	46	D, S	Sufficient supply.
9	NW.	12	"	"	"	Dug	30	2,400	- 20	2,380	30	2,370	Glacial sand	Hard, "alk-aline"	47	D, S	Sufficient supply.
10	SE.	13	"	"	"	Drilled	200	2,350	-180	2,170	200	2,150	Glacial quick-sand	Hard, iron	44	D, S	Sufficient supply.
11	SE.	15	"	"	"	Dug	16	2,380	- 10	2,370	16	2,364	Glacial quick-sand	Medium hard	46	D, S	Sufficient supply.
12	SW.	15	"	"	"	Dug	44	2,375	- 26	2,349	44	2,331	Glacial drift	Soft, sulphur	48	D	Insufficient supply; also 8-foot well and dam.
13	NW.	17	"	"	"	Bored	40	2,340	- 34	2,306	40	2,300	Glacial drift	Medium hard	46	D, S	Insufficient supply.
14	SE.	17	"	"	"	Bored	40	2,360	- 28	2,332	40	2,320	Glacial drift	Medium hard	46	D, S	Sufficient supply.
15	NE.	19	"	"	"	Drilled	240	2,250	-200	2,050	240	2,010	Glacial quick-sand	Hard, iron	48	N	Caved in lately.
1	NE.	6	20	13	3	Dug	10	1,790			10	1,780	Glacial drift	Soft		D, S	Sufficient supply.
1	SW.	4	20	14	3	Drilled	300	2,200	-150	2,050	300	1,900		Sediment	45	D, S	Sufficient supply.
	SE	22	17	13	3		44	2500	-3	2497	40	2460	Glacial gravel				No other information.
	SW	30	17	13	3		32	2450	-7	2443	30	2420	" "	Fresh			" " "
	NE	6	18	13	3		41	2400	-6	2394	40	2360	" "	Alkaline			" " "

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