CANADA
DEPARTMENT OF MINES

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BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF ABERNETHY No. 186 SASKATCHEWAN

BY

B. R. MacKay, H. N. Hainstock & G. L. Scott

Water Supply Paper No. 152

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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF ABERNETHY, NO. 186 SASKATCHEWAN

INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

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

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Abernethy, No. 186, is an area of approximately 300 square miles in southeastern Saskatchewan. It consists of four full townships described as tp. 19, range 10; tps. 20, ranges 10 and 11, and tp. 21, range 12; fractional tp. 19A, range 10; parts of the full tps. 18, ranges 10 and 11, tps. 19, ranges 11 and 12, tp. 20, range 12, and tps. 21, ranges 10 and 11; and part of fractional tp. 19A, range 11, all W. 2nd mer. A branch line of the Canadian Pacific railway traverses the northern part of the municipality and on it are located the villages of Balcarres and Abernethy. A branch line of the Canadian National railways that runs between Regina and Melville crosses the northern part of the municipality and on it are located the village of Balcarres and the hamlets of Gillespie and Lorlie. The two railways intersect one-half mile west of Balcarres. The village of Abernethy, located near the centre of the municipality, is 55 miles northeast of Regina.

Qu'Appelle river and lake Katepwe, one of a chain of lakes that lie within Qu'Appelle valley, form the southern boundary of the municipality. The valley floor is approximately one mile wide and is very flat. The surface of the lake is at an elevation of 1,569 feet and is approximately 275 feet below plain level. Numerous, wide, deep, gorge-like ravines, some of which contain small, intermittent streams, dissect the surface of the plain in the vicinity of the valley. Pheasant creek, a permanent stream, flows through one of these deep ravines in township 20, ranges 10 and 11, and township 19, range 11. Qu'Appelle valley is disproportionate to the size of the stream flowing in it and it apparently was excavated by the waters that drained a large glacial lake that existed to the west and southwest of this area.

A thick deposit of alluvium, composed of sand, gravel, silt, and clay, which in places attains a thickness of 40 feet, has been deposited to form the valley floor by the many floodings of the river and by the tributary streams. The deep ravines are also floored by Recent stream deposits. The western and north-eastern parts of the municipality are mantled by glacial lake clays that have a thickness of not more than 6 feet. These areas mark the sites of small glacial lakes and the ground surface is quite flat. The top soil is a black clay loam, free from stones, and forms an excellent soil for the growing of cereal grains. A small area in the northwestern corner is covered by glacial outwash sands and gravels. A portion of township 21, ranges 10 and 11, and township 19, range 10, are mantled by moraine. The ground surface of the moraine-covered areas is rough and undulating, and is thickly wooded with poplar. The remainder of the municipality is covered by boulder clay or glacial till. The ground surface of the till-covered areas is slightly undulating and is characterized by many, large, shallow depressions that in years of average rainfall contain water. The top soil in these areas is lighter and more sandy than that in the glacial lake clay-covered districts.

Water-bearing Horizons in the Unconsolidated Deposits

The thick and extensive deposits of sand and gravel that occur in the Recent alluvium in Qu'Appelle valley and its tributaries contain a fairly abundant supply of ground water. The water-bearing beds are struck at depths of less than 20 feet below the surface. The supply from the wells that tap these deposits is constant and is not readily affected by drought conditions. The water is hard and slightly mineralized, but is suitable for drinking. The alluvium-covered areas are always favourable localities for digging wells. Numerous springs, many

of which flow continuously, are located along the banks of the valley and tributary ravines. A number of farmers hauled water from these springs for both domestic use and for stock during the drought of 1930 to 1934.

In the glacial till and moraine-covered areas, water-bearing sands and gravels are very difficult to locate within 175 feet of the surface. The upper 50 feet of the glacial drift is generally composed of 20 feet of yellow or oxidized clay, and 30 feet of blue clay, both of which may contain small layers and occasional pockets of sand and gravel. In the northern 6 miles of the municipality a few dug wells have encountered pockets of sand and gravel that yield moderate supplies of hard, slightly mineralized water, but a number of dry holes are usually dug before a producing well is obtained. Throughout the municipality farmers generally dig wells beside creeks or undrained depressions in order to obtain the maximum amount of surface seepage. In years of average rainfall these wells yield sufficient water to meet farm requirements during the summer months, but during the winters and drought periods the wells may go dry. In the area outlined by the "A" boundary line on Figure 1 of the accompanying map there are not more than twelve wells that yield a sufficient supply of usable water for 25 head of stock during drought years, and three of these wells are drilled to depths greater than 300 feet. In this area the supply of water is almost entirely obtained from dams, dugouts, and seepage wells, and during the drought of 1930 to 1934 there was a severe shortage of water throughout this part of the municipality.

The villages of Balcarres and Abernethy use shallow wells less than 25 feet deep as a source of drinking water. The supply from these wells is insufficient during periods of drought, and water is often tanked into the villages by neighbouring farmers and sold to the residents. Reservoirs for collecting surface run-off

water have been excavated in both villages. Wells have been dug into the blue clay, but they yield only small supplies of highly mineralized water that is unfit for drinking.

The only district where permanent supplies of ground water are obtained from water-bearing horizons occurring at depths of less than 175 feet is in the northern parts of townships 21, ranges 10 and 12. In this district bored or drilled wells strike discontinuous beds of sand or gravel at depths ranging from 65 to 140 feet, and yield an abundant supply of hard, highly mineralized water that is under slight hydrostatic pressure. The water is suitable for stock, but cannot be used for drinking.

The glacial drift in this municipality has a maximum thickness of at least 450 feet, the Marine Shale series, locally termed "soapstone", being encountered at a depth of 450 feet in a well in the SE.$\frac{1}{4}$, sec. 12, tp. 21, range 11. Wells drilled to depths ranging from 175 to 450 feet have encountered at least three fairly definite but discontinuous water-bearing horizons of sand or gravel. In the northern 8 miles of the municipality most of the deep wells tap water-bearing horizons occurring at elevations of from 1,710 to 1,775 feet, and from 1,610 to 1,675 feet. In the southwestern part of the municipality it has been necessary to drill to an elevation of 1,490 to 1,560 feet to obtain water. Two wells in township 20, range 12, yield moderately soft water, but the other deep wells yield water that is hard, highly mineralized, and generally contains iron. It is being used for stock, but is rarely used for drinking or other domestic purposes. The hydrostatic pressure is not great and the water usually rises approximately 100 feet above the top of the aquifer. The supply is abundant and is not noticeably affected by drought conditions. Water is almost certain

to be found at depths greater than 200 feet in the glacial drift at most places in the municipality. Water is definitely known to exist at depth in the southern part of the area, for in the years 1900 to 1905 the Provincial Government drilled at least three wells that obtained water. One of these wells, located in township 19, range 11, was a flowing-artesian well. Considerable difficulty, however, is experienced with the fine sand plugging the well casings and partly shutting off the water supply. This trouble appears to be more prevalent in wells that tap aquifers near the base of the glacial drift, than it is in the 175- to 300-foot wells.

From the information at hand it appears advisable to drill to depths ranging from 175 to 450 feet in order to obtain a permanent supply of water. It does not appear advisable, however, to bore [1] for water, except in the northern parts of township 20, ranges 10 and 11. Before digging a well by hand, it is recommended that test borings be made with a small hand auger to a depth of 40 feet, in order to try and locate a pocket of water-bearing sand or gravel. Dams and deep dugouts are recommended as a means of collecting and storing run-off waters when drilling operations cannot be financed. The dugouts should be at least 12 feet deep and if possible located in a depression so as to collect the maximum amount of run-off water.

Water-bearing Horizons in the Bedrock

The Marine Shale series underlies the glacial drift throughout the township. It was encountered at an elevation of 1,470 feet in one well located on sec. 12, tp. 21, range 11. The Marine Shale in this part of Saskatchewan, however, is thought to contain very few water-bearing horizons and farmers and well drillers are advised to refrain from drilling into the shale, or "soapstone" as it is locally termed.

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1. Note: "Boring" is done with a large auger and can rarely be extended to a depth of much over 100 feet because of the presence of boulders in the glacial drift.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 18, Range 10

The part of this township that lies north of Qu'Appelle river is discussed in this report. The river lies at an elevation of 1,560 feet, and its banks rise steeply to the plain which has an elevation of 1,860 feet. A short, deep ravine occurs in sections 34 and 33, and a small, intermittent creek flows through sections 36 and 25 into Qu'Appelle river. The floor of Qu'Appelle valley is composed of Recent alluvium. The remainder of the township is covered by boulder clay.

The Recent alluvium is from 10 to 15 feet thick in the ravines and approximately 40 feet thick in Qu'Appelle valley, and consists of silt, clay, and thick layers of sand and gravel. Wells dug in the deposits usually yield a large supply of water, as the sand and gravel deposits are extensive and store large quantities of water. The only two wells in the township that yield a permanent supply of water have been dug in Recent deposits of sand and gravel. The wells are 10 feet deep and are located in the NE.$\frac{1}{4}$, section 28, and the SE.$\frac{1}{4}$, section 33. The water is hard and slightly "alkaline", and the supply from the individual wells is sufficient for 40 head of stock.

The remaining wells in the township have been dug or bored in the boulder clay, the deepest well being 80 feet deep. The upper 80 feet of the glacial drift in the till-covered regions is largely composed of yellow and blue clays that may contain in places small pockets of sand and gravel. The water supply depends entirely on surface seepage and for this reason most of the 15- to 20-foot wells have been dug near, or in, undrained depressions. In drought years their yield is barely sufficient for household requirements. The water in the deeper wells that have been bored into the blue clay is too highly

mineralized for use. Several farmers have built dams in coulées and use the water for stock. A well dug beside the dam is used for domestic needs.

As a rule the farmers in this township depend entirely on surface water, whether it be collected in sloughs, creeks, dams, or seepage wells, and as a result drought years cause a shortage of water for stock.

A permanent supply of water might be obtained by drilling to depths ranging from 200 to 400 feet below the surface. Boring methods are not recommended. Surface water could be collected and stored by means of deep dugouts or dams, if finances do not permit the drilling of deep wells.

Township 19A, Range 10

This fractional township consists of six full sections and six half sections. Qu'Appelle valley traverses the southern part of section 6, and deep ravines occur in sections 4, 5, and 6. The township is mantled by a deposit of glacial till and the ground surface, except where dissected by ravines in sections 4, 5, and 6, is a slightly undulating plain that is devoid of tree growth.

The supply of ground water obtained in this township is very small. There is not a single well that yields a satisfactory supply and all the farms were very short of water during the drought of 1930 to 1934. All wells have been dug or bored to depths less than 85 feet below the surface and within this range the glacial drift is almost entirely composed of clay. A pocket of sand was encountered in a 70-foot bored well in the SW.$\frac{1}{4}$, section 11, and a large supply was obtained, but the water was black and quite unfit for any use. Many dry holes have been put down. In years of average rainfall the farmers depend entirely on sloughs and seepage wells as a source of water for stock.

In the drought years of 1930 to 1934, practically all water for stock and domestic needs in this township was tanked. During the winter months snow and ice are melted or water is hauled.

There are two methods of alleviating the scarcity of water in this township. The first method is to drill to probable water horizons at depths between 200 and 400 feet below the surface. It appears useless to dig or bore in a search for water. The second method is to conserve surface run-off water either by means of dams or deep dugouts. If dugouts are made sufficiently deep, at least 12 feet, and located where a maximum amount of water can be collected in the freshet seasons, they should retain a supply of water that will be sufficient for stock use throughout the year.

Township 19A, Range 11

The three sections that lie north of Qu'Appelle valley in this fractional township are discussed in this report. This area lies within Qu'Appelle valley and its tributaries. The tributary ravines are thickly wooded with poplar, but the floor of the valley is devoid of tree growth. The banks of the valley and the ravines are mantled by boulder clay, but their floors are covered with Recent alluvium.

Two wells located in the NW.$\frac{1}{4}$, section 1, and the NW.$\frac{1}{4}$, section 2, and a spring in the SW.$\frac{1}{4}$, section 10, were the only sources of ground water recorded by the field party. The wells are 7 and 10 feet deep and tap sand deposits in the Recent alluvium. The water obtained is hard and slightly "alkaline", but it is being used for drinking. The supply is moderate and constant, and is sufficient for 25 to 40 head of stock. The spring is at the base of the valley bank and issues from a sand aquifer. The water is hard, contains iron, but is suitable for

drinking. The supply is abundant and little affected by prolonged drought periods.

Little difficulty is experienced as a rule in obtaining satisfactory supplies of water at shallow depths in the alluvial deposits and there should be no shortage of water in this township.

Township 19, Range 10

The elevation of the ground surface in this township decreases from 2,060 feet in the northeastern corner to approximately 1,850 feet in the southwestern corner. The southwestern quarter of the township is broken by several ravines that contain small, intermittent streams. An area in the northeastern corner is mantled by moraine and its ground surface is quite hilly. This area is part of Pheasant hills. The remainder of the township is covered by boulder clay or till and its ground surface is quite flat to gently undulating. Large, deep, undrained depressions are of common occurrence and the northern 4 miles of the township is thickly wooded with poplar.

The supply of ground water obtained in this township is small. In years of average rainfall farmers are able to secure sufficient water during the summer months from sloughs, dugouts, dams, and seepage wells, but in winters and prolonged drought periods, such as was experienced in 1930 to 1934, the water situation is acute. Water for stock purposes is tanked from large dams or one of the few wells that yield an abundant supply of water. Drinking water is usually hauled from the school well in the SE.$\frac{1}{4}$, section 3, from springs in sections 6 and 7, and from a well on the NW.$\frac{1}{4}$, section 36. The upper 120 feet of the glacial drift is composed of 15 feet of yellow or oxidized clay, and 105 feet of blue clay. A few scattered pockets and thin layers of sand occur in the clays, but they are very

scarce and most of the wells have not encountered sand or gravel deposits. Wherever possible farmers have dug their wells beside sloughs or in coulées in order to obtain the maximum amount of seepage water. Only four shallow wells yielded sufficient water for farm needs during the drought period and they are located in the NE.$\frac{1}{4}$, section 6, NE.$\frac{1}{4}$, section 7, NW.$\frac{1}{4}$, section 18, and the NW.$\frac{1}{4}$, section 36. Numerous dry holes have been dug throughout the township. Many farmers have excavated dugouts, but they have not been made deep enough and consequently do not retain sufficient water after the spring run-off to last during the remainder of the year. Many shallow wells have been dug beside the dugouts and the seepage water from the dugout is used for domestic purposes.

Very few of the bored wells in this township have been successful. Two bored wells located in the SW.$\frac{1}{4}$, section 32, and the NW.$\frac{1}{4}$, section 35, obtain a fairly abundant supply of hard, slightly "alkaline" water at depths of 60 and 65 feet, respectively. Two dry holes were put down in the NE.$\frac{1}{4}$, section 29, and ; in the SE.$\frac{1}{4}$, section 34. They were stopped in a bed of fine dry sand at a depth of 90 feet. A 90-foot well in the SE.$\frac{1}{4}$, section 11 yielded a green-coloured water, a 120-foot well in the SE.$\frac{1}{4}$, section 26, delivered water with an iron scum; a 65-foot well in the NE.$\frac{1}{4}$, section 26, and a 60-foot well on the NW.$\frac{1}{4}$, section 31, yielded water that has an offensive odour and is unfit for use. The other bored holes in the township were dry. It does not appear advisable, therefore, to bore for water in this township. The deepest well sunk by a farmer is 120 feet, but records show that the Saskatchewan Government drilled two wells in the vicinity of sections 2 and 3, and sections 10 and 11. These wells were 160 and 265 feet deep, respectively, and a good supply of water was obtained. They were drilled in the year 1900 and have since been abandoned. It is surprising that no other deep wells have been

drilled. The glacial drift is probably generally in excess of 400 feet thick and as deep drilling in the other townships of the municipality has been successful, farmers in this township are advised to drill to depths of at least 200 feet to obtain a permanent supply of water that will be suitable for stock and probably for drinking. Further digging or boring operations are not advised, as water-bearing horizons that will yield an adequate supply of usable water apparently do not exist in the upper 120 feet of the glacial drift. If dugouts are excavated they should be located in depressions or draws and should be at least 12 feet deep.

Township 19, Range 11

This township is drained by Qu'Appelle river and Pheasant creek, and by many, smaller, intermittent tributary creeks. Qu'Appelle river flows southeastwards across the southwestern corner of the township and Pheasant creek flows southward through the western half of the township emptying into Qu'Appelle river in sec. 9, tp. 19A, range 11. Both streams flow through wide, deep channels that are out of proportion to the size of the existing streams. The floors of both valleys consist of a thick deposit of Recent stream alluvium and the greater part of the area west of Pheasant creek is covered with glacial lake clay. The remainder of the township is mantled with glacial till. The slightly undulating plain surface is devoid of tree growth, but the ravines and banks of Qu'Appelle valley are quite thickly wooded.

The ground water conditions of township 19, range 10, and this township are similar. Only four wells are known that yield a permanent supply of water. Practically every farmer depends upon shallow dug seepage wells, dugouts, dams, streams, or sloughs for a supply of water for both stock and drinking

purposes. The upper 200 feet of the glacial drift is almost entirely composed of clay and apparently does not contain continuous water-bearing horizons of sand or gravel. Very small layers of sand have been struck in the upper 30 feet of the glacial drift, but wells tapping them are easily affected by drought conditions. Three of the four wells that yield permanent supplies of water are dug in the Recent alluvium deposits in the valleys of Qu'Appelle river and Pheasant creek. These wells are located in the SW.$\frac{1}{4}$, section 3, the SW.$\frac{1}{4}$, section 8, and the NW.$\frac{1}{4}$, section 18, and they are 26, 14 and 10 feet deep, respectively. They tap thick beds of sand and gravel that yield fair to abundant supplies of hard, slightly mineralized water that is suitable for drinking. The thickness of the Recent alluvium was determined by the well on the SW.$\frac{1}{4}$, section 3, where 26 feet of sand and clay were penetrated before the glacial blue clay was struck. The fourth well in the SE.$\frac{1}{4}$, section 30, was drilled to a gravel aquifer 301 feet below the surface and this well is the only one in the township in which water is being obtained at depth. A bed of sand of unrecorded thickness overlies the gravel aquifer that lies at an elevation of 1,520 feet, and the water rises under pressure from the gravel to a point 261 feet below the surface. The water is hard, contains iron, and is being used for drinking. The supply is abundant. A 328-foot well in the NE.$\frac{1}{4}$, section 31, tapped the same fine red sand water-bearing horizon at an elevation of 1,532 feet. An abundant supply of water was obtained that rose to a point 250 feet below the surface. This well was drilled through blue clay for the greater part of its depth, but passed through a 2-foot bed of dry sand at the 125-foot level. The fine sand particles have plugged the casing and rendered the well useless.

A well was drilled at Konlis school in 1905 by the Provincial Government. This well was approximately 200 feet deep and tapped a water-bearing horizon of very fine sand at an approximate elevation of 1,700 feet. The water rose to a point 10 feet above the surface and flowed for one day, when the supply was cut off by the fine sand particles plugging the casing. The water was hard and tasted of "sulphur" (hydrogen sulphide).

In the years of average rainfall, seepage wells, dams, dugouts, and sloughs would yield sufficient water during the summer months to meet a farmer's requirements, but in winter months and during periods of drought the water situation is very acute. The Provincial Government has built a dam on a tributary of Pheasant creek in the SE.$\frac{1}{4}$, section 21, and it is used by many farmers.

Two methods of alleviating the shortage of water could be used in this township, either to drill for water, or to collect and store the surface run-off water by dams or dugouts. It is important that dugouts be at least 12 feet deep. If drilling is undertaken farmers should be prepared to prospect to a depth of at least 200 feet and it is inadvisable to drill much deeper than 400 feet.

Township 19, Range 12

The ground water conditions of the northeast quarter of the township, north of Qu'Appelle river, are discussed in this report. The southern part of lake Katepwe lies in the northwestern part of the township. A long, narrow, deep ravine containing a small intermittent stream passes southeasterly through sections 35, 26, 25, 24, and 13, towards Qu'Appelle valley. The floor of Qu'Appelle valley consists of a deposit

of Recent alluvium 25 to 40 feet thick, the banks of the valley and ravines are covered with glacial till, and the remainder of the township is overlain by a thin veneer of glacial lake clays.

Four of the five farmers interviewed by the field party in this area have sufficient water to meet their local requirements. Several springs that yield an abundant supply of hard water, which is suitable for drinking, are located in the NE.$\frac{1}{4}$, section 27, along Qu'Appelle valley. A 12-foot well dug on the bank near the lake in the SE.$\frac{1}{4}$, section 34, yields a good supply of hard, "alkaline" water that is being used for drinking, and a 14-foot well near the ravine in the SE.$\frac{1}{4}$, section 35, obtains a constant supply of hard water from a gravel aquifer. The fourth source of water is a 328-foot drilled well in the NE.$\frac{1}{4}$, section 25, that taps a water-bearing horizon of gravel at an elevation of 1,512 feet. This water-bearing horizon is thought to be the same as that encountered by the wells in secs. 30 and 31, tp. 19, range 11. The water is hard and contains iron. It rises to a point 263 feet below the surface. The supply is abundant and was unaffected by the drought of 1930 to 1934.

A dry hole was drilled through 100 feet of blue clay in the SE.$\frac{1}{4}$, section 24. This well was not deep enough to tap the water-bearing horizon that lies at an approximate elevation of 1,520 feet, the base of this dry hole being at an approximate elevation of 1,710 feet. If this well were drilled 200 feet deeper it probably would encounter the same water-bearing horizon as the well in the NE.$\frac{1}{4}$, section 25.

Township 20, Range 10

Pheasant creek, a permanent stream, flows in a south-westerly direction through sections 36, 25, 26, 27, 22, 21, 17 and 18. Its valley is approximately 100 feet deep and numerous, short, deep tributary coulées are located on the south side of the valley and drain the run-off waters from Pheasant hills. The

ground surface is much more rolling on the south side of Pheasant creek than it is on the north. The floor of Pheasant Creek valley is formed by a deposit of Recent alluvium approximately 25 feet thick. The township is mantled with glacial till with the exception of the southwest quarter of section 2, which is covered by moraine. The southern 2 miles of the township and Pheasant valley are quite thickly wooded with clumps of poplar.

A fair supply of ground water is obtained in this township, but twelve farmers are unable to secure a sufficient supply of water to meet their requirements in all seasons of the year. Most of the wells in the township have been dug or bored to depths less than 60 feet in the glacial drift. The material penetrated by a well in this township is usually 5 to 20 feet of yellow, red, or white clay, and blue clay. Pockets or layers of sand and gravel may be struck at any depth in the upper 60 feet of the glacial drift. If the aquifer lies above the blue clay the supply of water obtained is usually not so abundant as the supply from an aquifer underlying the blue clay. Water from sand or gravel aquifers in the blue clay is usually highly mineralized and unsuitable for drinking, and rises under pressure. Since the deposits of sand and gravel occur as pockets and discontinuous layers it often happens that one well may strike one or possibly two aquifers within 30 feet of the surface, whereas another well, not far distant, will be sunk to a depth of 50 feet without striking any aquifer. The supply also varies greatly, for example, a 52-foot bored well in the NW.$\frac{1}{4}$, section 12, yields barely sufficient water for 20 head of stock in wet seasons, whereas a 45-foot well in the NW.$\frac{1}{4}$, section 13, yields a sufficient supply of water for 65 head of stock, although the supply was diminished during the drought of 1930 to 1934. Another well in the SE.$\frac{1}{4}$, section 18, encountered small layers of sand that did not contain water. A fairly abundant and permanent supply of water

is obtained from several 35 to 45-foot wells located in the NW.¼, section 5, SW.¼, section 10, SW.¼, section 16, SE.¼, section 17, and the SW.¼, section 28. Farmers are not at all certain, however, of striking a permanent supply of water by digging or boring to depths less than 60 feet below the surface, and it is advisable to prospect with a small hand auger prior to digging a well. A number of farmers have constructed small dams or excavated dugouts to collect run-off water for stock use. Springs that occur in Pheasant Creek and its tributaries are also used.

North of Pheasant Creek valley, six drilled wells have apparently tapped three separate water-bearing horizons of sand and gravel at approximate elevations of 1,770, 1,720 and 1,630 feet above sea-level. The first water-bearing horizon was struck by a 157-foot well in the NE.¼, section 29, and by a 135-foot well in the NW.¼, section 33, the aquifer being sandy gravel. The water rises under pressure to a point 107 feet below the surface in the 157-foot well, and the supply is abundant. The second water-bearing horizon is composed of sand and it is tapped by wells in the NE.¼, section 33, the NW.¼, section 35, and the NE.¼, section 36, at depths of 190, 200 and 200 feet, respectively. Hydrostatic pressure raises the water to points 160, 90, and 60 feet below the surface; the second well was pumped continuously for four days without lowering this level. The third water-bearing horizon, composed of fine sand, was struck by a 288-foot well in the NE.¼, section 30. The water rose to a point 230 feet below the surface and the supply is oversufficient for 40 head of stock. The water in all these drilled wells is hard and fairly highly mineralized, but it is being used for drinking. The water in the 135-foot well was termed "alkaline", and the water from the 288-foot well is slightly salty. Possibilities of striking water by drilling

to depths in excess of 150 feet in this township are considered very good. The glacial drift is very thick and may be as much as 400 to 450 feet in places. Drilling should be confined to the glacial drift.

Township 20, Range 11

Pheasant creek flows in a southwesterly direction across sections 13, 12, 11, 2, and 3. The floor of the valley, which is about 150 feet below plain level, is formed by a deposit of Recent alluvium, whereas the banks of the valley and the surrounding plain are covered with glacial till. The ground surface is slightly undulating and the elevation decreases from 1,940 feet in the northeastern corner, to 1,860 feet in the southwestern corner, of the township. Tree growth is confined to the banks of the valley.

The supply of ground water in this township is not abundant and there are only approximately twelve wells that deliver a permanent supply of water, five of which are deep, drilled wells. Dug wells, less than 40 feet deep, are used by most farmers. These wells usually tap small layers of sand or gravel and their supply is readily affected by drought conditions. In many places these wells are dug adjacent to dugouts, dams, or sloughs, and depend on water seeping through the clay from these reservoirs. During the drought of 1930 to 1934 they proved to be very unreliable. Occasionally fairly large pockets of sand and gravel are tapped by dug wells and they yield a fairly abundant and constant supply of water. Quarter-sections where wells of this type have been dug are the SE.$\frac{1}{4}$, section 2, the SW.$\frac{1}{4}$, section 4, the NW.$\frac{1}{4}$, section 21, the SE.$\frac{1}{4}$ and NE.$\frac{1}{4}$, section 28, and the SW.$\frac{1}{4}$, section 29. The well on the NW.$\frac{1}{4}$, section 21, yields a particularly large supply of water and as many as fifteen farmers tanked from this well during the drought without depleting the supply to any great

extent. This well is 30 feet deep and is situated on a knoll. The aquifer is a deposit of sand that underlies 3 feet of gravel at a depth of 28 feet below the surface. The water is not under hydrostatic pressure and it is hard and suitable for drinking.

The village of Abernethy derives its supply of water from several shallow, dug wells 20 to 30 feet deep. These wells tap thin layers of sand or gravel beneath yellow clay. A small supply of hard, slightly "alkaline" water is obtained from each well, but in times of prolonged drought the supply is insufficient to meet the population's requirements.

It appears that if water is not struck within a depth of 40 feet below the surface a supply of water that is usable will not be obtained within a depth of at least 150 feet. Water was obtained in two 60-foot bored wells in the NW.$\frac{1}{4}$, section 14, and the NE.$\frac{1}{4}$, section 22, but it was too highly mineralized to be used for stock. The water in the former well was analysed and pronounced unfit for use. Many dry holes have been dug and bored to a maximum depth of 150 feet and there is not a single well in the township between 40 and 200 feet deep that is being used.

Three drilled wells in the NE.$\frac{1}{4}$, section 32, the SE.$\frac{1}{4}$, section 33, and the SE.$\frac{1}{4}$, section 36, have tapped a common water-bearing horizon of sand and gravel at an elevation of 1,650 feet or at depths of 300, 275, and 285 feet, respectively. The water rises under hydrostatic pressure to points 210, 150, and 210 feet below the surface, and the supply is abundant. The water is hard and contains iron, but it is being used for drinking without any apparent ill effects. A sand pocket within the blue clay was penetrated at a depth of 90 feet below the surface in the 300-foot well, but the supply of water obtained from it was small. A 365-foot drilled well in the SW.$\frac{1}{4}$, section 14, located

a second water-bearing horizon composed of red gravel and white sand at an elevation of 1,540 feet. The water is hard, drinkable, and rises to a point 304 feet below the surface, and the supply is abundant.

A well 452 feet deep was drilled in the NE.$\frac{1}{4}$, section 23. Blue clay formed the bulk of the material penetrated, but a layer of water-bearing gravel was struck 80 feet below the surface and 40 feet of dry gravel was penetrated near the base of the well before water was struck at elevation 1,473 feet. It is believed that the base of this well is very close to the contact of the Marine Shale series. The water is hard and very highly mineralized. It has not been used for several years for stock and it has never been used for drinking. Farmers should be prepared to drill to a depth at least 250 feet below the surface, but it is inadvisable to drill deeper than 400 feet.

An alternative to obtaining a permanent supply of water by deep drilling is to excavate deep dugouts in large, undrained depressions.

Township 20, Range 12

Qu'Appelle valley traverses the southwestern part of the township and is occupied by Katepwe lake. Many, deep, wide ravines extend in a southwesterly direction across the township. The ravines and the shore of Katepwe lake are floored with Recent alluvium. The banks of the valley and the ravines, and a strip of country about one mile wide at the eastern border of the township are mantled with glacial till. The remainder of the township is covered with a thin deposit of glacial lake clays. Clumps of poplar trees are numerous in the western 4 miles of the township.

About ten farmers in the township depend upon surface water in creeks, sloughs, dugouts, dams, or seepage wells to

meet their farm requirements. Six farmers use drilled wells, and the remaining farmers obtain a good supply of water from shallow dug wells or springs. Shallow dug wells range from 4 to 30 feet in depth and the quantity of water obtained depends upon the thickness and extent of the sand and gravel aquifer. Fairly abundant supplies of hard, slightly "alkaline" water that is suitable for drinking are being obtained from deposits of Recent sand and gravel in the NW.$\frac{1}{4}$, section 14, and the SW.$\frac{1}{4}$, section 16. The first well was dug 12 feet deep in the bottom of a deep coulée and the second was dug 4 feet deep beside lake Katepwe. In the glacial till and lake clay-covered districts the occurrences of sand and gravel in the upper 30 feet of the glacial drift are very patchy and consequently the supply of water obtained from individual wells is exceedingly variable. For instance, a 17-foot well in the SW.$\frac{1}{4}$, section 24, taps a gravel aquifer that yields a very abundant and constant supply of water, whereas a 30-foot well in the SE.$\frac{1}{4}$, section 25, yields only sufficient water for drinking and household purposes.

Nine holes have been drilled in the township, eight of which have struck water, but only six of the nine wells yield an abundant supply of water. Two wells on the SE.$\frac{1}{4}$ and the NE.$\frac{1}{4}$, section 36, have tapped a fine sand aquifer at depths of 105 and 90 feet below the surface. Only a fair supply of water is yielded by the latter well, but the former well delivered an abundant supply until it became partly plugged in 1933. The water is hard and contains iron, but is being used for drinking. The hydrostatic pressure raises the water to a point 38 feet below the surface in the 108-foot well. Three wells in the NE.$\frac{1}{4}$, section 23, SE.$\frac{1}{4}$, section 28, and the SE.$\frac{1}{4}$, section 33, tap sand and gravel at depths of 236, 285, and 280 feet below the surface. The water is hard and is being used for drinking, although that

from the 236-foot well has a salty taste. Hydrostatic pressure raises the water to points 196, 235, and 230 feet below the surface, and the supply is abundant. It is not definitely known if the 236-foot well taps the same water-bearing horizon as that struck by the 285- and 280-foot wells. Two wells in the SE.$\frac{1}{4}$, section 3, and the NW.$\frac{1}{4}$, section 10, have been drilled to depths of 330 and 250 feet, respectively. They appear to tap a common aquifer composed of gravel at elevations 1,490 feet and 1,560 feet above sea-level. The water rises under pressure to a point approximately 240 feet below the surface and the water in both wells is so soft that it can be used for laundry purposes. The supply is abundant.

A hole was drilled 342 feet deep in the SE.$\frac{1}{4}$, section 24, but although water was obtained it was impossible to keep the quicksand, which forms the aquifer, from shutting off the supply and the well was abandoned. A dry hole 300 feet deep was drilled in the SE.$\frac{1}{4}$, section 33, which proves that the water-bearing horizons are discontinuous, as a 280-foot well on the same quarter-section struck water. No trouble should be experienced, however, in obtaining an abundant supply of water at depth at most places in the glacial drift in this township.

Township 21, Range 10

The Pipikisis Indian reserve occupies what would be sections 31 to 35 inclusive of the township if the reserve were subdivided. The flat plain area in the northeastern part of the township and the eastern half of section 1 are covered with a thin deposit of glacial lake clays. The northwestern corner is covered by moraine and is rough and rolling, whereas the remainder of the township is mantled with glacial till. The glacial till-covered area is slightly undulating. The general elevation of the ground-surface is 1,950 feet, with a slight decrease towards the south. Wooded areas are confined to sections 13, 14, 15, 16, 29 and 30.

Approximately ten farmers in the township depend almost entirely on surface water stored in dugouts in seepage wells, or sloughs to meet their requirements. Several other farmers have wells that yield permanent supplies of water, but these supplies are supplemented by small dugouts that are used for stock purposes. Abundant supplies of ground water are very difficult to locate at depths less than 40 feet below the surface and there are only three shallow wells that yield sufficient water for 20 to 30 head of stock. These wells are located in the NW.$\frac{1}{4}$, section 10, SW.$\frac{1}{4}$, section 27, and the SW.$\frac{1}{4}$, section 28. The upper 40 feet of glacial drift contains very little sand or gravel and most of the shallow wells depend almost entirely on seepage from sloughs or dugouts. The hamlet of Lorlie uses six shallow wells to meet its requirements.

Three bored and three drilled wells have struck permanent supplies of hard, highly mineralized water between depths of 67 and 101 feet below the surface. The water rises under pressure to a point half-way up the wells, the supply is abundant, and the drought of 1930 to 1934 did not deplete the supply to any great extent. The water is suitable for watering stock, but it is too "alkaline" to be considered good drinking water. Dry holes, 100, 131, and 135 feet deep, were bored in the NW.$\frac{1}{4}$, section 23, the SW.$\frac{1}{4}$, section 14, and the SE.$\frac{1}{4}$, section 15.

Five drilled wells, 180 to 240 feet deep, appear to tap a fairly general water-bearing horizon of sand or gravel at an approximate elevation of 1,725 feet above sea-level. The water rises under pressure to points ranging from 75 to 145 feet below the surface and the supply is abundant and was unaffected by the drought of 1930 to 1934. The water is hard, and contains iron, but is not so highly mineralized as the water from the 60- to 100-foot wells. It is more suitable for

drinking than the "alkaline" water from the shallower, bored, and drilled wells as it does not act as a laxative.

Possibilities of striking a permanent supply of water by drilling methods are very good in this township. The glacial drift may be as much as 475 feet thick. In this municipality the shallow drilled wells, 60 to 100 feet deep, and very deep wells that tap aquifers near the base of the drift, produce more highly mineralized water than the wells 200 to 350 feet deep. These latter wells usually yield water that contains considerable iron, but it is seldom "alkaline". Deep drilling is recommended in this township, but should be confined to the glacial drift.

Township 21, Range 11

The Pipikisis Indian reserve occupies what would be sections 36, 35, 34, and part of 33, of this township. Most of the sections north of the Canadian National railway are covered by moraine, the surface of which is very undulating and rough, and contains many sloughs. It is partly wooded with groves of poplar. The southwestern part of the township is a flat, treeless plain that is covered with a veneer of glacial lake clay. The remainder of the township is covered with glacial till. Its ground surface is slightly undulating and is characterized by a few sloughs and clumps of poplar.

The ground water supply in this township is unsatisfactory due to the fact that most of the farmers depend on dug and bored wells less than 100 feet deep, which seldom yield abundant or sufficient quantities of water in winter months or dry years. The upper 100 feet of the glacial drift is almost entirely composed of clay. Sandy, yellow boulder clay extends from the top soil to an approximate depth of 20 feet, and is underlain by blue clay. Pockets and small layers of sand or gravel occur in the clay at various depths and the thickness and extent of

the gravel or sand pockets tapped determine the amount of water obtained. Farmers experience much difficulty in striking these pockets. Four wells in sections 3, 4, and 5 have struck extensive deposits of sand and gravel at depths ranging from 30 to 50 feet below the surface. The 30-foot well in the SE.$\frac{1}{4}$, section 5, yields an abundant supply of water, and six to eight neighbouring farmers hauled water from this well during the drought of 1930 to 1934. Three shallow wells, 8, 30, and 12 feet deep, in the NW.$\frac{1}{4}$, section 12, the SE.$\frac{1}{4}$, section 13, and the SE.$\frac{1}{4}$, section 26, possess permanent supplies of water. The water from the latter well is soft and can be used for washing. It is interesting to note that seventeen dry holes were put down to a maximum depth of 62 feet before the 12-foot well struck a sand aquifer. Many farmers have been unable to strike an underground source of water and they have usually excavated dugouts or built small dams. The supply from these, supplemented by shallow seepage wells, is as a rule sufficient to meet their requirements in seasons of average rainfall. In winters and prolonged drought periods, however, sufficient surface water cannot be retained and the farmer is forced to haul water from wells that tap a large pocket of water-bearing sand or gravel. The hamlet of Gillespie secures its water supply from the Canadian National railways. At least eighteen farms in the township were short of water during the drought of 1930 to 1934.

Eight drilled wells tap water-bearing horizons of sand or gravel in the glacial drift at depths ranging from 90 to 333 feet below the surface. The supply from each well is abundant, and is not readily affected by drought conditions. The water is hard and in some wells it is too highly mineralized to be used for drinking, but it produces no ill effects on stock. The water rises under hydrostatic pressure, the highest pressure being in a

235-foot well in the SE.¼, section 19, where the water rises to a point 80 feet below the surface. Four wells have been drilled in the SE.¼, section 12. The first well struck boulders at a depth of 280 feet below the surface and had to be abandoned; the second well struck water at a depth of 375 feet, but the quicksand that forms the aquifer could not be held back. The third well was drilled 470 feet deep without striking a water-bearing horizon and the base of the well is in the bedrock or Marine Shale series, or "soapstone", as it is locally termed. This well definitely established the elevation of the contact of the glacial drift and the Marine Shale series at this point at 1,470 feet above sea-level. The fourth well struck a quick-sand aquifer 333 feet below the surface and the water rises to a point 260 feet below the surface. The supply is abundant, but the water is too highly mineralized for drinking although it is being used for stock.

The 470-foot well indicates that there is no continuous water-bearing horizon in the glacial drift. Notwithstanding this fact it is considered advisable to drill for water in this township, when finances permit, as the eight drilled wells show that large, discontinuous beds of sand and gravel occur in places in the thick deposits of glacial drift and yield abundant and permanent supplies of water. Deep dugouts are recommended as a means of collecting and storing surface water.

Township 21, Range 12

The southern two-thirds of the township is a flat plain that is overlain by glacial lake clays. The top soil is a heavy, black loam. The northern third of the township is a slightly undulating plain and with the exception of a rough, hilly area in the northwestern corner that is covered with glacial outwash sands and gravels, is mantled by glacial till. The township is

drained by intermittent streams occupying four main ravines that traverse the area in a northeast to southwest direction. These ravines become much deeper towards Qu'Appelle valley and have cut through the lake clays, and exposed the underlying glacial till. The western 3 miles of the township is quite thickly wooded with poplar.

Approximately twenty farmers in the township depend to a large extent on springs, shallow seepage wells, dams, dugouts, or sloughs for a supply of water. Two springs located in deep ravines in the SE.$\frac{1}{4}$, section 5, and the NE.$\frac{1}{4}$, section 6, deliver abundant supplies of water. The spring in the SE.$\frac{1}{4}$, section 5, yields 16 barrels of water in 5 minutes and many farmers tanked from it during the drought of 1930 and 1934. The water is hard and contains iron. The spring in the NE.$\frac{1}{4}$, section 6, also yields an abundant supply of water, but its location is not convenient so that it is not as extensively used as the other spring. There are other flowing springs in the many ravines of the township, the most notable being a spring near Balcarres that is used by the Canadian National railway.

Shallow wells, dug or bored to a maximum depth of 52 feet, do not, as a rule, yield sufficient supplies of water. A number of shallow wells located in the NE.$\frac{1}{4}$, section 8, the NW, $\frac{1}{4}$, section 10, the NE.$\frac{1}{4}$, section 19, the SW.$\frac{1}{4}$, section 22, the NW.$\frac{1}{4}$, section 31, the NE.$\frac{1}{4}$, section 34, and the SE.$\frac{1}{4}$, section 35, have tapped pockets of sand or gravel in the glacial drift, and yield sufficient water for 20 to 40 head of stock. Most of the shallow wells in the municipality, however, depend on seepage from surface waters for their supply. Where dams or dugouts have been made, shallow wells are dug beside them and water seeps from the reservoir to the well through sandy, yellow clay. The village of

Balcarres derives its water supply from shallow seepage wells, approximately 25 feet deep, that are situated near sloughs or slight depressions. This village, like Abernethy, owns a reservoir. The water supply in the village was insufficient during the drought years and water from springs in the southern part of the township was hauled and sold to some of the residents. The wells in the village are dug through a whitish clay, and blue clay was struck at an average depth of 25 feet below the surface. The Canadian Pacific Railway Company has built a dam on a creek in the NW.$\frac{1}{4}$, section 23, and uses the water for locomotives.

Deep drilling has been successful in this township and at least three water-bearing horizons in the glacial drift have been tapped by eleven drilled wells. The first water-bearing horizon occurs at an elevation of 1,720 to 1,775 feet and it has been tapped by wells in the NE.$\frac{1}{4}$, section 13, the SW.$\frac{1}{4}$, section 14, the NW.$\frac{1}{4}$, section 22, the SW.$\frac{1}{4}$, section 24, and the SE.$\frac{1}{4}$, section 25. These wells are 220, 220, 175, 209, and 250 feet deep, respectively, and the hydrostatic pressure raises the water to points ranging from 20 to 150 feet below the surface. The aquifer is a coarse sand or gravel and the supply of water is abundant and unaffected by drought conditions. The water is hard and often too highly mineralized for drinking, although it is suitable for stock. It contains iron that settles as a yellowish brown precipitate. Farmers who own these drilled wells dig shallow seepage wells that are used for household purposes. The second water-bearing horizon was struck by a 240-foot well in the NW.$\frac{1}{4}$, section 1, and a 285-foot well in the SE.$\frac{1}{4}$, section 14. The aquifer is a fine sand that lies at an elevation of 1,660 feet. The supply of water is abundant and it rises to a point 150 feet below the surface in the 240-foot well. The fine sand particles have plugged the casing of the 285-foot well and made it useless. The water is too highly mineralized

for drinking. The third water-bearing horizon was struck by two wells in the NE.$\frac{1}{4}$ and SE.$\frac{1}{4}$, section 16, at an elevation of 1,600 feet, or at a depth of 330 feet. The water rises under pressure to a point 150 feet below the surface in both wells and the supply is abundant. The water is hard and contains iron. A 428-foot well in the SE.$\frac{1}{4}$, section 16, struck quicksand at an elevation of 1,490 feet and had to be abandoned. This bed of quicksand probably lies at the contact of the glacial drift and the bedrock. Drilling operations in this township should be confined to depths ranging from 175 to 350 feet below the surface.

Boring operations are not recommended in this township. Several dry holes have been bored to depths of 90 to 92 feet. As the shallowest drilled well is 175 feet deep, it is apparent that there are no water-bearing horizons that will yield an abundant or permanent supply of water between 50 and 175 feet below the surface.

Pipikisis Indian Reserve No.81

An area of $8\frac{3}{4}$ square miles in the northern portion of the municipality is occupied by part of the Pipikisis Indian Reserve. The western 5 square miles of this area is covered by moraine, the ground surface of which is very undulating and hilly. The eastern 3 miles is covered by glacial lake clays. Between these two areas the surface is undulating and is mantled by boulder clay or glacial till. The moraine and till-covered districts are thickly wooded with poplar. No wells were recorded in this small area. The Indian Agency reports that drilled wells are provided for the Indians, but that they are seldom used, and that the residents use surface water from sloughs, lakes, or creeks.

It is assumed that the ground water conditions in this part of the reserve are similar to those in the northern parts of township 21, ranges 10 and 11. Permanent supplies of water will be difficult to locate at depths less than 60 feet below the surface. Boring or drilling to depths in excess of 60 feet will probably be successful, but water in wells 60 to 150 feet deep will probably be too highly mineralized for drinking.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF ABERNETHY, NO. 186, SASKATCHEWAN

Township	18	18	19A	19A	19	19	19	20	20	20	21	21	21	Total No. in municipality
West of 2nd meridian Range	10	11	10	11	10	11	12	10	11	12	10	11	12	
Total No. of Wells in Township	9	0	13	3	110	33	3	66	55	32	69	82	98	578
No. of wells in bedrock	0	0	0	0	0	0	0	0	0	0	0	1	0	1
No. of wells in glacial drift	7	0	13	0	110	30	3	66	55	30	69	81	98	562
No. of wells in alluvium	2	0	0	3	0	3	5	0	0	2	0	0	0	15
Permanency of Water Supply														
No. with permanent supply	4	0	2	3	23	27	7	53	43	31	41	28	40	302
No. with intermittent supply	4	0	6	0	29	6	0	10	4	0	8	21	10	98
No. dry holes	1	0	5	0	58	0	1	3	8	1	20	33	48	178
Types of Wells														
No. of flowing artesian wells	0	0	0	0	0	1	0	0	0	0	0	0	0	1
No. of non-flowing artesian wells	0	0	0	0	0	2	1	11	7	9	11	11	9	61
No. of non-artesian wells	8	0	8	3	52	30	6	52	40	22	38	38	41	338
Quality of Water														
No. with hard water	8	0	8	3	52	30	7	60	46	29	46	47	49	385
No. with soft water	0	0	0	0	0	3	0	3	1	2	3	2	1	15
No. with salty water	0	0	0	0	0	0	0	1	0	1	0	1	0	3
No. with "alkaline" water	3	0	1	1	14	5	1	5	15	5	18	13	8	89
Depths of Wells														
No. from 0 to 50 feet deep	6	0	8	3	72	30	6	54	45	23	46	60	66	419
No. from 51 to 100 feet deep	3	0	5	0	35	0	1	6	3	1	13	11	19	97
No. from 101 to 150 feet deep	0	0	0	0	3	0	0	1	2	1	5	5	1	18
No. from 151 to 200 feet deep	0	0	0	0	0	1	0	1	0	0	3	2	2	12
No. from 201 to 500 feet deep	0	0	0	0	0	2	1	1	5	7	2	4	10	32
No. from 501 to 1,000 feet deep	0	0	0	0	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	0	0	0	0
How the Water is Used														
No. usable for domestic purposes	6	0	5	3	35	31	7	58	37	31	43	37	42	335
No. not usable for domestic purposes	2	0	3	0	17	2	0	5	10	0	6	12	8	65
No. usable for stock	7	0	7	3	41	31	7	62	38	31	47	46	49	369
No. not usable for stock	1	0	1	0	11	2	0	1	9	0	2	3	1	31
Sufficiency of Water Supply														
No. sufficient for domestic needs	4	0	2	3	23	27	7	53	43	31	41	28	38	300
No. insufficient for domestic needs	4	0	6	0	29	6	0	10	4	0	8	21	12	100
No. sufficient for stock needs	2	0	2	3	16	14	6	39	25	23	30	21	28	209
No. insufficient for stock needs	6	0	6	0	36	19	1	24	22	8	19	28	22	191

ANALYSES AND QUALITY OF WATER

General Statement

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

Total Dissolved Mineral Solids

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

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

Mineral Substances Present

Calcium and Magnesium

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

Sodium

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

Sulphates

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

Chlorides

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

Iron

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

Hardness

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

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

Analyses of Water Samples from the Municipality of Abernethy, No. 186, Saskatchewan

LOCATION						Depth of well, Ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of water
No.	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alka-linity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	NE.	29	20	10	2	157	1,980	1,900	1,800	100	18	435	390	220	1,107	228	1,964	435	355		656		488	30		* 1
2	SE.	13	21	12	2	25	474										474	(1)	(2)	(3)					(4)	* 1

Water samples indicated thus, * 1, are from glacial drift.
Analyses are reported in parts per million; where numbers (1), (2), (3), and (4) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).

Analysis No. 2, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

The analyses of two samples taken from wells whose aquifers occur in the glacial drift are given on the accompanying table. The first sample is from one of the many deep drilled wells in the municipality. The total dissolved content of 1,980 parts per million is high, but not excessive. The water is very hard and contains a considerable amount of the laxative producing salts, magnesium sulphate (Epsom salts) and sodium sulphate (Glauber's salt). These two salts are very undesirable in drinking water. Sulphate water of this character probably is not injurious to anyone accustomed to its use, but it cannot be termed good drinking water. It is suitable and non-injurious for stock.

The second sample is from one of the village wells of Balcarres. The total dissolved content of 474 parts per million is very low and it will be noticed that the laxative producing salts are absent from this water. The main constituents are the calcium salts. This type of water is uncommon in this part of Saskatchewan. Water from wells whose aquifers lie above the impervious, blue clay generally is better drinking water than that from wells whose aquifers lie within the blue clay. The impervious, blue clay, because of its unweathered and unleached character, is apparently one of the chief sources of the mineral salts in the ground water.

Water from the Bedrock

The Marine Shale series yields little water, and the water that has been found in it at places in this general region is much too highly mineralized to be used even for stock. It contains a high proportion of magnesium sulphate, sodium sulphate, and sodium chloride.

WELL RECORDS—Rural Municipality of ABERCROMBY, NO. 186, 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	NE.	28	18	10	2	Dug	10	1,560	- 7	1,553	7	1,553	Recent river gravel	Hard, "alkaline"		D, S	Abundant supply for 40 head stock.
2	SE.	33	"	"	"	Bored	5	1,600	- 48	1,552	48	1,552	Glacial sand and gravel	Hard, iron		D, S	Not a large supply; waters stock at the river.
3	SE.	33	"	"	"	Dug	10	1,740	- 7	1,733	7	1,733	Recent stream gravel	Hard		D	Good supply; 1 dry hole 60 feet deep.
4	SE.	34	"	"	"	Dug	15	1,870	0	1,870			Glacial drift	Hard		S	Intermittent supply; hauls drinking water and waters stock at the river.
5	NW.	35	"	"	"	Bored	80	1,880	- 75	1,805			Glacial drift	Hard		N	Small supply of poor quality water; seepage well used for drinking.
6	SE.	36	"	"	"	Dug	30	1,850	- 5	1,845			Glacial drift	Hard, "alkaline"		D	Seepage well dug beside a dam.
7	NE.	36	"	"	"	Dug	12	1,855	0	1,855			Glacial drift	Hard, "alkaline"		D	Seepage well dug beside a dam.
1	SW.	1	19A	10	2	Dug	20	1,880	- 8	1,872			Glacial drift	Hard		S	Intermittent supply; 2 dry holes 85 feet deep; hauls water for house and 30 head stock.
2	NE.	2	"	"	"	Dug	15	1,890	0	1,890			Glacial drift	Hard, "alkaline"		D, S	Intermittent supply; uses sloughs and hauls water in winter and dry seasons.
3	NW.	3	"	"	"	Dug	5	1,880	- 2	1,878			Glacial drift	Hard		D, S	Seepage well dug beside a dam; 1 dry hole 50 feet deep.
4	SE.	4	"	"	"	Dug	13	1,895	0	1,895			Glacial drift	Hard		S	Intermittent supply; hauls house and stock water.
5	NW.	5	"	"	"	Bored	80	1,850					Glacial drift				Dry hole; uses seepage well, sloughs, melts ice and hauls water.
6	NW.	6	"	"	"	Dug	24	1,820	- 21	1,799			Glacial drift	Hard		D, S	Intermittent supply; hauls water during the winter.
7	SE.	9	"	"	"	Bored	70	1,880					Glacial drift				Dry hole; uses a dugout for stock and hauls drinking water.
8	SW.	11	"	"	"	Bored	20	1,910	0	1,910			Glacial drift	Hard		D	Intermittent supply; a 70-foot well dug in 1910 gave black, coloured water.
1	NW.	1	19A	11	2	Dug	7	1,600	- 2	1,598			Recent stream sand	Hard		D, S	Good supply.
2	NW.	2	"	"	"	Dug	10	1,570	- 4	1,566	4	1,566	Recent river sand	Hard, "alkaline"		D, S	Good supply of laxative producing water.
3	SW.	10	"	"	"	Spring		1,600	0	1,600			Recent river sand	Hard, iron		D, S	Abundant supply.
1	SW.	2	19	10	2	Dug	22	1,920	0	1,920			Glacial drift	Hard		S	Intermitent supply; dry holes 40 to 60 feet deep; hauls water winter and summer.
2	NW.	2	"	"	"	Bored	60	1,925					Glacial drift				Dry hole; several dry holes; uses slough and hauls water.
3	SE.	3	"	"	"	Bored	112	1,920	- 78	1,842	78	1,842	Glacial clay	Hard, "alkaline"		N	Water is unfit for use; uses sloughs and hauls water.
4	SE.	3	"	"	"	Dug	24	1,920	- 18	1,902			Glacial drift	Hard		S	School well; several farmers haul drinking water from this well.
5	NW.	4	"	"	"	Dug	15	1,915	0	1,915			Glacial clay	Hard		S	Intermittent supply; hauls water for domestic and stock use.
6	SE.	6	"	"	"	Dug	12	1,840	- 10	1,830	10	1,830	Glacial gravel	Hard		D, S	Sufficient for house use; uses several sloughs for watering stock.
7	NW.	6	"	"	"	Dug	14	1,820	- 2	1,818			Glacial drift	Hard		S	Intermittent supply; several dry holes 20 to 32 feet deep; uses a dugout to water 16 head stock.
8	NE.	6	"	"	"	Dug	10	1,820	- 7	1,813	8	1,812	Glacial gravel	Hard		D, S	Sufficient for 20 head stock; dry holes 20 to 30 feet deep.

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

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

WELL RECORDS—Rural Municipality of ABERNETHY, NO. 186, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
9	NW.	7	19	10	2	Dug	8	1,850	- 4	1,846	4	1,846	Glacial gravel	Hard, iron		D	Sufficient for house use only; one 90-foot dry hole; waters stock at a dam.
10	NE.	7	"	"	"	Dug	12	1,850					Glacial gravel	Hard		S	This well watered 40 head stock in winter of 1934.
11	NW.	8	"	"	"	Dug	10	1,925	0	1,925			Glacial drift	Hard		D	Seepage water from a dam; owns two dams that give enough water for stock.
12	NE.	9	"	"	"	Bored	90	1,950	- 8	1,942			Glacial drift	Hard, "alkaline"		D, S	Poor supply; waters 35 head stock at a dam; a 24-foot well yields a small supply.
13	SE.	10	"	"	"	Bored	80	1,940					Glacial drift				Dry hole; seepage well used for the house; waters stock at sloughs.
14	SE.	11	"	"	"	Dug	15	1,935	0	1,935			Glacial drift	Hard, "alkaline"		N	90-foot bored well yielded green water; uses sloughs and hauls water.
15	SE.	12	"	"	"	Dug	10	1,945	- 2	1,943			Glacial drift	Hard		D	Intermittent supply; waters stock at a dam.
16	NW.	12	"	"	"	Bored	62	1,975					Glacial drift				Dry hole; uses sloughs and hauls water for stock.
17	SW.	14	"	"	"	Dug	20	1,990	0	1,990			Glacial clay	Hard, "alkaline"		D, S	Intermittent supply; several dry holes; uses a dam and hauls water.
18	NE.	15	"	"	"	Dug	20	2,005	- 15	1,990			Glacial clay	Hard, "alkaline"		D	Intermittent supply; uses sloughs and hauls water in winter.
19	SE.	16	"	"	"	Bored	100	1,990					Glacial drift				The deepest of 6 dry holes; uses 4 dugouts and hauls water.
20	NW.	18	"	"	"	Dug	16	1,905	- 4	1,901	4	1,901	Glacial gravel	Hard		D, S	Several farmers tank drinking water from this well; waters stock at sloughs.
21	SE.	19	"	"	"	Dug	29	1,950	0	1,950			Glacial clay	Hard, "alkaline"		D, S	Seepage well beside a dugout; hauls water in winter.
22	SW.	19	"	"	"	Dug	12	1,955	0	1,955			Glacial drift	Hard, "alkaline"		D	Slough seepage well; 90-foot dry hole; uses a dugout and hauls water in winter.
23	SW.	21	"	"	"	Dug	20	2,000	- 16	1,984			Glacial drift	Hard		S	Intermittent supply; dry holes 65, 80, 90, and 110 feet deep; uses a dugout and hauls winter and summer.
24	NE.	22	"	"	"	Dug	20	2,015	- 10	2,005			Glacial clay and stones	Hard		D	Intermittent supply; waters stock at slough.
25	SW.	23	"	"	"	Dug	6	2,015	- 2	2,013			Glacial clay	Hard		S	Intermittent supply; uses a dugout and hauls water.
26	NW.	23	"	"	"	Bored	70	2,030					Glacial drift				Dry hole; hauls water for stock and domestic use.
27	NE.	23	"	"	"	Dug	16	2,025					Glacial clay	Hard, very "alkaline"		N	Hauls water for the house and uses sloughs for stock.
28	SE.	24	"	"	"	Dug	10	2,010					Glacial clay	Hard		D	Slough seepage well; waters stock at slough.
29	SW.	25	"	"	"	Dug	20	2,045	- 16	2,029			Glacial clay	Hard		D, S	Intermittent supply; dry hole 80 feet deep; uses a dugout and hauls winter and summer.
30	SE.	26	"	"	"	Dug	20	2,035	- 2	2,033			Glacial drift	Hard, "alkaline"		N	Well caving in; 120-foot well yielded iron-stained water; uses two dugouts and hauls water in winter.
31	NE.	26	"	"	"	Bored	65	2,040					Glacial sand and gravel	Hard, "alkaline"		N	Water has a bad odour; several dry holes and intermittent wells; uses a dugout and hauls water.
32	SW.	27	"	"	"	Dug	8	2,015	0	2,015			Glacial sand	Hard		D, S	Intermittent supply; hauls water in winter and dry years.
33	SE.	28	"	"	"	Dug	16	2,015	- 4	2,011			Glacial clay	Hard		D, S	A large dugout used for stock.

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

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

WELL RECORDS—Rural Municipality of ABERNETHY, NO. 186, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
34	NE.	28	19	10	2	Dug	12	2,020	0	2,020			Glacial clay	Hard		D	Intermittent supply; one 80-foot dry hole; uses a dugout and hauls water.
35	SW.	29	"	"	"	Dug	16	1,980	0	1,980			Glacial sand	Hard		D	Seepage water from a dugout; uses 2 dugouts and hauls water.
36	NW.	29	"	"	"	Dug	20	1,980	0	1,980			Glacial clay	Hard		D, S	Seepage water from a dugout; hauls water in winter.
37	NE.	29	"	"	"	Dug	18	2,000	0	2,000			Glacial clay	Hard, "alkaline"		D	Intermittent supply; 2 dry holes 90 feet deep; uses a dugout and hauls in winter and dry years.
38	SW.	30	"	"	"	Dug	15	1,960					Glacial clay	Hard		D, S	Slough seepage well; 2 similar intermittent wells; 60-foot dry hole; poor water supply.
39	NW.	31	"	"	"	Dug	26	1,965	− 6	1,959	11	1,954	Glacial sand	Hard		D, S	Sufficient for house use; 60-foot well yielded bad water; several dry holes; uses dam and hauls water.
40	SW.	32	"	"	"	Dug	50	1,985	− 48	1,937	48	1,937	Glacial sand and gravel	Hard, iron, "alkaline"		D, S	Sufficient for 100 head stock; uses a dugout in summer.
41	NE.	33	"	"	"	Bored	65	2,015					Glacial sand	Hard, iron		N	Sand caved in and shut off supply; dry holes 65, 80, and 100 feet deep; uses sloughs and seepage well.
42	SE.	34	"	"	"	Bored	90	2,030					Glacial drift				The deepest of several dry holes; hauls water in winter and uses sloughs and seepage well in summer.
43	SE.	35	"	"	"	Dug	16	2,050	− 6	2,044			Glacial sand	Hard		D	Insufficient in drought years; 2 dry holes 76 feet deep; waters stock at a dugout.
44	NW.	35	"	"	"	Bored	65	2,030	− 62	1,968	62	1,968	Glacial sand	Hard		D, S	Sufficient for 30 head stock; uses sloughs in summer for stock.
45	NW.	36	"	"	"	Bored	36	2,050	− 32	2,018	20	2,030	Glacial gravel	Hard		D, S	Good supply; several neighbours tank drinking water from this well; several dry holes and a dam.
1	SW.	1	19	11	2	Bored	45	1,860	− 25	1,835			Glacial drift	Hard, "alkaline", bitter		N	Seepage well; uses a dam for stock and seepage water from dam for domestic purposes.
2	SE.	2	"	"	"	Dug	12	1,840	− 10	1,830			Glacial clay	Soft		D, S	Seepage water from a dam.
3	NE.	2	"	"	"	Bored	46	1,860	− 15	1,845	19	1,841	Glacial gravel	Hard, "alkaline"		D, S	Insufficient supply; uses a dam ½ mile from buildings for stock; water imparts a laxative effect.
4	SW.	3	"	"	"	Sand-point	26	1,600	− 6	1,594	6	1,594	Recent stream sand	Hard, iron		D, S	Abundant supply; uses creek for stock usually.
5	SW.	8	"	"	"	Dug	14	1,580	− 8	1,572			Recent river gravel	Hard		D, S	Sufficient supply; uses river for stock.
6	NW.	10	"	"	"	Dug	6	1,610	− 2	1,608			Glacial clay	Hard		D	Seepage water from a dam.
7	SE.	12	"	"	"	Dug	15	1,875	− 10	1,865			Glacial sand	Hard		D	Slough seepage well; uses a dugout for stock.
8	NE.	13	"	"	"	Dug	25	1,890	− 20	1,870			Glacial clay	Hard, "alkaline"		D, S	Seepage water from a dam; sufficient water for 25 head stock.
9	SW.	14	"	"	"	Dug	37	1,900	− 17	1,883			Glacial drift	Hard		D, S	Intermittent supply; uses a dam for stock.
10	NE.	14	"	"	"	Dug	16	1,910	− 6	1,904			Glacial gravel	Hard		D, S	Water in this well is mostly seepage from a dam.
11	NE.	15	"	"	"	Dug	15	1,855	− 5	1,850			Glacial clay	Hard		D	Seepage water from a dam.
12	NE.	16	"	"	"	Dug	12	1,800	− 6	1,794			Glacial gravel	Hard		D	Seepage water from a dam.

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

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of ABERNETHY, NO. 186, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
13	SW.	16	19	11	2	Dug	10	1,750	- 4	1,746			Glacial gravel	Hard		D	Seepage well; stock are watered at a dugout.
14	NW.	18	"	"	"	Dug	10	1,750	- 5	1,745			Recent stream sand	Hard		D, S	Fair supply; uses a dam for stock purposes.
15	NE.	19	"	"	"	Dug	30	1,805	- 15	1,790			Glacial gravelly clay	Hard, "alkaline"		D	Seepage water from a dugout.
16	SE.	20	"	"	"	Dug	4	1,850	- 1	1,849			Glacial clay	Hard		D	Seepage water from a dugout.
17	SE.	21	"	"	"	Dug	18	1,850	- 10	1,840			Glacial clay	Hard		D, S	Well dug beside the government dam.
18	SE.	22	"	"	"	Dug	15	1,900	- 5	1,895			Glacial gravelly clay	Hard		D	Seepage well; uses a dam for stock; hauls water in dry years.
19	NE.	22	"	"	"	Drilled	200	1,910	+ 10	1,920	200	1,710	Glacial fine sand	Hard, sulphur		N	This well flowed for 1 day and then became plugged with sand.
20	SW.	23	"	"	"	Dug	20	1,915	- 5	1,910			Glacial clay	Hard		D, S	Seepage well; uses a dam for stock.
21	NW.	24	"	"	"	Dug	17	1,925	- 1	1,924			Glacial clay	Hard, "alkaline"		N	Slough seepage well; uses sloughs for watering stock.
22	SW.	25	"	"	"	Dug	14	1,940	0	1,940			Glacial clay	Soft		D, S	Seepage water from a dam.
23	NE.	25	"	"	"	Dug	15	1,955	- 2	1,953			Glacial clay	Hard		D	Seepage water from a dam.
24	NE.	27	"	"	"	Dug	16	1,900	- 11	1,889			Glacial clay	Hard		D	Seepage water from a dam.
25	SE.	29	"	"	"	Dug	12	1,800	- 6	1,794			Glacial clay	Hard		D	Seepage water from a dam.
26	SE.	30	"	"	"	Drilled	301	1,820	-261	1,559	300	1,520	Glacial gravel	Hard, iron		D, S	Abundant supply.
27	NE.	31	"	"	"	Drilled	328	1,860	-250	1,610	328	1,532	Glacial red sand	Hard, iron		N	Good supply of water until well became plugged with sand; water was of good quality.
28	SE.	36	"	"	"	Bored	25	1,950	- 18	1,932			Glacial sand	Hard		D	Used for domestic purposes only; 15-foot well used for stock.
1	SE.	24	19	12	2	Drilled	100	1,810					Glacial drift				Dry hole.
2	NE.	25	"	"	"	Drilled	328	1,840	-263	1,577	328	1,512	Glacial gravel	Hard, iron		D, S	Abundant supply.
3	SE.	27	"	"	"	Spring		1,600	+ 1	1,601			Recent river gravel	Hard		D, S	Several seepage wells and springs on this quarter-section.
4	SE.	34	"	"	"	Dug	12	1,585	- 6	1,579	1	1,584	Recent river sand and gravel	Hard, "alkaline"		D	Good supply; uses lake as a source of water for stock.
5	SE.	35	"	"	"	Dug	14	1,800	- 7	1,793			Glacial gravel	Hard		D, S	Good and constant supply.
1	SE.	2	20	10	2	Bored	50	2,035	- 35	2,000			Glacial drift	Hard		D, S	Intermittent supply; another similar 42-foot well; 1 dry hole 70 feet deep; uses a dugout for stock.
2	NW.	2	"	"	"	Dug	25	2,000	- 22	1,978	22	1,978	Glacial gravel	Hard		D, S	Plenty of water for 25 head stock; a flowing spring in a coulée.
3	NW.	3	"	"	"	Bored	45	1,990			35	1,955	Glacial fine sand	Very hard		D, S	Quicksand has plugged the well; uses 2 wells 28 feet deep; fair supply.
4	NW.	5	"	"	"	Bored	45	1,995	- 20	1,975	45	1,950	Glacial sand	Hard, "alkaline"		D, S	Sufficient for 50 head stock.
5	SW.	7	"	"	"	Dug	21	1,950					Glacial clay	Hard, cloudy		S	Poor supply; a dam is used for stock.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of ABERNETHY, NO. 186, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
6	SW.	8	20	10	2	Dug	20	1,960	- 18	1,942	4	1,956	Glacial yellow sand	Soft		D, S	Small supply; hauls water winter and summer.
7	NE.	8	"	"	"	Dug	30	1,945	- 25	1,920			Glacial sand	Hard		D, S	Fair supply; also uses a small dugout for stock.
8	NE.	9	"	"	"	Dug	15	1,960	- 10	1,950	10	1,950	Glacial gravel	Hard		D, S	Fair supply; a 30-foot well yields a good supply of water.
9	SW.	10	"	"	"	Bored	40	1,990	- 20	1,970	40	1,950	Glacial sand and gravel	Hard		D, S	Plenty of water for 40 head stock.
10	SW.	12	"	"	"	Bored	30	2,030	- 25	2,005			Glacial drift	Hard		D	A 12-foot well in gravel provides sufficient water for 20 head stock.
11	NW.	12	"	"	"	Bored	52	2,020	- 32	1,988			Glacial drift	Hard		S	Sufficient for 20 head stock in average years; has hauled water from 1930 to 1940.
12	NW.	13	"	"	"	Bored	45	1,995	- 25	1,970	2	1,993	Glacial sand	Hard		D, S	Plenty of water for 65 head stock; one other 38-foot well in sand.
13	NW.	14	"	"	"	Bored	60	1,950	- 30	1,920	60	1,890	Glacial sand	Hard, iron		D, S	Good supply for 35 head stock.
14	SW.	16	"	"	"	Dug	35	1,950	- 32	1,918	15	1,935	Glacial gravel	Hard, iron		D, S	Another 15-foot well; plenty of water for 40 head stock; many flowing springs in coulée.
15	SE.	17	"	"	"	Dug	45	1,900	- 7	1,893	45	1,855	Glacial sand	Hard		D, S	Good supply for 20 head stock.
16	SE.	18	"	"	"	Dug	9	1,800	- 7	1,793	7	1,793	Glacial sand	Hard		D	Sufficient for house use only; 1 dry hole 60 feet deep; uses a dam and creek for stock.
17	NW.	18	"	"	"	Dug	15	1,900	- 7	1,893			Glacial clay	Hard		D	Intermittent supply; uses a dam and spring for 40 head stock.
18	SW.	19	"	"	"	Dug	22	1,910	- 7	1,903			Glacial clay	Hard		D	Seepage water from a dam.
19	NE.	20	"	"	"	Bored	42	1,920	- 30	1,890			Glacial gravel	Soft		D, S	Sufficient supply; springs in Pheasant creek also used.
20	SW.	20	"	"	"	Dug	20	1,800	- 8	1,792			Glacial gravel	Hard		D, S	Sufficient supply.
21	SE.	22	"	"	"	Dug	10	1,880	0	1,880			Glacial sand	Hard		D, S	Sufficient for 20 head stock.
22	SW.	23	"	"	"	Spring		1,870	+ 2	1,872			Glacial gravel	Hard, "alkaline"		D, S	Abundant supply; several springs in the coulée.
23	NW.	25	"	"	"	Dug	6	1,850	- 3	1,847	3	1,847	Glacial gravel	Hard		D, S	Plenty of water for 15 head stock.
24	SW.	28	"	"	"	Dug	48	1,910	- 23	1,887			Glacial red clay	Hard		S	Good supply; seepage well beside slough used for drinking.
25	NE.	28	"	"	"	Dug		1,910					Glacial drift	Hard, odour, "alkaline"		N	Hauls drinking water and melts snow in winter for stock.
26	NE.	29	"	"	"	Drilled	157	1,915	-107	1,808	149	1,766	Glacial sand and gravel	Hard		D, S	Abundant supply for 80 head stock; also uses a dugout. #.
27	NW.	30	"	"	"	Dug	20	1,925	- 12	1,913			Glacial clay	Hard		D, S	A number of intermittent wells in sloughs; uses a dam for stock.
28	NE.	30	"	"	"	Drilled	238	1,920	-230	1,690	288	1,632	Glacial fine sand	Hard, salty		D, S	Good supply for 40 head stock.
29	NW.	32	"	"	"	Dug	35	1,920	- 25	1,895			Glacial sand	Hard		S	Poor supply; 120-foot well yielded highly mineralized water and filled in; hauls water in winters.
30	NW.	33	"	"	"	Drilled	135	1,910					Glacial sand and gravel	Hard, "alkaline"		D, S	Abundant supply.
31	NE.	33	"	"	"	Drilled	190	1,915	-160	1,755	190	1,725	Glacial sand	Hard		D, S	Good supply for 20 head stock; uses a dugout and sloughs in summer.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of ABERNETHY, NO. 186, 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
32	NW.	35	20	10	2	Drilled	200	1,910	- 90	1,820	200	1,710	Glacial sand	Hard		D, S	Pumped continuously 4 days and nights without lowering the level.
33	NE.	35	"	"	"	Dug	20	1,905	0	1,905			Glacial clay	Hard		D, S	Slough seepage well; dry hole 76 feet deep; uses a dugout and hauls water in winter.
34	SW.	36	"	"	"	Dug	22	1,830	0	1,830	22	1,808	Glacial sand	Hard		D, S	Abundant supply; a school and several neighbours use this well.
35	NE.	36	"	"	"	Bored	34	1,930	- 24	1,906	24	1,906	Glacial sand and gravel	Hard, "alkaline"		D	Used for domestic purposes only.
36	NE.	36	"	"	"	Drilled	200	1,930	- 60	1,870	200	1,730	Glacial sand	Hard, iron		S	Abundant supply for 30 head stock.
1	NW.	1	20	11	2	Dug	25	1,900	- 20	1,880			Glacial clay	Hard		D	Seepage well; a dugout is used for watering stock.
2	SW.	1	"	"	"	Dug	16	1,900	- 16	1,884			Glacial clay	Hard		D	Seepage well dug beside a dam.
3	SE.	2	"	"	"	Dug	12	1,880	- 6	1,874			Glacial gravel	Hard		D, S	Good supply; also uses a spring in coulée and a dam for stock.
4	SW.	4	"	"	"	Dug	20	1,810	- 8	1,802	20	1,790	Glacial gravel	Hard		D, S	Abundant supply.
5	NW.	6	"	"	"	Drilled	150	1,865					Glacial drift				Dry hole.
6	NW.	7	"	"	"	Bored	100	1,865					Glacial drift				Dry hole; dam used for stock and rainwater for drinking; dug many shallow wells that gave unusable water.
7	NW.	8	"	"	"	Dug	25	1,890	- 10	1,880			Glacial clay	Hard		D	Seepage well dug beside a dugout.
8	SW.	8	"	"	"	Dug	15	1,885	- 10	1,875			Glacial clay	Hard, odour, "alkaline"		N	Seepage water from a dugout; dugout used for stock.
9	SW.	10	"	"	"	Dug	15	1,840	- 9	1,831			Glacial sand	Hard		D, S	Also uses a dam for watering stock; sufficient water.
10	NW.	14	"	"	"	Bored	60	1,905	- 45	1,860	60	1,845	Glacial gravel	Hard, "alkaline"		N	Water was analysed and pronounced unfit for use; acts as a laxative on stock.
11	NE.	14	"	"	"	Dug	22	1,900	- 10	1,890			Glacial clay	Hard		D, S	Seepage water from reservoir filters through clay to the well.
12	SW.	14	"	"	"	Drilled	365	1,905	-304	1,601	365	1,540	Glacial white sand	Hard		D, S	Abundant supply.
13	SW.	16	"	"	"	Dug	35	1,910					Glacial drift				Dry hole; uses a dugout for stock and seepage water used for the house.
14	NE.	16	"	"	"	Dug	25	1,920					Glacial drift				One of several dry holes; dugout used for stock.
15	SE.	17	"	"	"	Dug	15	1,900	- 7	1,893			Glacial clay	Hard		D	Seepage well; dugout used for stock.
16	NW.	18	"	"	"	Dug	20	1,875	- 4	1,871			Glacial clay	Hard		D, S	Seepage water from a slough; dugout used for stock; hauls water for the house and stock in winter.
17	NW.	19	"	"	"	Dug	20	1,875	- 17	1,858			Glacial gravel	Hard		D, S	Well delivers 2 barrels of water a day; insufficient supply.
18	NW.	21	"	"	"	Dug	30	1,910	- 26	1,884	28	1,882	Glacial sand	Hard		D, S	Abundant supply; 15 farmers have hauled from this well in dry years; 1 dry hole 150 feet deep.
19	NE.	22	"	"	"	Bored	60	1,915	- 58	1,857			Glacial clay and boulders	Hard, "alkaline"		N	Poor supply of highly mineralized water.
20	NE.	23	"	"	"	Drilled	452	1,925	-337	1,588	425	1,500	Glacial gravel	Hard, iron, "alkaline"		S	Has not been used for several years; uses a reservoir for stock and a 16-foot well for the house.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of ABERNETHY, NO. 186, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
21	NW.	23	20	11	2	Dug	40	1,920	- 36	1,884			Glacial drift	Hard		N	Dugout used for stock.
22	SE.	23	"	"	"	Bored	18	1,915	- 6	1,909			Glacial gravel	Hard		D, S	Dugout used for stock.
23	NE.	24	"	"	"	Dug	30	1,920	- 24	1,896			Glacial drift	Hard		D, S	Seepage water from a slough; hauls water in dry years.
24	W½.	25	"	"	"	Dug	27	1,930	- 23	1,907			Glacial gravel	Hard		D	5 similar wells in village of Abernethy; very short of water from 1929 to 1934.
25	SE.	28	"	"	"	Dug	32	1,940	- 27	1,913			Glacial gravel	Hard, iron		D, S	Sufficient for 20 head stock.
26	NE.	28	"	"	"	Dug	32	1,950	- 27	1,923			Glacial sand and gravel	Hard, iron		D, S	Sufficient for 45 head stock.
27	SW.	29	"	"	"	Dug	30	1,915	- 15	1,900			Glacial gravel	Hard		D, S	Sufficient for 35 head stock.
28	NW.	29	"	"	"	Dug	30	1,915	- 15	1,900			Glacial sandy clay	Hard		D	Seepage water from a dugout.
29	NW.	30	"	"	"	Dug	14	1,890	- 8	1,882			Glacial clay	Hard		D, S	Seepage water from a dugout; hauls water for stock in winter.
30	NW.	32	"	"	"	Dug	20	1,920	- 14	1,906			Glacial sand	Hard		D, S	Uses a reservoir also to water 25 head stock.
31	NE.	32	"	"	"	Drilled	300	1,930	-210	1,720	275	1,655	Glacial fine sand	Hard, iron		D, S	Abundant supply.
32	NW.	33	"	"	"	Bored	35	1,940	- 33	1,907	6	1,934	Glacial sand	Hard		D	Sufficient for the house; a dugout is used for stock.
33	SE.	33	"	"	"	Drilled	275	1,950	-150	1,800	275	1,675	Glacial sand and gravel	Hard, iron		D, S	Abundant supply.
34	SE.	34	"	"	"	Dug	40	1,940	- 25	1,915			Glacial gravel	Hard, "alkaline"		D	Water imparts a laxative effect; insufficient supply.
35	SE.	35	"	"	"	Bored	20	1,935	- 5	1,930			Glacial clay	Hard		D	Seepage well; a dugout is used for stock.
36	SE.	36	"	"	"	Drilled	285	1,930	-210	1,720	285	1,645	Glacial black sand	Hard		D, S	Plenty of water for 100 head stock; also owns 3 dugouts.
1	NE.	2	20	12	2	Dug	22	1,820	- 12	1,808			Glacial gravelly clay	Very hard, iron		D, S	Good supply; also uses a dam for watering stock.
2	SE.	3	"	"	"	Drilled	330	1,820	-250	1,570	330	1,490	Glacial sand and gravel	Soft		D, S	Abundant supply.
3	NW.	10	"	"	"	Drilled	250	1,810	-232	1,578	250	1,560	Glacial gravel	Soft		D, S	Abundant supply.
4	SE.	13	"	"	"	Dug	24	1,865	- 10	1,855			Glacial clay	Hard, iron, "alkaline"		D, S	Seepage water from a dugout.
5	NW.	14	"	"	"	Dug	12	1,780	- 4	1,776			Recent stream gravel	Hard, "alkaline"		D, S	Abundant supply.
6	SW.	16	"	"	"	Dug	4	1,600	- 2	1,598			Recent river sand	Hard		D, S	Good supply; uses the lake for watering stock.
7	NW.	22	"	"	"	Dug	20	1,855	- 12	1,843			Glacial sandy clay	Hard		D	Slough seepage well; dugout used for stock.
8	SW.	22	"	"	"	Dug	12	1,835	- 7	1,828			Glacial sand	Hard		D	Fair supply; a seepage well made beside a dugout is used for watering stock.
9	NE.	23	"	"	"	Drilled	236	1,850	-196	1,654	236	1,614	Glacial fine sand	Hard, salty		D, S	Abundant supply.
10	SW.	24	"	"	"	Dug	17	1,860	- 7	1,853			Glacial gravel	Hard		D, S	Good supply.
11	SE.	24	"	"	"	Bored	30	1,875	- 25	1,850			Glacial drift	Hard		D, S	Seepage water from a dugout; one 342-foot drilled hole that contained 60 feet of water when first made.

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WELL RECORDS—Rural Municipality of ABERNETHY, NO. 186, 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
12	NE.	25	20	12	2	Dug	12	1,875	- 6	1,869			Glacial clay	Hard		D, S	Sufficient supply.
13	SE.	25	"	"	"	Dug	30	1,855	- 15	1,840			Glacial clay	Hard, "alkaline"		D	Slough seepage well; insufficient supply.
14	NW.	27	"	"	"	Dug	11	1,750	- 5	1,745			Glacial sand and gravel	Hard		D, S	Fair supply; will water about 30 head stock; it has never been dry; waters stock at creek also.
15	NW.	28	"	"	"	Bored	30	1,860	- 26	1,834			Glacial sandy clay	Hard		D, S	Slough seepage well.
16	SE.	28	"	"	"	Drilled	285	1,850	-225	1,625	285	1,565	Glacial sand and gravel	Hard		D, S	Abundant supply.
17	SW.	29	"	"	"	Dug	23	1,855	- 13	1,842			Glacial sand	Hard, "alkaline"		D, S	Sufficient supply.
18	NW.	30	"	"	"	Dug	13	1,850	- 3	1,847	6	1,844	Glacial fine sand	Hard		D	A 16-foot well is used for stock; sufficient supply.
19	NE.	30	"	"	"	Dug	18	1,855	- 12	1,843			Glacial sand	Hard		D, S	A 16-foot well is used for stock; sufficient supply.
20	SE.	33	"	"	"	Drilled	280	1,860	-230	1,630	280	1,580	Glacial fine sand	Hard, iron, "alkaline"		D, S	Abundant supply for 50 head stock; one 300-foot dry hole; several dry bored holes.
21	NE.	34	"	"	"	Spring		1,825	0	1,825			Glacial gravel	Hard		D, S	Uses the creek for watering stock.
22	SW.	34	"	"	"	Dug	11	1,840	- 9	1,831			Glacial gravel	Hard		D	Sufficient for the house only; waters stock at creek when possible, and hauls water.
23	SE.	36	"	"	"	Drilled	108	1,880	- 38	1,842	108	1,772	Glacial fine sand	Hard		D, S	A good supply until sand plugged the casing in 1933.
24	NE.	36	"	"	"	Drilled	90	1,880	- 70	1,810	90	1,790	Glacial sand	Hard, iron		D, S	Fair supply; also uses a dugout for stock.
1	NW.	1	21	10	2	Drilled	180	1,930	-110	1,820			Glacial drift	Hard, iron		D, S	Good supply for 35 head stock; owns a dugout.
2	SE.	2	"	"	"	Bored	48	1,930	- 18	1,912			Glacial drift	Soft		D, S	Sufficient for 6 head stock; owns a dugout.
3	NE.	4	"	"	"	Dug	20	1,950	- 8	1,942			Glacial fine sand	Hard, "alkaline"		D, S	Insufficient for 20 head stock; uses a dugout for stock.
4	SE.	6	"	"	"	Drilled	240	1,930	-144	1,786	220	1,710	Glacial sand	Hard, iron		D, S	Good supply for 25 head stock; owns 3 dugouts.
5	NW.	9	"	"	"	Dug	20	1,955	- 16	1,939			Glacial clay	Hard, "alkaline"		D, S	Insufficient for 25 head stock; owns 3 similar wells, a dugout and a dam.
6	NW.	10	"	"	"	Dug	16	1,950	- 8	1,942	10	1,940	Glacial fine sand	Hard		D, S	Sufficient for 25 head stock; 2 dry holes.
7	SE.	10	"	"	"	Drilled	200	1,940	- 75	1,865	190	1,750	Glacial sand	Hard, iron		D, S	Abundant supply for 20 head stock; uses a small dugout.
8	NE.	11	"	"	"	Drilled	180	1,940	- 40	1,900	180	1,760	Glacial sand	Hard, "alkaline"		D, S	Abundant supply for 20 head stock.
9	NE.	14	"	"	"	Drilled	101	1,955	- 50	1,905			Glacial sand	Hard		D, S	Good supply for 35 head stock.
10	SW.	14	"	"	"	Bored	131	1,950					Glacial drift				Dry hole.
11	SE.	15	"	"	"	Bored	24	1,950	- 18	1,932			Glacial clay	Hard		D, S	Intermittent supply; 12 dry holes 20 to 135 feet deep; uses a small dugout; insufficient water.
12	SW.	17	"	"	"	Dug	14	1,950					Glacial drift				Dry hole.
13	NW.	17	"	"	"	Drilled	230	1,950	- 81	1,869	230	1,720	Glacial gravel	Hard		S	Good supply for 40 head stock; a 13-foot well with soft water is used for the house.

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 ...BE-LIETHY, NO. 166, 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	NE.	18	21	10	2	Dug	20	1,950	- 16	1,934	18	1,932	Glacial fine sand	Soft		D	A 23-foot well will water 50 head stock; uses a dugout.
15	SW.	19	"	"	"	Dug	33	1,950	- 30	1,920	30	1,920	Glacial sand	Hard		D, S	2 wells 13 and 27 feet deep deliver a small supply; uses a dugout; sufficient water for 50 head stock.
16	NW.	20	"	"	"	Dug	25	1,950	- 15	1,935			Glacial clay	Hard		D, S	A 40-foot well is also used; insufficient water for 70 head stock.
17	SE.	22	"	"	"	Bored	80	1,950	- 40	1,910	80	1,870	Glacial sand	Hard, "alkaline"		S	Sufficient for 30 head stock; 14-foot well used for the house; owns a dugout.
18	NE.	22	"	"	"	Dug	14	1,950	- 2	1,948			Glacial sand	Hard		D, S	Two other wells with a small supply; uses 2 dugouts; sufficient water.
19	NW.	23	"	"	"	Dug	29	1,950	- 15	1,935	17	1,933	Glacial gravel	Hard, "alkaline"		D, S	Intermittent supply; 6 dry or poor supply wells 16 to 100 feet deep; insufficient water; owns small dugout.
20	NW.	24	"	"	"	Bored	67	1,950	- 47	1,903	67	1,883	Glacial sand	Hard, "alkaline"		D, S	Sufficient for 25 head stock.
21	SE.	25	"	"	"	Drilled	89	1,950	- 20	1,930	89	1,861	Glacial sand	Hard, iron		D, S	Sufficient for 30 head stock.
22	NE.	26	"	"	"	Dug	16	1,945	- 6	1,939			Glacial red clay	Hard, "alkaline"		D	Five similar wells in the village of Lorlie; sufficient supply.
23	SW.	26	"	"	"	Bored	40	1,950	- 14	1,936	22	1,928	Glacial sand	Hard		D, S	Insufficient for 10 head stock; 3 dry holes to 26 feet deep.
24	SW.	27	"	"	"	Bored	24	1,950	- 8	1,942	22	1,928	Glacial sand	Hard		D, S	Uses a dugout; sufficient water for 30 head stock.
25	SW.	28	"	"	"	Dug	23	1,955	- 18	1,937	18	1,937	Glacial sand and gravel	Hard		D, S	Sufficient for 30 head stock.
26	NE.	30	"	"	"	Drilled	100	2,000	- 70	1,930	100	1,900	Glacial drift	Hard, "alkaline"		S	Sufficient for 80 head stock; 20-foot well used for the house; owns dams and a dugout.
27	SE.	36	"	"	"	Bored	75	1,945	- 25	1,920			Glacial sand	Hard, iron		S	Sufficient water; too much iron to be suitable for drinking.
1	NE.	2	21	11	2	Bored	100	1,950					Glacial drift				Dry hole; 12-foot seepage well used in wet seasons; hauls water.
2	SW.	2	"	"	"	Dug	12	1,950	0	1,950	6	1,944	Glacial gravel	Hard		D, S	Intermittent and insufficient supply.
3	SW.	3	"	"	"	Dug	30	1,960	- 23	1,937	23	1,937	Glacial gravel	Hard, iron, "alkaline"		D, S	Plenty of water; several seepage wells with intermittent supply.
4	SE.	4	"	"	"	Bored	50	1,960	- 38	1,922	50	1,910	Glacial sand	Hard, iron		D, S	Plenty of water.
5	SW.	4	"	"	"	Bored	35	1,950	- 15	1,935			Glacial sand	Hard		D, S	Sufficient for 15 head stock.
6	SE.	5	"	"	"	Bored	30	1,925	- 15	1,910			Glacial gravel	Hard		D, S	Abundant supply; 6 to 8 farmers haul from this well; also owns a dam.
7	NW.	5	"	"	"	Dug	18	1,930	- 5	1,925			Glacial sand	Hard		D, S	Sufficient water.
8	NW.	6	"	"	"	Drilled	90	1,910					Glacial drift				Dry hole; hauls water.
9	SE.	7	"	"	"	Dug	15	1,930	- 8	1,922			Glacial clay	Hard		D	Intermittent supply; uses dugouts and hauls water.
10	SW.	7	"	"	"	Dug	35	1,915					Glacial drift				Dry hole; hauls water.
11	SW.	8	"	"	"	Drilled	137	1,930	- 75	1,855			Glacial sand	Hard, iron, "alkaline"		D, S	Abundant supply.
12	NE.	9	"	"	"	Dug	20	1,960	- 2	1,958			Glacial clay	Hard		D, S	Intermittent supply; uses a dam and sloughs for stock; hauls water in dry years.

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 ARBRNETHY, NO. 186, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
13	NW.	9	21	11	2	Dug	30	1,950	- 10	1,940			Glacial gravelly clay	Hard		D, S	Poor supply; uses a dugout and hauls water.
14	SE.	12	"	"	"	Drilled	333	1,950	-260	1,690	333	1,617	Glacial fine sand	Hard, iron, "alkaline"		S	Abundant supply; 18-foot well is used for drinking.
15	SE.	12	"	"	"	Drilled	470	1,940	..	.			Bedrock Marine Shale				Dry hole; 375-foot well struck water in fine sand; 280-foot well stopped because of boulders.
16	NW.	12	"	"	"	Dug	8	1,950	- 4	1,946			Glacial sand	Hard		D, S	Owns another 20-foot well; good supply of water.
17	SE.	13	"	"	"	Dug	30	1,950	- 20	1,930			Glacial drift	Hard		D, S	Sufficient for 50 to 70 head stock.
18	SE.	14	"	"	"	Drilled	130	1,960	- 40	1,920	130	1,830	Glacial sand	Hard, iron		D, S	Abundant supply; troubled with sand plugging the screen.
19	NE.	16	"	"	"		20	1,970	- 4	1,966			Glacial clay	Soft		D, S	Intermittent supply; uses dugouts and hauls water; one 80-foot dry hole.
20	NW.	18	"	"	"	Drilled	300	1,960	-150	1,810	300	1,660	Glacial sand	Hard, iron, salty, "alkaline"		S	Abundant supply; seepage well used for the house.
21	SE.	19	"	"	"	Drilled	235	1,970	- 80	1,890	235	1,735	Glacial sand	Hard, iron, "alkaline"		S	Abundant supply; hauls drinking water from Balcarres.
22	SW.	20	"	"	"	Dug	56	1,990	- 52	1,938	52	1,938	Glacial coarse gravel	Hard, iron, "alkaline"		S	Sufficient for 30 head stock; hauls drinking water; several dry holes to 200 feet.
23	NW.	20	"	"	"	Drilled	90	2,000	- 40	1,960			Glacial gravel			S	Sufficient supply.
24	SE.	21	"	"	"	Bored	50	1,990					Glacial drift				Dry hole; seepage wells used and hauls water.
25	NE.	21	"	"	"	Dug	25	2,020	- 12	2,008			Glacial clay	Hard		S	Intermittent supply; hauls water in dry years.
26	SW.	24	"	"	"	Dug	20	1,970	- 4	1,966			Glacial clay	Hard		D, S	Intermittent supply; shallow, dry holes; hauls water in winters and dry years.
27	NW.	24	"	"	"	Bored	60	1,980	- 55	1,925			Glacial drift	Hard, "alkaline"		N	Well abandoned; numerous seepage wells; hauls nearly all water.
28	SE.	25	"	"	"	Dug	27	1,976					Glacial drift				Dry hole; C.N.R. supplies water to the village of Gillespie.
29	SE.	26	"	"	"	Dug	12	2,000	- 2	1,998	3	1,997	Glacial sand	Soft		D, S	Good supply; 17 dry holes to a maximum depth of 62 feet; hauled and melted snow previous to 1932.
30	SE.	27	"	"	"	Dug	15	2,010					Glacial drift				Dry hole.
31	SW.	28	"	"	"	Dug	20	2,015					Glacial drift				Dry hole; seepage well beside a dugout is used.
32	NE.	29	"	"	"	Dug	30	2,050					Glacial drift				Dry hole; forced to haul water.
33	SE.	30	"	"	"	Bored	70	2,010	- 68	1,942			Glacial sand	Hard		S	Very poor supply; uses a dam and hauls water.
34	NW.	30	"	"	"	Bored	30	2,050	- 24	2,026	24	2,026	Glacial sand	Hard		D	Uses a dam in summer and hauls water in winter.
35	SW.	31	"	"	"	Dug	22	2,040	- 6	2,034			Glacial clay	Hard		D, S	Seepage water from a dam.
36	SW.	32	"	"	"	Drilled	138	2,050	- 42	2,008	138	1,912	Glacial sand	Hard, iron, "alkaline"		S	Plentiful supply; 22-foot seepage well used for drinking.
37	NW.	32	"	"	"	Drilled	132	2,060	- 67	1,993	132	1,928	Glacial coarse gravel	Hard, iron		S	Abundant supply.

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

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

WELL RECORDS—Rural Municipality of ARBUTHNOT, NO. 186, 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
38	SW.	33	21	11	2	Dug	14	2,050	- 7	2,043			Glacial clay	Hard		D, S	Intermittent supply; hauls water from a lake.
1	NW.	1	21	12	2	Drilled	240	1,900	-150	1,750	240	1,660	Glacial sand	Hard, iron		S	Abundant supply; rain water used for drinking.
2	NE.	2	"	"	"	Dug	20	1,900	- 2	1,898			Glacial clay	Hard, "alkaline"		D, S	Intermittent and insufficient supply.
3	NE.	4	"	"	"	Dug	12	1,870	- 4	1,866			Glacial clay	Hard		S	Intermittent supply; hauls from spring on the SE.¼, section 5.
4	SE.	5	"	"	"	Spring		1,800	0	1,800			Glacial gravel	Hard, iron		D, S	Will deliver approximately 190 barrels of water an hour; many farmers tank from here.
5	NE.	6	"	"	"	Spring							Glacial gravel	Hard			Good spring but located inconveniently in a deep coulée.
6	NE.	8	"	"	"	Dug	8	1,900	- 4	1,896	4	1,896	Glacial sand	Hard		D, S	Plentiful supply.
7	NW.	10	"	"	"	Dug	12	1,870	- 2	1,868			Glacial gravel	Hard		D, S	Good supply for 40 head stock.
8	SW.	10	"	"	"	Dug	12	1,900	- 7	1,893			Glacial sand	Hard		D, S	Insufficient supply; well can water 20 head stock; dry hole 22 feet deep.
9	SE.	13	"	"	"	Bored	40	1,950	- 12	1,938			Glacial clay	Hard, "alkaline"		N	Well has been abandoned because water is too highly mineralized.
10	SE.	13	"	"	"	Dug	25	1,950	- 10	1,940			Glacial clay	Hard		D	Typical well in village of Balcarres; unsatisfactory supply; several citizens buy water;#.
11	NE.	13	"	"	"	Drilled	220	1,960	- 20	1,940	220	1,740	Glacial sand	Hard, iron		S	Abundant supply; 13-foot well used for the house.
12	SE.	14	"	"	"	Drilled	285	1,940			285	1,655	Glacial sand	Hard		S	A good supply until it was shut off by sand plugging; uses a dugout and hauls water.
13	SW.	14	"	"	"	Drilled	220	1,940	- 70	1,870	220	1,720	Glacial gravel	Hard, iron		S	Abundant supply; hauls water for the house.
14	NE.	16	"	"	"	Drilled	330	1,940	-150	1,790	330	1,610	Glacial sand and gravel	Hard, iron		D, S	Abundant supply.
15	SE.	16	"	"	"	Drilled	330	1,920	-150	1,770	330	1,590	Glacial fine sand	Hard, iron		S	Abundant supply; several deep dry holes; one 428-foot well was abandoned on account of sand.
16	NE.	17	"	"	"	Bored	45	1,900					Glacial drift				The deepest of several dry holes; uses a dam and hauls water.
17	SW.	17	"	"	"	Bored	92	1,900					Glacial drift				Dry hole; hauls water.
18	NE.	19	"	"	"	Dug	12	1,920	- 6	1,914			Glacial sand	Hard		D, S	Good supply.
19	NW.	19	"	"	"	Dug	20	1,940					Glacial drift				Dry holes.
20	SW.	20	"	"	"	Dug	28	1,940	- 22	1,918			Glacial sand	Hard		D, S	18-foot well and a dam are also used; sufficient supply.
21	SW.	22	"	"	"	Bored	52	1,950	- 40	1,910			Glacial clay	Hard, "alkaline"		D, S	Will water about 20 head stock; 14-foot well in ravine used for stock.
22	NW.	22	"	"	"	Drilled	175	1,950	-125	1,825	175	1,775	Glacial gravel	Hard, iron		D, S	Good supply of laxative-producing water; well is never dry.
23	NW.	23	"	"	"	Dug	16	1,950	- 6	1,944			Glacial sand	Hard		D, S	Good supply; C.P.R. dam on this quarter section.
24	SW.	24	"	"	"	Drilled	209	1,960	-100	1,860	209	1,751	Glacial sand	Hard, iron, "alkaline"		S	Abundant supply of highly mineralized water; uses a 20-foot seepage well for the house.

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 ABERNETHY, NO. 186, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
25	SE.	25	21	12	2	Drilled	250	2,020	- 80	1,940	250	1,770	Glacial coarse sand	Hard, iron		D, S	Abundant supply.
26	SE.	26	"	"	"	Dug	20	1,960	- 17	1,943			Glacial sand	Hard		D, S	Insufficient supply in dry years.
27	NE.	28	"	"	"	Dug	18	2,000	- 17	1,983			Glacial sand	Hard		D, S	Intermittent and insufficient supply; hauls water from a spring.
28	NW.	28	"	"	"	Dug	16	2,005	- 15	1,990			Glacial sand	Hard		D, S	Delivers 1 barrel of water a day; hauls water from C.P.R. spring.
29	NW.	29	"	"	"	Dug	20	1,985					Glacial drift	Hard		D, S	Two seepage wells; very poor supply; hauls water.
30	NW.	31	"	"	"	Dug	12	2,020	- 4	2,016			Glacial sand	Soft		D, S	Plentiful supply.
31	SE.	33	"	"	"	Dug	10	2,000	- 7	1,993			Glacial sand	Hard		D, S	Sufficient supply; a spring is used also.
32	NE.	34	"	"	"	Dug	16	2,030	- 12	2,018			Glacial sand	Hard		D, S	Fair supply; will water about 40 head stock; 32 dry holes to a maximum depth of 92 feet.
33	SE.	35	"	"	"	Dug	11	2,000	- 6	1,994			Glacial sand	Hard		D, S	Sufficient for 25 head stock.

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

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