CANADA
DEPARTMENT OF MINES

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

BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF PIAPOT No. 110 SASKATCHEWAN

BY

B. R. MacKay, H. H. Beach & D. P. Goodall

Water Supply Paper No. 119

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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 wate· 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.

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

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

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

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

<u>Water Table.</u> 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.

<u>Wells.</u> 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 <u>Flowing Artesian Wells.</u>

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

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

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

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

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

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

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

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

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

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Piapot, No. 110, covers an area of 324 square miles in the southwestern part of southern Saskatchewan. The municipality consists of nine townships, described as tps. 10, 11, and 12, ranges 22, 23, and 24, W. 3rd mer. The village of Piapot, situated on the main line of the Canadian Pacific railway in the north-central part of the municipality, is about 39 miles east of the Alberta-Saskatchewan boundary. The small hamlets of Cross and Sidewood are also located on this railway, being, respectively, about 5 miles southwest and 9 miles northeast of Piapot.

The northern half of the municipality consists of an undulating to level lowland plain. Surface elevations range between 2,450 and 2,650 feet above sea-level, but do not vary greatly from 2,500 feet along the railway in the north-central and northeastern parts. A few miles south of the railway the surface rises in a southerly direction, gently at first then more abruptly in the southern part reaching elevations as great as 3,800 feet along the southern border, in range 24. These southern townships lie on the northern slopes of the Cypress Hills uplands. In the southeastern part, through the southeastern half of township 10, range 22, the uplands form an irregularly rolling benchland at an average elevation of about 3,500 feet above sea-level.

The steep northern slopes from the uplands are deeply dissected by numerous small, intermittently flowing stream channels, all of which converge to form three larger streams known as Piapot, Skull, and Bridge creeks. Piapot creek flows in a northerly direction down the steep slopes onto the lowlands on the western side of the municipality, and then northeastward to cross the northern border in the north-central part of the area. Bear creek, flowing northward through range 23, joins Piapot creek less than a mile northwest of Piapot village. The eastern side of the municipality is drained by Skull creek, a small stream that flows northward through range 22. Bridge creek crosses the eastern border in sec. 13, tp. 11, range 22, and drains only a small area in the southeastern part of the municipality. Although the drainage is well developed in the sloping southern half of the area, the creeks in their passage through the northern lowlands drain only a small area in their immediate vicinity. Here undrained depressions in the land surface are occupied by shallow "alkali" lakes and sloughs. Some of the largest of these lakes occurring a few miles southwest of Sidewood each cover about 600 acres of land. Most of the lakes and sloughs are shallow and when visited in 1935 nearly all were either dry or contained water that was too highly mineralized to be used for watering stock.

The creeks are a much better source of water for stock. In the southern uplands the streams are mostly spring-fed, and some of them maintain a fairly constant flow for some distance below the spring. These streams all disappear below ground before they reach the lowlands, so that the creeks in the northern part are a source of water only during the spring run-off. The surface waters are conserved in some places by constructing dams in the creek bottoms. The water is used not only for stock but for irrigating fairly extensive areas of hay meadows.

The major source of water supply in the township is the ground water that occurs in the unconsolidated Recent and glacial drift deposits. In the lowlands the bedrock cannot be regarded as a source of supply, but in the southern uplands it is water bearing and is believed to contain the source beds for most of the springs that occur in this part of the municipality.

Water-bearing Horizons in the Unconsolidated Deposits

The unconsolidated deposits consist of Recent sediments laid down in the stream channels during periods of flood, Recent wind-blown sand deposits forming sand hills, and a thick mantle of glacial drift consisting of different types of deposits, which form the surface covering throughout the rest of the municipality.

The stream deposits are important as a source of ground water only in the southern half of the area. Here fairly deep coulées have been carved in the land surface and, where the gradient is not too steep, the coulée floors are usually covered with 10 to 20 feet of clays and silts that are interbedded with and underlain by discontinuous beds of well-sorted sands and gravels. These sand and gravel beds form splendid reservoirs for the accumulation of ground water, particularly if the bed is sealed by impervious clay at its lower end, thus preventing loss of water by underground flow. The water supply to these aquifers are replenished by springs seeping from the coulée banks or by direct seepage from the stream. The water may be moderately hard, but seldom contains more than very small quantities of mineral salts in solution. These porous beds have been encountered in wells sunk to depths of 10 to 15 feet. Owing to the irregular occurrence of the porous beds, however, extensive prospecting may be required in some places before a suitable supply is located.

On the lowlands the creeks occupy narrow stream channels with few tributaries and the stream deposits are probably too thin to provide any large supply of ground water. The wind-blown deposits form a belt of Recent sand dunes varying from 1 to 2 miles in width, extending through township 12, ranges 23 and 24, parallel to and on the north side of the railway. The dunes are shaped into small, irregular, round-topped hills, 30 to 50 feet in height, and are composed of fine-grained quartz sand.

The surrounding lowlands, including the northwestern half of township 12, range 22, township 12 and the northwestern part of township 11, range 23, and township 12 and the northern half of township 11, range 24, are largely covered by 10 to 30 feet of similar sands and sandy clays forming part of the glacial drift.

The glacial drift includes all deposits laid down by the great continental ice-sheet, which, many thousands of years ago, spread in a general southwesterly direction over the province of Saskatchewan, and such deposits as were formed by flood waters resulting from the melting ice. As the ice-sheet advanced and again as the ice front retreated to the northward due to melting of the ice it laid down a layer of compact, bluish grey boulder clay over the surface of the bedrock. Much of the area covered by boulder clay is only gently rolling, and is referred to as till plain in differentiating it from more irregularly rolling, hillocky areas known as moraine. The till covering the southern slopes is very thin in many places, and along Skull creek it has been entirely eroded away leaving the bedrock exposed at the surface. Toward the lowlands, however, the drift becomes thicker, and over the most northern townships it may extend down to depths of 150 to 200 feet. The areas of moraine are confined to the southeast corner and to two larger areas, one extending along the northern part of the eastern border and the other capping the uplands in the area intervening between Bear and Skull creeks. They are considered to represent areas in which the retreating ice front paused for a considerable period of time, thus allowing the greater accumulation of a more irregular surface type of drift. Waters from the melting ice front gathered to form a large lake that extended over the northern lowland of this municipality. Sediments washed into the lake from the uplands formed a layer of lake sand, and more occasionally clay, over the bottom. The present distribution of these sands and clays as indicated on the accompanying map, Figure 1, marks the past areal extent of this lake. In more recent times the prevailing winds acting upon these lake sands have blown them into the dunes forming the sand hills in the vicinity of Piapot.

Ground waters from the glacial drift deposits are obtained mostly from wells sunk to depths of less than 25 feet. Such shallow wells are particularly common in the northern lowlands where the lake sands form the water-bearing beds. Surface waters tend to seep through the sands to collect upon the surface of the more impervious, underlying boulder clay. Hence, the sands immediately above the clay form a fairly continuous water-bearing horizon over large areas. In the low depressions the water-table may be very near the surface, whereas at points of higher elevation wells 15 to 30 feet in depth are required to reach water.

At most places an adequate supply of water might be obtained except for the tendency of the fine quicksand to enter the wells and plug them to the water-level. The sand pressure also tends to collapse the well cribbing, so that the average life of many of these wells is probably not over three to four years. Sand-points are used with some success, but the fine-meshed screen required becomes completely plugged. Sand-points driven to the bottom of the sand are usually the most successful producers. It is possible that the sand becomes coarser at depth. Ground water conditions in the dune-covered area are not essentially different from those existing in the lake sand areas. The dune sands, however, are even less consolidated, making it difficult to sink wells more than a few feet below the surface of the water-table. Waters contained in the lake sands vary greatly as to their mineral salt content from place to place. The greatest concentrations of mineral salts are encountered in waters obtained from shallow wells sunk in low flats, where surface evaporation tends to increase the salt concentration. In most of the wells in the area the water is hard and contains sufficient sulphate salts in solution to impart to it a slightly bitter taste, but only in a few places is the water reported to be so highly charged with sulphate salts as to be undrinkable.

The glacial lake clay as a rule is not sufficiently porous to permit ground water accumulation, although in this municipality it contains pockets of porous clays or sands, or may overlie sand beds that are water bearing. The till and moraine-covered areas, occupying considerably more than the southeastern half of the municipality, also yield water at shallow depths. The water here is concentrated in small, irregular-shaped pockets of sand and gravel that occur interspersed through the boulder clay. Wells encountering these water supplies are usually situated in the low depressions in the land surface, near sloughs, in draws, or at the bases of the steeper slopes. The yields from these wells are quite variable, and most of them are materially affected by drought conditions. The mineral salt concentration of the waters is also variable, but few waters from shallow depths in the drift are reported to be so highly mineralized as to be unsuitable for domestic use.

Water-bearing beds consisting largely of gravels and porous clays also occur at greater depth in the glacial drift in the lowland areas. These beds may in some places occur at the contact of the drift with the underlying bedrock. They have been tapped by wells sunk to depths ranging, as a rule, between 40 and

100 feet. The aquifers may represent material washed down from the uplands in early glacial or pre-glacial times, and subsequently covered by considerable thicknesses of boulder clay. Most of these wells are situated on the lower slopes and lowlands through township 11, range 24, but they may also occur at irregular intervals in other places in the northern two-thirds of the area, as a few other widely scattered wells are yielding water within this range of depths. Where these aquifers have been encountered in the west-central part of the township the waters are usually under sufficient hydrostatic pressure to cause the water to rise in the wells 20 to 40 feet above the aquifer. The water in most places is reported to be hard and quite suitable for drinking. Several analyses of waters from these wells are listed in the table of water analyses in a later section of this report.

It seems probable that the glacial drift is the most reliable source of ground water in the lowland part of the municipality, and extensive prospecting of the drift even in areas where little water has been found seems preferable to sinking wells into the underlying bedrock. On the uplands the drift is thinner and the underlying bedrock is porous and water bearing. Hence, should the supply found at shallow depths prove to be inadequate, deeper prospecting is recommended.

Water-bearing Horizons in the Bedrock

Four bedrock formations, known as the Cypress Hills, Ravenscrag, Eastend, and Bearpaw formations, immediately underlie the unconsolidated deposits in different parts of the municipality. All these formations may have at one time extended over the entire area, in the descending order given. Erosion, most of which took place prior to the deposition of the glacial drift, has entirely removed the three upper formations from the area north of the southern row of townships, so that now only the lowest or Bearpaw formation extends over the entire area. The overlying formations occupy progressively lesser areas up the steep slopes to the south, so that the Cypress Hills beds occur only on the highest land along the southern border at elevations greater than about 3,400 feet above sea-level.

The Cypress Hills formation is composed essentially of alternating layers of medium- to coarse-grained sand and sandstone interbedded with hard, cemented conglomerate. Water is encountered in wells sunk in this formation to depths ranging from only a few feet to 90 feet. The water is thought to be concentrated mostly in the lower beds, near the base of the formation, where they are underlain by less pervious beds of the Ravenscrag formation. Some of the springs that occur at elevations greater than 3,400 feet above sea-level on the edge of the benchland no doubt have their source beds in the Cypress Hills formation. Waters from aquifers in this formation are soft to moderately hard and are excellent for drinking.

The Ravenscrag formation underlying the Cypress Hills beds extends down to an elevation of about 3,300 to 3,250 feet above sea-level and underlies the drift for a short distance down the northern slopes beyond the border of the Cypress Hills formation. It consists chiefly of silts and soft shales interbedded with variable thicknesses of sands and sandstones and occasionally thin seams of lignite coal. The sands are generally grey to greenish grey, but weather to a light grey or buff in rock exposures. The colours of the shales range through a series of dark greys, greens, and browns, with the dark colours predominant. The sands and coal seams are sufficiently porous to form reservoirs for ground water accumulation and may be the source of many of the springs that occur on the steep slopes and coulée banks in areas where these sediments underlie the unconsolidated deposits. Wells sunk in the Ravenscrag formation are likely to strike an adequate water supply in any part of the southern uplands, although it may be necessary to drill to depths of 200 to 250 feet at most places on the southern benchland. These waters are slightly harder than, but otherwise not essentially different from, water in the Cypress Hills formation, and are usually quite satisfactory for domestic use.

The Eastend formation underlying the Ravenscrag beds extends for 1 to 2 miles farther north and down to an elevation of about 3,100 feet above sea-level. It is composed largely of grey clay shales and silts interbedded with a few thin porous layers of sand and sandstone. Its base is not well defined, as the formation apparently grades without a break into the compact dark grey shales of the underlying Bearpaw formation. The Eastend formation and possibly the upper 100 feet of the Bearpaw formation are sufficiently porous to be water bearing. These potential water-bearing beds are confined to the southern townships. Along the southern border of this area they are buried under 500 to 600 feet of sediments forming the upper formations, and probably will never contribute greatly to the ground water supply as water is to be expected at much shallower depths. On the lower slopes, however, they occur immediately beneath the drift and may prove to be productive at depths of less than 150 feet. Such waters as may occur in the Eastend and in the upper part of the Bearpaw formation are likely to contain a greater concentration of mineral salts than water from the younger formations, but it is not expected to be so highly mineralized as to be undrinkable.

The Bearpaw formation becomes more shaly towards its middle and lower parts, so that on the lower slopes and throughout the entire northern two-thirds of the municipality these compact, grey shales immediately underlie the unconsolidated deposits.

Outcrops of these shales occur at intervals along the banks of Skull creek. The Bearpaw formation is of marine origin and undoubtedly contains large amounts of readily soluble mineral salts, so that any water that might be obtained from the formation below the porous upper beds will probably be unfit for drinking and in some places it may even be unfit for stock. The Bearpaw shales may be distinguished in wells from the overlying clays of the drift by the absence of boulders, by its soapy feel when wet, and by the small, roughly cubical and frequently iron-stained fragments into which it breaks when dry. A close examination of the shale usually shows some indication of bedding.

Residents situated in the lowland area are advised to confine their search for water to the unconsolidated deposits rather than sink deep wells in the much less productive Bearpaw formation.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 10, Range 22

This township is situated on the steep northern flank of the Cypress Hills uplands. The northern border of the area extends along the southern edge of a lowland plain at an elevation of about 2,800 feet above sea-level. Toward the south the hillocky and steeply eroded land surface rises abruptly to a high, irregular-surfaced benchland that extends over most of the southeastern half of the township at an average elevation of about 3,550 feet above sea-level. Drainage on the benchland is poorly developed and many of the depressions lying between the hills are occupied by small lakes and sloughs. Surface run-off on the northern slopes is carried off by Skull creek and its many small tributaries, most of which rise from springs that occur along the edge of the benchland. As a large part of the township consists of range land, the sloughs and springs are a valuable source of water for stock. The springs are not everywhere conveniently located to farm buildings, however, and most of the residents have sunk wells in the unconsolidated deposits or in the bedrock formations in order to obtain a permanent water supply.

Wells drawing water from the unconsolidated deposits are nearly all situated in the stream channels, in which the sediments are largely of Recent age. The water-bearing beds usually consist of gravel buried under 5 to 10 feet of yellow clay. The yield from these wells varies greatly, as some of the aquifers have a steep gradient and are unable to retain water unless they are constantly replenished by seepage from springs or from the stream. Residents in search of these water-bearing beds are advised to prospect for them with a test auger as it is frequently necessary to sink several holes before a satisfactory yield is encountered. These waters are all reported to be satisfactory for household use and most of them are soft or only moderately hard.

The water-bearing beds contained in the glacial till and moraine deposits are probably more erratic in their distribution than those of the stream deposits. A large part of the eastern uplands is covered by an irregular glacial moraine. Pockets of sand and gravel are for the most part of more frequent occurrence in moraine deposits than in the boulder clay of the till plains. This may not hold true for this township, however, as the till deposited on the steep slopes was partly re-sorted by streams immediately after the retreat of the ice-sheet and also contains water-bearing sand and gravel pockets. The beds have been tapped by several wells situated along the gentle slopes in the northern part of the area at depths of usually less than 30 feet. The water is in many places found to be under sufficient hydrostatic pressure to cause it to rise 10 to 15 feet above the aquifer, and in nearly all the wells the supply is reported to be adequate for farm requirements. The quality of these waters varies, but no waters are reported to be so highly mineralized as to render them unsuitable for domestic use.

The upper bedrock formations underlying the glacial drift in the southern uplands are also water bearing, and have been tapped by several wells in this part of the area. The Cypress Hills beds form the uppermost bedrock on the benchland and extend down to an elevation of about 3,400 feet above sea-level. Two wells, sunk to depths of 90 and 85 feet, in sections 1 and 12 encountered an adequate yield of hard, drinkable water in a bed of sand. The exact depth at which the sand occurs was undetermined, although it is believed to be in the Cypress Hills formation. Springs that flow from the glacial drift on the coulée banks in sections 5 and 8 may also have their origin in these beds. Water may not be everywhere available in the Cypress Hills formation, but the underlying Ravenscrag formation is also known to be water bearing. Residents who sink wells on the southern benchland or on the upper slopes can be reasonably certain of obtaining an adequate supply of drinkable water at depths of less than 250 feet from either one or the other of these formations.

The Eastend formation underlying the Ravenscrag at an elevation of about 3,250 feet may extend down to an elevation of 3,100 feet above sea-level. The northern lowlands where surface elevations occur below 3,100 feet is underlain by the Bearpaw formation. The upper Eastend beds may be sufficiently porous to permit ground water accumulation. The lower beds and those of the Bearpaw formation, however, are composed largely of shales and are less likely to contain drinkable waters. Due to the very poor quality of any small supplies that might be found in the bedrock underlying this part of the area. Residents situated in the lowlands are advised to confine their search for water to the unconsolidated deposits rather than to sink deep wells.

Township 10, Range 23

Several sections in the southeastern part of the township are situated on the moderately rolling benchland on the Cypress Hills plateau at an elevation of about 3,550 feet above sea-level. The rest of the township slopes irregularly to the north, down to an average elevation of about 2,900 feet in the northern part. The surface run-off is carried to the north by Bear creek and its small tributaries. Most of these streams rise from springs at the edge of the uplands in the vicinity of the southern border and after flowing down the slope to the north converge to cross the northern border in section 32. The springs provide most of the water used for both stock and domestic requirements in the southern half of the area. Water from this source is available at only a few places in the lowland area in the northern part and here residents have sunk wells in the unconsolidated deposits, in which an adequate yield of water is usually encountered at depths of less than 30 feet.

The stream deposits, consisting of irregular layers of gravel and sand interbedded with clays and silts, are regarded as the most reliable source of water at shallow depths. These porous beds may form fairly continuous aquifers along the bottoms of most of the stream channels, and as they receive part of their water by seepage from the stream and part from springs wells sunk in the creek bottoms usually yield a permanent supply of drinkable water.

Porous sand and gravel pockets also occur scattered sparsely through the boulder clay of the glacial drift throughout the rest of the township. These pockets are water bearing in many places, but owing to their erratic distribution it is frequently necessary to sink several test holes before a water-bearing bed is located. The shallow aquifers occurring at depths of less than 20 feet are encountered more frequently in depressions between the hills and at the bases of steep slopes than on the ridges and in the areas of level till plain. The contact of the glacial drift with the underlying bedrock is also regarded as a potential water-bearing horizon, particularly in the lowlands in the northern part of the township. Wells situated in sections 27, 34, and 36 were sunk to depths of 54, 45, and 74 feet, respectively. These wells encountered water in clay and gravel beds at what is thought to be near the base of the drift. The water varies from place to place as to quality, and it is doubtful if the same aquifer has been tapped by any two of the wells. The yield obtained is not large, but the water is reported to be suitable for domestic use. Similar aquifers could possibly be encountered at other places in the northern sections at depths of less than 75 feet.

The bedrock formations underlying the drift in this township are thought to be similar to those described in the township bordering on the east. The upper formations, however, are restricted to smaller areas in the southeastern part of the township and the Bearpaw formation underlies the drift in a fairly extensive area in the northwest.

No wells are reported to have been sunk in the bedrock in this township, although the upper formations are no doubt water bearing. Springs that occur in sections 2, 11, and 12 are reported to flow from the Cypress Hills gravels and conglomerate. Other springs that issue from the drift on the northern slopes at lower elevations may be formed by seepage from the Ravenscrag and Eastend formations.

The Bearpaw formation is not expected to contain any large supplies of drinkable water at moderate depths. Residents situated in the northern part of the township would probably obtain more satisfactory water supplies by confining their search for water to the unconsolidated deposits.

Township 10, Range 24

Surface relief in this township approximates 1,100 feet. The lowest elevation of about 2,700 feet above sea-level occurs in the northwestern and northeastern corners. The north-central part is slightly higher, with an elevation of about 2,950 feet. Toward the south the surface rises rapidly to form the northern flank of the Cypress Hills uplands with a maximum elevation of about

3,800 feet above sea-level on the southern border. The south-eastern part of the township consists of rough, hilly land that is suited only for ranching. Throughout the northwestern half of the area the slopes are more gentle and much of it is farmed.

Springs that issue from the coulée banks and hill-sides are the chief sources of water supply in the uplands in the southern part of the township. Some of these flow throughout the year, providing a permanent supply of water for stock. These springs are similar to others that commonly occur along the upper northern slopes of the Cypress hills and are discussed in the preceding section dealing with the other townships in the southern part of the municipality.

On the lower slopes in the northern half of the township, particularly at elevations below 3,000 feet, flowing springs are scarce and most of the residents are obliged to sink wells to various depths in the unconsolidated deposits in order to obtain water. Most of these wells are drawing water from gravel beds that occur in the coulée bottoms at depths of less than 20 feet. The age of these deposits was not everywhere determined, but it is possible that many of them represent Recent wash from the higher slopes. The glacial deposits also contain well-sorted sand and gravel beds interspersed through the boulder clay. These shallow drift gravels differ little from the Recent stream deposits and are usually located in the bottoms of draws and at the bases of steep slopes at depths of less than 20 feet. Waters obtained from the shallow Recent and glacial drift aquifers are seldom highly mineralized, and all are reported to be suitable for domestic use. The yields from these wells vary. Most of them show the effects of drought conditions and hence many residents have been obliged to sink several wells in order to maintain an adequate supply of water for the stock.

Several wells situated in the northern part of the area have tapped a deeper water-bearing horizon which produces an adequate supply of hard, drinkable water. Depths of these wells range from 40 to 55 feet. The water occurs in gravel beds buried under 40 to 50 feet of clay, and when tapped by the drill the water usually rises several feet above the gravel bed. The exact areal extent of this horizon has not been determined. It has been encountered by several wells in the townships bordering on the north, but its southern limit in this township is not well defined owing to the scarcity of deep wells. It is expected to occur throughout most of the northern two-thirds of the township, however, and is considered worth a test in these sections.

No wells in the township are known to yield water from the bedrock formations. The formations in this township are similar to those of the preceding townships with regard to character and distribution. The Cypress Hills beds may not extend to elevations lower than 3,500 feet above sea-level, however, and are expected to be confined to a small area extending through sections 2 and 3. The underlying Ravenscrag formation is also restricted to a relatively small area in the southern part of the township, as it is not thought to extend for more than a mile north of the border of the Cypress Hills formation. Its base probably lies at an elevation between 3,400 and 3,500 feet above sea-level. The Eastend formation may extend over most of the southern half of the township, and slightly more in the central part, at elevations greater than 3,100 feet. The Bearpaw formation forms the upper bedrock throughout the northern part of the area.

Most of the springs that occur in the southern uplands are believed to be formed by seepage from the Cypress Hills and Ravenscrag aquifers, although the Eastend formation may also be the source of some of them. One spring, situated in the SW. $\frac{1}{4}$, section 4, issues from a coal seam in the Ravenscrag formation, but elsewhere the springs are all reported to seep to the surface through the overlying drift deposits. It is reasonable to suppose that these bedrock aquifers could be tapped by wells within reasonable depths of the surface. Owing, however, to the great variation in surface elevations no range of depths at which water is to be expected can be given. The Bearpaw formation does not usually contain water that is satisfactory for domestic use, particularly in its middle and lower beds. The upper 200 feet of the formation may be water bearing, however, although drilling wells in these beds is recommended only after the overlying drift has proved unproductive.

Township 11, Range 22

The land surface throughout most of this township is irregular to hilly. Surface elevations range from about 2,600 feet above sea-level in the northern part to elevations slightly greater than 2,900 feet along the southern border.

A thin layer of glacial lake clay covers a narrow belt extending along Bridge creek in sections 11, 12, and 13. The thickness of these clays is not expected to exceed 20 feet. Little water can be expected from these compact sediments, but they may be underlain by more porous boulder clay and possibly sand beds containing small quantities of water. The surface deposits throughout the rest of the area consist of till and moraine deposits, with the exception of a small area in the northwestern corner that is covered by a thin layer of glacial lake sands. The thickness of the glacial drift has not been determined. It probably does not exceed 75 feet at any point, however, since the underlying bedrock is exposed at several places on the banks of Skull creek. The boulder clay is reported to yield only small seepages of water where wells have been sunk in it. Several wells have penetrated isolated pockets of water-bearing gravels interspersed in the clay. Where encountered these waters contain less mineral salts in solution than the waters obtained directly from the clay. The yield of the wells is also larger and most of them produce sufficient water for the needs of the farms on which they are located. The wells seldom exceed 20 feet in depth, hence the water-bearing bed may be located by using a test auger.

Recent flood deposits consisting of silt and clay interbedded with gravel pockets also occur overlying the boulder clay in the coulée bottoms. Shallow wells sunk to the gravel pockets frequently encounter moderate supplies of drinkable water, although careful prospecting may be required in locating these beds in some stream channels. No wells are reported to have been sunk to depths greater than 30 feet in the township. It seems probable, however, that water might occur in sand or gravel beds lying at the contact of the glacial drift with the underlying bedrock. Since the bedrock probably does not occur at depths greater than 75 feet this potential horizon is considered to be worth testing. Deep drilling in the underlying Bearpaw formation is not recommended, however, as these shales are expected to contain very little water that is suitable for farm use.

Township 11, Range 23

The northwestern part of this township lies within a glacial lake basin, the surface of which is undulating to level with an average elevation of about 2,600 feet above sea-level. Slightly more than the southeastern half of the township consists of moderately rolling to hilly land, with surface elevations ranging from 2,600 to 2,900 feet above sea-level. This part is mantled by boulder clay in the form of both till plain and moraine deposits. The lake basin is covered largely by glacial lake sand and clay.

Surface water supplies are confined to a few shallow sloughs and to Bear creek. These supplies are not permanent as they usually dry up in midsummer. They could be increased in some places, however, by constructing dams or dugouts.

Although surface water is being used for stock at a few places, ground water, obtained from shallow wells sunk in the glacial drift forms the major source of water supply in the township. Wells sunk to depths of 10 to 25 feet in the low, clay-covered flat that extends along Bear creek in the northwestern part of the township encounter moderately large yields of water. The water is concentrated in pockets of sand that occur either interspersed within the lake clay or in the immediately underlying boulder clay. Two wells in this area are reported to yield water that is noticeably "alkali", but it is not so highly mineralized as to prohibit its use in the household. The glacial lake sands also produce small yields to several wells. These deposits are possibly thin and, consequently, non-water bearing throughout most of the area in which they occur. The greatest thickness is probably reached on the western side of the township, as evidenced by wells put down to depths of 25 and 32 feet in sections 17 and 20, where sands were passed through to the bases of the wells. In the northeastern part of the area only small seepages were encountered in the lake sands, but two wells, sunk to depths of 42 and 36 feet in sections 35 and 36, tapped water-bearing gravels in the boulder clay below the sands. These gravels may consist of isolated pockets, as they have not been encountered elsewhere in this vicinity.

Throughout the till-covered area water is concentrated in small, isolated pockets of sand and gravel that occur sparsely interspersed through the boulder clay. Most of these wells are over 25 feet deep. The yields vary, but most of the wells produce sufficient water for only a few head of stock, and for household use, making it necessary for some of the residents to sink several wells in different parts of their farm in order to procure sufficient water for their needs. Several residents report difficulty in locating even small yields, although they have sunk numerous test holes in different parts of their farms.

The deepest well put down in the township was bored to a depth of 70 feet in section 2. This well is reported to have struck soapstone; probably Bearpaw shale below the drift. A small flow of hard, drinkable water was obtained, but the exact depth to the horizon and the character of this aquifer were not determined. It may, however, lie at the base of the glacial drift, as porous sands and gravels are of common occurrence at the contact of the drift with the underlying bedrock in many parts of the municipality.

Deep drilling into the Bearpaw formation is not advisable, as few beds sufficiently porous to permit ground water accumulation can be expected to occur in these shales.

Township 11, Range 24

The southern third of this township is mantled by glacial till. The land surface here is strongly rolling, with elevations ranging from 2,600 to 2,900 feet above sea-level. A wide ridge that extends from the north half of section 23 through section 26 to section 34 is also covered with till. The rest of the area consists of a flat to undulating lowland plain lying at elevations between 2,550 and 2,600 feet above sea-level. This lowland is covered with 10 to 20 feet of glacial lake sand, with the exception of a narrow belt overlain by glacial lake clay extending through the central part of the township between Piapot creek and Bear creek. The lake clay is not expected to have a thickness greater than 15 feet, and may overlie either the lake sand or the boulder clay.

Wells sunk to depths of less than 100 feet in the glacial drift are the chief sources of water supply in the township, although the surface run-off is being conserved behind dams on several farms. The largest of these dams are constructed in sections 13 and 17 and are used to irrigate several hundred acres of hay meadows.

Little if any water can be obtained by sinking shallow wells in the glacial lake clay. The compact clay may be underlain, however, by water-bearing sand and sandy clay at depths of less than 20 feet. Such porous beds are yielding hard, "alkaline" water to a 16-foot well in section 23. This water is not suitable for domestic use, and considerable difficulty has been encountered by quicksand flowing into the wells in this vicinity. Elsewhere in the northern two-thirds of the township water of similar quality is obtained from shallow wells sunk in the glacial lake sand. Few of these are producing sufficient water for more than a few head of stock, although the farm supply is increased in most places by sinking several wells. Quicksand also limited the yield obtainable at many places. The major source of water in the township lies in extensive gravel beds that occur in the boulder clay at depths ranging from 38 to 100 feet. These water-bearing beds are found both below the lake deposits and in the till plains, and form a fairly extensive water-bearing horizon throughout the township. At most places the water is under sufficient hydrostatic pressure to cause it to rise in the wells 20 to 30 feet above the aquifer, and in one well put down to a depth of 101 feet in the SE. $\frac{1}{4}$, section 36, the water rises to within 10 to 20 feet of the surface. Nearly all wells tapping the deep gravels yield an adequate supply of water for the needs of the farms on which they are located. The mineral salt concentration in these waters is not excessive, as most of them are reported to be suitable for domestic use. The greater concentrations of salts occur, as a rule, in the shallower wells.

Residents in all parts of the township where unsatisfactory water is obtained from the shallow drift aquifers are advised to put wells down in search of these deeper gravels. No well location should be condemned as unproductive until the well has penetrated the shales at the top of the bedrock.

Deep drilling in the Bearpaw formation underlying the drift is inadvisable, as these shales are not likely to contain water that is suitable for farm use.

Township 12, Range 22

Slightly more than the northwestern half of this township consists of a level to slightly undulating plain lying within the old pre-glacial lake basin with an average surface elevation of about 2,500 feet above sea-level. The rest of the area to the southeast is an irregular to hilly plain with surface elevations ranging from 2,600 to 2,750 feet above sea-level. The surface here is covered largely by moraine, although several sections in the south-central part consist of a more evenly surfaced till plain. The low-lying, northwestern part of the township is covered with a layer of 10 to 20 feet of glacial lake sands overlying boulder clay.

Although the small, intermittently flowing Skull creek extends northward along the western side of the township, drainage is poorly developed in nearly all parts of the area. The surface run-off collects in sloughs and in several large, shallow, "alkali" lakes that occupy low depressions in the northwestern lowlands. Continued concentration of the mineral salts in the water by surface evaporation may in some places render it too highly mineralized for stock use.

In nearly all parts of the area water may be obtained by sinking wells in the lake sand or to sand and gravel pockets that occur interspersed through the upper 30 feet of the boulder clay. The yield from these wells is not everywhere sufficient for stock requirements, making it necessary for some of the residents to sink several shallow wells in different parts of the farm or construct dams and dugouts in order to obtain adequate supplies. Some of the shallow wells might yield larger supplies if they were not partly choked with quicksand. The quality of these waters varies greatly within short distances, so that it is impossible to predict the type of water to be expected in any one locality. It apparently makes little difference whether the water is contained in sand or clay aquifers, as in many places both waters are highly charged with mineral salts. Only a few wells, however, are reported to produce water that cannot be used for drinking, and no wells yield water that is too highly mineralized for stock use.

Although few wells in the township are reported to have been sunk to depths greater than 30 feet, other water-bearing horizons are known to occur at greater depth in the drift deposits. Three wells, sunk to depths of 71, 85, and 92 feet, in sections 14, 23, and 25, yield moderately large supplies of hard, drinkable water from what is reported to be a clay aquifer at or near the base of the wells. It is doubtful if the individual aquifers are continuous over great distances, but the chances of striking similar productive beds at depths of less than 100 feet are considered to be favourable in most parts of the township. The full thickness of the drift is undetermined, but it probably does not greatly exceed this amount.

The Bearpaw formation underlying the drift consists largely of compact shales from which little if any water may be expected. Residents drilling for water are advised to confine their search to the glacial drift rather than undergo the expense of sinking deep test holes in the bedrock.

Township 12, Range 23

The topography of this township is characterized by low, rounded hills interspersed with level flats. Piapot creek and its eastern tributary Bear creek merge in the vicinity of Piapot village and flow northeastward to cross the northern border of the township in section 34. These streams flow only during flood seasons and drain a relatively small area in their immediate vicinity. The rest of the area is poorly drained and some of the low depressions are occupied by shallow "alkali" sloughs. The sloughs are of little value as a source of water for range stock as they usually dry up in early summer or the water becomes too highly mineralized for use. Surface water may be conserved, however, by constructing dams in the creeks. A dam built across Bear creek at Piapot by the Canadian Pacific Railway Company provides a permanent water supply for locomotives at this point.

As most of the township consists of range land the ground water resources have remained undeveloped in most parts. Water is readily obtainable, however, by sinking shallow wells in the fine lake sands that form the surface deposits over nearly the entire area. These sands are not over 30 feet thick at most places, and overlie compact, blue-grey boulder clay. The water collects at the base of the sand, as downward percolation is retarded by the impervious, underlying clay. The fine grain of the sand is a serious handicap in producing water from these deposits, however, as it tends to flow into the wells and in time will fill the well to the water-level. Sand-points are used with some success, but a very fine screen is required. The residents in the village of Piapot obtain water from wells of this type. Some of these have been extended into the underlying clay, but the water comes in from the overlying sand. It is reported to be hard and to contain noticeable amounts of sulphate salts in solution, but it is being used without any apparent ill effects.

In a narrow belt trending in a northeast-southwest direction the lake sands have drifted, forming irregular dunes. These deposits are better sorted than the lake sands, but their ground water conditions are not essentially different.

In the southeastern part of the township a wide, clay-covered flat extends for about 2 miles along Bear creek. The clay deposited in the glacial lake basin is not expected to have a thickness greater than about 15 feet. It may directly overlie boulder clay, but probably at least a few feet of lake sand occurs between the lake clay and the underlying boulder clay. These sands may be water bearing. The boulder clay may also contain small pockets of water-bearing sands or gravels interspersed through it at various depths to 100 feet or possibly more. Only two wells in the township are recorded as having penetrated any appreciable thickness of boulder clay below the lake sands. One of these, sunk to a depth of 59 feet in section 17, is possibly yielding water from a sand bed at a depth of 34 feet, as the water maintains a constant level at this point. This water is hard and "alkaline", but is being used for the household drinking supply. The second well, put down to a depth of 55 feet in section 22, struck a good supply of hard, highly mineralized water in a bed of sand at a depth of about 40 feet. This water is reported to be unfit for humans, but it is used for stock. Drinkable waters probably occur in other parts of the township at similar depths, but these, as a whole, are expected to contain greater concentrations of mineral salts than water from the shallow sand horizon.

Depth to the underlying Bearpaw formation has not been determined in this township. The formation is expected to occur at depths not greater than 100 feet, however, and is not regarded as a potential source of drinkable water.

Township 12, Range 24

The surface of this township rises gradually toward the west from elevations ranging between 2,450 and 2,500 feet above sea-level on the eastern side to a maximum elevation of about 2,650 feet in the mid-western part. The surface is characterized by broad, low, round-topped hills with the exception of a more irregular, dune-covered belt that extends in a southwesterly direction across the southern part of the township north of Piapot creek. The sand dunes are covered by a growth of grass and scrub willow, and owing to their irregular relief and light soil are not suitable for farming. The soil throughout the rest of the township consists of light sandy loam, but this has also been partly sorted by the action of wind and streams, and in some places pure sand is encountered to depths as great as 30 feet. The sand is underlain by dark, compact boulder clay through which may be interspersed irregular pockets of well-sorted sands.

Residents in the township obtain almost their entire water supply from shallow wells sunk in the upper sandy zone. These wells range in depth from 4 to 32 feet. The water forms a saturated zone over the less pervious clay. In low depressions between the hills the water-table is near the surface and is reached by digging holes to depths of only a few feet. Some of the residents have excavated dugouts down to the water-table, thus procuring a fairly permanent water supply for stock. Correspondingly greater depths are required for wells put down at points of higher elevation. There has been a noted lowering of the water-table during the drought years prior to and including 1935, so that most wells had to be deepened or new wells dug. Quicksand is also a limiting factor in the yield of many of the wells. Sanding trouble is overcome to some extend by driving sand-points, but the exceptionally fine screen required greatly limits the water flow. The quality of the water from the shallow wells varies greatly within short distances, so that it is difficult to predict the type of water that might be encountered in any one locality. These waters, however, are nearly all hard, and many of them contain sufficient sulphate salts in solution to give them a slightly bitter taste. A few wells produce water that is too highly mineralized for domestic use, but these are usually located in low flats where the salts should be expected to reach a greater concentration, due to surface evaporation. Few wells are known to have been sunk to any appreciable depth in the underlying boulder clay. The deepest well recorded from the township was put down to a depth of 51 feet in section 30. The water stands 34 feet from the surface and the aquifer is reported to be clay, although the exact depth at which it was encountered was not determined. This water is highly mineralized and is not fit for human consumption. An analysis of the water is given in a later section of this report. In the township bordering on the south a deep water-bearing gravel horizon is tapped by a number of wells at depths ranging usually between 50 and 100 feet. Should this horizon extend northward through this township, it may not occur at depths greatly exceeding this range. As a rule, the water from these gravels is not highly mineralized, and if the gravels occur in this township they might be expected to produce a better quality of water than is obtained from the porous clays in section 30. The thickness of the glacial drift is not known, but it is probably not over 150 feet.

The drift is underlain by the Bearpaw formation throughout the township. These shales are usually non-water bearing, and residents are advised to confine their search for water to the unconsolidated deposits in which suitable supplies are much more likely to be found.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF PIAPOT, NO. 110, SASKATCHEWAN

West of 3rd mer. — Township	10	10	10	11	11	11	12	12	12	Total No. in Municipality
Range	22	23	24	22	23	24	22	23	24	
Total No. of Wells in Township	34	38	53	25	40	68	59	16	110	443
No. of wells in bedrock	5	4	1	0	1	0	0	0	0	11
No. of wells in glacial drift	24	31	48	15	38	68	59	16	107	406
No. of wells in alluvium	5	3	4	10	1	0	0	0	3	26
Permanency of Water Supply										
No. with permanent supply	34	33	42	24	35	50	56	16	66	356
No. with intermittent supply	0	5	11	1	2	4	3	0	43	69
No. dry holes	0	0	0	0	3	14	0	0	1	18
Types of Wells										
No. of flowing artesian wells	1	0	0	0	1	0	0	0	0	2
No. of non-flowing artesian wells	3	0	2	0	0	10	0	0	0	15
No. of non-artesian wells	30	38	51	25	36	44	59	16	109	408
Quality of Water										
No. with hard water	26	30	45	23	27	46	50	15	99	361
No. with soft water	8	8	8	2	10	8	9	1	10	64
No. with salty water	0	0	0	0	0	0	1	0	1	2
No. with "alkaline" water	2	6	9	3	16	13	15	11	75	150
Depths of Wells										
No. from 0 to 50 feet deep	29	36	50	25	36	49	56	14	109	404
No. from 51 to 100 feet deep	3	2	3	0	4	16	3	2	1	34
No. from 101 to 150 feet deep	0	0	0	0	0	3	0	0	0	3
No. from 151 to 200 feet deep	1	0	0	0	0	0	0	0	0	1
No. from 201 to 500 feet deep	1	0	0	0	0	0	0	0	0	1
No. from 501 to 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
How the Water is Used										
No. usable for domestic purposes	32	30	35	23	34	38	49	11	45	297
No. not usable for domestic purposes	2	8	18	2	3	16	10	5	64	128
No. usable for stock	32	37	53	25	37	53	58	13	59	367
No. not usable for stock	2	1	0	0	0	1	1	3	50	58
Sufficiency of Water Supply										
No. sufficient for domestic needs	34	31	40	24	35	49	55	16	65	349
No. insufficient for domestic needs	0	7	13	1	2	5	4	0	44	76
No. sufficient for stock needs	26	24	30	13	21	33	47	11	43	248
No. insufficient for stock needs	8	14	23	12	16	21	12	5	66	177

ANALYSES AND QUALITY OF WATER

General Statement

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

Total Dissolved Mineral Solids

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

Mineral Substances Present

Calcium and Magnesium

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

Sodium

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

Sulphates

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

Chlorides

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

Iron

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

Hardness

Calcium and magnesium salts impart hardness to water. Hardness of water is commonly recognized by its soap-destroying powers as shown by the difficulty of obtaining lather with soap. The total hardness of a water is the hardness of the water in its original state. Total hardness is divided into "permanent hardness" and "temporary hardness". Permanent hardness is the hardness of the water remaining after the sample has been boiled and it represents the amount of mineral salts that cannot be removed by boiling. Temporary hardness is the differance between the total hardness and the permanent hardness and represents the amount of mineral salts that ban be removed by boiling. Temporary hardness is due mainly to the bicarbonates of calcium and magnesium and iron, and permanent hardness to the sulphates and chlorides of calcium and magnesium. The permanent hardness can be partly eliminated by adding simple chemical softeners such as ammonia or sodium carbonate, or many prepared softeners. Water that contains a large amount of sodium carbonate and small amounts of calcium and magnesium salts is soft, but if the calcium and magnesium salts are present in large amounts the water is hard. Water that has a total hardness of 300 parts per million or more is usually classed as excessively hard. Many of the Saskatchewan water samples have a total hardness greatly in excesss of 300 parts per million; when the total hardness exceeded 3,000 parts per million no exact hardness determination was made. Also no determination for temporary hardness was made on waters having a total hardness less than 50 parts per million. As the determinations of the soap hardness in some cases were made after the samples had been stored for some time, the temporary hardness of some of the waters as they come from the wells probably is higher than that given in the table of analyses.

Analyses of Water Samples from the Municipality of Piapot, No. 110, Saskatchewan

LOCATION						Depth of Well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of water
No	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alkalinity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	CaCl	
1	NW.	20	10	23	3rd	30	480	500	320	180	7	380	130	61	57	40	451	233		223	6		77	12		* 1
2	NW.	15	11	24	3rd	71	977																			
3	SE.	16	11	24	3rd	119	1,171											(4)	(1)		(2)		(3)	(5)		* 1
4	NE.	7	12	23	3rd	40	406											(2)	(1)		(3)				(4)	* 1
5	NE.	7	12	23	3rd	18	1,131													(2)	(4)	(5)	(1)	(3)		* 1
6		30	12	24	3rd	51	5,674												(2)		(3)	(4)	(1)	(5)		* 1

Water samples indicated thus, * 1, are from glacial drift or other unconsolidated deposits.
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. 2 to 6, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

Only one sample of water from this municipality was taken for analysis by the Geological Survey in 1935. Five other analyses made by the Provincial Analyst of waters from various parts of the area are listed, however, and show the great variation that occurs in the mineral salt concentration in ground waters from this region.

Waters obtained from the stream deposits in the southern part of the municipality apparently contain very small concentrations of dissolved mineral salts. As the stream sediments consist largely of porous gravels the underground flow through them is fairly rapid and the water has little opportunity of taking salts in solution. The first analysis, although reported to be of water from the glacial drift is nearly representative of water from the stream sediments. On the lowlands these waters may be more highly mineralized owing to the slower circulation of the water through the fine sediments comprising these deposits.

Marked variations are noted in the quality of waters from the glacial drift, in many cases within limited areas. The compact boulder clay is usually regarded as the source of most of the objectionable sulphate salts that are so common in drift waters. Hence, wells sunk entirely in clay may produce water that is so highly charged with mineral salts as to be undrinkable. This is not everywhere true, however, as many wells in the municipality are reported to yield water of excellent quality from the clay aquifers, such as is represented by analysis No. 1. On the other hand, the sand aquifers, although usually containing less soluble salts than the clay aquifers, may yield a highly mineralized water. This variation in the quality of the waters in shallow wells is possibly due more to the concentration of the salts by surface evaporation than to the character of the water-bearing sediments. It is frequently found that wells sunk in extensive flats, particularly those near "alkali" sloughs, produce water with a high mineral salt content. Surface evaporation may also be the factor causing some of the waters in the lake sands to become highly mineralized.

The large variation encountered in the deeper drift waters is no doubt due largely to the variable character of the water-bearing sediments, although the porosity of the underlying bedrock may also influence the mineral salt concentration. Where the drift overlies the compact shales of the Bearpaw formation the downward percolating waters collect immediately above the shales and tend to dissolve salts from both the boulder clay and the bedrock. In areas where the underlying beds are more porous the water is not confined in its movement and less opportunity is afforded for the salts to become concentrated. In this municipality the highly mineralized type of glacial drift water is found only in the lowlands where the Bearpaw formation forms the uppermost bedrock.

Sodium sulphate (Na_2SO_4) or Glauber's salt is usually present in the greatest abundance of the salts forming the total solids, with calcium sulphate ($CaSO_4$) or magnesium sulphate ($MgSO_4$) taking second place. Sodium sulphate is nearly tasteless, but has a laxative effect if drunk in large amounts. One thousand to 1,200 parts per million is usually regarded as the upper limit of concentration for this salt in waters to be used domestically, although greater concentrations are frequently used by humans without causing any apparent ill effects. Waters containing concentrations as great as 4,000 parts per million of sodium sulphate are used for watering stock, although the use of such water is not recommended if water of better quality is obtainable.

Magnesium sulphate (Epsom salts) has about twice the laxative effect of an equal amount of sodium sulphate. It has a bitter taste and contributes to the permanent hardness of the water.

Calcium sulphate and the carbonates of calcium and magnesium are not considered to be detrimental to health, but they impart hardness. In the analyses listed in the table of water analyses the first five waters are considered to have a sufficiently low mineral salt concentration to permit their use as a domestic drinking supply. The fourth and fifth analyses are of water from two of the village wells in Piapot. These demonstrate the wide variations in waters obtained at different depths in one locality.

The sixth analysis is reported to come from blue clay at a depth of 51 feet in the drift. This water is highly laxative and is not recommended for use. Analysis Nos. 2 and 3, however, are taken from greater depths in the drift and do not contain excessive amounts of mineral salts, due in part to the fact that the aquifers in these wells are beds of sand or gravel.

Water from the Bedrock

No analyses of water from the bedrock were obtained in this municipality. The following discussion on the general characteristics of these waters is based largely upon analyses of bedrock waters in adjoining municipalities where the source beds are apparently similar.

Waters obtained from the Cypress Hills formation contain very little mineral salts in solution. The sediments comprising the formation are composed largely of quartzite, cemented in places by calcium carbonate. The carbonates are the only readily soluble salts present and form the chief constituents in waters from this formation. These waters are usually hard or moderately soft and are of excellent quality for drinking.

The Ravenscrag waters, where obtained, are not noticeably different from those of the Cypress Hills formation, although they may contain slightly greater mineral salt concentrations, particularly if the water is obtained from coal or shale beds.

The Eastend and upper porous beds of the Bearpaw formation frequently produce waters containing noticeable amounts of the objectionable sulphate salts, but these waters are so variable that it is impossible to predict the type of water that may be expected to occur in any one locality. As a rule, water from greater depth in the Bearpaw formation becomes increasingly more highly mineralized, and the small seepages derivable from the compact shales may be unfit for any farm use, due to the large amounts of sulphate salts and common salt in solution.

WELL RECORDS—Rural Municipality of PIAPOT, NO. 110, 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	10	22	3	Drilled	90	3,560	-60	3,500			Cypress Hills sand	Hard, clear		D, S	Sufficient for local needs.
2	SW.	5	"	"	"	Spring		3,410	0	3,410	0	3,410	Glacial gravel	Hard, clear		D, S	Also other springs are used for stock.
3	NE.	5	"	"	"	Spring	2	3,450					Glacial gravel	Hard, clear		D	Sufficient for domestic needs; stock watered at a creek.
4	NW.	8	"	"	"	Spring		3,400					Glacial gravel	Hard, clear		D, S	Sufficient for local needs.
5	NE.	8	"	"	"	Spring		3,350					Glacial gravel	Soft, clear		D, S	Sufficient for local needs.
6	NE.	12	"	"	"	Drilled	85	3,575	- 55	3,520			Cypress Hills	Hard, clear		D, S	Constant water-level.
7	SE.	14	"	"	"	Drilled	210	3,525					Ravenscrag sand	Soft, clear		D, S	Sufficient supply; well cannot be pumped dry.
8	SE.	15	"	"	"	Dug & Drilled	35	3,525	- 19	3,506			Glacial drift	Hard, clear		D, S	Sufficient for local needs.
9	SW.	16	"	"	"	Dug	10	3,250	- 8	3,242	8	3,242	Recent gravel	Soft, clear		D	Constant water-level; stock watered at springs.
10	NE.	17	"	"	"	Dug	14	3,150					Recent gravel	Soft, clear		D	Constant supply; stock watered at springs and creeks.
11	SW.	18	"	"	"	Bored	20	3,400	- 17	3,383	17	3,363	Ravenscrag coal	Hard, clear, iron		D	Sufficient for domestic needs; also a 2000 foot well, now abandoned; water stock at spring.
12	NE.	20	"	"	"	Dug	20	3,100					Recent gravel	Hard, clear		D	Sufficient supply; stock watered at a creek.
13	NW.	22	"	"	"	Drilled	65	3,250	- 15	3,235	30	3,220	Glacial sand	Soft, clear	42	D	Sufficient supply; also a flowing well 14 feet deep, and springs; water stock at a creek.
14	NW.	27	"	"	"	Drilled	35	3,000	- 30	2,970	30	2,970	Glacial gravel	Soft, clear		D, S	Sufficient for local needs.
15	NE.	28	"	"	"	Dug	10	2,950	- 7	2,943	7	2,943	Recent gravel	Hard, clear		D	Sufficient supply; stock watered at a creek.
16	NE.	29	"	"	"	Dug	30	3,000	- 20	2,980			Glacial drift	Soft, clear		N	Unfit for use; uses a shallow well near a creek.
17	SE.	31	"	"	"	Dug	21	2,950	- 11	2,939	21	2,929	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
18	SE.	32	"	"	"	Bored	15	2,925	- 9	2,916	9	2,916	Glacial gravel	Hard, clear		D	Sufficient for local needs.
19	NE.	33	"	"	"	Dug	15	2,900	- 5	2,895	12	2,888	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
20	SW.	34	"	"	"	Dug	14	2,950	- 11	2,939	11	2,939	Glacial sand	Hard, clear		D, S	Sufficient for local needs.
1	NE.	2	10	23	3	Spring		3,500	0	3,500	0	3,500	Glacial gravel	Soft, clear	40	D, S, I	Sufficient for local needs.
2	NW.	2	"	"	"	Dug	3	3,500	0	3,500	0	3,500	Glacial gravel	Soft, clear	40	S	Sufficient supply; also a spring with an intermittent supply.
3	NE.	7	"	"	"	Dug	3	3,005	0	3,005	0	3,005	Glacial gravel	Hard, clear	50	D, S	Sufficient supply; stock also watered at creek.
4	SE.	11	"	"	"	Spring		3,500	0	3,500	0	3,500	Cypress Hills gravel	Soft, clear	41	D, S	Sufficient for local needs.
5	SE.	12	"	"	"	Spring	3	3,450	0	3,450	0	3,450	Cypress Hills gravel	Soft, clear	40	D, S	Sufficient supply; also another spring.
6	SW.	12	"	"	"	Spring		3,450	0	3,450	0	3,450	Cypress Hills gravel	Soft, clear	40	D, S	Sufficient for local needs.
7	NE.	16	"	"	"	Spring		2,950	0	2,950	0	2,950	Glacial gravel	Hard, clear	42	D	Insufficient for local needs.

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 PIAPOT, NO. 110, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
8	SE.	18	10	23	3	Dug	25	3,000	- 21	2,979	21	2,979	Glacial drift	Hard, clear, "alkaline"	46	S	Intermittent supply; another 25-foot well is used for domestic needs.
9	NE.	18	"	"	"	Spring		2,950	0	2,950	0	2,950	Glacial gravel	Hard, clear	44	D, S	Sufficient supply; also two other similar springs.
10	NW.	20	"	"	"	Dug	30	2,900					Glacial drift	Hard, clear	46	D	Sufficient supply; stock watered at a creek; #
11	NW.	23	"	"	"	Dug	14	3,200	- 7	3,193			Glacial drift	Hard, clear		D	Sufficient supply; two other wells 25 and 12 feet deep are used for stock.
12	SW.	24	"	"	"	Spring		3,175	0	3,175	0	3,175	Glacial gravel	Hard, clear	44	D, S	Sufficient supply; also another similar spring.
13	NW.	24	"	"	"	Dug	16	3,210	0	3,210	15	3,195	Recent gravel	Hard, clear	44	D, S	Intermittent supply; also two other similar wells and a spring.
14	SE.	25	"	"	"	Dug	20	3,150	- 16	3,134	19	3,131	Glacial gravel	Hard, clear	47	D, S	Sufficient supply; also a 10-foot well that is not used.
15	SW.	26	"	"	"	Dug	25	3,030	- 11	3,019	23	3,007	Glacial gravel	Hard, clear	48	D, S	Sufficient supply; also two other wells 14 feet deep.
16	NW.	26	"	"	"	Bored	34	3,000	- 29	2,971	29	2,971	Glacial gravel	Hard, clear	46	D, S	Intermittent supply.
17	NW.	27	"	"	"	Bored	54	3,017	- 46	2,971			Glacial drift	Hard, clear, "alkaline", iron	44	D, S	Sufficient for local needs.
18	NW.	28	"	"	"	Dug	14	2,800					Glacial gravel	Hard, clear	50	D	Sufficient supply; stock watered at a creek.
19	NE.	34	"	"	"	Bored	45	2,850	- 37	2,813	43	2,807	Glacial gravel	Soft, clear	45	D	Insufficient supply; a spring is used for stock needs.
20	NE.	34	"	"	"	Dug	25	2,850	- 17	2,833			Glacial drift	Hard, clear, "alkaline"	46	S	Insufficient for local needs.
21	NE.	35	"	"	"	Bored	25	2,975	- 20	2,955			Glacial drift	Hard, clear, "alkaline", odour	46	S	Insufficient for local needs.
22	NE.	36	"	"	"	Dug	20	2,980	0	2,980			Glacial drift	Hard, clear	45	D, S	Sufficient supply; also a dam is used for stock needs.
23	NW.	36	"	"	"	Bored	74	3,000	- 44	2,956			Glacial drift	Hard, clear, iron	45	D, S	Sufficient supply; also a dam for stock needs.
1	NW.	2	10	24	3	Spring		3,550	0	3,550	0	3,550	Glacial drift	Soft, clear	42	D, S	Sufficient supply; also another spring.
2	SW.	4	"	"	"	Spring		3,400	0	3,400	0	3,400	Ravenscrag coal	Hard, clear, iron	50	S	Sufficient for local needs.
3	SW.	5	"	"	"	Spring		3,250	0	3,250	0	3,250	Glacial gravel	Hard, clear		S	Sufficient for local needs.
4	SE.	6	"	"	"	Dug	13	3,200	- 8	3,192	10	3,190	Glacial gravel	Hard, clear	46	D, S	Sufficient supply; also two springs with intermittent supplies.
5	NE.	7	"	"	"	Spring							Glacial drift	Hard		D, S	Sufficient for local needs.
6	SW.	10	"	"	"	Spring		3,350	0	3,350	0	3,350	Glacial drift	Hard, clear		D, S	Sufficient for local needs.
7	SE.	10	"	"	"	Spring		3,350	0	3,350	0	3,350	Glacial drift	Hard, clear		D, S	Sufficient for local needs.
8	NW.	15	"	"	"	Dug	22	3,175	- 20	3,155	20	3,155	Glacial gravel	Hard, "alkaline"	52	S	Sufficient for local needs.
9	SW.	16	"	"	"	Spring	3	3,150	0	3,150	0	3,150	Glacial gravel	Hard, clear, "alkaline"	48	D	Insufficient supply; a dam is used for stock needs.
10	NW.	17	"	"	"	Dug	14	2,990	- 11	2,979	11	2,979	Glacial sand and gravel	Hard, clear, "alkaline", iron	52	S	Insufficient supply; also two other similar wells and a spring.

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 PIAPOT, NO. 110, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
11	SW.	18	10	24	3	Dug	20	2,980	- 10	2,970	10	2,970	Glacial gravel	Hard, clear, iron		D, S	Sufficient for local needs.
12	NW.	18	"	"	"	Dug	20	2,900	- 17	2,883	17	2,883	Glacial gravel	Hard		D	Well is now filled in.
13	NW.	19	"	"	"	Dug	22	2,850	- 12	2,838			Glacial drift	Hard, clear	48	D, S	Intermittent supply.
14	NW.	20	"	"	"	Dug	5	2,950	0	2,950	0	2,950	Glacial gravelly clay	Hard, clear	52	D, S	Sufficient for local needs.
15	NE.	20	"	"	"	Spring							Glacial drift	Hard		D, S	Sufficient for 50 head stock.
16	SE.	20	"	"	"	Spring		3,000	0	3,000	0	3,000	Glacial gravel	Hard, clear	52	S	Sufficient for 200 head stock; also two other springs.
17	NW.	22	"	"	"	Dug	15	3,090	- 4	3,086			Glacial gravel	Hard, clear	47	D	Intermittent supply.
18	NW.	22	"	"	"	Dug	70	3,090	- 66	3,024			Glacial gravel	Hard, clear, "alkaline"		S	Intermittent supply; also a 23-foot well and a spring.
19	SW.	23	"	"	"	Dug	15	3,050	0	3,050	0	3,050	Recent gravel	Hard, clear	48	D, S	Intermittent supply.
20	NE.	23	"	"	"	Bored	22	2,980	- 6	2,974	6	2,974	Glacial gravel	Hard, clear, "alkaline"	48	S	Sufficient for local needs.
21	NE.	24	"	"	"	Drilled	65	3,000	- 50	2,950			Glacial drift	Hard, clear, iron	46	D, S	Insufficient supply; also another well 15 feet deep.
22	SE.	[illegible]	"	"	"	Dug	20	2,865	- 8	2,857	18	2,847	Glacial sand	Soft, clear	47	D, S	Intermittent supply; also a 10-foot well for stock needs.
23	SW.	26	"	"	"	Dug	16	2,950	- 12	2,938	12	2,938	Glacial gravelly clay	Hard, clear		D	Intermittent supply; also a 10-foot well for stock needs.
24	SE.	26	"	"	"	Spring	2	2,900	0	2,900	0	2,900	Glacial gravel	Hard, clear	50	S	Sufficient for local needs.
25	SE.	27	"	"	"	Dug	25	3,025	- 10	3,015	23	3,002	Glacial gravel	Hard, clear	46	S	Insufficient for local needs.
26	NW.	30	"	"	"	Bored	40	2,800	- 35	2,765	35	2,765	Glacial gravel	Soft, clear	46	D, S	Sufficient supply; also another well on farm.
27	NW.	31	"	"	"	Dug	30	2,700	- 26	2,674	26	2,674	Glacial gravel	Hard, clear	47	D, S	Intermittent supply.
28	NW.	32	"	"	"	Dug	50	2,800	- 44	2,756	44	2,756	Glacial gravel	Soft		D, S	
29	NW.	32	"	"	"	Dug	35	2,735	- 32	2,703	32	2,703	Glacial sand	Soft, clear		D, S	Intermittent supply.
30	SE.	32	"	"	"	Dug	28	2,850	- 4	2,846	22	2,828	Glacial drift	Soft		D, S	
31	NE.	32	"	"	"	Dug	10	2,850	- 5	2,845	5	2,845	Glacial coarse gravel	Hard, clear, "alkaline"	46	S	Insufficient for local needs.
32	NE.	34	"	"	"	Bored	28	2,900	- 12	2,888	26	2,874	Glacial gravel	Hard, clear		S	Constant water-level.
33	NW.	34	"	"	"	Bored	54	2,950	- 49	2,901	54	2,896	Glacial gravel	Hard, clear		D, S	Sufficient for local needs.
34	SE.	34	"	"	"	Spring	6	2,930	0	2,930	0	2,930	Glacial sand	Soft, clear	45	D, S	Sufficient for local needs.
35	NE.	35	"	"	"	Dug	22	2,770	- 16	2,754	16	2,754	Recent sand	Hard, clear	46	D, S	Insufficient supply; also two other wells 18 feet deep.
36	SW.	35	"	"	"	Dug	25	2,885	- 21	2,864	23	2,862	Glacial gravel	Hard, clear		D, S	Intermittent supply.
37	NE.	36	"	"	"	Dug	11	2,740	0	2,740	10	2,730	Glacial gravel	Hard, clear, "alkaline"	52	D	Insufficient for local needs.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PIAPOT, NO. 110, 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	11	22	3	Dug	25	2,950	- 20	2,930	20	2,930	Recent gravel	Soft, clear		D, S	Sufficient for local needs.
2	NE.	3	"	"	"	Dug	16	2,900	- 6	2,894	12	2,888	Glacial gravel	Hard, clear		D, S	Sufficient supply; also another similar well.
3	SE.	4	"	"	"	Bored	13	2,900	- 5	2,895	10	2,890	Recent gravel	Hard, clear		D	Sufficient supply; also another similar well.
4	NW.	4	"	"	"	Dug	13	2,825	- 5	2,820	5	2,820	Recent gravel	Hard, clear		S	Sufficient for local needs.
5	SE.	8	"	"	"	Dug	9	2,900	- 4	2,896			Glacial drift	Hard, clear, "alkaline"		S	Sufficient for local needs.
6	SE.	10	"	"	"	Dug	25	2,900	- 15	2,885	20	2,880	Glacial gravel	Hard, clear		D, S	Sufficient for local needs.
7	SE.	11	"	"	"	Dug	12	2,850	- 9	2,841	9	2,841	Recent gravel	Hard, clear		D, S	Sufficient for local needs.
8	NW.	12	"	"	"	Dug	22	2,850	- 19	2,831			Glacial drift	Hard, clear		D, S	Insufficient for local needs.
9	SE.	16	"	"	"	Dug	20	2,800	- 15	2,785			Glacial drift	Hard, clear		D, S	Sufficient for local needs.
10	SW.	22	"	"	"	Dug	12	2,750	- 8	2,742	8	2,742	Recent gravel	Soft, clear		D	Sufficient supply; also two springs are used for stock needs.
11	NE.	22	"	"	"	Dug	16	2,700	- 13	2,687	13	2,687	Recent gravel	Hard, clear		D	Sufficient supply; also another similar well.
12	SW.	26	"	"	"	Dug	20	2,750	- 17	2,733	17	2,733	Glacial gravel	Hard, clear		D, S	Insufficient for local needs.
13	SE.	32	"	"	"	Dug	30	2,650	- 26	2,624			Glacial drift	Hard, clear		D, S	Insufficient for local needs.
14	NE.	32	"	"	"	Dug	18	2,620	- 12	2,608	12	2,608	Glacial gravel	Hard, clear, "alkaline"		D, S	Sufficient supply; also another similar well.
15	NW.	33	"	"	"	Dug	18	2,625	- 10	2,615	10	2,615	Recent sand	Hard, clear		D	Intermittent supply.
16	SE.	34	"	"	"	Dug	20	2,680	- 14	2,666	14	2,666	Glacial sand	Hard, clear		D, S	Insufficient supply; also another similar well.
17	SW.	34	"	"	"	Dug	16	2,650	- 8	2,642	8	2,642	Recent sandy clay	Hard, clear		D, S	Barely sufficient supply; also an 18-foot well.
1	NE.	1	11	23	3	Dug	7	2,925	0	2,925			Glacial drift	Hard, clear, "alkaline", iron	46	D, S	Sufficient for local needs.
2	SE.	2	"	"	"	Bored	70	2,800	- 65	2,735			Bearpaw soapstone	Hard, clear	47	D, S	Insufficient for local needs.
3	SE.	4	"	"	"	Dug	6	2,662	- 3	2,659	3	2,659	Recent sand and gravel	Hard, clear	52	D	Sufficient for local needs.
4	NW.	6	"	"	"	Dug	15	2,776	- 2	2,774	7	2,769	Glacial gravel	Soft, clear	50	S	Insufficient for local needs.
5	NE.	9	"	"	"	Bored	30	2,700					Glacial drift	Soft		D, S	Was sufficient for 15 head horses; is now abandoned; also a dry hole 57 feet deep.
6	NW.	9	"	"	"	Dug	40	2,700									Dry hole in glacial drift.
7	NW.	10	"	"	"	Dug	7	2,772	- 3	2,769	5	2,767	Glacial gravel	Soft, clear	48	D, S	Barely sufficient supply; also another similar well.
8	SW.	13	"	"	"	Dug	30	2,800	- 22	2,778	20	2,774	Glacial sand	Hard, clear, "alkaline"	46	D, S	Sufficient for local needs.
9	NE.	13	"	"	"	Dug	16	2,790	0	2,790	14	2,776	Glacial sand	Soft, clear	48	D, S	Sufficient for local needs.
10	SE.	16	"	"	"	Dug	16	2,725	- 12	2,713	12	2,713	Glacial sand	Hard, clear, "alkaline"	42	S	Sufficient for local needs.

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 PIAPOT, NO. 110, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE Elev.	PRINCIPAL WATER-BEARING BED Depth	PRINCIPAL WATER-BEARING BED Elev.	PRINCIPAL WATER-BEARING BED Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
11	SW.	17	11	23	3	Bored	25	2,600	- 17	2,583	17	2,583	Glacial sand	Soft, clear, "alkaline"	46	D, S	Sufficient supply; another similar well 18 feet deep.
12	NW.	18	"	"	"	Dug	20	2,575	- 16	2,559	16	2,559	Glacial gravel	Hard, clear		D, S	Sufficient for local needs.
13	SW.	19	"	"	"	Dug	14	2,550					Glacial coarse sand	Hard, clear	48	D	Intermittent supply.
14	SW.	20	"	"	"	Dug	32	2,595	- 29	2,566	29	2,566	Glacial sand	Soft, clear	45	D, S	Insufficient for local needs.
15	SE.	21	"	"	"	Dug	24	2,750	- 18	2,732	18	2,732	Glacial sandy clay	Hard, clear	42	D, S	Insufficient supply; two other similar wells 15 feet deep.
16	NE.	21	"	"	"	Dug	30	2,695	- 25	2,670	25	2,670	Glacial sand	Hard, clear	44	D, S	Insufficient supply; also two other wells to a depth of 60 feet.
17	SE.	23	"	"	"	Dug	24	2,690	- 21	2,669	23	2,667	Glacial sand	Hard, clear	45	D, S	Insufficient for local needs.
18	SE.	24	"	"	"	Dug	14	2,725	- 8	2,717	8	2,717	Glacial gravel	Soft, clear	50	D, S	Sufficient for local needs.
19	SE.	25	"	"	"	Dug	30	2,655	- 26	2,629	26	2,629	Glacial sand	Hard, clear	48	D, S	Intermittent supply.
20	SE.	27	"	"	"	Dug	30	2,700									Dry hole in glacial yellow clay.
21	NE.	28	"	"	"	Dug	11	2,590	- 5	2,585	5	2,585	Glacial sandy clay	Hard, "alkaline"	45	D, S	Sufficient supply; also another well 16 feet deep.
22	SE.	30	"	"	"	Bored	12	2,550	- 6	2,544	6	2,544	Glacial sandy clay	Hard, clear, "alkaline"	45	D, S	Sufficient supply; also another similar well.
23	SW.	30	"	"	"	Bored	25	2,550	- 20	2,530	20	2,530	Glacial sand	Hard, clear, "alkaline"	45	D, S	Sufficient supply; also another similar well.
24	SW.	32	"	"	"	Dug	11	2,535	- 6	2,529	6	2,529	Glacial sandy clay	Hard, clear, "alkaline"	43	D, S	Sufficient supply; also another similar well.
25	SW.	34	"	"	"	Dug	16	2,665	- 10	2,655	13	2,652	Glacial sand	Hard, clear	48	D, S	Insufficient for local needs.
26	NE.	35	"	"	"	Dug	42	2,620	- 30	2,590	30	2,590	Glacial gravel	Hard, clear, "alkaline"	45	S	Sufficient for local needs.
27	NW.	36	"	"	"	Dug	36	2,620	- 10	2,610	10	2,610	Glacial sand and gravel	Hard, clear	46	D, S	Sufficient for local needs.
28	SE.	36	"	"	"	Dug	16	2,640	- 7	2,633	7	2,633	Glacial drift	Hard, clear, "alkaline"	46	D, S	Insufficient supply; also another similar well.
1	SE.	2	11	24	3	Bored	68	2,900	- 63	2,837	63	2,837	Glacial gravel	Hard, clear	43	D, S	Sufficient for local needs.
2	SW.	3	"	"	"	Bored	48	2,825	- 24	2,801	46	2,779	Glacial gravel	Hard, clear		D, S	Sufficient supply; also another similar well.
3	NW.	4	"	"	"	Bored	72	2,750	- 62	2,688	68	2,682	Glacial gravel	Hard, clear, "alkaline"	43	D, S	Sufficient for local needs.
4	SE.	6	"	"	"	Spring		2,650					Glacial gravel	Hard, clear			
5	SW.	8	"	"	"	Bored	60	2,660	- 40	2,620	58	2,602	Glacial gravel	Hard, clear		D, S	Sufficient supply; also an 8-foot well in a slough.
6	NW.	9	"	"	"	Bored	36	2,700	- 14	2,686			Glacial drift	Hard, clear, "alkaline"	47	D, S	Intermittent supply; also fourteen dry holes 15 to 100 feet deep.
7	SW.	10	"	"	"	Dug	50	2,700	- 46	2,654	46	2,654	Glacial gravel	Hard, clear	47	D, S	Sufficient for local needs.
8	NW.	10	"	"	"	Dug	111	2,700	-100	2,600	100	2,600	Glacial gravel	Hard, clear	47	D, S	Barely sufficient for local needs.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PIAPOT, NO. 110, 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	11	24	3	Bored	56	2,700	- 46	2,654	50	2,650	Glacial gravel	Hard, clear	47	S	Barely sufficient for local needs.
10	NW.	11	"	"	"	Dug	30	2,750	- 28	2,722	28	2,722	Glacial gravel	Hard, clear, "alkaline"	46	D, S	Sufficient for local needs.
11	SE.	12	"	"	"	Spring		2,725					Glacial gravel	Hard, clear	48	S	Yields 400 gallons a day.
12	SE.	12	"	"	"	Bored	27	2,700	- 19	2,681	19	2,681	Glacial gravel	Hard, clear		S	Intermittent supply.
13	NW.	12	"	"	"	Bored	76	2,725	- 46	2,679			Glacial drift	Hard, clear		D, S	Intermittent supply.
14	NW.	12	"	"	"	Bored	50	2,700	- 27	2,673	49	2,651	Glacial gravel	Hard, clear		D, S	Sufficient for local needs.
15	NE.	12	"	"	"	Spring		2,675					Glacial gravel	Hard, clear		S	Sufficient for local needs.
16	SW.	14	"	"	"	Spring		2,750					Glacial sand	Hard, clear		S	Sufficient for local needs.
17	NW.	15	"	"	"	Bored	42	2,550	- 2	2,548	36	2,514	Glacial gravel	Soft, clear	42	D, S	Sufficient supply; also a spring.
18	NW.	15	"	"	"	Dug	71	2,560	- 23	2,537			Glacial drift	Hard, red	44	D, S	Constant water-level; #.
19	SE.	15	"	"	"	Dug	119	2,600	- 59	2,541	59	2,541	Glacial drift	Hard, clear, iron	42	D, S	Sufficient for local needs; #.
20	SE.	18	"	"	"	Bored	40	2,575	- 34	2,541	38	2,537	Glacial gravel	Hard, clear		S	Sufficient for local needs.
21	NW.	18	"	"	"	Dug	20	2,650	- 18	2,632	18	2,632	Glacial sand	Hard, clear, "alkaline"	47	D, S	Insufficient supply; also another similar well.
22	NE.	18	"	"	"	Bored	22	2,550	- 18	2,532	18	2,532	Glacial sand	Hard, clear		D	Also another similar well.
23	NE.	20	"	"	"	Dug	26	2,550	- 25	2,525			Glacial drift	Hard, clear, "alkaline"	45	D	Insufficient supply.
24	NE.	20	"	"	"	Dug	18	2,550	- 15	2,535	15	2,535	Glacial sand	Soft, clear, "alkaline"	45	D, S	Barely sufficient supply; also two other similar wells.
25	SE.	22	"	"	"	Dug	25	2,550	- 22	2,528	22	2,528	Glacial gravel	Hard, clear	46	S	Intermittent supply.
26	SE.	22	"	"	"	Dug	14	2,650	- 11	2,639	11	2,639	Glacial sand	Hard, clear	48	D	Barely sufficient for local needs.
27	NW.	22	"	"	"	Dug	68	2,560	- 24	2,536	60	2,500	Glacial gravel	Hard, clear, "alkaline"	44	D, S	Sufficient for local needs.
28	SE.	23	"	"	"	Dug	16	2,550	- 13	2,537	13	2,537	Glacial sand	Hard, clear, "alkaline"		D	Insufficient supply;another similar well 8 feet deep.
29	SE.	27	"	"	"	Dug	20	2,550	- 16	2,534			Glacial drift	Hard, clear, "alkaline"	45	D, S	Insufficient for local needs.
30	SE.	27	"	"	"	Dug	8	2,550	- 4	2,546	4	2,546	Glacial sand	Hard, clear, "alkaline"	48	S	Insufficient for local needs.
31	NE.	27	"	"	"	Bored	47	2,550	- 25	2,525	42	2,508	Glacial gravel	Hard, clear, "alkaline"	45	S	Sufficient for local needs.
32	SE.	30	"	"	"	Dug	18	2,570	- 16	2,554	16	2,554	Glacial sand	Hard, clear	43	D, S	Insufficient supply; another similar well 14 feet deep.
33	NE.	30	"	"	"	Dug	11	2,550	- 5	2,545	5	2,545	Glacial gravel	Hard, clear, "alkaline"	49	D, S	Sufficient supply; also another well 14 feet deep.
34	SW.	31	"	"	"	Dug	6	2,550	- 3	2,547	3	2,547	Glacial sand	Hard, cloudy, "alkaline", odour	50	S	Sufficient for local needs.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PIAPOT, NO. 110, 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
35	SE.	34	11	24	3	Dug	13	2,585	- 12	2,573	12	2,573	Glacial sand	Hard, clear	46	D, S	Sufficient for local needs.
36	NE.	34	"	"	"	Dug	28	2,590	- 22	2,568			Glacial drift	Hard, clear	47	D, S	Sufficient for local needs.
37	NE.	34	"	"	"	Dug	16	2,590	- 12	2,578	12	2,578	Glacial sand	Soft, clear	48	S	Sufficient for local needs.
38	SE.	35	"	"	"	Dug	12	2,650	- 7	2,643			Glacial drift	Soft, clear	48	S	Insufficient for local needs.
39	NW.	35	"	"	"	Dug	24	2,600	- 10	2,590	10	2,590	Glacial sandy clay	Soft, clear	43	D, S	Insufficient supply; also another similar well.
40	NE.	35	"	"	"	Bored	56	2,600	- 40	2,560	40	2,560	Glacial sand	Hard, clear	44	S	Sufficient for local needs.
41	SE.	36	"	"	"	Dug	101	2,552	- 10	2,542	95	2,457	Glacial gravel	Hard, clear, "alkaline"	46	D, S	Sufficient for local needs.
42	SW.	36	"	"	"	Dug	18	2,600	- 14	2,586			Glacial drift	Hard, cloudy, "alkaline"	47	S	Sufficient for local needs.
43	NW.	36	"	"	"	Dug	25	2,600	- 15	2,585			Glacial drift	Hard, clear, "alkaline"	43	D	Sufficient supply; also a 60-foot well that is unfit for use.
1	NW.	1	12	22	3	Dug	24	2,750	- 18	2,732			Glacial drift	Hard, clear	45	D, S	Sufficient for local needs.
2	NW.	2	"	"	"	Dug	16	2,675	- 10	2,665			Glacial drift	Hard, clear	47	D, S	Sufficient for local needs.
3	SW.	5	"	"	"	Dug	22	2,595	- 18	2,577	18	2,577	Glacial gravel	Hard, clear	47	D, S	Sufficient supply; also a spring that is sufficient for 50 head stock.
4	NW.	7	"	"	"	Dug	14	2,550	- 11	2,539	11	2,539	Glacial sand	Hard, clear, "alkaline"	45	D, S	Sufficient supply; a dam is also used for stock needs.
5	SE.	9	"	"	"	Dug	15	2,600	- 13	2,587	13	2,587	Glacial sand	Hard, clear, "alkaline"	45	D, S	Insufficient supply; also another well 16 feet deep.
6	SE.	10	"	"	"	Dug	14	2,600	- 11	2,589			Glacial drift	Hard, clear		D, S	Intermittent supply.
7	SW.	10	"	"	"	Dug	16	2,530	- 12	2,518	12	2,518	Glacial sand	Soft, clear	45	D, S	Sufficient for local needs.
8	NW.	10	"	"	"	Dug	12	2,550	- 8	2,542			Glacial drift	Hard, clear, "alkaline"	45	D, S	Sufficient for local needs.
9	SE.	11	"	"	"	Dug	19	2,700	- 11	2,689			Glacial drift	Hard, clear, "alkaline"		S	Sufficient for local needs.
10	SE.	12	"	"	"	Dug	12	2,725	- 8	2,717			Glacial drift	Hard, clear, "alkaline"	45	D, S	Sufficient for local needs.
11	NW.	12	"	"	"	Dug	18	2,700	- 12	2,688			Glacial drift	Hard, clear, "alkaline"	45	D, S	Sufficient for local needs.
12	SE.	13	"	"	"	Dug	20	2,700	- 17	2,683	17	2,683	Glacial gravel	Hard, clear	44	D, S	Sufficient for local needs.
13	NW.	13	"	"	"	Dug	29	2,715	- 20	2,695			Glacial drift	Hard, clear	44	D, S	Sufficient for local needs.
14	NE.	14	"	"	"	Bored	71	2,700	- 61	2,639			Glacial drift	Hard, iron	44	D, S	Sufficient for local needs.
15	SW.	15	"	"	"	Dug	13	2,500	- 7	2,493			Glacial drift	Hard, "alkaline"	48	D, S	Sufficient for local needs.
16	NW.	15	"	"	"	Dug	13	2,500	- 7	2,493	7	2,493	Glacial sand	Hard, clear		D, S	Sufficient for local needs.
17	NE.	15	"	"	"	Dug	22	2,490	- 14	2,476	14	2,476	Glacial sand	Hard, clear	48	D, S	Sufficient for local needs.
18	SE.	17	"	"	"	Dug	20	2,540	- 22	2,518			Glacial drift	Soft, clear	48	D, S	Sufficient for local needs.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PIAPOT, NO. 110, 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
19	NW.	17	12	22	3	Dug	20	2,550	- 16	2,534	16	2,534	Glacial sand	Hard, clear	47	D, S	Insufficient for local needs.
20	NW.	17	"	"	"	Dug	8	2,550	- 6	2,544	6	2,544	Glacial sand	Hard, clear, "alkaline"		S	Intermittent supply.
21	NE.	17	"	"	"	Dug	12	2,550	- 10	2,540	10	2,540	Glacial sand	Soft, clear	45	D, S	Sufficient supply; also another similar well.
22	NW.	18	"	"	"	Dug	10	2,540	- 6	2,534	6	2,534	Glacial sand	Hard, clear	48	S	Sufficient supply; an 8-foot well is used for domestic needs.
23	SE.	20	"	"	"	Dug	12	2,500	- 8	2,492	8	2,492	Glacial sand	Hard, clear, "alkaline"		S	Sufficient for local needs.
24	SE.	20	"	"	"	Spring		2,500					Glacial sand and gravel	Hard, clear		S	Sufficient for 50 head stock.
25	NW.	20	"	"	"	Dug	10	2,500	- 7	2,493	7	2,493	Glacial sand	Hard, clear		D, S	Sufficient for local needs.
26	SW.	21	"	"	"	Dug	10	2,490	- 7	2,483	7	2,483	Glacial sand	Hard, clear, "alkaline", salty		S	Insufficient for local needs.
27	SE.	22	"	"	"	Spring		2,490					Glacial drift	Hard		S	Sufficient for 50 head stock.
28	SE.	23	"	"	"	Bored	85	2,650	- 70	2,580			Glacial drift	Hard, clear		D, S	
29	NW.	23	"	"	"	Dug	30	2,550	- 8	2,542	22	2,528	Glacial sand	Hard, clear		D, S	Also another similar well.
30	SW.	24	"	"	"	Dug	18	2,700	- 10	2,690			Glacial drift	Hard, clear		D, S	Sufficient supply; also another similar well.
31	NW.	24	"	"	"	Dug	20	2,650	- 16	2,634	16	2,634	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for local needs; also another similar well.
32	NE.	24	"	"	"	Dug	20	2,700	- 16	2,684	16	2,684	Glacial sand	Soft, clear	48	D, S	Sufficient for local needs.
33	SE.	25	"	"	"	Dug	12	2,600	- 5	2,595			Glacial drift	Hard, clear		D, S	Sufficient supply; also three other similar wells.
34	NW.	25	"	"	"	Dug	30	2,625	- 28	2,597	28	2,597	Glacial sandy clay	Hard, clear		D, S	Also another similar well.
35	NE.	25	"	"	"	Bored	92	2,650					Glacial sandy clay	Hard, clear		D, S	Sufficient for local needs.
36	SW.	27	"	"	"	Dug	29	2,545	- 26	2,519	26	2,519	Glacial sand	Hard, clear, "alkaline"	44	D, S	Sufficient for local needs.
37	NW.	27	"	"	"	Dug	17	2,525	- 16	2,509	16	2,509	Glacial sand	Hard, clear		D, S	Sufficient for local needs.
38	NE.	27	"	"	"	Dug	14	2,525	- 10	2,515	10	2,515	Glacial sand	Hard, clear		D,S	Sufficient for local needs.
39	NE.	28	"	"	"	Dug	20	2,500	- 17	2,483	17	2,483	Glacial sand	Hard, clear		D, S	Constant water-level.
40	NE.	29	"	"	"	Dug	30	2,500					Glacial sand				Well has filled with sand to within 10 feet of the top.
41	NE.	31	"	"	"	Dug	16	2,550	- 12	2,538	12	2,538	Glacial sand	Soft, clear	48	D, S	Sufficient for local needs.
42	SE.	32	"	"	"	Dug	12	2,490	- 7	2,483	7	2,483	Glacial sand	Soft		S	Constant water-level.
43	NE.	32	"	"	"	Dug	49	2,490	- 37	2,453			Glacial drift	Hard, clear, "alkaline"		D, S	Intermittent supply; also another well 36 feet deep.
44	NE.	34	"	"	"	Dug	14	2,510	- 11	2,499	11	2,499	Glacial sand	Hard, clear		S	Sufficient for local needs.
45	SW.	34	"	"	"	Dug	12	2,520	- 8	2,512	8	2,512	Glacial sand	Soft, clear		D, S	Insufficient for local needs.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of PIAPOT, NO. 110, 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				
46	NW.	34	12	22	3	Dug	18	2,510	- 13	2,497	13	2,497	Glacial sand	Hard, clear		D, S	Sufficient for local needs.
47	NW.	34	"	"	"	Dug	28	2,510	- 13	2,497	13	2,497	Glacial sand	Hard, clear, "alkaline"		D, S	
1	SW.	5	12	23	3	Dug	12	2,510	- 7	2,503			Glacial drift	Soft, clear, "alkaline"	47	D, S	Sufficient supply; also use a dugout for stock.
2	NE.	7	"	"	"	Dug	14	2,494	- 12	2,482	12	2,482	Glacial sand	Hard, clear	47	D, S	Insufficient supply; there are many wells in village of Piapot; some are unfit for use.
3	NE.	7	"	"	"	Dug	40	2,494	- 20	2,474			Glacial sand	Hard		D, S	#
4	NE.	7	"	"	"	Dug	18	2,494	- 16	2,478			Glacial sand	Hard		D, M	#
5	NW.	8	"	"	"	Bored	25	2,499	- 15	2,484	15	2,484	Glacial sand	Hard, clear, "alkaline"	47	D, M	Sufficient for local needs.
6	NE.	8	"	"	"	Dug	30	2,504	- 15	2,489	15	2,489	Glacial sand	Hard, clear, "alkaline"	47	S	Sufficient for local needs.
7	NW.	11	"	"	"	Dug	20	2,550	- 17	2,533	17	2,533	Glacial fine gravel	Hard, clear, "alkaline"	48	D, S	Insufficient for local needs.
8	SE.	17	"	"	"	Dug	15	2,496	- 11	2,485	11	2,485	Glacial sand	Hard, clear, "alkaline"	49	D	Sufficient supply; also another well 12 feet deep.
9	SE.	17	"	"	"	Dug	38	2,498	- 28	2,470	28	2,470	Glacial sand	Hard, clear	47	D	Sufficient for local needs.
10	SE.	17	"	"	"	Bored	59	2,500	- 34	2,466	34	2,466	Glacial sand	Hard, clear, "alkaline"	47	D, S	Sufficient for local needs.
11	SE.	17	"	"	"	Bored	25	2,496	- 17	2,479	17	2,479	Glacial sand	Hard, clear	47	D	Sufficient for local needs.
12	NE.	22	"	"	"	Dug	55	2,550	- 40	2,510	40	2,510	Glacial sand	Hard, clear, "alkaline"	45	S	Sufficient for local needs.
1	NE.	2	12	24	3	Dug	14	2,480	- 12	2,468	12	2,468	Glacial sand	Hard, clear, "alkaline"	45	D, S	Sufficient for local needs.
2	SW.	3	"	"	"	Dug	18	2,500	- 16	2,484	16	2,484	Glacial sand	Hard, clear, "alkaline"		D	Constant water-level; a 12-foot well is used for stock needs.
3	NW.	3	"	"	"	Dug	10	2,500	- 6	2,494	6	2,494	Glacial sand	Hard, clear, "alkaline"		S	Constant water-level.
4	SW.	4	"	"	"	Dug	12	2,550	- 9	2,541	9	2,541	Glacial sand	Hard, clear		D, S	Sufficient supply; stock are also watered at a creek.
5	NW.	4	"	"	"	Dug	10	2,550	- 8	2,542	8	2,542	Glacial sand	Hard, clear		D, S	Constant water-level; also several other wells to a depth of 6 feet in a creek bed.
6	NE.	5	"	"	"	Dug	10	2,550	- 8	2,542	8	2,542	Glacial sand	Hard, clear	46	S	Sufficient for local needs.
7	SW.	7	"	"	"	Dug	4	2,650	- 1	2,649	1	2,649	Glacial sand	Hard, clear, "alkaline"	50	S	Sufficient supply; also used a dugout.
8	NE.	8	"	"	"	Sand-point	32	2,580	- 4	2,576	4	2,576	Glacial sand	Soft, clear	42	D, S	Sufficient for local needs.
9	SE.	12	"	"	"	Dug	14	2,480	- 10	2,470	10	2,470	Glacial fine gravel	Hard, clear, "alkaline"	44	D, S	Sufficient supply with aid of two other wells 10 feet deep.
10	SW.	12	"	"	"	Dug	14	2,490	- 10	2,480	10	2,480	Glacial sand	Hard, clear, "alkaline"	44	D, S	Sufficient for local needs.
11	NE.	12	"	"	"	Dug	12	2,480	- 9	2,471	9	2,471	Glacial sand	Hard, "alkaline"	44	D, S	Sufficient for local needs.
12	SE.	17	"	"	"	Dug	14	2,600	- 9	2,591	9	2,591	Glacial sandy clay	Hard, clear		S	Sufficient for local needs.
13	SW.	17	"	"	"	Dug	6	2,625	0	2,625	0	2,625	Glacial sand	Soft, clear		D, S	Also a 10-foot dry hole.

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

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

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WELL RECORDS—Rural Municipality of PIAPOT, NO. 110, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
14	SW.	18	12	24	3	Dug	20	2,000	- 15	2,645	15	2,645	Glacial sand	Hard, clear, "alkaline"	45	D, S	Sufficient supply; also another well 8 feet deep.
15	SE.	19	"	"	"	Dug	12	2,610	- 6	2,604			Glacial drift	Hard, clear, "alkaline"	42	D, S	Sufficient for local needs.
16	SW.	20	"	"	"	Dug	16	2,600	- 16	2,584			Glacial drift	Hard, clear, "alkaline"	42	D, S	Sufficient supply; also another well 10 feet deep.
17	NE.	20	"	"	"	Dug	7	2,590	- 3	2,587	3	2,587	Glacial sand	Hard, clear, "alkaline"	48	D, S	Sufficient supply; another similar well 11 feet deep.
18	SE.	21	"	"	"	Dug	6	2,530	- 4	2,526	4	2,526	Glacial sand	Hard, "alkaline"	50	S	Sufficient supply.
19	SE.	21	"	"	"	Drilled	22	2,580					Glacial sand	Soft, clear		D, S	Sufficient supply; also another well with an intermittent supply.
20	SW.	21	"	"	"	Sand-point	24	2,550	- 4	2,546	4	2,546	Glacial sand	Soft, clear, iron	42	D, S	Sufficient for local needs.
21	SW.	21	"	"	"	Dug	14	2,600	- 11	2,589	11	2,589	Glacial sand	Hard, clear	48	S	Sufficient for local needs.
22	NW.	21	"	"	"	Dug	8	2,560	- 5	2,555	5	2,555	Glacial sand	Hard, murky		S	Insufficient for local needs.
23	NW.	22	"	"	"	Dug	6	2,525	- 3	2,522	3	2,522	Glacial sand	Hard, "alkaline"		S	Constant water-level; several other wells unfit for use.
24	NE.	24	"	"	"	Dug	22	2,370	- 17	2,353	17	2,353	Glacial sand	Hard, clear		S	Sufficient supply; also four other wells.
25	SE.	25	"	"	"	Dug	13	2,450	- 7	2,443	7	2,443	Glacial sand	Soft, sulphur		S	Insufficient for local needs.
26	SW.	25	"	"	"	Dug	16	2,450	- 14	2,436			Glacial drift	Hard, clear, "alkaline"		D, S	Insufficient supply; also a 30-foot well.
27	NE.	27	"	"	"	Bored	35	2,490	- 27	2,463	27	2,463	Glacial sand	Hard, cloudy, "alkaline"	45	S	Sufficient supply; also another well 18 feet deep.
28	SE.	28	"	"	"	Dug	25	2,500	- 17	2,483			Glacial drift	Hard, clear		D, S	Insufficient for local needs.
29	SE.	28	"	"	"	Dug	20	2,500	- 15	2,485			Glacial drift	Hard, clear		D, S	Insufficient supply; also several other wells that are unfit for use.
30	NE.	28	"	"	"	Dug	16	2,550	- 12	2,538			Glacial drift	Hard, clear, "alkaline"		N	Unfit for use; intermittent supply; forty other similar wells to a depth of 30 feet.
31	SW.	28	"	"	"	Dug	20	2,550	- 12	2,538	12	2,538	Glacial sand	Hard, clear	47	D, S	Insufficient supply; also a 30-foot well unfit for use.
32	SE.	29	"	"	"	Dug		2,570					Glacial drift	Hard, "alkaline"		N	Unfit for use; so well filled in.
33	SW.	29	"	"	"	Dug	8	2,600	- 5	2,595	5	2,595	Glacial sand	Soft, clear	48	D, S	Sufficient for local needs.
34	SE.	30	"	"	"	Dug	12	2,600	0	2,600	0	2,600	Glacial sand	Soft, clear		D, S	
35		30					51	2,600	- 34	2,566			Glacial drift	Hard			#
36	SW.	30	"	"	"	Dug	20	2,620	- 10	2,610			Glacial drift	Hard, clear, "alkaline"		D	Intermittent supply.
37	NW.	31	"	"	"	Dug	12	2,550	- 9	2,541	9	2,541	Glacial sand	Hard, clear, "alkaline", salty	46	S	Sufficient supply; also a 12-foot well for domestic needs.
38	NE.	31	"	"	"	Dug	10	2,550	- 9	2,541	9	2,541	Glacial sand	Soft, clear		S	Sufficient supply; a similar well is used for domestic needs.
39	NE.	32	"	"	"	Drilled	20	2,520					Glacial sand	Hard, clear		D, S	Sufficient for local needs.

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 PIAPOT, NO. 110, 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
40	SW.	33	12	24	3	Dug	12	2,540					Glacial sand	Hard, clear	48	D, S	
41	NW.	33	"	"	"	Dug	35	2,460	- 29	2,431			Glacial drift	Hard, "alkaline," iron	46	D, S	Insufficient for local needs.
42	SW.	34	"	"	"	Dug	5	2,500	- 4	2,496	4	2,496	Glacial sand	Soft, clear	50	D, S	Insufficient supply; also several wells to a depth of 12 feet.
43	NW.	35	"	"	"	Dug	16	2,500	- 12	2,488	12	2,488	Glacial sand	Hard, clear, "alkaline"		D, S	Sufficient for local needs.
44	NE.	36	"	"	"	Dug	12	2,550	- 11	2,539	11	2,539	Glacial sand	Hard		N	Sufficient supply; but not used now.

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.