CANADA
DEPARTMENT OF MINES

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

BUREAU OF ECONOMIC GEOLOGY

GEOLOGICAL SURVEY

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF BENSON No. 35 SASKATCHEWAN

BY

B. R. MacKay & H. N. Hainstock

Water Supply Paper No. 44

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INTRODUCTION

Lack of rainfall during the years 1930 to 1934 over a large part of the Prairie Provinces brought about an acute shortage both in the larger supplies of surface water used for irrigation purposes and the smaller supplies of ground water required for domestic and stock-raising purposes by settlers, villages, and Indian reserves. The drought conditions resulted in repeated crop failures, and in a large number of farms in the acute drought areas of Saskatchewan and Alberta being abandoned. In an effort to relieve the serious situation a number of special studies of the water problem were begun by both Federal and Provincial Governments and allied organizations. The Federal Department of Agriculture undertook among other phases of the drought problem an investigation into the existing supplies of surface water, their conservation by means of dams and dug-outs, and how they could be made more generally available for irrigation. The Geological Survey of the Federal Department of Mines began an extensive study of the underground water conditions of southern Saskatchewan, this water being used principally for domestic and stock-raising purposes. For many years past the water problems in this and other provinces of Canada have engaged the attention of the Geological Survey, and considerable information had already been collected. A number of short reports dealing with the ground water conditions of special areas in Manitoba, Saskatchewan and Alberta have been published by both the Federal and Provincial Geological Surveys, but no systematic study of the ground water resources has been made up to the present.

Field Work

The senior author was in charge of this investigation and was instructed to cover as much of the territory as possible in the season. To effect this it was decided to maintain an

office at Regina and to have a large party consisting of twenty-six units, each to consist of three men who would cover their respective areas and visit every farm. In order that the information gathered by these different party units would be as complete and uniform as possible a questionnaire was prepared on which could be tabulated answers to all the essential questions required for a detailed study of the ground water conditions. An effort was made in the field by each party unit to fill in the questionnaire as completely as possible. In many instances, however, it was found that wells had either been abandoned, or the resident had little or no knowledge of the character of the water-bearing horizon and associated beds. When a party unit had completed the survey of a township the set of questionnaires and a report describing the characteristic features pertaining to the underground water conditions were mailed to the field office. Messrs. D.C. Maddox, F.H. Edmunds, H.H. Beach, H.N. Hainstock, R.D. MacDonald, and D.P. Goodall acted as supervisors in inspecting the work of the field units.

During the field season an area of 80,000 square miles, comprising 2,200 townships, was systematically examined, and records of approximately 60,000 wells were obtained, together with water samples for analyses obtained from 720 representative wells. These are systematically classified so that information pertaining to any well may be readily consulted. These records are supplemented by a set of 24 sectional sheets which cover all of southern Saskatchewan north to include township 32. Each sectional sheet comprises 120 townships. On these are indicated by symbol the location, type, and source of water of each of the 60,000 wells.

Publication of Results

The publication of such a great mass of detailed information is out of the question. This forms the permanent record of the Geological Survey. It is highly desirable, however, that a digest of the essential information pertaining to the ground water conditions of each municipality be furnished in convenient form to the municipality offices, to certain Provincial and Federal departments, and to allied organizations, at which centres it will be possible for any resident of the municipality or other party interested in any particular area to consult these reports. Should anyone find that he requires more detailed data than that contained in the report such additional information as the Geological Survey possesses can be procured on application to the Director, Bureau of Economic Geology, Department of Mines, Ottawa. In making such request the applicant should indicate the exact location of the area by giving the quarter section, township, range and meridian.

The reports have been prepared principally for farm residents, municipal bodies, and well drillers who are either contemplating sinking a well for the first time or considering deepening their well to a lower horizon in order to obtain a more abundant supply of water. In describing the water and geological conditions a certain number of technical terms must of necessity be used, and in case the reader should not be familiar with them their meanings have been defined in the glossary.

How to Use the Report

It is advisable that anyone desiring water information pertaining to a particular section of the municipality read over first the section dealing with the municipality as a whole, as by so doing he will be in a much better position to understand the section of the report dealing with the ground water conditions of

the area in which he is particularly interested. As he reads the text he should keep open before him for constant reference the accompanying map of the municipality on which are two figures, one showing the surface and bedrock geology of the area as they affect the ground water supply, and the other the relief and the location and type of water wells. The land relief is shown by means of lines of equal elevation, termed "contours", which lie generally at vertical intervals of 50 feet. The elevation above sea-level of each fourth line is indicated on the map. The statistical summary that follows the text gives at a glance the main characteristics of the wells in each township of the municipality and of the municipality as a whole as listed under the various sub-headings. This is followed by a section dealing with the analyses and quality of the water derived from the unconsolidated deposits and from bedrock. The table of well records gives the detailed information pertaining to each well. In this are tabulated the altitude of the well, its depth, the height to which the water will rise, and the elevation of the water horizon. The wells are grouped in the table by townships and are numbered from the lower right corner of the township westward and northward, and the location of each well by its quarter section is given. The elevations used were determined by aneroid barometer and were checked frequently by elevations on the published maps or by instrument surveys.

Where the ground surface of an area is comparatively flat an effort has been made to indicate the position of the water-bearing horizon in feet below the surface. In rolling country where there is a considerable difference of elevation within short distances a uniform figure for the depth to the water horizon is not generally possible. It then becomes necessary to indicate the position in terms of the elevation of a water-bearing bed in feet above sea-level.

Should one desire to ascertain at any location at which no well has as yet been sunk, the approximate depth at which a particular water-bearing horizon can be reached it is necessary to know two things--first, the elevation of the land surface, and second, the probable elevation of the water-bearing bed, or aquifer. The elevation of the land surface can be obtained by noting the position of the well site on the map, Figure 2, with respect to the two bounding contour lines of known elevation, and estimating either how far above the lower, or how far below the upper, control elevation line the well site lies. The approximate elevation of the water-bearing horizon at the well site can be obtained by noting on the table of well records the elevation of the horizon in the wells adjacent to the proposed location and from the range of elevations given and the relative positions of the wells shown on the map to select what appears to be its most probable elevation at the new well site. Having determined this elevation the depth that it is necessary to sink in order to tap it is the difference between its elevation and the elevation of the land surface. This method is especially applicable when the water-bearing horizon is in bedrock. In unconsolidated deposits the water horizon either conforms to the rolling land surface or occurs in isolated sand beds at various horizons that do not form a continuous water-bearing bed over a large area. Care should be taken in making any calculations for depth of water-bearing horizons to be sure that the elevations selected for the determinations occur in the same geological horizon, that is they should be either all in glacial drift or in the same bedrock formation.

The table of well records also contains notes on the temperature, quality, and quantity of the water being obtained from the various wells, and from this it is possible to draw reasonable conclusions as to the character and quantity of the water likely to be encountered at the proposed well site.

Glossary of Terms Used

Alluvium. Deposits of earth, silt, sand and gravel, and other transported material laid down by rivers, floods, or other causes upon land that has been submerged beneath the waters of lakes or rivers.

Aquifer. Layers or pockets of water-bearing sand or gravel that occur in unconsolidated deposits or as beds forming part of a bedrock formation.

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 deposits of gravel, sand, silt, and marl that have been laid down by the agency of water and which through a long period of time and the weight of the overlying sediments have become cemented into a solid rock.

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 section in a river valley that is 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 exerted by the water at any given point. It is due mainly to the weight of the column of water occurring at higher levels in the same aquifer or water-bearing bed.

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

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

Potable. Suitable for drinking.

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.

Water-bearing Horizon. A layer in either unconsolidated deposits or in bedrock formations that is water-bearing; same as aquifer.

Zone of Saturation. An area in which the permeable rocks are saturated with water that will move under ordinary hydrostatic pressure.

Names and Descriptions of Geological Formations, Referred to in These Reports

Wood Mountain Formation. The local name given to a series of gravel and thin sand beds which have a maximum thickness of 50 feet, and which occurs as isolated patches on the higher elevations of Wood mountain. They are the youngest of the consolidated rocks and, where present, rest upon the beds of the Ravenscrag formation.

Cypress Hills Formation. The local name given to a series of conglomerates and sand beds occurring in the southwest corner of Saskatchewan, which rests upon the Ravenscrag or older formations. The thickness of this formation varies from 30 to 125 feet.

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

Whitemud Formation. The local name given to a series of white, grey, and buff coloured clays and sands that varies in thickness from 10 to 75 feet. The base of this formation grades in places into a coarse, limy sand having a maximum thickness of 40 feet.

Eastend Formation. The local 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 eastern escarpment of the Missouri coteau. The The thickness of the formation seldom exceeds 40 feet.

Marine Shale Formation. The general name given to the thick deposit of incoherent, dark grey to dark brownish grey, plastic shales, which weather light grey to buff in places. It forms the uppermost bedrock formation over the greater part of eastern and central Saskatchewan. In the western part of the province it consists of a series of dark shales termed the Bearpaw formation. This is underlain by a series of sands, shales, and coal seams, known as the Belly River formation.

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Benson is an area of 324 square miles in southeastern Saskatchewan. It consists of nine townships, described as townships 4, 5, and 6, ranges 7, 8, and 9. The centre of the municipality lies 100 miles southeast of Regina. The area is covered by a mantle of unconsolidated glacial drift that was deposited by the continental ice-sheet. The thickness of this drift mantle is not definitely known, but it appears to vary from a minimum thickness of 100 feet to a maximum thickness of 300 feet. As a thin lignite coal seam is encountered over most of the municipality at a depth of approximately 210 feet, the average thickness of the drift is probably around 200 feet. The drift occurs mainly in the form of boulder clay, till or ground moraine, but in two localities, which are shown on the accompanying map, it is in the form of small terminal moraines of slight relief. The terminal moraine that occurs in the vicinity of Benson has blocked the drainage and a flat, marshy lake bed has been formed to the southeast of it.

Water-bearing Horizons in the Unconsolidated Deposits

Throughout the municipality the upper 10 to 40 feet of the drift is composed of a yellow clay that contains scattered pockets of sand or gravel. Many of these pockets occur at the contact of the yellow clay and the underlying blue clay. The underlying blue clay is compact and impervious, but in a few localities pockets of sand have been encountered in it at depths of 40 to 65 feet. Deposits of sand and gravel have also been encountered at depths of 100 to 180 feet, and they are thought to have been deposited as part of the glacial drift rather than as belonging to the upper beds of the Ravenscrag formation.

Three water-bearing horizons occur in the glacial drift. The uppermost horizon is formed by the lenses of sand that occur within the upper 40 feet of the drift and by the sandy deposits of

the old glacial lake bed. Most of the shallow wells in the township are dug into this horizon, but the supply of water contained in it is small and is entirely dependant upon the amount of rainfall. Thus in dry years and the autumn and winter months the shallow wells will not produce a sufficient supply for local needs, and during the years 1930 to 1935 most of the farmers who were dependant upon shallow wells for their water supply had to haul water during at least part of the year. By using two or more shallow wells and a dugout, however, some farmers have been able to obtain a supply that is barely sufficient for their local needs. Unless deep wells are drilled the only method of obtaining a satisfactory supply is by the use of dugouts. This method is used by many of the farmers, but the dugouts have not been made large enough and their supply is exhausted by the end of the summer months. It has been proved that dugouts that are 100 feet by 50 in demension, and 12 feet or more in depth, will retain a supply of water during the summer and most of the winter months.

The sand lenses within the blue clay constitute a second water-bearing horizon. This horizon is encountered by two wells in township 6, range 7, and it may occur elsewhere. The water is hard and slightly alkaline in character, and although not abundant in quantity it is sufficient for local needs.

The third horizon is formed by the sand and gravel deposits that occur at depths of 130 to 180 feet. These deposits are apparently not continuous, so that the horizon formed by them occurs only as small local patches. The water is usually fairly abundant in quantity and hard and alkaline in character. It is usable for stock, but its "alkaline" content makes it unsuitable for household purposes. An abundant supply of water from the above-mentioned three horizons of the glacial drift is not to be expected.

Water-bearing Horizons in the Bedrock

The Ravenscrag formation underlies the glacial drift throughout the municipality. The thickness of this formation

is not definitely known, but it is thought to be less than 400 feet. A small lignite coal seam usually underlies the blue clay and this seam, where present, is underlain by 20 to 30 feet of fine sand. This sandy bed is in turn underlain by a series of soft shale and sandy beds that contain one or more small lignite coal seams.

Three main water-bearing horizons occur in the Ravenscrag formation. The uppermost horizon occurs at depths of 215 to 270 feet, and it is formed by the thick sand bed encountered below the coal seam. This horizon occurs throughout the municipality, with the exception of township 6, range 9, and it has been tapped by a large number of wells. The water is under pressure and rises to within 40 to 80 feet of the surface, and unless the well casings become plugged with the fine sand of the aquifer the individual wells supply sufficient water for 150 to 200 head of stock. The water varies in character, but in most cases it is hard and contains a fairly large amount of iron. When a considerable amount of the water is being derived from the coal seam it is usually "alkaline" in character. It is usable for stock, but in most cases it is not desirable for household use.

The second water-bearing horizon occurs at depths of 320 and 380 feet and has been encountered throughout the municipality, with the exception of township 6, ranges 7 and 8. It is formed by a sand bed that in some areas is overlain by a lignite coal seam. The water obtained from this horizon is usually soft and tastes of soda. In a few wells, however, the water is hard and contains a fairly large amount of iron. In township 6, range 9, the water from this horizon is quite salty in character. The hydrostatic pressure is sufficient to cause the water to rise to within 35 to 120 feet of the surface and unless the wells become plugged with sand the supply is sufficient for 200 head of stock.

In township 4, ranges 7 and 8, and in township 5, range 9, seven wells have been drilled into a third water-bearing horizon. It is formed by a gravel or sand bed and occurs at a depth of 470 to 500 feet. The water is usually soft and salty, but when the

iron content is high it is hard in character. It is fairly abundant in quantity, and the pressure is sufficient to cause it to rise to within 50 to 100 feet of the surface. It is not known if this horizon is continuous throughout the municipality. It is doubtful if a large supply of water can be obtained below 500 feet in depth, but little trouble should be experienced in obtaining satisfactory supplies of water from the bedrock at shallower depths.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 4, Range 7

Only a very small supply of water can be obtained from the glacial drift in this township. The upper 15 feet of the drift contains small scattered pockets of sand and gravel and they form the only water-bearing horizon in the glacial deposits. Numerous dry holes are dug before a sand pocket is located and on some sections the sand pockets are entirely absent. The water supply from wells tapping these pockets is sufficient for household purposes and 10 to 15 head of stock during the spring months, but during the summer and winter months the wells become practically dry and it is necessary to haul water for stock use.

Dugouts are used by many farmers and this method of storing the spring run-off waters alleviates somewhat the problem of water shortage. The impervious nature of the sub-soil is particularly suitable for the construction of dugouts and should they be made large enough they will retain a supply of water during the summer and early winter months.

An abundant supply of water is obtained from the Ravenscrag formation. Three water-bearing horizons have been encountered in this formation and these horizons should be continuous throughout the township. The uppermost horizon is formed by a sand bed that occurs at the top of the formation, at a depth of 285 to 300 feet, or at an elevation of approximately 1,640 feet. This horizon has been tapped in sections 10 and 12, and the wells are producing an

abundant supply of hard water that rises to within 60 feet of the surface, and that can be used for both stock and household purposes. The second horizon is encountered at depths of 360 to 380 feet, or at an elevation of 1,560 feet, and it is also formed by a bed of fine sand. The water from this aquifer rises to within 90 to 120 feet of the surface and is hard and slightly "alkaline" in character. It is usable for both humans and stock and unless the casings become plugged with the fine sand the supply is sufficient for over 100 head of stock. A third water-bearing horizon occurs at a depth of 440 to 480 feet and it is formed by a sandy shale strata. The water is hard and salty in character and contains a considerable amount of iron. The hydrostatic pressure is sufficient to cause the water to rise to within 14 to 100 feet of the surface. Should these horizons be tapped by other wells throughout the township an abundant supply of usable water is to be expected.

Township 4, Range 8

One water-bearing horizon occurs in the glacial drift in this township. It is formed by the pockets of sand and gravel that are found within the upper 30 feet of the drift, but it yields only a very small supply of hard, slightly "alkaline" water. Numerous dry holes are usually dug before a sand pocket is located. The wells that tap these sand pockets give a sufficient supply during the spring months, but during the summer and winter months their supply is insufficient for local needs and it is necessary to haul water from neighbouring deep wells. Dugouts can be used for storing the spring run-off waters and if they are made large enough a supply can be retained during the greater part of the year.

An abundant and permanent supply of water is obtained from the water-bearing horizons in the Ravenscrag formation. Three wells located in sections 4, 6, and 10, are deriving an abundant supply of medium-soft water from a sand bed that occurs at a depth of 215 to 240 feet, or at an elevation of 1,670 feet.

The water rises to within 70 feet of the surface and it is usable for both humans and stock. A second water-bearing horizon occurs at a depth of 300 to 360 feet and it is formed by a coal seam and its associated sandy beds. It has been tapped by two wells located in sections 12, and 34, and they are producing an abundant supply of soft usable water. The hydrostatic pressure is sufficient to cause the water to rise to within 80 feet of the surface. A third water-bearing horizon is encountered by a well located in the SW.¼, section 22. It is formed by a sand bed that occurs at a depth of 480 feet, or at an elevation of 1,450 feet. The water obtained from this horizon is abundant in quantity, hard in quality, and rises to within 50 feet of the surface. It is not known if these three horizons are continuous throughout the township, but it is reasonable to assume that they are. If such is the case, they will yield an abundant supply of usable water should they be tapped by other wells.

Township 4, Range 9

Only a small amount of water can be obtained from the glacial drift in this township. The sand pockets that occur within the upper 20 to 30 feet of the drift constitute a water-bearing horizon, but only one shallow well is deriving an abundant supply from this aquifer. The other wells that are dug into these pockets yield an adequate supply during the spring months, but during the remainder of the year it is necessary to haul water for stock requirements. Dugouts can be used for storing the spring run-off waters and the impervious nature of the subsoil is particularly suitable for their construction. Should they be made large enough, a supply can be retained for the greater part of the year. Unless wells are drilled into the bedrock dugouts are the only means of obtaining a sufficient supply of water for stock use.

In the southern part of the township a number of wells have been drilled to depths of 165 feet into the blue clay without

obtaining any water. In the NE.¼, section 20, and the SW.¼, section 27, however, two wells are obtaining a fairly abundant supply of hard, "alkaline" water from a sand deposit lying at the base of the blue clay at depths of 180 and 130 feet, respectively. The water is under pressure and rises to within 40 feet of the surface. It is not known if this horizon is continuous, or if the sand forming it is part of the Ravenscrag formation or the glacial drift.

An abundant supply of ground water is obtained from the Ravenscrag formation. At least two water-bearing horizons occur and they appear to be continuous throughout the township. The uppermost horizon is a sand bed and it is encountered at depths of 240 to 270 feet. The water is medium hard, and rises to within 30 to 60 feet of the surface. The second horizon is also a sand bed and it occurs at a depth of approximately 360 feet or at an elevation of 1,550 feet. The water rises to within 90 feet of the surface, and is hard and contains a considerable amount of iron. Unless the casings become plugged with the fine sand the wells that tap both these horizons yield an abundant supply of usable water.

Township 5, Range 7

Only a limited supply of ground water is obtained from the glacial drift. The pockets of sand that occur within the upper 30 feet of the drift form a water-bearing horizon and it is the source of supply for all of the shallow wells. As the pockets are not extensive, the amount of water contained in them is small and the supply of water from wells that tap these pockets is entirely dependant upon the amount of precipitation. Thus in drought periods and the autumn and winter months, those farmers who have only shallow wells are forced to haul water from neighbouring wells having a permanent supply. Dugouts can be used throughout the township and the impervious nature of the sub-soil is suitable for their construction.

In the SE.¼, section 7, and the NW.¼, section 12, two wells are obtaining a moderate supply of water from a sand bed lying at the base of the blue clay, at depths of 185 and 160 feet, respectively. The water is hard and contains a large amount of iron, but it is usable for both humans and stock. The areal extent of this horizon is not known, but as it was not encountered elsewhere in the township it is not thought to be extensive.

Two water-bearing horizons occur in the Ravenscrag formation and they appear to be continuous throughout the township. The uppermost is formed by a thick sand bed which is encountered at a depth of 250 to 280 feet. In the southern part of the township the water from this horizon is soft, but in the northern part the water from two wells tapping the horizon is hard and "alkaline." The water is under pressure and rises to within 30 to 80 feet of the surface. A second horizon occurs at a depth of 300 to 330 feet. It is also formed by a sand bed that underlies a lignite coal seam. The water rises to within 50 feet of the surface and varies in character, being medium soft in some wells, and hard and slightly "alkaline" in others. It can be used for both stock and domestic purposes. Should other wells be drilled into these horizons throughout the township they will obtain an abundant supply of water, providing that the fine sand of the aquifer does not plug the well casings.

Township 5, Range 8

Ground water from the glacial drift in this township is derived from two water-bearing horizons. The sand pockets that occur within the upper 20 feet of the drift constitute a water-bearing horizon, and all of the shallow wells, except those that depend on seepage from dugouts or sloughs, derive their supply from this aquifer. Many dry holes are dug, however, before a sand lens is located. By usuing two or more shallow wells and a dugout, some farmers have a sufficient supply of

water for 40 to 50 head of stock. In most cases, however, the wells that tap this horizon yield a sufficient supply during the spring months only, and during the autumn and winter months it is necessary to haul water from neighbouring wells having a permanent supply. Dugouts can be used successfully throughout the township as the sub-soil is impervious to water, and if they are excavated to a depth of 12 feet or more they should retain a supply of water through the winter months.

What is believed to be a second water-bearing horizon in the drift is encountered by two wells located in the SE.$\frac{1}{4}$, section 16, and the SW.$\frac{1}{4}$, section 34. At these localities deposits of sand and gravel occur below the blue clay at depths of 87 and 120 feet, respectively, and a fairly abundant supply of hard water is derived from them. This horizon is not extensive, however, as it was not encountered elsewhere in the township.

An abundant supply of ground water is being obtained from two water-bearing horizons in the Ravenscrag formation. In the southeastern corner of the township a sandstone bed occurring at a depth of 235 to 250 feet, or at an elevation of approximately 1,710 feet, forms a water-bearing horizon. It has been tapped by six wells and all of them are deriving an abundant supply of hard to medium soft, usable water from it. The water is under pressure and rises to within 60 to 100 feet of the surface. In the north-central part of the township, four wells have tapped a second horizon at depths of 310 to 345 feet. This horizon is formed by a sand bed and it yields an abundant supply of soft, usable water which rises to within 50 to 100 feet of the surface. These horizons should be fairly continuous and if they are tapped by other wells throughout the township an abundant supply of water is to be expected.

Township 5, Range 9

The small sand lenses that occur within the upper 30 feet of the glacial drift form a water-bearing horizon. This horizon

yields a small supply of water that is often too "alkaline" for household use, and several dry holes are usually dug before a lens is encountered. The water supply from this horizon is entirely dependant upon the amount of rainfall, and during the drought periods and winter months the shallow wells that tap this horizon are practically dry. Unless wells are drilled into the bedrock, the only method of obtaining a sufficient supply of water for farm needs is by excavating large dugouts and retaining the spring run-off water. If the dugouts are made large enough they will hold a sufficient supply of water to last through the winter months.

Nine wells are deriving an abundant supply of water from the Ravenscrag formation. In the SE.¼, section 21, a well is obtaining a moderate supply of hard water from a sand bed that underlies a small coal seam at a depth of 140 feet. This is the only locality in the township, however, where this horizon occurs. In sections 26 and 28, two wells are obtaining a very small supply of hard water from a sand bed that occurs at a depth of approximately 230 feet. This horizon does not contain an abundant supply of water. The best supply is being obtained from two deeper horizons, the uppermost of which occurs at a depth of 330 feet. This horizon has been tapped by wells located in sections 6, 14, and 18, and it is formed by a sand bed that immediately underlies a small coal seam. Each of the wells is producing an abundant supply of soft, usable water, which rises to within 20 to 60 feet of the surface. The lowermost water-bearing horizon is a sand or gravel bed and it is encountered by three wells, located in SW.¼, section 4; SW.¼, section 25, and the SW.¼, section 36, at depths of 512, 460, and 500 feet, respectively. The water is soft and salty in character, but it is not suitable for household use. The supply from this horizon is sufficient for local needs, but it is not abundant. Should these horizons be tapped by other wells throughout the township a fairly abundant supply of water can be expected.

Township 6, Range 7

Ground water is obtained from several horizons in the glacial drift. The uppermost horizon is formed by the lenses or pockets of sand that occur within the upper 25 feet of the drift, and it is the source of water for all of the shallow wells. In years of normal rainfall this horizon produces a supply of water that is sufficient for local needs, but in drought periods the supply is inadequate and water has to be hauled. In the southwestern corner of the township the sand deposits are fairly extensive as a lake bed occurs here, and wells in this locality produce a fairly abundant supply of water. The water is hard and in a few instances "alkaline", but it is used for household purposes. Dugouts are rarely used in this township as sloughs are abundant, and in wet years the stock are watered at these undrained depressions.

In the SE.$\frac{1}{4}$, section 6, and the SE.$\frac{1}{4}$, section 25, two wells are obtaining a moderate supply of hard water from sand lenses that occur within the blue clay at depths of 63 and 40 feet, respectively. Similar lenses may occur elsewhere in the blue clay. Four wells located in the SW.$\frac{1}{4}$, section 22, the SE.$\frac{1}{4}$, section 28, and the N.$\frac{1}{2}$, section 34, have tapped a water-bearing horizon that is formed by deposits of sand and gravel that immediately underlie the blue clay at depths of 150, 125, and 160 feet, respectively. The water from this horizon is hard and "alkaline" in character, abundant in quantity, and rises to within 10 to 100 feet of the surface. It is usable for stock, but it is too "alkaline" for household use. The areal extent of this aquifer is not known, but the writer is of the opinion that it is confined to the locations mentioned above.

The Ravenscrag formation contains one productive water-bearing horizon. Throughout the eastern half of the township a number of wells are deriving an abundant supply of water from a sand bed that immediately underlies a thin lignite coal seam

at a depth of 215 to 250 feet. The water varies from medium soft to hard and is slightly "alkaline". It is usable for stock and unless the iron and "alkaline" content is too high it can be used for household purposes. The hydrostatic pressure is sufficient to cause the water to rise to within 30 to 60 feet of the surface, where it maintains a constant level. This horizon should be continuous throughout the township. Other water-bearing horizons may occur at greater depths.

Township 6, Range 8

The glacial drift in this township contains one known water-bearing horizon and it is formed by the lenses of sand and gravel that occur within the upper 30 feet of the drift. With one exception, the water supply of this township is derived wholly from shallow wells tapping the horizon. The lenses of sand and gravel are fairly numerous and water can be readily found in most localities. The supply, however, is not large and many wells do not yield sufficient for local needs, and in drought years and during the autumn and winter months some farmers are forced to haul water from wells yielding a permanent supply. By using two or more wells and a dugout, a sufficient supply can usually be obtained. The water is hard and as a rule "alkaline" in character, in many cases too "alkaline" for use. In wet years this township has an abundant supply of water, but either large dugouts would have to be excavated or wells drilled into the bedrock in order to ensure a permanent supply of water during drought periods.

No information was obtained on the water-bearing horizons in the Ravenscrag formation, as only one deep well has been drilled in the township. This well is located in the SW.¼, section 36, and is obtaining an abundant supply of soft, slightly salty water from a sand bed that occurs at a depth of 190 feet. As an abundant supply of water is obtained from the water-bearing horizons of the Ravenscrag formation in the adjoining townships, it is logical to

assume that the same horizons will be found in this township.

Township 6, Range 9

Ground water is obtained from two water-bearing horizons in the glacial drift of this township. The lenses of sand and gravel that occur within the upper 30 feet of the drift form a water-bearing horizon. The shallow wells that are dug into these lenses do not yield a large supply of water and during drought periods and the autumn and winter months it often is necessary to haul water for stock use. The water is hard and usually "alkaline" in character, and good drinking water is scarce. Unless deep wells are drilled the only method of obtaining a sufficient supply of water is by using dugouts. They should be excavated to a depth of at least 12 feet.

A second water-bearing horizon in the glacial drift is encountered by two wells located in the NE.$\frac{1}{4}$, section 17, and the NE.$\frac{1}{4}$, section 20. This horizon is formed by a sand bed that occurs at depths of 150 and 100 feet, respectively. It is not known, however, if this sand bed occurs at the base of the blue clay. Lack of information does not permit the determination of its areal extent. The water is hard and "alkaline," not usable for humans, and is not abundant in quantity.

Four wells located in the north-central part of the township are deriving a fairly abundant supply of water from a horizon in the Ravenscrag formation. This horizon is formed by a sand or gravel bed, and it occurs at depths of 320 to 370 feet. The water is soft and salty in character, and rises to within 40 to 60 feet of the surface. It is potable for stock, but is too salty for human use. Should other wells be drilled throughout the township a fairly abundant supply of water will be obtained from this horizon or others that may occur.

Statistical Summary of Well Information in Rural Municipality of Benson, No. 35, Saskatchewan

Township	4	4	4	5	5	5	6	6	6	Total in Municipality
West of 2nd meridian Range	7	8	9	7	8	9	7	8	9	
Total No. of Wells in Township	100	108	78	73	126	64	128	111	118	906
No. of wells in bedrock	10	7	14	15	18	12	14	1	6	97
No. of wells in glacial drift	90	101	64	58	108	52	114	110	112	809
No. of wells in alluvium	0	0	0	0	0	0	0	0	0	0
Permanency of Water Supply										
No. with permanent supply	22	23	21	33	40	24	39	34	29	265
No. with intermittent supply	25	23	11	18	20	11	17	18	25	168
No. dry holes	53	62	46	22	66	29	72	59	64	473
Types of Wells										
No. of flowing artesian wells	0	0	0	0	0	0	0	0	0	0
No. of non-flowing artesian wells	10	7	8	14	14	7	14	1	8	83
No. of non-artesian wells	37	39	24	37	46	28	42	51	46	350
Quality of Water										
No. with hard water	38	39	25	41	53	28	52	47	49	372
No. with soft water	9	7	7	10	7	7	4	5	5	51
No. with salty water	3	0	1	1	0	4	1	1	4	15
No. with alkaline water	12	7	9	17	15	10	15	18	12	115
Depth of Wells										
No. from 0 to 50 feet deep	80	96	61	57	99	52	110	103	108	766
No. from 51 to 100 feet deep	8	5	3	2	6	0	5	7	2	38
No. from 101 to 150 feet deep	0	1	1	0	3	2	3	0	2	12
No. from 151 to 200 feet deep	0	0	1	2	4	0	2	1	0	10
No. from 201 to 500 feet deep	12	6	12	12	14	9	8	0	6	79
No. from 501 to 1,000 feet deep	0	0	0	0	0	1	0	0	0	1
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
How the Water is used										
No. usable for domestic purposes	38	41	29	38	42	24	48	49	40	349
No. not usable for domestic purposes	9	5	3	13	18	11	8	3	14	84
No. usable for stock	44	45	31	47	54	34	56	51	51	413
No. not usable for stock	3	1	1	4	6	1	0	1	3	20
Sufficiency of Water Supply										
No. sufficient for domestic needs	46	42	31	51	59	34	54	52	53	422
No. insufficient for domestic needs	1	4	1	0	1	1	2	0	1	11
No. sufficient for stock needs	20	19	17	25	29	16	21	18	12	177
No. insufficient for stock needs	27	27	15	26	31	19	35	34	42	256

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 and unless the figure is very high it does not imply that the water is too alkaline for irrigation purposes. The analyses are given in parts per million--that is, in parts by weight of the constituents in 1,000,000 parts by volume 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 practically all rocks, but in larger amounts 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 teakettles 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, and waters that contain a large amount of them cannot be used for irrigation.

Sulphates

Sulphates (SO_4) are one of the common constituents of natural water. The sulphate salts most commonly found are sodium sulphate (Glauber's Salt, Na_2SO_4), magnesium sulphate (Epsom

Salts, $MgSO_4$) and calcium sulphate ($CaSO_4$). Waters that contain these sulphate salts are called "sulphate waters". When the water contains large quantities of the sulphate of sodium ("White Alkali") it is injurious to vegetation and cannot be used for irrigation. According to Thresh and Beale, London, the continued use of water that contains 1,200 parts or more per million of magnesium sulphate and 500 parts or more per million of sodium sulphate causes diarrhoea and scour among stock, and one half this quantity makes the water unfit for domestic use.

Chlorides

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

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 out 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 had 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 to the bicarbonates of calcium and magnesium, and permanent hardness to the sulphates, and chlorides of calcium and magnesium. The permanent hardness can be partly eliminated by adding simple chemical softeners such as ammonia or sodium carbonate, or many prepared softeners. Water that contains a large amount of sodium carbonate and small amounts of calcium and magnesium salts is soft, but if the calcium and magnesium salts are present in large amounts the water is hard. The following table from "The Examination of Water and Water Supplies" by Thresh and Beale, London, 1925 , can be used for determining the relative hardness of a water.

Total Hardness	Character
Less than 50 parts per million	Very soft
50 - 100 " " "	Moderately soft
100 - 150 " " "	Slightly hard
150 - 200 " " "	Moderately hard
200 - 300 " " "	Hard
Over 300 " " "	Excessively hard

Many of the Saskatchewan water samples analysed by the Geological Survey 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.

The term "alkaline" has been applied rather loosely to some ground waters. Its original meaning was a chemical one and it implied that the substance in question would neutralize acids. The carbonates of calcium, magnesium, and sodium are the only compounds found in ground water that would make it alkaline chemically. A later application of the term "alkaline" was to soils that contain sufficient "black alkali" or "white alkali" to make them unfit for vegetation. In the Prairie Provinces a water is usually considered to be alkaline when it contains so much dissolved solids that it is not very suitable for human consumption; except that 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".

Analyses of Water Samples from the Municipality of Benson, No. 35, Saskatchewan.

No.	LOCATION					Depth of Well, Ft.	Total dis'vd Solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS								Source of Water
	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alkalinity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	
1.	SE.	6	4	8	2	236	3,140	35	not	det.	40	700	10	14	1,644	1,498	3,232	18		29		686	2,433	66		x 2
2.	SW.	14	5	7	2	370	1,420	180	170	10	112	960	20	32	86	677	1,310	36		67		895	127	185		x 2
3.	SE.	15	5	8	2	260	4,160	1,800	1,800	nil	70	285	510	223	2,448	908	3,858	285	851		665		1,942	115		x 2
4.	SW	26	5	9	2	220	1,740	440	280	160	103	400	40	65	771	691	1,695	72		136		176	1,141	170		x 2
5.	SE.	20	6	8	2	40	520	320	120	200	7	320	10	54	131	194	514	18		113		177	194	12		x 1

Water samples indicated thus, x 1, are from glacial drift.
Water samples indicated thus, x 2, are from bedrock, Ravenscrag formation.
Analyses are reported in parts per million.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

The waters from the glacial drift show marked similarity in the types of mineral salts contained in solution, but vary in the amounts of these salts. The downward seeping water dissolves some of the mineral salts contained in the deposits of clay, sand and gravel through which it passes. As some parts of the drift contain more mineral salts than others, the character of the waters may vary greatly within short distances. Thus, it is not uncommon to find water so highly charged with mineral salts that it is unfit for use, at the same depth, and not far distant from water that is usable for both humans and stock.

The waters from the drift in this municipality are as a rule usable for both humans and animals. Some of them contain a relatively large amount of sulphate salts and are "sulphated waters", or, using the term commonly employed in the Prairie Provinces, "alkaline waters".

One sample of water from the glacial drift was analysed and the results are listed in the accompanying table. This water is derived from a depth of 40 feet, and in the writer's opinion is not representative of water from the glacial drift. It has a total hardness of 320 parts per million, of which 200 parts are temporary and may be expelled by boiling. Invariably the waters from the drift are excessively hard in character, containing more than 300 parts per million of total hardness. In rare cases the water is soft, but in such instances the wells, are shallow and are obtaining water from direct seepage from sloughs or dugouts.

The sample analysed has a total dissolved solid content of 514 parts per million. This content is low for drift water, as the usual average total dissolved solid content is approximately 1,800 parts per million. Three thousand parts per million of total dissolved solids is usually considered the upper limit for waters that are used for domestic purposes. Such waters are being used,

however, with no noticeably ill effects, unless the solid content is made up almost entirely of one harmful mineral salt.

Sodium sulphate (Glauber's Salts) is the most abundant mineral salt present, with 194 parts per million. This salt is slightly laxative, but is not harmful unless it occurs in large quantities. Sodium carbonate (black alkali) is second in abundance with 177 parts per million. As a rule this mineral salt is entirely absent in waters from the drift. Waters that contain 200 parts per million of sodium carbonate are unfit for irrigation purposes. Smaller amounts of magnesium carbonate, calcium carbonate, and sodium chloride also occur. In the sample analysed, magnesium sulphate (Epsom Salts) is entirely absent. This mineral salt is usually one of the predominant salts in waters from the drift. When it occurs in large quantities it renders the water unfit for use, as it is highly laxative.

Water from the Bedrock

Four samples of water from the Ravenscrag formation were analysed. Three samples were from a depth of 220 to 260 feet, and the fourth from a depth of 370 feet. The water from the Ravenscrag formation is as a rule fairly soft. The samples analysed vary from very soft to excessively hard, depending upon the amounts of calcium and magnesium salts present. Water in which the total sodium salt content exceeds that of the calcium and magnesium salts is soft.

The total dissolved solid content of the three samples of water from a depth of 220 to 260 feet ranges from 1,740 to 4,160 parts per million. That from a depth of 370 feet contains 1,420 parts per million of dissolved solids. In the former three samples the predominant salt is sodium sulphate (Glauber's Salts). Its content varies from 1,141 to 2,433 parts per million, or forms practically one-half the total dissolved solid content. This mineral salt is relatively low in the sample obtained from a depth

of 370 feet. Sodium carbonate (black alkali) is second in abundance in two samples from a depth of 220 to 260 feet, and first in the deeper sample. In the sample having a total hardness of 1,800 parts per million, the calcium sulphate (gypsum) content is 851 parts per million, and the magnesium sulphate (Epsom Salts) content is 665 parts per million. Sodium chloride (common salt) occurs in all the samples, but its content is low, from 12 to 185 parts per million. Unless its content exceeds 200 parts per million the water will not have a salty taste. Small amounts of calcium carbonate and magnesium carbonate also occur.

The waters that contain a large amount of sodium sulphate and magnesium sulphate are unfit for domestic purposes as they cause the water to have a laxative effect. All of the waters will have a distinct soda taste due to the abundance of sodium salts. They are satisfactory for stock-raising requirements, but are unsuitable for irrigation purposes due to the sodium carbonate content.

WELL RECORDS—RURAL MUNICIPALITY OF BENSON NO. 35 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.	1	4	7	2	Dug	10	1,915	- 4	1,911	2	1,913	Glacial sand	Soft, clear		D, S	Insufficient for 8 head stock.
2	NW.	1	"	"	"	"	12	1,915	- 4	1,911	8	1,907	" "	" "	49	D, S, I	Insufficient for 13 head stock.
3	NW.	4	"	"	"	"	14	1,925	- 4	1,921	3	1,922	" "	Hard, clear	47	D, S, I	Waters 18 head stock.
4	NW.	5	"	"	"	"	14	1,920	- 13	1,907			" clay	" "		D,	House use only.
5	SW.	6	"	"	"	"	11	1,920	- 7	1,913	9	1,911	" sand	" "	43	D, S, I	Insufficient for 42 head stock.
6	SE.	8	"	"	"	"	22	1,925	- 7	1,918	18	1,907	" "	" "	43	D, S	Waters 20 head stock.
7	SW.	10	"	"	"	"	14	1,920	- 10	1,910	4	1,916	" "	iron Soft, clear		D, S	Dry 1931-1935.
8	NE.	10	"	"	"	Drilled	284	1,920	- 60	1,860	264	1,656	Ravenscrag sand	" yellow	43	D, S, I	Laxative; waters 48 head stock.
9	SE.	11	"	"	"	Dug	18	1,915	?		18	1,897	Glacial yellow clay	Hard, clear		D, S	Insufficient for 9 head stock.
10	SW.	12	"	"	"	"	15	1,915	- 8	1,907	13	1,902	Glacial gravel	Soft, clear	48	D, S	Insufficient for 13 head stock.
11	NE.	12	"	"	"	Drilled	318	1,915	- 40	1,875	298	1,617	Ravenscrag gravel	Hard, iron, alkaline	45	D, S, I	Waters 50 head stock.
12	NW.	14	"	"	"	Dug	20	1,925	- 10	1,915	10	1,915	Glacial sand	Hard, clear	42	D, S	Goes dry in autumn.
13	SE.	16	"	"	"	Drilled	475	1,930	- 40	1,890	470	1,460	Ravenscrag sand	" red sediment	44	D, S, I	Waters 60 head stock.
14	NW.	16	"	"	"	Dug	30	1,930	- 29	1,901	12	1,918	Glacial sand	Hard, red, alkaline		N,	Dry in 1935.
15	NW.	17	"	"	"	"	14	1,925	- 7	1,918	2	1,923	" "	Soft, clear		S,	Very poor supply.
16	NE.	18	"	"	"	"	9	1,925	- 4	1,921	5	1,920	" "	Hard, clear	43	D, S	Insufficient for 12 head stock.
17	SE.	18	"	"	"	"	20	1,920	- 18	1,902	11	1,909	" "	" "	44	D, S	Goes dry in autumn.
18	SW.	18	"	"	"	"	11	1,920	- 8	1,912	10	1,910	" "	" "	47	D, S	Insufficient for 30 head stock.
19	NW.	20	"	"	"	Drilled	425	1,930	-120	1,810	405	1,526	Ravenscrag gravel	Hard, soda, clear	45	S,	Waters 65 head stock.
20	SW.	22	"	"	"	"	448	1,930	- 18	1,912	448	1,482	" "	Hard, clear, iron	45	D, S	" 40 " " .
21	NE.	22	"	"	"	"	368	1,940	-120	1,820	364	1,576	" sandstone	Hard, salty, iron, clear	44	D, S	Abundant supply.
22	SE.	23	"	"	"	Dug	20	1,930	- 10	1,920	18	1,912	Glacial gravel	Soft, clear	43	D, S	House supply only.
23	SW.	24	"	"	"	"	12	1,935	- 5	1,930	4	1,931	" sand	Hard, clear, alkaline	45	D,	" " " .
24	SE.	24	"	"	"	"	16	1,935	- 8	1,927	12	1,923	" "	Hard, clear, alkaline	48	D, S	Insufficient for 4 head stock.
25	NE.	24	"	"	"	Drilled	401	1,940	- 90	1,850	371	1,569	Ravenscrag sand	Hard, clear, alkaline		S,	Waters 21 head stock.
26	SE.	28	"	"	"	"	380	1,940	- 75	1,865	380	1,560	" gravel	Soft, salty, clear	43	S,	Waters 14 head stock.
27	SW.	28	"	"	"	"	480	1,940	-100	1,840	480	1,460	" shale	Hard, soda, gas, brown	45	S,	Waters 100 head stock.

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

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

WELL RECORDS—RURAL MUNICIPALITY OF BENSON NO. 35 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
28	SE.	31	4	7	2	Dug	17	1,945	- 14	1,931	14	1,931	Glacial clay	Hard, clear, alkaline	49		Insufficient for 22 head stock.
29	NW.	33	"	"	"	"	18	1,955	- 3	1,952	7	1,948	" "	Hard, clear, alkaline	43	N,	Cannot be used.
1	NE.	1	4	8	2	Dug	14	1,905	- 3	1,902	10	1,895	" sand	Hard, clear	44	D, S, I	Waters 20 head stock.
2	SE.	2	"	"	"	"	30	1,905	- 15	1,890	27	1,878	" "	Soft, clear	43	D, S	Waters 35 head stock.
3	NW.	2	"	"	"	"	15	1,905	- 2	1,903	8	1,897	" "	Hard, clear		D, S	Poor supply.
4	SW.	2	"	"	"	"	22	1,905	- 11	1,894	11	1,894	" "	" " alkaline	42	D,	Insufficient for 14 head stock.
5	SW.	3	"	"	"	"	40	1,910					" clay				Dry hole.
6	NE.	4	"	"	"	Drilled	242	1,910	- 70	1,840	240	1,670	Ravenscrag sand	Hard, soda, yellow		S,	Waters 50 head stock.
7	SE.	4	"	"	"	"	110	1,900			110	1,790	?	Hard, iron, cloudy		D, S	Sufficient supply.
8	SE.	6	"	"	"	"	236	1,905	- 70	1,835	216	1,689	Ravenscrag sand	Soft, clear, soda		S,	Kills plants; waters 40 head stock.
9	SW.	8	"	"	"	Dug	15	1,910	- 3	1,907	12	1,898	Glacial gravel	Hard, clear	44	D,	House use only.
10	NW.	10	"	"	"	Drilled	265	1,910	- 40	1,870	245	1,665	Ravenscrag sand	Soft, soda, yellow	46	D, S	Kills plants. waters 20 head stock.
11	NE.	10	"	"	"	Dug	6	1,910	- 4	1,906	4	1,906	Glacial yellow clay	Soft, clear	58	D, S	Watered 10 head stock in 1935.
12	SE.	12	"	"	"	Drilled	360	1,910	-100	1,810	350	1,560	Ravenscrag sand	" soda, brown	44	D, S, I	Waters 24 " " .
13	NE.	12	"	"	"	Dug	14	1,925	- 4	1,921	12	1,913	Glacial sand	Hard, clear		D,	House supply only.
14	SE.	14	"	"	"	"	8	1,935	- 2	1,933	6	1,929	" gravel	" "	51	D, S, I	Waters 12 head stock.
15	SE.	14	"	"	"	"	12	1,935	- 6	1,929	10	1,925	" sand	" "		D, S	Insufficient for 12 head stock.
16	NW.	15	"	"	"	"	20	1,915			18	1,897	" "	" "		D, S, I	Waters 11 head stock.
17	NW.	16	"	"	"	"	18	1,920	- 6	1,914	13	1,907	" "	" "	42	D, S	Waters 20 head stock.
18	NW.	17	"	"	"	"	20	1,910	- 12	1,898	17	1,893	" "	Hard, clear, alkaline	47	D, S	Waters 6 head stock.
19	SE.	18	"	"	"	"	22	1,910	- 8	1,902	11	1,899	" "	Hard, clear	42	D, S, I	Waters 12 head stock.
20	SW.	19	"	"	"	"	28	1,915	- 26	1,889	24	1,891	" "	" cloudy		D, S	Insufficient for 24 head stock.
21	NE.	19	"	"	"	"	21	1,920	- 8	1,912	8	1,912	" "	" clear	42	D, S	Insufficient for 17 head stock.
22	SW.	20	"	"	"	"	32	1,910	- 8	1,902	16	1,894	" "	" "	43	D, S	Insufficient for 17 head stock.
23	SW.	22	"	"	"	Drilled	485	1,935	- 50	1,885	468	1,467	Ravenscrag sand	" " iron	45	D, S, I	Waters 100 head stock.
24	NE.	22	"	"	"	Dug	12	1,925	- 5	1,920	5	1,920	Glacial gravel	Hard, yellow	43	S,	Waters 25 head stock.
25	NW.	23	"	"	"	"	12	1,920	- 6	1,914	6	1,914	" "	" clear		D, S	Waters 20 head stock.

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

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

WELL RECORDS—RURAL MUNICIPALITY OF BENSON NO. 35, SASKATCHEWAN.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
26	NW.	24	4	8	2	Dug	14	1,935	- 12	1,923	9	1,926	Glacial sand	Hard, clear, alkaline	42	S,	Insufficient for 13 head stock.
27	NE.	27	"	"	"	"	30	1,950	- 27	1,923	20	1,930	" "	Hard, clear	44	D,	House supply only.
28	SE.	27	"	"	"	"	14	1,940	- 7	1,933	6	1,934	" "	" "		D, S, I	Dry since 1932.
29	SE.	31	"	"	"	"	22	1,950	- 18	1,932	18	1,932	" gravel	" " alkaline		D, S	Sufficient supply.
30	SW.	32	"	"	"	"	12	1,955	- 10	1,945	10	1,945	" "	Soft, clear		D, S	Dry since 1933.
31	NW.	34	"	"	"	"	28	1,945	- 18	1,927	26	1,919	" "	Hard, clear	40	D, S	Waters 14 head stock.
32	NE.	34	"	"	"	"	24	1,955	- 19	1,936	19	1,936	" "	" "	42	D, S	Watered 20 head stock in 1935.
33	SE.	34	"	"	"	Drilled	353	1,950	- 80	1,870	350	1,600	Ravenscrag	Soft, soda, clear		D,	Waters 30 head stock.
34	NW.	36	"	"	"	Dug	16	1,945	- 11	1,934	12	1,933	Glacial sand	Hard, clear		D, S	Very small supply.
35	SE.	36	"	"	"	"	16	1,945	- 11	1,934	12	1,933	" "	" "	45	D, S	Insufficient for 12 head stock.
1	NW.	2	4	9	2	Dug	34	1,915	- 26	1,889	32	1,883	Glacial gravel	Hard, clear, alkaline	45	S,	Waters 15 head stock.
2	SE.	4	"	"	"	"	33	1,900	- 5	1,895	21	1,879	" "	Soft, clear	47	D, S, I	" 25 " " .
3	NW.	5	"	"	"	Drilled	385	1,905	- 82	1,823	355	1,550	Ravenscrag sand	" "	45	D, S, I	" 50 " " .
4	NE.	6	"	"	"	"	290	1,905	- 60	1,845	290	1,615	"	Hard, clear, iron		D, S	" 60 "" " .
5	NE.	8	"	"	"	"	278	1,890	- 40	1,850	274	1,616	" gravel	Hard, clear, iron	45	D, S, I	" 14 " " .
6	NW.	9	"	"	"	Dug	18	1,895	0-10	1,885	10	1,885	Glacial clay	Hard, clear		D,	House supply only.
7	NW.	10	"	"	"	"	16	1,890	- 14	1,876	14	1,876	" sand	" "	45	D,	" " " .
8	NE.	10	"	"	"	"	22	1,900					" "	" "	42	D, S	Waters 35 head stock.
9	NE.	11	"	"	"	Drilled	367	1,910	- 90	1,820	327	1,583	Ravenscrag sand	" red sediment	44	D, S	" 26 " "
10	SE.	11	"	"	"	Dug	18	1,900	- 16	1,884	16	1,884	Glacial gravel	Soft, clear		D, S	Dry since 1930.
11	NE.	14	"	"	"	"	12	1,910	- 6	1,904	11	1,899	" sand	" "	42	D, S	Waters 30 head stock.
12	NW.	14	"	"	"	"	27	1,905	- 23	1,882	19	1,886	" "	Hard, clear, alkaline	40	S,	Insufficient for 15 head stock.
13	SW.	16	"	"	"	"	20	1,895	- 17	1,878	17	1,878	" "	Hard, clear	45	D, S	" " 9 " " .
14	NE.	18	"	"	"	Bored	40	1,900	- 6	1,894	21	1,879	" clay	" "		D, S	Dry since 1930.
15	SW.	20	"	"	"	Dug	20	1,900	- 16	1,884	16	1,884	" sand	Soft, clear	44	D,	House supply only.
16	NW.	20	"	"	"	Bored	30	1,905	- 20	1,885	9	1,896	" gravel	Hard, clear, alkaline	42	S,	Waters 3 head stock only.
17	NE.	20	"	"	"	Drilled	200	1,910	- 30	1,880	190	1,720	Sand	Hard, clear, soda	46	D, S	" 22 " " .

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(#) Sample taken for analysis.

WELL RECORDS—RURAL MUNICIPALITY OF BENSON NO. 35, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
18	SE.	20	4	9	2	Drilled	270	1,910	- 3	1,907	235	1,675	Ravenscrag sand	Soft, soda		N,	Plugged by sand.
19	SW.	22	"	"	"	Dug	16	1,890	- 6	1,884	12	1,878	Glacial gravel	Hard, clear		D, S	Dry since 1931.
20	SE.	24	"	"	"	"	27	1,910	- 12	1,898	12	1,898	" "	" iron, alkaline	45	D, S	Waters 20 head stock.
21	NE.	26	"	"	"	"	15	1,920	- 10	1,910	10	1,910	" sand	Hard, clear, alkaline	44	D, S	" 6 " " .
22	SW.	27	"	"	"	Drilled	137	1,920	- 37	1,883	127	1,793	Sand	Hard, iron, alkaline	44	D, S	Abundant supply; laxative.
23	NE.	28	"	"	"	"	356	1,935									Dry hole.
24	NW.	30	"	"	"	"	236	1,920	- 30	1,890	230	1,690	Gravel base of clay	Soft, clear	46	D, S	Abundant supply.
25	NE.	35	"	"	"	Dug	10	1,925	0-6	1,919	10	1,915	Glacial sand	" "		D, S	Goes dry in summer.
26	SE.	34	"	"	"	"	23	1,950	- 19	1,931	23	1,927	" "	Hard, clear	42	D, S	Laxative; insufficient supply.
1	SW.	1	5	7	2	Dug	12	1,945	- 4	1,941			Glacial clay	Soft, clear		D, S	Dry in July.
2	NE.	2	"	"	"	"	12	1,945	- 7	1,938	12	1,933	Glacial gravel	" "	45	D, S	Insufficient for 21 head stock.
3	NW.	3	"	"	"	Drilled	285	1,955	- 80	1,875	275	1,680	Ravenscrag sand	" "	44	D, S	Waters 35 head stock.
4	SE.	6	"	"	"	Dug	16	1,950	- 12	1,938	12	1,938	Glacial sand	Hard, clear		D, S	House supply only.
5	SW.	6	"	"	"	Drilled	280	1,950	- 30	1,920	270	1,680	Ravenscrag sand	Soft, soda		D, S	Waters 25 head stock.
6	NW.	7	"	"	"	"	180	1,950				1,770	?	Hard, clear, alkaline		S,	" 20 " " .
7	SE.	7	"	"	"	"	189	1,945	- 30	1,915	187	1,758	Gravel below blue clay	Hard, clear, iron		D, S	" 40 " " .
8	NE.	8	"	"	"	"	237	1,955	- 60	1,895	227	1,728	Ravenscrag sand	Soft, soda, clear		D, S	" 60 " " , kills plants.
9	SE.	10	"	"	"	Dug	16	1,955	- 8	1,947	14	1,941	Glacial sand	Hard, clear		D, S	" 7 " " .
10	NW.	12	"	"	"	Drilled	260	1,955	-135	1,820	160	1,795	Sand in blue clay	" "	45	D, S	Insufficient for 40 head stock.
11	NE.	12	"	"	"	Dug	12	1,950	- 5	1,945	10	1,940	Glacial gravel	" "		D, S	Caved in.
12	SE.	14	"	"	"	"	14	1,950					" clay				Dry hole.
13	SW.	14	"	"	"	Drilled	370	1,950	- 35	1,915	330	1,620	Ravenscrag	Soft, clear	44	D, S, I	Abundant supply.
14	NW.	14	"	"	"	"	260	1,945	- 35	1,910	285	1,660	" sand	" "	44	D, S, I	Waters 40 head stock.
15	SW.	17	"	"	"	Bored	52	1,940	- 30	1,910	47	1,893	Glacial sand	Hard, clear		S,	Insufficient for 25 head stock.
16	NE.	18	"	"	"	Dug	35	1,960					" clay				Dry hole.
17	SW.	20	"	"	"	Drilled	264	1,960	- 45	1,915	264	1,696	Gravel below blue clay	Hard, clear, alkaline		D, S	Waters 28 head stock;
18	NW.	21	"	"	"	"	275	1,960	- 50	1,910	270	1,690	?	Hard, clear, alkaline		D, S	Waters 20 head stock.

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(#) Sample taken for analysis.

WELL RECORDS—RURAL MUNICIPALITY OF BENSON NO. 35, 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
19	SW.	22	5	7	2	Dug	20	1,955					Glacial yellow clay				Dry hole.
20	NW.	24	"	"	"	"	20	1,940	- 19	1,921	19	1,921	Glacial sand	Hard, clear, alkaline	47	S,	Depends on seepage from sloughs.
21	SE.	27	"	"	"	"	18	1,945	- 6	1,839	17	1,928	" "	Hard, clear		D, S	Insufficient for 16 head stock.
22	NE.	28	"	"	"	"	15	1,940	- 4	1,936	14	1,926	" "	Soft, clear		D, S	House supply and 4 head stock.
23	NE.	28	"	"	"	Drilled	320	1,945	- 40	1,905	320	1,625	Ravenscrag gravel	Hard, clear, alkaline		D, S	Waters 25 head stock.
24	NW.	28	"	"	"	Dug	30	1,947	- 10	1,937			Glacial clay	Hard, clear		D, S, I	Two families in Woodley.
25	SW.	28	"	"	"	"	20	1,940	- 10	1,930	14	1,926	Glacial sand	" "		D,	House supply only.
26	NE.	29	"	"	"	Drilled	320	1,945	- 60	1,885	300	1,645	Ravenscrag sand	" salty		S,	Waters 50 head stock.
27	SE.	30	"	"	"	Dug	18	1,950	- 13	1,937	8	1,942	Glacial sand	" clear		D,	House supply only.
28	SW.	30	"	"	"	Drilled	322	1,950	- 60	1,890	322	1,628	Ravenscrag sand and coal	Soft, soda		D, S	Abundant supply, kills plants.
29	SW.	32	"	"	"	Dug	20	1,950	- 4	1,946	17	1,933	Glacial sand	Hard, clear		D, S	Waters 20 head stock.
30	SE.	33	"	"	"	"	16	1,945	- 12	1,933	14	1,931	" "	Soft, cloudy		D, S	Waters 3 head stock.
31	NW.	35	"	"	"	Drilled	311	1,970	- 75	1,895	291	1,679	Ravenscrag sand	Hard, clear, alkaline		S, I	Good supply; plugs with sand.
32	SW.	36	"	"	"	Dug	24	1,950	- 20	1,930	21	1,929	Glacial gravel	Hard, cloudy		D, S	Waters 10 head stock.
33	NW.	36	"	"	"	"	20	1,950	- 15	1,935	19	1,931	" sand	Hard, clear, alkaline		S,	Dry since 1932.
34	SE.	36	"	"	"	"	16	1,945	- 10	1,935	13	1,932	" "	Hard, clear, alkaline	43	D, S	Waters 15 head stock.
1	NE.	1	5	8	2	Drilled	252	1,955	- 44	1,911	242	1,713	Ravenscrag sandstone	Soft, clear		D, S	Waters 30 head stock.
2	NE.	2	"	"	"	"	250	1,950	- 75	1,875	240	1,710	Ravenscrag sandstone	" brown		S,	Waters 20 head stock.
3	NW.	2	"	"	"	Dug	12	1,950	- 5	1,945	10	1,940	Glacial sand	Hard, clear, alkaline		S,	Insufficient for 21 head stock.
4	NE.	3	"	"	"	"	24	1,955	- 20	1,935	24	1,931	" "	Hard, clear, iron		D, S	Waters 15 head stock.
5	SE.	8	"	"	"	"	18	1,950	- 16	1,934	6	1,944	" "	Hard, brown, alkaline		D, S	Insufficient for 7 head stock.
6	NE.	4	"	"	"	Drilled	237	1,955	-100	1,855	219	1,736	Ravenscrag sandstone	Hard, clear, soda		D, S	Waters 35 head stock.
7	NW.	4	"	"	"	Dug	13	1,955	- 4	1,951	5	1,950	Glacial gravel	Hard, clear		D, S	Insufficient supply.
8	NW.	5	"	"	"	"	24	1,955	- 6	1,949	24	1,931	" sand	" "		D, S	" for 20 head stock.
9	NE.	6	"	"	"	"	26	1,955	- 20	1,935	20	1,935	" gravel	" "		D, S	" " 24 " " .
10	NW.	10	"	"	"	"	25	1,955	- 20	1,935	20	1,935	" "	" "		D,	House supply only.
11	NE.	10	"	"	"	"	24	1,955	- 14	1,941	12	1,943	" sand	" "		S,	Insufficient for 17 head stock.

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(#) Sample taken for analysis.

WELL RECORDS—RURAL MUNICIPALITY OF BENSON NO. 35, 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	SW.	12	5	8	2	Dug	12	1,950					Glacial clay	Hard, clear, alkaline		D,	Seepage from slough.
13	NW.	12	"	"	"	Drilled	255	1,950	- 60	1,890	237	1,713	Ravonscrag sand	Hard, clear		D, S, I	Waters 25 head stock.
14	NW.	13	"	"	"	Dug	12	1,955	- 5	1,950	5	1,950	Glacial sandy clay	Hard, clear		D, S	Insufficient for 17 head stock.
15	SW.	14	"	"	"	Drilled	255	1,950	- 80	1,870	237	1,713	Ravenscrag sand	" "		D, S	Waters 30 head stock.
16	NW.	14	"	"	"	"	375	1,950	-100	1,850	345	1,605	" "	Soft, soda iron		D, S	Kills plants; waters 22 head stock.
17	SE.	15	"	"	"	"	260	1,955	- 35	1,920	251	1,704	" "	Hard, clear, alkaline		S,	Abundant supply.
18	SE.	16	"	"	"	"	87	1,950	- 80	1,870	87	1,863	Glacial gravel	Hard, clear	52	S,	Sufficient supply.
19	SW.	18	"	"	"	Dug	16	1,945	- 12	1,933	3	1,942	" sand	" "		D,	House supply only.
20	NW.	18	"	"	"	"	20	1,960	- 11	1,949	18	1,942	" gravel	" "		D, S	Insufficient for 15 head stock.
21	NW.	20	"	"	"	"	16	1,950	- 8	1,942	8	1,942	" "	Soft, clear		D, S	Waters 40 head stock.
22	NE.	22	"	"	"	Drilled	320	1,950	- 50	1,900	320	1,630	Ravonscrag	" "		D, S I	" 32 " " .
23	NW.	23	"	"	"	Dug	20	1,950					Glacial clay	Hard, clear		D, S	Seepage from slough.
24	SW.	24	"	"	"	"	12	1,955	- 2	1,953			" "	" "		D, S	" " " .
25	NW.	25	"	"	"	Drilled	114	1,950	- 84	1,866	110	1,840	Sand below blue clay	" "		D, S	Dry since 1935.
26	NW.	27	"	"	"	"	310	1,950	-100	1,850	310	1,640	Ravenscrag sand	" "		S,	Abundant supply.
27	SE.	28	"	"	"	"	320	1,950	-100	1,850	320	1,630	" "	Soft, clear		D, S	Plugged by sand.
28	NW.	26	"	"	"	Dug	21	1,950	- 11	1,939	10	1,940	Glacial sand	Hard, clear		D, S	Water 15 horses and 150 sheep.
29	NE.	29	"	"	"	"	13	1,950	- 9	1,941	12	1,938	" gravel	" "		D, S	" 25 head stock.
30	SE.	30	"	"	"	"	25	1,950	- 17	1,933	25	1,925	" sand	" "		D, S	Insufficient for 20 head stock.
31	NW.	30	"	"	"	"	15	1,950	- 11	1,939	10	1,940	" "	" "		D, S	Waters 20 head stock.
32	SW.	32	"	"	"	"	30	1,950	- 14	1,936	28	1,922	" "	" " alkaline		D, S	Laxative; insufficient for 20 head stock.
33	SE.	32	"	"	"	"	16	1,950	- 8	1,942	8	1,942	" gravel	Hard, clear		D, S	Waters 20 head stock.
34	SW.	34	"	"	"	Drilled	140	2,010	- 50	1,960	120	1,890	Sand below blue clay	Soft, red		S,	Abundant water, but plugs with sand.
35	NE.	34	"	"	"	Dug	15	1,950	- 7	1,943	12	1,938	Glacial sand	Hard, clear		D, S	" supply.
36	NW.	35	"	"	"	"	12	1,950	- 2	1,948	5	1,945	" "	" "		D, S	Waters 26 head stock.
37	NW.	36	"	"	"	"	22	1,945	- 12	1,933	20	1,925	" "	" "		D, S	Insufficient for 18 head stock.
1	SE.	2	5	9	2	Dug	14	1,945	- 4	1,941	11	1,934	Sandy clay	" " alkaline		D, S	" " 40 " " .

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(#) Sample taken for analysis.

WELL RECORDS—RURAL MUNICIPALITY OF BENSON NO. 35, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
2	NW.	2	5	9	2	Drilled	140	1,950	-133	1,817	120	1,830	Sand below blue clay	Hard, iron, alkaline		S,	Laxative; abundant supply.
3	NE.	3	"	"	"	Dug	10	1,950	- 4	1,946	7	1,943	Glacial sand	Soft, clear		D, S, I	Waters 10 head stock.
4	SW.	4	"	"	"	Drilled	512	1,940	- 36	1,904	500	1,440	Ravenscrag	Soft, salty, clear		S,	Abundant supply.
5	SE.	6	"	"	"	"	360	1,940	- 20	1,920	340	1,600	" sand	Soft, clear, soda		D, S	" " .
6	SE.	8	"	"	"	Dug	40	1,935	- 12	1,923	12	1,923	Glacial sand	Hard, clear, alkaline		S,	Sufficient supply.
7	NE.	9	"	"	"	Bored	17	1,950					" clay				Dry hole.
8	NW.	11	"	"	"	Dug	15	1,965	- 4	1,961			" "	Hard, clear, alkaline		D, S	Insufficient for 15 head stock.
9	NE.	12	"	"	"	"	20	1,960	- 16	1,944	19	1,941	" gravel	Hard, clear		D,	House supply.
10	SE.	14	"	"	"	Drilled	353	1,955	- 60	1,895	323	1,632	Ravenscrag sand	Soft, soda		D, S, I	Waters 20 head stock.
11	NE.	16	"	"	"	Dug	14	1,960	- 7	1,953	12	1,948	Glacial sand	Hard, clear		D,	House supply only.
12	SE.	18	"	"	"	"	25	1,940	- 15	1,925	15	1,925	" "	" " alkaline		S,	Goes dry in winters.
13	SW.	18	"	"	"	Drilled	335	1,940	- 40	1,900	323	1,617	Ravenscrag sand	Soft, clear		D, S	Waters 31 head stock.
14	SE.	21	"	"	"	"	140	1,955	-105	1,850	140	1,815	" "	Hard, clear		S, I	Abundant supply.
15	NW.	24	"	"	"	Dug	20	1,965	- 14	1,951	9	1,956	Glacial gravel	" "		D, S	Insufficient for 5 head stock.
16	SE.	24	"	"	"	"	12	1,950	- 8	1,942	11	1,939	" sand	" " alkaline		D, S	Dry since 1930.
17	SW.	25	"	"	"	Drilled	490	1,950	- 80	1,870	490	1,460	Ravenscrag	Soft, salty, clear		S,	Insufficient for 20 head stock.
18	SW.	26	"	"	"	"	220	1,950	-200	1,750	220	1,730	" sand	Hard, clear		D, S	Waters 25 head stock. #
19	NE.	28	"	"	"	Dug	14	1,950	- 11	1,939	11	1,939	Glacial sand	" "		D, S	Insufficient for 8 head stock.
20	SW.	28	"	"	"	"	28	1,950	- 18	1,932	10	1,940	" sand and gravel	Soft, clear		D,	House supply only.
21	SE.	34	"	"	"	"	32	1,955	- 31	1,924	28	1,927	Glacial sand	Hard, clear, alkaline		S,	Insufficient for 13 head stock.
22	SW.	36	"	"	"	Drilled	500	1,950	-100	1,850	500	1,450	Ravenscrag	Hard, salty, clear		S,	Waters 35 head stock.
23	NE.	36	"	"	"	Dug	20	1,960	- 4	1,956	9	1,951	Glacial sand	Hard, clear		D, S	Waters 20 head stock.
1	SE.	1	6	7	2	Drilled	250	1,950	- 50	1,900	250	1,700	Ravenscrag	Hard, clear		S,	Laxative; sufficnt supply
2	SE.	2	"	"	"	Bored	63	1,955			60	1,895	Glacial sand	" "		S,	Waters 25 head stock.
3	NE.	2	"	"	"	Dug	30	1,955	- 15	1,940	15	1,940	Glacial sand	" "		D, S	Insufficient for 18 head stock.
4	SW.	2	"	"	"	Drilled	212	1,960	- 55	1,905	210	1,750	Ravenscrag sand	" "		S,	Waters 25 head stock.
5	NE.	4	"	"	"	Dug	30	1,955	- 10	1,945	24	1,931	Glacial sand	" "		S,	" 25 " " .

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 BENSON NO. 35, 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.	4	6	7	2	Dug	26	1,945	- 11	1,934	19	1,926	Glacial gravel	Hard. clear, alkaline		D, S	Laxative, insufficient for 37 head stock.
7	SW.	5	"	"	"	"	6	1,940	- 3	1,937	4	1,936	" sand	Hard, clear		D, S, I	Waters 16 head stock.
8	SE.	6	"	"	"	"	14	1,950	- 12	1,938	12	1,938	" gravel	" "		D,	House supply only; 22 foot well waters 12 head stock.
9	NE.	6	"	"	"	"	26	1,965	- 18	1,947	25	1,940	" sand	" "		D, S	Waters 30 head stock.
10	SE.	8	"	"	"	"	28	1,955	- 13	1,942	21	1,934	" "	" " alkaline		D, S	Insufficient for 24 head stock.
11	SE.	10	"	"	"	Drilled	258	1,955	- 45	1,910	258	1,697	Ravenscrag gravel	Hard, clear		S,	Abundant supply.
12	SE.	11	"	"	"	"	190	1,950	- 60	1,890	170	1,780	Sand below blue clay	" iron, alkaline		S,	Laxative; waters 30 head stock.
13	SW.	12	"	"	"	Dug	20	1,955	- 12	1,943	16	1,939	Glacial sand	Hard, clear		D,	House supply only.
14	NE.	12	"	"	"	Drilled	251	1,960	- 60	1,900	226	1,734	Ravenscrag sand	Soft, clear		S,	Abundant supply.
15	NE.	14	"	"	"	Dug	27	1,960	- 10	1,950	8	1,952	Glacial sand	Hard, clear, alkaline		S,	Insufficient for 20 head stock.
16	NW.	14	"	"	"	Drilled	89	1,960	- 20	1,940	79	1,881	" "	Hard, clear, alkaline		D, S	Waters 30 head stock.
17	SE.	16	"	"	"	"	270	1,960	- 40	1,920	260	1,700	Ravenscrag sand	Soft, clear		D, S	Abundant supply.
18	SW.	16	"	"	"	Dug	10	1,955					Glacial clay				Dry hole.
19	SW.	18	"	"	"	"	18	1,955	- 10	1,945	16	1,939	" sand	Hard, clear		D, S	Insufficient for 12 head stock.
20	SE.	20	"	"	"	"	25	1,965	- 13	1,952	24	1,941	" clay	" "		D, S	" " 30 " " .
21	NE.	21	"	"	"	"	26	1,975	- 4	1,971	25	1,950	" sand	" " alkaline		D,	House use only; similar well for 25 head stock.
22	SW.	22	"	"	"	Drilled	150	1,960	- 10	1,950	150	1,810	" gravel	Hard, clear		D, S	Waters 50 head stock.
23	SE.	25	"	"	"	Bored	40	1,965	- 25	1,940	40	1,925	Gravel below blue clay	" " alkaline		S,	Insufficient for 15 head stock.
24	SE.	26	"	"	"	Drilled	240	1,970	- 30	1,940	215	1,755	Ravenscrag sand	Hard, red sediment		D, S	Abundant supply.
25	SE.	28	"	"	"	"	140	1,960	-100	1,860	125	1,835	Glacial sand	Hard, iron, alkaline		D, S	Laxative; abundant supply.
26	SW.	28	"	"	"	Dug	24	1,960	- 8	1,952	21	1,939	" "	Hard, clear		D, S	Insufficient for 16 head stock.
27	SW.	30	"	"	"	"	18	1,960	- 15	1,945	11	1,949	" "	" "		D, S	Waters 36 head stock.
28	NW.	32	"	"	"	"	35	1,970	- 33	1,937	30	1,940	" "	" "		D,	House use only.
29	NE.	32	"	"	"	"	30	1,965	- 27	1,938	27	1,938	" "	" iron, alkaline		D, S	Insufficient for 16 head stock.
30	SE.	32	"	"	"	"	18	1,980	- 8	1,972	6	1,974	" "	Hard, clear, alkaline		D, S	" " 12 " " .
31	NW.	34	"	"	"	Bored	160	1,965	- 60	1,905	160	1,805	Gravel below blue clay	Hard, clear, alkaline		S,	" " 30 " " .
32	NE.	34	"	"	"	Drilled	180	1,980	- 80	1,900	163	1,817	Sand below blue clay	Hard, clear, alkaline		S,	Abundant supply.

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(#) Sample taken for analysis.

WELL RECORDS—RURAL MUNICIPALITY OF BENSON, NO. 35, 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
33	NW.	36	6	7	2	Dug	25	1,960	- 12	1,948	12	1,948	Sandy clay	Hard, clear		D, S	House supply only.
34	SE.	36	"	"	"	Drilled	247	1,975	- 40	1,935	220	1,755	Ravenscrag sand	Soft, soda, clear		D, S	Abundant supply; laxative.
1	NE.	1	6	8	2	Dug	20	1,950	- 16	1,934	16	1,934	Glacial clay	Hard, clear, alkaline		S,	Insufficient for 20 head stock.
2	SW.	2	"	"	"	"	20	1,945	- 15	1,930	10	1,935	" sand	Hard, clear, alkaline		D, S	" " 11 " " .
3	SE.	3	"	"	"	"	15	1,945	- 5	1,940	13	1,932	" "	Hard, clear, alkaline		D, S	Waters 20 head stock.
4	NE.	4	"	"	"	"	30	1,950	- 3	1,947	24	1,926	" "	Hard, clear		D, S	" 14 " " .
5	SE.	5	"	"	"	"	14	1,955	- 11	1,944	14	1,941	" gravel	" "		D,	House supply only.
6	SW.	6	"	"	"	"	9	1,950	- 7	1,943	7	1,943	" sand	" " alkaline		D,	" " " .
7	NW.	6	"	"	"	"	23	1,950					" "	Hard, clear, alkaline		D, S	Insufficient for 12 head stock.
8	NE.	9	"	"	"	Bored	30	1,955	- 20	1,935	20	1,935	" "	Hard, clear		D, S	" " 18 " " .
9	NW.	10	"	"	"	"	32	1,955	- 26	1,929	28	1,927	" sand	" " alkaline		M,	Town of Benson; 100 people.
10	S½	10	"	"	"	Dug	22	1,950					" clay				Dry hole.
11	NE.	10	"	"	"	"	6	1,945	- 3	1,942	3	1,942	" gravel	Hard, clear, alkaline		D, S	Fairly abundant supply.
12	SE.	11	"	"	"	"	8	1,945	- 1	1,944	2	1,943	" "	Hard, clear		S, I	Waters 25 head stock.
13	SE.	12	"	"	"	"	11	1,955	- 8	1,947	8	1,947	" "	" "		D, S	" 21 " " .
14	SE.	13	"	"	"	"	18	1,950	- 13	1,937	16	1,934	" sand	" "		D, S	" 16 " " .
15	SW.	13	"	"	"	"	20	1,945	- 18	1,927	18	1,927	" "	" "		D,	House use only.
16	NE.	14	"	"	"	"	18	1,955	- 10	1,945	17	1,938	" gravel	" " alkaline		D, S	Laxative; waters 50 head stock.
17	SW.	14	"	"	"	"	28	1,980	- 14	1,966	25	1,955	" "	Soft, clear		D, S	Waters 33 head stock.
18	NE.	16	"	"	"	"	22	1,960	- 12	1,958	19	1,941	" "	Hard, clear		D, S	" 25 " " .
19	NW.	16	"	"	"	"	15	1,955	- 11	1,944	11	1,944	" "	Soft, clear		D, S, I	" 20 " " .
20	SW.	18	"	"	"	"	20	1,950	- 15	1,935	15	1,935	" sand	Hard, clear		D, S	Watered 40 head stock before drought.
21	NW.	20	"	"	"	"	22	1,960	- 12	1,948	12	1,948	" yellow clay	" "		D,	House supply only.
22	SE.	20	"	"	"	"	40	1,960	- 20	1,940	36	1,924	" gravel	" " alkaline		D, S	Waters 30 head stock.#
23	NW.	21	"	"	"	"	15	1,960	- 8	1,952	13	1,947	" "	Hard, clear, alkaline		S,	" 11 " " .
24	NE.	21	"	"	"	"	13	1,960	- 3	1,957	5	1,955	" sand	Hard, clear		D, S	Insufficient for 4 head stock.
25	SE.	22	"	"	"	"	20	1,945	- 6	1,939	6	1,939	Sandy clay	" "		D,	House supply only.

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

WELL RECORDS—RURAL MUNICIPALITY OF BENSON, NO. 35, SASKATCHEWAN.

WELL No.	LOCATION					TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE		PRINCIPAL WATER-BEARING BED			CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
	¼	Sec.	Tp.	Rge.	Mer.				Above (+) Below (−) Surface	Elev.	Depth	Elev.	Geological Horizon				
26	SW.	23	6	8	2	Dug	22	1,955	- 12	1,943	19	1,936	Glacial gravel	Hard, clear		D, S, I	Waters 18 head stock.
27	SE.	24	"	"	"	"	9	1,960	- 4	1,956	4	1,956	" sand	Soft, "		D, S	" 26 " " .
28	NE.	24	"	"	"	"	52	1,960					" clay				Dry hole.
29	SE.	25	"	"	"	"	12	1,965					" clay and sand				" " .
30	SE.	26	"	"	"	"	12	1,970	- 4	1,966	10	1,960	Glacial gravel	Hard, clear		D, S	Waters 28 head stock.
31	SE.	27	"	"	"	"	11	1,960	- 7	1,953	7	1,953	" "	" "		D, S	Insufficient for 15 head stock.
32	SE.	28	"	"	"	"	20	1,965	- 15	1,950	15	1,950	" sand	" "		D, S	" " 19 " " .
33	NE.	28	"	"	"	"	20	1,970	- 14	1,956	20	1,950	" gravel	" "		D, S	" " 30 " " .
34	SE.	29	"	"	"	"	20	1,960	- 10	1,950	18	1,942	" sand	" "		D, S	" " 25 " " .
35	NW.	33	"	"	"	"	30	1,970	- 27	1,943	16	1,952	" "	" "		S,	Waters 60 head stock.
36	NW.	34	"	"	"	"	35	1,975	-		33	1,942	" "	Soft, clear, alkaline		D,	Insufficient in dry years.
37	SW.	36	"	"	"	Drilled	190	1,975	- 22	1,953	180	1,795	Sand below blue clay	Soft, salty, clear		D, S	Kills plants; waters 25 head stock.
38	NE.	36	"	"	"	Dug	8	1,960	- 4	1,956	4	1,956	Glacial sand	Hard, clear		D, S	Waters 16 head stock.
1	SE.	1	6	9	2	Dug	11	1,960	- 3	1,957	3	1,957	Glacial sand	Hard, clear		D, S, I	" 15 " " .
2	SW.	2	"	"	"	"	30	1,965	- 5	1,960	26	1,939	" "	" "		D, S	Insufficient for 10 head stock.
3	NE.	7	"	"	"	"	30	1,960	- 10	1,950	30	1,930	" gravel	" " alkaline		S,	Laxative; insufficient for 30 head stock.
4	SW.	10	"	"	"	Bored	25	1,960	- 20	1,940	21	1,939	" clay and stones	Hard, clear		D,	House supply only.
5	SE.	10	"	"	"	Dug	12	1,960	- 4	1,956	6	1,954	Glacial sand	" "		D, S, I	Poor supply.
6	SW.	14	"	"	"	"	16	1,960	- 11	1,949	5	1,955	Glacial sand	Hard, clear		D, S, I	Waters 40 head stock.
7	NE.	15	"	"	"	"	14	1,960	- 6	1,954	6	1,954	Glacial gravel	" "		D,	House supply only.
8	NE.	17	"	"	"	Drilled	150	1,960			150	1,810	Sand below blue clay	" " alkaline		S,	Insufficient for 32 head stock.
9	NW.	18	"	"	"	Dug	18	1,970	- 15	1,955	12	1,958	Glacial sand	Hard, clear		D, S	" " 20 " " .
10	SW.	20	"	"	"	"	21	1,965	- 15	1,950	8	1,957	" "	" "		D, S	" " 11 " " .
11	NE.	20	"	"	"	Drilled	120	1,975	- 65	1,910	120	1,855	Sand below blue clay	" "		S, I	Waters 20 head stock.
12	NE.	22	"	"	"	"	360	1,965	- 60	1,905	360	1,605	Ravenscrag sand	Soft, salty, clear		S,	Abundant supply.
13	NW.	26	"	"	"	Dug	15	1,970	- 9	1,961	12	1,958	Glacial sand	Hard, clear		D,	House supply.
14	NW.	27	"	"	"	"	18	1,970	- 8	1,962	15	1,955	" "	" "		D, M	Village of 25 people.

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

WELL RECORDS—RURAL MUNICIPALITY OF BENSON NO. 35, 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
15	SW.	27	6	9	2	Dug	22	1,970	- 4	1,966	18	1,952	Sandy gravel	Hard, clear		D, S, I	Insufficient for 25 head stock.
16	NE.	28	"	"	"	Drilled	400	1,970	-100	1,870	400	1,570	Ravenscrag gravel	Soft, salty, clear		S,	" " 20 " " .
17	NE.	30	"	"	"	Dug	12	1,970	- 10	1,960	10	1,960	Glacial sand	Hard, clear		S,	Waters 40 head stock.
18	NW.	30	"	"	"	"	24	1,965	- 10	1,955	12	1,953	" gravel	" "		D, S	" 40 " " .
19	SW.	31	"	"	"	"	17	1,965					" clay				Dry hole.
20	SE.	32	"	"	"	Drilled	327	1,970	- 35	1,935	327	1,643	Ravenscrag	Soft, clear, soda		S,	Insufficient for 50 head stock.
21	SE.	33	"	"	"	Dug	17	1,970	- 7	1,963	10	1,960	Glacial sand	Hard, clear,		S,	" " 6 " " .
22	NE.	33	"	"	"	"	19	1,975	- 8	1,967	11	1,964	" "	" " alkaline		S,	" " 17 " " .
23	SW.	34	"	"	"	Drilled	350	1,970	- 40	1,930	350	1,620	Ravenscrag gravel	Soft, salty, clear		S,	Abundant supply.
24	NW.	36	"	"	"	Dug	14	1,955	- 6	1,949	6	1,949	Glacial gravel	Hard, clear		D, S, I	Waters 40 head stock.
25	SE.	36	"	"	"	"	22	1,960	- 15	1,945	15	1,945	" sandy clay	" " alkaline		D, S	Insufficient for 30 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.